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 EZRA D. HAUSMAN, Ph.D.

ON BEHALF OF DEERFIELD WIND, LLC

January 8, 2007

Summary:

Dr. Hausman testifies regarding 30 V.S.A. § 248(b)(2) and (b)(4). He reviews the need for new, fixed cost sources of power in the state and the region; the demand for renewable energy in particular; the expected environmental and economic benefits of the Project in terms of displaced air emissions of pollutants; and the financial viability of the Project.

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

Response: My name is Dr. Ezra D. Hausman. I am a Senior Associate with Synapse Energy Economics, Inc, 22 Pearl Street, Cambridge, MA 02139. Synapse Energy Economics ("Synapse") is a research and consulting firm specializing in energy and environmental issues, including electric generation, transmission and distribution system reliability, market power, electricity market prices, stranded costs, efficiency, renewable energy, environmental quality, and nuclear power.

Q. Please summarize your educational background and recent work experience.

Response: I graduated from Wesleyan University with a Bachelor of Arts Degree in 1986. In 1990, I received a Master of Science Degree in Civil Engineering from Tufts University. In 1994, I received a Master of Science Degree in Applied Physics from Harvard University; and in 1997, I received a Ph.D. from Harvard University's Department of Earth and Planetary Science, with a focus on Atmospheric Chemistry.

Since 1998, I have worked as a consultant in the electric power industry, performing a wide range of market analysis, price forecasting and asset valuation studies for clients in both the public and private sector. These studies have included long-range price forecasting studies for a number of purposes, including analysis of proposed capacity investments, contract valuation and liquidation studies, market power studies, market transition cost/benefit studies and market design support. I have testified or assisted in the preparation of testimony in a wide range of civil and regulatory cases. In addition to performing these studies for clients, I have spoken

and led several seminars on electricity pricing and hedging transmission cost risk in electricity markets. I have also published peer-reviewed papers on the topics of pricing of losses in electricity markets, and on the dynamics of the California price spikes during the winter of 2000-2001.

Prior to accepting my current position with Synapse, I was employed as a Senior Associate with Tabors, Caramanis and Associates (TCA) of Cambridge, MA from 1998 until 2004, and subsequently with Charles River Associates (CRA) when the latter acquired TCA.

A copy of my current resume is attached as ***Exhibit DFLD-EH-1***.

Q. Have you previously testified before the Public Service Board?

Response: No, I have not.

Q. What is the purpose of your testimony?

Response: Synapse was asked by Deerfield Wind, LLC to prepare an analysis of the economic and environmental benefits of the Deerfield Wind Project for the State of Vermont and the New England region as a whole. In response, we have reviewed the need for new, fixed-cost sources of power in the state and the region; the demand for renewable energy in particular; the expected environmental and economic benefits of the Project in terms of displaced air emissions of pollutants; and the financial viability of the Project. The results of this analysis are presented in ***Exhibit DFLD-EH-2***.

Q. Please summarize the analyses you performed, and the conclusions you reached, regarding the projected need for fixed-cost, renewable sources of power in Vermont and the surrounding region.

Response: As detailed in our report, we reviewed the current sources of supply for Vermont utilities and consumers, and found that approximately 2/3 of the current supply is procured under long-term contracts from the Vermont Yankee nuclear facility, owned by Entergy, and from Canadian hydropower sources owned by HydroQuebec. The Entergy contract will expire in 2012, and the hydropower contracts begin to expire in 2015. From this, we concluded that Vermont utilities and ratepayers will need to obtain new fixed-price, long-term contracts to support a reasonably diversified supply portfolio in the future. The proposed Deerfield Wind Project, which would produce enough energy to satisfy the demand of up to 20,000 Vermont homes, would present such an opportunity.

In addition, we reviewed the supply and demand for renewable energy and renewable energy credits, known as RECs, throughout the New England region. RECs are tradable instruments that represent the environmental attributes of renewable power, and are needed to satisfy state requirements that retail providers obtain a certain percentage of their supply from renewable energy. We found that there is a strong and growing demand for RECs throughout the region. In addition, we found that there is a regulatory mandate for utilities in Vermont to procure energy from renewable energy sources to match all load growth between now and 2012, under Act 61 of the 2004 legislative session. Depending on the success of this initiative, Vermont may initiate an RPS program similar to those in other New

England states in 2013. The Deerfield Wind Project would address the Vermont Act 61 requirement, and would also produce one REC for every MW of energy it generates. As these RECs would come from a new wind project, they would be qualified for sale within any program in the region.

Q. Why should the Public Service Board consider the need for power in the region in reviewing an in-state generation project under section 248(b)(2)?

Response: The state of Vermont is located within the broader region operated by ISO New England, which comprises a single, centrally-dispatched wholesale electricity market. The ISO's mandate is to produce the most efficient dispatch of generating units to meet load, subject to transmission constraints and reliability criteria, without regard to state boundaries. Because of this, the availability of power anywhere in the system affects electricity prices throughout the region. If there is a shortage of low-cost power in Massachusetts, for example, it will generally mean higher prices for utilities and consumers throughout the system, including in Vermont.

Q. Please summarize the analyses you performed, and the conclusions you reached, regarding the projected air emissions benefits of the Deerfield Wind Project.

Response: As we discuss in our report, the availability of wind generation means that certain other units will be backed down, as some of their output will no longer be required to meet load. As a result, they will produce less pollution, such as NOx,

SO_2, and CO_2, which are associated with social and economic costs related to adverse health impacts, acid rain, regional haze, and global climate change. The Deerfield Wind Project would produce a tangible benefit for the region by reducing overall emissions of these pollutants from the electric sector.

To quantify the air emissions benefits for the first several years of the Project's life, we relied on previous analyses performed by Synapse in this area in which we determined the regional marginal emissions rate in New England during the summer and winter seasons, for on-peak and off-peak periods. We then estimated what the output of emission-free energy from the Deerfield facility would be during these periods, and applied the marginal emission rates to project total annual displaced emissions. We found that the Project will prevent the emission of up to 141 tons of NO_x and up to 386 tons of SO_x per year during this period. In addition, we estimate that the Project will prevent the emission of as much as 100,386 tons of heat-trapping CO_2 each year during this period, thus contributing to efforts to address global climate change. These figures are based on a project capacity of 45 MW; if the Project size is different, the estimated displaced emissions benefits would be scaled accordingly, as reflected in the report.

During later years (5^{th} year and beyond), the emissions impact will be felt increasingly through the effect of the Project on generation investments and retirements than on changes in dispatch. This is because the system will adjust over time to the presence of Deerfield through changes in new entry and retirements, so that peaking units, for example, will begin to experience the same load factor that they would have in the absence of this new resource. In other words, the Project will,

on the margin, obviate some capacity investments and hasten some retirements. The net emissions impact will increasingly reflect a combination of this process instead of the operational effects described earlier. During this period, we calculate that the emissions benefits will include prevention of 50 to 96 tons of NO_x and 35 to 211 tons of SO_2 each year, as well as up to 73,794 to 87,090 tons of CO_2 annually, again based on a 45 MW project capacity.

Q. Please summarize your findings with respect to the economic benefit of displacing fossil fuel generation with the output of the Deerfield Wind Project.

Response: In order to quantify the economic benefit of replacing conventional generation sources with emissions-free generation from the Deerfield Wind Project, we reviewed the standards articulated in the Public Service Board's Orders in Dockets 5270 and 5980 for quantifying avoided externalities from demand-side management projects. This led to a projected annual benefit of between $0.6 million and $1.1 million in avoided external costs due to displaced conventional generation, depending both on project size and on which valuation model (based on Dockets 5270 or 5980) we assumed.

Q. Please explain why it is appropriate to apply the values from Docket 5270 to this generation project.

Response: The goal of the Order in Docket 5270 was to recognize both the benefits of reduced emissions, and of reduced risk, associated with reliance on demand side initiatives instead of fossil fuel-based generation. This is not a demand management

project, of course, but many of the benefits are the same—reduction in harmful pollutant emissions, reduced impact on global climate, and a reduction of risk associated with fuel supply and volatile fuel prices. However, some of the risk reductions associated with demand side initiatives do not apply here, so we reduced the risk adjustment by half. In this way, we tried to accommodate the *value* of these benefits to the State of Vermont, even if the means of realizing this value are different.

Q. Please explain why it is appropriate to apply the values from Docket 5980 to this generation project.

Response: As with Docket 5270, the Order in Docket 5980 is an attempt to quantify the value of avoided environmental externalities to the State of Vermont, this time with a fixed adder per megawatt of avoided fossil fuel generation. Because those same benefits would be realized through the Deerfield Wind Project, we rely on Docket 5980 as a reflection of an avoided emissions value that was deemed to be appropriate for Vermont by its regulatory body (although we recognize that the externality values in that case were deemed to be non-precedential.) As the Order in Docket 5980 was issued nine years after the Order in Docket 5270 and results in a very similar evaluation, it is evidence that this value is a realistic and reliable expression of the PSB's position in this area.

Q. Please summarize the analyses you performed, and the conclusions you reached, regarding the financial viability of the Deerfield Wind Project.

Response: We performed an independent analysis of Project costs, based on our own estimates of capital requirements, fixed and variable operating costs, and financing terms. We assumed that the Project will receive a production tax credit of $18 per MWh during its first ten years of life. We then estimated the revenues the Project is likely to receive from the sale of electricity, capacity and RECs. All of these are subject to considerable uncertainty, in particular the future value of RECs, which face considerable regulatory and supply uncertainty. Nonetheless, we conclude that the Project is likely to be economically viable given all of these sources of revenue. Further, we find reason for concern that natural gas prices will remain elevated in the foreseeable future relative to historical levels, and that the price of electricity may consequently remain higher than many recent projections indicate. Given this strong possibility, we find that there are considerable economic benefits for a source of supply that is insensitive to fossil fuel prices.

Q. Have you relied on the work of any other experts concerning this project?

Response: In performing this analysis, I relied on work previously performed by Synapse staff, primarily Dr. David White and Mr. Geoff Keith. In addition, Mr. Kenji Takahashi offered considerable assistance in researching the renewable energy markets in the northeast Unites States.

Q. What is your overall conclusion from this analysis?

Response: I conclude that there is a need for the power to be produced by the Deerfield Wind Project and that the Project would offer substantial economic and

environmental benefits for the State of Vermont and for the New England region as a whole. I further conclude that the Project is financially sound.

Q. Does this conclude your testimony at this time?

Response: Yes, it does.