STATE OF VERMONT
PUBLIC SERVICE BOARD

Docket No. _____

Petition of Deerfield Wind, LLC for a Certificate	)
of Public Good pursuant to 30 V.S.A. section 248,	)
authorizing it to construct up to a 45 MW wind electric	)
generation facility, and associated transmission and	)
interconnection facilities, in Searsburg and Readsboro,	)
Vermont, and operate the same.	)

PREFILED DIRECT TESTIMONY OF DAVID P. ESTEY, P.E.

ON BEHALF OF DEERFIELD WIND, LLC

January 8, 2007

Summary:

Mr. Estey describes the Deerfield Wind Project's proposed transmission facilities and the electrical interconnection options with the utility transmission system. He also provides testimony regarding the Project's compliance with 30 V.S.A. § 248 (b)(3) and (b)(10).

Q. Please state your name, occupation and business address.

Response. My name is David P. Estey. My business address is 249 Western Avenue, Augusta, Maine 04330. I am Manager, Power System Studies at E/PRO Engineering and Environmental Consulting, LLC.

Q. Please describe your background and qualifications.

Response. I received my B.S. degree in Electrical Engineering from the University of New Hampshire in 1974. In 1980, I was awarded an M.S. degree in management by Thomas College.

I have thirty-one years of experience in the electric utility industry, including extensive experience in the areas of: Energy Management/Demand Side Management, rate and regulatory activities, electrical engineering, EMF and power quality activities, business development, and engineering consulting. I have also been substantially involved with power system impact analyses, providing technical support, interpreting results of simulations, and assisting with the compilation of numerous system steady state and stability studies.

My resume is attached as ***Exhibit DFLD-DE-1***.

Q. Have you previously testified before the Public Service Board or in other judicial or administrative proceedings?

Response. I have not previously testified before the Vermont Public Service Board. However, I have had the privilege of testifying before the Maine Public Utilities Commission (MPUC) and the Federal Energy Regulatory Commission (FERC) on

various rate tariff issues. I have also presented testimony before the Massachusetts Facilities Siting Board on transmission line issues associated with various power plant projects including the Cape Wind Project. I have also presented similar testimony to the Connecticut Facilities Siting Council and the New York Public Service Board.

Q. What is the purpose of your testimony?

Response. I describe the Deerfield Wind Project's proposed transmission facilities and the electrical interconnection options with the utility transmission system. I also provide testimony regarding the Project's compliance with certain portions of the 30 V.S.A. § 248 criteria.

Q. Please describe the proposed interconnection options.

Response. The Deerfield Wind Project is considering two interconnection options within the Town of Searsburg, Vermont. As illustrated on ***Exhibit DFLD-DE-2,*** two potential substation locations are identified. One site is a new substation located adjacent to the 69 kV transmission line approximately 0.75 miles southwest of the Intersections of Route 8 and Route 9. The second site (alternate site) is the existing Green Mountain Power Sleepy Hollow Substation located southeast of Route 8 adjacent to the Sleepy Hollow Road.

Q. Please describe the proposed transmission and interconnection facilities for the preferred interconnection site.

Response. The wind farm electrical interconnection system can be divided into three primary components. These are: (1) the transmission system, (2) the substation facilities, and (3) the collector system.

Transmission System. As illustrated in ***Exhibits DFLD-DE-2*** and ***DFLD-DE-3***, the nearest utility transmission line is the National Grid USA (NGrid) / Vermont Electric Company (VELCO) 69 kV line designated Y25N. NGrid has upgraded their portion of the Y25N line such that it is capable of handling a minimum of 65 MW and VELCO is in the process of making similar upgrades on the portion of the line they own.

As illustrated in ***Exhibit DFLD-DE-4,*** a new substation will be constructed adjacent to the Y25N line to facilitate interconnection into the line. The Y25N line will be split and subsequently terminated within the new substation to create two transmission line segments where one previously existed. One line segment will now run from the new substation west to VELCO's Bennington substation. The other segment will run east to NGrid's Searsburg Station.

Substation. Also illustrated in ***Exhibit DFLD-DE-4*** is the proposed interconnection between the Deerfield Wind Project and the transmission system. A typical substation one-line diagram, a typical substation plan view, and a typical substation elevation diagram are illustrated in ***Exhibits DFLD-DE-5a, DFLD-DE-5b***, and ***DFLD-DE-5c,*** respectively. The primary purpose of the substation is to provide a means of isolation between the wind generators and the transmission system and to provide for a change in voltage from the medium voltage collector system to the 69 kV transmission system.

Collector System. The purpose of the collector system is to interconnect the individual wind turbines to the step-up transformer. The collector system will consist of two 34.5 kV collector circuits, one for each of the Eastern and Western Project Areas. The proposed collector system will comprise a combination of underground and overhead distribution class facilities. In the immediate area of the wind turbines and in areas subject to high winds and severe icing, the collector facilities will be placed below grade. As the collector system approaches the substation, the collector circuits will transition from below grade to Hendrix style overhead lines that will be placed along the access roads to the wind turbine sites. The length of collection system is projected to be approximately 2.0 mile (above ground) and 3.75 miles (underground).

Depending on the model of wind turbine, each unit will interconnect to the collector system via either a pad-mounted, feed through transformer or vacuum switch. The wind turbines will generate electricity at less than 1000 volts. This generator output needs to be stepped up to 34.5 kV to interconnect to the collector system. A transformer at each wind turbine will provide the necessary interface between the wind turbine and the collector system. As illustrated in ***Exhibit DFLD-DE-4***, the collector system will daisy-chain the wind turbines together on a string that runs to the substation to be transformed to a transmission-level voltage.

As illustrated in ***Exhibit DFLD-JZ-4a and 4b***, the collector system in the Eastern Project Area will pass through the existing Searsburg wind farm project. All collector facilities in this area will follow the original method of overhead along access roads and underground along the service roads in the vicinity of the wind

turbines. The collector system will remain sub-grade to the same point where the existing wind project makes its transition from sub-grade to overhead line. The line from the Eastern Project Area will pass by the Sleepy Hollow Substation to the south end of the Western Project Area and continue through the Western Project Area to the new substation on the north side of the Project. The existing overhead line between the existing Searsburg Wind facility and the Sleepy Hollow Substation will be rebuilt to accommodate both the existing and the new collector system lines. As the collector system approaches the southern end of the Western Project Area, the line will transition from overhead to underground through the Western Project Area

As illustrated in ***Exhibit DFLD-JZ-4a and 4b***, the collector system in the Western Project Area will run along the ridge line to the northern most point. The collector system along the ridge line will be sub-grade for its entirety. As the two underground collector circuits descend towards the new substation, the system will transition from underground to overhead and extend to and terminate at the new substation.

All overhead line construction is expected to be Hendrix style construction as illustrated in ***Exhibit DFLD-DE-6***.

Q. Please describe the proposed transmission and interconnection facilities for the alternate interconnection site.

At the alternate interconnection site, the nearest utility transmission line continues to be the National Grid USA (NGrid) / Vermont Electric Company

(VELCO) 69 kV line designated Y25N. However, the Y25N line is tapped in the area of the Sleepy Hollow Road and interconnects Green Mountain Power's existing Searsburg Wind Facility located adjacent to the proposed Deerfield Wind Project. This Y25N tap segment is owned by the Green Mountain Power Company and employs 336.4 kcmil ACSR (Linnet) conductors that offer marginally sufficient capacity (50+ MW) to accommodate both the proposed Deerfield Wind Project (45 MW) and the existing Searsburg facility (6 MW) at full output.

As illustrated in ***Exhibits DFLD-DE-7*** and ***DFLD-DE-8***, the 69 kV transmission tap terminates at the Sleepy Hollow Substation. The primary purpose of the existing Sleepy Hollow Substation is to provide a means of isolation between the existing wind generators and the transmission system and to provide for a change in voltage from the medium voltage collector system to the 69 kV transmission system. The Deerfield Wind Project reviewed the joint use of the Sleepy Hollow substation with Green Mountain Power Company as the alternative interconnection.

Under the Sleepy Hollow Substation option, it would be necessary to expand the substation to accommodate up to 45 MW of wind-powered generation. The expansion will consist of: a 69 kV Bus extension; a 69/34.5 kV transformer; two 34.5 kV collector circuits; a control building to house communication, control and protection equipment at the Sleepy Hollow location. In addition to modifications at the Sleepy Hollow Substation, additional equipment would be necessary at the Y25N tap point.

Under the alternative interconnection, the collector circuits will have the same routes but will terminate in the middle of the Project at the Sleepy Hollow

Substation as opposed to the north end of the Project as proposed in the preferred option.

Q. Why is the new substation the preferred option over the existing Sleepy Hollow Substation?

Response. While the Sleepy Hollow Substation is more central to the proposed Deerfield Wind Project, the transmission system operators have concluded that use of the Sleepy Hollow Substation as an interconnection point will require the addition of a new substation at the Sleepy Hollow tap point to provide adequate line protection and reliability. The requirement to construct a new substation in addition to expanding the existing Sleepy Hollow facility is more intrusive and less cost effective than building a single new substation.

Q. Who designed the proposed substation and collector systems?

Response. I was hired by Deerfield Wind, LLC to help develop conceptual designs of various wind project interconnections. I have previously provided guidance to enXco on their proposed Hoosac Wind Project interconnection in Monroe, Massachusetts, and PPM has requested similar advice on this project. Both projects have involved interconnection to NGrid's 69 kV Y25 line.

Q. What involvement have the utility companies had in the design of this interconnection?

Response. NGrid in cooperation with Green Mountain Power, VELCO, and ISO New England have reviewed the proposed design and conducted a feasibility study

of the proposed interconnection alternatives. See ***Exhibit DFLD-DE-9.***

Q. What were the conclusions of their review and the feasibility study?

Response. The report concluded that the 69 kV transmission lines were generally adequate to accommodate the addition of the 45 MW Deerfield Wind Project. The Project would not create significant pre- or post-contingency voltage violations. However, the study found that under certain contingency situations, the loss of the Y25N connection between Deerfield Wind and Bennington could cause the 69 kV line "J10" between Adams and Deerfield Hydro No. 5 to experience a significant overload condition. The solution to this condition is to upgrade line J10.

The feasibility study additionally identified a need for VELCO to upgrade their portion of Y25N, and that the Bennington transformer could possibly reach a loading of 100.3% of its capability. VELCO is already in the process of upgrading their portion of the Y25N line and has determined that the additional upgrade could be accomplished at no incremental costs. VELCO also determined that the potential overload on the Bennington transformer is not a concern and does not need to be addressed.

Due to significant transmission line protection issues, NGrid has taken the position that the Wind Project cannot directly connect into the Sleepy Hollow Substation, without creating a new three breaker ring bus substation at the Sleepy Hollow/Line Y25N tap location. This would require the construction of a new substation, comparable to the preferred new substation, in addition to the modifications to the Sleepy Hollow Substation previously identified.

The feasibility study also concludes that the increase in fault levels due to the Deerfield Wind Project is projected to be no more than 20% on the 69 kV system. The projected maximum fault duties at the point of interconnection are expected to be:

Three Phase Line to Ground (3LG)	6,854 amps @ 69 kV
Line to Line (LL)	5,759 amps @ 69 kV
Single Line to Ground (SLG)	4,671 amps @ 69 kV

Whereas the projected fault duties are less than the rated breaker duty capabilities, there are no instances where the equipment is overdutied due to the Project.

Q. Have you considered interconnection options other than those described above?

Response. No. Cost-effective options for interconnection are limited due to the presence of only one transmission line in the immediate area. The two options defined above represent the most economic and least intrusive options.

Q. Have you assessed the Project's compliance with the criteria of 30 V.S.A. § 248?

Response. Yes, I have assessed the Project's compliance with Section 248(b)(3), a portion of (b)(5) (as it relates to the Project's electrical components), and (b)(10), and determined that the Project complies with these criteria.

Q. Please explain.

Response. Per Section 248(b)(3), the Project will not adversely affect system stability and reliability. The Wind Project will be interconnected to the Vermont 69 kV transmission system via a three-breaker ring bus configuration which will improve reliability of the transmission line. Control and protection systems for the wind facility will be designed and installed consistent with the transmission line owners' recommendations after consultation with Deerfield Wind. Specific recommendations from those entities will not be available until the conclusion of the ISO New England System Impact Study. However, based upon my review of the Feasibility Study, past experience, and discussions with the transmission line owners and ISO New England, it is my opinion that the Project can meet all necessary standards of stability and reliability.

As previously stated, the transmission line owners have studied the proposed project and have indicated minimal concerns. The proposed Deerfield Wind Project does not violate any Voltage, Short Circuit or Power Quality standards. There is one thermal loading issue relative to Line J10 under contingency conditions. This thermal loading issue will be addressed by rebuilding the necessary segments of Line J10 to mitigate the thermal overloading.

Per Section 248 (b)(5), the Project will meet all applicable health and environmental conservation department regulations regarding the disposal of wastes and will not involve the injection of waste materials or any harmful or toxic substances into ground water or wells. None of the proposed electrical systems (collector system or substation) will produce any waste material or emit toxic or harmful substances into the ground water or wells. The proposed step-up

transformer in the substation will contain non-toxic mineral oil as an insulating medium. The transformer foundation will be designed to contain the entire volume of transformer insulating oil in the event of any leak or catastrophic failure.

The procurement specifications and construction contract will require the suppliers to satisfy all applicable health and environmental regulations regarding the disposal of wastes.

Per Section 248 (b)(10), the Project can be served economically by existing or planned transmission facilities without undue adverse effect on Vermont utilities or customers. As previously described above, the proposed Wind Project is expected to interconnect into a new substation located at the northwesterly end of the Project. This is the most economical interconnection alternative, and would have no cost impact to Vermont utilities or their ratepayers. The addition of the new substation will provide the utilities with better sectionalizing capabilities and offer improved reliability to the existing line by allowing either the westerly segment or the easterly segment to be interrupted as opposed to the entire line under its present configuration.

Q. Have you considered the effects of the proposed Deerfield project on EMF levels in the area?

Response: Yes, I have. The Project will be interconnecting to an existing 69 kV transmission line which will offer sufficient capability to transmit the output of the proposed Wind Project. The transmission facilities will not be changed as part of the Project. Since the voltage of the transmission line will not be changing, there will be

no difference in the electric field levels along the transmission line. While integration of the Wind Project on to the transmission may influence the direction of load flow influencing magnetic fields, the potential magnetic fields are limited by the capacity of the transmission line, which is not changing as part of this Project.

Since most regulatory limits have been placed on HV (115 & 230 kV) and EHV (345 & 500 kV) facilities and since there is no specific regulatory requirement to assess EMF effects of a power facility, no specific analysis has been performed on the before and after effects of the Project.

Q. Does this conclude your testimony at this time?

Response. Yes.