Acentech Report No. 0393
AI Project Number 620120

Fox Islands Wind Power Project
Vinalhaven Island, Maine
Construction, Operation, and Maintenance Noise Impact Assessment

James D. Barnes
Eric W. Wood

May 2009

Submitted by:

Acentech Incorporated
33 Moulton Street
Cambridge, MA 02138

Prepared for:

Fox Islands Wind, LLC
c/o Fox Islands Electric Cooperative
Main Street
Vinalhaven, ME 04863

EXHIBIT
30

Contents

1. Introduction 1

2. Site Description 1

3. Noise Regulation Requirements 2

4. Measured Baseline Ambient Sound 3

5. Project Construction Sound 4

6. Project Operation and Maintenance Sound 5

7. Noise Abatement 7

8. Noise Impact Assessment 7

9. Conclusion 8

Appendix A. Sound in Lay Terms 16

Appendix B. Operating Sound Measurement Protocol 19

Figures and Tables

Figure 1. Aerial View of Vinalhaven Island and Location of Project Site 8

Figure 2. Aerial View of Project Site, Turbines, Residents, and Measurement Locations 9

Figure 3. Wind Turbine Generator Illustration and Component Parts. 10

Figure 4. Hourly Measured Baseline Sound Levels and Wind Speeds. 11

Figure 5. Hourly Measured Baseline Sound Levels without Storm or Calm Conditions. 12

Table 1. Sound Measuring Instruments. 13

Table 2. Representative Construction Equipment Equivalent Sound Levels 13

1. Introduction

Fox Islands Wind, LLC ("Fox Islands" or the "Applicant") proposes to construct, operate, and maintain three wind turbine generators each rated at 1.5 MW at an elevated site near the center of Vinalhaven Island, Maine and is applying for all necessary federal, state, and local permits and approvals. The Applicant is working together with the Fox Islands Electric Cooperative and the Island Institute to promote on-island sustainable development while reducing the Island's dependence on fossil fuels and electricity that is now imported from the mainland via undersea cable.

Recent studies conducted on Vinalhaven Island have documented that the local wind resource at 80 meters above the site together with the three proposed grid-scale utility-grade wind turbines operating at the site should be capable of producing approximately 11 million kilowatt hours of electric power annually. This is approximately equal to the current annual on-island electricity use.

Wind turbines produce no electricity and no noticeable sound when the wind speed at the turbine is less than about 7 mph (what is called the cut-in speed). As the wind speed at the turbines increases above about 7 mph, the electricity produced and the sound generated by the turbines both slowly increase. Previous studies and our common experience demonstrate that background ambient sound levels also increase when local wind speeds increase.

This report addresses the expected sound during construction, routine operation, and maintenance of the three wind turbine generators proposed for Vinalhaven Island. Sections 2 and 3 of this report describe the existing site area and define applicable sound level requirements. Section 4 presents the baseline ambient sound levels measured near the Project site. Sections 5 and 6 describe the sound that will be produced during construction, operation, and maintenance of the Project. Noise mitigation is addressed in Section 7. The noise impact associated with the Project is assessed in Section 8 where it is concluded that the sound produced by regulated equipment will comply with all applicable sound limits. Conclusions are summarized in Section 9.

Appendix A describes sound in lay terms and defines various technical terms used in this report, for the convenience of the reader. Appendix B outlines a series of measurements that can be performed during project operation, if required by MDEP.

2. Site Description

The Project site, shown in the Figure 1 aerial photograph, is at an elevated location approximately 3.4 miles northwest of the Vinalhaven town center and along the southwest side of North Haven Road, and to the west of where Mills Farm and Company Point Roads extend from North Haven Road. Several miles to the north is nearby North Haven Island. The site and adjacent lands are mostly densely wooded with evergreen trees and occasional granite

outcroppings. Figure 2, an expanded view of the Figure 1 aerial photograph, shows the locations of the three proposed wind turbine generators and 16 residences (not including the one being bought by the Applicant) located in the vicinity of the site. The nearest house that will not be owned by the Applicant is approximately 1240 ft from the nearest turbine; all others are more than 1500 ft distant from the wind turbine towers.

Figure 3 presents a representative sketch showing the various elements of a wind turbine generator. The wind turbine hubs and electric generators will be mounted on three tubular-steel towers extending approximately 250 ft above local grade. The wind turbine rotor blades to be mounted at the hub will be approximately 120 ft long. An electrical transformer will be located onsite at ground level to transmit electricity from the generators to the existing distribution grid.

3. Noise Regulation Requirements

No federal noise regulations are applicable to the off-site environmental sound associated with the construction, operation, or maintenance of the proposed Project.

The Town of Vinalhaven relies upon noise standards established by the State of Maine Department of Environmental Protection as described below.

Chapter 375.10 of Maine's Site Location of Development Law Regulations includes the following noise standards applicable to the off-site sound produced during routine operation of regulated equipment for the proposed Project.

- Hourly equivalent operating sound level limits of 60 dBA during daytime hours from 7 a.m. to 7 p.m. and 50 dBA during nighttime hours from 7 p.m. to 7 a.m. at protected locations in areas where the zoning is not predominantly commercial or industrial.

- Hourly equivalent operating sound level limits of 55 dBA during daytime hours from 7 a.m. to 7 p.m. and 45 dBA during nighttime hours from 7 p.m. to 7 a.m. at particularly quiet protected locations where the pre-development ambient hourly sound level is equal to or less than 45 dBA during the daytime period and/or equal to or less than 35 dBA during the nighttime period.

- Hourly equivalent operating sound level limits of 70 dBA during daytime hours from 7 a.m. to 7 p.m. and 60 dBA during nighttime hours from 7 p.m. to 7 a.m. at protected locations in areas where the zoning is predominantly commercial or industrial.

- Hourly equivalent operating sound level limit of 75 dBA at the Facility property boundary.

Sources of sound exempt from the above limits include safety and protective devices and warning signals, construction operations from 7 a.m. to 7 p.m. or during daylight hours, whichever is longer, and registered and inspected motor vehicles that enter the site to make a

delivery or pickup, but not when parked at the facility with the engine running for more than 60 minutes.

No other regulations are applicable to the off-site environmental sound associated with the construction, operation, or maintenance of the proposed project.

4. Measured Baseline Ambient Sound

The above regulations do not require pre-development baseline ambient sound levels to be measured or reported. However, such measurements were made and are presented here for informational purposes.

The baseline ambient sound was measured continuously with calibrated sound level monitors at two locations near properties adjacent to the Project site. The monitors measured continuously and recorded the existing ambient equivalent A-weighted fast-response sound levels for two weeks from midday on 23 October to the late-morning of 7 November 2008. In addition, wind speeds were measured continuously during the baseline sound measurements. The sound measurement positions were selected based on the following general criteria aimed at identifying areas where the routine project operating sound might be heard.

- Measurements were obtained adjacent to residential areas because people are generally most sensitive to sounds at their homes.
- Measurements were obtained adjacent to the residential areas closest to the Project Site where the Project sound might be heard at a neighboring home.

The sound level monitors were field calibrated just prior to and directly following the measurements. In addition, the monitors had been laboratory calibrated within 12 months prior to the measurements. The instruments used for the measurements are identified in Table 1.

Weather conditions during the sound measurements included daytime high temperatures ranging from 43 to 63 degrees F and nighttime low temperatures ranging from 23 to 53 degrees F. Sky conditions ranged from sunny to overcast and fog. Average hourly wind speeds ranged from calm to 11 mph. Stormy conditions with high wind speeds and/or significant rain occurred during 25, 26, 28, and 29 October 2008.

Sound and wind speed measurements were made at location 1 (shown on Figure 2), which is within a clearing adjacent to a residence to the south of the Project site. Sound measurements were made at location 2 (also shown on Figure 2), which is within a wooded area near an unoccupied residence on the Applicant's site.

Hourly equivalent sound levels measured at both positions throughout the two-week period are shown in Figure 4. Also shown in Figure 4 are the hourly average and hourly gust wind speeds (right-hand scale) measured during the two-week period at location 1. Figure 5 presents the same measured baseline data after removing 1) the measurements made during the stormy conditions on 25, 26, 28, and 29 October 2008 and 2) the measurements made during periods

with nearly calm wind speeds less than 2 mph, conditions when the wind turbine generators are not apt to operate.

The sound level data measured at locations 1 and 2 and shown in Figure 5 have been analyzed so as to also calculate the daytime equivalent sound level (7 a.m. to 7 p.m.) and the nighttime equivalent sound level (7 p.m. to 7 a.m.) for both locations. The daytime and nighttime ambient hourly sound levels were computed by arithmetically averaging the daytime and nighttime values of the measured one hour equivalent sound levels after multiple values for specific hours were first energy averaged, in accordance with Maine DEP Regulation Chapter 375.10 Section H, §3, §3.1.

These daylong and nightlong equivalent sound levels are listed below. They represent the average sound level throughout the daytime periods and the average sound level throughout the nighttime periods that were measured at both locations during moderate weather conditions without storms and without calm wind conditions.

Daytime and Nighttime Equivalent Predevelopment Baseline Ambient Sound Levels Measured without Storm or Calm Wind Conditions.

Measurement Position	Daylong Equivalent Sound Levels from 7 a.m. to 7 p.m.	Nightlong Equivalent Sound Levels from 7 p.m. to 7 a.m.
1	42 dBA	37 dBA
2	38 dBA	37 dBA

hourly average wind speeds from 2 to 7 mph (see Figure 5)

At location 1, the daytime and nighttime average equivalent sound levels were 42 and 37 dBA, respectively. At location 2, the daytime and nighttime average equivalent sound levels were 38 and 37 dBA, respectively. The measured data presented above represent, and are considered to be typical of, the existing ambient sound environment adjacent to the proposed project site during times when the wind turbine generators can be expected to operate. The measured ambient sound levels reported here are similar to the sound levels found in lightly-populated areas.

5. Project Construction Sound

Construction of the wind turbine generator project is expected to extend over an approximately three to four month period. Initial construction activities will include site improvements and construction of the facility access road; then clearing, excavation, foundation, and backfill work at the site. This will be followed by delivery of equipment and materials, erection of the towers, installation of the wind turbine generators; trenching and installation of the electrical collection system, and installation of substation equipment. Finally, prior to commercial operation, the individual equipment items will be tested and commissioned.

A majority of the construction activities associated with the proposed project will be conducted during daytime hours from 7:00 a.m. to 7:00 p.m. or daylight hours whichever is longer.

Nighttime construction activities after the hours above are not anticipated. Any construction at the facility in the evening and nighttime is expected to be limited to relatively quiet activities.

Typical on-site equipment used during construction will include trucks, dozers, excavators, loaders, graders, backhoes, cranes, compressors, pumps, generators, and welders. Representative workday equivalent sound levels associated with construction equipment are listed in Table 2. The sound levels shown in Table 2 are based on the results of extensive previous acoustical studies of engine-powered construction equipment.

Construction equipment sound levels are presented here for informational purposes. The sound from construction equipment during daytime hours is exempt from limits in the Maine DEP Noise Regulation. But all equipment used in these activities on Vinalhaven Island will comply with any applicable federal noise regulations, and will include noise control devices in proper working condition and maintained as originally provided by the equipment manufacturer.

The following mitigation measures will be employed during the construction phase of the project:

- Effective exhaust mufflers in proper working condition will be installed on all engine-powered construction equipment at the site. Mufflers found to be defective will be replaced promptly.
- Construction contractors will be required to ensure that their employee and delivery vehicles are driven responsibly.
- Nighttime construction work that does occur will be limited to relatively quiet activities, such as welding and installing equipment, cabling, and instrumentation.
- The community will be notified in advance of any blasting activity at the Project site.

Construction activities will sometimes be audible to nearby residents. Construction sounds heard off-site will vary from hour-to-hour and day-to-day in accordance with the equipment in use and the operations being performed at the site. Since the construction activity at the site will be temporary, will occur mostly in the daytime hours, and will be similar to sounds from other construction projects, its overall impact is not expected to be significant.

6. Project Operation and Maintenance Sound

Sound associated with routine operation of the proposed Project will be produced by A) the on-site electrical transformer 24-hours per day and B) by the wind turbine generators when wind speeds at the turbine hub elevation are in the range of approximately 8 to 50 mph. During lower and higher wind speeds the wind turbines will not operate and can be expected to produce no noticeable sound.

Presented in the following table for the nearest noise-sensitive receptors are the ranges of expected hourly equivalent operating sound levels from regulated equipment during future

operation of the proposed project with low to high wind speeds. The expected sound levels are, of course, lower for locations that are farther from the proposed Project.

The expected operating sound levels are based on the distances between each wind turbine and the nearest noise-sensitive receptors and data received from the manufacturer for normal as well as noise-reduced operation. Noise-reduced operation entails reducing both the turbine sound output and the generator electrical power output. Such an operating curtailment regime could be expected to reduce electrical power output during an estimated 2412 hours each year, or 28% of the time. The maximum output loss would be 260kw per hour, though in most curtailment periods it would be less than this. Losses due to curtailment total 2.09% of annual output.

Residential Locations Shown in Figure 2	Expected Operating Sound Levels, dBA Low/High Wind Speeds
A	38/45
B	36/43
C	36/43
D	36/43
E	37/44
F	35/42
G	34/41
H	33/40
I	32/39
J	33/40
K	30/38
L	30/37
M	30/37
N	28/36
O	33/41
P	32/40

The Project will be designed and operated such that the routine hourly equivalent operating sound level from regulated equipment will comply with Maine DEP sound level standards that are applicable to the Project.

Maintenance of the Project will include activities such as machinery inspections, lubrication, occasional repairs and overhauls, and painting. Maintenance activities are not expected to produce significant off-site sounds that will be intrusive to neighbors.

Appendix B outlines a series of measurements that can be performed during project operation, if required by MDEP.