STATE OF RHODE ISLAND

PUBLIC UTILITIES COMMISSION

IN RE: REVIEW OF THE NARRAGANSETT ELECTRIC COMPANY

D/B/A NATIONAL GRID'S RATE DESIGN

PURSUANT TO R.I. GEN. LAWS § 39-26.6-24

Docket NO. 4568

PREFILED DIRECT TESTIMONY

OF

KARL R. RÁBAGO

EXECUTIVE DIRECTOR, PACE ENERGY AND CLIMATE CENTER

on behalf of

WIND ENERGY DEVELOPMENT LLC

November 23, 2015

BEFORE THE RHODE ISLAND PUBLIC UTILITIES COMMISSION

DOCKET NO. 4568

IN RE: REVIEW OF THE NARRAGANSETT ELECTRIC COMPANY D/B/A NATIONAL GRID'S RATE DESIGN PURSUANT TO R.I. GEN. LAWS §39-26.6-24	)))))	**DIRECT TESTIMONY OF KARL R. RÁBAGO on behalf of WIND ENERGY DEVELOPMENT LLC**

INTRODUCTION AND BACKGROUND

Q. Please state your name and business address.

A. My name is Karl R. Rábago. My business address is 78 North Broadway, White Plains, New York 10603

Q. By whom are you employed and in what capacity?

A. I am the executive director of the Pace Energy and Climate Center located at the Pace University School of Law.

Q. On whose behalf are you testifying in this proceeding?

A. I am testifying on behalf of Wind Energy Development LLC (WED).

Q. Please summarize your education and work experience.

A. I earned a B.B.A. in management (1977) from Texas A&M University, a J.D. with honors (1984) from the University of Texas School of Law, and LL.M. degrees in military law (1988) and environmental law (1990) from, respectively, the U.S. Army Judge Advocate General's School and Pace University School of Law. I served for more than twelve years as an officer in the U.S. Army, including in the Judge Advocate General's Corps and as an assistant professor of law at the United States Military Academy at West Point,

New York. I have also worked for more than 20 years in the electricity industry and related fields. I have served as a Commissioner with the Texas Public Utility Commission (1992-1994) and as a Deputy Assistant Secretary for the Office of Utility Technologies with the U.S. Department of Energy (1995-1996). More recently, I have served as Director of Government and Regulatory Affairs for the AES Corporation (2006-2008) and as Vice President of Distributed Energy Services for Austin Energy, a large urban municipal electric utility in Texas. In 2012, I founded and became the principal of Rábago Energy LLC. I also currently serve as Chairman of the Board of Directors of the Center for Resource Solutions (1997-present) and as a member of the Board of Directors of the Interstate Renewable Energy Council (2012-present). I started as the Executive Director of the Pace Energy and Climate Center in May 2014. My education and work experience is set forth in detail on my resume, attached as **Exhibit WED 2**.

Q. Have you testified previously before the Rhode Island Public Utilities Commission (the "Commission")?

A. No. I have testified under oath, participated in regulatory proceedings, or made presentations before state legislative or regulatory bodies in Arizona, California, Colorado, Connecticut, Florida, Georgia, Hawaii, Iowa, Kentucky, Michigan, Minnesota, Missouri, New York, North Carolina, Virginia, and Wisconsin. A table of my formal testimony is attached as **Exhibit WED 3**.

Q. What is the purpose of your direct testimony?

A. On July 31, 2015, Narragansett Electric Company d.b.a. National Grid (the Company), submitted a proposed rate design pursuant to R.I. Gen. Law §39-26.6-24 for the Commission's approval. Included in that proposal is the Company's proposal for a "Distribution Rate for Stand-Alone Generators," also called an "Access Fee." The purpose of my direct testimony is to point out the deficiencies in the Company's proposal for an Access Fee on distributed generation, and to submit for the Commission's consideration a path forward for improving the methodology used to determine the value of distributed renewable energy generation.

Q. What materials did you review in preparing this testimony?

A. I reviewed the Company's application and work papers, and other filings relevant to this proceeding. In addition, I reviewed applicable Rhode Island statutes, relevant Rhode Island court decisions, testimony that I have submitted in other regulatory proceedings, and reports relating to the value of distributed generation.

Q. What is your key recommendation to the commission in this proceeding?

A. The Commission should deny the Company proposal for an Access Fee for distributed generation. Further, the Commission should initiate a separate proceeding to establish a uniform methodology for fully and fairly evaluating the benefits and costs of distributed generation. The Commission should require the Company to participate in that proceeding. Any future proposal for a

distribution generation credit or fee should be based on the application of such a methodology.

Q. What is the company's burden in this proceeding?

A. Under Rhode Island General Law § 39-3-12, the burden of proof is on the Company. As the party seeking to impose the Access Fee, the Company has the burden of establishing its entitlement to the revenues associated with the Access Fee. This burden is not removed or shifted under the terms of §39-26.6-24, by the language of § 39-3-12, or by the fact that the proposed Access Fee would be implemented in a manner that is neutral to the Company's overall revenues. As the Rhode Island Supreme Court explained in United States v. Public Utilities Commission, 120 R.I. 959, 393 A.2d 1092 (1978), the Company must not only establish that the proposed charge is necessary, but also that it is nondiscriminatory. As I explain, the Company has failed to meet its burden on the proposed Access Fee for distributed generation.

Q. How does Rhode Island General Law §39-26.6-24 impact the company's proposal for an access fee for distributed generation?

A. Under §39-26.6-24(a), the Company must submit sufficient and competent evidence to support a Commission determination of "the appropriate cost responsibility and contributions to the operation, maintenance, and investment in the distribution system that is relied upon by all customers, including, without limitation, non-net metered and net-metered customers" and that any rate design provides for "the equitable recovery of costs associated with energy efficiency and any renewable-energy programs." More specifically, the statute

is very clear in §39-26.6-24(b), the Commission cannot approve any new rate unless the Company provides evidence that addresses a wide range of specified issues, as well as any other issues that the Commission deems relevant and appropriate. Section 39-26.6-24(b) requires that any proposed rate or charge applied to distributed generation must be based on comprehensive, objective, empirical, and reasonable evidence that is consistent with sound ratemaking principles. It is against the very clear legislative guidance in §39-26.6-24, and mindful of the assignment of the burden of proof under §39-3-12, that the Company's Access Fee proposal must be measured.

THE COMPANY'S PROPOSED ACCESS FEE

Q. What does the company propose for an access fee on distributed generators?

A. The Company proposes to impose a capacity-weighted and-denominated charge on all distributed generation under current and future programs. The proposed charge starts at $5.00 per kW-month, or $60 per kW-year for facilities connected at primary voltage level. The charge for facilities connected at secondary voltage is $7.25 per kW-month, or $87.00 per kW-year. The charge is then weighted for capacity factor, with facilities operating at a higher capacity factor to pay more.

Q. Does the company recognize the added value to the grid and other customers from higher capacity-factor facilities?

A. No. The Company proposes to impose higher charges for higher capacity value.

Q. Does the company propose facility-specific capacity charges?

A. No. The Company proposes a single capacity factor for each type of generation technology. According to the Company's Supplemental response to data request PUC 1-18, it intends to apply a capacity factor of 40% to solar, 30% to wind, and 10% to hydropower.

Q. Does the company adjust or weight the charge by the actual energy output or capacity factor of the distributed generation facility?

A. No. The proposed charge includes no factors for the actual performance of the distributed generation facility. The proposed Access Fee is inherently discriminatory in its failure to account for the actual operating performance of the distributed generation facility. In addition, it is bad policy to design a charge that does not have the effect of creating an incentive for more economic performance.

Q. What do you mean by "an incentive for more economic performance?"

A. The Access Fee proposed by the Company applies to the nameplate capacity of the distributed generation system. It is then weighted against a technology-specific, but not production-specific, multiplier. The proposed Access Fee does not change based on the value of the generation output, indeed, it charges high-capacity systems more than those with low capacity factors. The proposed Access Fee does not reward higher generation output and, in fact, punishes higher capacity value. Given these impacts, the proposed Access Fee is on its face unfairly discriminatory and uneconomic.

Q. Does the Company demonstrate that the proposed fee is calibrated to any aspect of revenue requirement?

A. No. The Company does not substantiate either a revenue shortfall or that the proposed Access Fee rate would address this shortfall efficiently or accurately.

Q. Does the company justify its proposed access fee according to the requirements of Rhode Island General Law §39-26.6-24?

A. No. The Company offers no objective or quantified evidence that it considered:

- the benefits of distributed-energy resources;
- the distribution services being provided to net-metered customers when the distributed generation is not producing electricity;
- simplicity, understandability, and transparency of rates to all customers, including non-net metered and net-metered customers;
- equitable ratemaking principles regarding the allocation of the costs of the distribution system;
- cost causation principles; or
- the general assembly's legislative purposes in creating the distributed-generation growth program.

In sum, the Company proposal is insufficient to support an approval by the Commission.

Q. Does the company recognize the need to justify its proposed access fee?

A. Only superficially. The Company states that "proper cost allocation and cost recovery should recognize demand that results from either inflows or outflows of energy," but other than an unquantified assertion that the proposed Fee

would "contribute towards the support for the distribution system" and "ongoing operation, maintenance and replacement costs," the Company offers absolutely no justification for its proposed Access Fee or its amount. Zschokke & Lloyd Testimony, July 31, 2015 ("Company Testimony"), at p. 62.

Q. How do you understand the reasoning used in the Company's argument in support of its proposed Access Fee?

A. The core rhetorical underpinning in the Company testimony regarding the proposed Access Fees is that energy transmitted for consumption over the distribution and transmission system and energy transmitted from generation are separate cost causers and cost drivers. This argument is technically and economically illogical. This is probably the reason that the Company offers no analytical support for its proposed Access Fee. The reasons the Company theory is unsupportable include:

- The current size and capacity of the distribution and transmission system is based on the load to be served by generation from all sources. The Company offers no evidence of incremental investments in the system that have been necessitated by distributed generation that has not already been recovered through interconnection and facility upgrade charges.
- The Company already charges rates that recover the entire cost of the system used to serve all customers, again without regard to the ultimate source of the generation. Adding another charge for being a distributed generator means that the Company proposes to double charge for the same

system costs—once to customers and once to distributed generators—for exactly the same use of the system.

- There is substantial benefit in siting distributed generation within the distribution system. A line of research going back two decades substantiates this value. The consulting firm of Clean Power Research has collected more than 100 studies relating to distributed solar generation resource value in reducing system capital and operating costs.[1] The Company makes no assessment of this value in seeking to establish its proposed Access Fee, with the result that the proposal is fatally flawed.
- In all, the Company fails to demonstrate that distributed generation systems impose any costs on the Company or ratepayers.

Q. Does the Company demonstrate that the proposed access fee would serve any other purposes?

A. No. The Company witnesses offer additional unsubstantiated assertions that the Access Fee would support payment for advanced meters, but it does not quantify the amount or term for recovery of such costs. In response to DIV 1-10, the Company reports that the cost difference for an advanced demand meter is about $117 compared to the cost of a standard AMR meter. This amount of cost would be recovered under the proposed Access Fee in a few months. The proposed Access Fee is perpetual. The same lack of quantification exists for the Company assertion that the proposed Fee is necessary to address a range of

[1] Available at: https://www.cleanpower.com/research/research-timeline/

costs associated with "management" of distributed generation. Company Testimony, p. 63.

Q. How does the Company propose to accomplish revenue neutrality in its proposed access fee for distributed generation?

A. The Company proposes to reduce the charges to the Revenue Decoupling Mechanism by the amount of the Access Fee revenues. Company Testimony, p. 64. The Company does not demonstrate that the costs otherwise charged to the Decoupling Mechanism are more properly charged to distributed generation customers. The Company has provided absolutely no analysis of the benefits and costs of distributed generation and it, therefore, cannot and does not offer any evidence that the proposed Access Fee is nondiscriminatory and equitable, or that its proposed revenue neutrality mechanism is not also nondiscriminatory and equitable.

Q. Distributed generation that does not serve onsite load will serve nearby customers with load, and the Company will charge those customers for that energy. Does this impact the revenue neutrality of the proposed access fee?

A. Yes it does. The Company recovers 100% of the costs to provide service from the customer ultimately served by the distributed generation. The collection of an additional access fee from the distributed generator is a double-charging of costs and is not made revenue neutral merely by reducing the Revenue Decoupling Mechanism charge.

Q. Have you reviewed the information about the access fee provided by the Company in response to discovery requests, and do those responses address the substantive failings in the company's proposal?

A. The Company does not correct for the deficiencies in its Access Fee proposal in the information it provides through discovery. A review of the discovery responses reveals:

WED 1-7 – The Company indicates that it is operating under a number of flawed logical premises in asserting that the Access Fee is required. The Company provides no data to support the magnitude or structure of its proposed Access Fee. Importantly, the Company does not account for the availability of distributed generation to reduce load on the system, the actual costs the Company has faced in having to install grid upgrades associated with distributed generation that were not paid by the distributed generator, the coincidence of distributed generation with system peaks, or the potential life extension of existing distribution system equipment due to distributed generation.

PUC 1-18 Supplemental – The Company states that the Access Fee will "assure standalone DG projects pay their fair share for the use of the distribution system," but provides no data or analysis to back the assertion.

PUC 1-19 – Though the PUC staff asked the Company to justify how its proposed Access Fee is reasonable, the Company provides no justification.

PUC 2-1 – The Company provides information to support its assertion that the capacity factor for solar generation is 40%, but does not provide additional justification for the Access Fee.

PUC 2-2 – The Company explains that the CREST tool does not fully address the benefits or costs of distributed generation, and does not offer any evidence that it conducted such an assessment.

PUC 2-5 – The Company repeats the assertion in its direct testimony that the proposed Access Fee will improve the allocation of distribution system costs, but offers no evidence of data or calculations to support that assertion.

PUC 2-7 – The Company asserts that there is an "Optimal Solution" that it did not propose, but offers no analysis or justification for that alternative rate.

DIV 1-4 – When asked by the Division to describe how the Access Fee proposal incorporates the benefits of distributed energy resources, the Company takes the position that it is required under §39-26.6-24 to take into account and balance the benefits of distributed energy resources. The Company asserts that the benefits of distributed generation may or may not be reflected in compensation rates set in other programs and tariffs, but offers no quantification or assessment of those benefits.

DIV 1-7 – The Company asserts that it calculates the size of a "cost shift" attributable to DG Standard Contracts using the circular logic of calculating what the Access Fee charges would be using the proposed Access Fee. That is, the Company claims a cost shift, but gives no analysis identifying or quantifying a cost shift. The Company only provides a quantification of what

the Access Fee charges would be if the proposed Access Fee is imposed. The Company does not provide evidence to meet its burden of demonstrating that the proposed fee reflects cost causation and nondiscriminatory cost allocation.

DIV 1-17 – The Company explains that its view is that customers who can offset consumption charges with net metering credits are not providing any revenue support for the distribution system, in spite of the fact that these customers are fully charged for 100% of their consumption under rates that are designed to recover distribution costs. The Company's intentional confounding of the concepts of offsetting and avoiding appears to underlie its proposal for the Access Fee, but is not supported by any quantified analysis. Of course, the Company already charges rates designed to capture all of its transmission and distribution costs.

DIV 1-23 and CLF 1-12 – The Company states that the proposed Access Fees "are not derived from the O&M costs, but rather reflect the per unit demand-related revenue requirements, as shown on Schedule NG-11, line 24," for primary and secondary rates. These cost figures cannot be found on Company Schedule NG-11 because the Company "further adjusted" some of the numbers "by approximately 85% (primary) and 75% (secondary)." The Company provides no explanation of what numbers were used, how they were manipulated, where they were sourced, why they are representative or appropriate, or in any way how they relate to actual costs and/or benefits associated with distributed generation.

WED 1-2 – The Company asserts that although costs and benefits to distributed generation and non-generation customers should be assessed to ensure equity, the benefits received under the Renewable Energy Growth Program are not equitable or sustainable. The Company offers no evidence to support this assertion, and points to field studies currently underway that may provide evidence to support or invalidate the proposed Access Fee charges or the current incentive rates for distributed generation.

WED 1-5 – The Company reports that one reason for it proposed Access Fee charges is that a distributed generator may trip off-line. The Company offers no evidence that the Access Fee is calibrated or calculated to reflect actual experience with such events, to equitably assign costs to customers based on such events, or that the proposed Access Fee is calibrated to reflect the benefits provided by distributed generation when it is operating properly. Nor does the Company establish that such operational issues are not already reflected in the interconnection protocols and interface equipment requirements.

WED 1-6 – The Company states that "recognizing the benefit associated with diversification of energy supply but not the costs would overstate the benefits provided by DG, and result in overcharging." The Company does not explain why its proposal to assume costs without evaluation of those costs or any assessment of benefits is not equally unsound.

WED 1-8 – The Company offers no analysis or quantified assessment of the impact of its proposed Access Fee on the Renewable Energy Growth Program, as required by the statute.

WED 1-11 – The Company asserts that it must charge the proposed Access Fee even though it is billing any customers served by the energy generated by the distributed generator at the full retail rate, thereby fully recovering the costs of distribution services from those customers.

Q. What, in your opinion, is the key flaw in the Company's proposed access fee proposal?

A. The Company completely fails to meet its burden of proof to support the imposition of the proposed Access Fee as necessary, justified, and nondiscriminatory. Therefore, the Commission should disapprove the Company proposal to impose an Access Fee on distributed generation.

Q. How does the Company's proposal compare to other similar proposals that you have reviewed?

A. I have reviewed fixed charge proposals proposed by utilities in Georgia, Virginia, and Wisconsin. I have also reviewed hundreds of other utility rate proposals of various kinds in both the electric and telephone industries. I have never seen such as poorly substantiated and documented rate or charge proposal in some twenty-five years of regulatory practice. The Company's Access Fee proposal is, in my opinion, completely inadequate and cannot support a Commission approval consistent with the laws of Rhode Island and the intent of the Rhode Island legislature.

Q. What else do you recommend?

A. Working from the "bottom up," I recommend a full valuation analysis for distributed technology. The Company proposal for an across-the-board Access

Fee that does not differentiate except according to capacity factor, and in fact penalizes facilities for having a higher capacity factor, fails to prevent discrimination or ensure fairness in the application of a distributed generation fee (or credit).

DISTRIBUTED GENERATION VALUATION

Q. What is the benefit of comprehensive value analysis for distributed generation resources?

A. Full and regularly updated evaluation of resource value improves the chance that rates applicable to such resources will strike the economically efficient balance in charges and credits. If a renewable generation resource is under-valued by the Company, it will be over-charged. Overcharging or under-crediting results in under-selection and under-utilization by customers; ultimately society loses the benefits that the resource can provide. This is precisely the situation that will result if the Company's proposed Access Fee is imposed on distributed generation. The Company does not account for all the value of distributed generation, and, as a result, the Company reaches a conclusion that distributed generation should be uneconomically burdened with charges. A full value analysis is necessary.

Q. How do utilities typically assess the value of Distributed Generation Resources?

A. Distributed generation resources have historically not fared well in traditional utility ratemaking systems, which often have a financial bias toward large, capital-intensive projects and infrastructure owned by the utility. Historically,

these utility-owned projects, if successful, tend to maximize profits at the expense of the lowest cost and highest value for customers. Historically utilized preferences tend to assign higher value to dispatchable generation options with low capacity cost, while undervaluing several increasingly valuable and important components, such as fuel price volatility, regulatory (especially environmental) risk, water supply and availability risk, transmission infrastructure requirements, and others. Traditional avoided cost methodologies, designed to set energy payments based on current, short-run costs and wholesale prices, can reduce the value of low or zero-risk resources and long run marginal cost and risk reductions.

Q. Is this approach apparent in the Company's Access Fee proposal?

A. The absence of information in the proposal makes this difficult to answer. The Company appears to acknowledge that it did not assess and characterize the full value of distributed generation in providing energy, capacity, transmission and distribution, risk-reduction, and other benefits. It also appears that the Company does not assign full credit to distributed generation that will accrue to the utility and all ratepayers over the full 25+ year useful life of installed distributed generation systems. Finally, the Company appears to assume a "lost revenues" cost to distributed generation that fails to account for all costs that the Company avoids. Such over-assessment of costs appears to drive the Company's proposal to double charge both distributed generation and ordinary consumption-only customers for distribution system costs, as previously explained. A modern,

complete evaluation of the value of distributed generation is essential to proposing a fair charge or credit.

Q. How has distributed generation valuation evolved in recent years?

A. As the U.S. Department of Energy reported to Congress in 2007,

> *"Calculating [distributed generation] benefits is complicated, and ultimately requires a complete dataset of site-specific operational characteristics and circumstances. This renders the possibility of utilizing a single, comprehensive analysis tool, model, or methodology to estimate national or regional benefits of [distributed generation] highly improbable. However, methodologies exist for accurately evaluating "local" costs and benefits (such as [distributed generation] to support a distribution feeder). It is also possible to develop comprehensive methods for aggregating local [distributed generation] costs and benefits for substations, local utility service areas, states, regional transmission organizations, and the Nation as a whole.[2]"*

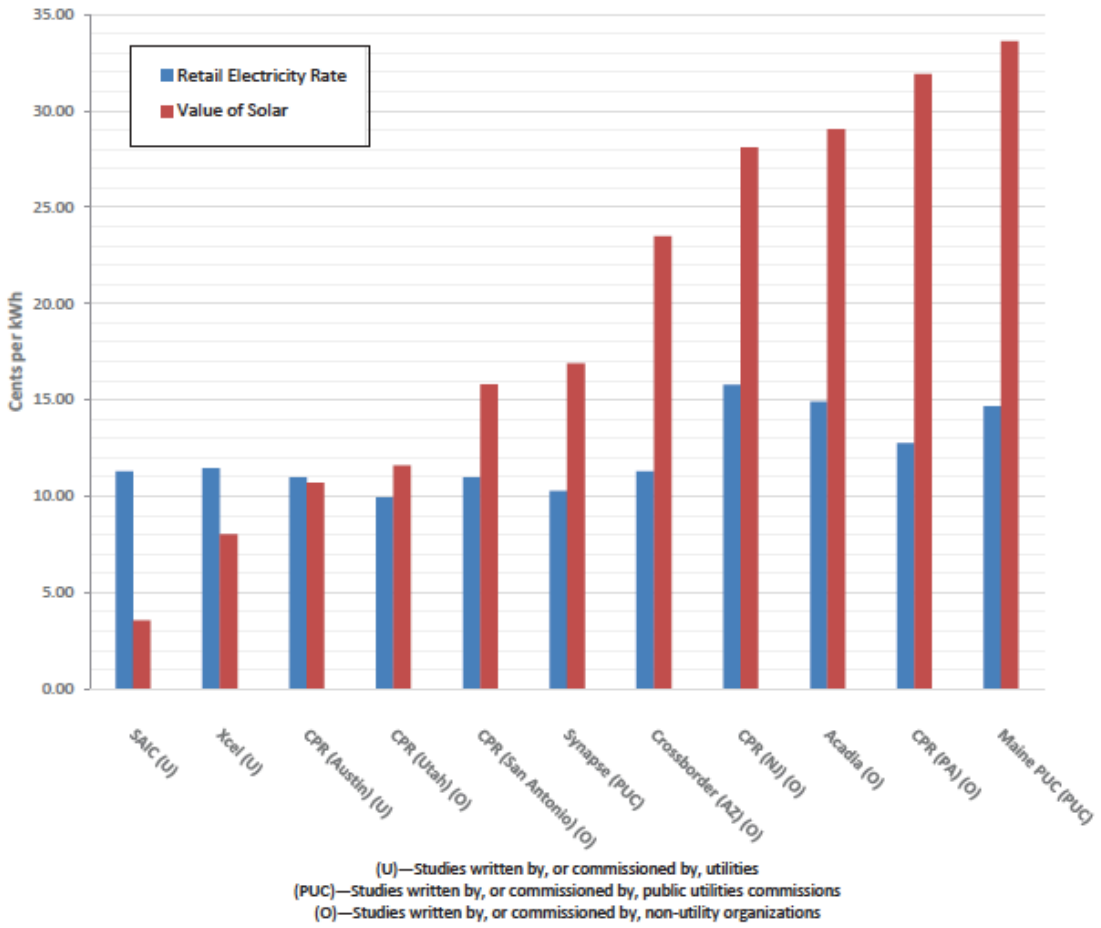
Over the past two decades, a number of state- and utility-specific studies have been conducted to calculate the benefits of distributed solar. These are generally termed "Value of Solar" studies, and offer insights and guidance in valuing other distributed generation resources. Today, Value of Solar analysis rests on a solid foundation of data that, if applied, would significantly improve the Company's rate proposals.

2 U.S. DOE, "The Potential Benefits of Distributed Generation and the Rate-Related Issues That May Impede Its Expansion: Report Pursuant to Section 1817 of the Energy Policy Act of 2005," June 2007.

Q. What does the experience in recent years with distributed solar generation valuation teach us?

A. In the summer of 2015, the Frontier Group and the Environment America Research and Policy Center released the "Shining Rewards" report that compiled the results of eleven value of solar studies, and concluded that these analyses show that "individuals and businesses that decide to 'go solar' generally deliver greater benefits to the grid and society than they receive through net metering.[3] The Shining Rewards report is **Exhibit WED 4** provided on the enclosed disk and available at http://www.environmentamerica.org/reports/amc/shining-rewards. The graphic below ("Shining Rewards," Figure ES-1, p. 6) aggregates the findings reported in the Shining Rewards study, including the fact that studies conducted through public processes open to stakeholder involvement produce higher value for distributed solar than the studies conducted internally by utilities.

[3] Available at http://www.environmentamerica.org/reports/amc/shining-rewards.



Q. What are the basic elements of distributed value of solar analysis?

A. Properly done value of solar analysis is, and any distributed generation value analysis should be, an expansion on a full avoided cost approach that adds a long term valuation perspective, including, as appropriate and quantifiable, social costs and benefits. There are two basic steps: first, benefits and costs are identified and grouped, then, second, the benefits are quantified. These steps are essentially the same as traditional ratemaking functions inherent in cost of service analysis. The focus is on the net value that distributed resources bring to utility and grid finances and operations.

Q. Is proper valuation analysis market-driven?

A. Yes. Valuation calculations are, at heart, avoided cost calculations that embrace a full range of costs avoided by distributed generation, including savings over the life of the generation system. So the source of the value of solar is in the market costs avoided and market benefits received. As explained earlier, valuation studies offer improved market pricing signals over traditional avoided cost calculations, which ignore long-term risk, especially fuel price and environmental regulatory risk. My own experience with Austin Energy's value of solar methodology is that the calculated value of solar better reflects market conditions and the value of solar investments than short-term avoided cost calculations and base rate calculations established in prior years based on sunk costs.

Q. How can a valuation methodology better reflect the costs avoided by different technologies?

A. In order to justify the imposition of a charge on distributed generation, or to calibrate a credit for excess value, an analysis of full range of benefits, or avoided costs, and cost of distributed generation is required. In order to fairly value the avoided cost and other benefits of different technologies, the contributions they can each make must be objectively and quantitatively analyzed. Each technology must be fully characterized in order to understand the energy, capacity, transmission, distribution, line loss reduction, operating risk, environmental, and other known and measurable costs that can be avoided with their deployment and operation.

The location, scale, timing and other operating characteristics of generation and other resource options should also be recognizable and recognized in determining the avoided cost benefits. The use of technology-specific load shapes in modeling costs and benefits of distributed generation resources is one example of the application of this principle. The Company recognizes this principle in a very superficial and inadequate way in its differentiation among distributed generators according to capacity factor in how it proposes to assess the proposed Access Fee. The range of potential avoided costs and other benefits must be fully documented and incorporated into a flexible methodology that calculates benefits and costs for each unique technology configuration.

Q. How should the Commission value distributed generation?

A. The record in this proceeding demonstrates that the Company cannot be relied upon to objectively assess the value of distributed generation. I therefore recommend that the Commission initiate a proceeding to establish an open, public, and transparent methodology to assess distributed generation value, including both costs and benefits.

Q. What benefits of distributed generation should the Commission require to be addressed in its methodology?

A. The following values need to be quantified in order to calculate the full avoided costs of distributed generation:

- **Avoided Energy Cost** – this is the utility's energy cost that is avoided by distributed generation. Avoided energy cost should be calculated based on

the difference between long-term production costs with the distributed generation, compared to the production costs without the distributed generation.

- **Avoided System Loss Cost** – the line-loss savings that accrue where distributed generation displaces generation from remote, central station plants. This should be calculated based on marginal losses, which should be load-weighted and distinguished between distribution and transmission losses.
- **Avoided Generation Capacity Cost** – the cost of generation that is deferred or avoided due to non-utility distributed generation. This should be calculated using Effective Load Carrying Capability[4] or similar analysis.
- **Avoided Transmission and Distribution Capacity Cost** – the cost of transmission or distribution that is avoided due to non-utility distributed generation, after netting the utility's costs to integrate distributed resources. This calculation should utilize the approach described for generation capacity, and should not be limited to large planning increments.
- **Avoided Financial Cost – Fuel Price Hedge** – the utility's costs associated with fuel price volatility that are avoided due to renewable distributed

[4] ELCC is a percentage that expresses how well a resource is able to meet reliability conditions and reduce expected reliability problems or outage events (considering availability and use limitations). It is calculated via probabilistic reliability modeling, and yields a single percentage value for a given facility or grouping of facilities. ELCC can be thought of as a derating factor that is applied to a facility's maximum output in order to determine its qualifying capacity. Because this derating factor is calculated considering both system reliability needs and facility performance, it will reflect not just the output capabilities of a facility but also the usefulness of this output in meeting overall electricity system reliability needs. See "Effective Load Carrying Capacity and Qualifying Capacity Calculation Methodology for Wind and Solar Resources," California Public Utilities Commission Energy Division, CPUC Resource Adequacy Proceeding, R.11-10-023 (January 16, 2014) Available at: http://www.cpuc.ca.gov/NR/rdonlyres/D05609D5-DE35-4BEE-8C9A-B1170D6E3EFD/0/R1110023ELCCandQCMethodologyforWindandSolar.pdf

generation. Solar, wind, and hydropower generators do not have fuel costs that vary with market conditions. The fact that prices of energy will not vary for these resources offers distinct financial value beyond that captured in energy prices.

- **Avoided Financial Cost – Market Price Response** – the costs that a utility avoids due to generation from a distributed generator due to decreases in its average price of fuel and reduced peak demand. This impact is sometimes referred to as Demand Reduction Induced Price Effect (DRIPE) and is also a distinct financial value beyond that reflected in energy prices.
- **Avoided Environmental Costs** – the costs that a utility avoids due to generation from a distributed generator, including avoided costs related to environmental regulation not already reflected in energy costs. It is appropriate to consider whether these future environmental costs, though not reflected in current energy prices through compliance costs, may be otherwise addressed through other incentive or pricing systems.

It is worth noting that the Company will likely have assembled most, if not all, of the technology-specific data necessary for calculating full avoided costs for distributed generation in the course of developing resource plans and other regulator activities. Where utility-specific data is not readily available, analysts may develop suitable estimation methods or use third-party data (such as SolarAnywhere® data for solar performance).

Q. How should the Commission calculate the avoided cost of energy?

A. The avoided cost of energy can be calculated by modeling the long-term production costs of the system with a distributed generator, compared to system costs without the resource. This method is generally appropriate, subject to certain parameters.

I recommend that the Commission calculate the avoided cost of energy based upon technology-specific and location-specific load shapes. For example, tracking photovoltaic ("PV") systems produce more energy late in the afternoon than south-facing fixed-mount PV systems. This same issue would apply to wind energy and other resources whose generation potential varies in a reasonably predictable manner across the hours of the day and the weeks of the year.

Q. Over what time period should the avoided cost of energy be measured?

A. Because intermittent resources such as solar and wind energy provide a long-term, reliable hedge against fluctuations in fuel costs, I recommend evaluation for terms of 25 and 20 years, respectively, which also match up well with typical terms of vendor guarantees and service agreements for distributed generation.

Q. How should the Commission value line losses?

A. A critical part of the avoided cost of energy is the degree to which line losses are incurred or avoided by the distributed generator. The Commission should calculate marginal losses specific to the Company's distribution and transmission systems. This calculation should be load-weighted, using the

specific hourly generation patterns of various types and locations of distributed generation, correlated to the specific hourly line losses attributable to distribution and transmission lines in the utility system.

Q. How should the Commission value the capacity contribution of an intermittent resource?

A. The capacity value for distributed generation systems should reflect their expected contribution to peak system capacity needs.

Three principles should guide this determination. First, the capacity value should be based on the technology and location of the distributed generation facility based on a model of historical resource (wind or solar) availability correlated to historical system load during peak hours. The preferred approach is known as Effective Load Carrying Capacity ("ELCC"). Second, the capacity value should be fixed at the time that the system owner commits to interconnect the system to the grid so that the owner can be certain what value the utility will attribute to the distributed generation facility. Third, as distributed generation is scaled up on the system, the capacity attributed to new distributed generation sources will likely be different from that attributed in earlier years.

This capacity determination should, in turn, be applied to both the calculation of the avoided cost of generation as well as applicable avoided cost of transmission and distribution capacity.

Q. Are there quantifiable financial benefits that should be considered to be "avoided costs"?

A. Distributed renewable generation offers financial benefits, by hedging against fuel price volatility and escalation, and through market price response. Both of these effects have measurable impacts on the costs of utility service and should be included in valuing distributed generation.

Q. Please describe the financial benefit of fuel price hedging.

A. The cost of producing energy from renewable energy resources like wind, solar, and small hydropower will not fluctuate with fuel prices. Moreover, unlike "traditional" qualifying facilities that rely on natural gas or biomass fuels, with fuel-free resources like solar and wind there is no risk that the distributed generator's business will fail due to changes in fuel costs, because there are no fuel costs. While quantifying the fuel-price hedging benefits of renewable energy resources may be challenging, the value should not be set at zero.

Q. Please describe the financial benefit of market price response.

A. Generation from fuel-free solar or wind qualifying facilities allows the systems to dispatch their natural gas or coal power plants less frequently, which in turn decreases the average cost of fuel used to generate electricity in two ways. First, there is a reduction in the number of hours in which higher fuel-cost power plants are dispatched. Second, when conventional generators buy less fuel, this reduces the market price of fuel overall. These price response effects have been studied in several regions.

Q. Please discuss avoided environmental costs.

A. It is reasonable to assume that current energy prices reflect current environmental compliance costs. Long-lived renewable energy resources also avoid additional environmental costs associated with future compliance costs. While these costs must be estimated like any long-term avoided cost, planning numbers associated with regulation of greenhouse gas emissions reflect imminently real costs that are not zero.

Q. What costs associated with distributed generation should be assessed?

A. I believe it is appropriate to assess utility costs as well. These costs include direct utility costs and may include an assessment of lost revenues. I note that assumptions about administrative costs (such as billing costs) should reflect automated billing systems. Interconnection costs incurred solely by the customer should not be included. It is important that integration costs should not be based on unrealistic assumptions about distributed generation penetration rates.

Q. Are there general principles that the Commission should adopt in addressing distributed generation valuation going forward?

A. Yes. I would recommend two fundamental principles. First, the Commission should adopt a forward-looking approach. Second, the avoided cost process should be open, transparent, and collaborative.

Q. Please discuss what you mean by a "forward-looking approach."

A. The Commission should adopt a valuation methodology that values distributed generation and resources according to their ability to create both short and long-

term benefits over the life of the resource. Such an approach can be configured to encourage long-term operation and performance of distributed generation resources. As previously discussed, longer evaluation horizons are appropriate for long-lived wind and solar generation resources, for example. It is important to note that over the long-term, distributed generation can and will defer and/or avoid future fixed cost investments. This benefit is often ignored by traditional utility entities like the Company, when they limit evaluation of fixed costs to sunk costs. The principles of electric utility regulation provide that utilities are entitled to a reasonable opportunity to recover prudently invested capital and a reasonable return on those investments. The Company appears to operate under two key misconceptions regarding its capital investments.

First, the Company appears to believe that it is entitled to recover any and all of its capital investments, and profit on those investments, regardless of whether those investments are reasonable. As distributed energy resources become increasingly cost-effective and market penetrations increase, the Company must account for this market development to prevent imprudent overbuilding of its system. The Company's request to establish a non-bypassable Access Fee on distributed generation denominated as a fixed charge substantially reduces the consequences to the Company of imprudent overbuilding. The proposed Access Fee insulates the Company from the economic consequences of refusing to acknowledge the reduced sales due to distributed energy resource market growth.

Second, the Company makes the category error of assuming that all fixed costs are sunk costs, and refuses to evaluate the extent to which distributed generation will defer or avoid future capital investments associated with the maintenance and operation of the distribution system. Again, the economic consequence of this refusal to evaluate the future fixed cost avoidance value of distributed generation is likely imprudent overbuilding of the distribution system. This uneconomic investment will in turn drive the Company to seek even greater fixed cost recovery, probably through more non-bypassable fixed charges.

Denying the Company's proposed Access Fee for distributed generation is an important measure in holding the Company responsible for fairly evaluating the full range of benefits associated with distributed generation, and in ensuring that the Company pursues only cost-effective and prudent capital investments in its distribution system.

Q. Please describe the need for an open and collaborative process.

A. The types and performance characteristics of distributed generation and resources are constantly evolving due to the rapid evolution of technology. Utility costs are constantly changing, especially at the distribution edge of the grid. The Commission's valuation methodology should be improved to create a more open, collaborative, and transparent process for establishing and modifying and updating avoided cost values. Calculation and estimation algorithms as well as source data should be open to full review by stakeholders on an ongoing basis, subject to reasonable requirements for confidential data.

Rather than requiring utilities to come to a private internal conclusion about avoided costs and then requiring non-utility generators to contest utility data and methodologies in highly adversarial proceedings, the process for setting avoided costs should reflect technology and cost dynamics through more meaningful opportunities for non-utility participation in the early stages of the process. By adopting a framework for a more data-driven, technology-specific methodology for calculating avoided costs, this Commission can facilitate a more transparent and collaborative process going forward.

Q. Are you aware of any recent reports or research on the value of distributed generation for Rhode Island or neighboring states?

A. Yes. I call the Commission's attention to an IREC whitepaper, a policy framework document, and two solar valuation studies, for Maine and Rhode Island, in particular. While these studies are specific to solar photovoltaic generation, they elucidate and demonstrate principles and findings that can inform the Commission's efforts to establish a comprehensive and transparent valuation methodology for distributed generation in Rhode Island.

Q. Please describe the IREC report and its relevance to your recommendations.

A. In October 2013, the not-for-profit Interstate Renewable Energy Council (IREC), published a paper authored by Jason Keyes and me, entitled "A Regulator's Guidebook: Calculating the Benefits and Costs of Distributed Solar Generation," **Exhibit WED 5** on the attached disk and also at http://www.irecusa.org/publications/. I am a member of the Board of Directors

for IREC. The Guidebook draws on many distributed solar valuation studies to recommend a framework for a methodology for performing a benefit/cost evaluation for distributed solar. The Guidebook recommended approach stands in stark contrast to the dearth of information or analysis provided by the Company. Key principles underlying the methodology that my co-author and I recommended include reliance on data, transparency, reasonable evaluation of costs and benefits, and consistency in approach. I note that while the Guidebook is focused on distributed solar generation, much of the information is fairly applied, with adjustments, to other forms of distributed generation.

Q. What does the IREC guidebook report recommend regarding the scoping of a benefits/costs study?

A. The Guidebook recommends that the Commission clarify a number of issues at the onset of a benefit/cost study, these include:

What is the appropriate discount rate for evaluation of costs and benefits?

- Studies typically use the utility weighted average cost of capital, though there is a strong argument for use of a risk-adjusted discount rate to reflect the performance characteristics of solar generation.

What is being considered – all distributed generation or exports to the grid only?

- Where net metering is in place, it may be appropriate to limit the evaluation to exported energy. However, for a two-part rate, all generation should be evaluated.

Over what timeframe with the study examine the benefits and costs of distributed generation?

- The timeframe for analysis should reflect the useful life of the resources, today typically 30 years for solar, for example. There is a strong argument that a sensitivity evaluation should consider a longer useful life, as long as 35 years for solar.

What does utility load look like in the future?

- Under traditional net metering arrangements, customer-sited distributed generation operates to reduce utility load. However, under a two-part rate approach such as a feed-in tariff, distributed generation can be seen as not reducing load, but instead contributing to energy and capacity requirements at or near the point of generation.

What level of market penetration for distributed generation is assumed in the future?

- It is unreasonable to assume a market penetration rate equivalent to 100% of residential class energy demand for the purpose of assessing integration costs, and to simultaneously assume insufficient market penetration to impact future fixed cost investments. Sensitivity analysis can be useful to gauge the impacts of reasonable penetration rate scenarios.

What models are used to provide analytical inputs?

- Utility models such as Strategist are extremely useful in conducting integrated resource plan analysis, but often are constrained in their ability to model small-scale resources. Extrapolation of results from such models can

induce errors. Full transparency and sensitivity analysis at varying scales of deployment, and with variation in other assumptions (such as the penetration rate of distributed storage technology) is essential to accurately model distributed generation.

What geographic boundaries are assumed in the analysis?

- Distributed resources may demonstrate improvements in availability due to geographic dispersion. Solar insolation and wind resource values, which drive energy production, vary depending on location. These variations should be accounted for in study design.

What system boundaries are assumed?

- Integration costs for distributed generation may vary with the siting location. These factors extend beyond land and construction costs and should be accounted for in a study.

From whose perspective are benefits and costs measured?

- I recommend that the Commission use a combined test that incorporates ratepayer impacts testing and societal cost testing. That is, private investment costs are not relevant in evaluating distributed generation.

Are benefits and costs estimated on an annualized or levelized basis?

- A levelized analysis extending over the useful life of the generation resource is the best approach for fully capturing the avoided costs and delivered benefits of distributed generation.

Q. What data sets are required in order to conduct a full benefits/costs analysis for distributed generation?

A. The Guidebook recommends that the entity that conducts the valuation study obtain or develop the following data sets. Most electric service providers like the Company already possess most, if not all, of this data. Where Company-specific data is not readily available, analysts may develop suitable estimation methods or use third-party data.

- The five or ten-year forward price of natural gas, the most likely fuel for marginal generation, along with longer-term projections in line with the life of the distributed generation system.
- Hourly load shapes, broken down by customer class to analyze the intra-class and inter-class impacts of distributed generation.
- Hourly production profiles for distributed generators, including south-facing and west-facing solar arrays, for example.
- Line losses based on hourly load data, so that marginal avoided line losses due to distributed generation can be calculated.
- Distribution planning costs that identify the capital and O&M cost (fixed and variable) of constructing and operating distribution upgrades that are necessary to meet load growth.
- Hourly load data for individual distribution circuits, particularly those with current or expected higher than average penetrations of distributed generation, in order to capture the potential for avoiding or deferring circuit upgrades.

Q. How can the IREC Guidebook be applied to shape distributed generation market policy?

A. The Acadia Center has applied the principles and concepts in the IREC Guidebook in crafting a widely-supported "Next Generation Solar Policy Framework for Massachusetts. "[5] The Policy Framework is **Exhibit AC-4** to the Acadia Center's November 23 testimony and illustrates how the Commission can adapt distributed generation valuation concepts into a comprehensive policy framework for Rhode Island.

Q. Please describe the Maine Distributed Solar Valuation Methodology and its relevance to your recommendations.

A. The Maine Public Utilities Commission transmitted a report to the Maine Legislature on the Value of Distributed Solar Energy Generation on March 2, 2015. The report is **Exhibit WED 6** on the attached disk and can also be found at: http://www.maine.gov/mpuc/legislative/archive/2014-2015ReportstoLegislature.shtml. During its 2014 session, the Maine Legislature enacted an Act to Support Solar Energy Development in Maine. P.L Chapter 562 (April 24, 2014). Section 1 of the Act contains the Legislative finding that it is in the public interest to develop renewable energy resources, including solar energy, in a manner that protects and improves the health and well-being of the citizens and natural environment of the State while also providing economic benefits to communities, ratepayers and the overall economy of the State.

[5] Available at http://acadiacenter.org/document/next-generation-solar-policy-framework-for-ma/.

Section 2 of the Act required the Public Utilities Commission to determine the value of distributed solar energy generation in the State, evaluate implementation options, and to deliver a report to the Legislature. The Commission engaged a project team comprising Clean Power Research (Napa, California), Sustainable Energy Advantage (Framingham, Massachusetts), Pace Energy and Climate Center at the Pace Law School (White Plains, New York), and Dr. Richard Perez (Albany, New York).

Under the project, the team developed the methodology under a Commission-run stakeholder review process, conducted a valuation on distributed solar for three utility territories, and developed a summary of implementation options for increasing deployment of distributed solar generation in the State.

Q. What are the major features of the Maine Value of Solar Methodology?

A. The Maine study assessed or created placeholders for future assessment of avoided energy cost, avoided generation capacity and reserve capacity costs, avoided natural gas pipeline costs, solar integration costs, avoided transmission capacity cost, avoided distribution capacity cost, voltage regulation, net social cost of carbon, SO2, and NOx, market price response, and avoided fuel price uncertainty.

Figure 1: Central Maine Power 25 Year Levelized Value of Distributed Solar

25 Year Levelized		Gross Value A ($/kWh)	× Load Match Factor B (%)	× Loss Savings Factor (1+C) (%)	= Distr. PV Value D ($/kWh)	
Energy Supply	Avoided Energy Cost	$0.076		6.2%	$0.081	
	Avoided Gen. Capacity Cost	$0.068	54.4%	9.3%	$0.040	
	Avoided Res. Gen. Capacity Cost	$0.009	54.4%	9.3%	$0.005	
	Avoided NG Pipeline Cost					
	Solar Integration Cost	($0.005)		6.2%	($0.005)	Avoided Market Costs
Transmission Delivery Service	Avoided Trans. Capacity Cost	$0.063	23.9%	9.3%	$0.016	$0.138
Distribution Delivery Service	Avoided Dist. Capacity Cost					
	Voltage Regulation					
Environmental	Net Social Cost of Carbon	$0.020		6.2%	$0.021	
	Net Social Cost of SO_2	$0.058		6.2%	$0.062	Societal Benefits
	Net Social Cost of NO_x	$0.012		6.2%	$0.013	$0.199
Other	Market Price Response	$0.062		6.2%	$0.066	
	Avoided Fuel Price Uncertainty	$0.035		6.2%	$0.037	
					$0.337	

Q. Why do you recommend the Commission's and the Company's attention to the Maine methodology?

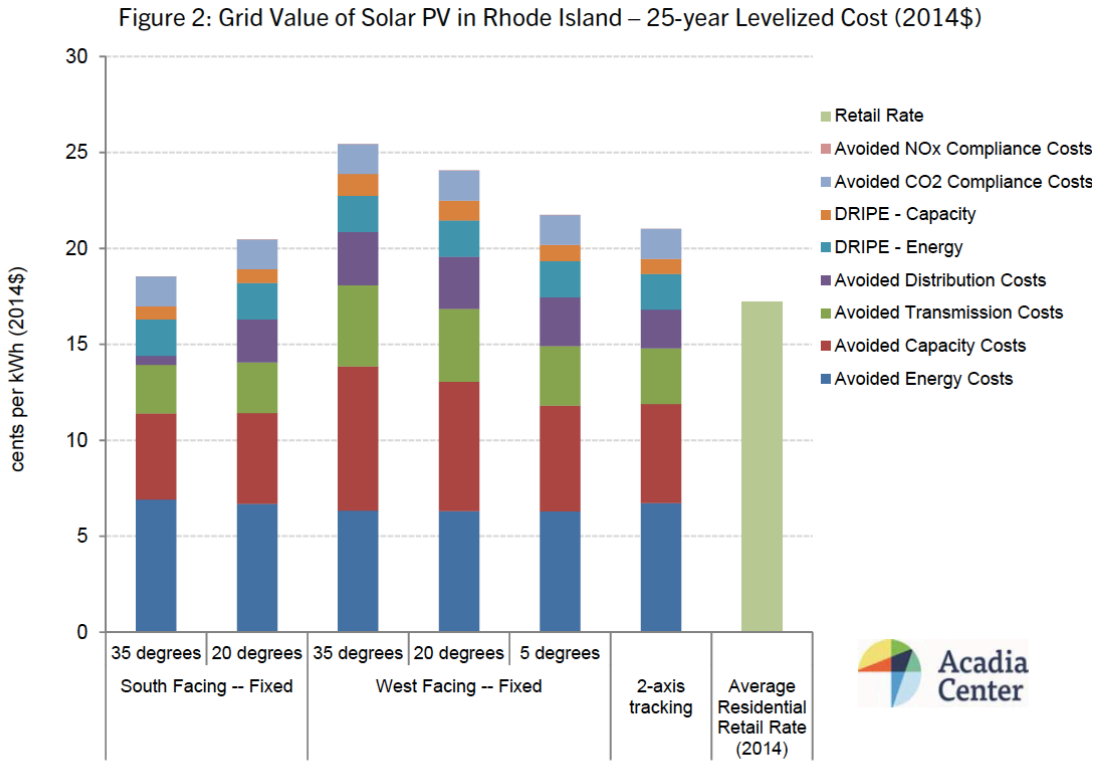
A. The Maine methodology stands in very stark contrast to absence of evidence offered by the Company to support its Access Fee proposal. The Maine Value of Solar Methodology demonstrates the kind of comprehensive, objectively verifiable approach that can be developed when a broad range of stakeholder and expert opinions are focused on the distributed generation valuation issue.

Q. Please describe the Rhode Island Value of Distributed Generation report and its relevance to your recommendations.

A. In July, 2015, the Acadia Center, a not-for-profit organization, published a valuation study for distributed solar generation in Rhode Island. The study, which used a methodology similar to that in the Maine study, found that the value of solar exceeds the average retail rate in Rhode Island. The Acadia

Center Rhode Island Value of Distributed Generation report is Exhibit AC-5 to the Acadia Center's November 23, 2015 testimony.

Figure 2: Rhode Island 25 Year Levelized Value of Distributed Solar



Note: Where appropriate, avoided reserve capacity costs, transmission and distribution losses, and a wholesale risk premium or price hedge are included in the calculations.

Q. Why do you recommend the Commission's and the Company's attention to the Acadia Center methodology?

A. The Acadia Center report also used a great deal more analysis and data than the Company provided to support its Access Fee proposal.

Q. Why is it significant that both the Rhode Island and Maine studies find value for distributed solar generation that exceeds average retail rates?

A. Their conclusions regarding the value of distributed solar generation in Rhode Island and Maine strongly suggest that whatever process the Company used in setting its proposed Access Fee is deeply flawed, improperly biased, and

incomplete. It further indicates that other distributed generation resources may also have value higher than retail rates. If that is the case, not only is an access fee unjustified, but distributed generators may be entitled to a credit for extra value provided to the utility, the electrical system, and other customers.

Q. Does that conclude your direct testimony?

A. Yes