STATE OF CONNECTICUT
CONNECTICUT SITING COUNCIL

Petition of BNE Energy Inc. for a Declaratory Ruling for the Location, Construction and Operation of a 3.2 MW Wind Renewable Generating Project on New Haven Road in Prospect, Connecticut	Docket/Petition No. 980 March 8, 2011

Supplemental Pre-filed Testimony of David Pressman

The following pre-filed testimony supplements my pre-filed testimony filed on February 16, 2011, in connection with the above-captioned matter.

Q: What is the purpose for your Supplemental Testimony?

A: Under Section 16-50(g) , the Council is required "To provide the balancing of the need for adequate and reliable utility services *at the lowest reasonable cost* to consumers with the need to protect the environment ..." In my pre-filed direct testimony submitted 2/18/11, I provided data and evidence on why the Prospect project would likely not provide the lowest cost alternative for Connecticut consumers versus other renewable power projects (e.g. biomass or other wind sites closer to the coast). As part of my evidence, I documented the performance of existing Northeastern wind projects operated closer to the range of 25-26 percent capacity factor on average during the period 2007-2009—below the BNE claimed capacity factor of 30 percent. According to public wind resource maps, these existing projects were located in areas with superior wind resources in comparison to the proposed Prospect site. Given that the project would not release its wind data for independent review, I was unable to independently verify that the site could support a capacity factor as high as 30%.

In this testimony, I will further document that one reason contributing to the overestimation of the project performance was the applicant's input assumption that the project

would have only 10 percent losses. I believe the project will have greater than average power losses due to increased turbulence effects from a combination of the too close proximity of the turbines to one another, dense tree elevations and high regional icing conditions in New England. These above average power losses should result in lower power output and higher production costs. In addition, the increased turbulence effects and the anticipated need to clear a larger area to address this problem would indicate that BNE's estimates of the area to be cleared may be understated. A larger cleared area would exacerbate the adverse impacts on ground and surface water quality described in my prior prefiled testimony and further discussed herein. .

Turbine Location

Q: In BNE's application, does the proposed spacing of turbines 1 & 2 comply with current industry practices?

A: No. BNE's drawings and site plans are not inconsistent with respect to the spacing of turbines 1 and 2, but generally show that the two turbines are proposed to be located between 700 to 1200 feet apart. In either case, this would not meet current industry practices. BNE plans to use GE's 1.6 MW, 82.5 meter (270 ft) rotor diameter turbines, with a hub height of 100 meters (328 feet). The two turbines are proposed to be constructed at heights with different elevations- Turbine 1 is at 762 feet, while Turbine 2 is at approximately 640 ft. Additionally, the site is lined with trees. In their application, BNE has assumed the tree line will extend an average of 65 feet in the air.

Q: What is the industry standard for the minimum distances that turbines should be sited from each other?

A: A 2003 German wind study[1] suggests that wind turbines should be placed together not "closer than five diameter in the prevailing wind direction. Between three and five diameters it must be proved by specialist reports that the structural integrity is not affected."

Q: A review of BNE's Prospect site plans indicates that the bases of the two turbines may be sited only 700 feet apart. Assuming this distance, how far apart would the swept area of the two turbines be from another?

A: The proposed turbines have rotor diameters of 82.5 meters, or approximately 270 feet. BNE has requested in their application that the rotor diameter of 100m be approved. If approved, each turbine would have a rotor diameter of 328 feet. As illustrated in Exhibit DHP-1, if the two turbines are sited approximately 700 feet apart, as BNE's application indicates, there would be only 430 feet between the swept areas of the two turbines, or approximately 1.6 times the rotor length. If a 100 meter turbine is used, there would only be 372 feet of space between the swept areas of each turbine, or approximately 1.13 times the rotor diameter.

Q: Industry standards suggest that a distance of at least five rotor diameters separate wind turbines. If the distance is between only one and two rotor diameters, what impact will this have on the project?

A: Even if GE's 1.6 MW (82.5 meter rotor) turbine is used, the distance between the two turbines would result in disruptive wind turbulence. The impact of erratic wind streams would adversely impact project operation and reduce output.

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[1] Recommendations for Spacing in Wind Farms, Henry Seifert, Jurgen Kroning. Paper presented at EWEC Madrid, Spain 17 June 2003

Q: As provided in BNE's application, Turbine 2 is sited at an elevation of 640 feet, while Turbine 2 is sited at 762 feet. Given that Turbine 1 and 2 are already sited extremely close to one another, will this difference in turbine heights pose any additional problems?

The 122-foot difference in turbine heights could pose additional turbulence problems. Given the difference in the hub height and swept area relative to one another, the wind patterns created by the Turbine 2 could adversely impact operation of Turbine 1. Siting the turbines base structures on areas with similar elevations could mitigate this problem.

Q: BNE's application assumes an average tree height of 65 feet. The proposed turbine, GE's 1.6 MW unit, has a hub height of 325 feet, while the rotor diameter extends 270 feet (82.5 meters). What is the difference in height between the bottom of the turbine's swept area and top of the tree line?

A: Assuming usage of GE's 1.6 MW turbine, there would only be 128 feet between the bottom of the turbine's swept area and the tree tops. As is illustrated in Exhibit DHP-1, EVA calculated this number by subtracting the half of the span of the 270 ft. rotor diameter (135 feet) from the hub height (328 feet). There is a 193 foot difference between the bottom of the turbine's swept area and the ground. In their application, the developers assume the tree tops extend an average of 65 feet in the air. When tree tops are included, there is only 128 feet from the bottom of the turbine's swept area to the top of the trees.

Q: The developers have requested that a rotor diameter of 100 meters (328 feet) be approved. If the developers were to use a 328-foot rotor diameter, what would the distance be between the bottom of the swept area and tree tops?

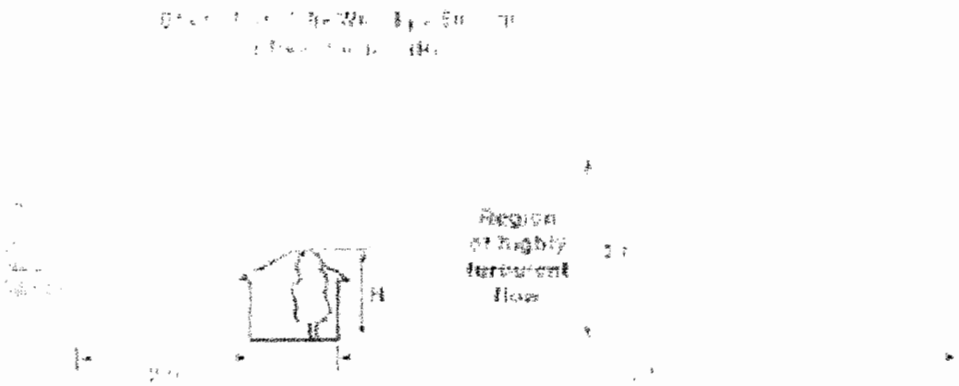
A: If a turbine with a 328-foot rotor diameter was used, there would only be 99 feet between the bottom of the turbine's swept area and the tree tops.

Q: Why is the distance between the swept area and tree tops an issue?

A: Wind turbines operate most efficiently when sited in wide open spaces where there is little turbulence, or high along mountain ridges where they are exposed to the most robust winds. While the Prospect site is slightly elevated, the presence of high tree tops means that the wind will likely bounce off the trees and hit the turbine swept areas in disruptive wind patterns, creating turbulence and further adversely impacting project output. That there is likely to be only 128 feet (or 99) between the bottom of the turbine's swept area and top of the tree line is another area that could create disruptive wind patterns and negatively impact project output. This is illustrated in the DOE graphic Exhibit DHP-2 below.

Exhibit DHP-2 (Source:

http://www.windpoweringamerica.gov/pdfs/small_wind/small_wind_va.pdf)



Icing

Q: What generation deduction losses have wind developers historically assumed in their wind models?

A: In a 2006 Clipper Wind report, "The Economics of Wind Energy", Clipper assumes a generic 40% capacity factor for wind projects. However, they assume a 16.2% deduction in their assessment of wind project availability, bringing their capacity factor of 34.4%. While few wind projects currently operating in the United States have ever achieved a 34.4% factor, Clipper's assumptions toward generation deductions prove useful to examine for their applicability in the Prospect project. They include:

- Transformer/Line Losses/Transmission Line -3.0%
- Wake Losses -4.8%
- Control Algorithm/Turbulence -1.6%
- Blade Contamination -1.5%
- Icing -1.0%
- Turbulence 0.0%
- Turbine Availability -3.0%

Q: The generation losses due to icing seem quite low in Clipper's report. What might the icing losses likely be for the Prospect project?

A: One report, "Wind Energy: Cold Weather Issues[2]" states that "icing represents the most important threat to the integrity of wind turbines in cold weather…it was determined that icing weather can occur as much as 15% of the time between the months of December and March." The report goes on to state that at lower elevations, such as the Prospect site, the "type of

[2] Wind Energy: Cold Weather Issues. Dr. James Manwell, Antoinne LaCroix, UMass Amherst Renewable Energy Research Laboratory. June 2000

meteorological hazard most likely to happen at lower elevations is glaze ice." The study cites a historical report that Connecticut has historically seen 6-9 days of freezing precipitation annually. (Exhibit DHP-3). Given that this icing occurs during the periods of greatest average wind speeds, the losses on an average basis are magnified.

Exhibit DHP-3

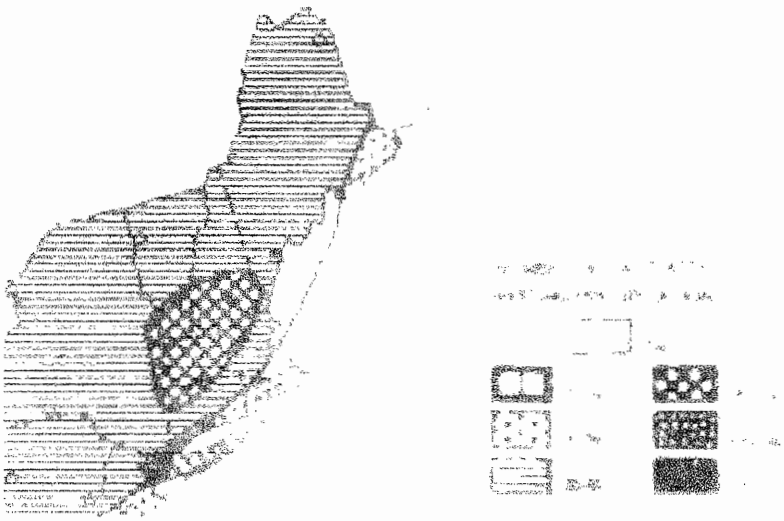


Figure 4. Total number of days with freezing rain or drizzle in the 10-year period from 1939 to 1948. Based on data from 95 Weather Bureau stations (Adapted from Bennett, 1959)

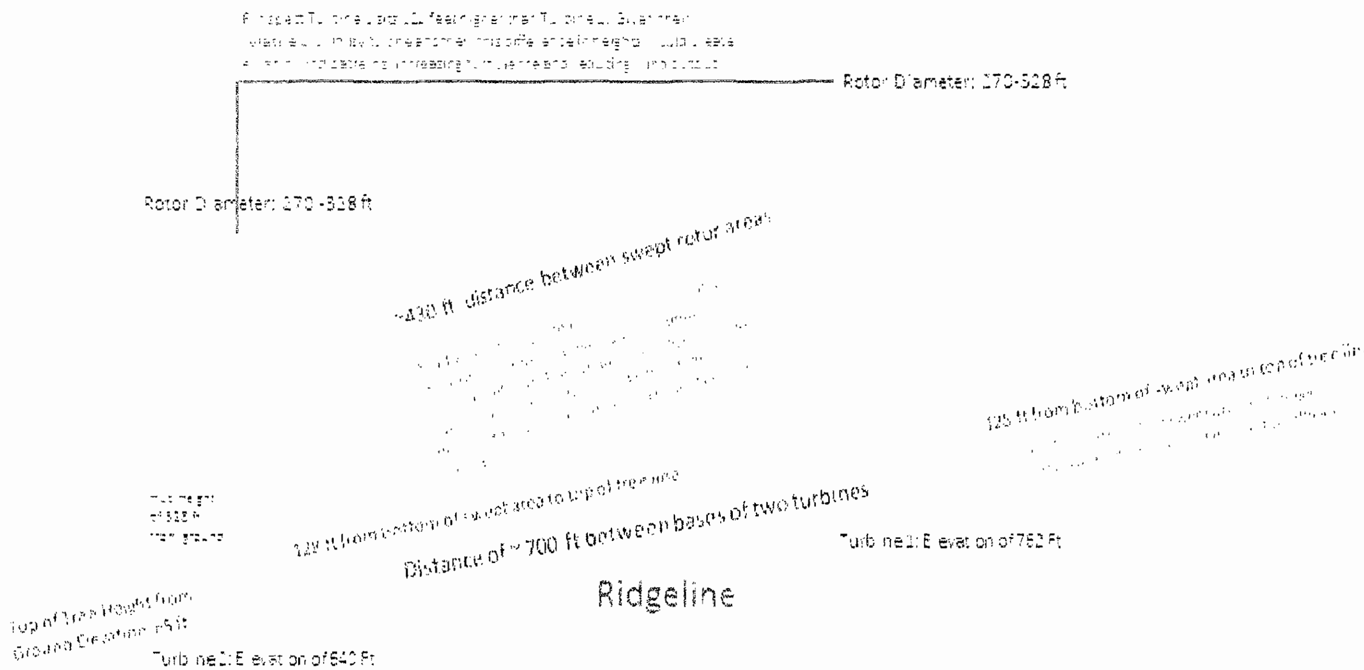
Conclusion

Q: Is the 10 percent BNE generation loss assumption reasonable?

A: No it is not. It appears that the combination of the turbulence losses from being located so close together, the losses from turbulence from the tree cover, icing losses, transmission losses, availability losses will easily be greater than 10%. I believe that there is a good possibility that BNE may decide to reduce its future turbulence losses by clearing more trees onsite to improve performance. This future operational decision could have site environmental impacts.

Exhibit DHP-1

Prospect 1&2's proposed location compared to one another



- According to the American Wind Energy Association, 60 acres per MW is a proper distance between wind turbines. This would equal approximately 96 acres for GE's 1.6 MW turbine, the model proposed for the Prospect site.
- A German study proposed that wind turbines should not be closer than 5 rotor diameters distance from one another. Prospect turbines 1&2 would be approximately 1.5 rotor diameters away from each other
- Little distance between the two turbines, a difference of ~122 ft in elevation and only 128 feet from the bottom of the swept area to the tree top would result in high levels of wind turbulence.
- High levels of turbulence between Prospect 1&2 would result in lower power output and higher maintenance costs. The combination of these two would adversely impact turbine operation and project profitability.

Sea Level