Exhibit A6

BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF SOUTH DAKOTA

IN THE MATTER OF THE APPLICATION OF DAKOTA RANGE I, LLC AND DAKOTA RANGE II, LLC FOR AN ENERGY FACILITY PERMIT TO CONSTRUCT A WIND ENERGY FACILITY

SD PUC DOCKET EL-18-003

PREFILED REBUTTAL TESTIMONY OF ROBERT O'NEAL ON BEHALF OF DAKOTA RANGE I, LLC AND DAKOTA RANGE II, LLC

May 21, 2018

I. INTRODUCTION

Q. Please state your name.

A. My name is Robert O'Neal.

Q. Did you provide Direct Testimony in this Docket on January 24, 2018?

A. Yes.

Q. What is the purpose of your Rebuttal Testimony?

A. The purpose of my Rebuttal Testimony is to respond Jon Thurber's testimony related to shadow flicker submitted on behalf of the South Dakota Public Utilities Commission Staff ("Staff"). I will also respond to the testimony of David Hessler regarding sound, also submitted on behalf of Staff.

Q. Do you have any updates to your Direct Testimony?

A. No.

II. RESPONSE TO TESTIMONY OF JON THURBER

Q. Are you familiar with the commitment related to shadow flicker proposed by Dakota Range that Mr. Thurber discusses in his testimony?

A. Yes. As Mr. Thurber notes in his testimony, I understand that Dakota Range stated in a data request response that it "would agree to a permit condition that requires Dakota Range to take reasonable steps to mitigate shadow flicker concerns at the 11 residences that could experience shadow flicker levels above 30 hours per year."

Q. Staff requests that Dakota Range commit to mitigating shadow flicker for any residence that experiences shadow flicker in excess of 30 hours per year, based on actual operation. Is it your understanding that Dakota Range is willing to make such a commitment?

A. Yes.

Q. Are the anticipated shadow flicker level results shown in Epsilon's analysis conservative?

A. Yes. The calculations assume a "bare earth" scenario. This means no trees or vegetation were assumed which, if present, could reduce or eliminate shadow flicker at a location. In addition, the "greenhouse mode" for receptors was selected which means the calculations assumed a window faced the wind turbines on every side of the house. This may or may not be true depending on individual home construction.

The calculation distance of potential shadow flicker is also conservative. In the United States, shadow flicker is commonly evaluated out to a distance of ten times the rotor diameter. At Dakota Range, ten times the rotor diameter is 1,360 meters (4,462 feet). Our modeling used 1.25 miles (6,600 feet). This is conservative because the shadows become more diffuse as distance from the wind turbine increases.

Q. Mr. Thurber testified that Staff "is interested in putting greater definition around reasonable steps by the Company providing other acceptable mitigation measures for shadow flicker." Please describe the types of mitigation measures typically employed in response to shadow flicker.

A. If shadow flicker from a wind turbine is a concern at a residence, often outdoor plantings are offered on the affected side of the house. These would be non-deciduous trees high enough to block the flicker. In addition, window blinds, shades or curtains can be offered so the homeowner can close them during the brief periods of flicker.

Q. With respect to shadow flicker mitigation, would you expect that appropriate and effective mitigation measures may vary by property?

A. Yes. Using the examples discussed above, some homeowners prefer shades/blinds/curtains while others want plantings, and some prefer both. Typically

the wind turbine owner will work with each potentially affected homeowner to customize a solution that fits their preferences.

III. RESPONSE TO TESTIMONY OF DAVID HESSLER

Q. What is your overall response to Mr. Hessler's testimony?

A. I have reviewed Mr. Hessler's Direct Testimony in this case dated May 4, 2018. Mr. Hessler concludes that Epsilon Associates' analysis was satisfactory and consistent with good industry practice (see p. 3, ln. 11-12). He also agrees with our conclusion that the Project would meet the sound level standards required by Grant and Codington Counties (see p. 8, ln. 19-21). However, Mr. Hessler also goes beyond evaluating the objective noise standards of Grant and Codington Counties and, instead, focuses on potential subjective reactions to and perception of individuals to the sound produced by wind turbines. I do not agree that evaluating potential subjective reactions of individuals is appropriate when determining whether the Project will meet applicable noise standards.

Q. Mr. Hessler critiques your analysis for not "assessing or addressing in any way the potential for an adverse community reaction to project noise." Do you agree with this criticism?

A. No. Mr. Hessler is correct that my analysis did not assess the "potential for adverse community reaction," but I do not agree that it should have done so. Epsilon Associates' analysis modeled the Project's anticipated sound level to determine whether the Project will comply with Grant County's noise limit of 50 dBA, average A-weighted sound pressure at the perimeter of the principal and accessory structures of off-site residences, businesses, and government buildings, and Codington County's noise limit of 50 dBA, average A-weighted sound pressure at the property line of off-site residences, businesses, and government buildings. Thus, Epsilon Associates conducted an objective, scientifically-based analysis to determine compliance with both Counties' noise standards. In contrast, a community's reaction to sound is partly subjective and is based on factors other than

the sound level actually produced by wind turbines. Thus, a community's potential subjective reaction is not and should not be the applicable standard for this Project.

Q. Please explain further the difficulties in basing sound limits on potential community reactions.

A. Determining an appropriate sound level requirement based on potential community perception is extremely difficult to assess scientifically, and will vary from community to community. A person's perception of sound is based on a number of factors other than the actual sound level produced. Specifically, several recent studies found that a person's annoyance with a wind project's sound is related to visual appearance, perceived fairness in the permitting process, age, prior support or opposition to a wind project, personal financial benefit from a wind project, and reported noise sensitivity of the individual.[1][2][3] As such, the objectively measured sound level is just one of multiple factors that can impact an individual's reaction to a project, and it is not actually the strongest factor of those I referenced in the studies.

Q. How does Mr. Hessler's suggested 45 dBA sound level relate to the modeling you completed to determine if the Project will meet the Counties' 50 dBA standards?

Q. I understand that the 45 dBA level that Mr. Hessler proposes does not take into account some of the conservativeness factored into Epsilon Associates' modeling for

[1] *Response to noise from modern wind farms in The Netherlands,* E. Pedersen et al, J. Acoust. Soc. Am. 126(2), August 2009.

[2] *Exposure to wind turbine noise: Perceptual responses and reported health effects,* D. Michaud et al, J. Acoust. Soc. Am. 139(3), March 2016.

[3] *Personal and situational variables associated with wind turbine noise annoyance,* D. Michaud et al, J. Acoust. Soc. Am. 139(3), March 2016.

the Project. There are three main differences between Mr. Hessler's proposed 45 dBA standard and the sound levels modeled by Epsilon:

(1) **Long-Term Average vs. Hourly Average**: Mr. Hessler's proposed 45 dBA limit is a long-term-average sound level. This means that it is an average level of sound measured over a certain period of time, during which the sound level may vary, but the median sound level during that period must not exceed 45 dBA. In contrast, our modeling predicted sound levels over a one-hour period. Given the shorter time period, Epsilon identified anticipated maximum hourly average sound levels that would be higher than long-term average sound levels.

(2) **Uncertainty Factor**: Epsilon Associates included the turbine manufacturers' 2 dBA uncertainty factor, which is a recommendation that 2 dBA be added to a turbine model's projected sound level to account for potential uncertainty in the actual sound level the turbine will produce. In contrast, to predict the long-term average in the manner Mr. Hessler proposes), the modeling would not include this 2 dBA uncertainty factor.

(3) **Operational/Downwind Assumptions**: Epsilon Associates assumed that all turbines were operating at peak output all the time and that all receivers were downwind (per ISO 9613-2) all the time. Since this could not actually physically occur, conservativeness is built into the model. In contrast, Mr. Hessler's 45 dBA is based on sound measurements at actual wind farms, at which all turbines may not have been operating, and where the points of measurement were not always downwind. Thus, it is not as conservative as Epsilon's modeling.

Overall, considering these differences, Epsilon Associates' modeled sound levels for the Project are likely between 3 and 6 dBA more conservative than the 45 dBA standard recommended in Mr. Hessler's testimony. More simply, if Epsilon had

used Mr. Hessler's long-term average sound modeling approach, we would have modeled sound levels for the Project that would be less than the sound levels presented by Epsilon in the Application. For example, if Epsilon's modeling showed a maximum hourly sound level of 44 dBA at a given receptor, that same receptor may have a sound level of between 38 dBA and 41 dBA under Mr. Hessler's modeling assumptions. Because of the differences in the modeling assumptions, Mr. Hessler's recommendation should not be directly applied to Epsilon Associates' modeled maximum hourly sound levels for the Project.

Q. On page 9 of his testimony, Mr. Hessler recommends a permit condition related to noise for the Commission's consideration. What is your response to Mr. Hessler's recommended condition?

A. After Mr. Hessler's testimony was filed in this docket, I understand that Mr. Hessler agreed to a different noise-related condition in the Crocker Wind Farm proceeding (EL 17-055). In that proceeding, Mr. Hessler agreed that the following condition was appropriate:

> The Project, exclusive of all unrelated background noise, shall not generate a long-term average sound pressure level (equivalent continuous sound level, Leq), as measured over a period of at least two weeks that includes all integer wind speeds from cut in to full power, of more than 45 dBA at any non-participating residence or more than 50 dBA at any participating residence. The Applicant shall, upon Commission formal request, conduct field surveys or provide post-construction monitoring data verifying compliance with specified noise level limits. If the long-term average level exceeds 45 dBA at any non-participating residence or 50 dBA at any participating residence, then the Project Owner shall take whatever steps are necessary to rectify the situation. Sound monitoring will not be repeated in a representative area during any five year period unless operational or maintenance changes result in a reasonable assumption of higher turbine sound levels.

I think this is generally a reasonable condition. However, I would add the following clarifications (shown in bold and underlined text below) to ensure the measurements align with American National Standards Institute ("ANSI") methods, proper sound

measurement data are collected, the testing request process is not abused, and any post-measurement response is reasonable:

> The Project, exclusive of all unrelated background noise, shall not generate a long-term average sound pressure level (equivalent continuous sound level, Leq), as measured over a period of at least two weeks that includes all integer wind speeds from cut in to full power, of more than 45 dBA **within 25 feet of** ~~at~~ any non-participating residence or more than 50 dBA **within 25 feet of** ~~at~~ any participating residence. The Applicant shall, upon Commission formal request, conduct field surveys or provide post-construction monitoring data verifying compliance with specified noise level limits **using applicable American National Standards Institute (ANSI) methods. The formal request shall only be levied in the instance of a verifiable concern within 0.5 miles of the nearest wind turbine generator.** If the long-term average level exceeds 45 dBA at any non-participating residence or 50 dBA at any participating residence, then the Project Owner shall take whatever steps are **reasonably** necessary **and in accordance with prudent operating standards** to rectify the situation. Sound monitoring will not be repeated in a representative area during any five year period unless operational or maintenance changes result in a reasonable assumption of higher turbine sound levels.

Q. Based on your modeling, will the Project meet the sound limits in Dakota Range's proposed condition?

A. Yes. The highest one-hour modeled sound level at a participating residence is 45 dBA (Grant County), while the highest one-hour modeled sound level at a non-participating residence is 44 dBA (Grant County). Using the adjustments to take a modeled one-hour sound level (modeled by Epsilon Associates) to the long-term sound limit described above (as recommended by Mr. Hessler) would lower the 45 dBA level at a participating residence to 39-42 dBA. This is well below the 50 dBA limit in Dakota Range's proposed condition. Similarly, using the same adjustments to take a modeled one-hour sound level to the long-term sound limit described above would lower the 44 dBA level at a non-participating residence to 38-41 dBA, which is also well below the 45 dBA limit in Dakota Range's proposed condition.

Q. Are you familiar with the work of Australian acoustician Steven Cooper, as referenced by Mr. Hessler?

A. Yes. Mr. Hessler references a paper authored by Mr. Steven Cooper of The Acoustics Group in Australia. Mr. Cooper was the lead investigator of a sound level measurement study at the Cape Bridgewater Wind Farm near Victoria, Australia, which, among other things, sought to measure infrasound and low frequency sound.

Q. What is your opinion of Mr. Cooper's study?

A. In my opinion, the study did not use scientifically verifiable methods. It is also not peer-reviewed, and, in my experience in this profession, the study is not reliable. More specifically, there were several problems with the methodology of the study. First, the Cooper study was performed at three residences whose occupants had been complaining about noise from the wind farm. No other locations were tested, and no other individuals participated. Second, while various levels of broadband, low frequency, and infrasound were measured at the three residences, comparable levels of the same sound energy were also measured at many of the other residences in the vicinity of the wind farm that were not part of this study (presumably because the residents in these homes did not complain of wind turbine noise). Notably, the participants in the study indicated complaints both when the wind farm was operating and when it was not operating. This observation raises significant questions about the validity of their noise complaints.

Q. Do you agree with Mr. Hessler's analysis of Mr. Cooper's study?

A. No. The Cooper paper referenced by Mr. Hessler presents results of a lab test where some people noted complaints related to infrasound. However, this paper does not provide any evidence or link to adverse health effects from infrasound or low frequency sound, a point confirmed by many other health experts.[4] In addition,

[4] McCunney, Robert J., K. Mundt, W. D. Colby, R. Dobie, K. Kaliski, and M. Blais. "Wind Turbines and Health: A Critical Review of the Scientific Literature." Journal of Occupational and Environmental Medicine **56** (11), November 2014.

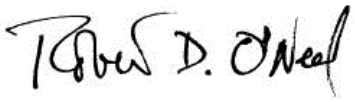
as I explained previously, the study is not reliable because of its significant methodological flaws, as well as the fact that its participants noted complaints when the wind farm was not operational.

IV. CONCLUSION

Q. Does this conclude your Rebuttal Testimony?

A. Yes.

Dated this 21st day of May, 2018.



Robert O'Neal