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BEFORE THE OHIO POWER SITING BOARD

In the Matter of the Application of Hardin Wind LLC, for a Certificate to Construct a Wind-Powered Electric Generating Facility in Hardin and Logan Counties, Ohio	)	**Case No. 13-1177-EL-BGN**
***In the Matter of the Application of* Hardin Wind LLC for a Certificate of Environmental Compatibility and Public Need for a Substation Project in Hardin County**	)	**Case No. 13-1767-EL-BSB**
In the Matter of the Application of Hardin Wind LLC for a Certificate of Environmental Compatibility and Public Need for a 345kV Transmission Line in Hardin County	)	**Case No. 13-1768-EL-BTX**

DIRECT TESTIMONY OF CHRISTOPHER FERRELL

Q.1. Please state your name, title and business address.

A.1. My name is Christopher Ferrell. I am a Project Director for UC Synergetic, LLC (formerly Pike Energy Solutions) ("UCS"). My business address is 10101 Claude Freeman Drive, Suite 100W, Charlotte, North Carolina 28262.

Q.2. What are your duties as Project Director?

A.2. As Project Director, I oversee a staff of 10 engineers and electrical utility designers. My staff and I, along with other UCS personnel, provide design engineering, construction, and operation and maintenance support to electrical utility and renewable energy clients on a nationwide basis.

Q.3. What is your educational and professional background?

A.3. I have a Bachelor of Engineering Degree (Electrical Engineering) from North Carolina State University (1999) and a Masters of Business Administration from Wake Forest University (2005). I am a certified Project Management Institute Professional. My employment history includes over 13 years of experience in project management and the engineering, design and construction of transmission and generation related facilities and projects. I have completed engineering analyses and design work for a number of wind and biomass projects and have worked on multiple underground and overhead transmission and distribution projects in voltages ranging up to 525 kV in addition to substation, electrical controls, communications, system modeling and project management. A statement of my educational background and professional qualifications is attached as Exhibit A to my direct testimony.

Q.4. On whose behalf are you offering testimony?

A.4. I am testifying on behalf of the Applicant, Hardin Wind LLC.

Q.5. What is the purpose of your testimony?

A.5. The purpose of my testimony is to provide information on the key aspects of the planning and design for the transmission line and point of interconnect substation (POI Substation) prepared by UCS, as well as health and safety information accompanying the applications for the transmission line and the POI Substation.

Q.6. Please provide a brief description of the proposed layout of the Scioto Ridge POI Substation.

A.6. The POI Substation will be approximately 467 by 467 feet in size, or 5 acres in area, and will be enclosed by a chain-link fence. The POI Substation will allow for

delivery of electricity from the wind turbines to the regional power grid. The POI Substation design includes three 345 kV circuit breakers configured in a breaker and one half bus arrangement which will be operated as a ring-bus. The POI Substation also includes 345 kV metering, SCADA, and associated equipment. A 345 kV line extension is required to break the existing line to allow it to loop through the proposed POI Substation. The orientation of the POI Substation and the orientation of the equipment within the fence of the POI Substation have changed slightly as result of the shift in the transmission line which Hardin Wind gave notice of in its December 16, 2013 filing with the Ohio Power Siting Board. A copy of a general arrangement drawing of the POI Substation that was submitted with Hardin Wind's December 16, 2013 filing is included in the exhibit that has been marked as Company Exhibit 4.

Q.7. Please provide a brief description of the proposed design for the Scioto Ridge Transmission Line.

A.7. The Scioto Ridge Transmission Line (Transmission Line) will be designed and operated at 345 kV. The preferred route design for the Transmission Line has been shifted slightly as described in the notice that Hardin Wind filed on December 16, 2013, and my testimony today reflects those changes. The Transmission Line will be supported on multiple mono-pole structures with direct embedment type foundations. The various structure types are illustrated in Figures 6 through 9 in the Application. The Scioto Ridge Transmission Line will be installed within a 120-foot wide right-of-way (ROW), which will extend 60 feet from the centerline of the transmission line along each side. To minimize potential clearing impacts to forestland, the preferred transmission route is located predominately near open agricultural land. A total of 34 structures are proposed

along the 4.8-mile preferred route, which equates to an average spacing of approximately 760 feet between structures.

Q.8. What methodology did UCS use in conducting its design for the Transmission Line and location for the POI Substation?

A. 8. To assess the Transmission Line route and POI Substation siting, UCS collected an array of land use, cultural resource and environmental data, compiled it, and displayed it on different data layers prepared in Geographic Information System format (ArcGIS) to allow accurate spatial and proximity analyses relative to the proposed Transmission Line route and POI Substation location. This information was then entered into a transmission line planning software package (PLS-CADD) and the entire line was modeled for pole sizing, foundation requirements, conductor suitability and EMF studies.

Q.9. Please describe the proposed new structures for the Transmission Line.

A.9. The structures for the proposed Scioto Ridge Transmission Line are consistent with industry standards. The Transmission Line will be supported on multiple mono-pole structures with direct embedment foundations and will be constructed based on the type of configuration. For dead-end configurations (assuming an angle range of 0-90 degrees), the tower design will be a single, mono-pole design with anchors and down-guys for each dead-end. For running angle configurations (assuming an angle range of up to 15 degrees), the tower design will be a single, mono-pole design with insulators stacked on the angle side of the pole with down-guys and anchors supporting each conductor point. For tangent configurations (assumes an angle range of 0-1 degree), the tower design will be a single, mono-pole design with a delta configuration. The mono-

pole structures will be direct embedded in the soil utilizing appropriate backfill materials as required by the engineering design and geotechnical investigations.

Q.10. Please describe the construction process for the direct embedded poles.

A.10. Disturbed area for the direct embedded poles will be an auger-drilled hole approximately five feet (or smaller) in diameter (pole will be three feet or smaller at ground level). Self supported poles are not anticipated. The excavated soil will be used for backfill where possible, and if not used, evenly spread in accordance with local, state and federal guidelines. Permanent disturbance resulting from pole placement includes a one-foot area of material used to backfill the hole (typically gravel) around the pole base and remain clear of vegetation. The total pole heights will range from 125-135 feet, with a direct embedded foundation (typically 10% of the total height plus five additional feet). Therefore, above ground heights will range from 107.5 feet to 116.5 feet.

Q.11. Is there any proposed underground portion of the Transmission Line?

A.11. No underground 345 kV circuitry is not proposed for this project, nor do I recommend underground 345 kV circuitry for this project.

Q.12. Please describe the ROW necessary for the Transmission Line.

A.12. The Transmission Line will be installed within a 120-foot wide ROW, which will extend 60 feet from the centerline of the Transmission Line along each side. To minimize potential clearing impacts to forestland, the preferred transmission route is located predominately within open agricultural land.

Q.13. What are electric and magnetic fields ("EMF")?

A.13. EMFs are emitted by any electrical wire or electronic device, including a wide variety of devices common in homes and workplaces (such as computers, televisions, and microwaves), as well as power lines.

Q.14. Did you evaluate the electric and magnetic field ("EMF") levels for the proposed Transmission Line?

A.14. Yes, we evaluated the EMF levels for the proposed Transmission Line based on evaluating it with current industry standard software and the anticipated loading of the transmission line from the generators. Based on the analysis, and comparing it with all available state standards, the EMF levels from the proposed Transmission Line will be below all available standards and at levels that are considered acceptable in the utility transmission and distribution industry.

Q.15. Based on your experience, do you believe EMF levels from the proposed Transmission Line and from the conductors within the proposed POI Substation will lead to any issues or complaints?

A.15. No. The EMF levels estimated from the Transmission Line are below all state mandated levels in the United States, though Ohio does not have set limits. As well, the EMF levels from the conductors within the proposed POI Substation will be similar to or less than the EMF levels associated with the existing AEP 345 kV line and the proposed Transmission Line.

Q.16. Does this conclude your direct testimony?

A.16. Yes, it does.

CERTIFICATE OF SERVICE

I certify that a copy of the foregoing document was served by electronically or by regular U.S. mail (as indicated) upon the following this 9th day of January 2014:

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/s/ Michael J. Settineri
Michael J. Settineri

UC/SYNERGETIC

EXHIBIT
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CHRISTOPHER S. FERRELL, PE, PMP

Title/Position: Director of Renewables **Years of Experience: 12**

SUMMARY

Mr. Ferrell has several years of project management, business and engineering experience working with a wide variety of clients. He has been involved in wind and biomass project development, preliminary engineering and estimating, interconnection studies and filings, full electrical and civil engineering and ongoing operations and maintenance efforts in projects across the country. He has experience in multiple underground and overhead transmission and distribution projects in voltage ranges up to 345kV in addition to substation, electrical controls, communications and modeling project management. He has also participated in special utility project management, as well as various analyst and project management roles in information technology efforts.

Recently, MR. Ferrell provided project management and engineering oversight for Everpower's Twin Ridges Wind 138kV generation tie line. The project consisted of county and city commission presentations to allow for approval of the 8.3 miles of overhead and 1.76 miles of underground transmission. The major considerations were to accommodate view shed concerns of scenic railways and rails-to-trails hiking areas.

He was also the Project Manager for the engineering efforts for approximately 3000km of rural electrification efforts in Tanzania. He has given client presentations and interaction, project and proposal management, and engineering and analyst efforts for a range of clients. Throughout his career, his resourcefulness, diverse background and education, and new ideas have enabled him to solve challenges he has faced with his projects.

EDUCATION

- MBA (Finance, Information Technology), Wake Forest University - Babcock Graduate School, Winston-Salem, North Carolina, 2005
- BS, Electrical Engineering (Power, Communications), North Carolina State University, Raleigh, North Carolina, 1999

PROFESSIONAL REGISTRATIONS & INDUSTRY AFFILIATIONS

- Registered Professional Engineer in the state of North Carolina, #040275
- Project Management Professional, # 493208

EXPERIENCE

UC Synergetic **09/2008 to Present**
Director of Substations and Renewables **07/2013 to Present**
Sr. Project Manager **09/2008 - 06/2013**
Following the Pike Corporation acquisition of Shaw EDS, Mr. Ferrell transitioned to a similar role and responsibilities, as those previously held at Shaw.

UC/SYNERGETIC

Project Manager **01/2008 - 08/2008**
Shaw Energy Delivery Services, Inc.
Project and Proposal Manager for various power delivery projects, which included distribution, substation, transmission, wind, and biomass. These projects included balance-of-plant engineering, full EPC proposals, Owner's Engineer, full project engineering, and other project execution efforts. Typical projects range up to a $1M engineering budget and voltages up to 345kV.

Project Manager and Senior Analyst **10/2005 - 10/2007**
The Norman Group / Norman Technologies
Diverse experience as a Project Manager and Project Analyst Consultant, interfacing with external clients. Work efforts focused on understanding the client's information technology needs and future strategies, developing requirements and specifications, and managing the implementation of system upgrade procedures. Industries included insurance, banking, freight logistics, farming and others.

Relay and Controls Engineer **10/2001 - 07/2003**
Duke Energy, Energy Delivery Services
General junior engineering duties, including client and vendor interfacing. Contributed in an engineering role to project and proposal development teams as well as developing and updating relay and controls engineering drawings.

Optical System Engineer **07/1999 - 07/2001**
Nortel Networks, Optical Systems
Interfaced with clients, project managers, sales engineers and other internal and external Nortel clients to understand client needs, design cost effective solutions, educate and train clients on operations and continual maintenance and upgrading of installed equipment. Worked with SONET optical and electrical equipment, designed OC-192, OC-48, OC-12/3 systems and DWDM communications systems. System size ranged from intra-building to cross-country communications links.

Engineering Project Management Projects - (includes general project management, client contract development, electrical and civil engineering and design, subcontractor coordination, O&M support)

- Los Vientos I Windpower – Duke Energy Renewables (TL, Sub, P&C, Modeling, Collection)
- Los Vientos II Windpower – Duke Energy Renewables (TL, Sub, P&C, Modeling, Collection)
- Hardin Wind 345kV CPCN, EMF, Town Hall and Permitting Efforts – Everpower Wind Holdings
- Twin Ridges 138kV Overhead and Underground Transmission Line Engineering and Design, CPCN Permitting, EMF Study and Expert Testimony – Everpower Wind Holdings
- Windthorst II Owner's Preliminary and Owner's Engineer Review – OwnEnergy, Inc.
- Cimarron 1 Wind Project Electrical Engineering – Wanzek Construction, Inc.
- Cimarron 2 Wind Project Electrical and Civil Site Engineering – Duke Energy Renewables
- Buckeye Wind Collection System Analysis and Estimating – Everpower Wind Holdings
- Laurel Hill Windpower Electrical and Civil Engineering – Duke Energy Renewables
- Ironwood Windpower Electrical and Civil Engineering – Duke Energy Renewables
- Power Quality Metering and Breaker Wear Monitoring Upgrade Project (320 Station Upgrades) – Duke Energy Progress
- NERC Line Re-Rating Project – Duke Energy Progress
- Bison 2 Collection System Engineering and Design – Barr Engineering (Minnesota Power)
- Bison 3 Collection System Engineering and Design – Barr Engineering (Minnesota Power)
- Notrees Grid Support Battery Bank Electrical Infrastructure and Control Design (24MW-hr) – Duke Energy Renewables

UC/SYNERGETIC

- Ashtabula 138kV CT Plant Interconnection Upgrade Engineering – Duke Energy Generation Services
- Tanzania Distribution Engineering Project for MCA-T and REA, Tanzania, Africa
- Top of the World Windpower - Duke Energy Generation Services
- Three Buttes / Campbell Hill Wind Project Electrical and Civil Engineering – Duke Energy Renewables
- Latigo 230kV Switch Station Electrical Engineering - PacifiCorp / Duke Energy Renewables
- Notrees Wind Project Phase 1A, 1B, 1C Electrical and Civil Engineering – Duke Energy Renewables
- Las Palmas Windpower Transmission and CPCN Permitting – Duke Energy Renewables
- Ming Yang Wind Turbine Suitability Analysis – Ming Yang Wind Power
- Millennium Challenge Account – Tanzania – Rural Electrification Efforts Lots 1, 2 and 3
- Twin Ridges Overhead and Underground Electromagnetic Frequency Report – Everpower Wind Holdings
- Fox Hill / Lei Ridge Wind Collector Substation - AES
- Preliminary Engineering, Estimating, Permitting Assistance and Site Analysis for Multiple Projects Across 25+ states.
- Arc Flash System Modeling for Multiple Wind Projects (Substation, Collection System, Wind Turbine Generator)
- Operations and Maintenance Reviews of Operational Wind Projects Including Transmission Lines, Substations and Collection Systems for various Clients to address ongoing issues.
- Biomass Client Interconnection Studies, Transmission Routing Analysis, and Preliminary Engineering and Estimating
- Amayo Wind Owner's Engineer Third Party Review
- PacifiCorp Latigo 230kV Switching Station
- Duke Energy Relay and Controls and Substation Engineering
- Duke Energy Smartgrid Substation Engineering Upgrade Projects (120 R&C, Physical Projects)
- Aberdeen Proving Grounds System Study – EwingCole, US Army Corp of Engineers
- Duke Energy Substation and Transmission Line Effort
- Progress Energy Substation SPCC Project
- UNC-Chapel Hill Bus Differential Relay Upgrade
- Eaton Corp Oil Testing
- Eaton Relay Upgrade Effort
- NRG Meridian and MDM Engineering Consulting

Strategic Services (Safety Training) - (includes general project management, client contract development, subcontractor and vendor coordination)

- Duke Energy Training Center Staff Augmentation
- Southern Piedmont Community College Electrical Safe Work Practices (ESWP)
- TEPPCO ESWP Training
- Navajo Utilities Tribal Authority – ESWP Assessment
- Nucor Business Systems – ESWP Training
- ATI/Allvac – Arc Flash Study, ESWP Assessment and Training
- Duke Energy McGuire Bucket Safety Training
- Jamestown Board of Public Utilities – ESWP Training