Fox Islands Wind Power Project Noise Impact Assessment -- Peer Review

VINALHAVEN ISLAND, MAINE

Warren L. Brown

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Submitted by:

EnRad Consulting
516 Main Street
Old Town, Maine 04468

Submitted to:

Kristen Chamberlain
Maine Department of Environmental Protection.
Statehouse Station 17
Augusta ME 04433

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1.0 Introduction

Fox Island Wind LLC (RHW) proposes to construct, operate and maintain three 1.5 MW wind turbine generators at an elevated site near the center of Vinalhaven Island, Maine. At the request of the Maine Department of Environmental Protection (MDEP) a peer review is undertaken to determine if the applicant's noise impact assessment is reasonable and technically correct according to standard engineering practices and the Department Regulations on Control of Noise (06-096 CMR 375.10).

It should be noted that the above mentioned noise assessment review included additional information provided in 2 separate e-mails from the applicant's consultant.

The proposed wind turbine noise assessment report will be generally critiqued unless detailed criticism is given.

2.0 Site Description

This rural island project site is located on 3 prominences (approximate elevations 150-200 feet), which is mostly surrounded by dense evergreens with the exception of roadways and numerous residences (1270-3660 feet). The site is near the Atlantic Ocean on three sides (West -- 2.5 miles, East -- 3.5 miles, South -- 5.0 miles) and 2.5 miles south of North Haven Island. Acadia National Park (Isle Au Haut) is approximately 11 miles to the southeast.

Operation of an on-site transformer for grid connection is mentioned.

3.0 Noise Regulation Requirements

The town of Vinalhaven Land Use Ordinance Amended Section 20: Wind Power Facility defers to Maine DEP Chap 375.10 for its "Noise Report" requirement.

4.0 Measured Baseline Ambient Sound

Baseline ambient sound levels were measured for informational purposes. Measurements were conducted at the two nearest residences along property lines common to the project site during the period of October 23 through November 7, 2008. In addition surface wind speeds (12' 4" above grade) were measured continuously during the baseline sound measurements in a clearing adjacent residence A, as reported.

Sound level limits were determined at protected locations and property lines based on calculations from a select grouping of measurement results after removing storm and calm period (0-2 mph) data values from the measured results. The applicant's consultants did not measure hub level wind speeds, allowing a concurrent correlation between hub level and surface level winds.

Sixteen nearby sensitive receiver points are listed with distances from nearest wind turbine, MDEP hourly limits/ limit basis.

5.0 Project Construction Sound

A standard construction sound discussion is provided which is thorough and complete.

6.0 Project Operation and Maintenance Sound

Routine operation sound levels were calculated for 16 nearby protected locations based on operating sound loss due to distance and air absorption. Values reported for maximum wind turbine sound output (not to be confused with maximum electric output) indicated 5 locations, where predicted levels were 43-45 dBA.

Noise-reduced operation technology is mentioned as an inclusion into the design to allow adjustment of wind turbine sound at the expense of electrical power output loss.

The report confirms a design and operation plan such that routine hourly sound levels will comply with the Maine DEP standards applicable to the project

7.0 Noise Abatement

A standard discussion is given for a "good neighbor" acoustic policy specifying state and federal compliance with requirements for noise control of construction equipment, etc..

Sound masking during increased ambient sound levels is mentioned as a result of wind sounds in the trees.

8.0 Noise Impact Assessment

Standard construction sound compliance discussion.

Routine operating sound levels will occur under a wide range of surface level conditions at times causing wind turbines to be completely inaudible and other times more prominent. Routine operation of regulated equipment is expected to produce sound levels that all are equal or lower than applicable sound level limits contained in chapter 375.10 of Maine site location of development law regulations, although the noise level limits have not been numerically specified within the report.

9.0 Conclusion

It's my opinion the Fox Island Wind Project noise assessment is essentially reasonable and technically correct according to standard engineering practices and the Department Regulations on Control of Noise (06-096 CMR 375.10).

The very modest elevation change between wind turbine towers and nearby residents is suggestive of vigorous wind masking noise from area trees during significant turbine operation, but potential compliance concerns exist for the nearest 6 protected locations, identified in this report as locations A-E. I will expand in the following comments/recommendations.

Ambient sound levels were measured and average daytime/nighttime values calculated disregarding sound levels during wind speeds 0-2 mph. The regulation speaks to limiting measurements during high wind speeds (12 mph or perhaps manufacturer specified limits for microphone windscreens), but not low wind speeds. The nearby protected locations are within a very quiet rural setting, easily observed from the data submitted with the study.

RECOMMENDATION -- require "quiet area" sound level limits: daytime -- 55 dBA, nighttime -- 45 dBA

Significant vertical and directional wind shear in the Gulf of Maine (islands included) is documented for elevations similar to proposed turbine project during winds from the southwest through Southeast (as documented by the applicant wind rose data for spring through fall -- prominent wind directions for the proposed site.) Pubnico Point Wind Project NS ~150 miles east of Vinalhaven Island in the Gulf of Maine has documented occasional sound levels far in excess (of those predicted using standard methods (divergence, air absorption, ground, etc.) under these wind conditions.

These occasional periods of significant wind shear, may also produce amplitude modulations at +/-1 Hz in excess of 6 dBA

RECOMMENDATION -- compliance requirements specify measurement conditions to adequately evaluate sound levels associated with this phenomena, including appropriately specified controls for sound level assessment and adjustment for levels in excess of the limits.

RECOMMENDATION -- compliance should be demonstrated, based on following outlined conditions for 12, 10-minute measurement intervals per monitoring location meeting 06-096 CMR 375.10 requirements.

Extraneous sounds could potentially or do complicate routine operation compliance assessment. If the applicant must adjust for such sounds, background ambient monitoring may be necessary. If background ambient monitoring is proposed, locations, times and methodology should be determined with concurrence from the MDEP.

a. Compliance will be demonstrated when the required operating/test conditions have been met for twelve 10-minute measurement intervals at each monitoring location.

b. Measurements will be obtained during weather conditions when wind turbine sound is most clearly noticeable, i.e. when the measurement location is downwind of the development and maximum surface wind speeds $\leq$ (6-12) mph with concurrent turbine hub-elevation wind

speeds sufficient to generate the maximum continuous rated sound power from the wind turbines to the measurement location. Measurement intervals affected by increased biological activities, leaf rustling, traffic, high water flow or other extraneous ambient noise sources that affect the ability to demonstrate compliance will be excluded from reported data. The intent is to obtain 10-minute measurement intervals that entirely meet the specified criteria. A downwind location is defined as within 45° of the direction between a specific measurement location and the acoustic center of the wind turbines.

c. Sensitive receiver sound monitoring locations should be positioned to most closely reflect the representative protected locations for purposes of demonstrating compliance with applicable sound level limits, subject to permission from the respective property owner(s). Selection of monitoring locations should require concurrence from MDEP.

d. Meteorological measurements of wind speed and direction should be collected using anemometers at a 10-meter height above ground at the center of large unobstructed areas and generally correlated with sound level measurement locations. Results should be reported, based on 1-second integration intervals, and be reported synchronously with hub level and sound level measurements at 10 minute intervals. The wind speed average and maximum should be reported from surface stations. MDEP concurrence on meteorological site selection is required.

e. Sound level parameters reported for each 10-minute measurement period, should include A-weighted equivalent sound level, 10/90% exceedance levels and ten 1-minute 1/3 octave band linear equivalent sound levels (dB). Amplitude modulation repetitive events (multiple repetitive pulses) should be characterized by event duration and amplitude. Event frequency is defined as the average event frequency +/- 1SD and amplitude is defined as the peak event amplitude minus the average minima sound levels immediately before and after the event, as measured at an interval of 50 ms or less, A-weighted and fast time response, i.e. 125 ms. For each 10-minute measurement period short duration repetitive sound events should be reported by percentage of 50 ms or less intervals for each observed amplitude integer above 4 dBA. Reported measurement results should be confirmed to be free of extraneous noise in the respective measurement intervals to the extent possible and in accordance with (b.).

f. Compliance locations should be determined in consultation with the Department.

Compliance data collected in accordance with the assessment methods outlined above for representative locations selected in accordance with this protocol should be submitted to the Department for review and approval prior to the end of the first year of facility operation. Compliance testing for each or any location indicated A-E in this assessment should be required following significant noise related complaints (locations A-E) after the commencement of operation, with consideration for the required weather, operations, and seasonal constraints.