

**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 EL18-053

**PRE-FILED REBUTTAL TESTIMONY OF DR. JEFFREY ELLENBOGEN
ON BEHALF OF DEUEL HARVEST WIND ENERGY LLC**

April 1, 2019

1 **I. INTRODUCTION**

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3 **Q. Please state your name.**

4 A. My name is Jeffrey Ellenbogen.

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6 **Q. Have you previously provided testimony in this docket?**

7 A. Yes. I provided Supplemental Testimony on February 14, 2019.

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9 **II. PURPOSE OF TESTIMONY**

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11 **Q. What is the purpose of your Rebuttal Testimony?**

12 A. The purpose of my Rebuttal Testimony is to respond to the testimony of Jon Thurber
13 on behalf of the South Dakota Public Utilities Commission Staff (“Commission Staff”)
14 and intervenor Christina Kilby concerning wind turbines and health.

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16 **Q. What exhibits are attached to your Rebuttal Testimony?**

17 A. The following exhibits are attached to my Rebuttal Testimony:

- 18 • Exhibit 1: Moller M, Pedersen CS. Hearing at Low and Infrasonic
19 Frequencies. Noise and Health. 2004
- 20 • Exhibit 2: Figure 9 of Moller M, Pedersen CS. Hearing at Low and Infrasonic
21 Frequencies. Noise and Health. 2004
- 22 • Exhibit 3: Figure 15 of Moller M, Pedersen CS. Hearing at Low and Infrasonic
23 Frequencies. Noise and Health. 2004

24

25 This article (Exhibit 1), and the accompanying figures (Exhibits 2 and 3),
26 demonstrate the levels of energy needed for the human sensory system to detect
27 infrasound, and how this is many times higher than anything a person would
28 experience at home with respect to Deuel Harvest North Wind Farm (the “Project”).
29 This information is relevant to my response to Ms. Kilby, below.

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31 **III. RESPONSE TO THURBER**

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Q. Mr. Thurber attaches an October 13, 2017 letter from the South Dakota Department of Health (“SDDH”) to his testimony. What is your response to this letter?

A. The letter is written by the Secretary of Health of South Dakota in 2017 and is addressed to Commission Staff. The purpose of this letter from the Secretary was “...to comment on the potential health impacts associated with wind facilities,” which I take to mean that its content is broadly applicable (i.e., not unique to Crocker Wind Farm).

Specifically, the letter goes on to acknowledge that SDDH “...has not taken a formal position on the issue of wind turbines and human health,” a statement based on “...studies reviewed to date...” The letter goes on to cite the wind-specific studies commissioned by two public health agencies, Massachusetts and Minnesota. The letter states: “[t]hese studies generally conclude that there is insufficient evidence to establish a significant risk to human health.”

As one of the authors of the Massachusetts study, I am very familiar with that document. The Secretary accurately characterized the position of that study. I would add further that, since the time of the writing of the Secretary’s letter, there is not only “insufficient evidence to establish a significant risk to human health,” but also, there is now evidence to establish that there is not a significant risk to human health.

Q. Mr. Thurber states that, since its October 13, 2017 letter, SDDH “has not become aware of any additional studies that would cause [SDDH] to re-evaluate their position.” Do you have a response?

A. Health Canada has now completed and published the work of its major study that formally investigated the potential for wind turbine noise to impact human health. This research examined multiple dimensions, including stress, sleep, and cardiovascular disease. Please refer to my pre-filed Supplemental Testimony and accompanying Exhibits 3, 4, and 5. The overall conclusion of that work is that there

63 were no positive associations between wind turbine noise and health outcomes. In
64 my opinion, these study results would support SDDH changing its position to be
65 even more affirmative in their position that wind turbine noise does not pose a risk to
66 human health.

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68 **IV. RESPONSE TO KILBY**

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70 **Q. Have you reviewed the testimony filed by Christina Kilby?**

71 A. Yes, and I will respond to some of her assertions in more detail below. As a general
72 matter, it does not appear that Ms. Kilby acknowledges the Supplemental Testimony
73 I submitted on February 14, 2019. My Supplemental Testimony already provides
74 responsive and more updated information regarding the issues raised by Ms. Kilby.
75 Overall, as I will discuss in more detail below, the current state of the science on
76 wind turbines and human health does, in fact, shows that wind turbines are not
77 associated with adverse health effects.

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79 **Q. On page 3 of her testimony, Ms. Kilby states, “[t]here has been no evidence 80 presented proving wind turbines do not cause harm to animals and people. 81 According to the Massachusetts Study, ‘Evidence regarding wind turbine 82 noise and human health is limited.’” Do you agree with this characterization?**

83 A. No. As discussed above and in my Supplemental Testimony, there has been
84 substantial study work completed since the Massachusetts Study, and this work
85 demonstrates no negative health outcomes associated with wind turbines.

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87 **Q. On page 3 of her testimony, Ms. Kilby states, “I believe in addition to any 88 physical affects from the unique sound of wind turbines, or physical effects or 89 symptoms from infrasound, continued annoyance will result in negative health 90 effects, possibly from stress or sleep problems.” What is your response?**

91 A. At the levels produced by wind turbines, it is my professional opinion that there are
92 no “physical effects or symptoms from infrasound.” Please see Exhibits 1, 2, and 3.
93 Further, regarding the concern of annoyance resulting in negative health effects, the

94 Health Canada study addressed these elements directly. The Health Canada study
95 did show an increase in annoyance that correlated with wind turbine noise, but there
96 was not a correlation between wind turbine noise and any measure of health effects,
97 including stress or sleep difficulty. Thus, in that instance, annoyance did not result in
98 negative health effects.

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100 **Q. Ms. Kilby attaches an article titled “Wind Turbine Noise and Sleep: Pilot**
101 **Studies on the Influence of Noise Characteristics” to her testimony (the “Noise**
102 **Characteristics Article”). Have you reviewed this article?**

103 A. Yes. There are serious methodological flaws that undermine its relevance in this
104 proceeding for the following reasons.

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106 First, the authors of this study were not physicians, and none had extensive training
107 or expertise in brain sciences including sleep.

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109 Second, the experiments were trivial in size: including only six participants, one of
110 whom had some or all of his/her data excluded from analysis. (By comparison,
111 Health Canada examined over 1,200 people.) The authors of this article state that
112 the study was “...conducted with the intention to guide the design and
113 implementation of a larger-scale main study,” and it “...was not hypothesis
114 testing...” In other words, the authors themselves acknowledge that the findings are
115 too small and too rudimentary to have value in an applied setting (such as this
116 proceeding). Rather, the findings were intended only to be used to gain experience
117 and information in how to conduct a proper study.

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119 Third, the study examined people in synthetic laboratory environments in which “the
120 background level [of sound] was unnaturally low (<13 dB LAEq)” and “the levels [of
121 wind turbine noise used in the study] were selected to represent worst-case
122 conditions....” Testing the effects of noise from turbines in this context is like testing
123 the brakes of a car on an oil-slicked road – the lab conditions are unrealistic and
124 distort any potential finding. Finally, all participants in the study “...were classed as

125 being noise sensitive....,” meaning, the study participants were chosen based on
126 their tendency toward being likely to awaken from any noise. This kind of selection is
127 referred to by researchers, epidemiologists and statisticians as “biased,” which is a
128 major flaw in scientific validity.

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130 To summarize, the study was performed by people who were not experts in sleep,
131 the population studied was biased, the study conditions were distorted and
132 exaggerated, and the sample size was too trivial to be anything other than a pilot
133 study. The authors themselves acknowledge that “...the findings should not be taken
134 as clear evidence of sleep disturbance due to WTN [wind turbine noise].” These
135 facts are counter to other substantive studies, including Health Canada, that showed
136 no relationship between wind turbine noise and sleep disturbance. In short, this pilot
137 study in no way informs a serious discussion regarding wind turbines and sleep. Any
138 use of it to that effect is a distortion of the authors’ intent and a misrepresentation of
139 medical science.

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141 **Q. On page 4 of her testimony, Ms. Kilby states, “just saying something has not**
142 **been proven is not the same as proving it is not true. . . . Several studies that**
143 **have been done conclude that more research needs to be done.” What is your**
144 **response?**

145 A. More recent work has been done concerning the potential relationship between wind
146 turbine noise and human health outcomes. These findings are reassuring in that
147 they provide evidence that wind turbine noise at the levels studied do not cause any
148 known health effect. These studies were already discussed in my Supplemental
149 Testimony and accompanying exhibits.

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151 **Q. On page 4 of her testimony, Ms. Kilby states, “I believe there is some evidence**
152 **supporting that people can perceive infrasound and be extremely bothered by**
153 **it.” Do you agree?**

154 A. I am not aware of any reliable study demonstrating that humans can perceive
155 infrasound from wind turbines – let alone be extremely bothered by it – at the levels

156 we are discussing with respect to wind turbines. The levels of infrasound produced
157 by wind turbines are well below audible thresholds for perception. See Exhibits 1, 2,
158 and 3, attached, which show that for infrasound to be even slightly perceived, it
159 needs to be several times the noise levels that we are discussing here with respect
160 to wind turbines.

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162 **Q. Ms. Kilby attaches an article titled “Altered cortical and subcortical**
163 **connectivity due to infrasound administered near the hearing threshold –**
164 **Evidence from fMRI” to her testimony (the “Cortical Article”). Have you**
165 **reviewed this article?**

166 A. Yes.

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168 **Q. What is your response to the Cortical Article?**

169 A. It is an article of very limited value for the following four reasons. First, it was not a
170 study of noise produced by wind turbines or people living near them, so it has little
171 relevance. Second, the authors claim that they demonstrate the brain’s capacity to
172 respond to infrasound, even below the hearing threshold. But the experiment used
173 only 2 dB below the hearing threshold, which is within the margin of error of that
174 threshold, making their claim unsupported. Third, the levels of noise produced in all
175 aspects of this experiment (77 to 94.5 dB at 12 Hz) were orders of magnitude higher
176 than levels we are discussing with respect to wind turbines, so it cannot reasonably
177 be applied to the facts at issue. Ms. Kilby introduced a document in her pre-filed
178 testimony that readily demonstrates this point. (See her Exhibit 2, figure on page 6.)
179 Fourth, there are a number of methodological and statistical concerns I have about
180 the experiment itself. For instance, I find it hard to believe that any noise study could
181 be conducted in an MRI, which itself is incredible noisy; and, a study of only 14
182 people usually has limited validity.

183

184 **Q. On page 5 of her testimony, Ms. Kilby quotes from “Wind Turbine Health**
185 **Impact Study: Report of Independent Expert Panel, January 2012.” Please**
186 **provide context for this quotation.**

187 A. This statement (which I co-authored) was intended to be supportive of any ongoing
188 efforts to further characterize potential relationships between wind turbine noise and
189 human health. At the time of the writing of that statement (in 2012), based on the
190 research I reviewed at that time, I did not expect any such relationships would be
191 found, but I wanted to be supportive of ongoing research. I felt it would be a
192 welcome addition to the public discussion regarding safety. Since that time, scientific
193 studies have provided the key evidence I would have needed to be more definitive in
194 our panel's statements in 2012. Please see my Supplemental Testimony.

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196 **Q. With respect to infrasound, on page 6 of her testimony, Ms. Kilby states, “[i]t**
197 **appears the panel did not have enough information on infrasound and low**
198 **frequency noise to make any conclusion. . . .” Have there been additional**
199 **studies since that time that provide relevant information?**

200 Yes. Health Canada studied potential health effects from noise produced by wind
201 turbines. It presented the data in dB(A). Because infrasound and dB(A) are linked
202 together, studying one is studying the other. As such, the Health Canada study
203 provides the information Ms. Kilby asserts was missing, and the Health Canada
204 study showed no association between wind turbines and human health, as I have
205 discussed above.

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207 **V. CONCLUSION**

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209 **Q. Does this conclude your Rebuttal Testimony?**

210 A. Yes.

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212 Dated this 1st day of April, 2019.

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214



215 Dr. Jeffrey Ellenbogen