JoAnne Blank Direct Testimony, Ex. A____

BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF SOUTH DAKOTA

IN THE MATTER OF THE APPLICATION BY DEUEL HARVEST WIND ENERGY LLC FOR ENERGY FACILITY PERMITS OF A WIND ENERGY FACILITY AND A 345-KV TRANSMISSION LINE IN DEUEL COUNTY, SOUTH DAKOTA FOR THE DEUEL HARVEST NORTH WIND FARM

SD PUC DOCKET NO. ________________

PRE-FILED DIRECT TESTIMONY OF JOANNE BLANK
ON BEHALF OF DEUEL HARVEST WIND ENERGY LLC

November 30, 2018

I. INTRODUCTION AND QUALIFICATIONS

Q. Please state your name, employer, and business address.

A. My name is JoAnne Blank. I am a senior scientist and project manager in the energy market sector at Stantec Consulting Services Inc. ("Stantec"). My business address is 1165 Scheuring Road, De Pere, Wisconsin 54115.

Q. Briefly describe your educational and professional background and your current work for Stantec.

A. I have a Bachelor of Science degree in Atmospheric and Oceanic Sciences, a Master of Science degree in Atmospheric and Oceanic Sciences, and a Master of Science degree in Environmental Monitoring. I have more than 20 years of professional experience and have been with Stantec for 8.5 years.

I specialize in feasibility, permitting and compliance of power and renewable energy projects across the United States. I have been involved in the design and permitting of more than 3.0 gigawatts of wind and other renewable energy projects. My project and management experience include federal, state and local permitting, feasibility analyses, expert witness testimony, project siting, shadow/flicker analyses, sound studies, environmental permitting, NEPA documents (EA and EIS), CPCN and CA applications, FAA permits, preliminary engineering design, Phase I site assessments, property surveys, erosion control plans, geospatial information analysis and management, and post-construction compliance. I also have management experience with contractors, utilities, regulatory agencies and energy developers that has provided me with a broad understanding of the processes and requirements necessary for the successful development, monitoring and post-construction compliance of energy projects. A copy of my curriculum vitae is provided as Exhibit 1.

Q. What is Stantec's role with respect to the Deuel Harvest North Wind Farm ("Project")?

A. Stantec was retained by Deuel Harvest Wind Energy LLC ("Deuel Harvest") to conduct a shadow flicker study for the Project. I conducted shadow flicker modeling for the Project's proposed layout and prepared the associated shadow flicker analysis, which is provided in Appendix F of the Project's Application for Facility Permits ("Application").

II. OVERVIEW

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to discuss the methodology and the results of the shadow flicker modeling conducted for the Project.

Q. Please identify which sections of the Application you are sponsoring for the record.

A. I am sponsoring the following sections of the Application:

- Section 15.5: Shadow Flicker
- Appendix F: Shadow Flicker Study

III. SHADOW FLICKER AND APPLICABLE STANDARDS

Q. Could you please explain what shadow flicker is?

A. Yes. Shadow flicker is a term used to describe the intermittent change in the intensity of light cast on an area resulting from the rotation of an operating wind turbine's blades. When the wind turbine blades rotate and pass in front of the sun, a flickering or flashing effect may occur when the shadows of the rotating blades cause alternating changes in light intensity at a given stationary location, a receptor, such as the window of a home.

Shadow flicker occurs only under very specific conditions. For example, shadow flicker only occurs during the day-time, when skies are not overcast or cloudy. Turbines must be operational, as the flicker effect is caused by rotation of the blades as they intercept the sunlight cast on a receptor. When a turbine is not operating, it may cast a stationary shadow, similar to the shadow cast by other objects such as trees or utility poles. Shadow flicker does not occur when the sun-angle is less than three degrees above the horizon, due to atmospheric diffusion.

The presence and intensity of shadow flicker are dependent on many factors, including but not limited to the position of the sun in relation to the turbine and receptor, distance of receptor from turbine, physical characteristics of the turbine and blades, time of day, season of year and topography of the Project area. The amount of shadow flicker received in an area is dependent on the alignment of the rotor blades in relation to the sun and receptor. Maximum shadow flicker is received when both the sun and rotor plane are perpendicular to the receptor. This alignment occurs when the wind is blowing directly from a source turbine towards a receptor. At times when the wind is blowing from other directions, the shadow cast on the target receptor is diminished and the shadow flicker effect passes more quickly.

The total number of hours that turbines may cause shadow flicker is also dependent on time that the turbine is operational (i.e., blades turning). The total number of hours that turbines are able to cause shadow flicker takes into account non-operational time due to low or high wind speeds. The turbine type that Deuel Harvest proposes to use will generally operate when winds at hub-height are between 3 meters per second ("m/s") and 20 m/s.

Shadow flicker also diminishes as the distance between the source turbine and receptor increases. It is generally accepted that between a distance of approximately 10 times the rotor diameter and 1,500 meters (4,921 feet), the flicker effect is less pronounced due to dissipation and the relative ratio of the turbine blade to the sun disk area. Shadow flicker becomes nearly imperceptible beyond approximately 1,500 meters (4,921 feet).

Q. Are you aware of any federal, state, or local shadow flicker regulations for wind energy facilities located in South Dakota?

A. Shadow flicker is not currently regulated in applicable state or federal law. However, Deuel County's Zoning Ordinance limits shadow flicker from wind turbines.

Q. Please describe Deuel County's shadow flicker requirement for wind energy facilities to be located in that county.

A. Pursuant to Section 1215 of Deuel County's Zoning Ordinance, shadow flicker at permanent residential dwellings may not exceed 30 hours annually.

IV. SHADOW FLICKER ANALYSIS

Q. Was the Shadow Flicker Study provided as Appendix F to the Application prepared by you or under your supervision and control?

A. Yes.

Q. What was the purpose of the shadow flicker modeling and analysis discussed in the Shadow Flicker Study?

A. The purpose of the Shadow Flicker Study was to estimate the potential annual frequency of shadow flicker associated with the operation of the Project wind turbines and to assess compliance with the shadow requirements of the Deuel County Zoning Ordinance.

Modeling was completed for the two turbine models proposed by Deuel Harvest: General Electric ("GE") 2.82-127 (2.8 megawatt ("MW")) and GE 2.3-116 (2.3 MW). The modeling was completed assuming 111 GE 2.82-127 turbines and 13 GE 2.3-116 turbines. Although up to 112 turbines are expected to be installed, modeling was conducted at all 124 potential turbine locations of the proposed configuration to ensure that any location selected has been considered in the shadow flicker analysis and represented in the results of such analysis. Modeling was done to assess shadow flicker durations at 231 potential receptors (i.e., inhabited residences) located within approximately 1.25 miles of representative turbine locations.

Q. Could you provide an overview of the methodology used in conducting the shadow flicker modeling?

A. I used WindPRO's Version 3.1 Shadow Module software to predict the expected amount of shadow flicker. WindPRO is an industry-accepted modeling program that calculates the number of hours per year that any given receptor will receive shadow flicker from the source turbines. The results provided by WindPRO include the number of annual hours that shadow flicker is expected to occur at each receptor, given the climatological conditions of the area. Climatological information was acquired from the National Climatic Data Center regional meteorological stations.

The WindPRO software considers the attributes and positions of the wind turbines in relation to receptors within the area. The shadow flicker calculation also considers the percentage of sunshine based on local regional sunshine statistics; the alignment of the blades in relation to the receptor due to wind direction; and the amount of time that the blades would not be rotating due to wind speeds outside of the turbines operating parameters. The percentage of sunshine probability was estimated from an analysis of average sunshine statistics for the Huron, South Dakota weather station. The modeling used a 90 percent operational-time, based on available Project-specific wind data, for purposes of calculating the potential expected hours of shadow flicker. Wind data was acquired at on-site meteorological towers.

The modeling was completed for two different turbine models, the GE 2.82-127 and the GE 2.3-116, assuming 111 GE 2.82-127 turbines and 13 GE 2.3-116 turbines. The GE 2.82-127 turbines were modeled with an 88.6-meter (290-foot) hub height and a rotor diameter of 127 meters (416 feet). The GE 2.3-116 turbines were modeled with an 80-meter (262-foot) hub height and a 116-meter (380.6-foot) rotor diameter. The model input parameters include inhabited, permanent residences within approximately 1.25 miles (approximately 2,000 meters) of representative turbine locations.

Q. What assumptions were included in your model?

A. The modeling was performed using a conservative approach with Project site-specific conditions. For example, the model utilizes a “greenhouse” approach which defines each receptor as a one meter glass cube, representing a window able to receive shadow from all directions. This means that each receptor was modeled as having windows on all sides and effectively causing the home to be susceptible to flicker effects in all directions. The model also accounts for topography.

Obstacles located between a receptor and a turbine, such as vegetation or buildings, may reduce or eliminate the duration and/or intensity of shadow flicker. Our analyses were performed using conservative model inputs and do not include the blocking of shadow flicker due to vegetation or other obstacles. Obstacles such as barns, garages or silos may further reduce the effect of shadow flicker on an individual receptor.

Shadow flicker is widely considered imperceptible beyond 1,500 meters (4,921 feet), which is less than the 1.25-mile (approximately 2,000-meter) study distance used in the model. Further, the model conservatively analyzed the impact at all distances when more than 20 percent of the sun would be covered by a turbine blade.

Further, the results discussed in the Shadow Flicker Study assume that wind turbines at all 124 potential turbine locations are operational. However, Deuel Harvest is proposing to construct 112 of the 124 sites included in the model; therefore, the overall expected shadow from the final 112-turbine Project will be less than the predicted shadow flicker of 124 turbines summarized in the Shadow Flicker Study.

Q. Could you summarize the results of the shadow flicker modeling?

A. The majority of residences within the area of analysis are expected to receive between 0 and 10 hours of shadow flicker each year. Of the 231 potential receptors analyzed, none is expected to receive more than 30 shadow hours annually. The expected hours of shadow on many receptors will be less than predicted, as not all the potential turbines will be constructed. Due to the conservative approach of the analysis, the actual duration and intensity of shadow flicker experienced at each receptor is expected to be less than those reported in the Shadow Flicker Study.

Q. Based on the results of the shadow flicker analysis set forth in the Study, will the Project comply with the Deuel County shadow flicker limit?

A. Yes, even using the conservative modeling methodology described above, the Project is not projected to result in shadow flicker levels above 30 hours per year at any residential inhabited building. Therefore, the Project will comply with the Deuel County ordinance.

V. CONCLUSION

Q. Does this conclude your direct testimony?

A. Yes.

Dated this 30th day of November, 2018.

JoAnne Blank

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