State of Rhode Island and Providence Plantations

DEPARTMENT OF ATTORNEY GENERAL
150 South Main Street • Providence, RI 02903
(401) 274-4400
TDD (401) 453-0410

Patrick C. Lynch, Attorney General

February 2, 2010

VIA HAND DELIVERY & ELECTRONIC MAIL

Luly E. Massaro, Commission Clerk
Rhode Island Public Utilities
89 Jefferson Boulevard
Warwick, Rhode Island 02888

Re: Docket 4111 – Review of Proposed Town of New Shoreham Project Pursuant to RI General Laws § 39-26.1-7
Response to Data Request

Dear Ms. Massaro:

Enclosed please find an original and nine (9) copies of the testimony of Division witness Richard S. Hahn for filing by the Division of Public Utilities and Carriers in the above-captioned proceeding.

Please be advised that the testimony of Richard S. Hahn may refer to information, contain data or have data embedded therein of a nature that National Grid or Deepwater Wind Block Island, LLC have asserted a claim of confidentiality toward. The Division is thus providing a redacted copy of Richard S. Hahn's testimony and an un-redacted version of this testimony under seal in order to preserve the rights, privileges, claims or objections of the parties. The Division through this filing is otherwise is in no way waiving any of its rights or objections with respect to these matters.

I appreciate your attention in this matter and if you should have any questions, please feel free to contact me.

Very truly yours,

Jon G. Hagopian
Special Assistant Attorney General

Enclosures

cc: Service List

BEFORE THE
RHODE ISLAND PUBLIC UTILITY COMMISSION

DOCKET NO. 4111
REVIEW OF THE PROPOSED TOWN OF NEW SHOREHAM PROJECT
PURSUANT TO R.I.G.L. § 39-26.1-7

DIRECT TESTIMONY

OF

RICHARD S. HAHN

PUBLIC (REDACTED) VERSION

ON BEHALF OF THE
RHODE ISLAND DIVISION OF PUBLIC UTILITIES AND CARRIERS

February 2, 2010

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I. INTRODUCTION

Q. Please identify yourself for the record.

A. My name is Richard S. Hahn. I am a Principal Consultant for La Capra Associates, Inc. ("La Capra Associates"). My business address is La Capra Associates, One Washington Mall, Boston, Massachusetts 02108.

Q. On whose behalf are your testifying?

A. The Rhode Island Division of Public Utilities and Carriers (the "Division").

Q. Could you please describe your educational background?

A. I have a both a Bachelors of Science and Masters of Science in Electrical Engineering from Northeastern University. I also have a Masters of Business Administration from Boston College.

Q. Mr. Hahn, please summarize your experience and qualifications.

A. I am a Registered Professional Engineer in Massachusetts. I have worked in the electric utility business for more than 35 years. From 1973 to 2003, I worked at NSTAR Electric & Gas (formerly Boston Edison Company). I have held many technical and managerial positions in both regulated and unregulated subsidiaries covering all aspects of utility planning, operations, regulatory activities, and finance. In 2004, I joined La Capra Associates. Since then, I have worked on projects related to power procurement, generating asset valuations, resource planning, transmission, analyzing market rules and prices, mergers, and litigation support. My resume is provided in Exhibit RSH-1.

Q. What has been your experience and expertise relative to Purchase Power Agreements ("PPAs") and assessments of power supply options?

A. At various times throughout my career, I have been involved in planning and procuring power supplies for utilities in both regulated and unregulated markets. I have also been involved in negotiating power sales and purchase agreements, including unit entitlements and system power, and in valuing generating assets. My electrical engineering degrees are from Northeastern University's Power Engineering Program, which specialized in electric utility power systems.

Q. What is the purpose of your testimony in this proceeding?

A. La Capra Associates has been retained by the Division to review and comment on the petition submitted by Narragansett Electric Company ("Narragansett" or the "Company") to the Rhode Island Public Utilities Commission ("Commission") for approval of the PPA with Deepwater Wind ("Deepwater"). Specifically, my testimony provides information that will be helpful to the Commission in determining whether the prices in the PPA comport with the standards contained in the Rhode Island General Laws regarding the proposed project. I have also been asked to review the other, non-price terms and conditions of the PPA.

Q. Have you previously testified before the Commission?

A. Yes. I submitted testimony on behalf of the Division in Docket No. 4041 in reviewing Narragansett Electric Company's plan to procure default service power supplies and in Docket No. 4065 in reviewing certain aspects of Narragansett Electric Company's rate case.

Q. Have you reviewed the Company's filing in this case?

A. Yes. I have reviewed the filings of the Company and Deepwater. In addition, I have reviewed the testimony filed by Mr. Short and Mr. and Mrs. Delia, the testimony of Mr. Hashway on behalf of the Rhode Island Economic Development Corporation, and the testimony of Mr. Sabitoni on behalf of the Rhode Island Building and Construction Trade Council. I have also reviewed relevant responses to discovery questions.

II. EXECUTIVE SUMMARY

Q. Please summarize the results of your review.

A. I have several observations, as summarized below.

- The price in the Deepwater PPA, which will be paid by Rhode Island ratepayers, is at the high end of the range of expected prices for other comparable renewable energy projects. Only projects based upon solar photovoltaic technologies have been found to have higher prices than the Deepwater project
- Based upon Deepwater's own assumptions, the rate of return to the project's developers is higher than would be expected for other comparable renewable energy projects. It appears that the Deepwater project could be successfully developed at a lower PPA price.
- A lower PPA price will reduce the subsidy to the project and the premium to be paid by Rhode Island ratepayers through higher electric rates, and achieve a better balance between the interests of ratepayers and the desire to jump start a nascent renewable energy business in Rhode Island.

- If the PPA price is to be approved as filed, the Commission and the State's policy makers should do so with the full knowledge of the state of that balance contained in the proposed PPA.
- The PPA contains some provisions unrelated to price that should be changed. These are discussed in detail later in this testimony.

III. SUMMARY OF THE PROPOSAL

Q. Please briefly describe the Company's proposal in its petition.

A. Narragansett Electric Company has negotiated a twenty year PPA with Deepwater. Deepwater will install eight 3.6 MW wind turbines in the waters to the Southeast of Block Island. Total nameplate capacity is 28.8 MW. Deepwater will also install electrical connections from the eight wind turbines to a new substation to be located on Block Island. The price for the output of the wind turbines delivered to Block Island is specified in the PPA. For each MWH of electricity generated by the wind turbines and delivered to the Block Island substation, the Company will pay a rate that begins at $235.75 in 2012$ and escalates annually at a fixed rate of 3.5%. Thus, in 2013, the proposed first full year of operation according to Deepwater, the PPA price will be $244 per MWH. By the end of the twenty-year term of the PPA, the price will be $469 per MWH. In addition, Narragansett Electric Company will receive an incentive payment equal to 2.75% of the payments to Deepwater for the wind farm output.

Q. Does the current proposal address how the Deepwater project will deliver power to the mainland?

A. No. The parties acknowledge that a Transmission Cable will be required to connect Block Island to the Company's existing transmission and distribution system on the mainland. However, the detailed arrangements for constructing, owning, and operating that Cable have not been finalized. The cost of the Transmission Cable is not included in the PPA price per MWH cited above, but represents an additional cost to Rhode Island ratepayers.

Q. How do you define the cost of this project?

A. The total cost of the project that will be paid by Rhode Island ratepayers is the sum of (1) PPA payments to Deepwater by the Company, (2) the cost of building, owning, and operating the Transmission Cable, and (3) the incentives paid to Narragansett Electric Company. For the purposes of comparing the Deepwater PPA price to other newly developed renewable projects, I define the gross cost of the Deepwater project as the PPA payments plus the cost of the Transmission Cable. I exclude the Narragansett incentive payments from this definition of gross costs because the Company would be eligible to collect this incentive from other renewable projects with which it signs PPAs.

The Company will receive the revenues from the capacity, energy, and Renewable Energy Certificates ("RECs") produced by the wind turbines. From the viewpoint of Rhode Island consumers, these market revenues are an offset to the PPA payments. Narragansett Electric Company will take title to the energy, sell this output into ISO-NE energy markets, and receive market revenues. The Company will similarly take title to the RECs, and can use them to reduce the cost of compliance with Rhode Island's

Renewable Portfolio Standard ("RPS") or they can sell them to other parties. I understand that the deal between Deepwater and the Company will allow Deepwater to retain title to the capacity from the wind turbines, but will flow the benefits of that capacity to the Company in the form of a financial settlement. This arrangement allows the Company to use the full benefits from capacity, energy, and RECs to offset some of the PPA payments. Therefore, the net cost of the Deepwater project is the gross cost defined above less the benefits from capacity, energy, and RECs produced by the wind turbines. The net cost defines how much above estimated market prices Rhode Island ratepayers will pay for the project.

IV. STANDARD OF REVIEW

Q. What is the standard for evaluating the price in the PPA between NGRID and Deepwater?

A. The PPA between NGRID and DWW was negotiated pursuant to Chapter 39-26.1 of the Rhode Island General Laws. The purpose of this chapter is to "encourage and facilitate the creation of *commercially reasonable* long-term contracts between electric distribution companies and developers or sponsors of newly developed renewable energy resources with the goals of stabilizing long-term energy prices, enhancing environmental quality, creating jobs in Rhode Island in the renewable energy sector, and facilitating the financing of renewable energy generation within the jurisdictional boundaries of the state or adjacent state or federal waters or providing direct economic benefit to the state".

Therefore, the definition of '*commercially reasonable*" can be determined from a reading of Chapter 39-26.1 and its references. The following excerpts demonstrate the development of this definition.

Section 39-26.1-2 defines *commercially reasonable* as "terms and pricing that are reasonably consistent with what an experienced power market analyst would expect to see in transactions involving *newly developed renewable energy resources*. Commercially reasonable shall include having a credible project operation date, as determined by the commission, but a project need not have completed the requisite permitting process to be considered commercially reasonable. If there is a dispute about whether any terms or pricing are commercially reasonable, the commission shall make the final determination after evidentiary hearings".

Section 39-26.1-2(6) states that *newly developed renewable energy resources* are defined as electrical generation units that use exclusively an *eligible renewable energy resource*, and that have *neither begun operation, nor have the developers of the units implemented investment or lending agreements necessary to finance the construction of the unit*; provided, however, that any projects using *eligible renewable energy resources* and located within the state of Rhode Island which obtain project financing on or after January 1, 2009, shall qualify as newly developed renewable energy resources for purposes of the first solicitation under this chapter.

Section 39-26.1-2(4) states that an *eligible renewable energy resource* "means resources as defined in § 39-26-5 and any references therein."

Section 39-26-5 defines an *eligible renewable energy resource* as follows:

(a) For the purposes of the regulations promulgated under this chapter, eligible renewable energy resources are generation units in the NEPOOL control area using:

(1) Direct solar radiation;

(2) The wind;

(3) Movement or the latent heat of the ocean;

(4) The heat of the earth;

(5) Small hydro facilities;

(6) Biomass facilities using eligible biomass fuels and maintaining compliance with current air permits; *eligible biomass fuels* may be co-fired with fossil fuels, provided that only the renewable energy fraction of production from multi-fuel facilities shall be considered eligible;

(7) Fuel cells using the renewable resources referenced above in this section;

(8) Waste-to-energy combustion of any sort or manner shall in no instance be considered eligible except for fuels identified in § 39-26-2(6).

(b) A generation unit located in an adjacent control area outside of the NEPOOL may qualify as an eligible renewable energy resource, but the associated generation attributes shall be applied to the renewable energy standard only to the extent that the energy produced by the generation unit is actually delivered into NEPOOL for consumption by New England customers. The delivery of such energy from the generation unit into NEPOOL must be generated by:

(1) A unit-specific bilateral contract for the sale and delivery of such energy into NEPOOL; and

(2) Confirmation from ISO-New England that the renewable energy was actually settled in the NEPOOL system; and

(3) Confirmation through the North American Reliability Council tagging system that the import of the energy into NEPOOL actually occurred; or

(4) Any such other requirements as the commission deems appropriate.

(c) NE-GIS certificates associated with energy production from off-grid generation and customer-sited generation facilities certified by the commission as eligible renewable energy resources may also be used to demonstrate compliance, provided that the facilities are physically located in Rhode Island.

Lastly, section 39-26-2 defines *eligible biomass fuel* as "fuel sources including brush, stumps, lumber ends and trimmings, wood pallets, bark, wood chips, shavings, slash and other clean wood that is not mixed with other solid wastes; agricultural waste, food and vegetative material; energy crops; landfill methane; biogas; or neat bio-diesel and other neat liquid fuels that are derived from such fuel sources."

Q. Please summarize how the above references come together to establish a definition of commercially reasonable?

A. Based upon the above definitions contained in Rhode Island Law, the definition of commercially reasonable means terms and prices for other projects that have the following attributes.

- **Technology**: A project that can serve as a benchmark for commercial reasonableness may use direct solar radiation, off shore and onshore wind, tidal or ocean thermal, geothermal, small hydro facilities, biomass facilities using eligible biomass fuels, fuel cells using eligible biomass fuels, and waste-to-energy combustion using eligible biomass fuels.

- **Development Status**: The benchmark project must not have begun operation nor have arranged financing. Such benchmark projects must have a credible in-service date, but are not required to have obtained all permits.
- **Location**: The benchmark project must either be (a) located within New England, or (b) located in New York, New Brunswick, or the Hydro Quebec system in Canada[1] and have its output deliverable into New England.

Q. Other parties in this proceeding have suggested that certain attributes, such as the benefits to the Town of New Shoreham, the potential for job creation, or the pilot project nature of the Deepwater project be considered in the definition of commercially reasonable. How do you respond?

A The legislation has to some extent already addressed the pilot project nature of the Deepwater proposal by requiring it to be compared to newly developed projects, projects which are not in service and do not have financing. Regarding the inclusion of benefits to the Town of New Shoreham, it is not clear whether such attributes should be included in the definition of commercially reasonable. I draw a distinction between the attributes necessary to qualify for the RFP pursuant to the legislation and the attributes to be included in the definition of commercially reasonable. Clearly, in order to even participate in the RFP in accordance with the legislation, projects needed to provide benefits to the Town of New Shoreham. But there is no specific provision in the legislation requiring that the commercially reasonable standard consider attributes such as benefits to the Town of New Shoreham, nor would it make sense to do so. The only

[1] New York, New Brunswick, and the Hydro Quebec system in Canada are the adjacent Control Areas to New England.

project being considered by the Commission is the Deepwater proposal. If the commercially reasonable standard meant only comparing the terms and pricing of Deepwater to other projects that benefit the Town of New Shoreham, it would become a self referent standard. It seems logical that the legislation sought a comparison of winning projects in the RFP to other eligible renewable projects as defined by Rhode Island law. Therefore, in my opinion, such other attributes should not be included in the definition of the commercially reasonable standard.

V. COMPARATIVE METRICS

Q. What metrics or statistics should be used to evaluate the prices in the PPA?

A. I believe that there are two important, commonly used metrics or statistics that can be useful in evaluating the commercial reasonableness of the Deepwater project. In assessing whether the Narragansett - Deepwater PPA price comports with the commercially reasonably standard, that price formula per MWH can be compared to prices for other contracts or to the costs that an experienced power market analyst would expect to see in transactions involving other newly developed renewable projects. Because some of these other comparative projects may have different in-service dates and contract terms, it is necessary to develop a comparative metric or common statistic that can be determined for each such project. The metric that I have selected for the comparison is to express the cost or price of each project in real levelized 2013$.

Q. Can you define what is meant by real levelized cost or price in 2013$?

A. The real levelized cost or price in 2013$ for any project is the price in the year 2013 that escalates at the expected rate of inflation that yields the same net present value as the

project's actual year-by year expected costs, which may escalate at rates that are different from inflation. This metric is very commonly used in analyzing energy and REC prices.

Q. Can you provide an illustration of how such a real levelized price is determined?

A. The Deepwater PPA price is $237.75 per MWH in 2012$, and it escalates at a fixed 3.5% per year. As noted previously, the 2013 price is $244.00 per MWH and the 2032 price is $469.09 per MWH, due to the fixed escalation of 3.5% per year. La Capra's current expectation is that inflation will average approximately 2.5% per year[2]. If a 2013 price of $262.83 per MWH is escalated at the rate of inflation of 2.5%, the resulting set of annual prices would produce the same net present value as the Narragansett - Deepwater PPA prices. Thus, the real levelized PPA price is **$262.83** per MWH. Exhibit RSH-2 provides the calculations that yield this figure. A 9% discount rate, which is Narragansett's composite cost of capital from Docket No. 4065, has been assumed in this calculation.

Q. What is the second metric or statistic that you propose to use in evaluating the commercial reasonableness of the Deepwater project?

A. The second metric is the internal rate of return on after tax cash flows to equity investors. I will refer to this metric as the "IRR". An investor in a project such as Deepwater or any other renewable project purchases equity, which is one source of funding to build the project. Such projects typically also use debt financing. The equity investors will receive any cash generated by the operation of the project after operating expenses and debt principal and interest are paid. The IRR is the discount rate that will return the initial

[2] In the last ten years, annual inflation based upon the Consumer Price Index had averaged 2.5%.

equity investment on a net present value basis over a specific period of time, typically the life of the project or the term of its contract.

Q. Can you illustrate how to determine an IRR?

A. Consider a simple hypothetical project that has $100 of invested equity, and the cash flow to the equity investor is $20 per year for the ten-year life of the project. As shown in Exhibit RSH-3, the IRR for this project is 15%. The net present value of the ten-year stream of $20 per year using a 15% discount rate is $100, which equals the $100 initial investment.

Q. Is an IRR the same as a return on equity ("ROE")?

A. No. An ROE is calculated for a much shorter period of time, such as yearly. The annual ROE equals book net income for the year divided by the outstanding equity either (a) at the end of the year or (b) using the average of the beginning and year-end equity values. Thus, an ROE typically looks at one year while an IRR typically looks at the return from cash flow over the life of the project. In addition to the timing difference, book net income is also very different from cash flow, so a direct comparison between a ROE and an IRR for the same project may not be meaningful. However, comparing the IRRs for two or more projects is a valuable indicator of financial feasibility and the desirability of investing equity in those projects.

Q. Why is a project's IRR useful in evaluating the reasonableness of its pricing terms?

A. When considering a potential investment, equity investors seek projects with an IRR that is high enough to meet their expectations of the return of and on that invested capital. If the expected IRR is lower than the target level, these entities will invest their funds

elsewhere. Conversely, the buyer of the output of such a project seeks an IRR that is not excessive, but is the minimum necessary to allow the project to be financed, built, and operated. In successful projects, the agreed-upon price yields an IRR through arms-length negotiation that is acceptable to both parties.

Relative to the PPA before the Commission, though Narragansett negotiated the contract with Deepwater, Narragansett does not have a financial stake in the arrangement, other than the incentive payments it will receive, because it is entitled to recover the payments to the developer from its customers. Therefore, it is difficult to determine if Narragansett has ensured that the payments to the developer represents the minimum subsidy necessary to allow the project to be built, or at least a reasonable level of subsidy.

Q. What level of IRR is typically expected from equity investments in renewable projects, such as Deepwater?

A. Given that the Narragansett – Deepwater PPA has fixed prices that do not depend upon market revenues, and that escalate at fixed rates over the life of the contract, a typical IRR for renewable projects with that form of revenue streams would be in the 12% to 15% range, based upon my experience.

VI. TRANSMISSION CABLE COSTS

Q. Please define the Transmission Cable.

A. As noted above, the Transmission Cable will connect the proposed substation on Block Island, which is the delivery point for the output of the wind turbines in the PPA, to Narragansett Electric Company's existing transmission system on the mainland. The cost of building, owning, and operating this Cable is not included in the PPA price, but

represents an additional cost to Rhode Island ratepayers. Addressing the Cable cost is also relevant in order to compare to the delivered cost of other renewable projects.

Q. What is the estimated cost of the Cable?

A. The Company has provided a range of estimates for the installed cost of the Cable, with the midpoint being approximately $42.5 million. The Company has further stated that the annual O&M costs for this Cable would be de minimus.

Q. Which entities are the likely users of the Cable?

A. The Company will use the Cable to deliver the output of the wind turbines from Block Island to the mainland. In addition, the Block Island Power Company ("BIPCO") could use the cable to deliver power from the mainland and the ISO-NE markets to Block Island. Currently, there is no connection between BIPCO and the mainland, and BIPCO relies on local diesel powered generators to supply the Island's electricity needs. The Cable could allow BIPCO to import power from ISO-NE. Energy costs in ISO-NE are substantially lower than the cost of diesel generators, so BIPCO could significantly reduce its energy costs by importing power from the mainland. The legislation that led to the PPA between Deepwater and Narragansett Electric Company clearly envisions such a possibility.

Q. Does BIPCO have an obligation or requirement to use the Cable?

A. I am not aware of any such obligation or requirement. However, it would appear that BIPCO would have an economic incentive to do so in order to reduce electricity costs on Block Island.

Q. Assuming that BIPCO does decide to use the Cable to supply its load on Block Island, how might the cost of the Cable be allocated between Narragansett Electric Company and BIPCO?

A. The options are that these costs are socialized and shared among all utilities in the ISO, or that it is paid for only by Narragansett Electric Company and BIPCO. The former seems very unlikely, as it will be intrastate and will probably not be viewed as providing reliability benefits to New England as a whole. Assuming no regional cost socialization, there are a number of methods by which the costs of the Cable might be shared between Narragansett Electric Company and BIPCO, which produce very different results. One possibility is that the allocation is based on the same method that is used by the ISO to charge for transmission, which is the 12 Monthly Coincident Peak ("12 CP") allocator. The total monthly peak in the denominator would be the sum of Narragansett and BIPCO's peaks. Using this allocator, I estimate that BIPCO would pay between 0.15% and 0.18% of the cable based on this allocation methodology. This would result in Narragansett's annual costs being reduced by less than $10,000, which would have a de minimus impact on mitigating the cost of the Deepwater PPA on Rhode Island ratepayers. Another method would be to determine the energy savings that would accrue to BIPCO as a result of being able to use the Cable to access power from the mainland, and to base BIPCO's share of the Cable costs to some amount of those savings. Hypothetically, if BIPCO were charged an annual share of the Cable costs based on an amount equal to approximately 50% of those annual energy savings, BIPCO would pay approximately 11% of the Cable costs. There are other options for allocation, but I

believe these two approaches encompass the high and low boundaries. In the next section of this testimony, I will address the impact of potential ranges of sharing Cable cost on the total cost of the Deepwater project to Rhode Island consumers.

VII. DEEPWATER TOTAL, GROSS, AND NET COSTS

Q. You have previously defined the total cost of the Deepwater project as including PPA payments, Cable costs, and incentive payments to Narragansett Electric Company. Gross costs equal total costs less the Narragansett incentive. Net costs were defined as gross costs less market revenues. Have you estimated these costs for the Deepwater project?

A. Exhibit RSH-4 (CONFIDENTIAL) provides those estimates. In including the Cable costs, I estimated the revenue requirements of the Cable using the midpoint of the range of the Company's installed cost and assumed no O&M expenses. The estimated revenue requirements were similar to those estimated by the Company. Exhibit RSH-4 (CONFIDENTIAL) also assumes that BIPCO does not share in the Cable Costs. The result is that the real levelized total cost of the Deepwater project to Rhode Island consumers is **$317.85** per MWH, or 21% higher than the real levelized PPA price of **$262.83** per MWH. When the Narragansett incentive payments are removed, the real levelized gross cost is **$310.62** per MWH.

Estimating the net costs for Deepwater requires that assumptions regarding future market prices for energy, capacity, and RECs be made. In preparing Exhibit RSH-4 (CONFIDENTIAL), I have used the forecast of market prices for those products provided

by ESAI in the Company's filing. Because these forecasts are confidential, my exhibit has been designated as confidential. As shown in Exhibit RSH-4 (CONFIDENTIAL), the real levelized net (above market) cost for the Deepwater Project using the ESAI market forecast is **$192.77** per MWH. It should be noted that I have assumed that Deepwater will commence receiving capacity revenues at the beginning in 2013, even though Forward Capacity Market auctions have already procured capacity through May 31, 2013.

Q. How do these gross and net costs change if BIPCO does decide to use the Cable and share in its costs?

A. In that scenario, I previously mentioned that BIPCO's share of the Cable costs could range from near zero to 11%, depending upon the allocation method chosen. If BIPCO were to pay 11% of the costs of the Cable, the gross real levelized cost for Deepwater would decrease to **$305.36** per MWH, down from **$310.62** per MWH if BIPCO's share was zero. Net real levelized costs for Deepwater would decrease to **$187.51** per MWH from **$192.77** per MWH. These differences are relatively small, less than 2%. Given the uncertainty regarding BIPCO's use of the Cable at this time, I shall assume that no Cable costs are allocated to BIPCO in the remainder of this testimony.

Q. Why did you use the ESAI market prices forecasts instead of other forecasts provided in this proceeding?

A. I compared the energy prices in the early years of the forecasts filed in this proceeding to recent NYMEX futures prices for ISO-NE Locational Marginal Prices ("LMPs"). The ESAI energy price forecast was closer to those futures prices than other forecasts

provided in this proceeding, so I adopted the ESAI energy price forecast for the net cost calculation above. I believe that there should be consistency between energy prices and REC prices, as REC prices are theoretically supposed to bridge the gap between market prices and the cost of renewable projects, which are generally above market. Therefore, to maintain that desired consistency, I opted to use the ESAI REC price forecast. The capacity price forecast for ESAI was similar to the forecast of witness Nickerson on behalf of Deepwater, but closer to what I would expect to see based on current market conditions for capacity. Therefore, I based the net cost analysis discussed above on the ESAI forecasts of market prices.

It is important to note that future market prices are uncertain, especially over the next 25 years. Alternative price forecasts can be considered. The absolute level of these market prices will be important in determining how much Rhode Island consumers will ultimately be expected to pay in above market costs for any specific renewable project, including Deepwater. However, the forecast of market prices, whatever they are, would apply equally to Deepwater and any newly developed renewable energy projects to which Deepwater will be compared. These forecasts have no impact on the gross costs of such renewable projects.

VIII. REAL LEVELIZED COST COMPARISONS

Q. You testified earlier that one way to assess the commercial reasonableness of the Deepwater PPA price is to compare that price to other renewable projects. Have you been able to develop such a comparison?

A. There are several ways to develop such comparisons. The first approach is to compare the Deepwater PPA to the expected prices from other newly developed renewable energy projects, as required by the legislation. Adherence to the legislated definition would seem to preclude renewable projects that are already in operation or have already received financing. Exhibit RSH-5 provides expected cost data for each of the renewable energy technologies that qualify for Rhode Island's definition of renewable. Using this cost data, and assumptions for other common parameters, the gross real levelized costs for each technology can be estimated. In developing these estimates, I assumed a capitalization structure of 50% debt and 50% equity, debt interest rate of 8%, a combined federal and state effective income tax rate of 40%, and an inflation rate of 2.5%. Personal property taxes were estimated using the rates shown in Exhibit RSH-5 applied to each year's net book value of the asset. The average rate for Rhode Island municipalities of approximately $25 per $1,000 of valuation was used a proxy for these projects. For each technology, I estimated the real levelized price per MWH that would yield an IRR of 15% over the life of the project. A target IRR of 15% was selected because it is at the high end of the range of appropriate values. This first approach complies with the legislated definition described earlier in this testimony.

The second approach is to attempt to identify actual projects that have signed PPAs, but have not obtained financing or commenced construction. Data on such contracts are hard to come by, as most are confidential and not available to the public. One such contract is the Bluewater Wind project ("Bluewater"), a 200 MW offshore wind project in Delaware

that has signed a PPA with Delmarva Power & Light, which is public. To the best on my knowledge, Bluewater has not commenced construction. I do not know the status of Bluewater's financing. However, Bluewater interconnects in the PJM control area, which is not an adjacent control area to ISO-NE. Nonetheless, because Bluewater has a PPA and is an offshore wind facility, it is useful to include such a project in my comparison, even though it might not strictly comport with the legislated definition of comparable projects.

Another approach is to examine a broader range of renewable projects. This would include PPAs with facilities that are in operation. Examples of such transactions would be the Linden Wind Energy and the Milford Wind facilities, both of which are located in California. This approach would also include facilities that have installed cost estimates, from which real levelized costs can be calculated. Examples of these types of transactions include the solar projects proposed by Western Massachusetts Electric Company and National Grid in Massachusetts, and the Mass DOER project. Given the difficulty in getting publicly available data, it seems helpful to include such projects in the comparison even though they might not strictly comport with the legislated definition of comparable projects.

Q. Please summarize the results of your comparison of gross and net real levelized costs.

A. Exhibit RSH-6 and RSH-7 provide the results of the gross and net cost comparisons that I have been able to prepare. The Deepwater PPA price is at the high end of the range of all

projects included in these Exhibits. The only renewable projects that have higher costs are based on solar photovoltaic technology.

Q. Are you aware of any related industry developments that could shed additional light on the subject of comparative costs of renewable energy?

A. Yes. National Grid has recently announced that it has agreed to purchase output from the proposed offshore Cape Wind project. Also, a clean energy developer related to the Chevron oil and Gas company has announced plans to install and operate up to four wind turbines in public lands in coastal Narragansett, RI. I am not aware that any price terms have been made public for these projects. Obviously, when price information does become publicly available, it will provide information that will be useful in assessing the commercial reasonableness of the Deepwater project. This information should be added to the comparison I am providing in this testimony.

IX. IRR ANALYSIS

Q. Have you reviewed the IRR that the Deepwater project and its PPA prices are expected to yield to its equity investors?

A. In response to request DIV-1-17, Deepwater provided a confidential pro forma financial analysis that estimated the IRR for the Deepwater project assuming the price contained in the PPA and other assumptions made by Deepwater. [redacted]

[redacted]

Q. Do you concur with this assessment?

A. No. [redacted]

[redacted]

[redacted]

Q. Have you developed an independent estimate of the IRR for the Deepwater project?

A. Yes. I first attempted to replicate Deepwater's estimated IRR. Using all of Deepwater's assumptions, I was able to reasonably replicate the IRR provided in response to request DIV-1-17. I then developed alternative estimates of the IRR using assumptions that I believe are more appropriate. For example, using a capitalization structure of 50% debt and 50% equity, and retaining all of Deepwater's other assumptions, the IRR increases to 21.2%. If capitalization structure is assumed to be 80% (as Deepwater has stated they will use) and all other Deepwater assumptions maintained, the IRR increases to 98.6%. Even under this highly leveraged capitalization structure, debt coverage ratios appear to be adequate at the current PPA price. The O&M costs assumed by Deepwater are very high. If an alternative estimate of O&M costs based upon recent research is used in place of Deepwater's estimate, the IRRs increase as shown in figure 1 below.

Figure 1
IRR at PPA Price

Debt Portion of Capitalization	Original O&M Estimate	Alternative O&M Estimate
50%	21.2%	24.5%
80%	98.6%	103.6%

Q. Please comment on the projected IRRs.

A. The price that currently exists in the proposed PPA yields rates of return under a range of assumptions that are well above what experienced power analysts would expect to see in comparable renewable projects. Using Deepwater's own assumptions results in an IRR that is above expectations. Such high IRRs would be more acceptable if the PPA price were close to or only slightly above market prices. There is no dispute, however, that the Deepwater PPA price is substantially above market levels.

X. ASSESSMENT OF THE PPA PRICE

Q. Please summarize your assessment of the PPA price.

A. When compared to other renewable projects as defined by Rhode Island statute, the Deepwater PPA price is at the very high end of the range. While some other benchmark projects have higher costs, these are typically based upon solar photovoltaic technologies, which are known to be the highest cost form of renewable energy. The PPA price also yields an IRR that is considerably higher than I would expect from comparable projects. Based upon Deepwater's own assumptions regarding capital and O&M costs but with a reasonable capitalization structure, it appears that the project could be successfully financed, constructed, and operated at lower PPA rates. Even if the target IRR is increased to 18% from 15%, a lower price can be justified. The current PPA price

formula has a starting price in 2012$ of 235.75 per MWH, which escalates to $244.00 per MWH in 2013, the expected year of commercial operation. Figure 2 below provides the PPA prices necessary to yield an IRR in the 15% to 18% range. These prices range from $170 per MWH to $214 per MWH.

Figure 2
PPA Initial Price in 2012 to Yield Target IRRs
(assumes 3.5% fixed annual escalation and 50% debt capitalization)

Target IRR	Deepwater O&M Estimate	Alternative O&M Estimate
15%	$196.00	$170.00
18%	$214.00	$188.50

Changing that $235.75 per MWH starting price to a lower level, such as **$200.00** per MWH, while retaining the fixed 3.5% escalation aspect of the formula will yield IRRs that range from 15.7% to 19.7% that, while high, are more in line with expectations. If the PPA price were set to this level, it would still be in the upper end of the range of other newly developed renewable projects, as shown in Exhibit RSH-8. [redacted]. It is possible that the actual cost could be less than this figure, which would indicate that greater reduction in the PPA starting price could be warranted.

Rhode Island legislation has been enacted to encourage this project to be built, perhaps with the full understanding that such projects will cost considerably more than acquiring conventional power supplies and RECs. Figure 3 below summarizes the total costs to Rhode Island ratepayers over the term of the PPA. As proposed, the PPA results in total

costs that are more than $520 million higher than the market value of the output of the Deepwater project.

Figure 3
Summary of Costs to Rhode Island Ratepayers

Cost Category	Sum Over Term of PPA (millions)	NPV (millions of 2012$)
PPA Payments	**$696.34**	**$288.75**
Utility Incentive	**19.15**	**7.94**
Cable Cost	**101.88**	**52.50**
Total Cost	**$817.37**	**$349.19**
Less Market Revenues	**$296.35**	**$129.47**
Above Market Cost	**$521.02**	**$219.72**

The commercially reasonable standard in the legislation is an appropriate mechanism to help ensure that Rhode Island consumers pay the minimum subsidy necessary to allow this project to be built. I believe that the Deepwater project could be successfully developed, constructed, and operated at a lower PPA price than is included in the current version of the contract. Reducing the 2012 starting price in the PPA to $200 per MWH from $235.75 per MWH will reduce the above market costs to $412 million from $521 million, saving $109 million for Rhode Island ratepayers while still allowing the project to be built. Deepwater should be required to demonstrate to the Commission why such a lower price cannot lead to the successful development of the project. The Company and Deepwater should be encouraged to attempt to arrive at a revised PPA price that reflects a more just and reasonable balance between the interests of ratepayers and the desire to jump start a nascent renewable energy business in Rhode Island. If the PPA price is to be

approved as filed, the Commission and the State's policy makers should do so with the full knowledge of the state of that balance contained in the proposed PPA. The premium to be paid in electric rates appears to be relatively high in terms of both absolute dollars and the expected return to the project developers.

XI. NON-PRICE TERMS

Q. Have you reviewed the non-price terms and conditions of the Deepwater PPA?

A. Yes.

Q. Do you have any observations or recommendations for changes in these non-price terms and conditions?

A. There are several non-price provisions of the PPA that merit consideration and further review. These are highlighted as follows:

- Operational Limits: On page 6, the definition of Operational Limits includes the time required for start-up and a limit on the number of scheduled start-ups per Contract Year. This definition appears to be applicable to a fossil-fueled generator, rather than a wind generator. This definition should be modified to remove these references.
- Commercial Operation Extension: On page 10, the PPA gives Deepwater the unilateral right to extend the commencement of commercial operation for up to five years. Prior to Commercial Operation, Narragansett must purchase energy, capacity, and RECs produced by the Deepwater project. This effectively gives Deepwater the right to create a 25 year agreement. Prior to Commercial Operation, energy and capacity is priced at Real Time Locational Marginal Prices ("RT LMPs") while RECs are priced based upon then current broker quotes. This arrangement may force

Narragansett to buy products that they don't need or want. The PPA should be changed to state that, if Deepwater extends the date of Commercial Operation, then Deepwater must separately offer energy, capacity, and RECs to Narragansett at some discount off of the then current market rates for each product. Narragansett may elect to buy these products at their sole discretion. If Narragansett declines to buy, then Deepwater is free to sell these pre-commercial products to others.

- Capacity Price: On page 13, the PPA states that prior to commercial operation, capacity is sold at RT LMPs. These rates apply to energy, not capacity. This offer should be tied to Forward Capacity Market prices, not energy prices.
- Assignment: In section 14.2, Deepwater may assign the agreement to an Affiliate of Deepwater, or in connection with any Financing, without the consent of Narragansett. I believe that any assignment of the PPA should require the consent of Narragansett, not to be unreasonably withheld. This will prevent an unwarranted transfer of Deepwater's obligations under this agreement to the detriment of Rhode Island ratepayers.
- Favored Nations Pricing: During the discovery process, it became apparent that additional wind turbines could be added at a lower cost than the cost of the original eight wind turbines. Since Narragansett's ratepayers are fully funding the first eight turbines, they should receive some of the benefit of additional turbines at a lower cost. The PPA should be modified to state that Deepwater must first offer the output from any additional wind turbines to Narragansett. If Narragansett declines to purchase this incremental output, then Deepwater may offer the output to third

parties. However, Narragansett should have the right, but not the obligation, to have the rate for this sale to third parties apply to the PPA for the first eight turbines. This will ensure that Narragansett ratepayers do not further subsidize the development of additions to this project

XII. CONCLUSION

Q. Does that conclude your testimony?

A. At this time, yes. Should additional information become available, I will update this testimony as appropriate.

Exhibit RSH-1

Resume of Richard S. Hahn

La Capra Associates

Richard S. Hahn

Principal Consultant

Mr. Hahn is a senior executive in the energy industry, with diverse experience in both regulated and unregulated Company. He joined La Capra Associates in 2004. Mr. Hahn has a proven track record of analyzing energy, capacity, and ancillary services markets, valuation of energy assets, developing and reviewing integrated resource plans, creating operational excellence, managing full P&Ls, and developing start-ups. He has demonstrated expertise in electricity markets, utility planning and operations, sales and marketing, engineering, business development, and R&D. Mr. Hahn also has extensive knowledge and experience in both the energy and telecommunications industries. He has testified on numerous occasions before the Massachusetts Department of Telecommunications and Energy, and also before FERC.

SELECTED EXPERIENCE – *LA CAPRA ASSOCIATES*

- Performed an assessment of plans to procure Default Service Power Supplies for a Rhode Island utility. Provided expert testimony before the Rhode Island Public Utilities Commission.
- Served as an advisor to Vermont electric utilities regarding the evaluation of new power supply alternatives.
- Conducted a review of Massachusetts electric utilities' proposal to construct, own, and operate large scale PV solar generating units. Served as an advisor to the Massachusetts Attorney General in settlement negotiations.
- Served as a key member of a La Capra Team evaluating wind generation RFPs in Oklahoma.
- Performed an assessment of plans to procure Default Service Power Supplies for Pennsylvania utilities. Provided expert testimony before the Pennsylvania Public Utilities Commission.
- Performed an assessment of a merchant generator proposal to construct, own, and operate 800 MW of large scale PV solar generating units in Maine.
- Analyzed proposed environmental upgrades to an existing coal-fired power plant in Wisconsin, including an economic evaluation of this investment compared to alternative supply resources. Provided expert testimony before the Public Service Commission of Wisconsin.
- Performed a study of non-transmission alternatives (NTAs) to a proposed set of transmission upgrades to the bulk power supply system in Maine.
- Served as a key member of the La Capra Team advising the Connecticut Energy Advisory Board (CEAB) on a wide range of energy issues, including integrated resources plan and the need for and alternatives to new transmission projects.
- Performed a study of non-transmission alternatives (NTAs) to a proposed set of

transmission upgrades to the bulk power supply system in Vermont.

- Served as an advisor to the Delaware Public Service Commission and three other state agencies in the review of Delmarva Power & Light's integrated resource plan and the procurement of power supplies to meet SOS obligations.
- Served as an expert witness in litigation involving a contract dispute between the owner of a merchant powerplant and the purchasers of the output of the plant.
- Served as an advisor to the Maryland Attorney General's Office in the proposed merger between Constellation Energy and the FPL Group.
- Reviewed and analyzed outages for Connecticut utilities during the August 2006 heat wave. Prepared an assessment of utility filed reports and corrective actions.
- Conducted a study of required planning data and prepared forecasts of the key drivers of future power supply costs for public power systems in New England.
- Reviewed and analyzed Hawaiian Electric Company integrated resource plan and its DSM programs for the State of Hawaii. Prepared written statement of position and testified in panel discussions before the Hawaii Public Utility Commission.
- Assisted the Town of Hingham, MA in reviewing alternatives to improve wireless coverage within the Town and to leverage existing telecommunication assets of the Hingham Municipal Light Plant.
- Conducted an extensive study of distributed generation technologies, options, costs, and performance parameters for VELCO and CVPS.
- Analyzed and evaluated proposals for three substations in Connecticut. Prepared and issued RFPs to seek alternatives in accordance with state law.
- Performed an assessment of merger savings from the First Energy – GPU merger. Developed a rate mechanism to deliver the ratepayers share of those savings. Filed testimony before the PA PUC.
- Prepared long term price forecasts for energy and capacity in the ISO-NE control area for evaluating the acquisition of existing powerplants.
- Conducted an assessment of market power in PJM electricity markets as a result of the proposed merger between Exelon and PSEG. Developed a mitigation plan to alleviate potential exercise of market power. Filed testimony before the PA PUC.
- Performed a long-term locational installed capacity (LICAP) price forecast for the NYC zone of the NYISO control area for generating asset acquisition.
- Served as an Independent Evaluator of a purchase power agreement between a large mid-west utility and a very large cogeneration plant. Evaluated the implementation of amendments to the purchase power agreement, and audited compliance with very complex contract terms and operating procedures and practices.
- Performed asset valuation for energy investors targeting acquisition of major electric generating facility in New England. Prepared forecast of market prices for capacity and energy products. Presented overview of the market rules and operation of ISO-NE to investors.

- Assisted in the performance of an asset valuation of major fleet of coal-fired electric generating plants in New York. Prepared forecast of market prices for capacity and energy products. Analyzed cost and operations impacts of major environmental legislation and the effects on market prices and asset valuations.
- Conducted an analysis of the cost impact of two undersea electric cable outages within the NYISO control area for litigation support. Reviewed claims of cost impacts from loss of sales of transmission congestion contracts and replacement power costs.
- Reviewed technical studies of the operational and system impacts of major electric transmission upgrades in the state of Connecticut. Analysis including an assessment of harmonic resonance and type of cable construction to be deployed.
- Conducted a review of amendments to a purchased power agreement between an independent merchant generator and the host utility. Assessed the economic and reliability impacts and all contract terms for reasonableness.
- Assisted in the development of an energy strategy for a large Midwest manufacturing facility with on-site generation. Reviewed electric restructuring rules, electric rate availability, purchase & sale options, and operational capability to determine the least cost approach to maximizing the value of the on-site generation.
- Assisted in the review of the impact of a major transmission upgrade in Northern New England.
- Negotiated a new interconnection agreement for a large hotel in Northeastern Massachusetts.

SELECTED EXPERIENCE – *NSTAR ELECTRIC & GAS*

President & COO of NSTAR Unregulated Subsidiaries

Concurrently served as President and COO of three unregulated NSTAR subsidiaries: Advanced Energy Systems, Inc., NSTAR Steam Corporation, and NSTAR Communications, Inc.

Advanced Energy Systems, Inc.

- Responsible for all aspects of this unregulated business, a large merchant cogeneration facility in Eastern Massachusetts that sold electricity, steam, and chilled water. Duties included management, operations, finance and accounting, sales, and P&L responsibility.

NSTAR Steam Corporation

- Responsible for all aspects of this unregulated business, a district energy system in Eastern Massachusetts that sold steam for heating, cooling, and process loads. Duties included management, operations, finance and accounting, sales, and P&L responsibility.

NSTAR Communications, Inc.

- Responsible for all aspects of this unregulated business, a start-up provider of telecommunications services in Eastern Massachusetts. Duties included management, operations, finance and accounting, sales, and P&L responsibility.
- Established a joint venture with RCN to deliver a bundled package of voice, video, and data services to residential and business customers. Negotiated complex indefeasible-right-to-use and stock conversion agreements.
- Installed 2,800 miles of network in three years. Built capacity for 230,000 residential and 500 major enterprise customers.
- Testified before the Congress of the United States on increasing competition under the Telecommunications Act of 1996.

VP, Technology, Research, & Development, Boston Edison Company

- Responsible for identifying, evaluating, and deploying technological innovation at every level of the business.
- Reviewed Electric Power Research Institute (EPRI), national laboratories, vendor, and manufacturer R&D sources. Assessed state-of-the-art electro-technologies, from nuclear power plant operations to energy conservation.

VP of Marketing, Boston Edison Company

- Promoted and sold residential and commercial energy-efficiency products and customer service programs.
- Conducted market research to develop an energy-usage profile. Designed a variable time-of-use pricing structure, significantly reducing on-peak utilization for residential and commercial customers.
- Designed and marketed energy-efficiency programs.
- Established new distribution channels. Negotiated agreements with major contractors, retailers, and state and federal agencies to promote new energy-efficient electro-technologies.

Vice President, Energy Planning, Boston Edison Company

- Responsible for energy-usage forecasting, pricing, contract negotiations, and small power and cogeneration activities. Directed fuel and power purchases
- Implemented an integrated, least-cost resource planning process. Created Boston Edison's first state-approved long-range plan.
- Assessed non-traditional supply sources, developed conservation and load-management programs, and purchased from cogeneration and small power-production plants.
- Negotiated and administered over 200 transmission and purchased power contracts.

- Represented the company with external agencies. Served on the Power Planning Committee of the New England Power Pool.
- Testified before federal and state regulatory agencies.

EMPLOYMENT HISTORY

La Capra Associates, Inc.	Boston, MA
Managing Consultant	*2004 – present*
Advanced Energy Systems, Inc.	Boston, MA
President & COO	*2001-2003*
NSTAR Steam Corporation	Cambridge, MA
President & COO	*2001-2003*
NSTAR Communications, Inc.	
President & COO	*1995-2003*
Boston Edison Company	Boston, MA
VP, Technology, Research, & Development	*1993-1995*
VP, Marketing, Boston Edison Company	*1991-1993*
Vice President, Energy Planning, Boston Edison Company	*1987-1991*
Manager, Supply & Demand Planning	*1984-1987*
Manager, Fuel Regulation & Performance	*1982-1984*
Assistant to Senior Vice President, Fossil Power Plants	*1981-1982*
Division Head, Information Resources	*1978-1981*
Senior Engineer, Information Resource Division	*1977-1978*
Assistant to VP, Steam Operations	*1976-1977*
Electrical Engineer, Research & Planning Department	*1973-1976*

EDUCATION

Boston College	Boston, MA
Masters in Business Administration	*1982*
Northeastern University	Boston, MA
Masters in Science, Electrical Engineering	*1974*
Northeastern University	Boston, MA
Bachelors in Science, Electrical Engineering	*1973*

PROFESSIONAL AFFILLIATIONS

Director, NSTAR Communications, Inc.	*1997-2003*
Director, Advanced Energy Systems, Inc.	*2001-2003*
Director, Neuco, Inc.	*2001-2003*
Director, United Telecom Council	*1999-2003*

Head, Business Development Division, United Telecom Council	*2000-2003*
Elected Commissioner – Reading Municipal Light Board	*2005-present*
Registered Professional Electrical Engineer in Massachusetts	

Exhibit RSH-2
Calculation of a Real Levelized Price for the Deepwater PPA Prices

Deepwater Wind

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	sum	npv
nameplate capacity	MW	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8		
FCM capacity	MW	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1		
output	MWH	100,915	100,915	100,915	100,915	100,915	100,915	100,915	100,915	100,915	100,915	100,915	100,915	100,915	100,915	100,915	100,915	100,915	100,915	100,915	100,915	2,018,304	
PPA price	$/MWH	$244.00	$252.54	$261.38	$270.53	$280.00	$289.80	$299.94	$310.44	$321.30	$332.55	$344.19	$356.23	$368.70	$381.61	$394.96	$408.79	$423.09	$437.90	$453.23	$469.09		$2,861.29
real levelized rate	$/MWH	$262.83	$269.40	$276.14	$283.04	$290.12	$297.37	$304.80	$312.42	$320.23	$328.24	$336.44	$344.86	$353.48	$362.31	$371.37	$380.66	$390.17	$399.93	$409.93	$420.17		$2,861.29
real levelized (2013$)	$/MWH	$262.83																					

Exhibit RSH-3
IRR Example

HYPOTHETICAL IRR EXAMPLE

0	1	2	3	4	5	6	7	8	9	10
($100.00)	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00	$20.00

IRR= 15%

Exhibit RSH-4 (CONFIDENTIAL)
Page 1 of 2
Total Real Levelized Costs for Deepwater

CONFIDENTIAL

	Deepwater Wind		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
			2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	sum	npv
	nameplate capacity	MW	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8		
	FCM capacity	MW	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1		
	output	MWH	100,915	100,915	100,915	100,915	100,915	100,915	100,915	100,915	100,915	100,915	100,915	100,915	100,915	100,915	100,915	100,915	100,915	100,915	100,915	100,915	2,018,304	
	PPA price	$/MWH	$244.00	$252.54	$261.38	$270.53	$280.00	$289.80	$299.94	$310.44	$321.30	$332.55	$344.19	$356.23	$368.70	$381.61	$394.96	$408.79	$423.09	$437.90	$453.23	$469.09		$2,861.29
	real levelized rate	$/MWH	$262.83	$269.40	$276.14	$283.04	$290.12	$297.37	$304.80	$312.42	$320.23	$328.24	$336.44	$344.86	$353.48	$362.31	$371.37	$380.66	$390.17	$399.93	$409.93	$420.17		$2,861.29
	real levelized (2013$)	$/MWH	$262.83																					
Total Costs																								
	PPA payments	$millions	$24.62	$25.49	$26.38	$27.30	$28.26	$29.24	$30.27	$31.33	$32.42	$33.56	$34.73	$35.95	$37.21	$38.51	$39.86	$41.25	$42.70	$44.19	$45.74	$47.34	$696.34	$288.75
2.75%	NGRID incentive	$millions	$0.68	$0.70	$0.73	$0.75	$0.78	$0.80	$0.83	$0.86	$0.89	$0.92	$0.96	$0.99	$1.02	$1.06	$1.10	$1.13	$1.17	$1.22	$1.26	$1.30	$19.15	$7.94
esc	Cable rev req	$millions	$4.64	$7.94	$7.60	$7.26	$6.94	$6.62	$6.31	$6.00	$5.70	$5.40	$5.10	$4.80	$4.50	$4.20	$3.90	$3.60	$3.30	$3.00	$2.70	$2.40	$101.88	$52.50
2.50%	Cable O&M	$millions	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
	Allocation of Cable	%	0%	allocated to BHCO																				
	total gross costs	$millions	$29.94	$34.13	$34.70	$35.31	$35.97	$36.67	$37.41	$38.19	$39.02	$39.88	$40.79	$41.74	$42.73	$43.77	$44.85	$45.99	$47.17	$48.40	$49.69	$51.04	$817.37	$349.19
	gross all-in rate	$/MWH	$296.65	$338.19	$343.86	$349.94	$356.43	$363.34	$370.68	$378.44	$386.63	$395.21	$404.19	$413.59	$423.42	$433.71	$444.45	$455.68	$467.41	$479.65	$492.42	$505.74		$3,460.25
	real levelized rate	$/MWH	$317.85	$325.79	$333.94	$342.29	$350.85	$359.62	$368.61	$377.82	$387.27	$396.95	$406.87	$417.05	$427.47	$438.16	$449.11	$460.34	$471.85	$483.64	$495.74	$508.13		$3,460.25
	real levelized (2013$)	$/MWH	$317.85																					

Exhibit RSH-4 (CONFIDENTIAL)
Page 2 of 2
Gross and Net Real Levelized Costs for Deepwater

CONFIDENTIAL

Deepwater Wind

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
			2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	sum	npv
Total Costs																								
	PPA payments	$millions	$24.62	$25.49	$26.38	$27.30	$28.26	$29.24	$30.27	$31.33	$32.42	$33.56	$34.73	$35.95	$37.21	$38.51	$39.86	$41.25	$42.70	$44.19	$45.74	$47.34	$696.34	$288.75
0.00%	NGRID incentive	$millions	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
esc	Cable rev req	$millions	$4.64	$7.94	$7.60	$7.26	$6.94	$6.62	$6.31	$6.00	$5.70	$5.40	$5.10	$4.80	$4.50	$4.20	$3.90	$3.60	$3.30	$3.00	$2.70	$2.40	$101.88	$52.50
2.50%	Cable O&M	$millions	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
	Allocation of Cable	%	0%	allocated to BIPCO																				
	total gross costs	$millions	$29.26	$33.43	$33.97	$34.56	$35.19	$35.86	$36.57	$37.33	$38.12	$38.96	$39.83	$40.75	$41.71	$42.71	$43.76	$44.85	$45.99	$47.19	$48.43	$49.74	$798.22	$341.25
	gross all-in rate	$/MWH	$289.94	$331.24	$336.67	$342.50	$348.73	$355.37	$362.43	$369.91	$377.79	$386.06	$394.72	$403.79	$413.28	$423.21	$433.59	$444.44	$455.77	$467.60	$479.95	$492.84		$3,381.56
	real levelized rate	$/MWH	$310.62	$318.39	$326.35	$334.50	$342.87	$351.44	$360.23	$369.23	$378.46	$387.92	$397.62	$407.56	$417.75	$428.19	$438.90	$449.87	$461.12	$472.65	$484.46	$496.57		$3,381.56
	real levelized (2013$)	$/MWH	$310.62																					
Net Costs																								
	FCM revenues	$millions																						$4.83
	REC revenues	$millions																						$54.75
	Energy Market Revenues	$millions																						$69.89
	subtotal	$millions																						$129.47
	total net costs																							$211.78
	net all-in rate	$/MWH																						$2,098.60
	real levelized rate	$/MWH	$192.77	$197.59	$202.53	$207.59	$212.78	$218.10	$223.56	$229.14	$234.87	$240.75	$246.76	$252.93	$259.26	$265.74	$272.38	$279.19	$286.17	$293.32	$300.66	$308.17		$2,098.60
	real levelized (2013$)	$/MWH	$192.77																					

Exhibit RSH-5
Cost Assumptions for Generic Qualified Rhode Island Renewable Energy Technologies

			2008$/kw		2013$/kw	2008$/kw-yr	2013$/kw-yr	2008$/mwh	mmBTU/ mwh	2008$/ mmBTU	2013$/mwh						
	MW	CF	overnight installed cost	capex multiplier	installed cost	fxd o&m	fxd o&m	var o&m	heat rate	fuel costs	total var costs	book life	loan term	tax life	DB%	ITC	property tax rate
solar	5.0	15.00%	6,171	1.00	7,154	11.94	13.51	0.00	0.00	0.00	0.00	20.00	15.00	5.00	200%	30.00%	2.50%
wind onshore	50.0	30.00%	1,966	1.29	2,933	30.98	35.05	0.00	0.00	0.00	0.00	20.00	15.00	5.00	200%	30.00%	2.50%
wind offshore	100.0	35.00%	3,937	1.38	6,298	86.92	98.34	0.00	0.00	0.00	0.00	20.00	15.00	5.00	200%	30.00%	2.50%
tidal	2.0	40.00%	3,512	1.17	4,764	118.67	134.49	0.00	0.00	0.00	0.00	20.00	15.00	20.00	200%	30.00%	2.50%
geothermal	50.0	40.00%	1,749	1.17	2,372	168.33	190.45	0.00	32.97	0.00	0.00	20.00	15.00	20.00	200%	30.00%	2.50%
small hydro	5.0	45.00%	3,811	1.17	5,169	28.53	32.27	2.49	0.00	0.00	2.82	20.00	15.00	20.00	150%	30.00%	2.50%
biomass	80.0	85.00%	3,849	1.17	5,221	65.89	74.55	6.86	9.45	4.50	55.88	20.00	15.00	20.00	150%	30.00%	2.50%
fuel cells	10.0	85.00%	5,478	1.17	7,430	5.78	6.54	49.00	7.93	9.00	136.19	20.00	15.00	20.00	200%	30.00%	2.50%
landfill gas	30.0	85.00%	2,599	1.17	3,525	116.80	132.15	0.01	13.65	0.00	0.01	20.00	10.00	7.00	200%	30.00%	2.50%

Exhibit RSH-6
Gross Levelized Cost Comparison

		real levelized gross $ per MWH (2013$)			
PROJECT	MW	DWW	generic projects	specific projects	total
WMECO Solar	6.00			650.60	650.60
NGRID MA Solar	4.88			544.98	544.98
solar	5.00		442.00		442.00
MA Solar	0.50			318.00	318.00
DWW as filed	**28.80**	**310.62**			**310.62**
fuel cells	10.00		244.25		244.25
wind offshore	100.00		195.00		195.00
tidal	2.00		185.00		185.00
small hydro	5.00		152.00		152.00
Euro offshore-DPN	185.00			143.50	143.50
biomass	80.00		141.50		141.50
BlueWater Wind	200.00			141.10	141.10
Linden CA wind	50.00			128.20	128.20
geothermal	50.00		127.00		127.00
Milford CA wind	200.00			113.75	113.75
wind onshore	50.00		102.00		102.00
landfill gas	30.00		62.75		62.75
VT landfill	1.60			40.60	40.60

Exhibit RSH-7
Net Levelized Cost Comparison

		real levelized net $ per MWH (2013$)			
PROJECT	MW	DWW	generic projects	specific projects	total
WMECO Solar	6.00			492.37	492.37
NGRID MA Solar	4.88			394.29	394.29
solar	5.00		320.84		320.84
MA Solar	0.50			196.84	196.84
DWW as filed	**28.80**	**192.77**			**192.77**
fuel cells	10.00		123.41		123.41
wind offshore	100.00		76.52		76.52
tidal	2.00		71.54		71.54
small hydro	5.00		31.57		31.57
Euro offshore-DPN	185.00			25.65	25.65
BlueWater Wind	200.00			23.25	23.25
biomass	80.00		21.40		21.40
Linden CA wind	50.00			11.14	11.14
geothermal	50.00		5.70		5.70
Milford CA wind	200.00			(3.82)	(3.82)
wind onshore	50.00		(15.43)		(15.43)
landfill gas	30.00		(57.35)		(57.35)
VT landfill	1.60			(79.13)	(79.13)

Exhibit RSH-8
Adjusted Gross Levelized Cost Comparison

		real levelized gross $ per MWH (2013$)			
PROJECT	MW	DWW	generic projects	specific projects	total
WMECO Solar	6.00			650.60	650.60
NGRID MA Solar	4.88			544.98	544.98
solar	5.00		442.00		442.00
MA Solar	0.50			318.00	318.00
DWW as filed	**28.80**	**310.62**			**310.62**
DWW at $200/MWH	**28.80**	**270.76**			**270.76**
fuel cells	10.00		244.25		244.25
wind offshore	100.00		195.00		195.00
tidal	2.00		185.00		185.00
small hydro	5.00		152.00		152.00
Euro offshore-DPN	185.00			143.50	143.50
biomass	80.00		141.50		141.50
BlueWater Wind	200.00			141.10	141.10
Linden CA wind	50.00			128.20	128.20
geothermal	50.00		127.00		127.00
Milford CA wind	200.00			113.75	113.75
wind onshore	50.00		102.00		102.00
landfill gas	30.00		62.75		62.75
VT landfill	1.60			40.60	40.60