

**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 SUPPLEMENTAL DIRECT TESTIMONY OF JACOB BAKER  
ON BEHALF OF DEUEL HARVEST WIND ENERGY LLC**

February 14, 2019

1 **I. INTRODUCTION**

2

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

4 A. My name is Jacob Baker. I am Director of Operations and Maintenance,  
5 Renewables, at Invenergy LLC (“Invenergy”). My business address is 2192 East  
6 25th Road, Marseilles, Illinois.

7

8 **Q. Please describe your educational and professional background.**

9 A. I have been with Invenergy since 2008 and have worked in renewable energy for  
10 more than a decade. While my current role focuses on our solar and battery storage  
11 operations and maintenance, I have more than 13 years of experience with site  
12 operations and maintenance of wind energy facilities, 10 years of which are with  
13 Invenergy. My areas of site operations responsibility for wind farms included  
14 Wisconsin, Illinois, Michigan, Nebraska, Illinois, New York, Quebec, Canada and  
15 Ontario, Canada. I have a Bachelor of Science in Industrial Engineering from Illinois  
16 State University. My resume is attached as Exhibit 1.

17

18 **Q. Did you provide Direct Testimony in this docket on October 26, 2018?**

19 A. No.

20

21 **II. PURPOSE OF TESTIMONY**

22

23 **Q. What is the purpose of your Supplemental Direct Testimony?**

24 A. The purpose of my Supplemental Direct Testimony is to provide additional  
25 information regarding the Project’s design and Project operations as they relate to  
26 the risk of ice throw.

27

28 **Q. What exhibits are attached to your Supplemental Direct Testimony?**

29 A. The following exhibit is attached to my Supplemental Direct Testimony:

- 30
  - Exhibit 1: Resume.

31

32 **III. ICE THROW**

33

34 **Q. Are you familiar with the issue of icing on wind turbine blades?**

35 A. Yes, I am aware that icing on wind turbine blades is sometimes raised as an issue  
36 with respect to wind projects. Specifically, concerns are raised regarding ice  
37 shedding, which is when ice that has built up on blades falls from the blades.

38

39 **Q. Is icing a common occurrence on wind turbines?**

40 A. Icing can occur on blades. The concern that arises is ice shedding that can occur  
41 once ice accumulates. Ice shedding is not common and is generally controlled by  
42 ice detection systems on the turbines.

43

44 **Q. What causes icing on wind turbine blades?**

45 A. Turbines experience icing during conditions of freezing rain – this occurs as  
46 temperatures are dropping down to and below freezing, and moisture is falling.

47

48 **Q. How will icing on the wind turbine blades be detected for the Deuel Harvest  
49 North Wind Farm?**

50 A. The Project has been designed to minimize the risk of ice throw. The turbines  
51 utilized for the Project are equipped with software to monitor for situations when the  
52 ambient temperatures are below 3°C (37.4°F) and when there are deviations in the  
53 turbine's standard power curve greater than established thresholds. Wind turbines  
54 function by having blades with airfoil cross-sections. This means that the wind  
55 blowing across the blades generates lift, which causes rotation of the rotor and this  
56 rotation is channeled into a generator to generate electricity. Each turbine model has  
57 a power curve, or a rated amount of power production for a given wind speed. If ice  
58 were to accumulate on blades, it would change the profile of the blades, potentially  
59 decreasing the amount of lift they can generate for a given windspeed. This potential  
60 mis-match is what would cause turbine shutdowns during icing conditions. In  
61 addition to this software, Deuel Harvest will use meteorological data from onsite  
62 permanent meteorological towers, on-site anemometers, and other relevant

63 meteorological sources to determine if ice accumulation is occurring. These control  
64 systems would either automatically shut down the turbine(s) in icing conditions (per  
65 the sensors), or Deuel Harvest would manually shut down turbine(s) if icing  
66 conditions are identified (using meteorological data). Turbines would not return to  
67 normal operation until the control systems indicate icing is no longer a concern.

68  
69 These mechanical and software safeguards, in addition to turbine setbacks, mitigate  
70 the potential hazard associated with ice throw, and minimize the potential that ice  
71 shed from turbine blades could reach public roads and residences. Ice throw is not  
72 expected to be a hazard for the Project. The measures to be employed for the  
73 Project are consistent with measures approved by the Commission in prior wind  
74 project dockets.<sup>1</sup>

75  
76 **Q. Please discuss the risk of ice throw.**

77 A. It is very rare, and there are methods to minimize and prevent ice throw. Typically,  
78 ice is shed from (i.e., falls in close proximity to) a turbine. The Project will be set  
79 back at least 550 feet (1.1 times the tip height of the tallest proposed turbine)<sup>2</sup> from

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<sup>1</sup> See *In the Matter of the Application by Prevailing Wind Park, LLC for a Permit of a Wind Energy Facility in Bon Homme County, Charles Mix County and Hutchinson County, South Dakota, for the Prevailing Wind Park Project*, Docket No. EL 18-026, Final Decision and Order Granting Permit to Construct Facilities and Notice of Entry, Condition No. 38 (Nov. 28, 2018); see also *In the Matter of the Application of Dakota Range I, LLC and Dakota Range II, LLC for a Permit of a Wind Energy Facility in Grant County and Codington County, South Dakota, for the Dakota Range Wind Project*, Docket No. EL 18-003, Final Decision and Order Granting Permit to Construct Wind Energy Facility; Notice of Entry, Condition No. 40 (July 23, 2018).

<sup>2</sup> Following are the specifications for the two proposed turbines:

Manufacturer	Turbine Name	Hub Height	Rotor Diameter	Tip Height	MW Rating
General Electric (GE)	GE 2.3-116	80 m (263 ft)	116 m (381 ft)	138 m (452 ft)	2.3
General Electric	GE 2.82-127	88.6 m (291 ft)	127 m (417 ft)	152.1 m (499 ft)	2.82

80 non-participating property lines, and roads. This distance is consistent with state  
81 standards and the manufacturer's recommendations (discussed below).

82

83 **Q. Are you aware of public comments in this proceeding regarding ice throw?**

84 A. Yes. I am aware of comments made at the January 24, 2019 public input hearing  
85 regarding an alleged ice throw incident in Minnesota. Specifically, I am aware that  
86 there were allegations that ice flung from a turbine at the Bent Tree Wind Farm in  
87 Freeborn County, Minnesota, on February 22, 2018, dented a truck 300 feet away.<sup>3</sup>  
88 However, Bent Tree Wind Farm staff investigated the events of February 22, 2018,  
89 and could not confirm that the damage to the truck resulted from an ice throw from  
90 the Bent Tree Wind Farm.<sup>4</sup> As described in a letter filed by the operator of the Bent  
91 Tree Wind Farm following a voicemail alleging the incident, the technician  
92 immediately dispatched to the site did not find any ice along the highway and did not  
93 witness any turbines shedding ice.<sup>5</sup>

94

95 The Bent Tree Wind Farm wind turbines are setback at least 250 feet from the edge  
96 of the nearest public road right-of-way in accordance with the site permit for that  
97 project and standard Minnesota Public Utilities Commission ("MPUC") practice.<sup>6</sup>

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<sup>3</sup> See *In the Matter of Freeborn Wind Energy, LLC for a Large Wind Energy Conversion System Site Permit for the 84 MW Freeborn Wind Farm in Freeborn County*, Minnesota Public Utilities Commission Docket No. IP-6946/WS-17-410, Order Issuing Site Permit and Taking Other Action at 17 (December 19, 2018), available at <https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId={A06BC867-0000-C813-98D1-BE9196003A96}&documentTitle=201812-148595-01>

<sup>4</sup> *Id.* at 18.

<sup>5</sup> *In the Matter of the Site Permit Issued to the Wisconsin Power and Light Company for the Bent Tree Project in Freeborn County*, Minnesota Public Utilities Commission Docket No. ET6657/WS-08-573, Letter by Wisconsin Power & Light (February 23, 2018), available at <https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId={C0D9C461-0000-CC1B-9E19-36C0A1A7EA7D}&documentTitle=20182-140446-01>

<sup>6</sup> *In the Matter of the Site Permit Issued to the Wisconsin Power and Light Company for the Bent Tree Project in Freeborn County*, Minnesota Public Utilities Commission Docket No. ET6657/WS-08-573, Site Permit for the Bent Tree Wind Project at Condition III(C)(3) (October 20, 2009), available at <https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId={1DA5766B-212D-4B4C-9408-CA7F776E4C6E}&documentTitle=200910-43044-01>

99 In a wind permitting proceeding pending before it at the time of the alleged Bent  
100 Tree Wind Farm ice throw, the MPUC considered these allegations and found them  
101 “insufficient to justify the adoption of novel policies regarding turbine setbacks or the  
102 need to monitor turbine blades for ice accumulation.”<sup>7</sup> The MPUC concluded that a  
103 250-foot setback from public road right-of-way and 1,000-foot setback from  
104 residences provide an appropriate measure of safety.<sup>8</sup> I also note that Minnesota’s  
105 250-foot setback from public roads, and 1,000-foot setback from residences are far  
106 less than those imposed by Deuel County.

107

108 **Q. Do Project setbacks provide adequate protection for ice throw?**

109 A. Yes. Project setbacks are consistent with the setbacks recommended by General  
110 Electric (“GE”) in its *Setback Considerations for Wind Turbine Siting* (attached to the  
111 Application as Appendix V). Specifically, when considering the risk of ice throw, GE  
112 recommends a setback of 1.1 times the turbine tip height from public use areas,  
113 residences, public buildings, and public roads. Deuel Harvest adhered to these  
114 setbacks in developing the layout for the Project. Turbines will be sited at least 550  
115 feet from existing roadways, at least 4 times the turbine height from non-participating  
116 residences (approximately 2,000 feet), at least 1,500 feet from participating  
117 residences, and at least 550 feet from non-participating property lines. As such, the  
118 setbacks incorporated into the layout for the Project provide more than adequate  
119 protection for ice throw.

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121 **IV. CONCLUSION**

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123 **Q. Does this conclude your Supplemental Direct Testimony?**

124 A. Yes.

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<sup>7</sup> *In the Matter of Freeborn Wind Energy, LLC for a Large Wind Energy Conversion System Site Permit for the 84 MW Freeborn Wind Farm in Freeborn County*, Minnesota Public Utilities Commission Docket No. IP-6946/WS-17-410, Order Issuing Site Permit and Taking Other Action at 18 (December 19, 2018).

<sup>8</sup> *Id.*

126 Dated this 14th day of February, 2019.

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131 Jacob Baker

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