**BEFORE THE PUBLIC UTILITIES COMMISSION**
**OF THE STATE OF SOUTH DAKOTA**

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| **IN THE MATTER OF THE APPLICATION OF SWEETLAND WIND FARM, LLC FOR FACILITY PERMITS FOR A WIND ENERGY FACILITY AND A 230-KV TRANSMISSION FACILITY IN HAND COUNTY, SOUTH DAKOTA FOR THE SWEETLAND WIND FARM PROJECT** | * * * * * * * * * * | **APPLICANT'S RESPONSES TO STAFF'S FIRST SET OF DATA REQUESTS TO APPLICANT**<br><br>**EL19-012** |

Below, please find Applicant's responses to Staffs First Set of Data Requests to Sweetland Wind Farm, LLC ("Applicant").

1-1) Provide copies of all data requests submitted by any intervenor to you in this proceeding and copies of all responses to those data requests. Provide this information to date and on an ongoing basis.

Mollie Smith: None at this time. Sweetland will provide copies of data requests from other parties, if received.

1-2) Provide copies of all pleadings in any civil appeal associated with the county permit(s) related to this project.

Mollie Smith: None.

1-3) Confirm that the setbacks accounted for section line roads, which are defined as public highways pursuant to state law.

Mark Wengierski: Yes, this statement is accurate.

1-4) Do the studies submitted with the Application, including but not limited to shadow and noise studies, account for the cumulative impact any other existing or planned project in the area?

Mark Wengierski: As stated on page 10-4 of the Application, "[t]here are no other operating energy conversion facilities, existing or under construction, or other major industrial facilities under regulation by the Commission within or adjacent to the Project Area. . . . Given the lack of energy conversion facilities in the vicinity of the Project, and the distance of existing wind energy facilities from the Project, construction and operation of the Project would not result in cumulative effects on resources, as addressed in ARSD 20:10:22:13." The closest existing wind farm is approximately 11.5 miles from the Project.

1-5) Has Applicant applied to the FAA for approval to utilize ADLS technology? Provide copies of agency communication.

Mark Wengierski: No, not at this time.

1-6) Provide a copy of the contract/land use agreement signed by landowners, as well as any contracts that differ from the standard contract.

Mark Wengierski: See Attachments 1-6(A) and 1-6(B), which are being provided confidentially. Public versions may be provided if requested.

1-7) On page 2-1 the Applicant states it offers a "good neighbor" contract, provide a sample contract.

Mark Wengierski: See Attachment 1-6(B), which has been provided confidentially. A public version may be provided if requested.

1-8) Did Applicant base its 30 hour per year shadow flicker limit on any factor other than county ordinance? If so, provide support.

Mark Wengierski: As discussed in Section 2.3, Table 9-1, and Section 15.5 of the Application, Hand County's ordinance does not include shadow flicker limits, and the Project is a permitted use in Hand County. The Applicant's Development Agreement with Hand County limits shadow flicker from Project wind turbines at currently occupied residences to 30 hours per year or less, unless waived in writing by the owner of the occupied residence. Thus, the 30 hours per year limit is established in the Development Agreement. The 30 hours per year limit is also consistent with industry standards, including limits approved by the PUC in prior dockets.

1-9) Have all four participants that may exceed the 30 hour per year shadow flicker limit signed waiver agreements? If not, when will these waiver agreements be signed?

Mark Wengierski: Sweetland has determined that it will not construct Turbine No. 43, and has confirmed that, as a result, the expected shadow flicker level at receptor 6 is below 30 hours per year. In addition, Sweetland has determined through further field verification that receptor 43 is not an occupied residence. As a result, Sweetland will only need to obtain two waivers. Sweetland plans to present the shadow flicker waiver agreements to the two participating landowners in the near future, and will address the waivers further in Supplemental Testimony.

1-10) Provide an update on any pending easements in the project area. When will these easements be signed?

Mark Wengierksi: As discussed in the letter filed on April 24, 2019, Sweetland is in the process of securing three Good Neighbor Agreements and one amendment to an existing Wind Energy Lease and Easement Agreement, as identified in the revised Figure A-2.

Sweetland expects to have the agreements finalized soon, and will address the status of the agreements further in Supplemental Testimony. Sweetland only knows of the four agreements needed for the out-lots identified in the revised Figure A-2. Sweetland continues to do title curative and plans to secure additional agreements, if needed.

1-11) What capacity factor was assumed when calculating the predicted tax revenue?

Mark Wengierski: Please see the response provided as Attachment 1-11, which is being provided confidentially.

1-12) Have any landowners waived the maximum dBA requirement? If not, when will these waiver agreements be signed?

Mark Wengierski: Based on the sound modeling analysis conducted for the Project (Appendix L to the Application), no such waivers will be needed.

1-13) For what reason did Hand County desire to have the PUC complete its process before the county issued a CUP?

Mark Wengierski: To clarify, and as stated in Section 2.3 of the Application, the Wind Farm is a permitted use in Hand County, so no CUP is required for the Wind Farm. A CUP is required only for the Project substation and switchyard. Sweetland is not aware of the specific reason that Hand County requested that those CUPs be obtained after the Commission's process.

1-14) Provide an update on when Applicant will have a pole type selected for the transmission line?

Mark Wengierski: Sweetland has not yet selected a pole type for the transmission line and will provide an update when it has done so.

1-15) Refer to Figure A-2. Confirm that “Karen Haigh” is actually “non-participating” as shown in the middle of the project area when to the south “Clinton & Karen Haigh” are listed as “participating”.

Mark Wengierski: Yes, the parcels owned by Clinton and Karen Haigh are under lease, but the parcel owned by Karen Haigh was not included in the lease agreement.

1-16) Provide a status update on the remaining 32% of the APE surveys remaining.

Mark Wengierski and Doug Shaver: The remaining cultural field surveys are anticipated to be completed by June 7, weather permitting. The report will then take a few weeks to finalize.

1-17) Refer to page 8-5 of the application. Has Sweetland picked a final O&M Facility location. If so, which location was chosen? If not, when will a final decision be made?

Mark Wengierski: Sweetland is still analyzing the location of the O&M Facility, and the final location will not be selected until after geotechnical analysis is performed. That geotechnical analysis is considered an interim action by WAPA, and Sweetland will work with WAPA to obtain approval to do such work.

1-18) Refer to page 8-6 of the application. Provide Specific location of the 4 meteorological towers.

Mark Wengierski: As with the O&M Facility, the location of the met towers for the Project is dependent upon geotechnical analysis and selection of the final turbine locations. See Response to DR 1-17.

1-19) Also, on page 8-6 of the application, provide the decision, if made, on how the company will mount each transformer either at the base of the turbine, in the nacelle, or within the tower. If a determination hasn't been made, when will Sweetland finalize that portion of the construction layout?

Mark Wengierski: Sweetland proposes to use General Electric turbines for the Project. General Electric turbines have a pad mount transformer.

1-20) Refer to page 8-13, explain when the Noxious and Invasive Weed Management Plan will be completed. If already completed, provide a copy of the plan.

Mark Wengierski: Consistent with our experience on other projects, Sweetland will have a completed Plan before the start of construction.

1-21) Refer to page 8-16, which of the two locations for the temporary laydown yard has the company chosen? If a decision has not been made, when will the company make a decision?

Mark Wengierski: The final locations of laydown yards will be made once the location of the O&M Facility is determined. See Response to DR 1-17.

1-22) Refer to page 11-9, when does Sweetland anticipate the SWPPP will be completed?

Carrie Barton: The SWPPP will be completed prior to construction; the SWPPP is related to construction activities and the SDDENR permits for which it is required, which are required before construction begins.

1-23) Refer to pages 13-9 and 13-10, provide the results for Year 2 of the Avian surveys when it becomes available.

Todd Mabee: Year 2 avian surveys are anticipated to be completed this spring, with data analysis completed and preliminary results available by late July.

1-24) Refer to page 15-4, do the NRCS Grassland Reserve program parcel easements allow wind turbines or transmission towers to be built on them while under contract with the NRCS?

Mark Wengierski: Yes, but NRCS and landowner approval is required. Sweetland will coordinate with the NRCS and landowners, as needed, to secure approval.

1-25) Refer to page 19-1, provide an updated completion dates in the chart. If completion dates have been missed or moved out explain why.

Mark Wengierski: Due to ongoing title curative work, land acquisition may extend into Q3 2019. See Response to DR 1-10.

1-26) Refer to page 27-2, when will the final design of the project be completed?

Mark Wengierski: As discussed in Section 2.6 of the Application, "[f]inal micro-siting of Project facilities will continue to occur between now and summer 2019, based on the Phase I Environmental Site Assessment; remaining wetland and waterbodies evaluations, cultural and tribal resource surveys, and geotechnical analysis; and final engineering design."

1-27) ARSD 20:10:22:11 requires that a map be filed that includes places of historical significance and transportation facilities. Provide a map showing the locations of these items or confirm that no places of historical significance or transportation facilities are located in the project area.

Carrie Barton: Roads are shown on Figures A-1 and A-5. There are no historical markers or public historical sites in the Project Area.

1-28) Refer to ARSD 20:10:22:12, provide the following:

a. The general criteria used to select alternative sites, how these criteria were measured and weighed, and reasons for selecting these criteria;

Mollie Smith and Mark Wengierski: Please refer to Sections 9.1 and 9.2 of the Application, which discuss the criteria that were considered when selecting the proposed Project site. All criteria were equally important to the decision making process, as they are the key criteria used in selecting a wind project site.

b. An evaluation of alternative sites considered by the applicant for the facility

Mollie Smith: Please refer to Sections 9.1 and 9.2 of the Application.

1-29) Refer to ARSD 20:10:22:14, provide "(8) An analysis of any constraints that may be imposed by geological characteristics on the design, construction, or operation of the proposed facility and a description of plans to offset such constraints."

Mollie Smith: Please refer to Chapter 11.0 of the Application, in particular, the first sentence of Section 11.1.2.1.

1-30) Refer to ARSD 20:10:22:15, provide the following:

a. A map drawn to scale of the plant, wind energy, or transmission site showing surface water drainage patterns before and anticipated patterns after construction of the facility;

Mollie Smith: Please see Figure A-9 in Appendix A of the Application. Additionally, as discussed in Section 12.2.2 of the Application, the Project is not anticipated to result in changes to existing drainage patterns in the Project Area.

b. A map drawn to scale locating any known surface or groundwater supplies within the siting area to be used as a water source or a direct water discharge site for the proposed facility and all offsite pipelines or channels required for water transmission;

Mark Wengierski: As discussed on page 12-7 of the Application, Sweetland's preference is to utilize Mid-Dakota Rural Water System's water distribution system, and Sweetland plans to coordinate to locate and map the network of distribution lines within the Project Area and determine if a rural water supply connection is necessary for the Project. The location of any potential connection pipe would then be determined in coordination with Mid-Dakota Rural Water System. Water resources within the Project Area are shown on Figure A-9.

c. If aquifers are to be used as a source of potable water supply or process water, specifications of the aquifers to be used and definition of their characteristics, including the capacity of the aquifer to yield water, the estimated recharge rate, and the quality of ground water;

Mark Wengierski: If the Project is able to utilize the Mid-Dakota Rural Water System, aquifers will not be used.

1-31) Refer to ARSD 20:10:22:18(1) and page 15-2 of the application. 20:10:22:18(1) requires a map noting all noise sensitive land uses and page 15-2 states that there are identified noise sensitive land uses in the project area yet the maps in appendix A do not identify where these noise sensitive locations are. Provide a map detailing the locations of each noise sensitive land use location in the project area.

Mollie Smith: The "noise sensitive land uses" are the residences identified in Figure 5-2 of Appendix L.

1-32) Refer to ARSD 20:10:22:23, provide a forecast of the impact on population, income, occupational distribution, and integration and cohesion of communities.

Mollie Smith: As described in Sections 20.1.2, 20.2.2, 20.3.2, and 20.4.2, and Chapter 21.0 of the Application, no negative impacts from the Project are anticipated to the specified items; rather, the Project is anticipated to result in positive impacts.

1-33) Refer to Appendix L of the Application, Sound Study, Figure 5-2. Has the Applicant discussed the Project with the property owners of receptors 8 and 11? If yes, please provide the following information:

Mark Wengierski: See specific responses in subsections below.

i) Have either property owners indicated any concerns regarding the sound associated with the Project?

Mark Wengierski: Sweetland has discussed the Project with the owner of Receptor 8, who did not identify any concerns. Sweetland has contacted the owner of Receptor 11, but has not received a response and is not aware of any concerns by that landowner.

ii) Have either property owners indicated any concerns regarding the shadow flicker associated with the Project?

Mark Wengierski: See Response to DR 1-33(i).

iii) Have either property owners indicated any concerns regarding the Project?

Mark Wengierski: See Response to DR 1-33(i).

iv) Did the Applicant ask these property owners to participate in the Project? If yes, please provide the reason(s) why the property owners did not elect to participate. If no, please explain why the Applicant did not ask these landowners to participate in the Project.

Mark Wengierski: No, as these residences are outside the Project Area.

1-34) Refer to Appendix L of the Application, Sound Study, Figure 5-2. Please provide a revised Figure 5-2 with turbine locations 10 and 22 utilizing the GE 2.82 – 127 LNTE turbine model. Provide the expected sound level at receptors 8 and 11 with this turbine model change. Explain any challenges or additional costs from changing the turbine model at the requested locations.

Rob O'Neal and Mark Wengierski: If turbines 10 and 22 utilized the GE 2.82 - 127 LNTE turbine model, the sound modeling results are as follows:

- Receptor 8: The modeled sound level would remain 43 dBA.
- Receptor 11: The modeled sound level would change from 42 dBA to 41 dBA.

A 1 dBA change in sound level is generally unperceivable to the human ear, and the cost per turbine to add LNTE technology would be $12,000.

1-35) Refer to Appendix L of the Application, Sound Study, Figure 5-2. Please provide a revised Figure 5-2 with turbine locations 9, 10, 21, and 22 utilizing the GE 2.82 – 127 LNTE turbine model. Provide the expected sound level at receptors 8 and 11 with this turbine model change. Explain any challenges or additional costs from changing the turbine model at the requested locations.

Rob O'Neal and Mark Wengierski: If turbines 9, 10, 21, and 22 utilized the GE 2.82 - 127 LNTE turbine model, the sound modeling results are as follows:

- Receptor 8: The modeled sound level would change from 43 dBA to 42 dBA.
- Receptor 11: The modeled sound level would change from 42 dBA to 41 dBA.

A 1 dBA change in sound level is generally unperceivable to the human ear, and the cost per turbine to add LNTE technology would be $12,000.

1-36) Refer to Appendix L of the Application, Sound Study, Figure 5-2. Please provide a revised Figure 5-2 with turbine locations 10 and 22 eliminated. Provide the expected sound level at receptors 8 and 11 with these turbine locations eliminated.

Mark Wengierski and Mollie Smith: Sweetland does not have the information requested. Such an analysis has not been completed because the sound levels at receptors 8 and 11 comply with the sound level limit specified in the Hand County Development Agreement, which is consistent with the non-participating residence sound level limit approved by the Commission in past dockets.

1-37) Refer to Appendix L of the Application, Sound Study, Figure 5-2. Please provide a revised Figure 5-2 with turbine locations 9, 10, 21 and 22 eliminated. Provide the expected sound level at receptors 8 and 11 with these turbine locations eliminated.

Mark Wengierski and Mollie Smith: See Response to DR 1-36.

1-38) Refer to Appendix L of the Application, Sound Study, Table B-1.

a) Please confirm there are 15 participating residences with expected Project sound levels between 46 dBA and 50 dBA.

Mark Wengierski: Yes, the statement is accurate.

b) Please explain how the Applicant has communicated the potential sound impacts associated with the Project with the property owner(s) identified in response to subpart (a) to establish the appropriate sound expectations.

Mark Wengierski: Sweetland has discussed this topic with landowners throughout the leasing process. Many of the landowners are familiar with wind farms in the region and have not expressed a concern regarding this topic. Additionally, the sound levels to

which Sweetland has committed are at or below regulatory limits in other jurisdictions, and both the participating and non-participating sound level limits are consistent with limits approved by the Commission in past dockets.

c) Have the participating landowners identified in subpart (a) visited a nearby wind farm to experience sound levels similar to what is predicted for this Project?

Mark Wengierski: Sweetland is not aware of whether landowners have visited other wind farms. However, there are operating wind farms in the general region of the Sweetland Project, so the landowners are likely to have (at a minimum) traveled in proximity to nearby wind farms.

d) Has Scout Clean Energy received any noise complaints from participating landowners at other wind energy facilities that it has developed or operates when the sound level exceeds 45 dBA? If yes, please provide the number of complaints and brief description of each complaint.

Mark Wengierski: No.

e) Does Sweetland anticipate any noise complaints from participating landowners where the Project sound level is between 46 dBA and 50 dBA? Please explain.

Mark Wengierski: No. As noted above, the sound levels to which Sweetland has committed are at or below the regulatory limits in other jurisdictions, and both the participating and non-participating sound level limits are consistent with limits approved by the Commission in past dockets.

Dated this 13th day of May, 2019.

By /s/ *Mollie M. Smith*

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**BEFORE THE PUBLIC UTILITIES COMMISSION**
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| **IN THE MATTER OF THE APPLICATION OF SWEETLAND WIND FARM, LLC FOR FACILITY PERMITS FOR A WIND ENERGY FACILITY AND A 230-KV TRANSMISSION FACILITY IN HAND COUNTY, SOUTH DAKOTA FOR THE SWEETLAND WIND FARM PROJECT** | * * * * * * * * * * | **APPLICANT'S UPDATED RESPONSES TO STAFF'S DATA REQUESTS 1-36 AND 1-37**<br><br>**EL19-012** |

Below, please find Applicant's updated responses to Staff's Data Requests 1-36 and 1-37 to Sweetland Wind Farm, LLC ("Applicant").

1-36) Refer to Appendix L of the Application, Sound Study, Figure 5-2. Please provide a revised Figure 5-2 with turbine locations 10 and 22 eliminated. Provide the expected sound level at receptors 8 and 11 with these turbine locations eliminated.

Mark Wengierski and Mollie Smith: Sweetland objects to the request on the basis that it seeks information that was not previously in the custody or control of Sweetland; specifically, Sweetland did not have the information and incurred additional cost to conduct additional modeling and provide the requested information. Such an analysis had not been completed because the sound levels at receptors 8 and 11 comply with the sound level limit specified in the Hand County Development Agreement, which is consistent with the non-participating residence sound level limit approved by the Commission in past dockets. Sweetland further objects to the request on the grounds that the requested information is not relevant in light of the information provided in Data Requests 1-34 and 1-35 and the more conservative modeling parameters utilized by Epsilon than that of Mr. Hessler, who had been engaged by Staff in prior dockets. Without waiving the foregoing objections, Sweetland states as follows:

If turbines 10 and 22 were eliminated, the sound modeling results are as follows:

- Receptor 8: The modeled sound level would change from 43 dBA to 40 dBA under the modeling parameters utilized by Epsilon (which are more conservative (by approximately 2 dBA) than those utilized by Mr. Hessler in prior dockets).
- Receptor 11: The modeled sound level would change from 42 dBA to 39 dBA under the modeling parameters utilized by Epsilon (which are more conservative (by approximately 2 dBA) than those utilized by Mr. Hessler dockets).

*See also* Attachment 1-36. Sweetland does not support the removal of turbines 10 and 22 because:

- If turbines 10 and 22 were eliminated, each of the currently hosting landowners would lose the opportunity for significant income (as was testified to in the Deuel Harvest docket, six figures per turbine).
- Elimination of one or more of the specified turbines may result in other turbines in the string being eliminated, as removal of a turbine has an impact on the overall Project design.
- Elimination of one or more of the specified turbines also reduces the Project's overall number of alternative turbine locations. Since cultural and tribal resource surveys are on-going, and geotechnical analyses have not yet been completed, it is important that the Project maintain as many alternative turbine locations as possible.
- The primary turbine locations have been selected not only to meet all applicable requirements and commitments, but to maximize Project efficiency and output; thus, elimination of one or more primary turbines may affect the overall Project economics.
- There have been no complaints regarding the Project's modeled sound levels (including from the owners of Receptors 8 and 11), and the Project meets the sound level agreed upon in the Hand County Development Agreement.

1-37) Refer to Appendix L of the Application, Sound Study, Figure 5-2. Please provide a revised Figure 5-2 with turbine locations 9, 10, 21 and 22 eliminated. Provide the expected sound level at receptors 8 and 11 with these turbine locations eliminated.

Mark Wengierski and Mollie Smith: Sweetland objects to the request on the basis that it seeks information that was not previously in the custody or control of Sweetland; specifically, Sweetland did not have the information and incurred additional cost to conduct additional modeling to provide the information. Such an analysis had not been completed because the sound levels at receptors 8 and 11 comply with the sound level limit specified in the Hand County Development Agreement, which is consistent with the non-participating residence sound level limit approved by the Commission in past dockets. Sweetland further objects to the request on the grounds that the requested information is not relevant in light of the information provided in Data Requests 1-34 and 1-35 and the more conservative modeling parameters utilized by Epsilon than that of Mr. Hessler, who had been engaged by Staff in prior dockets. Without waiving the foregoing objections, Sweetland states as follows:

If turbines 9, 10, 21, and 22 were eliminated, the sound modeling results are as follows:

- Receptor 8: The modeled sound level would change from 43 dBA to 39 dBA under the modeling parameters utilized by Epsilon (which are more conservative (by approximately 2 dBA) than those utilized by Mr. Hessler in prior dockets).
- Receptor 11: The modeled sound level would change from 42 dBA to 38 dBA under the modeling parameters utilized by Epsilon (which are more conservative (by approximately 2 dBA) than those utilized by Mr. Hessler in prior dockets).

*See also* Attachment 1-37. Sweetland does not support the removal of turbines 9, 10, 21, and 22 because:

- If the turbines were eliminated, each of the currently hosting landowners would lose the opportunity for significant income (as was testified to in the Deuel Harvest docket, six figures per turbine).
- Elimination of one or more of the specified turbines may result in other turbines in the string being eliminated, as removal of a turbine has an impact on the overall Project design.
- Elimination of one or more of the specified turbines also reduces the Project's overall number of alternative turbine locations. Since cultural and tribal resource surveys are on-going, and geotechnical analyses have not yet been completed, it is important that the Project maintain as many alternative turbine locations as possible.
- The primary turbine locations have been selected not only to meet all applicable requirements and commitments, but to maximize Project efficiency and output; thus, elimination of one or more primary turbines may affect the overall Project economics.
- There have been no complaints regarding the Project's modeled sound levels (including from the owners of Receptors 8 and 11), and the Project meets the sound level agreed upon in the Hand County Development Agreement.

Dated this 3rd day of June, 2019.

By /s/ *Mollie M. Smith*

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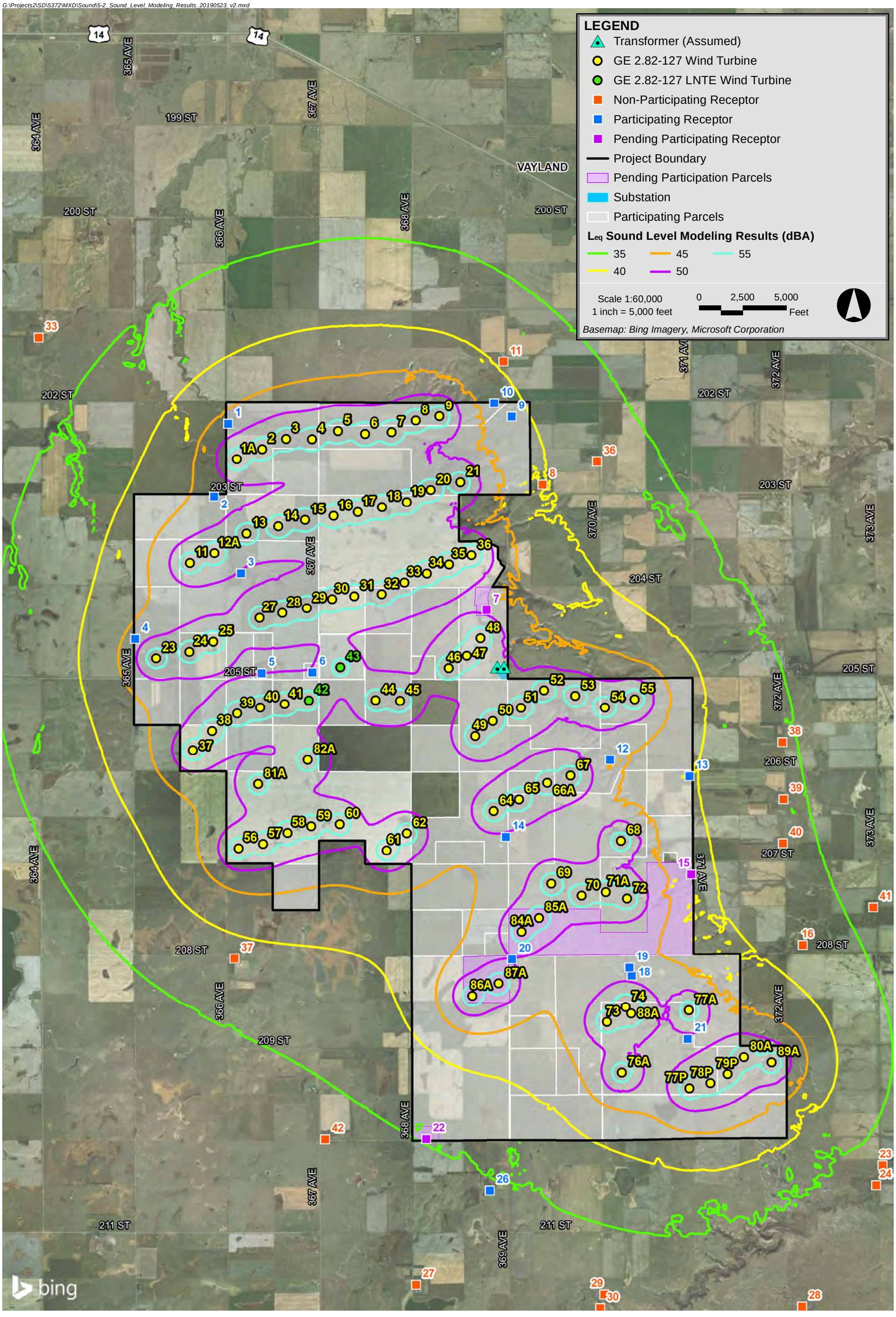


**Sweetland Wind** **Hand County, South Dakota**

**Figure 5-2**

*$L_{eq}$ Sound Level Modeling Results (Wind Turbines 10 and 22 Removed)*

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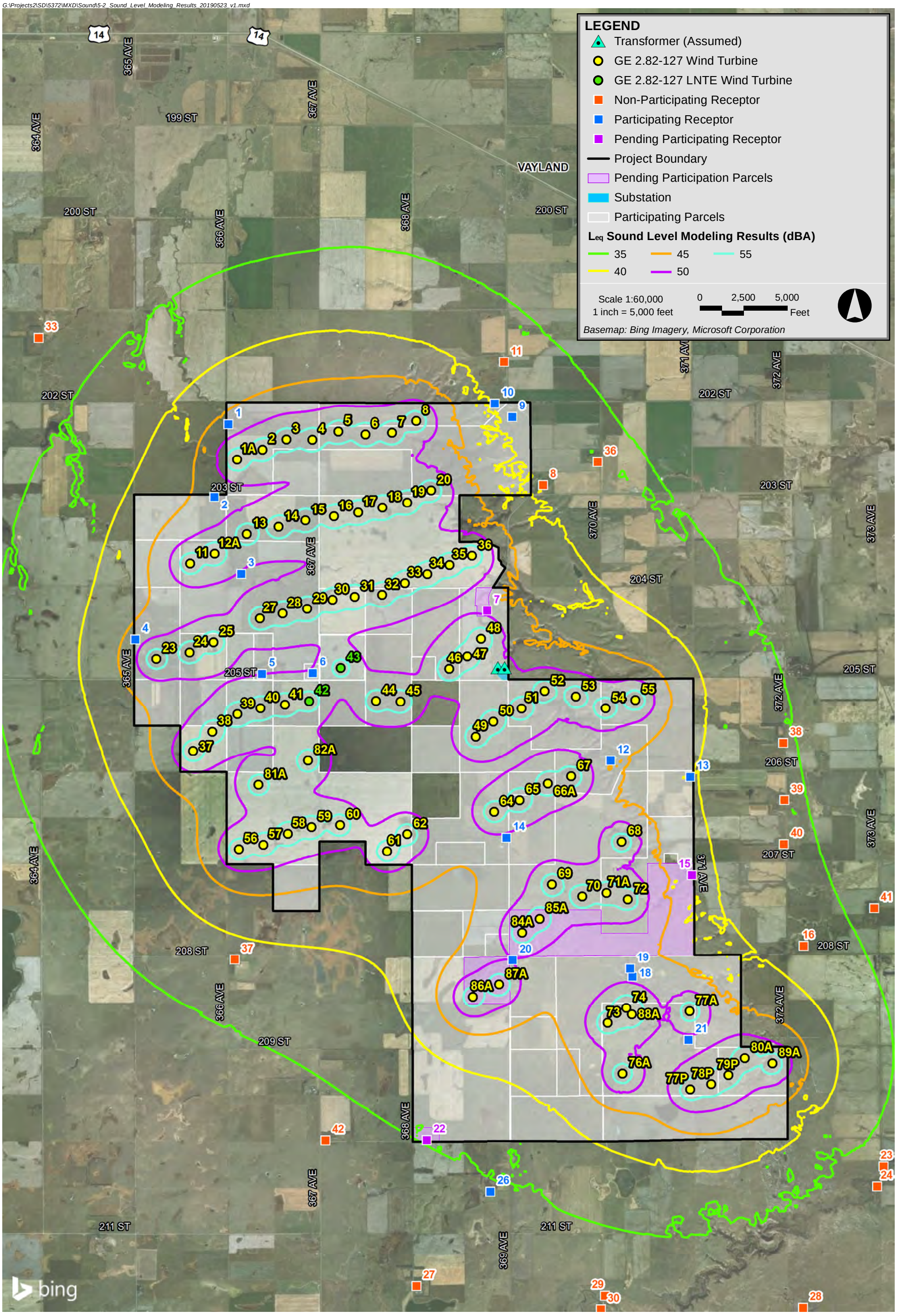


**Sweetland Wind** **Hand County, South Dakota**

**Figure 5-2**

*$L_{eq}$ Sound Level Modeling Results (Wind Turbines 9, 10, 21, and 22 Removed)*

**BEFORE THE PUBLIC UTILITIES COMMISSION**
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| **IN THE MATTER OF THE APPLICATION OF SWEETLAND WIND FARM, LLC FOR FACILITY PERMITS FOR A WIND ENERGY FACILITY AND A 230-KV TRANSMISSION FACILITY IN HAND COUNTY, SOUTH DAKOTA FOR THE SWEETLAND WIND FARM PROJECT** | * * * * * * * * * * | **APPLICANT'S RESPONSES TO STAFF'S SECOND SET OF DATA REQUESTS TO APPLICANT EL19-012** |

Below, please find Applicant's responses to Staff's Second Set of Data Requests to Sweetland Wind Farm, LLC ("Applicant").

2-1) Refer to Page 3-4 of the Application. Please explain the role of the tribal monitor during construction.

Doug Shaver: The tribal monitor will be present during construction activities to ensure compliance with applicable commitments regarding tribal cultural resources, including avoidance of identified traditional cultural properties ("TCP") and maintenance of agreed-upon setbacks from TCPs. Additionally, if any additional potential TCPs are identified during construction of the Project, the tribal monitor would facilitate communications with the necessary parties to determine appropriate next steps.

2-2) Refer to Page 6-1 of the Application. Please provide the basis for a 35-year useful life for the Project. Does the Applicant propose to use this estimate for the funding of the financial assurance for decommissioning? Please explain.

Mark Wengierski: Based on the currently available turbine models, which are able to perform longer than their predecessors, it is anticipated that the life of the Project will be 35 years. A Project life of 35 years was used for purposes of the decommissioning cost estimate provided in the Decommissioning Plan in Appendix P of the Application.

2-3) Provide GIS shape files for the project and project facilities.

Mark Wengierski: The requested files are provided with these responses.

2-4) Provide the safety and operations manuals for the General Electric 2.82-127 turbines.

Mark Wengierski/Mollie Smith: The General Electric Operating Manual Applicable for Wind Turbine Generators from 2.0 MW to 2.8 MW, which contains safety information, is

provided as Attachment 2-4. The manual is being provided as confidential and proprietary as it contains General Electric's confidential and proprietary business information.

2-5) For each non-participating residence that is located less than 1 mile from the closest turbine in the Project Layout, please provide the following information:

(a) Name of property owner

Mark Wengierski: There is currently only one non-participating landowner, Steven Runge, within 1 mile of the Project, as Lyle and Rebecca Resel (owners of Receptor 8) recently executed a good neighbor agreement with the Project.

(b) Address

Mark Wengierski: 20161 369th Avenue, Wessington, South Dakota 57381.

(c) Distance from closest turbine

Mark Wengierski: 3,617 feet from Turbine 10

(d) Receptor ID

Mark Wengierski: Receptor 11

(e) Predicted Shadow Flicker (Hours per Year)

Rob O'Neal: 7:05 (HH:MM/yr)

(f) Predicted Sound Level

Rob O'Neal: 42 dBA (with 2 dBA manufacturer's uncertainty factor)

2-6) Are there any private airstrips within 1 mile of the Project Area? If yes, please provide the location, a description, and the distance from the closest turbine of each private airstrip.

Mark Wengierski: Sweetland's consultant, Capitol Airspace Group, conducted a detailed analysis of aerial imagery near the Project Area. No landing strips were identified within 1.5 nautical miles of the proposed wind turbines. The closest private-use airport identified in the Federal Aviation Administration's dataset was more than 17 nautical miles from the Project. See also Attachment 2-6.

Dated this 24th day of June, 2019.

By /s/ ***Mollie M. Smith***

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February 7, 2019

Mark Wengierski
Project Manager
Scout Clean Energy
4865 Sterling Drive, Suite 200
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Re: Evaluation of private-use airstrips near the Sweetland Wind Project

Dear Mr. Wengierski,

Capitol Airspace evaluated various resources and datasets to determine the likelihood of the proposed Sweetland wind project having an adverse effect on private-use, or unregistered, airstrips.[1] This evaluation included direct coordination with the South Dakota Department of Transportation (DOT), analysis of Federal Aviation Administration's (FAA) National Aviation Systems Resources (NASR) dataset, and analysis of high-resolution aerial imagery.

The following was determined:

1) South Dakota DOT does not maintain a state-specific dataset and utilizes airport data maintained by the FAA.
2) The closest private-use airport described in FAA's NASR dataset is more than 17 nautical miles from the proposed wind project.
3) High-resolution aerial imagery indicates that it is unlikely that any private-use, or unregistered, airstrips are in proximity to the proposed wind turbines.[2,3]

Please direct any questions regarding these findings to me at (571) 297-6507 or *joe.anderson@capitolairspace.com*.

Sincerely,

Digitally signed
by Joe Anderson
Date: 2019.02.07
18:03:37 -05'00'

Joe Anderson
Senior Project Manager & Airspace Specialist

[1] Scout Clean Energy provided a total of 89 wind turbine locations located in an eastern section of Hand County, South Dakota.
[2] High-resolution imagery was obtained from the South Dakota Department of Environment & Natural Resources, dated 2016.
[3] Capitol Airspace analyzed aerial imagery within a 1.5 nautical mile buffer. This buffer was used to account for the lateral boundaries of Category B visual flight rules (VFR) traffic pattern airspace and is defined in FAA Order 7400.2M Paragraph 6-3-8, "Evaluating Effect on VFR Operations."

**BEFORE THE PUBLIC UTILITIES COMMISSION**
**OF THE STATE OF SOUTH DAKOTA**

| | | |
|---|---|---|
| **IN THE MATTER OF THE APPLICATION OF SWEETLAND WIND FARM, LLC FOR FACILITY PERMITS FOR A WIND ENERGY FACILITY AND A 230-KV TRANSMISSION FACILITY IN HAND COUNTY, SOUTH DAKOTA FOR THE SWEETLAND WIND FARM PROJECT** | * * * * * * * * * * | **APPLICANT'S RESPONSES TO STAFF'S THIRD SET OF DATA REQUESTS TO APPLICANT EL19-012** |

Below, please find Applicant's responses to Staff's Third Set of Data Requests to Sweetland Wind Farm, LLC ("Applicant").

3-1) Provide a map that shows the proposed turbines within 1/2 mile from the property line of the properties owned by Theresa J. Lichty. See Page 88 of 156 of Staff Exhibit_JT-1 in Docket EL18-003 for an example (http://puc.sd.gov/commission/dockets/electric/2018/EL18-003/exhibits/staff/s1.pdf). In addition, please identify the distance in feet of all turbines within 1/2 mile.

Mark Wengierski: See provided Attachment 3-1.

3-2) Provide a proposal for an indemnity bond pursuant to SDCL 49-41B-38.

Mark Wengierski: The preferred route is approximately 3.86 miles long. As such, Sweetland proposes a $500,000 bond, which is half the amount of the bond in the Dakota Range III docket (EL 18-046) where the generation tie-in line was approximately 8 miles long.

3-3) Refer to Page 3-3 of the Application regarding ADLS. The Applicant states "Wind turbines will be illuminated in accordance with Federal Aviation Administration (FAA) regulations and will employ an Aircraft Detection Lighting System (ADLS), ***if required***." (***emphasis added***)

(a) Is Hand County requiring the employment of an ADLS? Please explain.

Mark Wengierski: No, Hand County does not have a wind ordinance at this time, so does not have an ADLS requirement.

(b) If the answer to (a) was no, will the Applicant agree to install ADLS for the state permit? If no, please explain.

Mark Wengierski: Yes.

3-4) Refer to Page 7, lines 181 – 187 of the pre-filed direct testimony of Mr. Wengierski. Mr. Wengierski states the Applicant has secured 32 wind leases and 4 good neighbor agreements for the project.

(a) Please provide the name(s) of the four landowners that signed good neighbor agreements.

Mark Wengierski:

1. Gary Fisher
2. Mark & Paul Fulton
3. Cole Mehling
4. DK Nelson LP

See also the Response to DR 2-5 (referencing Resel good neighbor agreement) and Supplemental Testimony of Mark Wengierski at p. 2, ln. 37-43 (referencing the Fanning good neighbor agreement (executed) and the Letsche good neighbor agreement (proposed)). Since filing Supplemental Testimony, the Letsches have executed a good neighbor agreement.

(b) Please explain why each of the four landowners were offered good neighbor agreements.

Mark Wengierski: See response to DR 3-4(c).

(c) How does the Applicant determine which landowners will be offered good neighbor agreements?

Mark Wengierski: Mark and Paul Fulton, Gary Fisher, DK Nelson LP, and Cole Mehling all own property within the Project Area. In the final Project engineering design, no infrastructure was sited on their properties, but Sweetland offered them good neighbor agreements so that they could still participate in the Project.

3-5) Refer to Page 7, lines 163 – 168 of the direct testimony of Ms. Barton. Does the Applicant expect WAPA will approve a final EA and issue a Finding of No Significant Impact by the hearing in this docket on July 31, 2019? Please provide an update on the process.

Carrie Barton: An approved Final EA and Finding of No Significant Impact are not anticipated by the hearing date of July 31, 2019. A revised Draft EA was submitted to WAPA on June 12, 2019, for a second round of review. Once the draft is approved, it will be released for a 30-day public review period, which is anticipated to start in July 2019.

3-6) Refer to Page 2-3 of the Application. The Applicant states "Sweetland entered into a Development Agreement with Hand County, which was approved by the County Commission on November 8, 2018, and executed on December 4, 2018." Did Gilbert Rodgers vote for approval of the Development Agreement as a County Commissioner in Hand County? Please provide supporting documentation.

Mark Wengierski: Yes, Gilbert Rodgers voted in favor of the Development Agreement. I was present at the December 4, 2018 Board of County Commissioners' meeting and witnessed the vote. If documentation is needed, Hand County could provide a copy of the minutes.

3-7) Refer to Page 9, lines 249 - 251 of the direct testimony of Robert O'Neal. Mr. O'Neal states "an uncertainty factor of 2.0 dBA was added to the sound power level for the proposed turbine to account for uncertainty in the manufacturer's sound data." Please explain the basis of adding a 2.0 dBA uncertainty factor to the sound power level. Is there an industry standard that suggests this uncertainty factor? Please explain.

Rob O'Neal: Every wind turbine manufacturer performs extensive sound testing of their turbines in a variety of wind speeds through the procedure outlined in IEC 61400-11 "Wind Turbines – Part 11: Acoustic noise measurement techniques". The "apparent" sound level is the mean sound level of all the wind turbine sound tests. An additional "uncertainty" (called the "K" factor in the IEC standard) is usually added to the modeled sound levels to account for unit-to-unit product variation and measurement uncertainty. This is known as the "declared apparent" sound level. The "declared apparent" sound level provides the upper limit of sound levels from a wind turbine, which is then incorporated into the sound modeling. The value of "K" is provided by the turbine manufacturer. In the case of Sweetland, GE estimated a "K" value of 1.6 dBA, which Epsilon Associates rounded up to 2 dBA.

3-8) Refer to Page 12, lines 331 - 332 of the direct testimony of Robert O'Neal. Mr. O'Neal states "the most common limit is 30 hours per year." Please provide the other shadow flicker limits Mr. O'Neal is aware of and please provide supporting documentation.

Rob O'Neal: There are not many jurisdictions that have adopted shadow flicker regulations. More often permitting bodies (County Commissioners; Planning Commissions) set a shadow flicker limit to address potential nuisance. This is most often set at 30 hours/year, which is consistent with the shadow flicker limit set in the Hand County Development Agreement with Sweetland Wind Farm, LLC. Actual rules or regulations that I am aware of are listed below.

1. In Maine, wind energy projects are required to be designed to avoid unreasonable adverse shadow flicker impacts at a non-participating residence. This is specified in the Code of Maine Rules as 30 hours/year. 06-096 Code of Maine Rules, Ch. 382, § 4.

2. In Connecticut, the Regulations of Connecticut State Agencies limits the annual duration of shadow flicker to 30 hours at any off-site occupied structure. Regs. Conn. State Agencies § 16-50j-95(c).

3. In Ohio, the Ohio Power Siting Board has proposed regulations out for comment which limit shadow flicker to 30 hours/year at any non-participating residence within 1,000 meters of any wind turbine. Ohio Admin. Code. § 4906-04-09(H).

4. In the Town of Barre, New York, Local Law No. 2, Section 350-103(J) limits shadow flicker to 25 hours/year on a residential structure. Town of Barre, Orleans County, New York, Local Law No. 2 of the Year 2008, Section 350-103(J).

5. In New Hampshire, the NH Code Admin. R. Site Evaluation Committee limits shadow flicker to 8 hours/year on a residence. NH Code Admin. R. Site 301.14(f)(2)(b).

3-9) Refer to Page 3, lines 72 – 74 of the supplemental direct testimony of Mark Wengierski. Mr. Wengierski stated that the Applicant anticipated receiving two shadow flicker waivers by the end of May. Please provide an update on the status of the waivers.

Mark Wengierski: Sweetland has deferred obtaining the shadow flicker waivers as it continues to do title curative. Sweetland's intent is to approach landowners once with all documentation requiring a signature after title review is complete.

3-10) At what temperature (degrees F), if any, must the turbines be shut down? For example see https://puc.sd.gov/commission/dockets/electric/2019/EL19-003/prefiledexhibits/crownedridge/a66.pdf.

Mark Wengierski: For the General Electric turbines Sweetland is considering, Sweetland would employ the cold weather package. With this cold weather package, the turbines could operate down to a temperature of -30 degrees Celsius. In the event the temperature is below -30 degrees Celsius, the Project will be shut down.

Dated this 26th day of June, 2019.

By /s/ ***Mollie M. Smith***

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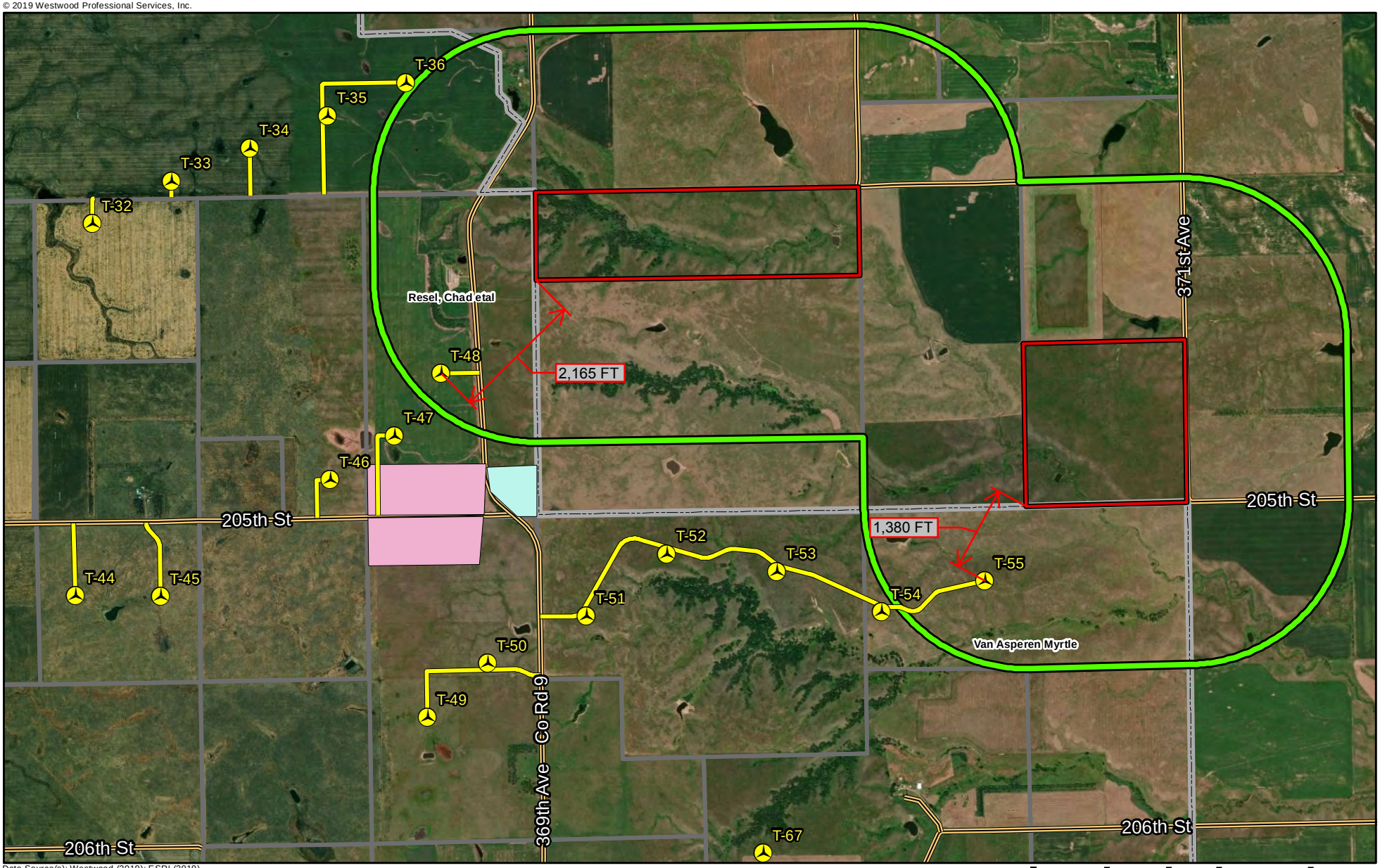
Map Document: N:\0015724.00\GIS\SL_Landowner_Exhibit_190531.mxd 5/31/2019 5:29:12 PM KAFeffer






Data Source(s): Westwood (2019); ESRI (2019).

Turbine
Turbine - Alternate
Access Road
Access Road - Alternate
Major Roadways
Laydown
Substation
Parcels
Project Boundry
Theresa Lichty etal Parcels
0.5 mi buffer

# Sweetland Wind Project

Hand County, South Dakota

## Landowner Exhibit

May 31, 2019

N

0 2,200 Feet

Westwood
Toll Free (888) 937-5150 westwoodps.com
Westwood Professional Services, Inc.

**BEFORE THE PUBLIC UTILITIES COMMISSION**
**OF THE STATE OF SOUTH DAKOTA**

| | | |
|---|---|---|
| **IN THE MATTER OF THE APPLICATION OF SWEETLAND WIND FARM, LLC FOR FACILITY PERMITS FOR A WIND ENERGY FACILITY AND A 230-KV TRANSMISSION FACILITY IN HAND COUNTY, SOUTH DAKOTA FOR THE SWEETLAND WIND FARM PROJECT** | * * * * * * * * * * | **APPLICANT'S AMENDED RESPONSES TO STAFF'S FOURTH SET OF DATA REQUESTS TO APPLICANT EL19-012** |

Below, please find Applicant's amended responses to Staff's Fourth Set of Data Requests to Sweetland Wind Farm, LLC ("Applicant").

4-1) Please describe the technology that will be employed at each turbine to detect and assess ice buildup.

Mark Wengierski: The GE 2.X turbine models have a mode referred to as Winter Ice Operation Mode ("WIOM"). WIOM is a standard feature of the GE 2.X turbine models, and no additional technology is required. See also Attachments 4-1(a), (b), and (c).

4-2) Refer to the Safety Manual for the proposed turbines request in Commission Staff data request 2-4.

(a) Refer to Section 8.4. Is Sweetland installing an ice detector as discussed in the Safety Manual?

Mark Wengierski/Mollie Smith: Based on discussions with Staff, the confidential and proprietary Operations Manual provided as Attachment 2-4 in response to DR 2-4 does not contain the sections referenced in DR 4-2. Therefore, Sweetland is not able to answer the specific request. However, Sweetland has confirmed with General Electric that the 1.1x turbine tip height setback set forth in the General Electric Setback Considerations for Wind Turbine Siting document (Appendix D to the PUC Application) is recommended for the turbine models under consideration, which will include WIOM. See provided Attachment 4-2(a).

(b) If the answer to (a) is no, please provide documentation from General Electric confirming that the technology being employed by Sweetland to assess and detect ice buildup alleviates the need to cordon off an area during freezing weather conditions pursuant to the formula identified in Section 8.4.1.

See response to DR 4-2(a).

4-3) In Docket EL18-026, the Commission ordered Prevailing Wind Park to fund a decommissioning escrow account annually at a rate of $5,000 per turbine per year for the first 30 years, commencing no later than the commercial operation date. See Condition 40, subparts (a) – (j) of the Final Decision and Order Granting Permit to Construct Facilities and Notice of Entry for the entire condition. Does the Applicant agree to the decommissioning condition referenced above for this permit? Please explain.

Mark Wengierski: Yes, Sweetland will agree to the proposed decommissioning condition, subject to the following: if the Commission authorizes Triple H Wind Project, LLC to provide a form or forms of financial security other than an escrow account in Docket EL 19-007, Sweetland would propose a condition whereby it is also allowed to provide the same form or forms of financial security.

4-4) In Docket EL17-055, Crocker Wind Farm stated that "a conservative decommissioning cost estimate in current dollars is between $100,000 to $150,000 per turbine after salvage value, including associated facilities" (Exhibit A6, Page 14, Lines 407 – 408). In Docket EL18-046, Dakota Range III provided a decommissioning cost estimate of $101,420 per turbine in 2018 dollars, and $183,710 per turbine in 2050 dollars, assuming no resale of the Project's major components (Appendix M, Page 20). Sweetland is representing a decommissioning cost estimate of $37,091 per 89-meter hub height turbines and $40,956 per 114-meter hub height turbines, assuming salvage of wind turbine and transmission facility components. (Application Page 23-1).

(a) Please explain why Sweetland's estimate of decommissioning costs is significantly lower per turbine than other wind facilities that have been recently permitted. Please list some of the major assumptions that would drive significant differences in decommissioning cost estimates.

Mollie Smith: Per correspondence with Jon Thurber on June 19, 2019, answers to DR 4-4 are not necessary since Sweetland is agreeing to the decommissioning funding level set forth in DR 4-3.

(b) Regarding the decommissioning cost estimate of $37,091 per 89-meter hub height turbines, please provide the estimated cost estimate in 2050 dollars. Please provide and explain the assumptions and calculations to determine the 2050 dollars estimate.

See Response to DR 4-4(a).

(c) Regarding the decommissioning cost estimate of $40,956 per 114-meter hub height turbines, please provide the estimated cost estimate in 2050 dollars. Please provide and explain the assumptions and calculations to determine the 2050 dollars estimate.

See Response to DR 4-4(a).

(d) Please explain why a salvage credit should be included in the decommissioning estimate when determining an appropriate amount to establish a financial assurance.

See Response to DR 4-4(a).

Dated this 28th day of June, 2019.

By /s/ ***Mollie M. Smith***

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GE Energy

# Winter Ice Operation Mode

fact sheet

## Introduction

GE offers a Winter Ice Operation Mode (WIOM) control option for Turbine Control software version 042 and greater on the 1.X platform, and version 044 and higher on the 2.X platform. This upgrade provides stall mitigation during blade icing events. By optimizing pitch controls, the WIOM control option improves power output. In addition, the option reduces the effects of icing on blade stall, which in turn reduces potential blade vibrations.

## Applicable Platforms

All 1.X and 2.X MW series wind turbines, particularly in colder climates.

## Technical Description

Snow and ice accretion on wind turbine blades is common for units located in winter climates. Winter blade ice-fouling can produce aerodynamic stall, resulting in reduced power output (*See Figure 1*). Turbine operation with blade stall can also lead to increased blade vibration levels. In rare cases, blade vibrations at a resonant frequency can lead to blade damage. WIOM is a software enhancement that features TSR pitch control to reduce stall and gain back lost power during iced operation.

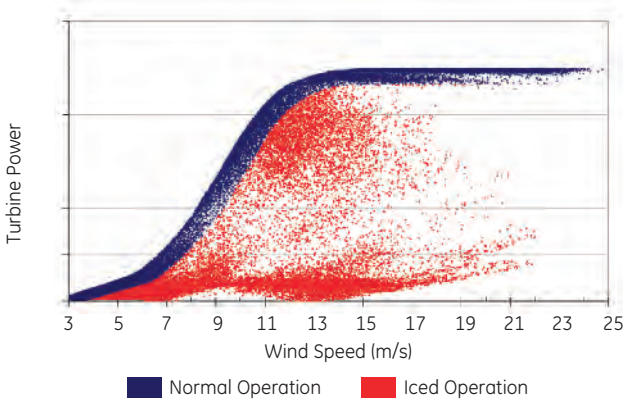


Figure 1. Representative power production data demonstrates that wind turbines perform worse under iced conditions than under normal operations.

## TSR Pitch Control

Anti-stall operation is accomplished with a blade tip speed ratio (TSR) algorithm executed by the PLC. The TSR pitch control algorithm intends to improve power capture for the rotor while reducing the risk of blade stall (*See Figure 2*). The tip speed ratio is calculated from the turbine rotor speed and density corrected anemometer wind speed inputs, and is evaluated every 40 ms. The modified pitch control scheme will become active when icing via low power is detected.

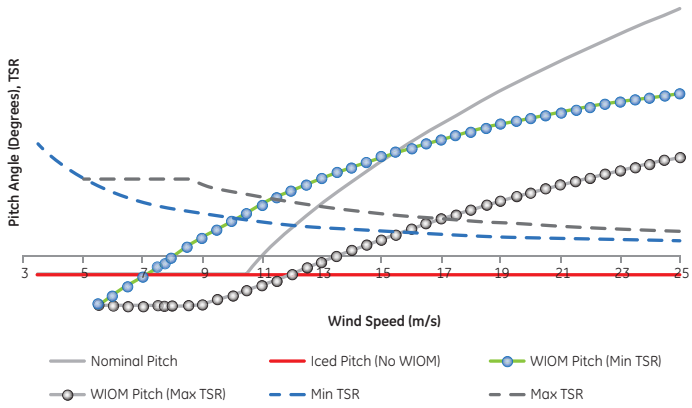


Figure 2. TSR pitch control schedule.

## Benefit

WIOM has been developed to mitigate blade stall due to icing, which may result in an increase of annual energy production by approximately 1% to 3% for sites with four to six months of winter weather opportunity.

## Scope of Supply

WIOM Turbine Control Software enhancement.

## Scope of Work

GE will provide the installation and commissioning resources necessary to implement this upgrade.

Contact your local GE Representative for assistance or for additional information.



GEA18093B (12/2011)

GE Energy

# GE WIND

## INTRODUCTION

GE turbines have been installed on a wide range of sites throughout the world. In many areas, ice storms are a normal occurrence during large portions of the year. It is well known that icing can negatively impact the performance of turbines. Some wind turbine operators choose to shut down their machines, while others continue to operate during icing conditions. GE has recently developed software capable of both reducing loads and increasing power output of our 1.5 MW turbines during icing situations.

## TECHNICAL DESCRIPTION

Iced wind turbine components, specifically the blades can result in decreased production efficiencies. When ice accumulates on the blades of a turbine, the dynamic loading changes in addition to the aerodynamic properties. The common result from icing is increased airfoil drag, and decreased lift. Under the current software configuration, the blades run with a limited margin before entering aerodynamic stall, which will greatly reduce power capture. Turbine operation at stall can additionally generate blade vibration loads. In extreme cases, blade vibrations at a resonant frequency can exceed the structural limit leading to significant turbine damage. The wide range of losses due to icing can be seen in Figure 1. If the control algorithm of the blades is changed, the blades can be pitched back to feather to move away from stall and allow the flow to re-attach and regain power capture.

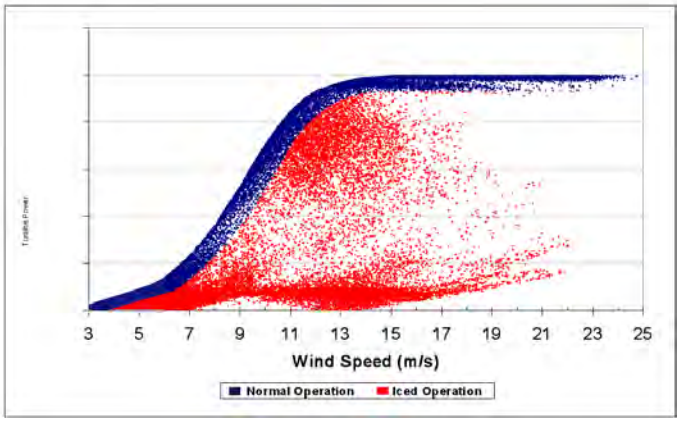


Figure 1: Reduced Power Output Due To Icing

## TSR PITCH CONTROL

Anti-stall operation is accomplished with a blade tip speed ratio (TSR) algorithm executed by the PLC. Fundamentally the tip speed ratio is defined as the speed of the blade tip, divided by the free stream wind approaching the rotor. The tip speed ratio is calculated from turbine rotor speed and anemometer wind speed inputs. The control algorithm intends to maximize power capture ($C_P$) for the rotor while minimizing the risk of blade stall (See Figure 3). The modified pitch control scheme applies primarily for operation of the turbine during rated winds.

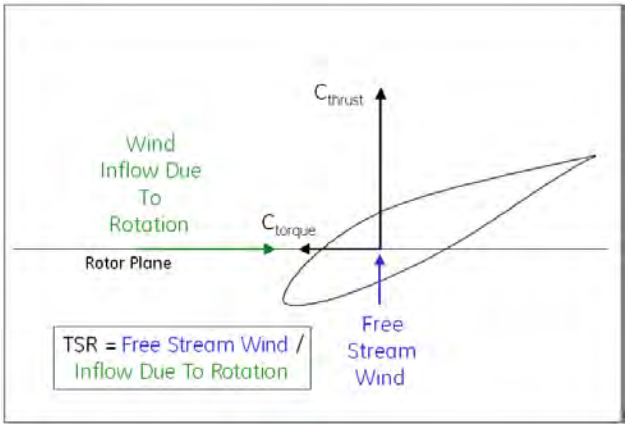


Figure 2: Tip Speed Ratio Equation

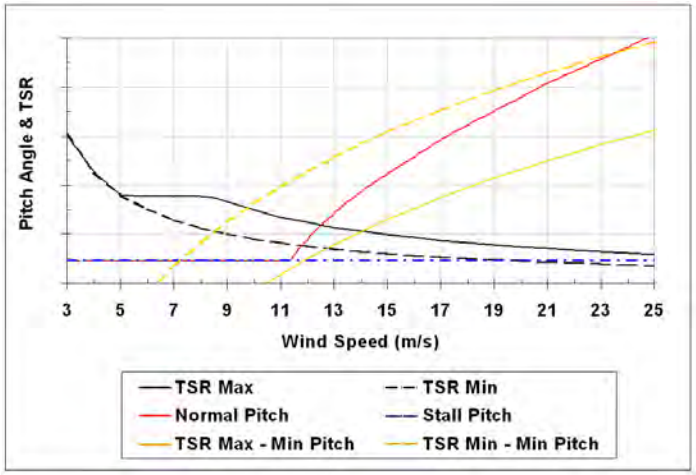


Figure 3: TSR Control Interactions

The TSR algorithm is implemented at wind speeds between 11-25 m/s as indicated in Figure 3. The cumulative increase in energy capture can be seen in Figure 3 below.

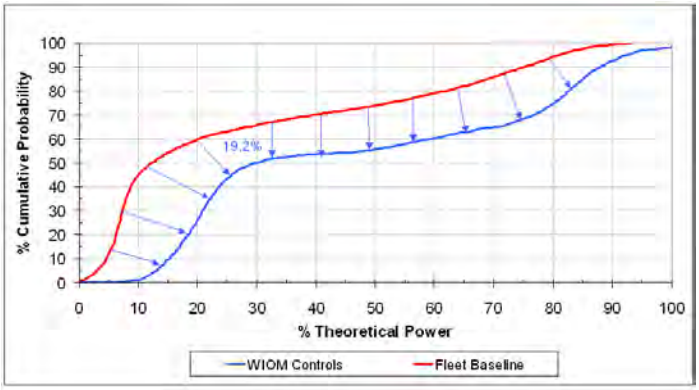


Figure 4: Added energy capture with WIOM controls in place

## CASE STUDY

During the winter 0f 2008-2009, GE implemented the TSR control algorithm at a beta site on more than 40 turbines. The site was one that had been in operation for a number of years. During the winter of 2005-2006, no icing controls were in place and for the winter of 2008-2009 the WIOM software with TSR control was in place. The results from the test demonstrated very promising results. Increased annual energy production of 2-3% during the typical winter season of 4-6 months was evident. These results were for a site located in a climate that experienced icing frequently. Results may vary from site-to-site depending on the weather patterns.

| | First Trial | Second Trial |
|---|---|---|
| **Winter Control Package** | Standard | TSR Pitch Control |
| **Winter Date Range** | Jan 1 - Apr 1 | Nov 1 - Apr 1 |
| **Winter Power (MWhr)** | 582 | 2036 |
| **Uncaptured Power** | 43 | 85 |
| **Winter AEP Loss** | 7.4% | 4.2% |

Table 1: Increase In Energy Production

## CONCLUSION

GE is now offering software upgrades for sites experiencing icing on their turbines. The software is available as a component of version 42 and greater.

GE Power & Water
Renewable Energy



CASE STUDY

firstwind.
CLEAN ENERGY. MADE HERE.®

# Winter Ice Operation Mode (WIOM)
## Improving Wind Turbine Production During Icing Events

## **Problem** Facing Customer

Wind turbine operation during icing events leaves owners/operators with many difficult decisions to make. A major issue of turbine icing is the significant loss in power production. Below are just some examples of how turbines produce less power during icing events:

1) Power performance loss due to non-optimal airfoil shape caused by ice buildup
2) Availability loss due to increased turbine faults caused by icing
3) Wind farm safety shutdowns due to close proximity to public areas
4) Balance of plant network disturbances due to ice on aboveground power cables
5) Turbine accessibility issues on site due to icy/snowy roads

First Wind, a Boston based company, has developed and operates 750 megawatts (MW) of generating capacity at twelve wind energy projects in Maine, New York, Vermont, Utah and Hawaii. One of their wind farms in Maine faces severe icing events year after year. The site consists of 20+ GE 1.5-77 turbines that from 2008 to 2010 have averaged over 55 MWhrs/turbine/year lost from turbine underperformance caused by icing. Different types of icing can cause different severities in power curve performance degradation. Based on past GE data, it has been found that in-cloud or rime icing can cause a 15%–40% loss in power performance. Glaze icing, which is heavier precipitation-based ice, however, can cause a 70%–95%+ loss in power performance. Both types of icing events cause serious underperformance that hurt the bottom line of turbine owners and operators.

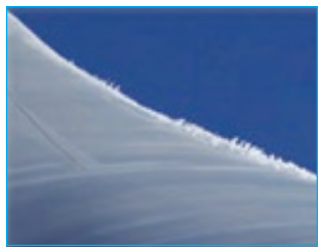

FIGURE 1
Rime/In-Cloud Icing

FIGURE 2
Glaze Icing

From First Wind's perspective, wind turbine icing is a serious issue that negatively impacts a wind park's production budget. "Looking at the power curves, it was clear that we were leaving a lot of generation at the table during icing conditions. We wanted to know if there were easy solutions in recouping some of that loss," said Cegeon Chan, a Wind Resource Analytics Manager for First Wind.

imagination at work

## **Solution** Provided by GE

To address the power performance lost due to icing at the Maine site, First Wind decided to upgrade their farm with a software product called Winter Ice Operation Mode (WIOM) offered by GE. This software upgrade utilizes a "smart" pitch schedule based on the Tip-Speed-Ratio (TSR) of the turbine. The TSR is the ratio of the rotational velocity of the blade tip divided by the incoming wind velocity, and is a key parameter to maximize as blade pitch changes. Whenever icing conditions on the turbine are detected via atmospheric conditions and low power performance, WIOM implements a control algorithm that results in an improved pitch setting based on the TSR. This allows the turbine to avoid significant stall and gain back power production during icing events (see *Figure 3*).

David Eldridge, GE Wind Services Product Manager, describes WIOM as the following: "Essentially, WIOM works to avoid severe stall, whether that is caused by icing, a degraded leading edge, or even poor up flow/shear characteristics. Ice that builds up on the blade alters its airfoil and degrades its flow properties. If a turbine were to try to operate through an icing event without WIOM, significant stall would occur, especially at higher wind speeds. This could also result in extreme load events on the blades. At GE, we are always looking to increase turbine production for our customers; WIOM is one product that can do just that during the winter months."

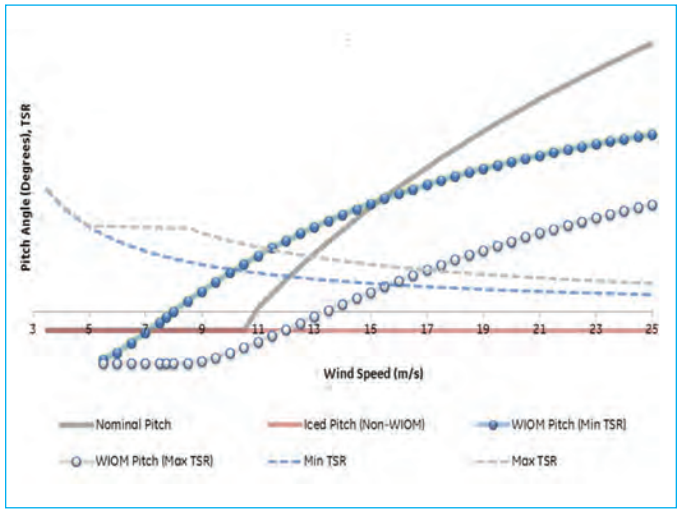


FIGURE 3
WIOM's Tip-Speed-Ratio Control Strategy

To validate the proposed benefit of WIOM, First Wind decided to conduct a comparison study of production gains on turbines with WIOM versus turbines without WIOM. To do this, turbines 11 and 13 at the Maine wind farm had the WIOM function disabled while all other turbines had WIOM activated. The study period was from November 15th, 2011 through March 15th, 2012 and most of the focus was placed on turbines 10–14 as they are in the same region and experience similar wind/icing conditions. The 2011–2012 Winter in the northeast was one of the warmest on record and experienced very little snow accumulation, but the benefits of WIOM still paid dividends for First Wind.

FIGURE 4
Winter Conditions at Wind Farm in Maine

One of the major icing events at the wind farm occurred between December 7th and December 9th of 2011. The combination of cold temperatures, high humidity, and precipitation created the perfect conditions for icing. As illustrated in *Figure 5*, there was a significant difference between power production of the WIOM turbines versus the non-WIOM turbines during the two-day icing event. This severe stall event is most indicative of glaze icing on the wind turbine blades, as proven by both the weather conditions and the power curve signature in which 95% underperformance occurred.

Additionally, the two turbines without WIOM experienced much more severe loading on the wind blades because at the higher wind speeds, the blades were still pitched fully to power (i.e., fully open) to try and get out of their low power production state. The turbines with WIOM were able to maintain performance closer to the expected power curve, while the turbines without WIOM experienced significant stall and generated little to no energy even with high winds.

The WIOM turbines on average generated an additional 29 MWhrs over the two days compared to the non-WIOM turbines (see *Table 1*). During icing events with heavy precipitation and glaze icing such as this, a lot of weight can build up on the blades and this makes it very difficult to ever get out of a stalled operation. The weight of the ice can cause the rotor to be out of balance and without the proper pitch schedule; the iced turbines are not able to recover.

This December icing event showed the biggest benefit of WIOM for the Maine wind farm over the winter period, but there were several smaller events throughout the four-month test period where WIOM was working effectively to mitigate stall and generate more power. First Wind also validated the benefit of WIOM over the test period by comparing how much energy was captured during icing events at different wind speeds. *Figure 6* clearly illustrates that WIOM has the greatest benefit at wind speeds of 8 m/s and above, with tremendous benefit at rated wind speeds. The improvement of power recovery during icing events with WIOM is evident at all wind speeds, but the percentage of energy recovery starts to drastically rise from a 12% increase in energy capture at 9 m/s, to a 58% increase in energy capture at 15 m/s.

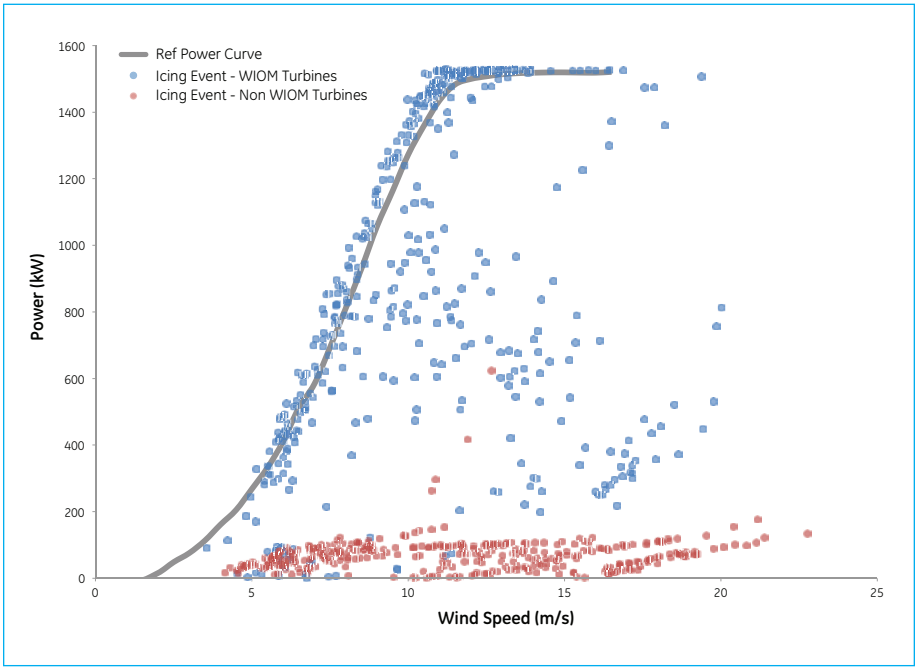


FIGURE 5
December Icing Event: WIOM versus Non-WIOM Turbine Operation

| | WIOM WTG 10 | Non-WIOM WTG 11 | WIOM WTG 12 | Non-WIOM WTG 13 |
|---|---|---|---|---|
| **Energy Produced (MWhrs)** | 38.97 | 5.34 | 28.89 | 4.70 |
| **Average Wind Speed (m/s)** | 11.26 | 10.78 | 10.07 | 13.84 |

TABLE 1
WIOM versus Non-WIOM Turbine Production (December 7th, 2011–December 9th, 2011)

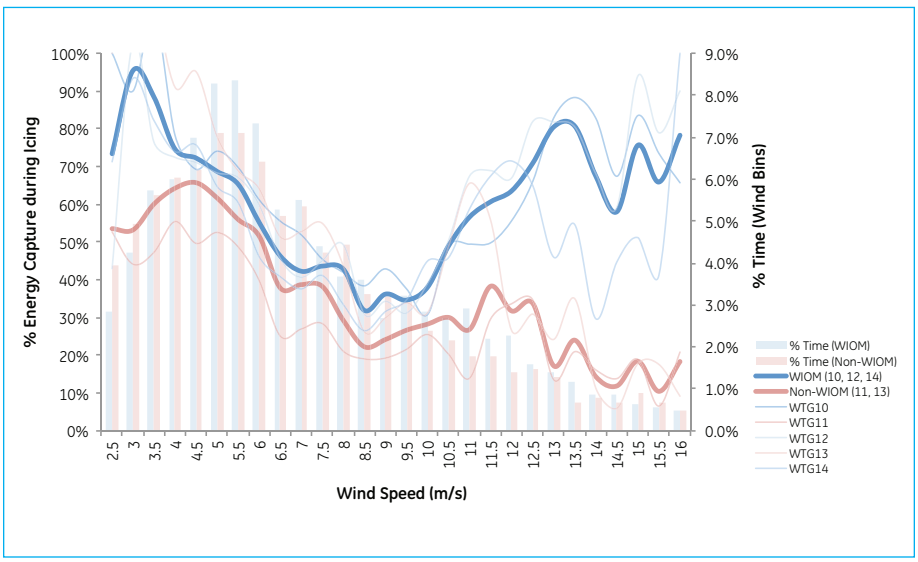


FIGURE 6
Energy Capture During Icing by Wind Speed for WIOM vs. Non-WIOM turbines

## Payback and **Benefit to Customer**

From November 15th, 2011 through March 15th, 2012, the Maine wind farm was able to capture back or "save" over 650 additional megawatt hours (MWh) in energy production due to WIOM. This production increase was calculated using the percent improvement in energy gain of WIOM turbines versus non-WIOM turbines and extrapolating that over all turbines at the wind farm that had WIOM installed. On average, WIOM turbines were able to recover 51.8% of the reference power production during icing events, compared to just 32.1% recovery for non-WIOM turbines. Additionally, the two turbines without WIOM would have generated an additional 69 MWh of energy with the bulk of that benefit coming from the one major ice storm in December. On average, each turbine generated an additional **25.8 MWhrs** over a **four-month** period (see *Figure 7*). The WIOM software upgrade will provide varying degrees of energy capture during icing events based on the ice shape, mass and formation process. WIOM has proven to capture back roughly 50% plus of lost energy due to icing, and this study was very much in line with those estimates.

By looking at the performance of the wind turbines during the 2011–2012 winter months and measuring the increased energy capture due to WIOM, an economic analysis can be performed: Using average energy prices for New England, the WIOM product resulted in a **payback period** of just over **two years** and an **IRR of 42%**.

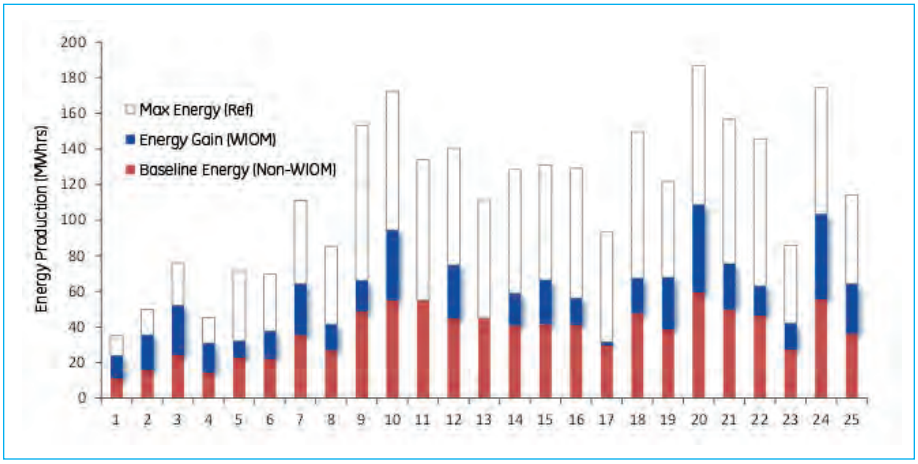


FIGURE 7
Energy gain by turbine during the 2011–2012 Winter due to WIOM. Resulted in an average energy benefit of 25.8 MWh per turbine from November 15th, 2011 through March 15th, 2012 during icing events.



GEA20042A (02/2013)

## Pat Landess

**From:** Pat Landess
**Sent:** Thursday, June 27, 2019 4:49 PM
**To:** Pat Landess
**Subject:** RE: Sweetland-- PUC data request questions re: GE Ice buildup - CONFIDENTIAL/PROPRIETERY

**From:** Lobdell, Scott K (GE Renewable Energy) <scott.lobdell@ge.com>
**Sent:** Wednesday, June 26, 2019 8:16 AM
**To:** Jim Sardonia <Jim@scoutcleanenergy.com>
**Cc:** Fesenmeyer, Daniel (GE Renewable Energy) <daniel.fesenmeyer@ge.com>; Lynch, Matt (GE Renewable Energy) <matt.lynch@ge.com>; Davis, Dylan T (GE Renewable Energy) <dylan.davis@ge.com>
**Subject:** RE: Sweetland-- PUC data request questions re: GE Ice buildup - CONFIDENTIAL/PROPRIETERY

Jim –

Please see answers to your questions below.

Q1. Is there a mode or physical hardware 'system' called a Winter Ice Operation Mode (WIOM) for the 2.82-127s? If so, do you have any technical documentation on this?
A1. Yes, there is a mode "system" called "Winter Ice Operation Mode (WIOM)" for the 2.8-127s. There are technical documents within the 2.8-127 Technical Specifications that describe the WIOM functionality, but there is no single, dedicated document for this feature.

Q2. I did not think there was any additional hardware, but that this is the method to shutdown turbines based on existing sensors (met sensors, vibration sensors and the expected vs actual power production compared to the stated power curve)

From my understanding working with GE in the past, the method of icing detection includes the following:

(1) Applicant will use the following methods to detect icing conditions on turbine blades: ( 1 ) Sensors and instrumentation installed in and on the nacelle will measure ambient air temperatures, wind speeds, wind directions, and power output of the wind turbine. The software control system of each wind turbine has an algorithm to autonomously monitor and detect any deviation from the stated power curve due to ice build-up on the blades. If the deviation from the stated power curve exceeds a pre-set limit programmed by the wind turbine OEM, the turbine controller will automatically shut the turbine down. (2) Vibration sensors installed in the nacelle will detect when blades become imbalanced or create vibrations due to ice accumulation or shedding. Turbine(s) will be shut-down when an imbalance and/or vibrations exceed pre-set limits set by the wind turbine OEM. (3) Applicant's site personnel will also utilize meteorological data from on-site permanent meteorological towers, on-site anemometers, and any other relevant meteorological sources to determine if ice accumulation is occurring. Applicant has the ability to manually shut down turbine(s) if icing conditions are identified. Turbines will not return to normal operations until the control systems no longer detect (a) an excessive imbalance or vibrations (b) an out of limit power curve deviation, or when observed visual observations and weather conditions either remove icing on the blades or indicate icing is no longer a concern.

Can you confirm that the above accurately describes the WIOM mode, if it is more of a control model and not additional hardware?
If there is additional hardware, what are the costs?

A2. The description of WIOM you provided above is representative of how WIOM operates. The is no additional hardware and no additional cost to you, as WIOM is a standard feature of the 2.8-127 Wind Turbine Generator, and is included in the price.

Q3. Ice Throw setback: In the attached pdf, there is an email affirming that GE recommend a setback distance of 1.1 x tip height with a 170m minimum to address ice throw away from objects of concern. Could you send an email with a similar statement confirming this as well?

A3. GE confirms that the WIOM system functions as an ice detector pursuant to the references in section 8.4.1 of GE's safety manual, Operating_Manual_1-2MW_Safety_EN_r02. With the WIOM system, GE recommends a setback distance of 1.1 *tip height with a 170 m minimum to address ice throw away from the following example objects of concern: Public use areas, residences, office buildings, public buildings, parking lots, public roads, and railroads. Property lines are not considered an object of concern subject to ice throw setback recommendations. GE recommends that turbines are set back a distance of 1.1 *blade_length from property lines, provided there is remote chance of future development or inhabitancy during the life of the wind farm.

Scott

**Scott K. Lobdell**
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Commercial Operations

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General Electric Company

GE imagination at work



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**From:** Jim Sardonia <Jim@scoutcleanenergy.com>
**Sent:** Tuesday, June 25, 2019 7:16 PM
**To:** Fesenmeyer, Daniel (GE Renewable Energy) <daniel.fesenmeyer@ge.com>; Lobdell, Scott K (GE Renewable Energy) <scott.lobdell@ge.com>
**Subject:** EXT: FW: Sweetland-- PUC data request questions re: GE Ice buildup - CONFIDENTIAL/PROPRIETERY

Dan and Scott,
We are getting the following questions for our Sweetland PUC permit application for SD with regards to GE Icing detection systems and Ice throw setback recommendations from GE. The email chain has background information.

1. Is there a mode or physical hardware 'system' called a Winter Ice Operation Mode (WIOM) for the 2.82-127s? If so, do you have any technical documentation on this?
2. I did not think there was any additional hardware, but that this is the method to shutdown turbines based on existing sensors (met sensors, vibration sensors and the expected vs actual power production compared to the stated power curve)
   From my understanding working with GE in the past, the method of icing detection includes the following:

(1) Applicant will use the following methods to detect icing conditions on turbine blades: ( 1 ) Sensors and instrumentation installed in and on the nacelle will measure ambient air temperatures, wind speeds, wind directions, and power output of the wind turbine. The software control system of each wind turbine has an algorithm to autonomously monitor and detect any deviation from the stated power curve due to ice build-up on the blades. If the deviation from the stated power curve exceeds a pre-set limit programmed by the wind turbine OEM, the turbine controller will automatically shut the turbine down. (2) Vibration sensors installed in the nacelle will detect when blades become imbalanced or create vibrations due to ice accumulation or shedding. Turbine(s) will be shut-down when an imbalance and/or vibrations exceed pre-set limits set by the wind turbine OEM. (3) Applicant's site personnel will also utilize meteorological data from on-site permanent meteorological towers, on-site anemometers, and any other relevant meteorological sources to determine if ice accumulation is occurring. Applicant has the ability to manually shut down turbine(s) if icing conditions are identified. Turbines will not return to normal operations until the control systems no longer detect (a) an excessive imbalance or vibrations (b) an out of limit power curve deviation, or when observed visual observations and weather conditions either remove icing on the blades or indicate icing is no longer a concern.

Can you confirm that the above accurately describes the WIOM mode, if it is more of a control model and not additional hardware?
If there is additional hardware, what are the costs?

3. Ice Throw setback: In the attached pdf, there is an email affirming that GE recommend a setback distance of 1.1 x tip height with a 170m minimum to address ice throw away from objects of concern.
   Could you send an email with a similar statement confirming this as well?

Thanks again,
Jim

Jim Sardonia
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**BEFORE THE PUBLIC UTILITIES COMMISSION**
**OF THE STATE OF SOUTH DAKOTA**

| | | |
|---|---|---|
| **IN THE MATTER OF THE APPLICATION OF SWEETLAND WIND FARM, LLC FOR FACILITY PERMITS FOR A WIND ENERGY FACILITY AND A 230-KV TRANSMISSION FACILITY IN HAND COUNTY, SOUTH DAKOTA FOR THE SWEETLAND WIND FARM PROJECT** | * * * * * * * * * * | **APPLICANT'S RESPONSES TO STAFF'S FIFTH SET OF DATA REQUESTS TO APPLICANT EL19-012** |

Below, please find Applicant's responses to Staff's Fifth Set of Data Requests to Sweetland Wind Farm, LLC ("Applicant").

5-1) Refer to page 27-3 of the application. Pursuant to SDCL 49-32-3.1, provide an update on the status of notifying all telecommunications companies in the project area and an update on any meetings with the telecommunications companies Sweetland has had. When will this step of the process be complete?

Mark Wengierski: Sweetland has provided notice of the Project to Venture Communications and CenturyLink, the two telecommunications companies with infrastructure in the Project Area. Both have provided information on the location of their facilities, but neither has requested a meeting. Sweetland has incorporated the information provided into the design of the Project.

Dated this 28th day of June, 2019.

By /s/ ***Mollie M. Smith***

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