STATE OF RHODE ISLAND AND PROVIDENCE PLANTATION

PUBLIC UTILITIES COMMISSION

In Re: Docket No. 4185 - Review of Amended Purchase Power Purchase Agreement between Narragansett Electric d/b/a National Grid and Deepwater Wind Block Island, LLC Pursuant to R.I.G.L § 39-26.1-7	:	**Docket No. 4185**

Pre-Filed Testimony of Expert Witness

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Q. **Please state your name and business address:**

A. My name is William P. Short III. My current business address is 44 West 62nd Street, New York, New York 10023-7008 and my mailing address is P.O. Box 237173, New York, New York 10023-7173.

Q. **Please describe your qualification and experience.**

A. I am an independent consultant with a practice specializing in the field of renewable energy.

I began my professional career with Philadelphia Electric Company (now Exelon Corporation) in 1973. There I was a project engineer in its Engineering & Research Department and worked on the design, construction and operations of nuclear power plants, specializing in the emergency core cooling systems for nuclear power plants. From 1978 until 1980, I worked, as project engineer, for EBASCO (now a part of Raytheon), designing nuclear power plant security systems. From 1980 until 1996, I worked for a major investment bank, Kidder, Peabody (now part of UBS Financial Services), as an investment banker. I specialized in the financing of renewable energy companies and renewable energy projects. I financed wind farms, landfill gas power plants, geothermal power plants, geothermal companies, biomass plants and small hydro facilities. For ten years, I managed, on behalf of Kidder's investors, the operations of several wind farms in which its clients had invested.

I consulted during 1996 and 1997 on electric power de-regulation in California, advising Prudential Insurance, Deutsche Bank and CIGNA on their geothermal loan investments. During the same period of time, for Southern California Edison Company I performed analysis to support buy-out offers for above-market long-term power purchase agreements with renewable energy projects.

I worked from 1997 through 2008 for Ridgewood Power Management Corporation (hereinafter referred to as "Ridgewood"), where I was its vice president of power marketing. I managed its sales of energy, capacity and renewable energy certificates (hereinafter referred to as "REC") from its generating facilities, including two biomass plants, two landfill plants and 16 small hydro plants in New England. The two landfills and one of the hydros were located in Rhode Island. I represented Ridgewood in the legislative and regulatory process that created the various New England state Renewable Energy or Portfolio System programs (hereinafter referred to as "RPS"). I managed the regulatory effort to qualify the Ridgewood generating facilities in the various New England state RPS programs. I materially participated in the creation of the New England Power Pool Generation Information System (hereinafter referred to as "NEPOOL GIS").[1] Although Ridgewood was a small company, during the mid-2000s, with its generating assets, I, nevertheless, managed to control as much as 45% and 40% of the supply of Massachusetts and Connecticut RPS requirements, respectively, for "new" renewable facilities. For the period of 2002 through 2006, Ridgewood was the largest generator of "new" REC[2] (hereinafter referred to as "New REC") in New England. These efforts were quite successful and, by 2007, resulted in additional revenues between 66 2/3% and 100% of the combined energy and capacity revenues for Ridgewood's New England facilities.

Concerning traditional power marketing activities, I aggressively marketed the energy and capacity from Ridgewood's New England power plants. In 1999, Ridgewood's plants were the first New England independent renewable generators to sell their energy into the ISO-NE markets. In 2004, Ridgewood's plants became the first renewable generators to sell their generators' gross energy production while at the same time purchasing all of their station service needs from ISO-NE. In 2007, Ridgewood became the first New

[1] The NEPOOL GIS is the tracking and trading system that was established for, among other things, the verification of compliance with the various New England state RPS programs. It also provides a data base of public reports on generator production.

[2] "New" RECs may be defined collectively as Massachusetts Class I, Connecticut Class I, New Hampshire Class I, Maine Class I and Rhode Island New REC.

England independent renewable generator to serve load under a Standard Offer Service (hereinafter referred to as "SOS") agreement[3] exclusively with energy from renewable generation. Through 2002, until I left Ridgewood, I negotiated discounted transmission service, station service and metering service contracts with our facilities' local electric distribution companies. The SOS agreement raised Ridgewood's energy revenues by approximately $10 per megawatt-hour (hereinafter referred to as "MWh") over what they would have been otherwise while these other agreements reduced operating expenses approximately $5/MWh.

Since leaving Ridgewood in 2008, I established a consulting practice. Given my knowledge of and experience with the New England power and REC markets, all of my clients' operations are located in New England. I represent the owners or developers of wind, biomass, solar, co-generation and hydro-electric projects. I qualify, manage and sell for these clients some or all of their REC production. I also represent load serving entities in Connecticut, Massachusetts, Maine, New Hampshire and Rhode Island. I regularly manage and purchase for these clients all of their REC requirements. I maintain a proprietary data base on the supply and demand for the various New England RPS programs. I offer extracts of this data-base to both my load and generator clients. I also act as an Independent Third Party Meter Reader, qualifying behind-the-generation for the various New England RPS programs and then reading and verifying their production.

Q. **Please describe your education.**

A. I was graduated by Duke University with a Bachelor of Science in Engineering (Electrical Engineering) in 1973, the University of Pennsylvania with a Masters of Science in Engineering (Systems Engineering) in 1978 and New York University with a Masters of Business Administration (Finance and Accounting) in 1978.

[3] Ridgewood's affiliate Indeck Maine Energy served load under the Maine Standard Offer Service arrangement, an arrangement similar to the Basic Service of Narragansett Electric.

Q. **Have you previously testified before State Legislatures or State Energy or Public Utility Commissions on matters pertaining to renewable energy policy or projects?**

A. Yes, I have testified on matters pertaining to renewable energy policy at the Maine, New Hampshire, Massachusetts, California and Connecticut state legislatures. I have testified on matters pertaining to renewable energy policy or projects at the California Energy Commission, California Public Utilities Commission, New York Public Service Commission, New Hampshire Public Utilities Commission, Maine Public Utilities Commission, Massachusetts Department of Energy Resources, Rhode Island Public Utilities Commission and Connecticut Department of Public Utility Control.

Q. **Were you a participant in Docket No. 4111 - National Grid - Review of Proposed Town of New Shoreham Project Pursuant to R.I.G.L. § 39-26.1-7?**

A. Yes, I was retained by Maggie and Michael Delia (the "Delias") as their expert witness in that proceeding. I prepared written testimony and answered one set of questions from the Division.[4] Unfortunately, before I could answer additional questions and provide oral testimony, the Delias withdrew from the proceeding as an Intervenor and my testimony was changed to Public Comment.

Q. **Do you belong to any professional organizations or committees?**

A. Yes, I am a member of the American Nuclear Society, the Geothermal Resources Council and the Institute of Electrical and Electronic Engineers.

Q. **What is your role in this proceeding?**

A. I have been retained by the Department of Attorney General of the State of Rhode Island & Providence Plantations as its expert witness in this proceeding.

Q. What have you done to prepare for this proceeding?

4 My written testimony and answer can be found at http://www.ripuc.org/eventsactions/docket/4111page.html.

A. In order to prepare my testimony, I have reviewed the file for both Docket No. 4185 and No. 4111 as well as relevant industry literature.

Q. Assume for the sake of this question the following legal conclusion: The most recent amendment to the LTC statute (chap. 31 of the 2010 PL of RI & chap. 32 of 2010 PL of RI) does not preclude the selection of developers other than Deepwater Wind Block Island, LLC ("Deepwater") as "the developer." With that assumption in mind, can you elaborate on the selection process that would be necessary to support a conclusion of commercial reasonableness?

A. Yes. The selection process of Deepwater as the developer of the Project was seriously flawed. Essentially, there was no competitive process held to select the developer of the Project and then negotiate the contract now before the Commission. With no competitive process, it is my opinion that the contract terms and conditions cannot be judged to be commercially reasonable.

National Grid is familiar with competitive bidding to obtain the lowest cost renewable energy contracts. Recently, the Massachusetts Department of Energy Resources and the Massachusetts electric distribution utilities, including National Grid, conducted a joint solicitation for long-term contracts to purchase Bundled Energy from Massachusetts renewable energy projects. In that case, there was a mass e-mailing of a notice of a request for proposals, a comment period with questions and answers, and then a bid period where offers were made using a form of standard contract. This was followed with a negotiating period where exceptions to the standard contract were finalized. Obviously, none of this happened here.

On a personal level, I, representing my renewable clients, regularly respond to offers from National Grid to purchase RECs for the various RPS programs that its distribution companies are subject to. These solicitations are made to a very broad group of renewable energy generators, REC brokers and REC traders. I generally make a non-conforming

bid. Having participated in this process for several years, the executed contracts are not the same as the ones initially proposed by National Grid. As previously mentioned, the final product of this competitive process is contracts that contain commercially reasonable terms and conditions.

In summary, given the form of solicitation that National Grid undertook with the Project, a sole source solicitation for a commodity product without competitive bidding, the contract before the Commission cannot contain commercially reasonable terms and conditions.

Q. **Do you have any opinions on the proposed power purchase agreement between Narragansett and Deepwater for the Project? If so, what are your opinions?**

A. Yes. To a reasonable degree of engineering and economic certainty, my opinions are that the Project's power purchase agreement between Narragansett Electric Company and Deepwater of up to 8 wind turbines, up to 30 MW wind farm (hereinafter the "Project"):

1. Does not contain terms and conditions that are commercially reasonable; the terms and conditions, such as the price, escalation rate and construction cost, are not commercially *reasonable* for a to-be-developed renewable energy resource (the Project) between a Rhode Island electric distribution company (Narragansett Electric Company) and a developer or sponsor (Deepwater Wind Block Island, LLC); and

2. Does contain arcane provisions that provide for a decrease in contract pricing but only if substantial savings can first be achieved in the construction cost of the Project that solely benefit the Project owner; and

3. Will create only a minimal number of jobs in the renewable energy sector in Rhode Island while costing Rhode Island many more jobs in other sectors of its economy and will not provide any net direct economic benefit to Rhode Island; and

4. Will, at best, only minimally provide environmental benefits to Rhode Island, including the reduction of carbon emissions and, at worst, may contribute to global warming by causing the electric generation network of New England to operate at sub-optimal levels.

Q. **Do you have an opinion whether certain provisions of the Project's contract are not commercially *reasonable* terms and conditions between Narragansett Electric Company and Deepwater Wind, LLC? If so, what is your opinion?**

A. Yes. The Project's contract contains provisions that are commercially *unreasonable* terms and conditions.

The commercially *unreasonable* terms and conditions of the contract can be divided into three general areas – unreasonable cost of the product (the combined price of energy, capacity and RECs or Bundled Energy), unreasonable cost of operations and unreasonable rates of return to the Project and its equity owners.

The unreasonable cost of the Project can be determined in several ways – the comparable cost to construct of-similar-size off-shore wind projects, the comparable price of the product from other projects, the comparable initial estimate of operating expenses and the comparable escalation in revenues and expenses. Fortunately, we have Great Lakes Wind Energy Center project[5] (the Cleveland project) and Delaware Bluewater Wind project[6] (the Bluewater project) to compare against the Project. On rates of return, we have utility rate cases to determine what should be appropriate returns on rate base and equity.

[5] See pages 324 to 377 of Great Lakes Wind Energy Center-- Final Feasibility Study. The full report can be viewed at http://blog.case.edu/case-news/2009/05/01/windfeasibilitystudy. The Great Lakes Wind Energy Center is a proposed 15-20 MW off-shore wind project to be constructed near downtown Cleveland, Ohio (hereinafter the Great Lakes Wind Energy Center is described as the "Cleveland project").

[6] The Delaware Bluewater Wind project is a proposed 450 MW off-shore wind project to be constructed 11 miles east of Rehoboth Beach, Delaware (hereinafter the Delaware Bluewater Wind project is described as the "Bluewater project"). Its executed contract with Delmarva Power & Light can be viewed at http://www.ceoe.udel.edu/windpower/DE-Qs/Delmarva-Bluewater-PPA-10-December-07.pdf.

The construction cost of the Cleveland project, when adjusted from a 15-20 MW off-shore wind project to the same size as the Project, should range from $138 million for twelve 2.5 MW wind turbines to $159 million for six 5.0 MW wind turbines. Using the estimated construction cost of $220 million of the Project, the Project's construction costs are estimated to be between $61 million and $82 million more (41% to 59% higher, respectively) than the Cleveland project.

The operating cost of the Cleveland Project, adjusted for the size of the Project, should range between $6.1 million for twelve 2.5 MW wind turbines to $4.6 million for six 5.0 MW wind turbines. While the operating cost of the twelve 2.5 MW wind turbine project is similar to that of the Project, the operating cost of the six 5.0 MW wind turbine project is approximately 3/4 of the operating cost of the Project or 25% less than the Project's 2013 operating cost of $6.2 million.

In addition, the Cleveland project assumed a 2.5% rate of increase in its contract price versus 3.5% for the Project. This difference (the gap of a percentage point between project price escalators; that is to say, a 40% per cent higher rate of increase as compared to the other escalator clause) increases the unreasonableness of the Project dramatically over time.

The product cost of the Bluewater project also raises serious issues that the Project's contract prices are not commercially reasonable terms and conditions. With a 2013 cost of $140 per MWh to the Delaware ratepayers of Delmarva Power & Light versus $244 per MWh to Rhode Island ratepayers, the cost of the Bluewater project represents a $104 per MWh or 43% discount to the Project's cost. After adding an additional $21 to $35 per MWh to adjust the Project's small size relative to the Bluewater project,[7] the comparable

[7] The Great Lakes Wind Energy Center -- Final Feasibility Study assumed that large offshore wind facilities should have operating cost in the range of $25-40 per MWh. Interpolating between these costs and the assumed operating costs of the Cleveland project adjusted for a 30 MW facility, these adjustment factors were determined.

2013 contract price for the Project should range from $161 to $175 per MWh. Thus, the comparable cost of the Project is between $69 and $83 per MWh (39% to 52%, respectively) more than the 2013 contract price of the Bluewater project.

In addition, the contract for the Bluewater project has a 2.5% rate of annual increase in contract prices versus 3.5% for the Project. This difference (1% or 40% more the Project's escalation rate) over time increases dramatically the unreasonable cost of the Project.

Regarding the Project's economic returns, under the proposed terms and conditions contained in the contract, they are generous to the developer. In fact, the Project should earn for its owners commercially unreasonable rates of return. Using information supplied by the Project's owners in Docket No. 4111 and owners' estimates (which I deem to be unreasonably high) of construction cost ($220 million), operating expenses ($6.2 million) and contract prices ($244 per MWh in 2013) and, using my estimate of a 60/40% project debt/equity financing, I have arrived at the following. The Project's leveraged after-tax rate-of-return is 21.3% while the Project's unleveraged after-tax return is 9.1%. However, comparable utility rates of returns of 7.2%[8] for investment[9] and 9.0% for equity would be the norms. These costs-of-capital would produce to the Project owners just and reasonable returns.

Combining all of these observations together, it is my opinion that the commercially reasonable cost to construct the Project is in the vicinity of $160 million, the commercially reasonable cost of annual operations of the Project is in the vicinity of $5.35 million, the commercially reasonable rate of annual escalation of contract prices is 2.5% and the commercially reasonable return on investment and equity would be 7.2% and 9.0%, respectively. Using these parameters, the Project would need a 2012 contract price of

[8] A 60/40 debt equity ratio with a 6% cost of debt and 9% cost of equity has been assumed.
[9] For purposes of this analysis, the return on investment is analogous to return on rate base.

only $167.00 per MWh ($171.18 per MWh in 2013) and not the price of $235.70 per MWh ($243.95 per MWh in 2013) as specified in the contract.

At these commercially reasonable terms and conditions, the ratepayer would see a life-time reduction in the revenue requirements of the Project from $696.2 million to $441.3 million, for a decrease of $254.9 million or 36.1%. On a present value basis, the ratepayer savings would be worth $120.3 million.

In summary, it is my opinion that the Project contract ***explicitly*** contains the following commercially ***unreasonable*** terms and conditions:

1. A 2012 starting price of $235.70 per MWh; and
2. A cost to construct the Project of $220,403,512; and
3. An annual escalation rate of 3.5% of contract prices.

It is also my opinion that the Project contract ***implicitly*** contains the following commercially *unreasonable* terms and conditions:

1. Return on investment of 9.1%; and
2. Return on equity of 21.3%; and
3. A 2013 operating expense of $6.2 million.

Q. Do you have an opinion as to whether the power purchase agreement between Narragansett Electric Company and Deepwater Wind Block Island, LLC contain provisions that provide for a decrease in pricing if savings can be achieved in the actual cost of the Project. If so, what is your opinion?

A. Yes. From a narrow perspective, the answer is yes. In the larger context, the contract is a one-sided document that strongly favors Deepwater if any savings in construction costs are realized.

In general, there is one change in the proposed contract over the prior proposed contract that will definitely benefit Rhode Island ratepayers and one other change that may benefit Rhode Island ratepayers.

The former change is a minuscule reduction of the contract price for 2012 from $235.75 per MWh under the former proposed contract to $235.70 per MWh under the current proposed contract.[10] This reduction is just $0.05 per MWh, for percentage reduction of 0.021%. The escalation rate in the contract price of 3.5% remains the same. The impact of this price reduction is to reduce ratepayer requirements of the Project by approximately $5,096 in 2013 and $144,119 ($70,035 in discounted dollars) over the term of the contract.

Regarding the latter change, the current proposed power purchase agreement now provides for a reduction in the 2012 contract price from $235.70 per MWh if the Project cost less than $205,403,512, but more than $155,403,512, to construct. At the lower construction cost ($155,403,512), the 2012 contract price is equal to $189.70 per MWh for a price reduction of $46.00 per MWh or 19.5%. A $65 million or nearly a 30% reduction in construction cost leads only to a less than 20% reduction in the 2012 contract price. However, the first $15 million in cost reductions is solely for the benefit of the Project owners. Obviously, these constructions savings will be the first to be realized, the "low hanging fruit." In this sense, the reductions in Project cost may be simply illusory to Rhode Island ratepayers since the first benefit would fall solely to the Project owner. For example, if construction costs are reduced by $20 million from $220,403,512 to $200,403,512, the Rhode Island ratepayers will only realize 25% of the benefit. Instead of an $18.40 per MWh reduction in the 2012 contract price, Rhode Island ratepayers will see only a price reduction in the 2012 contract price of $4.60 per MWh.

[10] See page 4 of Appendix X of "Power Purchase Agreement between Narragansett Electric Company d/b/a National Grid and Deepwater Wind Block Island LLC, as of June 30, 2010."

The uneven allocation of potential savings to the Project owner does not stop here. The revised power purchase agreement does not provide for any reduction in the contract price if the operating costs of the Project are less or if the rate of escalation of 3.5% of the contract price is in excess of the rate of inflation.

In summary, it is my opinion that the proposed power purchase agreement:

1. Provides for a minuscule reduction in the 2012 contract price;
2. Provides the potential for additional reductions in the 2012 contract price if the cost to construct is less than $205,403,512, but only on a disproportionate basis in favor of the Project owner and on a somewhat illusory basis to Rhode Island ratepayers;
3. Does not provide for any reductions in the contract price if the cost of operations of the Project should decrease; and
4. Does not provide for any reductions in the contract price if the rate of inflation should be less than 3.5%.

Q. **Do you have an opinion whether the Project will create minimal jobs in Rhode Island in the renewable energy sector? If so, what is your opinion?**

A. Yes. Other than a few construction jobs, just one full-time job should be created in Rhode Island as a result of the Project.

The Project in and of itself is too small to build a renewable energy industry for off-shore wind for the Mid-Atlantic and New England states. In the direct testimony of Madison Milhous (who was a witness for National Grid in Docket #4111), the Project was called a "demonstration project."[11] These wind turbines should be assembled elsewhere. Only the site mobilization should occur on-shore. Basically, everything else should float in on barges or derricks. From those platforms, work should be performed and, once completed,

[11] See page 9, line 2 of the direct testimony of Madison Milhous in Docket No. 4111. Mr. Milhous pre-filed testimony and answers to questions can found at http://www.ripuc.org/eventsactions/docket/4111page.html.

then leave. During the construction period, there should only be a brief influx of a small number of construction workers and within a season they should be gone.

After the construction is over, the only full-time job that I see being created is that of a caretaker or night watchman. Other than inspecting and securing equipment after an equipment failure, this person would have little to do. The Project should be monitored and operated remotely. Maintenance would be performed by rotating crews, brought in periodically. I seriously doubt that these maintenance workers would be based in the Rhode Island area.

In summary, it is my opinion that the Project will result in a few construction jobs for a brief period of time in Rhode Island and followed by only one semi-skilled permanent job on Block Island after the completion of the Project.

Q. **Do you have an opinion whether the Project will provide any net economic benefit to Rhode Island? If so, what is your opinion?**

A. Yes. The simple answer is no.

While the Project does provide some direct economic benefits to Rhode Island, its above-market costs to the ratepayers of Rhode Island far exceed that benefit. Even using the economic benefit cited by Dave Nickerson,[12] the lifetime, non-discounted benefit of the Project is only $48 million. Assuming that the National Grid above-market analysis is correct, the above-market cost of the Project is nearly $400 million on a non-discounted basis and $185 million on a discounted basis. The negative benefit on a non-discounted basis would be the $352 million ($400 million less the $48 million). The benefits of the Project are only 1/8th of its costs. In summary, the Project should produce minimal

[12] See Dave Nickerson answer to Division's Question 2-4 in Docket No. 4111. Mr. Nickerson pre-filed testimony and answers to questions can found at http://www.ripuc.org/eventsactions/docket/4111page.html.

economic benefits to Rhode Island and, when its above-market costs are included, negative net benefits to the ratepayers of Rhode Island.

Q. Do you have an opinion whether the Project could actually cost the Rhode Island economy jobs, producing an overall net job loss? If so, what is your opinion?

A. Yes. The simple answer it that the Project, once completed, would cost the Rhode Island economy more jobs than the six jobs that Deepwater Wind estimates to be created. *Per force,* the project, once completed would cost the Rhode Island economy more than the one job that I estimate to be created.

In a summary report of the economic analysis[13] of the Bluewater project prepared by Professor Edward C. Ratledge of the Univeristy of Delaware, it was estimated that:

> "... the negative impact of higher electricity prices would cause an average [job] loss between 237 and 785 over a 25-year term.[14] In addition, he estimated a total loss of disposable income in the State of between $430 million and $1.5 billion due to the above-market prices. This premium for the Bluewater Wind power purchase depresses the economy in the same way as a tax increase on Delaware's citizens.

> "... the net effect of the Bluewater Wind power purchase agreement ("BWW PPA"), calculating both the increase in jobs from the wind farm and the decrease created by higher electricity prices. Depending on which consultants' results he used, his analysis shows a net loss of at least 90 jobs and as many 639 lost as a consequence of the BWW PPA. Professor Ratledge computed the net dollars lost to Delaware from the proposed BWW PPA, as well, assuming that Bluewater Wind pays operations and maintenance personnel an average annual salary of $60,000 (which the Committee considers a high estimate) and pays all applicable State taxes. Even with these conservative assumptions, the State can expect a net

[13] See pages 103 to 108 of Delaware Senate and Energy Transmit Committee, "Comprehensive Report on Affordable, Environmentally Friendly Energy with a Detailed Analysis of the Proposed Bluewater Power Purchase Agreement." The full report with its summary of Professor Ratledge's analysis of the Bluewater Wind project may be found at http://www.ceoe.udel.edu/windpower/DE-Qs/senatemajorityrpt042308.pdf

[14] The study used Regional Economic Models Inc. (REMI), of Amherst, Massachusetts, to perform its economic analysis. REMI was founded in 1980 for the purpose of developing regional forecasting and policy analysis models. REMI is often used to analyze public policy decisions in economic development, the environment, energy, transportation, taxation, and others. Additional information on REMI can be found at http://www.remi.com/.

> loss of between $165 million and $1.2 billion over the 25 years that customers will pay for the BWW PPA.
>
> "The proposed BWW PPA impacts Delaware's economy in two distinct but opposing respects.
>
> "First, BWW offers the prospect of a jobs influx for the State, initially during construction of the offshore facility and during its 25 years of operations. BWW has also suggested that Delaware could become **a hub for development of wind-based industry that would supply equipment and related services along the East coast, but these potential benefits are highly speculative and certainly unquantifiable**. (Emphasis added).
>
> "Second -- and cutting decidedly in the opposite direction -- because Delawareans will pay above-market electricity prices for most or all of its 25-year term, the BWW PPA will act as a drain on the economy, reducing disposable income and eliminating jobs as businesses suffer the effects of higher electric costs. Based on the evidence presented to the Committee, these negative economic effects attributable to the proposed BWW PPA will overwhelm any potential benefits, and **the net impact of the offshore wind project will likely be significant financial detriment for customers and the State as a whole**." (Emphasis added).

Apples-to-apples comparisons between the Bluewater project and the Project are hard to make. Nevertheless, a linear interpolation can be made. Accordingly, the Project should cost Rhode Island between 6 and 42 net full-time jobs and Rhode Island's economy between $8 million and $65 million. The economic impact of the Project may be understated since the Bluewater project has a greater workforce (80 versus an allegedly 6 full-time jobs), a substantially lower 2013 contract price ($140 per MWh versus $244 per MWh in 2013) and a lower annual escalation rate (2.5% versus 3.5%).

A recent economic study has been published on the job destruction caused by Spain's efforts to develop "green jobs."[15] That report found the job loss from making uneconomical investment in renewable energy was 2.2 private sector jobs for every "green job" created. On an annual productive basis, the report arrived at the same private sector job loss per "green job." However, a detailed review of the Spanish report indicates a

[15] See pages 28 to 29 of "Study of the Effects in Employment of Public Aid to Renewable Energy Sources." A copy of this study may be found at http://www.juandemariana.org/pdf/090327-employment-public-aid-renewable.pdf.

potential far greater job loss in Rhode Island than Spain's experience. Unless the cost to create the average new private sector job in Rhode Island is $16.7[16] million and the annual productivity of that worker is $0.9 million,[17] Rhode Island should suffer a similar job loss as Spain arising from developing the Project. As shown below, the cost to create a new private sector job and the annual productivity of a new private sector job in Rhode Island are significantly less than these numbers; thus, the job loss from the Project may be far higher.

For 2008 (the latest year that economic statistics are available for Rhode Island) the average job productivity was $77,360.[18] (As of the time of this filing, a source of the average capital cost to create a private sector in Rhode Island has not been located. Once that number is located, I will supplement my filing). Thus, the Project should cost the Rhode Island economy a net loss of approximately 25 jobs in 2013. Given that the Project has an annual escalation rate in the Project's contract price (3.5%) greater than the forecasted rate of inflation (2.5%), I expect that this job loss should increase over time.

In 2009, the Vermont Department of Public Service commissioned a study on the economic impacts of its recently-enacted feed-in tariff, titled "The Economic Impacts of Vermont Feed in Tariffs."[19] The study looks at the economic impact[20] on Vermont arising from the installation of 47.8 MW of solar, wind, biomass (including landfill and farm

[16] For the Project, the capital cost per job is equal to $220 million (the cost of the Project) divided by 6 full-time jobs or $36.7 million per job. Thus, in order for the Project to have the same negative job impact as observed in Spain, the capital cost of a private sector job in Rhode Island must be at least $16.7 million ($36.7 million divided by 2.2 lost jobs).

[17] The Project, using as an above-market 2013 cost of the Project's Bundled Energy of $118 per MWh, produces a total above-market cost of $12 million for the Project or $2.0 million per job. Thus, in order for the Project to have the same negative job impact as observed in Spain, the annual productivity of a private sector job in Rhode Island must be at least $.9 million ($2.0 million divided by 2.2 lost jobs).

[18] For 2008, Rhode Island had gross state product of $47.364 billion, total state employment of 612,258 and, thus, an average worker productivity of $77,360. Although private sector gross state product for Rhode Island for 2008 was found $41.269 billion), private sector employment for Rhode Island could not be located.

[19] A copy of the study can be found at http://publicservice.vermont.gov/planning/DPS%20White%20Paper%20Feed%20in%20Tariff.pdf.

[20] The study also used Regional Economic Models Inc. (REMI), of Amherst, Massachusetts, to perform its economic analysis.

methane) and small hydro generation with an estimated capital cost of $228 million. Among some of the study's findings were:

> "Certainly the population most directly affected by the Standard Offer is utility **ratepayers who will pay a significant premium for a portion of their electricity** for up to 25 years. (Emphasis added).
>
> "Above-market energy costs had **the deleterious effects of reshuffling consumer spending and increasing the cost of production for Vermont businesses.** Increased costs for households and employers reduced the positive employment impacts of renewable energy capital investment and the annual repair and maintenance activities. (Emphasis added).
>
> "the smaller sized resources supported under this program suffer from diseconomies of scale within each renewable type. 50 MW of renewable electricity can be procured for Vermont ratepayers on a long-term basis at a much lower cost if the program dictated that the least cost renewable should be chosen. Put another way **Vermont consumers are paying a higher price for a portion of their renewable energy with no discernable benefit.**" (Emphasis added).

In summary, it is my opinion that only a few construction jobs in Rhode Island should be created by the Project and then for only a brief period of time. This should be followed up with only one semi-skilled permanent job on Block Island after the completion of the Project. For the balance of the Rhode Island economy, between 6 and 42 net full-time jobs should be lost with a net negative economic impact ranging from the low tens of millions of dollars to several hundred millions of dollars over the life of the Project.

Q. **Do you have an opinion whether the Project will only minimally enhance environmental quality as opposed to other renewable energy technologies? If so, what is your opinion?**

A. Yes. The project utilizes wind energy. Wind at this project scale is an unreliable, intermittent energy source; thus, its ability to reduce or retire fossil generation is limited. As a small generator, the Project's rapid changes in output would cause its capacity to be largely ignored by ISO-NE.

A power pool such ISO-NE cannot rely on wind generation to be there at critical times. This is particularly true during the afternoon summer hours when peak loads are the highest. Since the production from a wind resource of this size cannot be reliably forecasted, ISO-NE does not require wind resources to schedule any of their production in the ISO-NE Day-Ahead energy market.[21] Instead, wind resources are permitted to operate exclusively in the Real-Time energy market.[22]

The ISO-NE divides its energy markets into Day-Ahead energy market and Real-Time energy market. The Day-Ahead energy market is roughly nine times the size of Real-Time energy market. Since wind resources of this size only operate in the Real-Time energy market, they influence essentially only the dispatch of approximately 10% of the generation in New England. Even then, when wind operates, it will not necessarily be backing down fossil-fired resources but rather generation used to provide regulation for the regional grid such as pumped storage or hydro units with automatic generation control. Both of these types of generation have no air emissions and minimal environmental impact.

Looking at the dispatch of generation resources over a five-minute time period, although the electric grid does respond quickly to changes in the generation of all intermittent units, it does not respond immediately but, rather, with a small time delay. Within five minutes or less ISO-NE will re-dispatch the system based upon the then-prevailing level of load and generation resources in operation. Thus, the grid immediately absorbs the unexpected wind production when excesses are produced but does not change the order of generation

[21] Day-Ahead energy market is the market for which all reliable generators are required to participate by ISO-NE. This market requires generators to offer firm levels of production for each hour of the next power day. If the generator cannot perform in the Day-Ahead energy market, the generator is penalized. If the generator can perform in the Day-Ahead energy market, these generators generally earn superior prices to prices of the Real-Time energy market. Given the unreliable nature of wind resources, wind generators are not required to participate in the Day-Ahead energy market.

[22] The Real-Time energy market is a pure spot market. There are no penalties of non-performance and, generally, prices are less than the prices paid for Day-Ahead energy market. Whatever these generators produce is purchased by ISO-NE at the clearing price of the Real-Time energy market.

dispatch until the next dispatch period. The same thing happens when wind resources quickly reduce their output.

Looking at wind generation in isolation, and not considering the time of day and time of year of the generation, or the other power facilities on the grid at the time the wind was blowing, presents an overly-simplistic and inaccurate description of how the grid operates. While wind generation may offset fossil fuel use, which here in New England is likely natural gas, any emission reduction would need to be evaluated in the context of New England's power pool of over 30,000 megawatts. The premise that one MWh of wind generation will lead to one less MWh of fossil-fired generation is not correct. For these reasons, I believe that the Project will have a lower impact on reducing the air emissions than the supposed displacement of 30 MW of fossil-fired generation. Correspondingly, the carbon benefit of the Project will not be equal to the estimates offered by Dave Nickerson.[23]

This conclusion has been observed by others. Professor Jay Apt of Carnegie Mellon University has estimated CO_2 and NOx emissions reductions to gas generators operating in conjunction with wind.[24] The salient points of his conclusions are as follows:

> "Carbon dioxide emissions reductions from a wind (or solar PV) plus natural gas system are likely to be 75-80% of those assumed by policy makers. … For the best system we examined, NOx reductions with 20% wind or solar PV penetration are 30-50% of those expected. For the worst, emissions are increased by 2-4 times the expected reductions with a 20% RPS with using wind or solar PV."

Professor Apt's observation in his last sentence is alarming. Wind-power can abruptly force off-line very efficient generation facilities (which occurred recently in Colorado and

[23] See Dave Nickerson response to Division's Question 2.7 in Docket No. 4111. Mr. Nickerson pre-filed testimony and answers to questions can found at http://www.ripuc.org/eventsactions/docket/4111page.html.
[24] See "Air Emissions Due To Wind And Solar Power," Warren Katzenstein and Jay Apt. http://pubs.acs.org/doi/pdfplus/10.1021/es801437t.

Texas[25]), such as combined cycle facilities (in Texas) or steam plants (in Colorado), causing air emissions to soar. When the wind disappears quickly, these units cannot return to their prior levels of production without raising their overall emissions rates as they ramp back up. In two cases studies, it was found that:

> "... the surprising conclusion that **the use of wind energy** in the Public Service of Colorado ("PSCO") and Electric Reliability Council of Texas ("ERCOT") context results in **increased SO_2 and NO_X** and, in the case of PSCO, **CO_2**. (Emphasis Added). The mechanism driving increased emissions is the need to cycle coal facilities in order to accommodate wind, which is considered a "must-take" resource due to the respective states' RPS mandates. When wind generation comes online, generation from coal (and natural gas-fired) plants is curtailed until the wind subsides, then their generation is once again ramped up to meet demand. Cycling coal units in this manner drives their heat rate up and their operating efficiency down, resulting in higher emissions of SO_2, NO_X and CO_2 than would have been the case if the units had not been cycled."

In the case of ISO-NE, a project of this size will most likely back-off (substitute for) combined cycle natural gas to correct for the excess generation conditions and then call on oil-fired, simple cycle combustion turbines to fill the void when the wind disappears. However, these latter facilities are relatively inefficient with heat rates greater than 10,500 BTU/KWh (approximately 30% or less efficient) versus combined cycle heat rates of less than 7,000 BTU/KWh (approximately 50% or more efficient). In addition, simple cycle combustion facilities produce several times the levels of N_2O, a serious greenhouse gas with a 310 times multiplier over that of CO_2,[26] over that of combined cycle power plants. Thus, wind generation of this scale may force a 50% increase of CO_2 emissions due to differences in generation efficiency and, when one includes the CO_2 effect of N_2O emissions, the Project may actually contribute to global warning rather than cure it.

[25] See "How Less Became More: Wind, Power and Unintended Consequences of the Colorado Power Market" http://www.bentekenergy.com/documents/bentek_how_less_became_more_100420-319.pdf.

[26] For example, three pounds of N_2O emissions are the Greenhouse Gas equivalent of 930 pounds of CO_2 emissions. Information on the relative weighting of greenhouse gases may be found at http://www.epa.gov/cleanrgy/energy-resources/calculator.html.

Looking out over a longer operating period, if wind resources of this scale were reliable generating resources that could consistently follow a dispatch schedule like a biomass plant or landfill facility, the marginal air emissions analysis of Dave Nickerson would be accurate.[27] Then, wind resources would provide another feature that reliable renewable resources provide -- permanently back-out the need for fossil generation since they can consistently be relied upon to operate. For example, a 30 MW biomass power plant can force the retirement of 30 MW of fossil-fired generation while a 30 MW wind farm will be lucky if it leads to the retirement of any fossil-fired generation. For wind, the truth appears to be that projects of this size fail to produce their claimed air emissions reductions for either brief or long-term periods of time.

In summary, it is my opinion that the Project will only, at best, minimally enhance environmental quality as compared against other reliable, renewable energy technologies or larger projects. Under a worst case scenario, the Project may actually worsen the environmental quality of Rhode Island.

Q. **Do you have an opinion whether the Project will decrease the nation's energy independence from foreign sources of fossil fuels? If so, what is your opinion?**

A. Yes, I have such an opinion. If you are referring to foreign sources of oil, the answer is no.

Although fossil fuels are used to generate a majority of New England's electricity, oil in only a small fraction of that total. In 2009, New England derived 35.0%, 12.1% and 5.3% of its electrical energy from natural gas, coal and oil, respectively. Of the first two fuels, the overwhelming percentage is from domestic sources, inexpensive and plentiful. Regarding natural gas, approximately 15% of the nation's supply is from foreign sources,

[27] See Dave Nickerson response to Division's Question 2.7 in Docket No. 4111. Mr. Nickerson pre-filed testimony and answers to questions can found at http://www.ripuc.org/eventsactions/docket/4111page.html.

with Canada making up about 70% of the supply. The balance, 4%, is from other foreign countries.

Although 70% America's oil is from imported sources, oil represents a small and shrinking source of New England's fuel used for electric generation. In 2009, all forms of oil-fired generation generated only 5.3% of New England's electricity. This percentage is down from 11.6% six years ago. Of the current number, 3.7% is burned in generating facilities used primarily for reliability or voltage stability purposes while the balance, 1.6%, is burned in oil-fired steam plants. Oil is rarely the fuel for the marginal power plant. In 2009, oil fueled these power plants less than 2% of the time.

Given the generation characteristics of small wind facilities, building wind facilities in the hope of reducing or eliminating the use of imported oil will achieve limited success. What has led to the recent drop in the use of oil in power plants in New England has been the construction and operation of very efficient combined cycle power plants, fired with relatively inexpensive and plentiful natural gas. Until wind facilities of this magnitude are capable of following dispatch or required to build storage to hold their production for high demand periods, wind energy will not be a factor in reducing or eliminating this use of oil in New England.

In summary, it is my opinion that there will be no material reduction caused by wind facilities, including the Project, in New England's use of imported oil as a boiler fuel for electric generation.

In conclusion, along with all of my other comments, it is my opinion that the contract between Narragansett Electric Company and Deepwater Wind Block Island, LLC for the Project should not be approved by the Commission.

Q. Does this conclude your testimony?

A. Yes.