BEFORE THE POWER SITING BOARD OF THE STATE OF OHIO

In the Matter of the Application of Trishe Wind Ohio, LLC for a Modification to its Certificate to Install and Operate a Wind-Powered Electric Generation Facility in Paulding County, Ohio.	))))	**16-1687-EL-BGA**

Members of the Board:

Chairman, Public Utilities Commission
Director, Development Services Agency
Director, Department of Health
Director, Department of Agriculture
Director, Environmental Protection Agency
Director, Department of Natural Resources
Public Member
Ohio House of Representatives
Ohio Senate

To the Honorable Power Siting Board:

Please review the attached Staff Report of Investigation, which has been filed in accordance with Ohio Power Siting Board rules. The application in this case is subject to an approval process as required by Section 4906.03 of the Ohio Revised Code.

Sincerely,

Patrick Donlon
Director, Rates and Analysis
Public Utilities Commission of Ohio

OPSB STAFF REPORT OF INVESTIGATION

Case Number:	16-1687-EL-BGA (associated with prior case numbers 13-0197-EL-BGN and 16-0343-EL-BGA)
Project Name:	Northwest Ohio Wind Energy Wind Farm
Project Location:	Paulding County
Applicant:	Trishe Wind Ohio, LLC
Application Filing Date:	August 5, 2016
Inspection Date:	September 29, 2016
Report Date:	January 31, 2017
Applicant's Waiver Requests:	none
Staff Assigned:	G. Zeto, M. Bellamy, A. Conway

Application Description

On December 16, 2013, in case number 13-0197-EL-BGN, the Ohio Power Siting Board (Board) authorized Northwest Ohio Wind Energy, LLC to construct a major utility facility, specifically a wind-powered electric generating facility consisting of up to 60 turbine sites with a combined generation capacity of 100 megawatts (MW) in Paulding County, Ohio (the Original Certificate).

On August 19, 2014, Trishe Wind Ohio, LLC (Applicant) filed an application to transfer the certificate from Northwest Ohio Wind Energy, LLC to Trishe Wind Ohio, LLC. On November 24, 2014, the Board ordered that the application to transfer the certificate from Northwest Ohio Wind Energy, LLC to the Applicant be granted.

On February 2, 2016, in case number 16-0343-EL-BGA, the Applicant filed an application to amend the Original Certificate. On August 5, 2016, the Applicant filed a notice of withdrawal of the application. On September 22, 2016, the Board issued an entry to dismiss the case and close the record.

In the present application, the Applicant is proposing to add three turbine models for potential operation in this project: the General Electric (GE) 2.3-116 (2.3 MW), the Vestas V110 (2.1 MW), and the Vestas V126 (3.45 MW). The Applicant is also considering two different tower designs for both the GE 2.3-116 turbine model and the Vestas V110 turbine model. The different tower designs would result in the GE 2.3-116 turbine model with a hub height of either 80 or 94 meters and the Vestas V110 turbine model with a hub height of either 80 or 95 meters.[1] Additionally, the Board approved the Gamesa G114 (2.0 MW) turbine model in the Original Certificate and the Applicant proposes in this application to increase the output for this turbine model from 2.0 MW to 2.1 MW as a result of a software upgrade. The dimensions of the Gamesa G114 turbine model

[1] Turbine model hub heights are typically described by the manufacturer in meters. However, the Ohio law describes such measurement in feet increments. Therefore, when the heights of these turbine models are subsequently described relative to the Ohio law, Staff references them in feet.

would not change. Staff has determined that the environmental impacts associated with this turbine model have not changed as a result of the software upgrade.

The output of the proposed turbine models would be an increase over the output of the previously certificated Vestas V100 (1.8 MW), GE 1.7-100 (1.7 MW), and Gamesa G114 (2.0 MW) turbine models. The 100 MW nameplate capacity for the project would not change. As a result of the increased output of each individual turbine, the Applicant would only construct between 29 and 50 turbines within the 60 approved sites, depending on the turbine model chosen. The Applicant stated that the total output of the facility would be further limited to 100 MW both through fully automatic, software based controls offered by each manufacturer as well as the interconnection agreement. The turbine locations and location of the project's associated facilities – access roads, collector lines, substation, transmission line tie-in, concrete batch plant, and the operation and maintenance facility – would remain unchanged.

Application Review

The Applicant's present filing requests only the addition of three turbine models to the list of acceptable turbine models for this project and the upgrade in capacity of one previously approved turbine model. As such, Staff's review of the Applicant's request is solely focused on these turbine models and whether their addition to the list of acceptable turbine models for this project would impact any of the stipulated conditions or result in a material increase in environmental impact as compared to the original project.

Additional Turbine Models

The Board previously certificated the Applicant's use of the Vestas V100, GE 1.7-100, and Gamesa G114 turbine models. The dimensions of the previously certificated turbine models and the presently proposed turbine models are detailed in the following table.

	Turbine Model	**Rotor Diameter** (feet)	**Total Height** (feet)
Approved	Vestas V100 (1.8 MW)	328	476
	GE 1.7-100 (1.7 MW)	328	479
	Gamesa G114 (2.0 MW)	374	492
Proposed	Gamesa G114 (2.1 MW)	374	492
	GE 2.3-116 (2.3 MW) (80 m)	381	453
	GE 2.3-116 (2.3 MW) (94 m)	381	499
	Vestas V110 (2.1 MW) (80 m)	361	443
	Vestas V110 (2.1 MW) (95 m)	361	492
	Vestas V126 (3.45 MW)	413	492

Applicable to the Original Certificate, 750 feet in horizontal distance from the tip of the turbine's nearest blade at 90 degrees to the exterior of the nearest, habitable, residential structure is the minimum distance a turbine is authorized to be located in proximity to a habitable structure on an adjacent property, without property owner approval. Likewise, applicable to the Original Certificate, the minimum property line setback is equal to a horizontal distance, from the turbine's

base to the property line of the wind farm property, equal to one and one-tenth times the total height of the turbine structure, as measured from its base to the tip of its highest blade.

Applying the minimum setback requirements of the Original Certificate and the dimensions of each turbine model led to Staff's calculation of the following residential and property line setback distances:

	Turbine Model	**Residential Setback**	**Property Line Setback**
Approved	Vestas V100 (1.8 MW)	914 feet	524 feet
	GE 1.7-100 (1.7 MW)	914 feet	527 feet
	Gamesa G114 (2.0 MW)	937 feet	541 feet
Proposed	Gamesa G114 (2.1 MW)	937 feet	541 feet
	GE 2.3-116 (2.3 MW) (80 m)	941 feet	498 feet
	GE 2.3-116 (2.3 MW) (94 m)	941 feet	549 feet
	Vestas V110 (2.1 MW) (80 m)	931 feet	487 feet
	Vestas V110 (2.1 MW) (95 m)	931 feet	541 feet
	Vestas V126 (3.45 MW)	957 feet	541 feet

As shown in the table, the maximum turbine blade length of the turbine models approved in the Original Certificate led to a minimum residential setback calculation of 937 feet from the turbine base to the exterior of the nearest habitable residential structure for the turbine model with the longest blade length, without adjacent property owner approval. The maximum turbine height of the turbine models approved in the Original Certificate led to a minimum property line setback of 541 feet from the turbine base to the property line of the wind farm property, without adjacent property owner approval, for the tallest turbine model.

Using the maximum blade length of the turbine models proposed by this application (i.e. the blade length of the Vestas V126 turbine model) and the minimum residential setback requirement applied in the Original Certificate, the turbine model with the longest blades would add 20 feet to the setback distance and require the turbine base to be located at least 957 feet from the exterior of the nearest habitable residential structure on an adjacent property, without property owner approval.

Using the maximum turbine height of the three turbine models proposed in this filing (i.e. the GE 2.3-116 turbine model with a 94 meter hub height) and the minimum property line setback requirement applied in the Original Certificate, the tallest turbine model would add eight feet to the setback distance and require the turbine base to be located at least 549 feet from the property line of the wind farm, without adjacent property owner approval.

With regard to compliance with the required minimum setback distances for each turbine, Staff finds that the addition of the proposed turbine models does not create the need for any additional stipulated conditions or result in a material increase in environmental impact when compared to the original project. Consistent with the Original Certificate, if the location of a wind turbine does not meet the required setback, it may not be constructed unless the Applicant secures appropriate executed waiver(s) of the minimum setback requirement.

Safety Manuals

The Applicant is required to provide the generation equipment manufacturer's safety standards, such as a safety manual or similar document. Staff reviews this safety information to ensure safety requirements or recommendations are and will be upheld by the wind farm owner/operator and for inclusion in the wind farm operator's overall safety culture. Staff reviewed the safety manuals for the proposed turbine models.

In relation to the safety manuals, Staff determined that the proposed change in turbine model would not pose any material increase in environmental impacts as compared to the previously certificated project and that the Applicant's commitments and Conditions 13, 18, 20, 21, 22, 23, and 35 from the Original Certificate adequately address the potential safety considerations relative to the proposed turbine models.

Communication / Radar Interference

Microwave communication systems are wireless point-to-point links that communicate between two antennas and require clear line-of-site conditions between each antenna. These transmit video, audio, or data for the telecommunications industry. Wind farm developers generally avoid locating wind turbines within the clear line-of-site path necessary for these antennas. Since the Original Certificate in 2013, the number of proposed and licensed microwave paths in the project area has increased significantly.

The Applicant commissioned microwave studies dated March 2013, October 2014, March 2016, and August 2016. The Applicant identified 37 licensed or proposed microwave paths intersecting the project area. The Applicant's microwave studies indicated that turbine locations T11, T12, T30, T31, T38, T53, T54, T55, and T56 would potentially obstruct microwave paths and cause signal degradation. A worst case Fresnel zone (WCFZ) was calculated for each of the identified microwave paths. The WCFZ represents the area or path in which a turbine or other structure might cause a deflection of microwave signals and interference with its operation. The Applicant stated it will avoid impacts to the microwave paths by constructing only turbine locations outside of the microwave paths and associated WCFZ.

The Applicant also performed further analysis of turbine location T36 and found that this turbine location would not interfere with microwave paths in the area. However, turbine location T36 had a short signal clearance (i.e. a short distance from the turbine blade to the nearest WCFZ). The Applicant committed to avoid this signal clearance for T36 during construction by ensuring that cranes operate on the opposite side of the turbine and that erection of the rotor avoids the WCFZ.

Pursuant to Condition 24 of the Original Certificate, the Applicant provided a copy of the latest study to the path licensees. As of the date of this filing, no additional concerns have been identified.

Therefore, in relation to Communication and Radar Interference, Staff determined the proposed change in turbine model would not pose a material increase in environmental impacts as compared to the previously certificated project and that the Applicant's commitments and Conditions 5, 24, 25, and 26 from the Original Certificate adequately address all communication systems and radar interference issues for the proposed turbine models.

Noise

Noise would be generated during both construction and operation of the wind farm facility. Construction noise would be associated with construction equipment and construction procedures that are common to many large-scale construction activities. However, Staff believes the adverse impact of this noise would be minimal because of the transient nature of the construction activities, the distance of the activities from most residential structures, the limitation of construction activities to normal daytime working hours, and noise mitigation that has been proposed in the application.

During facility operation, noise would be associated with the nacelle and turbine blades when the units are generating electricity. Staff reviewed the potential noise impacts in the Original Certificate and the present application by comparing the modeled impact of the turbine models to the project area ambient average nighttime noise level, which was found to be 42 A-weighted decibels (dBA). The noise studies of the Gamesa 114 (2.0 MW) turbine model from the Original Certificate, the presently-proposed and increased capacity Gamesa 114 (2.1 MW) turbine model, and the five presently proposed turbine model/hub height combinations show that the modeled impact would be less than the project area ambient average nighttime noise level plus five dBA, or 47 dBA, for all turbine models impacting all nonparticipating receptor locations.

Additionally, in the present application, the Applicant committed to adhering to the noise condition specified in the Original Certificate, Condition 38, specifically:

> (38) The facility shall be operated so that the facility noise contribution does not result in noise levels at the exterior of any currently existing nonparticipating sensitive receptor that exceed the project area ambient nighttime average sound level (LEQ) (42 dBA) by five dBA. During daytime operation only (7:00 a.m. to 10:00 p.m.), the facility may operate at the greater of: the project area ambient nighttime LEQ (42 dBA) plus five dBA; or the validly measured ambient LEQ plus five dBA at the location of the sensitive receptor. After commencement of commercial operation, the Applicant shall conduct further review of the impact and possible mitigation of all project-related noise complaints through its complaint resolution process.

Therefore, in relation to noise impact, Staff determined that the proposed change in turbine model would not pose any material increase in environmental impacts as compared to the previously certificated project and that Condition 38 of the Original Certificate adequately addresses the potential noise impact of the proposed turbine models.

Shadow Flicker

Shadow flicker from wind turbines occurs when rotating wind turbine blades pass between the sun and the viewer at low solar elevation angles. Shadow flicker is generally experienced in areas near wind turbines where the distance between the viewer and blade is short enough that the glare from the sunlight is insufficient to conceal the blade. When the blades rotate, this shadow creates a visual effect with the sun known as shadow flicker.

In the application for the Original Certificate, the Applicant's shadow flicker study showed that zero non-participating residences were modeled to receive more than 30 hours per year of shadow flicker. In the present application, the Applicant's shadow flicker study showed that of the five proposed turbine model/hub height combinations modeled and the increased capacity of the one

previously certificated turbine model, the number of nonparticipating receptors modeled to exceed 30 hours of shadow flicker would be as follows:

Turbine Model	Number of Receptors Impacted Above 30 hours/year
Gamesa G114 (2.1 MW)	0
GE 2.3-116 (2.3 MW) (80 m)	1
GE 2.3-116 (2.3 MW) (94 m)	3
Vestas V110 (2.1 MW) (80 m)	0
Vestas V110 (2.1 MW) (95 m)	0
Vestas V126 (3.45 MW)	9

Staff also reviewed any other factors that may have increased potential shadow flicker impacts since the Original Certificate. First, Staff notes that after the Board issued the Original Certificate, the Haviland Plastics Products Company (Haviland Plastics) constructed three 1.5 MW wind turbines in and around the project area in Haviland, Ohio. The three Haviland Plastics turbines have caused five nonparticipating receptors to be modeled with shadow flicker in excess of 30 hours per year. Second, the Applicant modeled the shadow flicker impact of the five proposed turbine model/hub height combinations as well as the existing Haviland Plastics turbines. The Applicant's turbines are modeled to add less than two minutes of annual shadow flicker to the five nonparticipating receptors modeled to receive shadow flicker in excess of 30 hours per year by the Haviland Plastics turbines.

The Original Certificate contained with a condition limiting shadow flicker, Condition 39, which states:

> (39) The facility shall be operated so that the facility shadow flicker contribution does not result in shadow flicker levels that exceed 30 hours per year for any nonparticipating sensitive receptor. After commencement of commercial operation, the Applicant shall conduct further review of the impact and possible mitigation of all project-related shadow flicker complaints through its complaint resolution process.

Because all receptors are required to receive less than 30 hours of shadow flicker per year, pursuant to Condition 39 of the Original Certificate, the potential impact posed by the proposed turbine models will be limited.

Therefore, in relation to shadow flicker, Staff determined that the proposed change in turbine model would not pose any material increase in environmental impact as compared to the previously certificated project and Staff recommends the Board find that Conditions 5 and 39 of the Original Certificate adequately address the potential shadow flicker impact of the proposed turbine models.

Ice Throw

Ice throw occurs when accumulated ice on the wind turbine blades separates from the blade and falls, or is thrown, from the blade. Staff evaluated the potential for ice throw for the proposed turbine models as compared to the certificated turbine models. Both the previously certificated and proposed turbine models will have ice detection equipment and safety features that would shut

down a turbine if the buildup of ice would cause excess vibrations or the speed to power ratio to become too high.

Therefore, the probabilities for ice throw associated with the proposed turbine models would be similar to the previously certificated turbine models. In relation to ice throw, Staff determined that the proposed change in turbine model would not pose any material increase in environmental impacts as compared to the previously certificated project and that Conditions 36 and 37 of the Original Certificate adequately address the potential ice throw impact.

Blade Shear

Blade shear occurs when a wind turbine blade, or segment, separates from the rotor and is thrown or dropped from the tower. Staff evaluated the potential for blade shear for the proposed turbine models as compared to the previously certificated turbine models. Both the previously certificated and proposed turbine models have multiple safety features to address blade shear, including two fully independent braking systems, a pitch control system, and turbine shut-offs in the event of excessive wind speeds, excessive blade vibration, or stress.

Therefore, the probabilities for blade shear associated with the proposed turbine models would be similar to the previously certificated turbine models. In relation to blade shear, Staff determined that the proposed change in turbine model would not pose any material increase in environmental impacts as compared to the previously certificated project.

Conclusion

Staff's review of the Applicant's request regarding the three proposed turbine models and the upgrade in capacity of one previously approved turbine model focuses solely on the potential impacts associated with the turbine models and whether the proposed turbine models impact any of the stipulated conditions or result in a material increase in environmental impact when compared to the original project. The proposed addition of three turbine models to the list of authorized turbine models and the upgrade in capacity of one previously approved turbine model would not require any change in location of any turbine sites or non-turbine associated facilities. Staff finds, if any of the three proposed turbine models or the turbine model with an upgraded capacity is selected, the conditions of the Original Certificate are adequate to ensure that adverse environmental impacts would continue to be minimized for this project.

Recommended Findings

Staff recommends that the Board approve the application related to the three proposed wind turbine models and the upgrade in capacity of one previously approved turbine model, provided that the certificate continues to include the 40 conditions specified in the Opinion, Order, and Certificate for case number 13-0197-EL-BGN, including the Applicant's compliance with the applicable statutory setback requirements.

Recommended Condition

(1) The Applicant shall continue to adhere to all conditions of the Opinion, Order, and Certificate for the Northwest Ohio Wind Farm Project in case number 13-0197-EL-BGN, and as modified by this application, with the GE 2.3-116 (including 80 and 94 meter hub heights), Vestas V110 (including 80 and 95 meter hub heights), Vestas V126, and upgraded Gamesa G114 turbine models to be added as acceptable turbine models.

Summary: Staff Report of Investigation electronically filed by Yvonne W Cooper on behalf of Staff of OPSB