PUBLIC

STATE OF NEW JERSEY
BOARD OF PUBLIC UTILITIES

In the Matter of the Petition of Nautilus Offshore Wind, LLC for the Approval of the State Waters Wind Project and Authorizing Offshore Wind Renewable Energy Certificates	)	**BPU Docket No. QO18080843**

DIRECT TESTIMONY OF DAVID E. DISMUKES, PH.D.
ON BEHALF OF THE
DIVISION OF RATE COUNSEL

STEFANIE A. BRAND, ESQ.
DIRECTOR, DIVISION OF RATE COUNSEL

DIVISION OF RATE COUNSEL
140 East Front Street-4th Floor
P. O. Box 003
Trenton, New Jersey 08625
Phone: 609-984-1460
Email: njratepayer@rpa.state.nj.us

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PUBLIC

TABLE OF CONTENTS

PUBLIC

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ON BEHALF OF THE

NEW JERSEY DIVISION OF RATE COUNSEL

BPU DOCKET NO. QO18080843

I. INTRODUCTION

Q. WOULD YOU PLEASE STATE YOUR NAME AND BUSINESS ADDRESS?

A. My name is David E. Dismukes. My business address is 5800 One Perkins Place Drive, Suite 5-F, Baton Rouge, Louisiana, 70808.

Q. WOULD YOU PLEASE STATE YOUR OCCUPATION AND CURRENT PLACE OF EMPLOYMENT?

A. I am a Consulting Economist with the Acadian Consulting Group ("ACG"), a research and consulting firm that specializes in the analysis of regulatory, economic, financial, accounting, statistical, and public policy issues associated with regulated and energy industries. ACG is a Louisiana-registered partnership, formed in 1995, and is located in Baton Rouge, Louisiana.

Q. DO YOU HOLD ANY ACADEMIC POSITIONS?

A. Yes. I am a full Professor, Executive Director, and Director of Policy Analysis at the Center for Energy Studies, Louisiana State University ("LSU"). I am also a full Professor in the Department of Environmental Sciences and the Director of the Coastal Marine Institute in the School of the Coast and Environment at LSU. I also serve as an Adjunct Professor in the E. J. Ourso College of Business Administration (Department of Economics), and I am a member of the graduate research faculty at LSU. Appendix A provides my academic curriculum vitae, which

includes a full listing of my publications, presentations, pre-filed expert witness testimony, expert reports, expert legislative testimony, and affidavits.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?

A. I have been retained by the New Jersey Division of Rate Counsel ("Rate Counsel") to provide an expert opinion to the Board of Public Utilities ("BPU" or "Board") on the offshore wind ("OSW") development application submitted by Nautilus Offshore Wind, LLC ("Nautilus" or "the Company") on August 1, 2018. Specifically, I was asked by Rate Counsel to review the proposed Nautilus project for consistency with *N.J.S.A.* 48:3-87 et seq. and *N.J.A.C.* 14:8-6, et. seq., pertaining to the statutory requirements under the Offshore Wind Economic Development Act ("OWEDA"),[1] as well as to provide an expert assessment pertaining to questions of public interest and the net economic benefits of the Nautilus project relative to its proposed Offshore Wind Renewable Energy Certificate ("OREC") proposal. This proceeding has been expedited and limited my ability to examine certain details in the Company's filing in significant detail, particularly its economic "multiplier" impacts. The fact that I have not discussed certain parts of the Company's filing should not be interpreted as my agreement with those assumptions, analyses, or conclusions.

Q. HAVE YOU PREPARED ANY SCHEDULES IN SUPPORT OF YOUR RECOMMENDATIONS?

A. Yes. I have prepared 32 schedules in support of my direct testimony that were prepared by me or under my direct supervision.

Q. HOW IS THE REMAINDER OF YOUR TESTIMONY ORGANIZED?

A. My testimony is organized into the following sections:

[1] Administrative rules pertaining to the OWEDA were approved by the Board in *N.J.A.C.* Section 14:8-6.

- Section II: Summary of Conclusions and Recommendations
- Section III: Overview of the Company's Proposal
- Section IV: Prior Board OSW Project Decision
- Section V: Proposed Project Cost
- Section VI: Proposed Project Environmental Benefits
- Section VII: Proposed Project Energy Revenues
- Section VIII: Proposed Project Capacity Revenues
- Section IX: Proposed Project REC Benefits
- Section X: Proposed Project Volatility Benefits
- Section XI: Proposed Project Discount Rate
- Section XII: Proposed Project Fails its CBA
- Section XIII: Proposed Project's CBA is not Credible Compared to Prior Application
- Section XIV: Conclusions and Recommendations

II. SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

Q. PLEASE SUMMARIZE YOUR CONCLUSIONS AND RECOMMENDATIONS.

A. I recommend that the Board not approve the Nautilus project and reject its requested OREC plan since neither are in the public interest and do not meet the statutory requirements of the OWEDA. The proposed Nautilus project, and its proposed OREC plan, do not produce a net economic benefit to New Jersey ratepayers and should be rejected by the Board.

Q. IS THIS AN EXPENSIVE PROJECT?

A Yes. The Nautilus project is estimated to cost [redacted]

[redacted]

[redacted] The Nautilus proposal is clearly expensive relative to any traditional fossil fuel-fired resource, but also exceptionally expensive relative to a wide range of other commercially-available renewable energy resources. More importantly, as shown in Figure 1 below, the Nautilus proposal is [redacted]

[redacted]

[2] Company Petition, Appendix B, page 9 and Attachment 59.

[3] *Id.*

Q. DO YOU AGREE THAT A PILOT PROGRAM HAS MERITS FOR U.S. AND NEW JERSEY OSW DEVELOPMENT?

A. No. The Company's application attempts to make the case that the Nautilus project is an important and necessary first step in understanding how OSW development will occur in New Jersey.[4] This benefit, however, does not appear to be consistent with current industry trends. Most OSW development in the U.S., with the exception of Rhode Island, is moving forward quickly with expansive programs that effectively skip any form of "experimental" or "pilot" process. Governor Murphy's January 2018 Executive Order ("EO8") makes clear that his intent is to move forward with full scale OSW development in New Jersey.[5] The Board's Order on September 17, 2018 furthers the implementation of EO8 by opening the application window for the solicitation of 1,100 MW of OSW.[6] There is nothing in the language of EO8 or the Board Order that suggests that "experimental" or "pilot" approaches are preferred to large-scale OSW development. Nor is there any language to suggest that New Jersey should use a small-scale pilot to study how OSW development and supply chain economics would evolve. EO8 and the Board Order promote one thing: the quick movement to large-scale OSW project development. The Governor's Executive Order calls for the development of 3,500 MW of OSW capacity by 2030. This is roughly equal to 300 MW per year between now and 2030: a level that cannot be reached efficiently on a [redacted] individual pilot project basis.

[4] Company Petition, page 5, ¶8; Company Petition, Appendix B, page 91, lines 10-12.
[5] Executive Order No. 8, (January 31, 2018).
[6] Docket No. QO18080851, September 17, 2018.

Q. SHOULD THE COMPARISON IN THIS PROCEEDING BE BETWEEN A FOSSIL RESOURCE AND A SMALL OSW PROJECT?

A. No, since any small-scale project approved for development in New Jersey will just be pulling resources and opportunities away from the large-scale development intended by the Governor's Executive Order and the Board's recent Order. One question facing the Board in this proceeding will be whether it wants to sink a considerable amount of resources, on a relative basis, on a small-scale OSW project that distracts from the Governor's broader OSW goals. The answer should be "no."

Q. WILL THE NAUTILUS PROPOSAL GENERATE ANY POSITIVE BENEFITS THAT ARE OVER AND BEYOND THOSE ASSOCIATED WITH A MUCH LARGER OSW PROJECT?

A. No, that does not appear to be the case from the record evidence in this proceeding. Many of the benefits touted by the Company for the Nautilus project will be the same as those that will arise from a larger-scale OSW project. The construction, development and operation of a larger-scale OSW project will also create positive economic impacts in terms of output, jobs, wages, and indirect business taxes; larger scale projects will also provide merit-order dispatch benefits; and, more importantly, larger-scale OSW projects will also lead to comparable environmental benefits, at least on a per-unit basis, to those touted by the Nautilus developers.

Q. IS THE COMPANY'S CBA REASONABLE?

A. No, and another important question the Board needs to ask in this proceeding is whether the Company's filed CBA passes a "reasonableness check" in terms of its results. It is very difficult to accept that a project with unit costs that are [redacted] the prevailing estimates for OSW projects in the U.S. and Europe

will result in any form of net benefits to New Jersey ratepayers. The CBA provided in this proceeding has a number of individual results that simply do not pass any form of "reasonableness test" and are wildly different than the CBA assumptions and results filed during the earlier incarnation of this project just a few years ago. Later in my testimony, I provide a comparison of the prior FACW filing to the current Nautilus CBA results that underscore the unreasonableness of the CBA results in this proceeding.

III. OVERVIEW OF THE COMPANY'S PROPOSAL

A. Introduction

Q. PLEASE PROVIDE AN OVERVIEW OF THE NAUTILUS PROPOSAL.

A. The Company is seeking approval for a proposed [redacted] OSW project that has been in development for more than ten years.[7] This project filed a petition with the Board in 2012 for project approval and a corresponding OREC plan under the name of Fishermen's Energy Atlantic City Windfarm, LLC ("FACW"). This prior version of the project was rejected by the Board in March 2014.[8] The current Nautilus proposal differs somewhat in its composition from the prior FACW application. The current project will utilize [redacted]

[7] Company Petition, Appendix B, page 91, line 21.
[8] In the Matter of the Petition of Fishermen's Atlantic City Wind Farm, LLC for the Approval of the State Waters Project and Authorizing Offshore Wind Renewable Energy Certificates, BPU Docket No. EO11050314V, Board Decision on the Merits of the Application, dated March 28, 2014
[9] Company Petition, Appendix B, page 22, lines 18-19.
[10] Company Petition, Appendix B, Attachment 59.
[11] Schossberg, T. 2016. America's first offshore wind farm spins to life. New York Times. Dec 14. Available at: https://www.nytimes.com/2016/12/14/science/wind-power-block-island.html.

[redacted]

[redacted]

Q. PLEASE EXPLAIN THE PROPOSED PROJECT'S ANTICIPATED CORPORATE STRUCTURE AND ORGANIZATION.

A. Nautilus Offshore Wind, LLC, an entity under the control of FACW, is the project developer. [redacted]

[redacted]

Q. HOW DO CURRENT FEDERAL TAX INCENTIVES IMPACT THE PROJECT FILING?

A. [redacted]

[12] Company Petition, Appendix B, Figure 3, page 48.
[13] Company Petition, page 2.
[14] Company Petition, page 2.
[15] Company Petition, page 9.
[16] Company Petition, Appendix B, page 49, lines 16-19.
[17] Company Petition, page 9.

a. Offshore Project Location

Q. WHERE WILL THE PROPOSED PROJECT BE LOCATED?

A. The proposed OSW project will be located in New Jersey state waters, approximately 2.8 miles off the coast from Atlantic City, New Jersey.[18] The Company states that its proposed wind turbines will be located as far offshore as possible, while still staying within state waters.[19]

[redacted]

b. Technology and Vendor Selection

Q. PLEASE PROVIDE AN OVERVIEW OF THE COMPANY'S PROPOSED WIND TURBINE.

A. [redacted]

[18] Company Petition, page 1.
[19] Company Petition, Appendix B, page 22, lines 13-15.
[20] Company Petition, Appendix B, page 31, lines 20-22.
[21] Company Petition, Appendix B, page 44, lines 2-4.
[22] Company Petition, Appendix B, page 44, lines 4-7.
[23] Company Petition, Appendix B, page 29, lines 19-22.

[redacted]

[redacted]

Q. WHO WILL DEVELOP THE PROJECT'S JACKET FOUNDATIONS?

A. [redacted]

[redacted]

[redacted]

[redacted]

Q. WHICH VENDORS WILL BE EMPLOYED TO TRANSPORT AND INSTALL THE JACKET FOUNDATIONS?

A. [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

c. Timeline

Q. WHAT IS YOUR UNDERSTANDING OF THE PROJECT'S ANTICIPATED DEVELOPMENT TIMELINE.

A. [redacted]

[redacted]

[24] Company Petition, Appendix B, page 29, lines 27-29.
[25] Company Petition, Appendix B, page 23, lines 1-2.
[26] Company Petition, Appendix B, page 31, lines 6-7.
[27] Company Petition, Appendix B, page 39, lines 22-27.
[28] Company Petition, Appendix B, page 41, lines 6-12.

[redacted] An outline of the project's anticipated delivery timeline is provided in Schedule DED-2.

d. Total Project Costs and Benefits

Q. EXPLAIN THE PROPOSED PROJECT'S DEVELOPMENT COSTS.

A. Schedule DED-3 presents a breakdown of these estimated development costs that include construction activities and major equipment purchases. [redacted]

[29] Company Petition, Appendix B, Attachment 4.
[30] Company Petition, Appendix B, page 37, lines 11-15.
[31] Company Petition, Appendix B, Attachment 28.
[32] Company Petition, Appendix B, Attachment 34.
[33] Company Petition, Appendix B, Attachment 35
[34] Company Petition, Appendix B, Exhibit B, page 73, lines 15-18.
[35] Company Petition, Appendix B, Attachment 29.

[redacted]

Q. PLEASE DISCUSS THE PROJECT'S PROPOSED OREC PLAN.

A. [redacted]

Q. WHAT ARE THE PROJECT'S ANTICIPATED OREC REVENUES?

A. [redacted] Further, the OREC revenue stream can be thought of as the rate impacts that will be generated by this proposal since they are the amounts that will be needed to be recovered from ratepayers to finance the proposed project. [redacted]

[36] Company Petition, Appendix B, Attachment 59.
[37] Company Petition, Appendix B, page 59, lines 9-11; and Company Petition, Appendix B, Attachment 72.
[38] Company Petition, Appendix B, page 60, lines 3-6; and Company Petition, Appendix B, Attachment 73.

[redacted]

Q WILL THERE BE ANY CREDIT OR OFFSETS USED AGAINST THIS OREC PRICING PLAN?

A. [redacted]

Q. PLEASE EXPLAIN THE COMPANY'S CBA.

A. A summary of the Company's CBA has been provided in Schedule DED-5. [redacted] The Company's CBA is

[39] Company Petition, Appendix B, Attachment 72.
[40] Company Petition, Appendix B, Attachment 73.
[41] Company Petition, Appendix B, page 62, lines 8-15.
[42] Company Petition, Appendix B, Attachment 72.

comprised of anticipated benefits that include: (a) wholesale energy and capacity sales revenue benefits; (b) merit order benefits; (c) avoided REC purchase benefits; (d) multiplier benefits associated with the construction and development of the wind turbines (net of rate impact multiplier "costs"); (e) environmental benefits; and (f) volatility hedge benefits.[43] The total costs included in the Company's CBA are restricted to those associated with OREC payments. [redacted]

Q. DO YOU AGREE WITH THE METHODS AND RESULTS ASSOCIATED WITH THE PROJECT'S CBA?

A No. As a general matter, there are a number of issues associated with the methods, data, inputs and assumptions associated with the Company's CBA that lead to an overstatement of project benefits. A summary of the shortcomings I have found with the Company's CBA includes:

- I prepared alternative estimates for wholesale energy revenues using projected wholesale prices from Rutgers Center for Energy, Economic, and Environmental Policy's ("CEEEP") 2018 Cost-Benefit Analysis Avoided Cost Assumptions, rather than the Company's output from the black-box AURORA model.
- I prepared alternative estimates for PJM capacity revenues using projected capacity prices from CEEEP's 2018 Cost-Benefit Analysis Avoided Cost Assumptions, rather than the

[43] Company Petition, Appendix B, page 83, Figure 10.
[44] Company Petition, Appendix B, Attachment 72.

Company's estimates that attempt to capture [redacted]

- I prepared alternative estimates for Class I REC benefits using projected Class I REC prices from CEEEP's 2018 Cost-Benefit Analysis Avoided Cost Assumptions rather than the Company's [redacted]
- I prepared alternative estimates for the emissions impacts using CEEEP's 2018 Cost-Benefit Analysis Avoided Cost Assumptions rather than the Company's inflated social costs.
- I prepared an alternative volatility hedge analysis; and
- I changed the discount rate from the Company's exceptionally low "societal-discount" rate of 2.96 percent to seven percent which is a more acceptable rate for utility ratemaking and regulatory planning, and published in CEEEP's 2018 Cost-Benefit Analysis Avoided Cost Assumptions.[47]

I will discuss each of these in greater detail throughout the remaining sections of my direct testimony. Further, as I noted earlier, this proceeding has been expedited and limited my ability to examine certain details in the Company's filing in significant detail, particularly its economic "multiplier" impacts. The fact that I have not identified any additional shortcomings with other parts of the Company's filing should not be interpreted as my agreement with those assumptions, analyses, or conclusions.

[45] Company response to Data Request RCR-RE-32, Confidential.
[46] Company response to Data Request RCR-RE-5, Confidential.
[47] Company Petition, Appendix B, page 97, lines 2-3; and Attachment 72.

IV. PRIOR BOARD OSW PROJECT DECISION

Q. PLEASE DISCUSS THE COMPANY'S PRIOR APPLICATIONS FOR THE FACW-BASED OSW PROJECT.

A. FACW first filed an application for an offshore wind project on May 19, 2011. A year later, FACW filed a subsequent amended application on June 1, 2012 and a supplemented application on March 8, 2013. [redacted] FACW proposed to construct an offshore wind facility with a total project capacity of 25 MW in state waters, approximately 2.8 miles east of the coastline of Atlantic City, New Jersey.[48] The project at the time was estimated to cost $188.2 million with ratepayer financial support at a starting rate of $263 per OREC.[49] FACW proposed that the OREC price escalate at an annual rate of 3.5 percent.[50] FACW at the time estimated that the net present value of the anticipated stream of ratepayer financial support for the project was to be $240.3 million.[51] The Board ultimately rejected the FACW project finding that the proposed project did not pass the standard for a qualified offshore wind facility as provided for in N.J.S.A 48:3-87.1 et seq. and N.J.A.C. 14:8-6.5 et seq.[52]

Q. WHAT WERE THE CRITERIA OR STANDARDS THE BOARD USED TO EVALUATE THE EARLIER FACW PROPOSAL?

A. The Board outlined five conditions that needed to be satisfied in order to approve the FACW project:

[48] In the Matter of the Petition of Fishermen's Atlantic City Wind Farm, LLC for the Approval of the State Waters Project and Authorizing Offshore Wind Renewable Energy Certificates, BPU Docket No. EO11050314V, Board Decision on the Merits of the Application, dated March 28, 2014, p. 4.
[49] *Id.*, p. 11.
[50] *Id.*, p. 11.
[51] *Id.*, p. 12.
[52] *Id.*, p. 29.

(1) The filing is consistent with the New Jersey Energy Master Plan ("EMP"), in effect at the time the Board is considering the application;

(2) The cost-benefit analysis demonstrates positive economic and environmental net benefits to the State;

(3) The financing mechanism is based upon the actual electrical output of the project, fairly balances the risks and rewards of the project between ratepayers and shareholders, and ensures that any costs of non-performance, in either the construction or operational phase of the project, shall be borne by shareholders;

(4) The entity proposing the project demonstrates financial integrity and sufficient access to capital to allow for a reasonable expectation of completion of construction of the project; and

(5) The total level of subsidies to be paid by ratepayers for qualified offshore wind projects over the life of the project and any other elements the Board deems appropriate.[53]

Q. WHY DID THE BOARD REJECT THE FACW PROPOSAL?

A. The Board found several flaws or shortcomings in the FACW proposal, most of which were associated with the project's purported positive economic and environmental benefits. In its decision, the Board found that: (1) the proposed project was inconsistent with the EMP because the project resulted in a net cost to ratepayers; (2) that the OREC price used in calculating economic benefits should not include the Department of Energy ("DOE") grants or the ITC; (3) the applicant has the burden to reasonably and justifiably quantify the value of economic benefits; (4) the estimated benefits of tourism were not substantiated; (5) environmental benefits should be tied to market prices in order to ensure fair, just, and reasonable ratepayer impact; (6) the estimates of the merit order effect were not supported; (7) there is no economic benefit associated with "lessons learned"; (8) the Company had not demonstrated financial integrity; and (9) the ratepayer subsidy was too expensive and should not imposed.[54]

Q. DID ANY OF THESE REASONS STAND OUT MORE THAN OTHERS?

[53] *Id.*, p. 15.
[54] *Id.*, pp. 17-29.

A. Yes. The Board appears to have placed a significant weight on the quality of a project's economic benefits as a major factor to determine consistency with the EMP.[55] The Board's Order states:

> It cannot be understated that positive economic benefits are essential to the EMP and essential to the Board's review. The phrase "sufficient quality" gives the Board insight as to the nature of economic benefits that an applicant must demonstrate. The Board interprets this phrase to require more than marginal economic benefits, but to require OSW projects to produce economic benefits of such a "quality" to justify ratepayer's investment.
>
> …
>
> It is possible for a project to pass the net benefits test pursuant to N.J.S.A. 48:3-87.1(b)(1)(a) and be inconsistent with the EMP if the Board determines that the projected economic benefits are outweighed by the costs, both to ratepayers and to the State.[56]

Q. WHAT WAS THE BOARD'S REASON FOR EXCLUDING FEDERAL SUBSIDIES FROM THE OREC PRICE USED IN THE CBA?

A. In its Order denying FACW's wind project, the Board explicitly stated that for policy reasons subsidies such as DOE grants or ITC should not be included stating:

> [S]ubsidies that are not known or measurable with any degree of certainty should be excluded from the OREC price. Although an applicant has an obligation to apply for such funds and pass the benefit along to ratepayers, and an applicant may advise the Board of the economic impact if such subsidies are received, a qualified wind facility must be able to survive scrutiny and pass the net benefits test even if such funds never materialize.
>
> Equally important, an applicant's failure to receive subsidies should not undermine the project's integrity…If the Board were to approve an OREC price based on an applicant's optimism that it will successfully compete, qualify, and receive federal subsidies, the Board runs the risk of approving a project that is artificially inflated

[55] Details on the current New Jersey EMP can be found at: https://www.nj.gov/emp/archives/.
[56] In the Matter of the Petition of Fishermen's Atlantic City Wind Farm, LLC for the Approval of the State Waters Project and Authorizing Offshore Wind Renewable Energy Certificates, BPU Docket No. EO11050314V, Board Decision on the Merits of the Application, dated March 28, 2014, pp. 16-17.

and underfunded. OWEDA does not require the Board to approve such a project.[57]

Q. WHO DID THE BOARD INDICATE BEARS THE BURDEN OF PROOF IN SUBSTANTIATING ECONOMIC AND ENVIRONMENTAL BENEFITS?

A. The Board found that many of the purported benefits in FAWC's cost benefit analysis were unsubstantiated or not reasonably quantified and stated that "it is the burden of the applicant to reasonably and justifiably quantify" the value of these purported benefits.[58]

Q. WHAT WAS THE BOARD'S FINDING REGARDING FACW'S EMISSION REDUCTION ESTIMATES?

A. The Board found that the use of societal values in the determination of the emissions reductions benefits (environmental benefits) were not reasonable since they were not tied to market prices.[59] The Board, in its Order, stated "environmental benefits should be tied to market prices because that is a reasonable manner to ensure fair, just and reasonable ratepayer impact."[60] The Board further stated that tying environmental benefits to market prices is "consistent with the EMP, which focuses on quantifiable, market-based gains that can be measured."[61]

Q. WHY DID THE BOARD FIND THE RATEPAYER SUBSIDY TO BE TOO EXPENSIVE IN THE FACW PROJECT?

A. The Board noted in its Order that at an estimated level of OREC payments with a net present value of $240.3 million and a total project cost of $7,520 per kW the project would be more expensive than utility scale projects as well as commercial scale offshore windfarms constructed in Europe. The Board in its decision stated:

[57] *Id.*, p. 20.
[58] *Id.*, p. 21.
[59] *Id.*, pp. 23-24.
[60] *Id.*, p. 24.
[61] *Id.*, p. 24.

> Boston Pacific highlights a significant policy issue for the Board, namely, whether ratepayers should subsidize a 25 MW project that is more expensive than utility-scale projects which aims to use New Jersey as the testing waters for a turbine with no offshore commercial history. The answer is no. Ratepayers should not be asked to pay for a project that costs significantly more per kilowatt than commercial projects, yet produces only a fraction of the output.
>
> …
>
> Moreover, the Board is not inclined to approve use of new technology if the economics of the project do not bear in favor of ratepayers.
>
> In sum, based on the facts and circumstances of this matter, the Board **FINDS** that the ratepayer subsidy is too expensive and should not be imposed.[62]

Q. DOES THE COMPANY'S CURRENT NAUTILUS PROPOSAL SUFFER FROM THE SAME FLAWS OR SHORTCOMINGS PREVIOUSLY IDENTIFIED BY THE BOARD?

A. Yes. The Company's current offshore wind project proposal suffers from many of the same shortcomings that the Board identified in its Order denying FACW's project and proposed OREC plan. I will address each of these shortcomings individually. However, from a big-picture perspective, the Board should be aware that, in addition to suffering from many of the same problems as the FACW proposal, [redacted]

[62] *Id.*, p. 29.

[63] In the Matter of the Petition of Fishermen's Atlantic City Wind Farm, LLC for the Approval of the State Waters Project and Authorizing Offshore Wind Renewable Energy Certificates, BPU Docket No. EO11050314V, Amended Application, Testimony Exhibit 9, p. 2, p.5; and Company Petition, Appendix B, Attachment 59.

Q. IS THE COMPANY'S PROPOSAL CONSISTENT WITH THE EMP?

A. No. As will be discussed in further detail in my testimony, the Company's proposal does not result in significant net benefits, and as the Board acknowledged in its FACW rejection Order, this is necessary in order for the project to be considered consistent with the EMP.[64] Furthermore, and as will be explained further below, the Company's environmental benefits analysis is also inconsistent with the EMP since the analysis is not based on market-based prices or costs.[65] In addition, the Nautilus project, as will be discussed later, does not pass a CBA once a number of critical assumptions and benefits estimates are corrected. I will discuss the errors in the Company's CBA calculations later in my testimony.

Q. [redacted]

A. [redacted]

Q. HAS THE COMPANY OFFERED ANY OTHER NON-QUANTIFIABLE BENEFITS FOR THE BOARD'S CONSIDERATION?

[64] In the Matter of the Petition of Fishermen's Atlantic City Wind Farm, LLC for the Approval of the State Waters Project and Authorizing Offshore Wind Renewable Energy Certificates, BPU Docket No. EO11050314V, Board Decision on the Merits of the Application, dated March 28, 2014, pp. 16-17.
[65] *Id.*, p. 24.
[66] Company Petition, Appendix B, pages 59-60. See also, Attachment 72 and Attachment 73.

A. Yes. The Company's application includes unquantified benefits in which it has asked the Board to consider in its review of project net benefits.[67] These non-quantifiable benefits includes such items as "lessons learned" and tourism benefits.[68] It is interesting that the Company would ask for the Board to consider "lessons learned" given the Board's explicit rejection of such benefits in the FACW decision. In that decision, the Board noted that it found "no economic value for lessons learned,"[69] and while the Board acknowledged some potential tourism benefits it rejected such benefits since FACW did not meet its burden to "reasonably and justifiably quantify" this benefit.[70] The Company has not satisfied its burden of proof in quantifying these purported benefits in this proceeding either and the Board should reject them for the same reasons it did in the FACW proceeding.

Q. DOES THE COMPANY'S CURRENT EMISSION BENEFITS ANALYSIS SUFFER FROM THE SAME FLAWS AS THE PRIOR FACW APPLICATION?

A. Yes. The Company's avoided emissions benefits analysis suffers from the same flaws as the previous FACW application. The Company's current emission benefits analysis uses the estimated social cost per ton of avoided emissions based on the Environmental Protection Agency's ("EPA") November 15, 2015 analysis of the Cross-State Air Pollution Updated Rule.[71] The Company, instead of using market prices, has once again used societal values to estimate environmental benefits despite the explicit rejection of these societal values by the Board in the

[67] Company Petition, Appendix B, page 79, line 28 through page 80, line 1.
[68] Company Petition, Appendix B, page 79, line 28 through page 80, line 1; and page 91, lines 19-20.
[69] In the Matter of the Petition of Fishermen's Atlantic City Wind Farm, LLC for the Approval of the State Waters Project and Authorizing Offshore Wind Renewable Energy Certificates, BPU Docket No. EO11050314V, Board Decision on the Merits of the Application, dated March 28, 2014, p. 25.
[70] *Id.*, p. 21.
[71] Company Petition, Appendix B, page 88, lines 26-27.

prior FACW proceeding.[72] The Company's emissions impact analysis is not based on market prices, does not follow Board precedent, and is inconsistent with the EMP. Therefore, it does not result in fair, just, and reasonable ratepayer impacts and should be rejected by the Board. I will discuss these shortcomings in more detail later in my testimony.

Q. HOW DOES THE PROPOSED RATEPAYER SUBSIDY IN THIS PROCEEDING COMPARE TO THAT IN THE FACW PROCEEDING?

A. As will be discussed in further detail later in my testimony, the ratepayer subsidy in this proceeding is [redacted]

The Board should once again reject the Company's proposed project since it comes at a cost too high for New Jersey ratepayers.

[72] In the Matter of the Petition of Fishermen's Atlantic City Wind Farm, LLC for the Approval of the State Waters Project and Authorizing Offshore Wind Renewable Energy Certificates, BPU Docket No. EO11050314V, Board Decision on the Merits of the Application, dated March 28, 2014, p. 24.

[73] U.S. Energy Information Administration. 2018. Cost and performance characteristics of new generating technologies. Available at: https://www.eia.gov/outlooks/aeo/assumptions/pdf/table_8.2.pdf; Lazard. 2017. Lazard's levelized cost of energy analysis – version 11.0. Available at: https://www.lazard.com/perspective/levelized-cost-of-energy-2017/; IRENA (2018), Renewable Power Generation Costs in 2017, International Renewable Energy Agency. Available at: http://www.irena.org/publications/2018/Jan/Renewable-power-generation-costs-in-2017; REN21. 2018. Renewables 2018 Global Status Report, page 114. Available at: http://www.ren21.net/status-of-renewables/global-status-report/; and Frankfurt School-UNEP Centre/BNEF. 2018. Global Trends in Renewable Energy Investment 2018. Available at: http://www.greengrowthknowledge.org/resource/global-trends-renewable-energy-investment-report-2018.

V. PROPOSED PROJECT COST

Q. PLEASE EXPLAIN IN GREATER DETAIL THE PROJECT'S OVERALL DEVELOPMENT COSTS.

A. A detailed cost breakdown for the Nautilus project has been provided in Schedule DED-3.

[redacted]

Q HOW DOES THE PROJECT'S COST COMPARE TO OTHER OSW PROJECT COSTS?

A. [redacted] Schedule DED-6 provides a comparison of European OSW projects on a constant cost and standardized basis.

[redacted]

[74] Company Petition, Appendix B, Attachment 59.

Q. HOW DOES THE PROJECT'S COST COMPARE TO OTHER OSW PROJECTS USING SIMILAR TURBINES?

A. [redacted]

Q. HOW DOES THE PROPOSED NAUTILUS PROJECT'S COSTS COMPARE TO OTHER RECENTLY-APPROVED U.S. OSW PROJECTS?

A. Schedule DED-8 provides a comparison of the installed cost of five recently completed or awarded U.S. OSW projects. [redacted]

[75] Company Petition, Appendix B, page 44, lines 2-7.
[76] Company Petition, Exhibit B, page 29, lines 21-22.
[77] Company Petition, Appendix B, page 50, lines 25-27.

Q HAVE YOU CONDUCTED ANY OTHER OSW PROJECT COST COMPARISONS?

A Yes. I have conducted a statistical analysis that compares the Nautilus project to other European OSW projects that have been completed. The dataset I used was summarized earlier in Schedule DED-6. These costs are standardized in "overnight dollar" terms to control for OSW projects, that are often developed across differing time periods and may face differing exchange rates, interest rates and inflation. The goal in this process is to standardize costs in a way that puts them on an "apples-to-apples" basis before attempting to do any statistical comparative analysis. This statistical analysis also includes a set of independent variables that "controls" for various OSW characteristics including size, distance to shore, and construction year. I have also plotted project costs against capacity to show how the Nautilus project compares to other projects in the dataset: (1) comparing Nautilus' total project costs to the project costs of all European OSW facilities; (2) comparing Nautilus' total project costs to a subset of smaller-sized European OSW facilities; (3) comparing Nautilus' unit development costs ($ per kW) to the unit development costs of all European OSW facilities; and (4) comparing Nautilus' unit development costs ($ per kW) to the unit development costs of a subset of smaller-sized European OSW facilities.

Q. WHAT DOES YOUR FIRST COMPARISON SHOW?

A. My first comparison, examines the standardized total cost of the Nautilus project to all other European OSW projects and is provided in Schedule DED-9. This chart shows that the Nautilus project is [redacted]

Q. WHAT DOES YOUR SECOND COMPARISON SHOW?

A. My second comparison, which compares the Nautilus project to a sub-set of smaller European OSW projects, is provided in Schedule DED-10. This chart also shows that the Nautilus development costs are [redacted]

Q. WHAT DOES YOUR THIRD COMPARISON SHOW?

A. My third comparison compares the Nautilus unit development cost ($ per kW) to those of the full European OSW database I discussed earlier and is provided in Schedule DED-11. This chart shows that the unit development costs for the Nautilus project are [redacted]

Q. WHAT DOES YOUR FOURTH COMPARISON SHOW?

A. My fourth comparison compares Nautilus' development costs to a smaller subset of OSW projects (in terms of capacity) and is provided in Schedule DED-12. [redacted]

[78] **##BEGIN CONFIDENTIAL##** This unit cost of $7,682 per kW differs from the $8,063 per kW cited elsewhere in my testimony as a result of the overnight cost standardization method used for this analysis. **##END CONFIDENTIAL##**

Q. WHAT DOES YOUR STATISTICAL ANALYSIS SHOW REGARDING AN APPROPRIATE OR AVERAGE COST FOR A FACILITY THAT HAS SOME OF THE SAME CHARACTERISTICS AS NAUTILUS?

A. My statistical analysis, based on the experience of European OSW development, estimates an average development unit cost of $4,169 per kW for an offshore facility that has the same capacity, is located the same distance to shore, and is developed across the same time period.

Q. HOW DOES NAUTILUS' PROPOSED OREC PLAN COMPARE TO THE PRICES OFFERED BY OTHER RECENTLY-APPROVED U.S. OSW PROJECTS?

A. I have provided a comparison of Nautilus' proposed OREC price to other recently-approved U.S. OSW projects in Schedule DED-13. This schedule shows that the OREC pricing plan being proposed by Nautilus is [redacted]

Q. HAVE YOU TRIED TO ESTIMATE A MORE REASONABLE OREC PRICE BASED UPON YOUR EARLIER STATISTICAL COST ANALYSIS?

A. Yes. Schedule DED-14 provides a revised OREC pricing calculation that uses a [redacted]

Q. HAVE YOU CALCULATED THE IMPLIED RETURN ON INVESTMENT IF THE PROJECT WERE TO INCUR NORMAL COSTS AT THE CURRENT SET OF PROPOSED OREC PRICES?

A. Yes, and that analysis is provided in Schedule DED-15. If Nautilus were to maintain its current OREC pricing proposal, but only incurred costs that were consistent with the reasonable level of the [redacted]

Q. HAVE YOU REVIEWED ANY OTHER SOURCES TO SUPPORT YOUR COST ESTIMATES?

A. Yes. There are several other publicly-available published sources for offshore wind cost estimates. First, the U.S. Energy Information Administration ("EIA") incorporates cost and performance characteristics for new generating technologies as part of its Annual Energy Outlook ("AEO"). These estimates represent EIA's assessment of the cost to develop and install various generating technologies used in the electric power sector. The EIA's 2018 base overnight cost estimate for offshore wind is $4,694 per kW. The total capital cost, which includes contingency factors and represents costs for plants that would come online in 2018 is $6,454 per kW. It is important to also note that these capital costs do not include any investment tax credits.[79] Another frequently cited and well-known source for renewable cost estimates is Lazard. The financial advisory and asset management firm publishes an annual *Levelized Cost of Energy Analysis*. Lazard's latest report, issued in November 2017, is its 11th publication in the series and reports a

[79] U.S. Energy Information Administration. 2018. Cost and performance characteristics of new generating technologies. Available at: https://www.eia.gov/outlooks/aeo/assumptions/pdf/table_8.2.pdf.

"mid-point" OSW levelized cost estimate assuming a capital cost range of $2.36 –$4.50 per watt ($2,360/kW to $4,500/kW).[80]

Q. ARE YOU FAMILIAR WITH OTHER SOURCES OF OSW COST ESTIMATES?

A. Yes. The International Renewable Energy Agency ("IRENA") is an intergovernmental organization that promotes the adoption of renewable energy and publishes an annual *Renewable Power Generation Cost* report to highlight trends for renewable power technologies based on the latest cost and auction price data from projects around the world.[81] The 2018 IRENA report states that OSW costs fell between 2010 and 2017, and that 2016 and 2017 have been "breakthrough years" as auction results "have confirmed that a step-change in costs has been achieved" and suggest that projects commissioned from 2020 onward would fall to between $60 and $100 per MWh.[82] Schedule DED-16 presents weighted-average total installed costs for offshore wind from the IRENA report. From 2010 through 2017, the average cost ranged from $3,782 per kW to $5,452 per kW. Only in one year, 2013, did the range of costs exceed $6,000 per kW.

Q. ARE THERE ANY OTHER RELEVANT OSW COST ESTIMATES?

A. Yes. The Renewable Energy Policy Network for the 21st Century, or "REN21" is an international, multi-stakeholder network of over 900 experts from governments, inter-governmental organizations, industry associations, non-governmental organizations, and science and academia. The REN21 Renewables Global Status Report was first released in 2005 and provides the latest data on the development and uptake of renewable energy, the evolution of distributed renewables and energy efficiency. The 2018 REN21 report announces that the "big

[80] Lazard. 2017. Lazard's levelized cost of energy analysis – version 11.0. Available at: https://www.lazard.com/perspective/levelized-cost-of-energy-2017/.
[81] IRENA (2018), Renewable Power Generation Costs in 2017, International Renewable Energy Agency. Available at: http://www.irena.org/publications/2018/Jan/Renewable-power-generation-costs-in-2017.
[82] *Id.*, pages 16 and 19.

story of 2017 was tumbling bid prices for wind power – both onshore and offshore." The report attributes the fall in prices to several factors, including: technology innovation and scale; expectations of continued technology advances; lower financing costs due to lower perceived risk; and industry competition.[83] The REN21 annual report presents the following 2017 OSW total investment costs:

- Asia: $1,890 minimum, $5,055 maximum, $3,290 weighted-average;
- Europe: $2,698 minimum, $6,480 maximum, $4,355 weighted-average; and
- China: $1,890 minimum, $4,258 maximum, $3,249 weighted-average.

Another international publication, the Global Trends in Renewable Energy Investment Report ("GTR") is jointly prepared by the Frankfurt School-UNEP Collaborating Centre for Climate & Sustainable Energy Finance, Bloomberg New Energy Finance and UN Environment.[84] This annual report was first produced in 2007 with a focus on tracking and publishing comprehensive information about international investments in renewable energy. The figures in this report are based on the output of a database of Bloomberg New Energy Finance. The 2018 GTR states:

> Offshore wind costs have declined in the past couple of years as developers compete for contracts in auctions, meaning that less investment is required per megawatt of capacity. The average capital expenditure for offshore wind has fallen from $4.1 million per MW in 2016 to $3.7 million per MW in 2017.[85]

Q. WHAT ARE YOUR CONCLUSIONS REGARDING NAUTILUS' PROPOSED COSTS AND ITS OREC PRICING PROPOSAL?

[83] REN21. 2018. Renewables 2018 Global Status Report, page 114. Available at: http://www.ren21.net/status-of-renewables/global-status-report/.
[84] Frankfurt School-UNEP Centre/BNEF. 2018. Global Trends in Renewable Energy Investment 2018. Available at: http://www.greengrowthknowledge.org/resource/global-trends-renewable-energy-investment-report-2018.
[85] *Id.*, p. 50.

A. The proposed Nautilus project is [redacted] Further, the OREC pricing proposal results in ratepayer costs that are too high relative to the corresponding benefits likely to arise from this project. I will discuss these unnecessarily high costs and how they impact the project's overall net benefits in much greater detail in the later sections of my testimony.

VI. PROPOSED PROJECT ENVIRONMENTAL BENEFITS

A. Avoided Emissions

Q. WHAT ENVIRONMENTAL BENEFITS DOES THE COMPANY IDENTIFY IN ITS CBA?

A. The Company notes that traditional fossil fuel-based electric power generation emits greenhouse gases ("GHG"), such as carbon dioxide ("CO_2"), and other pollutants such as nitrous oxides ("NO_X"), sulfur dioxide ("SO_2"), mercury ("Hg"), and other fine particulate matter ("PM").[86] The Company states that these emissions contribute to global climate change, acid rain, smog, haze, and other harmful impacts to the environment and human health.[87] The Company therefore argues that the proposed Nautilus project will provide benefits to New Jersey ratepayers from the avoidance of these harmful environmental effects through the use of an emission and fuel free electricity technology.[88]

Q. HOW DID THE COMPANY ESTIMATE AVOIDED EMISSIONS ASSOCIATED WITH THE PROPOSED NAUTILUS PROJECT?

[86] Company Petition, Appendix B, page 66, lines 13-14.
[87] Company Petition, Appendix B, page 66, lines 14-16.
[88] Company Petition, Appendix B, page 66, lines 16-20.

A. The Company primarily utilized emission data within the EPA's Emissions & Generation Resource Integrated Database for 2016 ("eGRID2016").[89] Specifically, the Company utilized non-baseload output emission rates associated with the Reliability First East eGRID subregion that are included in eGRID2016 summary tables. Reliability First East was chosen as it is the subregion in which the State of New Jersey is located.[90]

Q. WAS THE EPA DATABASE USED BY THE COMPANY TO ESTIMATE AVOIDED EMISSIONS FOR ALL POLLUTANTS?

A. No. While the eGRID2016 database was used for avoided SO_2 and NO_x emission, the Company argues that CO_2 and fine particulate matter emissions are not currently reported and tracked under any large-scale federal program.[91] Therefore, to estimate avoided emissions associated with these two pollutants, the Company utilized emission factors from EPA's AP-42 emission factors in conjunction with generation data by fuel type from the eGRID2016 database.[92]

Q. HAVE YOU REVIEWED THE eGRID2016 DATABASE?

A. Yes. eGrid uses data from both the EIA and EPA, specifically EPA's clean air markets program, to create plant-specific data for all U.S. electricity generating plants.[93] Because it provides data on a generation unit specific basis, the eGrid database allows users to estimate environmental emissions by state, region, NERC region, or potentially RTO.[94] As stated earlier, the Company utilized emission rates associated with non-baseload output emissions in Reliability First East eGRID subregion.

[89] Company Petition, Appendix B, page 67, lines 22-24.
[90] Company Petition, Appendix B, page 68, lines 13-15.
[91] Company Petition, Appendix B, page 68, lines 6-7.
[92] Company Petition, Appendix B, page 68, lines 8-11.
[93] Emissions & Generation Resource Integrated Database (eGrid) Questions and Answers, Environmental Protection Agency, available online at: https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid-questions-and-answers#egrid1.
[94] *Id.*

B. Societal Costs

Q. HOW DOES THE COMPANY CALCULATE MONETARY BENEFITS ASSOCIATED WITH AVOIDED ENVIRONMENTAL EMISSIONS?

A. The Company uses the monetary benefits included in the EPA's November 15, 2015 analysis of the Cross-State Air Pollution ("CSAPR") Updated Rule.[95] CSAPR rules were initially promulgated by the EPA in July of 2011 to address the interstate transport of NO_x emissions that were determined to contribute significantly to nonattainment or interference with the maintenance of states held by the EPA as not meeting the EPA's 2008 ozone National Ambient Air Quality Standard ("NAAQS"). However, in July of 2015, the D.C. Circuit Court of Appeals remanded certain elements of the rule for reconsideration.[96] The referenced November 15, 2015 analysis was the EPA's Regulatory Impact Analysis ("RIA") of its revised rules after the judicial remand.[97]

Q. DO YOU RECOMMEND USING THE EPA'S 2015 RIA?

A. No. The RIA approach is motivated by Executive Order 12866, signed by President Clinton in September 1993.[98] The executive order holds that all Federal agencies must assess the cost and benefits of all actions, and that the benefits of any proposed action outweigh the estimated costs.[99] Importantly, the RIA process is an evaluation process to assess the societal costs of a public good: in this instance, the "public good" EPA is trying to enhance is clean air. However, the EPA's regulatory responsibilities differ considerably from the Board's. The instant proceeding is not an independent determination of the impact of a public good, but instead, is an evaluation of

[95] Company Petition, Appendix B, page 88.
[96] Regulatory Impact Analysis for Proposed Cross-State Air Pollution Rule (CSAPR) Update for the 2008 Ozone National Ambient Air Quality Standards (NAAQS) (November 2015), Environmental Protection Agency, EPA-452/R-15-009 at ES-1.
[97] *Id.*
[98] Executive Order 12866 (September 30, 1993).
[99] Executive Order 12866 (September 30, 1993).

the development of a generation resource that will have benefits, such as the energy and capacity sales from the facility, primarily restricted to New Jersey ratepayers.

Q. WHY IS THIS DIFFERENTIATION IMPORTANT?

A. The EPA 2015 RIA is not comparable to a rate proceeding, or the approval of a resource investment, but instead represents the EPA's attempt to measure the societal costs of emissions to the general public. Specifically, CSAPR intended to set new cross-state emission guidelines for NO_x emissions.[100] With these reduced NOx emissions, the EPA found that the policy would additionally reduce emissions of SO_2 and CO_2.[101] Additionally, the policy would reduce fine particulate formation from NO_x present in the atmosphere.[102] The EPA then performed the complex task of evaluating the human health benefits and climate benefits of these reduced emissions.

Q. HOW DID THE EPA ESTIMATE THE HUMAN HEALTH BENEFITS OF THE PROPOSED AVOIDED ENVIRONMENTAL EMISSIONS?

A. The EPA constructed a damage function for each pollutant based on evidence included in Integrated Science Assessments.[103] Schedule DED-17 shows the individual effects that were assessed in calculating the monetary impact of fine particulate emissions. As can be seen, the range of negative effects assessed by the EPA ranged from premature mortality and school absences, to acute bronchitis and lost work days: all of which are societal impacts, not those restricted to the economic impacts of a resource acquisition.

[100] Regulatory Impact Analysis for Proposed Cross-State Air Pollution Rule (CSAPR) Update for the 2008 Ozone National Ambient Air Quality Standards (NAAQS) (November 2015), Environmental Protection Agency, EPA-452/R-15-009 at 6-1.
[101] *Id.,* at 6-2.
[102] *Id.,* at 6-2.
[103] *Id.* at 6-4.

Q. WHAT IS A SOCIETAL COST?

A. Theory states that, in order to estimate the avoided environmental costs, one needs to quantify the utility (or lack of disutility) that individuals receive if fewer pollutants are emitted into the environment. The value of pollution is rooted in preference theory.[104] The underlying commonly-made assumption is that as the amount of pollution in the environment increases, individuals' overall utility decreases (as measured by a damage function like that employed by the EPA), and thus individuals will have some willingness to pay ("WTP") in order to avoid the disutility. Therefore, in order to value the total social cost of these pollutants, one must add up the WTP of all of the individuals who live in the polluted areas.

Q. HOW DOES THIS LINE UP WITH ECONOMIC THEORY?

A. Economic theory suggests that the goal of policy makers will be to make the marginal cost to society of polluting equal to the marginal benefit received through "taxes" that will be imposed on polluters.[105] However, this ultimately makes the valuation of external benefits associated with reduced pollution within cost-benefit analyses two different sides of the same coin; the cost of polluting to society and policy makers' goal of imposing taxes/creating regulations on polluters in order to reimburse society for the negative externality and/or minimize the size of this externality. As will be explained in greater detail later, other jurisdictional regulators, such as the EPA, already have established regulations or market-based cap and trade programs that must be adhered to. Thus, these compliance costs are embedded in existing wholesale market rates.

[104] Hanley, N., J. Shogren and B. White. 2007. Environmental Economics in Theory and Practice. Second Edition. pages 2-7.

[105] These "taxes" can be in the form of traditional taxes that are imposed on pollution or can also refer to regulations that decrease pollution at the expense of the polluter.

Q. ARE THERE ANY FURTHER CONCEPTUAL ISSUES WITH USING SOCIETAL COSTS TO CALCULATE BENEFITS IN A REGULATORY FRAMEWORK?

A. Yes. The use of non-market-based approaches, such as "societal costs," to value air emissions is based upon the premise that current clean air markets and EPA regulations do not value or control for air emissions appropriately. These non-market approaches are also problematic in that the values presented represent estimates, rather than reported data or valuations. They also cannot be tested or verified to the true societal cost of the emission in question. This causes circumstances where estimates of societal costs vary widely between researchers.

Q. CAN SOCIETAL BENEFIT ESTIMATES VARY WIDELY BETWEEN RESEARCHERS?

A. Yes. Schedule DED-18 presents a comparison of societal environmental externalities estimates for carbon emissions between 1982 and 2006. Importantly, the vertical axis has been constructed as an exponential function to encompass all studies. The comparison shows that some studies have found societal costs for carbon emissions that is as high as nearly $1,000 per ton of CO_2 emissions. Likewise, other studies have found an appropriate societal cost for avoided CO_2 at nearly $0 per ton of avoided CO_2. Even peer-reviewed academic studies have found societal costs for CO_2 emissions as high as $200 per ton of emissions. In other words, the acceptable range of values on the benefits of avoiding CO2 emissions is a 200-fold range in values.

Q. DOES THE EPA NOTE A DEGREE OF UNCERTAINTY IN ITS ANALYSIS?

A. Yes. The EPA fully admits that the nature of its analysis includes some range of uncertainty. Further, the EPA explicitly notes that its analysis should **NOT** be viewed as an

estimate of the actual benefits anticipated to be found from the implementation of its proposed CSAPR regulations.[106]

> In any complex analysis using estimated parameters and inputs from numerous models, there are likely to be many sources of uncertainty. This analysis is no exception. This analysis includes many data sources as inputs, including emission inventories, air quality data from models (with their associated parameters and inputs), population data, population estimates, health effect estimates from epidemiology studies, economic data for monetizing benefits, and assumptions regarding the future state of the world (i.e., regulations, technology, and human behavior). Each of these inputs may be uncertain and would affect the estimate of benefits. **When the uncertainties from each stage of the analysis are compounded, even small uncertainties can have large effects on the total quantified benefits.** In addition, the use of the benefit-per-ton approach adds **additional uncertainties** beyond those for analyses based directly on air quality modeling. Therefore, the estimates of benefits should be viewed as representative of the **general magnitude of benefits** of the regulatory control alternatives for the 2017 analysis year, **rather than the actual benefits** anticipated from implement the proposal.[107]

Q. WHAT ACCOUNTS FOR THE WIDE RANGE OF VARIATION IN ESTIMATES OF SOCIETAL COSTS?

A. The variation in societal costs is a function of a wide range of differences in the underlying studies. These include the methodologies employed, the discount rates used, and the damage functions employed.

Q. ARE THERE ANY ALTERNATIVES TO USING A SOCIETAL VALUE TO ESTIMATE THE BENEFITS OF AVOIDED EMISSIONS?

A. Yes. Market-based approaches, such as cap-and-trade programs value societal costs on an objective, as opposed to a subjective, basis. In these programs, valuation is based on the interplay

[106] Regulatory Impact Analysis for Proposed Cross-State Air Pollution Rule (CSAPR) Update for the 2008 Ozone National Ambient Air Quality Standards (NAAQS) (November 2015), Environmental Protection Agency, EPA-452/R-15-009 at 6-20 and 6-21, emphasis added.
[107] *Id.,* emphasis added.

between willing buyers and sellers. These values are furthermore verifiable and readily available. Examples of cap-and-trade markets include the EPA's acid rain program,[108] and the Regional Greenhouse Gas Initiative ("RGGI").[109]

Q. HAS THE BOARD PREVIOUSLY ADDRESSED THE USE OF SOCIETAL COSTS AND BENEFITS FOR OSW PROJECTS?

A. Yes. In the prior FACW proceeding, the Company also utilized societal valuations of environmental benefits in order to partially support the CBA included its application. Indeed, FACW utilized an inter-agency federal government report[110] similar to the EPA 2015 RIA being utilized in the current proceeding. The Board noted that both Rate Counsel and Board Staff's consultant discouraged the use of societal costs in valuing the then-proposed project. [111] Indeed, the Board noted that its consultant cautioned that use of a societal cost values the cost of emissions against an incorrect baseline, essentially providing two options, emissions or no emissions, without recognizing the multitude of options to reduce environmental emissions, and that a proposal only provides monetary benefits to ratepayers if it is the least expensive option.[112]

> Environmental benefits were not demonstrated because they are based on an estimate of the social benefits of displacing CO2, SO2, and NOX emissions from fossil-fuel generation, rather than a market price for the emission. **The calculation of environmental benefits should be tied directly to the market prices because offshore wind is just one alternative to cutting emissions and its 'benefit' occurs if, and only if, it is less expensive than the alternative ways.**[113]

[108] Acid Rain Program, Environmental Protection Agency, available online at: https://www.epa.gov/airmarkets/acid-rain-program.
[109] The Regional Greenhouse Gas Initiative: an initiative of the New England and Mid-Atlantic States of the US, RGGI, available online at: https://www.rggi.org/.
[110] In the Matter of the Petition of Fishermen's Atlantic City Wind Farm, LLC for the Approval of the State Waters Project and Authorizing Offshore Wind Renewable Energy Certificates, Docket No. EO11050314V, Board Decision on the Merits of the Application, p. 23.
[111] *Id.,* p. 23.
[112] *Id.,* p. 23.
[113] *Id.,* p. 23, emphasis added.

Q. DID THE BOARD REFERENCE ANY OTHER PROBLEM WITH THE USE OF SOCIETAL COSTS FOR AVOIDED ENVIRONMENTAL EMISSIONS?

A. Yes. The Board, in addition to noting the technical concern with utilizing societal costs in determining the benefits associated with avoided environmental emissions, also addressed the inherent policy concern with their use. Specifically, the Board is an economic regulator, charged with establishing "just and reasonable" rates for jurisdictional utilities.[114] The Board is not an environmental regulator, and has responsibilities that differ from those of the EPA. This is foremost true when considering the Board's responsibility to focus on known and measurable costs in the context of rate cases.[115] Unlike societal costs, market-based valuations are truly known and measurable, be they through compliance with EPA clean air markets, regulations, or compliance with RGGI.[116]

Q. WHAT WAS THE BOARD'S ULTIMATE DETERMINATION IN THE FACW PROCEEDING?

A. The Board ultimately agreed with its Staff and Rate Counsel regarding the use of market-based prices for the valuation of environmental costs and benefits. The Board found this to be a reasonable method that ensures fair, just and reasonable ratepayer impacts. The Board also found the approach consistent with the published EMP, which focused on quantifiable, market-based gains.[117] The Board should not deviate from its established precedent, unless the Company can demonstrate a valid reason for doing so, which it has not in the current proceeding. As the Board concluded:

[114] *Id.,* p. 24.
[115] *Id.,* p. 24.
[116] *Id.,* p. 24.
[117] *Id.,* p. 23.

> The Board agrees with Rate Counsel and Staff – environmental benefits should be tied to market prices because that is a reasonable manner to ensure fair, just and reasonable ratepayer impact. This approach is also consistent with the EMP, which focuses on quantifiable, market-based gains that can be measured. As such, the Board FINDS that this presumed benefit was not demonstrated.[118]

C. Value of Avoided Carbon Emissions

Q. HOW DID THE COMPANY MONETIZE THE ANTICIPATED BENEFIT ASSOCIATED WITH AVOIDED CO_2 EMISSIONS?

A. The Company evaluated avoided CO_2 benefits based on a document called the "Current Technical Support Document (2016): Technical Update to the Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12866" ("2016 TSD").[119] The Company further suggests that this document is required for use by New Jersey executive agencies by the New Jersey Legislature and the Governor. The Petition states:

> Pursuant to P.L. 2018, c.16 (codified at N.J.S.A. 48:3-87.3), signed into law by Governor Murphy in May 2018, monetary benefits of CO2 emissions reductions are based on the "Current Technical Support Document (2016): Technical Update to the Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12866." Additionally, according P.L. 2018, c.16, "The social cost of carbon, as calculated by the U.S. Interagency Working Group on the Social Cost of Carbon in its August 2016 Technical Update, is an accepted measure of the cost of carbon emissions."[120]

Q. DO YOU AGREE WITH THE INFERENCE THAT THE CITED STATUTE REQUIRES THE USE OF SOCIETAL COSTS?

A. No. While I am not an attorney, I am often called upon to opine on the policy implications of certain statutes, rules and regulations. Contrary to the Company's assertion, the plain intent of the statute in question does not require the use of societal values, particularly in this proceeding.

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[118] *Id.,* p. 23.
[119] Company Petition, Appendix B, page 88 and 89.
[120] Company Petition, Appendix B, page 88 and 89, emphasis added.

The statute (P.L. 2018, c.16), expressed a desire by the Legislature that New Jersey should expand its portfolio of zero-emission resources, and specifically identified nuclear power generation in this statute as a means of meeting these zero-emissions goals.[121] In fact, the primary purpose of the statute is to establish a zero-emission certificate ("ZEC") program to help finance struggling nuclear generation facilities in the State.[122] The referenced section of the statute merely explains the Legislature's rationalization of its determined ZEC program. No further reference to the 2016 TSD is made within the statute.[123]

It is important to note that the above-cited statute does not require the use of societal values in any fashion nor does it state that the 2016 TSD is the only means for evaluating the social value of carbon, but instead opines that it is "an accepted measure."

Q DID THE ZEC STATUTE IDENTIFY OSW PROJECTS OR OWEDA IN ANY FASHION?

A. No. The statute, if explicitly meant for societal values to be utilized in executive agency decisions regarding OSW approval decisions could have included this language, but no such language is included. Further, if the Legislature meant for societal values to be utilized in the CBA and net benefits test identified in OWEDA, it could have done so, and it did not. Thus, the suggestion that the use of societal values for carbon are required in this OSW proceeding is not accurate.

Q. HAVE YOU REVIEWED THE 2016 TSD?

A. Yes. Executive Order 12866 required agencies "to assess both the costs and benefits of the intended regulation and, recognizing that some costs and benefits are difficult to quantify, propose

[121] P.L. 2018, c.16 §1(a)(6).
[122] P.L. 2018, c.16 §1(a)(8).
[123] *Id.*

or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its cost."[124] Importantly, this is the same Executive Order that necessitated the EPA's RIA process, and the 2016 TSD provides federal executive agencies guidance on the appropriate means to estimate the effects of CO_2 emissions. As shown by Schedule DED-19, the 2016 TSD determined a range of potential social cost of carbon ("SC-CO_2") estimates at three different discount rates. The average impact ranges from as low as $12 (2007$) per ton at a five percent discount rate, to $62 (2007$) per ton at a 2.5 percent discount rate. Likewise, the document found a "high impact" of $123 (2007$) per ton as the 95th percentile impact using a three percent discount rate.

Q. WHAT VALUE DID THE COMPANY USE TO ESTIMATE THE SOCIAL IMPACTS OF CO_2 EMISSIONS?

A. The Company's analysis is not completely clear regarding how it determined its benefit associated with avoided CO_2 emissions. The Company's analysis utilizes a monetary value of avoided CO_2 emissions of [redacted]

Q. ASSUMING THIS IS HOW THE COMPANY IS UTILIZING THE RESULTS OF THE 2016 TSD, DO YOU AGREE WITH THE COMPANY'S METHODOLOGICAL APPROACH?

[124] Technical Support Documents: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866 (August 2016), Interagency Working Group on Social Cost of Greenhouse Gases at 3.
[125] Company Petition, Appendix B, Attachment 72.

A. No. Both the 2016 TSD's findings represent findings of societal costs using social discount rates. In particular, the 2016 TSD's central estimate is determined by using a three percent discount rate, where the 2016 TSD's higher finding uses a 2.5 percent discount rate. These are discount rates far below what is reasonable outside of a social cost evaluation context. As discussed later in this testimony, this results in benefits that do not appropriately represent the true opportunity cost of capital for ratemaking purposes and is consistent with the discount rates used by the Board for other broad planning activities like other renewable energy evaluations and for energy efficiency program evaluation.

Q. IS THERE A READILY-AVAILABLE SOURCE OF MARKET-DERIVED COSTS ASSOCIATED WITH CO_2 EMISSIONS?

A. Yes. On January 29, 2018, Governor Phil Murphy signed Executive Order 7, directing the New Jersey Department of Environmental Protection ("DEP") and the Board of Public Utilities ("BPU") to take all necessary regulatory and administrative measures to ensure New Jersey's timely return to full participation in the RGGI.[126,127] As such, New Jersey is now in the process of re-joining RGGI, which hosts periodic allowance auctions for the emission of CO_2.

Q. HAVE YOU REVIEWED THE RESULTS OF THESE CO_2 ALLOWANCE AUCTIONS?

A. Yes, and this analysis is presented in Schedule DED-20. As shown in this schedule, the highest auction for CO_2 allowances in RGGI was $7.50 per ton in December 2015. In recent months, RGGI prices have consistently been between $2.50 and $4.50 per ton. These values are considerably lower than those proposed by the Company.

[126] Executive Order No. 7. Available at: https://nj.gov/infobank/eo/056murphy/pdf/EO-7.pdf.
[127] Regional Greenhouse Gas Initiative (RGGI), New Jersey Department of Environmental Protection, Division of Air Quality, Energy and Sustainability, available online at: https://www.state.nj.us/dep/aqes/rggi.html.

Q. WHAT IS YOUR RECOMMENDATION WITH REGARDS TO THE VALUATION OF CO_2 EMISSIONS?

A. Importantly, like emissions of SO_2 and NO_x, RGGI represents a cap and trade market wherein all electric generation units must purchase sufficient allowance credits to satisfy their emission requirements. Therefore, these prices are already embedded in existing wholesale market prices.

Q. DO YOU HAVE ANY ALTERNATIVE RECOMMENDATIONS?

A. Yes. If the Board decides to depart from its prior precedent set in its FACW decision, then I recommend it use the same social values of carbon that are identified in the set of assumptions used by the New Jersey Office of Clean Energy ("OCE") for energy efficiency program evaluation including the cost-benefit analyses conducted for these programs. These social carbon values, in addition to a host of other assumptions that are used for energy efficiency evaluation purposes, were prepared by the Rutgers Center for Energy, Economic, and Environmental Policy ("CEEEP").[128] CEEEP has prepared these avoided cost assumptions on numerous occasions over the past decade for use in evaluating Clean Energy Programs.[129] CEEEP notes that its analysis is based upon independent and publicly-available sources to ensure transparency.[130] The CEEEP document presents values for the social cost of carbon as published by the U.S. Government Interagency Working Group on Social Cost of Carbon. In addition, the CEEEP document includes damages estimates for SO_2, NOx and PM.

[128] Center for Energy, Economic & Environmental Policy. 2018. Energy Efficiency Cost-Benefit Analysis Avoided Cost Assumptions. Available at: http://www.njcleanenergy.com/files/file/Library/Market%20Research/Avoided%20Cost%20Memo%20(3-13-18).pdf

[129] Previously used avoided cost assumptions are available at: http://ceeep.rutgers.edu/publications/.

[130] Center for Energy, Economic & Environmental Policy. 2018. Energy Efficiency Cost-Benefit Analysis Avoided Cost Assumptions, page 1. Available at: http://www.njcleanenergy.com/files/file/Library/Market%20Research/Avoided%20Cost%20Memo%20(3-13-18).pdf

VII. PROPOSED PROJECT ENERGY REVENUES

Q. HOW DOES THE COMPANY ESTIMATE WHOLESALE ELECTRIC ENERGY SALES REVENUES?

A. The Nautilus rate impact model includes a revenue credit from the sale of electric energy generated by the project into the PJM market.[131] To estimate this revenue credit, wholesale prices were computed using a North American power market simulation model called AURORA.[132] The AURORA model attempts to simulate actual market conditions by dispatching available generation resources to predict future prices.[133] The Company then applies these future prices to the Nautilus project's anticipated generation values to project the revenues it will receive in the PJM day-ahead and real-time energy markets.

Q. WHAT ARE THE MAIN INPUTS TO THE AURORA MODEL?

A. The Company notes that fuel prices, and specifically natural gas prices, are a main driver of electric prices and thus an important input to the AURORA model.[134] The Company explained that it used forecasted natural gas prices based on a blend of current futures prices and the EIA AEO reference case for Henry Hub, adjusted for transportation and delivery charges.[135]

Q. HAVE YOU REVIEWED THE COMPANY'S NATURAL GAS PRICE FORECAST?

A. Yes. The Company provided a workpaper with its natural gas price forecast in response to discovery.[136] [redacted]

[131] Company Petition, Appendix B, page 84, lines 8-9.
[132] Company Petition, Appendix B, page 84, lines 12-14.
[133] Company Petition, Appendix B, page 84, lines 14-15.
[134] Company Petition, Appendix B, page 84, lines 15-18.
[135] Company Petition, Appendix B, page 84, lines 18-21.
[136] Company response to Discovery Request RCR-RE-4, Confidential.

[redacted]

Q. HAVE YOU EXAMINED ANY OTHER INPUTS TO THE AURORA MODEL?

A. No. [redacted] Thus, there is no way to analyze or alter what was actually modeled, such as: the regions and/or sub-regions modeled; generating technology cost and performance (cost, fixed and variable O&M, capacity factors); expected cost and performance of future generating capacity; constraints on generation unit deployment; interregional trading and cost; electricity demand; energy efficiency representation; and any applicable environmental regulations.

Q. DID THE COMPANY USE THIS MODEL IN ITS PRIOR FACW FILING?

A. No. Interestingly, the Company did not use the AURORA model in its last filing and instead, used the EIA's AEO to estimate wholesale energy sales revenues.

Q. DID YOU EXAMINE THE OUTPUT OF THE AURORA MODEL?

[137] Company response to Discovery Request RCR-RE-6, Confidential.
[138] Company response to Discovery Request RCR-RE-6, Confidential.

A. Yes. As shown in Schedule DED-21, the forecast prices resulting from the AURORA model that the Company uses to estimate wholesale energy revenues increases at an average annual rate of [redacted]

Q. DO YOU HAVE AN ALTERNATIVE ENERGY PRICE FORECAST?

A. Yes. I recommend that the Board reject the Company's price forecast and resulting wholesale energy revenues since it is based upon an un-replicable black-box software model that does not give parties the ability to validate model inputs and assumptions. This is a particularly important shortcoming for an evaluation processes that is on such an expedited time frame. Instead, I recommend the Board use the same set of wholesale spot energy prices that are included in the prior-referenced CEEEP document that is used for the evaluation of over $288 million in energy efficiency programs by the OCE.[139] This CEEEP analysis uses historic New Jersey wholesale electric prices from PJM and escalates those prices based on the annual percent change published in the EIA's 2017 AEO using the Reliability First Corporation-East ("RFC-East") electricity generation prices.[140] CEEEP also used seasonal peak and off-peak factors derived from historic PJM LMP data. As noted by CEEEP, the annual percent change was, on average about 2.5 percent.[141] Schedule DED-22 presents a comparison of my alternative wholesale electric revenues with those used by the Company.

VIII. PROPOSED PROJECT CAPACITY REVENUES

[139] New Jersey Office of Clean Energy, FY2019 Draft Budget. Available at: http://www.njcleanenergy.com/main/njcep-policy-updates-request-comments/policy-updates-and-request-comments.

[140] Reliability First is one of eight regional entities responsible for ensuring reliability of the North American Bulk-Power System. These entities are approved by the Federal Energy Regulatory Commission ("FERC") and function under delegation agreements with the North American Electric Reliability Corporation ("NERC").

[141] An updated 2018 AEO is currently available. The annual percent change for the RFC-East prices is about 2.2 percent.

Q. DOES THE COMPANY INCLUDE CAPACITY SALES REVENUE BENEFITS?

A. Yes. The Nautilus rate impact model includes a revenue credit from the sale of capacity in PJM's Reliability Pricing Model ("RPM") capacity market.[142] The PJM RPM ensures long-term grid reliability by securing electricity supply resources needed to meet forecast energy demand.[143] Under the RPM, PJM conducts an annual Base Residual Auction ("BRA") that establishes annual market-based resource clearing prices for Local Deliverability Areas ("LDA") within PJM three years in advance of the actual delivery year. Incremental auctions are also conducted to cover any variances in supply or demand that may develop after a BRA.[144]

Q. HOW DOES THE COMPANY CALCULATE CAPACITY SALES REVENUE BENEFITS?

A. To estimate this revenue credit, the Company used [redacted]

Q. WHAT IS YOUR RECOMMENDATION FOR THE ESTIMATION OF CAPACITY SALES REVENUE BENEFITS?

A. I recommend the Board utilize the capacity prices included in the earlier-referenced CEEEP analysis which uses New Jersey Utility PJM RPM prices for the four electric utilities for 2010 through 2019 and weighted them by each utility's historic peak load to derive an average

[142] Company Petition, Appendix B, page 85, lines 1-2.
[143] PJM Learning Center, Capacity Market. Available at: https://learn.pjm.com/three-priorities/buying-and-selling-energy/capacity-markets.aspx.
[144] *Id*.
[145] Company Petition, Appendix B, page 85, lines 5-6.
[146] Company Petition, Appendix B, page 85, lines 5-7.

New Jersey capacity price.[147] To project prices through 2038, CEEEP used the projected annual change in U.S. GDP Chain-type Price Index as reported by the EIA. The PJM's Forecast Pool Requirement is a multiplier that converts load values into capacity obligation. I applied this requirement to the capacity prices to estimate an alternative capacity sales revenue that is provided in Schedule DED-23.

IX. PROPOSED PROJECT REC BENEFITS

Q. HOW DOES THE COMPANY ESTIMATE AVOIDED REC BENEFITS?

A. The Nautilus rate impact model includes a revenue credit for avoided RPS Class I REC purchases reflecting a reduced need for retail electric suppliers to purchase Class I RECs.[148] To estimate this credit the Company uses an aggressive and artificially inflated rate of increase in Class I REC prices. The Company's forecast is based on current forward trading prices for 2020 through 2022 and a "supply-demand and incremental revenue analysis" for the years 2025 and beyond. The years 2023 and 2024 are a blend of futures prices and the Company's forecast prices.[149] The Company believes that so much Class I renewable capacity is going to be needed in the 2022-2023 timeframe, that Class I RECs are going to skyrocket from their current levels of around [redacted]

[147] Center for Energy, Economic & Environmental Policy. 2018. Energy Efficiency Cost-Benefit Analysis Avoided Cost Assumptions. March 13, 2018. Page 4. Available at: http://www.njcleanenergy.com/files/file/Library/Market%20Research/Avoided%20Cost%20Memo%20(3-13-18).pdf.
[148] Company Petition, Appendix B, page 86, lines 2-6.
[149] Company Petition, Appendix B, page 86, lines 7-10.

Q. WHAT ARE THE HISTORIC TRENDS FOR NEW JERSEY CLASS I REC PRICES?

A. Data from the New Jersey Office of Clean Energy shows that New Jersey weighted-average Class I REC prices have barely gone above $15 per MWh, even in the early days of the RPS. In fact, weighted-average Class I REC prices fell from $15 per MWh in 2016 to just over $12 per MWh in 2017. Schedule DED-25 shows New Jersey's historic weighted-average Class I REC prices on an annual basis. Schedule DED-26 shows these actual New Jersey Class I REC prices combined with the Company's projected Class I REC prices.

Q. HOW DOES THE COMPANY ESTIMATE PROJECTED CLASS I REC PRICES?

A. In response to discovery, the Company provided [redacted]

[150] Company response to Discovery Request RCR-RE-5, Confidential.
[151] U.S. Energy Information Administration, Levelized cost and levelized avoided cost of new generation resources in the Annual Energy Outlook 2018. Available at: https://www.eia.gov/outlooks/aeo/pdf/electricity_generation.pdf
[152] Company response to Discovery Request RCR-RE-5, Confidential and Attachment Confidential - RCR-RE-5-1 (P0094196xD5D5A).xlsx

Q. DO YOU AGREE WITH THIS METHOD FOR ESTIMATING FUTURE CLASS I REC PRICES?

A. No. [redacted]

Q. DO YOU HAVE AN ALTERNATIVE RECOMMENDATION?

A. Yes. I recommend that the Board use the renewable energy adder that is included in the CEEEP analysis that is used for evaluating energy efficiency programs. This adder is a proxy for a combined REC/SREC unit cost and, as such, will be somewhat higher than an estimate based on Class I RECs alone, but it is still a more reasonable estimate than what has been utilized by the Company in its CBA. A comparison of the Company's estimated REC benefits and my alternative benefits using the CEEEP prices is provided in Schedule DED-27.

X. PROPOSED PROJECT VOLATILITY BENEFITS

Q. DOES THE COMPANY ARGUE THAT THERE WILL BE BENEFITS ASSOCIATED WITH A HEDGE AGAINST TRADITIONAL FOSSIL FUEL PRICES?

A. Yes. The Company argues that clean energy technologies, such as the proposed Nautilus project, provide electricity at a known price and allow ratepayers to avoid the purchase of

electricity at unknown future prices.[153] Essentially, the Company argues that the proposed project will provide a fixed price hedge against volatile wholesale energy costs. The Company further argues that these benefits will accrue for the life of the project, or 20 years.[154]

Q. HOW DOES NAUTILUS CALCULATE THE MONETARY BENEFIT ASSOCIATED WITH ITS PURPORTED VOLATILITY HEDGE BENEFIT?

A. The Company states that the risk avoidance benefit can be calculated as a price adder to the cost of electricity or natural gas.[155] To determine this adder, the Company reviewed past studies and regulatory decisions that included such an adder and concluded from this survey that a ten percent premium is a "conservative" estimate.[156]

Q. WHAT IS THE TOTAL MONETARY BENEFIT ASSOCIATED WITH THE CLAIMED VOLATILITY HEDGE BENEFIT?

A. The Company claims that the proposed project will provide [redacted]

Q. DO YOU AGREE THAT THE PROPOSED NAUTILUS PROJECT WILL HAVE THIS LEVEL OF VOLATILITY HEDGE BENEFITS?

A. No, since there are a number of conceptual and analytic problems with the Company's "estimation" process. First, the Company's claim for volatility benefits is premised on the project providing electricity to New Jersey ratepayers at a fixed (constant) price. The Nautilus project

[153] Company Petition, Appendix B, page 89, lines 7-16.
[154] Company Petition, Appendix B, page 89, line 14.
[155] Company Petition, Appendix B, page 89, lines 17-18
[156] Company Petition, Appendix B, page 89, lines 20-21.
[157] Company Petition, Appendix B, Attachment 72.
[158] Company Petition, Appendix B, Attachment 72.

will not provide an overall effective fixed (constant) price to ratepayers since the OREC payment that will be made by ratepayers (in order to finance the project) will be made net of Nautilus energy and capacity sales revenues, which vary with the market and will not be held constant. Hence, the effective OREC price that ratepayers will see each year will vary given the changes in these PJM/market-based revenue credits. It is incorrect to argue that the proposed project will provide a volatility hedge from fossil fuel-based market prices since the revenues associated with the sales of electricity from the proposed OSW project will move with natural gas prices.

Q. WHAT ARE SOME OF THE ANALYTIC PROBLEMS ASSOCIATED WITH THE COMPANY'S VOLATILITY HEDGE BENEFIT ESTIMATE?

A. The primary analytic problem with the Company's volatility hedge benefits is that they are not directly estimated based upon the specifics of the Nautilus proposal, but instead, are based upon a survey of other studies that have very limited applicability to the instant proceeding. Schedule DED-28 summarizes the results from the studies surveyed by the Company in their analysis. This table shows that there are a wide range of estimates from each study, ranging from a 7.5 percent benefit on the low end, to a 24 percent benefit on the high end.

Q. WHY DO THESE RESULTS ESTIMATING HEDGE BENEFITS VARY?

A. Benefits associated with fixed price hedges are dependent on the specific regional electricity markets in question and the market conditions prevailing at the time in which the study was conducted. From a regional power market perspective, several studies included in the Company's analysis are well outside of, and have nothing to do with, the market conditions in New Jersey or the mid-Atlantic region. Some of these studies, for instance, were conducted for such geographic markets as Mississippi, Oregon, and Ohio.

Q. HOW CAN THE TIMING OF STUDIES IMPACT THE ESTIMATION OF VOLATILITY HEDGE BENEFITS?

A The timing of such studies can heavily influence the estimation of associated volatility hedge benefits. Consider that the majority of the studies reviewed by the Company were published between 2013 and 2014. However, from March 2012 until March 2014, there was significant movement (volatility) in Henry Hub natural gas spot prices.[159] Natural gas prices increased from $2.06 per MMBtu on March 30, 2012 to $6.55 per MMBtu on February 14, 2014, before decreasing in 2015 to below $4.00 per MMBtu, where prices remained until 2018.[160] Also, there was a major spike in New Jersey electricity prices on January 14, 2014, where for a few hours, the price spiked to over $1,800 per MWh.[161] This Polar Vortex-induced spike accounts for the largest discrepancy between the proposed OREC price at market prices from 2008 to 2018 and represents a very extreme example for a limited amount of time in which electricity prices spiked due to harsh weather.[162] Another study used by the Company in its analysis includes the 2000-2001 natural gas price spike time period.[163]

Q. WHAT OTHER FACTORS CAN INFLUENCE THE ESTIMATION OF VOLATILITY HEDGE BENEFITS?

A. Volatility hedge benefits are also dependent on the generation resource being examined since the cost of the given resource determines its "fixed price" level and the magnitude of its hedging ability (i.e., its ability to offset peak and needle peak prices in any given market).

[159] U.S. Energy Information Administration, Henry Hub Natural Gas Spot. Available at: https://www.eia.gov/dnav/ng/hist/rngwhhdW.htm.
[160] *Id*.
[161] Baatz, Barrett, Stickles, Estimating the Value of Energy Efficiency to Reduce Wholesale Energy Price Volatility, April 2018, Page 10.
[162] *Id.*
[163] Bolinger et al, Quantifying the Value that Energy Efficiency and Renewable Energy Provide as a Hedge Against Volatile Natural Gas Prices. Lawrence Berkley National Labs.

Schedule DED-28 shows that the generation resources reviewed in the studies relied upon by the Company vary tremendously. Some of the studies listed assess the benefit of fixed contracts as they relate to natural gas-fired electric generating units. Others refer primarily to small-scale solar facilities participating in net metering programs. There is at least one study that examines the volatility hedge benefits of relatively lower-cost energy efficiency programs.[164] Only two of the studies listed by the Company refer to wind generation facilities,[165] and only one briefly mentions OSW facilities.[166]

Q. DO YOU HAVE ANY OTHER CONCERNS WITH THE COMPANY'S LITERATURE SURVEY ON VOLATILITY HEDGE BENEFITS?

A. Yes. The survey appears to rely on the same study, performed by the same consulting firm, on repeated occasions. For instance, close to half of the studies surveyed by the Company (44 percent) were conducted by Synapse Energy Economics,[167] with at least three of them being repeatedly cited for Mississippi. This Mississippi study utilized a 10 percent adder for volatility hedging benefits and appears to be heavily influencing the Company's proposed volatility hedge benefit adjustment in this proceeding.[168] Simple mathematics suggests that if you use the same study in a sample average over and over again, it will bias the resulting average in favor of that study's results.

[164] *See*, Baatz, Brendon, *et. al.* (April 2018); Estimating the Value of Energy Efficiency to Reduce Wholesale Energy Price Volatility; American Council for an Energy-Efficient Economy ("ACEEE"), Report U1803.
[165] *See*, Hornby, Rick, *et. al.* (July 12, 2013); Avoided Energy Supply Costs in New England: 2013 Report; Avoided-Energy-Supply-Component (AESC) Study Group; and 2013 Integrated Resource Plan (April 30, 2013), PacificCorp.
[166] Hornby, Rick, *et. al.* (July 12, 2013); Avoided Energy Supply Costs in New England: 2013 Report; Avoided-Energy-Supply-Component (AESC) Study Group, pages 4-20 and 4-21.
[167] Schedule DED-29.
[168] Net Metering in Mississippi: Cost, Benefits, and Policy Considerations (September 19, 2014); Synapse Energy Economics, pp 60-61.

Q. HAVE YOU ATTEMPTED TO ESTIMATE YOUR OWN, INDEPENDENT VOLATILITY HEDGE BENEFIT?

A. Yes, but in order to make such an estimate, I had to assume that prices under the Company's proposal are fixed, which is not the case in this instance, but such an assumption can be used to show how the Company's estimates are considerably over-estimated. The Board needs to recognize however, that the volatility estimate benefit that I estimate only arises if there is a true fixed price OREC and ignores the fact that the effective OREC payment made by ratepayers from this project, if approved, will vary each year with energy and capacity sales credits. However, even with this assumption, my analysis finds very little volatility hedge benefit from the proposed Nautilus project.

Q. PLEASE EXPLAIN THE RESULTS FROM YOUR VOLATILITY HEDGE BENEFITS ESTIMATE.

A. The results of this analysis are provided in Schedule DED-29. This chart shows historic real-time prices for the PJM-based New Jersey Hub for the period January 2008 to July 2018, which itself consists of 90,000 separate observations. The analysis concludes that over a ten-year period, only 234 hours saw wholesale electricity prices that would be avoided by the proposed project. Indeed, on average, the proposed OREC price is sufficiently high as to only avoid an average of 21 hours of electricity price spikes per year, or slightly more than two-tenths of one percent of the hours in any given year. I estimate the total recognized monetary value of the proposed hedge for the period January 2008 to July 2018 to have been only $793,917, or less than a $1 million for the entire decade.

Q. WHY IS YOUR HEDGE BENEFIT ESTIMATE SO LOW?

A. The historic recognized hedge value of the proposed project is so low due to the expensive nature of the Company's proposal. As stated previously, the Company requests an OREC of [redacted] As shown in Schedule DED-29, during the period January 2008 to July 2018, average market prices were $39.77 per MWh, a value that has been declining with the fall of natural gas prices. Likewise, the standard deviation in prices has been $33.14 per MWh, meaning that approximately 95 percent of all hourly prices are $106.05 per MWh or less. [redacted]

Q. DO YOU THINK THAT YOUR ESTIMATES MAY OVERSTATE THE VOLATILITY HEDGE BENEFIT FROM THE NAUTILUS PROPOSAL?

A. Yes, even my estimate may be an overstatement since the volatility trends in energy commodity markets over the past several years has dampened considerably, in large part due to the substantial decrease in natural gas price volatility and the emergence of excess generation capacity in many regional power markets. For instance, the volatility of spot energy markets during the period January 2008 to January 2014, which are included in my analysis, saw a standard deviation in average prices of $28.51 per MWh whereas the standard deviation in spot energy prices for the period January 2015 through July 2018 at the New Jersey hub since that time period has fallen to as low as $24.21 per MWh. This is a decline in volatility of more than 15 percent.

XI. PROPOSED PROJECT DISCOUNT RATE

Q. WHAT DISCOUNT RATE HAS THE COMPANY USED IN ITS CBA?

A. The Company's CBA, and the revenue/cost streams of each of its individual components (such as energy and capacity sales revenues, avoided REC costs and environmental benefits) use an exceptionally low discount rate of 2.96 percent.[169] The discount rate used by the Company is more akin to one commonly referred to as a "societal discount rate" and is considerably lower than the type of discount rate utilized in traditional utility ratemaking and electric resource planning proceedings.

Q. WHAT DO YOU MEAN BY DISCOUNTING?

A. Discounting is a common method used in economics and finance to adjust for the fact that a dollar today does not have the same value as a dollar in the future.[170] Discounting is an important component of project evaluation when costs and benefits span many years and, in some instances, (like the Nautilus proposal), decades. Failure to appropriately discount costs and/or benefits can lead to erroneous conclusions about investment profitability (from either a public or private investment perspective). To see this, consider the following scenario: Suppose an individual is offered two financial options. The first option is for a $1,000 cash payment today and the other option is for the same $1,000, but in five years from now. Typical individuals, who are risk averse, will take the $1,000 today instead of the option for payment in the future due to (1) the uncertainty associated with the future payment; and (2) the fact that a dollar today is not worth a dollar in the future. Even if that individual does not actually intend to use the money for five years, they still have the ability to invest the money and earn a return on that investment. The rate of return on the

[169] Company Petition, Appendix B, page 97, lines 2-3; and Attachment 72.
[170] Danthine, Jean-Pierre and John B. Donaldson. Intermediate Financial Theory. Second Edition. Chapter 2.

investment is what you forgo if the individual simply took $1,000 in the future without some form of additional financial compensation.

Q. CAN DISCOUNTING BE AN IMPORTANT COMPONENT OF PROGRAM EVALUATION IN THE ELECTRIC POWER INDUSTRY?

A. Yes. Discounting is necessary in comparing the costs and benefits on an "apples-to-apples" basis when evaluating the costs and benefits of a program that occur over a multiple-year period. The challenge with the use of discount rates in many CBAs is that some utilize an incorrect discount rate (i.e., one that is either too high or too low) or often utilize differing discount rates for cost versus benefit streams over time.

Q. WHAT IS MEANT BY A "SOCIAL" OR "SOCIETAL" DISCOUNT RATE?

A. A social discount rate is used in analysis of public policies which provide future benefits that are largely public in nature, known as "societal goods" or "public goods." These public goods are often paid for by one group of citizens but enjoyed by all. Examples of such benefits traditionally recognized as public goods include clean air and clean water or national defense. Public goods are often referred to as those that are non-rival and non-exclusionary in their benefits. In other words, all, or the overwhelming bulk of a public good's benefits are shared by all of society.

Q. DO YOU AGREE WITH THE COMPANY THAT A SOCIETAL DISCOUNT RATE IS AN APPROPRIATE WAY TO EVALUATE NAUTILUS' PROPOSED COSTS AND BENEFITS?

A. No. If approved, the Nautilus project will provide electricity service to New Jersey ratepayers just like any other generation resource. The proposed Nautilus project is not a public good that is "non-rival" in consumption since the primary benefits of the project are being

developed on the behalf of New Jersey ratepayers, not those in another state such as Georgia or Missouri.

Q. ARE YOU SAYING THERE WON'T BE ANY POSITIVE "EXTERNALITIES"[171] CREATED BY THE NAUTILUS PROJECT IF IT IS APPROVED?

A. No, but the fact that Nautilus may facilitate a number of positive externalities (like economic impacts, reduced emissions, improved regional dispatch, etc.) is not justification for evaluating the entire project as a "public good." While the Project's externalities may be valuable, it is still the fact that the overwhelming majority of the program's benefits are likely to be paid for and will accrue to New Jersey ratepayers. Including these externalities as individual benefit items is the more appropriate way to account for them in the CBA. Estimating these individual externalities and then also applying a societal discount rate to their benefit streams over time, effectively double counts benefits and puts a "hand on the scale" that biases the overall CBA in the Company's favor.

Q. HAVE ANY REGULATORY COMMISSIONS RECOGNIZED THE IMPROPRIETY OF USING SOCIETAL DISCOUNT RATES IN EVALUATING CAPITAL INVESTMENTS AND PROGRAMS THAT ARE PAID FOR BY RATEPAYERS?

A. Yes. In 2012, the Illinois Commerce Commission ("ICC") took issue with a CBA provided by Commonwealth Edison Company ("ComEd") related to its Advanced Metering Infrastructure ("AMI") proposal. The ICC found ComEd's use of a societal discount rate equal to 3.087 percent discount rate "dubious," noting that the rate is at the low end of a reasonable range of discount rates, and did not reflect customers' cost of capital since it was based on a risk-free return on

[171] A positive externality is a benefit to parties which do not incur the costs of the program.

government bonds.[172] Furthermore, the ICC felt that from a ratepayer perspective, the proposed AMI investment was not "risk-free," since there were no guarantees that the Company's assumptions would hold true or that even the meters being installed would remain in service as long as expected by the Company.[173]

Q. PLEASE EXPLAIN THE CBA DISCOUNT RATE USED BY FEDERAL EXECUTIVE AGENCIES.

A. Beginning in 1992, and periodically updated since, the White House Office of Management and Budget ("OMB") publishes Circular No. A-94, which sets guidelines and specific discount rates to be applied to all CBAs performed by executive agencies. Section 8(b)1 of the current circular orders all executive agencies to report net present value using a real discount rate of seven percent,[174] an estimate of the average before-tax rate of return to private capital in the U.S. economy.[175] When examining the effects of regulation that do not fall exclusively or primarily on the allocation of capital, such as the effect on private consumption due to higher consumer prices for goods and services, the OMB may use a lower three percent "societal" discount rate, based on the real, inflation adjusted, returns to a 10-year Treasury note since 1973.[176]

Q. WHAT DISCOUNT RATE HAS BEEN USED BY THE BOARD IN ASSESSING ENERGY EFFICIENCY PROGRAMS BENEFITS?

A. In October 2012, the CEEEP at Rutgers University published the results of its retrospective CBA of the New Jersey Clean Energy Program Energy Efficiency Programs. The CEEEP study

[172] Commonwealth Edison Company Petition for Statutory Approval of a Smart Grid Advanced Metering Infrastructure Deployment Plan pursuant to Section 16-108.6 of the Public Utilities Act, Illinois Commerce Commission Docket, 12-0298, p. 30.
[173] *Id*.
[174] Office of Management and Budget, Circular No. A-94 Revised, Section 8(b)1 (October 29, 1992).
[175] Office of Management and Budget, Circular No. A-4, p. 33 (September 17, 2003).
[176] *Id.*, pp. 33-34 (September 17, 2003).

used an eight percent nominal discount rate to discount the value of future benefits from the Clean Energy Program offerings.[177] The current CEEEP memo used throughout my testimony uses an updated discount rate of seven percent and notes "[t]his is approximately the average of the prevailing weighted average cost of capital (cost of capital or WACC) for utilities in NJ as compiled by CEEEP from publicly available documents."[178]

Q DID THE COMPANY UTILIZE A SOCIETAL DISCOUNT RATE IN ITS PRIOR FACW FILINGS?

A No. [redacted]

Q. WHAT DISCOUNT RATE DO YOU RECOMMEND USING IN THIS PROCEEDING?

A I recommend using a seven percent discount rate. This is consistent with what has been used in recent Board-approved analyses and is more appropriate to use for ratemaking and regulatory planning purposes. Schedule DED-30 applies this revised discount rate to the Company's CBA and shows that overall net benefits are substantially lower than those included

[177] Center for Energy, Economic & Environmental Policy. 2011. Cost-Benefit Analysis of the New Jersey Clean Energy Program Energy Efficiency Programs: 2011 Retrospective & 2012 Prospective Summary Report, p. 5.
[178] Center for Energy, Economic & Environmental Policy. 2018. Energy Efficiency Cost-Benefit Analysis Avoided Cost Assumptions, page 9, fn 26. Available at: http://www.njcleanenergy.com/files/file/Library/Market%20Research/Avoided%20Cost%20Memo%20(3-13-18).pdf.
[179] BPU Docket No. EO11050314V, Company Petition, Appendix B: Cost Benefit Analysis for Fishermen's Energy Atlantic City Wind Farm, May 22, 2012; and Company response to Discovery Request RCR-PF2-6.

in the Company's original application. Net benefits for the Nautilus project, using this more appropriate discount rate are [redacted]

XII. PROPOSED PROJECT FAILS ITS CBA

Q. WHAT ADJUSTMENTS HAVE YOU MADE TO THE COMPANY'S ANALYSIS?

A. The following lists the modifications and changes I have made in calculating the Company's individual project costs and benefits:

- I prepared alternative estimates for wholesale energy revenues using projected wholesale prices from CEEEP's 2018 Cost-Benefit Analysis Avoided Cost Assumptions, rather than the Company's output from the black-box AURORA model.
- I prepared alternative estimates for PJM capacity revenues using projected capacity prices from CEEEP's 2018 Cost-Benefit Analysis Avoided Cost Assumptions, rather than the Company's estimates that attempt to capture [redacted]
- I prepared alternative estimates for Class I REC benefits using projected Class I REC prices from CEEEP's 2018 Cost-Benefit Analysis Avoided Cost Assumptions rather than the Company's [redacted]
- I prepared alternative estimates for the emissions impacts using CEEEP's 2018 Cost-Benefit Analysis Avoided Cost Assumptions rather than the Company's inflated social costs.

[180] Company response to Data Request RCR-RE-32, Confidential.
[181] Company response to Data Request RCR-RE-5, Confidential.

- I prepared an alternative volatility hedge analysis; and
- I changed the discount rate from the Company's exceptionally low "societal-discount" rate of 2.96 percent to seven percent which is a more acceptable rate for utility ratemaking and regulatory planning, and published in CEEEP's 2018 Cost-Benefit Analysis Avoided Cost Assumptions.[182]

Q HOW HAVE YOU UTILIZED THE SOCIAL VALUE OF EMISSIONS IN YOUR CBA?

A. My primary recommendation is that the Board should not utilize societal values for emissions based upon its prior FACW decision and the other reasons I enumerated earlier in my testimony. However, if the Board decides to reverse this decision, my alternative recommendation is that it utilize the societal values included in the CEEEP report I discussed earlier. I have included separate columns in Schedule DED-31 that estimate the CBA results with these revised societal values.

Q. DOES THE NAUTILUS PROPOSAL RESULT IN POSITIVE NET BENEFITS?

A. No. The Nautilus proposal does not pass the net benefits test of OWEDA. [redacted] and my revised costs and benefits calculations, the project yields negative net benefits of [redacted]

Q. HOW DO THESE CBA RESULTS CHANGE IF SOCIETAL VALUES FOR EMISSIONS ARE INCLUDED?

[182] Company Petition, Appendix B, page 97, lines 2-3; and Attachment 72.

A. The Nautilus proposal still does not pass the net benefits test of OWEDA. If the Board uses the societal emissions values estimated by CEEP, and my revised costs and benefits calculations, the project yields negative net benefits of [redacted]

Q. [redacted]

A [redacted]

Q. [redacted]

A [redacted]

XIII. PROPOSED PROJECT'S CBA IS NOT CREDIBLE COMPARED TO PRIOR APPLICATION

Q. DOES THE COMPANY'S CURRENT CBA FOR THE NAUTILUS PROJECT SUFFER FROM SOME OF THE SAME PROBLEMS IDENTIFIED BY THE BOARD IN ITS REJECTION OF THE EARLIER FACW PROPOSAL?

A. Yes, the Company's current CBA for the Nautilus project suffers from some of the same deficiencies that were identified by the Board in the rejection of the similar FACW proposal. For

instance, the Board noted in its last FACW Order that the Project's CBA was deficient since it relied heavily on societal and not market-based values in attempting to quantify the Project's environmental benefits.[183] The Board also noted that the prior FACW application's CBA was deficient since it failed to adequately quantify many of the "first mover," "lessons learned," or "learning by doing" impacts.[184] The same is true in the instant proceeding where the Company has again enumerated and expanded upon many of these same benefits, and has claimed that the Board should consider these in its evaluation, and yet has failed to directly quantify any of these benefits.[185]

Q. ARE THERE ANY NOTICEABLE DIFFERENCES BETWEEN THE CBA PROVIDED IN THE FACW APPLICATION AND THE CURRENT NAUTILUS APPLICATION?

A. Yes. There are a number of considerable differences in the results of the CBA provided for the FACW proposal and the one in the instant proceeding despite the fact that the Project is the [redacted] These differences raise serious questions about both the reliability and credibility of the estimates between the two studies given the very

[183] In the Matter of the Petition of Fishermen's Atlantic City Wind Farm, LLC for the Approval of the State Waters Project and Authorizing Offshore Wind Renewable Energy Certificates, BPU Docket No. EO11050314V, Board Decision on the Merits of the Application, dated March 28, 2014, p. 24.
[184] In the Matter of the Petition of Fishermen's Atlantic City Wind Farm, LLC for the Approval of the State Waters Project and Authorizing Offshore Wind Renewable Energy Certificates, BPU Docket No. EO11050314V, Board Decision on the Merits of the Application, dated March 28, 2014, p. 25.
[185] Company Petition, Appendix B, page 91, lines 10-20; and page 96, lines 10-14.
[186] Company Petition, Appendix B, Attachment 59; and In Re Petition of Fishermen's Atlantic City Windfarm, LLC for the Approval of the State Waters Wind Project and Authorizing Offshore Wind Renewable Energy Certificates, Docket No. EO11050314V, Amended Application, Appendix D, Optimized Project C-B Analysis.xlsx (Confidential); Petition Supplement No. 1, June 8, 2011, Table 11.x.1 (Confidential); and Response to data request RCR-PF-3 (Confidential).

wide differences in their results. Some of the more significant differences in the CBA results between the two applications rests with: (a) the orders-of-magnitude differences in the quantified environmental benefits; (b) the avoided REC purchase assumptions; (c) the volatility hedge benefits and (d) other omitted benefits such as those associated with tourism and "lessons learned."

Q. HAVE YOU DEVELOPED A SCHEDULE THAT COMPARES THE TWO CBA RESULTS?

A. Yes. Schedule DED-32 provides a summary and comparison of two different CBA results. The table is organized in a fashion that compares common study components at the top and itemizes findings from components that differ between the two studies. For instance, both the FACW and the Nautilus CBAs include benefit estimates for avoided emissions, economic multiplier impacts, energy revenues, capacity revenues, avoided REC revenues and merit order impacts. There are three study components that differ between the two CBAs: the FACW CBA included a tourism benefit and a "lessons learned" benefit whereas the Nautilus CBA includes a "volatility hedge benefit."

Q. BEFORE GETTING INTO ANY DETAILS, ARE THERE ANY OBVIOUS HIGH-LEVEL CHALLENGES IN THE CBA RESULTS FROM THESE TWO APPLICATIONS?

A. The first and most obvious difference is that the last FACW application estimated as much as [redacted] This should create considerable concern for the Board since it underscores just how volatile and uncertain many of these project benefits can be. What is more problematic about the wide difference in these

estimates is that the Company is asking New Jersey ratepayers to assume the entire risk associated with their accuracy.

Q. THESE TWO CBAS HAVE A NUMBER OF COMMON COMPONENTS. ARE THE RESULTS BETWEEN THE TWO CBAS COMPARABLE FOR JUST THESE COMMON STUDY ELEMENTS?

A No. I have included a sub-total for the benefits from categories that are generally common between the two CBA studies. [redacted] Again, the high degree of variability between the results of these two CBA studies raises serious questions about the reliability of the results.

Q. ARE THE ENVIRONMENTAL BENEFITS BETWEEN THE TWO CBAS COMPARABLE?

A. No, they are wildly different despite the fact that the OSW facility being developed is the [redacted] Further, the two proposals are only five years apart so even if a "societal" value were appropriate to use for valuing these avoided emissions, it seems reasonable that the avoided environmental unit costs would be comparable between the two studies. This is clearly not the case as the table in Schedule DED-32 shows. [redacted]

Q. ARE THE ESTIMATES FOR THE TOTAL AVOIDED CARBON EMISSIONS BENEFITS COMPARABLE BETWEEN THE TWO STUDIES?

A No. In the FACW application, the Company estimated avoided carbon emissions benefits of [redacted]

Q. ARE THE AVOIDED NOX EMISSIONS BENEFITS THE SAME BETWEEN THE TWO CBA STUDIES?

A. No. The prior FACW application included [redacted]

Q. EXPLAIN THE EXTENT TO WHICH ASSUMPTIONS ABOUT TURBINE LIVES MAY IMPACT THE TWO RESPECTIVE ENVIRONMENTAL BENEFIT ESTIMATES

A. [redacted]

[187] In Re Petition of Fishermen's Atlantic City Windfarm, LLC for the Approval of the State Waters Wind Project and Authorizing Offshore Wind Renewable Energy Certificates, Docket No. EO11050314V, Optimized Project C-B Analysis.xlsx.

[redacted]

Q. TO WHAT EXTENT ARE DIFFERING SOCIETAL VALUES FOR CARBON IMPACTING THE VARIANCE BETWEEN THESE TWO EMISSION BENEFIT ESTIMATES?

A Differences in the societal unit cost of carbon appears to be the primary difference in the two filings. In its FACW filing, the Company assigned a social cost of CO_2 between [redacted]

Q. DISCUSS THE DIFFERENCES IN THE ESTIMATED REC BENEFITS BETWEEN THE TWO APPLICATIONS.

[188] *Id.*; and Company Petition, Appendix B, Attachment 72.
[189] In Re Petition of Fishermen's Atlantic City Windfarm, LLC for the Approval of the State Waters Wind Project and Authorizing Offshore Wind Renewable Energy Certificates, Docket No. EO11050314V, Optimized Project C-B Analysis.
[190] Company Petition, Appendix B, Attachment 72.
[191] *Id.*; and In Re Petition of Fishermen's Atlantic City Windfarm, LLC for the Approval of the State Waters Wind Project and Authorizing Offshore Wind Renewable Energy Certificates, Docket No. EO11050314V, Optimized Project C-B Analysis.

A. There are substantial differences between the REC benefits estimated in the prior FACW application and the current Nautilus application. [redacted] I discussed the issues associated with these estimates, and the assumptions which have led to this overestimated benefit, earlier in my testimony. However, in examining the differences between the two studies, the Board needs to highly discount the Company's currently purported benefits, particularly given prior REC benefit estimates provided in the last FACW filing.

Q. HAS THE COMPANY DEVELOPED ANY NEW BENEFIT CATEGORIES IN THIS APPLICATION?

A. Yes. The Company's current Nautilus application includes a new economic benefit that was not included in its prior FACW application that attempts to estimate what it refers to as volatility hedge benefits. This new category includes [redacted] in benefits that were not included in the prior application. I discussed the problems associated with these estimated volatility hedge benefits earlier in my testimony and noted that there are likely no hedge benefits associated with this proposed transaction.

Q. WHAT JUSTIFICATION, IF ANY, DID THE COMPANY PROVIDE FOR THE EXCLUSION OF ANY QUANTIFIED TOURISM AND "LESSONS LEARNED" BENEFITS IN THE CURRENT APPLICATION?

A. In its prior FACW filing, tourism and lessons learned benefits accounted for [redacted]

[redacted] However, in its current filing, the Company stated that offshore wind is a form of eco-tourism[192] and that the value of lessons learned will be significant.[193] However, it did not attempt to quantify the monetary value of such benefits or provide clarification regarding its decision to exclude them from its costs-benefits analysis.

XIV. CONCLUSIONS AND RECOMMENDATIONS

Q WHAT ARE YOUR RECOMMENDATIONS?

A. I recommend the Board reject the Nautilus proposal since it fails the net benefits test required under OWEDA. The project is simply too expensive and will lead to more costs than benefits for New Jersey ratepayers despite the fact that these costs burdens, according to the Company, may amount to only a few dollars per year.

Q. DOES THIS CONCLUDE YOUR TESTMONY FILED ON OCTOBER 2, 2018?

A. Yes it does. However, I reserve the right to supplement my testimony if any updated or additional information becomes available during the course of this proceeding. I also reserve the right to supplement my testimony after further and more detailed review of the Company's late-filed discovery responses.

[192] Company Petition, Appendix B, page 96, lines 10-14.
[193] Company Petition, Appendix B, page 91, lines 10-20.

DAVID E. DISMUKES, PH.D.

Professor, Executive Director &
Director of Policy Analysis
Center for Energy Studies
Louisiana State University
Baton Rouge, LA 70803-0301
Phone: (225) 578-4343
dismukes@lsu.edu

URL: www.enrg.lsu.edu

Consulting Economist
Acadian Consulting Group, LLC
5800 One Perkins Place Drive
Suite 5-F
Baton Rouge, LA 70808
Phone: (225) 769-2603
daviddismukes@acadianconsulting.com

URL: www.acadianconsulting.com

EDUCATION

Ph.D., Economics, Florida State University, 1995.
M.S., Economics, Florida State University, 1992.
M.S., International Affairs, Florida State University, 1988.
B.A., History, University of West Florida, 1987.
A.A., Liberal Arts, Pensacola State College, 1985.

Master's Thesis: *Nuclear Power Project Disallowances: A Discrete Choice Model of Regulatory Decisions*

Ph.D. Dissertation: *An Empirical Examination of Environmental Externalities and the Least-Cost Selection of Electric Generation Facilities*

ACADEMIC APPOINTMENTS

Louisiana State University, Baton Rouge, Louisiana

Center for Energy Studies

2014-Current	Executive Director
2007-Current	Director, Division of Policy Analysis
2006-Current	Professor
2003-2014	Associate Executive Director
2001-2006	Associate Professor
1999-2001	Research Fellow and Adjunct Assistant Professor
1995-2000	Assistant Professor

College of the Coast and the Environment (Department of Environmental Studies)

2014-Current	Professor (Joint Appointment with CES)
2010-Current	Director, Coastal Marine Institute
2010-2014	Adjunct Professor

E.J. Ourso College of Business Administration (Department of Economics)

2006-Current	Adjunct Professor
2001-2006	Adjunct Associate Professor
1999-2000	Adjunct Assistant Professor

Michigan State University, East Lansing, Michigan

Institute of Public Utilities

2018-current Senior Fellow

Florida State University, Tallahassee, Florida

College of Social Sciences, Department of Economics

1995 Instructor

PROFESSIONAL EXPERIENCE

Acadian Consulting Group, Baton Rouge, Louisiana

2001-Current Consulting Economist/Principal
1995-1999 Consulting Economist/Principal

Econ One Research, Inc., Houston, Texas

1999-2001 Senior Economist

Florida Public Service Commission, Tallahassee, Florida

Division of Communications, Policy Analysis Section

1995 Planning & Research Economist

Division of Auditing & Financial Analysis, Forecasting Section

1993 Planning & Research Economist
1992-1993 Economist

Project for an Energy Efficient Florida/FlaSEIA, Tallahassee, Florida

1994 Energy Economist

Ben Johnson Associates, Inc., Tallahassee, Florida

1991-1992 Research Associate
1989-1991 Senior Research Analyst
1988-1989 Research Analyst

GOVERNMENT APPOINTMENTS

2017-Current Member, National Petroleum Council.
U.S. Department of Energy.

2007-Current Louisiana Representative, Interstate Oil and Gas Compact Commission; Energy Resources, Research & Technology Committee.

2007-Current Louisiana Representative, University Advisory Board Representative; Energy Council (Center for Energy, Environmental and Legislative Research).

2005 Member, Task Force on Energy Sector Workforce and Economic Development (HCR 322).

2003-2005 Member, Energy and Basic Industries Task Force, Louisiana Economic Development Council

2001-2003 Member, Louisiana Comprehensive Energy Policy Commission.

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5. "Value of Production Losses Tallied for 2004-2005 Storms." (2008). With Mark J. Kaiser and Yunke Yu. *Oil and Gas Journal*. Vol. 106.27: 32-26 (July 21) (part 3 of 3).

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ACADEMIC CONFERENCE PAPERS/PRESENTATIONS

1. "The changing nature of Gulf of Mexico energy infrastructure." (2017). Session 3B: New Directions in Social Science Research. 27th Gulf of Mexico Region Information Technology

Meetings. U.S. Department of the Interior, Bureau of Ocean Energy Management, Environmental Studies Program. New Orleans, LA. August 24.

2. "Capacity utilization, efficiency trends, and economic risks for modern CHP installations." (2017). U.S. Department of Energy, 2017 Industrial Energy Technology Conference, New Orleans, LA June 21.

3. "The Impact of Infrastructure Cost Recovery Mechanisms on Pipeline Replacements and Leaks." (2015). With Gregory Upton. Southern Economic Association Meeting 2015. New Orleans, Louisiana. November 23.

4. "The Impact of Infrastructure Cost Recovery Mechanisms on Pipeline Replacements and Leaks" (2015). With Gregory Upton. 38th IAEE International Conference, Antalya, Turkey. May 26.

5. "Modifying Renewables Policies to Sustain Positive Economic and Environmental Change" (2015). IEEE Annual Green Technologies ("Greentech") Conference. April 17.

6. "The Gulf Coast Industrial Investment Renaissance and New CHP Development Opportunities." (2014). Industrial Energy and Technology Conference, New Orleans, Louisiana. May 20.

7. "Estimating Critical Energy Infrastructure Value at Risk from Coastal Erosion" (2014). With Siddhartha Narra. American's Estuaries: 7th Annual Summit on Coastal and Estuarine Habitat Restoration. Washington, D.C., November 3-6.

8. "Economies of Scale, Learning Curves, and Offshore Wind Development Costs" (2012). With Gregory Upton. Southern Economic Association Annual Conference, New Orleans, LA November 17.

9. "Analysis of Risk and Post-Hurricane Reaction." (2009). 25th Annual Information Transfer Meeting. U.S. Department of the Interior, Minerals Management Service. January 7.

10. "Legacy Litigation, Regulation, and Other Determinants of Interstate Drilling Activity Differentials." (2008). With Christopher Peters and Mark Kaiser. 28th Annual USAEE/IAEE North American Conference: Unveiling the Future of Future of Energy Frontiers. New Orleans, LA, December 3.

11. "Gulf Coast Energy Infrastructure Renaissance: Overview." (2008). 28th Annual USAEE/IAEE North American Conference: Unveiling the Future of Future of Energy Frontiers. New Orleans, LA, December 3.

12. "Understanding the Impacts of Katrina and Rita on Energy Industry Infrastructure." (2008). American Chemical Society National Meetings, New Orleans, Louisiana. April 7.

13. "Determining the Economic Value of Coastal Preservation and Restoration on Critical Energy Infrastructure." (2007). With Kristi A. R. Darby and Michelle Barnett. International Association for Energy Economics, Wellington, New Zealand, February 19.

14. "Regulatory Issues in Rate Design, Incentives, and Energy Efficiency." (2007). 34th Annual Public Utilities Research Center Conference, University of Florida. Gainesville, FL. February 16.

15. "An Examination of LNG Development on the Gulf of Mexico." (2007). With Kristi A.R. Darby. US Department of the Interior, Minerals Management Service. 24th Annual Information Technology Meeting. New Orleans, LA. January 9.

16. "OCS-Related Infrastructure on the GOM: Update and Summary of Impacts." (2007). U.S. Department of the Interior, Minerals Management Service. 24th Annual Information Technology Meeting. New Orleans, LA. January 10.

17. "The Economic Value of Coastal Preservation and Restoration on Critical Energy Infrastructure." (2006). With Michelle Barnett. Third National Conference on Coastal and Estuarine Habitat Restoration. Restore America's Estuaries. New Orleans, Louisiana, December 11.

18. "The Impact of Implementing a 20 Percent Renewable Portfolio Standard in New Jersey." (2006). With Seth E. Cureington. Mid-Continent Regional Science Association 37th Annual Conference, Purdue University, Lafayette, Indiana, June 9.

19. "The Impacts of Hurricane Katrina and Rita on Energy infrastructure Along the Gulf Coast." (2006). Environment Canada: 2006 Artic and Marine Oilspill Program. Vancouver, British Columbia, Canada.

20. "Hurricanes, Energy Markets, and Energy Infrastructure in the Gulf of Mexico: Experiences and Lessons Learned." (2006). With Kristi A.R. Darby and Seth E. Cureington. 29th Annual IAEE International Conference, Potsdam, Germany, June 9.

21. "An Examination of the Opportunities for Drilling Incentives on State Leases in Louisiana." (2005). With Kristi A.R. Darby. 28th Annual IAEE International Conference, Taipei, Taiwan (June).

22. "Fiscal Mechanisms for Stimulating Oil and Gas Production on Marginal Leases." (2004). With Jeffrey M. Burke. International Association of Energy Economics Annual Conference, Washington, D.C. (July).

23. "GIS and Applied Economic Analysis: The Case of Alaska Residential Natural Gas Demand." (2003). With Dmitry V. Mesyanzhinov. Presented at the Joint Meeting of the East Lakes and West Lakes Divisions of the Association of American Geographers in Kalamazoo, MI, October 16-18.

24. "Are There Any In-State Uses for Alaska Natural Gas?" (2002). With Dmitry V. Mesyanzhinov and William E. Nebesky. IAEE/USAEE 22nd Annual North American Conference: "Energy Markets in Turmoil: Making Sense of It All." Vancouver, British Columbia, Canada. October 7.

25. "The Economic Impact of State Oil and Gas Leases on Louisiana." (2002). With Dmitry V. Mesyanzhinov. 2002 National IMPLAN Users' Conference. New Orleans, Louisiana, September 4-6.

26. "Moving to the Front of the Lines: The Economic Impact of Independent Power Plant Development in Louisiana." (2002). With Dmitry V. Mesyanzhinov and Williams O. Olatubi. 2002 National IMPLAN Users' Conference. New Orleans, Louisiana, September 4-6.

27. "New Consistent Approach to Modeling Regional Economic Impacts of Offshore Oil and Gas Activities in the Gulf of Mexico." (2002). With Vicki Zatarain. 2002 National IMPLAN Users' Conference. New Orleans, Louisiana, September 4-6.

28. "Distributed Energy Resources, Energy Efficiency, and Electric Power Industry Restructuring." (1999). American Society of Environmental Science Fourth Annual Conference. Baton Rouge, Louisiana. December.

29. “Estimating Efficiency Opportunities for Coal Fired Electric Power Generation: A DEA Approach.” (1999). With Williams O. Olatubi. Southern Economic Association Sixty-ninth Annual Conference. New Orleans, November.

30. "Applied Approaches to Modeling Regional Power Markets." (1999.) With Robert F. Cope. Southern Economic Association Sixty-ninth Annual Conference. New Orleans, November 1999.

31. “Parametric and Non-Parametric Approaches to Measuring Efficiency Potentials in Electric Power Generation.” (1999). With Williams O. Olatubi. International Atlantic Economic Society Annual Conference, Montreal, October.

32. “Asymmetric Choice and Customer Benefits: Lessons from the Natural Gas Industry.” (1999). With Rachelle F. Cope and Dmitry Mesyanzhinov. International Association of Energy Economics Annual Conference. Orlando, Florida. August.

33. “Modeling Regional Power Markets and Market Power.” (1999). With Robert F. Cope. Western Economic Association Annual Conference. San Diego, California. July.

34. “Economic Impact of Offshore Oil and Gas Activities on Coastal Louisiana” (1999). With Dmitry Mesyanzhinov. Annual Meeting of the Association of American Geographers. Honolulu, Hawaii. March.

35. “Empirical Issues in Electric Power Transmission and Distribution Cost Modeling.” (1998). With Robert F. Cope and Dmitry Mesyanzhinov. Southern Economic Association. Sixty-Eighth Annual Conference. Baltimore, Maryland. November.

36. “Modeling Electric Power Markets in a Restructured Environment.” (1998). With Robert F. Cope and Dan Rinks. International Association for Energy Economics Annual Conference. Albuquerque, New Mexico. October.

37. “Benchmarking Electric Utility Distribution Performance.” (1998) With Robert F. Cope and Dmitry Mesyanzhinov. Western Economic Association, Seventy-sixth Annual Conference. Lake Tahoe, Nevada. June.

38. “Power System Operations, Control, and Environmental Protection in a Restructured Electric Power Industry.” (1998). With Fred I. Denny. IEEE Large Engineering Systems Conference on Power Engineering. Nova Scotia, Canada. June.

39. “Benchmarking Electric Utility Transmission Performance.” (1997). With Robert F. Cope and Dmitry Mesyanzhinov. Southern Economic Association, Sixty-seventh Annual Conference. Atlanta, Georgia. November 21-24.

40. “A Non-Linear Programming Model to Estimate Stranded Generation Investments in a Deregulated Electric Utility Industry.” (1997). With Robert F. Cope and Dan Rinks. Institute for Operations Research and Management Science Annual Conference. Dallas Texas. October 26-29.

41. “New Paradigms for Power Engineering Education.” (1997). With Fred I. Denny. International Association of Science and Technology for Development, High Technology in the Power Industry Conference. Orlando, Florida. October 27-30

42. “Cogeneration and Electric Power Industry Restructuring.” (1997). With Andrew N. Kleit. Western Economic Association, Seventy-fifth Annual Conference. Seattle, Washington. July 9-13.

43. "The Unintended Consequences of the Public Utilities Regulatory Policies Act of 1978." (1997). National Policy History Conference on the Unintended Consequences of Policy Decisions. Bowling Green State University. Bowling Green, Ohio. June 5-7.

44. "Assessing Environmental and Safety Risks of the Expanding Role of Independents in E&P Operations on the Gulf of Mexico OCS." (1996). With Allan Pulsipher, Omowumi Iledare, Dmitry Mesyanzhinov, and Bob Baumann. U.S. Department of Interior, Minerals Management Service, 16th Annual Information Transfer Meeting. New Orleans, Louisiana.

45. "Empirical Modeling of the Risk of a Petroleum Spill During E&P Operations: A Case Study of the Gulf of Mexico OCS." (1996). With Omowumi Iledare, Allan Pulsipher, and Dmitry Mesyanzhinov. Southern Economic Association, Sixty-Sixth Annual Conference. Washington, D.C.

46. "Input Price Fluctuations, Total Factor Productivity, and Price Cap Regulation in the Telecommunications Industry" (1996). With Farhad Niami. Southern Economic Association, Sixty-Sixth Annual Conference. Washington, D.C.

47. "Recovery of Stranded Investments: Comparing the Electric Utility Industry to Other Recently Deregulated Industries" (1996). With Farhad Niami and Dmitry Mesyanzhinov. Southern Economic Association, Sixty-Sixth Annual Conference. Washington, D.C.

48. "Spatial Perspectives on the Forthcoming Deregulation of the U.S. Electric Utility Industry." (1996) With Dmitry Mesyanzhinov. Southwest Association of American Geographers Annual Meeting. Norman, Oklahoma.

49. "Comparing the Safety and Environmental Performance of Offshore Oil and Gas Operators." (1995). With Allan Pulsipher, Omowumi Iledare, Dmitry Mesyanzhinov, William Daniel, and Bob Baumann. U.S. Department of Interior, Minerals Management Service, 15th Annual Information Transfer Meeting. New Orleans, Louisiana.

50. "Empirical Determinants of Nuclear Power Plant Disallowances." (1995). Southern Economic Association, Sixty-Fifth Annual Conference. New Orleans, Louisiana.

51. "A Cross-Sectional Model of IntraLATA MTS Demand." (1995). Southern Economic Association, Sixty-Fifth Annual Conference. New Orleans, Louisiana.

ACADEMIC SEMINARS AND PRESENTATIONS

1. "Air Emissions Regulation and Policy: The Recently Proposed Cross State Air Pollution Rule and the Implications for Louisiana Power Generation." Lecture before School of the Coast & Environment. November 5, 2011.

2. "Energy Regulation: Overview of Power and Gas Regulation." Lecture before School of the Coast & Environment, Course in Energy Policy and Law. October 5, 2009.

3. "Trends and Issues in Renewable Energy." Presentation before the School of the Coast & Environment, Louisiana State University. Spring Guest Lecture Series. May 4, 2007.

4. "CES Research Projects and Status." Presentation before the U.S. Department of the Interior, Minerals Management Service, Outer Continental Shelf Scientific Committee Meeting, New Orleans, LA May 22, 2007.

5. "Hurricane Impacts on Energy Production and Infrastructure." Presentation Before the 53rd

Mineral Law Institute, Louisiana State University. April 7, 2006.

6. "Trends and Issues in the Natural Gas Industry and the Development of LNG: Implications for Louisiana. (2004) 51st Mineral Law Institute, Louisiana State University, Baton Rouge, LA. April 2, 2004.

7. "Electric Restructuring and Conservation." (2001). Presentation before the Department of Electrical Engineering, McNesse State University. Lake Charles, Louisiana. May 2, 2001.

8. "Electric Restructuring and the Environment." (1998). Environment 98: Science, Law, and Public Policy. Tulane University. Tulane Environmental Law Clinic. March 7, New Orleans, Louisiana.

9. "Electric Restructuring and Nuclear Power." (1997). Louisiana State University. Department of Nuclear Science. November 7, Baton Rouge, Louisiana.

10. "The Empirical Determinants of Co-generated Electricity: Implications for Electric Power Industry Restructuring." (1997). With Andrew N. Kleit. Florida State University. Department of Economics: Applied Microeconomics Workshop Series. October 17, Tallahassee, Florida.

PROFESSIONAL AND CIVIC PRESENTATIONS

1. "Infrastructure and capacity: challenges for development." (2018). Society of Utility and Regulatory Financial Analysts (SURFA) Annual Meeting, New Orleans, LA, April 20.

2. "Louisiana industrial cogeneration trends." (2018). Annual Louisiana Solid Waste Association Conference, Lafayette, LA, March 16.

3. "Gulf Coast industrial development: overview of trends and issues." (2018). Gulf Coast Power Association Meetings, New Orleans, LA, February 8.

4. "Energy outlook – reflection on market trends and Louisiana implications." (2017). IberiaBank Corporation Bank Board of Directors Meeting, New Orleans, LA. November 15.

5. "Integrated Carbon Capture and Storage in the Louisiana Chemical Corridor." (2017). Industry Associates Advisory Council Meeting, Baton Rouge, LA. November 7.

6. "The outlook for natural gas and energy development on the Gulf Coast." (2017). Louisiana Chemical Association, Annual Meeting, New Orleans, LA. October 26.

7. "Critical energy infrastructure: the big picture on resiliency research." (2017). National Academies of Science, Engineering, and Medicine. New Orleans, LA. September 18.

8. "The changing nature of Gulf of Mexico energy infrastructure." (2017). 27th Gulf of Mexico Region Information Technology Meetings, New Orleans, LA, August 24.

9. "Capacity utilization, efficiency trends, and economic risks for modern CHP installations." (2017). Industrial Energy Technology Conference, New Orleans, LA. June 21.

10. "Crude oil and natural gas outlook: Where are we and where are we going?" (2017). CCREDC Economic Trends Panel. Corpus Christi, TX, June 15.

11. "Navigating through the energy landscape." (2017). Baton Rouge Rotary Luncheon. Baton Rouge, LA, May 24.

12. “The 2017-2018 Louisiana energy outlook.” (2017). Junior Achievement of Greater New Orleans, JA BizTown Speaker Series. New Orleans, LA, May 12.

13. “The Gulf Coast energy economy: trends and outlook.” (2017). Society for Municipal Analysts. New Orleans, LA, April 21.

14. “Recent trends in energy: overview and impact for the banking community.” (2017). Oil and Gas Industry Update, Louisiana Bankers Association. Baton Rouge, LA, March 24.

15. “How supply, demand and prices have influenced unconventional development.” (2016). Energy Annual Meeting, CLEER-University Advisory Board Lecture. New Orleans, LA, September 17.

16. “The Basics of Natural Gas Production, Transportation, and Markets.” (2016). Center for Energy Studies. Baton Rouge, LA, August 1.

17. “Gulf Coast industrial development: trends and outlook.” (2016). Investor Relations Group Meeting, Edison Electric Institute. New Orleans, LA, June 23.

18. “The future of policy and regulation: Unlocking the Treasures of Utility Regulation.” (2016). Annual Meeting, National Conference of Regulatory Attorneys. Tampa, FL, June 20.

19. “Utility mergers: where’s the beef?”. (2016). National Association of State Utility Consumer Advocates Mid-Year Meetings. New Orleans, LA, June 6.

20. “Overview of the Clean Power Plan and its application to Louisiana.” (2016). Shell Oil Company Internal Meeting. April 12.

21. “Energy and economic development on the Gulf Coast: trends and emerging challenges.” (2016). Gas Processors Association Meeting. New Orleans, LA, April 11.

22. “Unconventional Oil and Gas Drilling Trends and Issues.” (2016). French Delegation Visit, LSU Center for Energy Studies. March 16.

23. “Gulf Coast Industrial Growth: Passing clouds or storms on the horizon?” (2016). Gulf Coast Power Association Meetings. New Orleans, LA, February 18.

24. “The Transition to Crisis: What do the recent changes in energy markets mean for Louisiana?” (2016). Louisiana Independent Study Group. February 2.

25. “Regulatory and Ratepayer Issues in the Analysis of Utility Natural Gas Reserves Purchases” (2016). National Association of State Utility Consumer Advocates Gas Consumer Monthly Meeting. January 25.

26. “Emerging Issues in Fuel Procurement: Opportunities & Challenges in Natural Gas Reserves Investment.” (2015). National Association of State Utility Consumer Advocates Annual Meeting. Austin, Texas. November 9.

27. “Trends and Issues in Net Metering and Solar Generation.” (2015). Louisiana Rural Electric Cooperative Meeting. November 5.

28. “Electric Power: Industry Overview, Organization, and Federal/State Distinctions.” (2015). EUCI. October 16.

29. “Natural Gas 101: The Basics of Natural Gas Production, Transportation, and Markets.” (2015). Council of State Governments Special Meeting on Gas Markets. New Orleans, LA. October 14.

30. "Update and General Business Matters." (2015). CES Industry Associates Meeting. Baton Rouge, Louisiana. Fall 2015.

31. "The Impact of Infrastructure Cost Recovery Mechanisms on Pipeline Replacements and Leaks." (2015). 38th IAEE 2015 International Conference. Antalya, Turkey. May 26.

32. "Industry on the Move – What's Next?" (2015). Event Sponsored by Regional Bank and 1012 Industry Report. May 5.

33. "The State of the Energy Industry and Other Emerging Issues." (2015). Lex Mundi Energy & Natural Resources Practice Group Global Meeting. May 5.

34. "Energy, Louisiana, and LSU." (2015). LSU Science Café. Baton Rouge, Louisiana. April 28.

35. "Energy Market Changes and Impacts for Louisiana." (2015). Kinetica Partners Shippers Meeting, New Orleans, Louisiana. April 22.

36. "Incentives, Risk and the Changing Nature of Utility Regulation." (2015). NARUC Staff Subcommittee on Accounting and Finance Meetings, New Orleans, Louisiana. April 22.

37. "Modifying Renewables Policies to Sustain Positive and Economic Change." (2015). IEEE Annual Green Technologies ("Greentech Conference"). April 17.

38. "Louisiana's Changing Energy Environment." (2015). John P. Laborde Energy Law Center Advisory Board Spring Meeting, Baton Rouge, Louisiana. March 27.

39. "The Latest and the Long on Energy: Outlooks and Implications for Louisiana." (2015). Iberia Bank Advisory Board Meeting, Baton Rouge, Louisiana. February 23.

40. "A Survey of Recent Energy Market Changes and their Potential Implications for Louisiana." (2015). Vistage Group, New Orleans, Louisiana. February 4.

41. "Energy Prices and the Outlook for the Tuscaloosa Marine Shale." (2015). Baton Rouge Rotary Club, Baton Rouge, Louisiana. January 28.

42. "Trends in Energy & Energy-Related Economic Development." (2014). Miller and Thompson Presentation, Baton Rouge, Louisiana. December 30.

43. "Overview EPA's Proposed Rule Under Section 111(d) of the Clean Air Act: Impacts for Louisiana." (2014). Louisiana State Bar: Utility Section CLE Annual Meeting, Baton Rouge, Louisiana. November 7.

44. "Overview EPA's Proposed Clean Power Plan and Impacts for Louisiana." (2014). Clean Cities Coalition Meeting, Baton Rouge, Louisiana. November 5.

45. "Impacts on Louisiana from EPA's Proposed Clean Power Plan." (2014). Air & Waste Management Annual Environmental Conference (Louisiana Chapter), Baton Rouge, Louisiana. October 29, 2014.

46. "A Look at America's Growing Demand for Natural Gas." (2014). Louisiana Chemical Association Annual Meeting, New Orleans, Louisiana. October 23.

47. "Trends in Energy & Energy-Related Economic Development." (2014). 2014 Government Finance Officer Association Meetings, Baton Rouge, Louisiana. October 9.

48. "The Conventional Wisdom Associated with Unconventional Resource Development." (2014). National Association for Business Economics Annual Conference, Chicago,

Illinois. September 28.

49. Unconventional Oil & Natural Gas: Overview of Resources, Economics & Policy Issues. (2014). Society of Environmental Journalists Annual Meeting. New Orleans, Louisiana. September 4.

50. "Natural Gas Leveraged Economic Development in the South." (2014). Southern Governors Association Meeting, Little Rock, Arkansas. August 16.

51. "The Past, Present and Future of CHP Development in Louisiana." (2014). Louisiana Public Service Commission CHP Workshop, Baton Rouge, Louisiana. June 25.

52. "Regional Natural Gas Demand Growth: Industrial and Power Generation Trends." (2014). Kinetica Partners Shippers Meeting, New Orleans, Louisiana. April 30.

53. "The Technical and Economic Potential for CHP in Louisiana and the Impact of the Industrial Investment Renaissance on New CHP Capacity Development." (2014). Electric Power 2014, New Orleans, Louisiana. April 1.

54. "Industry Investments and the Economic Development of Unconventional Development." (2014). Tuscaloosa Marine Shale Conference & Expo, Natchez, Mississippi. March 31.

55. Discussion Panelist. Energy Outlook 2035: The Global Energy Industry and Its Impact on Louisiana, (2014). Grow Louisiana Coalition, Baton Rouge, Louisiana. March 18.

56. "Natural Gas and the Polar Vortex: Has Recent Weather Led to a Structural Change in Natural Gas Markets?" (2014). National Association of Statue Utility Consumer Advocates Monthly Gas Committee Meeting. February 19.

57. "Some Unconventional Thoughts on Regional Unconventional Gas and Power Generation Requirements." (2014). Gulf Coast Power Association Special Briefing, New Orleans, Louisiana. February 6.

58. "Leveraging Energy for Industrial Development." (2013). 2013 Governor's Energy Summit, Jackson, Mississippi. December 5.

59. "Natural Gas Line Extension Policies: Ratepayer Issues and Considerations." (2013). National Association of Statue Utility Consumer Advocates Annual Meeting, Orlando, Florida. November 19.

60. "Replacement, Reliability & Resiliency: Infrastructure & Ratemaking Issues in the Power & Natural Gas Distribution Industries." (2013). Louisiana State Bar, Public Utility Section Meetings. November 15.

61. "Natural Gas Markets: Leveraging the Production Revolution into an Industrial Renaissance." (2013). International Technical Conference, Houston, TX. October 11.

62. "Natural Gas, Coal & Power Generation Issues and Trends." (2013). Southeast Labor and Management Public Affairs Committee Conference, Chattanooga, Tennessee. September 27.

63. "Recent Trends in Pipeline Replacement Trackers." (2013). National Association of Statue Utility Consumer Advocates Monthly Gas Committee Meeting. September 19.

64. Discussion Panelist (2013). Think About Energy Summit, America's Natural Gas Alliance, Columbus Ohio. September 16-17.

65. "Future Test Years: Issues to Consider." (2013). National Regulatory Research Institute,

Teleseminar on Future Test Years. August 28.

66. "Industrial Development Outlook for Louisiana." (2013). Louisiana Water Synergy Project Meetings, Jones Walker Law Firm, Baton Rouge, Louisiana. July 30.

67. "Natural Gas & Electric Power Coordination Issues and Challenges." (2013). Utilities State Government Organization Conference, Pointe Clear, Alabama. July 9.

68. "Natural Gas Market Issues & Trends." (2013). Western Conference of Public Service Commissioners, Santa Fe, New Mexico. June 3.

69. "Louisiana Unconventional Natural Gas and Industrial Redevelopment." (2013). Louisiana Chemical Association/Louisiana Chemical Industry Allianace Annual Legislative Conference, Baton Rouge, Louisiana. May 8.

70. "Infrastructure Cost Recovery Mechanism: Overview of Issues." (2013). Energy Bar Association Annual Meeting, Washington, D.C. May 1.

71. "GOM Offshore Oil and Gas." (2013). Energy Executive Roundtable, New Orleans, Louisiana. March 27.

72. "Louisiana Unconventional Natural Gas and Industrial Redevelopment." (2013). Risk Management Association Luncheon, March 21.

73. "Natural Gas Market Update and Emerging Issues." (2013). NASUCA Gas Committee Conference Call/Webinar, March 12.

74. "Unconventional Resources and Louisiana's Manufacturing Development Renaissance." (2013). Baton Rouge Press Club, De La Ronde Hall, Baton Rouge, LA, January 28.

75. "New Industrial Operations Leveraged by Unconventional Natural Gas." (2013) American Petroleum Institute-Louisiana Chapter. Lafayette, LA, Petroleum Club, January 14.

76. "What's Going on with Energy? How Unconventional Oil and Gas Development is Impacting Renewables, Efficiency, Power Markets, and All that Other Stuff." (2012). Atlanta Economics Club Monthly Meeting. Atlanta, GA. December 11.

77. "Trends, Issues, and Market Changes for Crude Oil and Natural Gas." (2012). East Iberville Community Advisory Panel Meeting. St. Gabriel, LA. September 26.

78. "Game Changers in Crude and Natural Gas Markets." (2012). Chevron Community Advisory Panel Meeting. Belle Chase, LA, September 17.

79. "The Outlook for Renewables in a Changing Power and Natural Gas Market." (2012). Louisiana Biofuels and Bioprocessing Summit. Baton Rouge, LA. September 11.

80. "The Changing Dynamics of Crude and Natural Gas Markets." (2012). Chalmette Refining Community Advisory Panel Meeting. Chalmette, LA, September 11.

81. "The Really Big Game Changer: Crude Oil Production from Shale Resources and the Tuscaloosa Marine Shale." (2012). Baton Rouge Chamber of Commerce Board Meeting. Baton Rouge, LA, June 27.

82. "The Impact of Changing Natural Gas Prices on Renewables and Energy Efficiency." (2012). NASUCA Gas Committee Conference Call/Webinar. 12 June 2012.

83. "Issues in Gas-Renewables Coordination: How Changes in Natural Gas Markets Potentially Impact Renewable Development" (2012). Energy Bar Association, Louisiana

Chapter, Annual Meeting, New Orleans, LA. April 12, 2012.

84. "Issues in Natural Gas End-Uses: Are We Really Focusing on the Real Opportunities?" (2012). Energy Bar Association, Louisiana Chapter, Annual Meeting, New Orleans, LA. April 12, 2012.

85. "The Impact of Legacy Lawsuits on Conventional Oil and Gas Drilling in Louisiana." (2012). Louisiana Oil and Gas Association Annual Meeting, Lake Charles, LA. February 27, 2012.

86. "The Impact of Legacy Lawsuits on Conventional Oil and Gas Drilling in Louisiana." (2012) Louisiana Oil and Gas Association Annual Meeting. Lake Charles, Louisiana. February 27, 2012.

87. "Louisiana's Unconventional Plays: Economic Opportunities, Policy Challenges. Louisiana Mid-Continent Oil and Gas Association 2012 Annual Meeting. (2012) New Orleans, Louisiana. January 26, 2012.

88. "EPA's Recently Proposed Cross State Air Pollution Rule ("CSAPR") and Its Impacts on Louisiana." (2011). Bossier Chamber of Commerce. November 18, 2011.

89. "Facilitating the Growth of America's Natural Gas Advantage." (2011). BASF U.S. Shale Gas Workshop Management Meeting. Florham Park, New Jersey. November 1, 2011.

90. "CSAPR and EPA Regulations Impacting Louisiana Power Generation." (2011). Air and Waste Management Association (Louisiana Section) Fall Conference. Environmental Focus 2011: a Multi-Media Forum. Baton Rouge, LA. October 25, 2011.

91. "Natural Gas Trends and Impact on Industrial Development." (2011). Central Gulf Coast Industrial Alliance Conference. Arthur R. Outlaw Convention Center. Mobile, AL. September 22, 2011.

92. "Energy Market Changes and Policy Challenges." (2011). Southeast Manpower Tripartite Alliance ("SEMTA") Summer Conference. Nashville, TN September 2, 2011.

93. "EPA Regulations, Rates & Costs: Implications for U.S. Ratepayers." (2011). Workshop: "A Smarter Approach to Improving Our Environment." 38th Annual American Legislative Exchange Council ("ALEC") Meetings. New Orleans, LA. August 5, 2011.

94. Panelist/Moderator. Workshop: "Why Wait? Start Energy Independence Today." 38th Annual American Legislative Exchange Council ("ALEC") Meetings. New Orleans, LA. August 4, 2011.

95. "Facilitating the Growth of America's Natural Gas Advantage." Texas Chemical Council, Board of Directors Summer Meeting. San Antonio, TX. July 28, 2011.

96. "Creating Ratepayer Benefits by Reconciling Recent Gas Supply Opportunities with Past Policy Initiatives." National Association of State Utility Consumer Advocates ("NASUCA"), Monthly Gas Committee Meeting. July 12, 2011.

97. "Energy Market Trends and Policies: Implications for Louisiana." (2011). Lakeshore Lion's Club Monthly Meeting. Baton Rouge, Louisiana. June 20, 2011.

98. "America's Natural Gas Advantage: Securing Benefits for Ratepayers Through Paradigm Shifts in Policy." Southeastern Association of Regulatory Commissioners ("SEARUC") Annual Meeting. Nashville, Tennessee. June 14, 2011.

99. "Learning Together: Building Utility and Clean Energy Industry Partnerships in the Southeast." (2011). American Solar Energy Society National Solar Conference. Raleigh Convention Center, Raleigh, North Carolina. May 20, 2011.

100. "Louisiana Energy Outlook and Trends." (2011). Executive Briefing. Counsul General of Canada. LSU Center for Energy Studies, Baton Rouge, Louisiana. May 24, 2011.

101. "Louisiana's Natural Gas Advantage: Can We Hold It? Grow It? Or Do We Need to be Worrying About Other Problems?" (2011). Louisiana Chemical Association Annual Legislative Conference, Baton Rouge, Louisiana, May 5, 2011.

102. "Energy Outlook and Trends: Implications for Louisiana. (2011). Executive Briefing, Legislative Staff, Congressman William Cassidy. LSU Center for Energy Studies, Baton Rouge, Louisiana. March 25, 2011.

103. "Regulatory Issues in Inflation Adjustment Mechanisms and Allowances." (2011). Gas Committee, National Association of State Utility Consumer Advocates ("NASUCA"). February 15, 2011.

104. "Regulatory Issues in Inflation Adjustment Mechanisms and Allowances." (2010). 2010 Annual Meeting, National Association of State Utility Consumer Advocates ("NASUCA"), Omni at CNN Center, Atlanta, Georgia, November 16, 2010.

105. "How Current and Proposed Energy Policy Impacts Consumers and Ratepayers." (2010). 122nd Annual Meeting, National Association of Regulatory Utility Commissioners ("NARUC"), Omni at CNN Center, Atlanta, Georgia, November 15, 2010.

106. "Energy Outlook: Trends and Policies." (2010). 2010 Tri-State Member Service Conference; Arkansas, Louisiana, and Mississippi Electric Cooperatives. L'Auberge du Lac Casino Resort, Lake Charles, Louisiana, October 14, 2010.

107. "Deepwater Moratorium and Louisiana Impacts." (2010). The Energy Council Annual Meeting. Gulf of Mexico Deepwater Horizon Accident, Response, and Policy. Beau Rivage Conference Center. Biloxi, Mississippi. September 25, 2010.

108. "Overview on Offshore Drilling and Production Activities in the Aftermath of Deepwater Horizon." (2010) Jones Walker Banking Symposium. The Oil Spill: What Will it Mean for Banks in the Region? New Orleans, Louisiana. August 31, 2010.

109. "Long-Term Energy Sector Impacts from the Oil Spill." (2010). Second Annual Louisiana Oil & Gas Symposium. The BP Gulf Oil Spill: Long-Term Impacts and Strategies. Baton Rouge Geological Society. August 16, 2010.

110. "Overview and Issues Associated with the Deepwater Horizon Accident." (2010). Global Interdependence Meeting on Energy Issues. Baton Rouge, LA. August 12, 2010.

111. "Overview and Issues Associated with the Deepwater Horizon Accident." (2010). Regional Roundtable Webinar. National Association for Business Economics. August 10, 2010.

112. "Deepwater Moratorium: Overview of Impacts for Louisiana." Louisiana Association of Business and Industry Meeting. Baton Rouge, LA. June 25, 2010.

113. Moderator. Senior Executive Roundtable on Industrial Energy Efficiency. U.S. Department of Energy Conference on Industrial Efficiency. Office of Renewable Energy and Energy Efficiency. Royal Sonesta Hotel, New Orleans, LA. May 21, 2010.

114. "The Energy Outlook: Trends and Policies Impacting Southeastern Natural Gas Supply

and Demand Growth." Second Annual Local Economic Analysis and Research Network ("LEARN") Conference. Federal Reserve Bank of Atlanta. March 29, 2010.

115. "Natural Gas Supply Issues: Gulf Coast Supply Trends and Implications for Louisiana." Energy Bar Association, New Orleans Chapter Meeting. Jones Walker Law Firm. January 28, 2010, New Orleans, LA.

116. "Potential Impacts of Federal Greenhouse Gas Legislation on Louisiana Industry." LCA Government Affairs Committee Meeting. November 10, 2009. Baton Rouge, LA

117. "Regulatory and Ratemaking Issues Associated with Cost and Revenue Tracker Mechanisms." National Association of State Utility Consumer Advocates ("NASUCA") Annual Meeting. November 10, 2009.

118. "Louisiana's Stakes in the Greenhouse Gas Debate." Louisiana Chemical Association and Louisiana Chemical Industry Alliance Annual Meeting: The Billing Dollar Budget Crisis: Catastrophe or Change? New Orleans, LA.

119. "Gulf Coast Energy Outlook: Issues and Trends." Women's Energy Network, Louisiana Chapter. September 17, 2009. Baton Rouge, LA.

120. "Gulf Coast Energy Outlook: Issues and Trends." Natchez Area Association of Energy Service Companies. September 15, 2009, Natchez, MS.

121. "The Small Picture: The Cost of Climate Change to Louisiana." Louisiana Association of Business and Industry, U.S. Chamber of Commerce, Louisiana Oil and Gas Association, and LSU Center for Energy Studies Conference: Can Louisiana Make a Buck After Climate Change Legislation? August 21, 2009. Baton Rouge, LA.

122. "Carbon Legislation and Clean Energy Markets: Policy and Impacts." National Association of Conservation Districts, South Central Region Meeting. August 14, 2009. Baton Rouge, LA.

123. "Evolving Carbon and Clean Energy Markets." The Carbon Emissions Continuum: From Production to Consumption." Jones Walker Law Firm and LSU Center for Energy Studies Workshop. June 23, 2009. Baton Rouge, LA

124. "Potential Impacts of Cap and Trade on Louisiana Ratepayers: Preliminary Results." (2009). Briefing before the Louisiana Public Service Commission. Business and Executive Meeting, May 12, 2009. Baton Rouge, LA.

125. "Natural Gas Outlook." (2009). Briefing before the Louisiana Public Service Commission. Business and Executive Meeting, May 12, 2009. Baton Rouge, LA.

126. "Gulf Coast Energy Outlook: Issues and Trends." (2009). ISA-Lafayette Technical Conference & Expo. Cajundome Conference Center. Lafayette, Louisiana. March 12, 2009.

127. "The Cost of Energy Independence, Climate Change, and Clean Energy Initiatives on Utility Ratepayers." (2009). National Association of Business Economics (NABE). 25th Annual Washington Economic Policy Conference: Restoring Financial and Economic Stability. Arlington, VA March 2, 2009.

128. Panelist, "Expanding Exploration of the U.S. OCS" (2009). Deep Offshore Technology International Conference and Exhibition. PennWell. New Orleans, Louisiana. February 4, 2009.

129. "Gulf Coast Energy Outlook." (2008.) Atmos Energy Regional Management Meeting. Louisiana and Mississippi Division. New Orleans, Louisiana. October 8, 2008.

130. "Background, Issues, and Trends in Underground Hydrocarbon Storage." (2008). Presentation before the LSU Center for Energy Studies Industry Advisory Board Meeting. Baton Rouge, Louisiana. August 27, 2008.

131. "Greenhouse Gas Regulations and Policy: Implications for Louisiana." (2008). Presentation before the Praxair Customer Seminar. Houston, Texas, August 14, 2008.

132. "Market and Regulatory Issues in Alternative Energy and Louisiana Initiatives." (2008). Presentation before the 2008 Statewide Clean Cities Coalition Conference: Making Sense of Alternative Fuels and Advanced Technologies. New Orleans, Louisiana, March 27, 2008.

133. "Regulatory Issues in Rate Design, Incentives, and Energy Efficiency." (2007) Presentation before the New Hampshire Public Utilities Commission. Workshop on Energy Efficiency and Revenue Decoupling. November 7, 2007.

134. "Regulatory Issues for Consumer Advocates in Rate Design, Incentives, and Energy Efficiency." (2007). National Association of State Utility Consumer Advocates, Mid-Year Meeting. June 12, 2007.

135. "Regulatory and Policy Issues in Nuclear Power Plant Development." (2007). LSU Center for Energy Studies Industry Advisory Council Meeting. Baton Rouge, LA. March 23, 2007.

136. "Oil and Gas in the Gulf of Mexico: A North American Perspective." (2007). Canadian Consulate, Heads of Mission EnerNet Workshop, Houston, Texas. March 20, 2007.

137. "Regulatory Issues for Consumer Advocates in Rate Design, Incentives & Energy Efficiency. (2007). National Association of State Utility Consumer Advocates ("NASUCA") Gas Committee Monthly Meeting. February 13, 2006.

138. "Recent Trends in Natural Gas Markets." (2006). National Association of Regulatory Utility Commissioners, 118th Annual Convention. Miami, FL November 14, 2006.

139. "Energy Markets: Recent Trends, Issues & Outlook." (2006). Association of Energy Service Companies (AESC) Meeting. Petroleum Club, Lafayette, LA, November 8, 2006.

140. "Energy Outlook" (2006). National Business Economics Issues Council. Quarterly Meeting, Nashville, TN, November 1-2, 2006.

141. "Global and U.S. Energy Outlook." (2006). Energy Virginia Conference. Virginia Military Institute, Lexington, VA October 17, 2006.

142. "Interdependence of Critical Energy Infrastructure Systems." (2006). Cross Border Forum on Energy Issues: Security and Assurance of North American Energy Systems. Woodrow Wilson Center for International Scholars. Washington, DC, October 13, 2006.

143. "Determining the Economic Value of Coastal Preservation and Restoration on Critical Energy Infrastructure." (2006) The Economic and Market Impacts of Coastal Restoration: America's Wetland Economic Forum II. Washington, DC September 28, 2006.

144. "Relationships between Power and Other Critical Energy Infrastructure." (2006). Rebuilding the New Orleans Region: Infrastructure Systems and Technology Innovation Forum. United Engineering Foundation. New Orleans, LA, September 24-25, 2006.

145. "Outlook, Issues, and Trends in Energy Supplies and Prices." (2006.) Presentation to the Southern States Energy Board, Associate Members Meeting. New Orleans, Louisiana. July 14, 2006.

146. "Energy Sector Outlook." (2006). Baton Rouge Country Club Meeting. Baton Rouge, Louisiana. July 11, 2006.

147. "Oil and Gas Industry Post 2005 Storm Events." (2006). American Petroleum Institute, Teche Chapter. Production, Operations, and Regulations Annual Meeting. Lafayette, Louisiana. June 29, 2006.

148. "Concentration of Energy Infrastructure in Hurricane Regions." (2006). Presentation before the National Commission on Energy Policy Forum: Ending the Stalemate on LNG Facility Siting. Washington, DC. June 21, 2006.

149. "LNG—A Premier." (2006). Presentation Given to the U.S. Department of Energy's "LNG Forums." Los Angeles, California. June 1, 2006.

150. "Regional Energy Infrastructure, Production and Outlook." (2006). Executive Briefing for Board of Directors, Louisiana Oil and Gas Plc., Enhanced Exploration, Inc. and Energy Self-Service, Inc. Covington, Louisiana, May 12, 2006.

151. "The Impacts of the Recent Hurricane Season on Energy Production and Infrastructure and Future Outlook." Presentation before the Industrial Energy Technology Conference 2006. New Orleans, Louisiana, May 9, 2006.

152. "Update on Regional Energy Infrastructure and Production." (2006). Executive Briefing for Delegation Participating in U.S. Department of Commerce Gulf Coast Business Investment Mission. Baton Rouge, Louisiana May 5, 2006.

153. "Hurricane Impacts on Energy Production and Infrastructure." (2006). Presentation before the Interstate Natural Gas Association of America Mid-Year Meeting. Hyatt Regency Hill Country. April 21, 2006.

154. "LNG—A Premier." Presentation Given to the U.S. Department of Energy's "LNG Forums." Astoria, Washington. April 28, 2006.

155. Natural Gas Market Outlook. Invited Presentation Given to the Georgia Public Service Commission and Staff. Georgia Institute of Technology, Atlanta, Georgia. March 10, 2006.

156. The Impacts of Hurricanes Katrina and Rita on Louisiana's Energy Industry. Presentation to the Louisiana Economic Development Council. Baton Rouge, Louisiana. March 8, 2006.

157. Energy Markets: Hurricane Impacts and Outlook. Presentation to the 2006 Louisiana Independent Oil and Gas Association Annual Conference. L'Auberge du Lac Resort and Casino. Lake Charles, Louisiana. March 6, 2006

158. Energy Market Outlook and Update on Hurricane Damage to Energy Infrastructure. Presentation to the Energy Council 2005 Global Energy and Environmental Issues Conference. Santa Fe, New Mexico, December 10, 2005.

159. "Putting Our Energy Infrastructure Back Together Again." Presentation Before the 117th Annual Convention of the National Association of Regulatory Utility Commissioners (NARUC). November 15, 2005. Palm Springs, CA

160. “Hurricanes and the Outlook for Energy Markets.” Presentation before the Baton Rouge Rotary Club. November 9, 2005, Baton Rouge, LA.

161. “Hurricanes, Energy Supplies and Prices.” Presentation before the Louisiana Department of Natural Resources and Atchafalaya Basin Committee Meeting. November 8, 2005. Baton Rouge, LA.

162. “The Impact of the Recent Hurricane’s on Louisiana’s Energy Industry.” Presentation before the Louisiana Independent Oil and Gas Association Board of Directors Meeting. November 8, 2005. Baton Rouge, LA.

163. “The Impact of the Recent Hurricanes on Louisiana’s Infrastructure and National Energy Markets.” Presentation before the Baton Rouge City Club Distinguished Speaker Series. October 13, 2005. Baton Rouge, LA.

164. “The Impact of the Recent Hurricanes on Louisiana’s Infrastructure and National Energy Markets.” Presentation before Powering Up: A Discussion About the Future of Louisiana’s Energy Industry. Special Lecture Series Sponsored by the Kean Miller Law Firm. October 13, 2005. Baton Rouge, LA.

165. “The Impact of Hurricane Katrina on Louisiana’s Energy Infrastructure and National Energy Markets.” Special Lecture on Hurricane Impacts, LSU Center for Energy Studies, September 29, 2005.

166. “Louisiana Power Industry Overview.” Presentation before the Clean Air Interstate Rule Implementation Stakeholders Meeting. August 11, 2005. Louisiana Department of Environmental Quality.

167. “CES 2005 Legislative Support and Outlook for Energy Markets and Policy.” Presentation before the LMOGA/LCA Annual Post-Session Legislative Committee Meeting. August 10-13, 2005. Perdido Key, Florida.

168. “Electric Restructuring: Past, Present, and Future.” Presentation to the Southeastern Association of Tax Administrators Annual Conference. Sheraton Hotel and Conference Facility. New Orleans, LA July 12, 2005.

169. “The Outlook for Energy.” Lagniappe Studies Continuing Education Course. Baton Rouge, LA. July 11, 2005.

170. “The Outlook for Energy.” Sunshine Rotary Club. Baton Rouge, LA. April 27, 2005.

171. “Background and Overview of LNG Development.” Energy Council Workshop on LNG/CNG. Biloxi, Ms: Beau Rivage Resort and Hotel, April 9, 2005.

172. “Natural Gas Supply, Prices, and LNG: Implications for Louisiana Industry.” Cytec Corporation Community Advisory Panel. Fortier, LA January 14, 2005.

173. “The Economic Opportunities for a Limited Industrial Retail Choice Plan.” Louisiana Department of Economic Development. Baton Rouge, Louisiana. November 19, 2004.

174. “Energy Issues for Industrial Customers of Gas and Power.” Louisiana Association of Business and Industry, Energy Council Meeting. Baton Rouge, Louisiana. October 11, 2004.

175. “Energy Issues for Industrial Customers of Gas and Power.” Annual Meeting of the Louisiana Chemical Association and the Louisiana Chemical Industry Alliance. Point Clear, Alabama. October 8, 2004.

176. “Energy Issues for Industrial Customers of Gas and Power.” American Institute of Chemical Engineers – New Orleans Section. New Orleans, LA. September 22, 2004.

177. “Natural Gas Supply, Prices and LNG: Implications for Louisiana Industry.” Dow Chemical Company Community Advisory Panel Meeting. Plaquemine, LA. August 9, 2004.

178. “Energy Issues for Industrial Customers of Gas and Power.” Louisiana Chemical Association Post-Legislative Meeting. Springfield, LA. August 9, 2004.

179. “LNG In Louisiana.” Joint Meeting of the Louisiana Economic Development Council and the Governors Cabinet Advisory Council. Baton Rouge, LA. August 5, 2004.

180. “Louisiana Energy Issues.” Louisiana Mid-Continent Oil and Gas Association Post Legislative Meetings. Sandestin, Florida. July 28, 2004.

181. “The Gulf South: Economic Opportunities Related to LNG.” Presentation before the Energy Council’s 2004 State and Provincial Energy and Environmental Trends Conference. Point Clear, AL, June 26, 2004.

182. “Natural Gas and LNG Issues for Louisiana.” Presentation before the Rhodia Community Advisory Panel. May 20, 2004, Baton Rouge, LA.

183. “The Economic Opportunities for LNG Development in Louisiana.” Presentation before the Louisiana Chemical Association Plant Managers Meeting. May 27, 2004. Baton Rouge, LA.

184. The Economic Opportunities for LNG Development in Louisiana.” Presentation before the Louisiana Chemical Association/Louisiana Chemical Industry Alliance Legislative Conference. May 26, 2004. Baton Rouge, LA.

185. “The Economic Opportunities for LNG Development in Louisiana.” Presentation before the Petrochemical Industry Cluster, Greater New Orleans, Inc. May 19, 2004, Destrehan, LA.

186. “Industry Development Issues for Louisiana: LNG, Retail Choice, and Energy.” Presentation before the LSU Center for Energy Studies Industry Associates. May 14, 2004, Baton Rouge, LA.

187. “The Economic Opportunities for LNG Development in Louisiana.” Presentation before the Board of Directors, Greater New Orleans, Inc. May 13, 2004, New Orleans, LA.

188. “Natural Gas Outlook: Trends and Issues for Louisiana.” Presentation before the Louisiana Joint Agricultural Association Meetings. January 14, 2004, Hotel Acadiana, Lafayette, Louisiana.

189. “Natural Gas Outlook” Presentation before the St. James Parish Community Advisory Panel Meeting. January 7, 2004, IMC Production Facility, Convent, Louisiana.

190. “Competitive Bidding in the Electric Power Industry.” Presentation before the Association of Energy Engineers. Business Energy Solutions Expo. December 11-12, 2003, New Orleans, Louisiana.

191. “Regional Transmission Organization in the South: The Demise of SeTrans” Presentation before the LSU Center for Energy Studies Industry Associates Advisory Council Meeting. December 9, 2003. Baton Rouge, Louisiana.

192. “Affordable Energy: The Key Component to a Strong Economy.” Presentation before the National Association of Regulatory Utility Commissioners (“NARUC”), November 18, 2003, Atlanta, Georgia.

193. “Natural Gas Outlook.” Presentation before the Louisiana Chemical Association, October 17, 2003, Pointe Clear, Alabama.

194. “Issues and Opportunities with Distributed Energy Resources.” Presentation before the Louisiana Biomass Council. April 17, 2003, Baton Rouge, Louisiana.

195. “What’s Happened to the Merchant Energy Industry? Issues, Challenges, and Outlook” Presentation before the LSU Center for Energy Studies Industry Associates Advisory Council Meeting. November 12, 2002. Baton Rouge, Louisiana.

196. “An Introduction to Distributed Energy Resources.” Presentation before the U.S. Department of Energy, Office of Renewable Energy and Energy Efficiency, State Energy Program/Rebuild America Conference, August 1, 2002, New Orleans, Louisiana.

197. “Merchant Energy Development Issues in Louisiana.” Presentation before the Program Committee of the Center for Legislative, Energy, and Environmental Research (CLEER), Energy Council. April 19, 2002.

198. “Power Plant Siting Issues in Louisiana.” Presentation before 24th Annual Conference on Waste and the Environment. Sponsored by the Louisiana Department of Environmental Quality. Lafayette, Louisiana, Cajundome. March 12, 2002.

199. “Merchant Power and Deregulation: Issues and Impacts.” Presentation before the Air and Waste Management Association Annual Meeting. Baton Rouge, LA, November 15, 2001.

200. “Moving to the Front of the Lines: The Economic Impact of Independent Power Production in Louisiana.” Presentation before the LSU Center for Energy Studies Merchant Power Generation and Transmission Conference, Baton Rouge, LA. October 11, 2001.

201. “Economic Impacts of Merchant Power Plant Development in Mississippi.” Presentation before the U.S. Oil and Gas Association Annual Oil and Gas Forum. Jackson, Mississippi. October 10, 2001.

202. “Economic Opportunities for Merchant Power Development in the South.” Presentation before the Southern Governor’s Association/Southern State Energy Board Meetings. Lexington, KY. September 9, 2001.

203. “The Changing Nature of the Electric Power Business in Louisiana.” Presentation before the Louisiana Department of Environmental Quality. Baton Rouge, LA, August 27, 2001.

204. “Power Business in Louisiana: Background and Issues.” Presentation before the Louisiana Interagency Group on Merchant Power Development . Baton Rouge, LA, July 16, 2001.

205. “The Changing Nature of the Electric Power Business in Louisiana: Background and Issues.” Presentation before the Louisiana Office of the Governor. Baton Rouge, LA, July 16, 2001.

206. “The Changing Nature of the Electric Power Business in Louisiana: Background and Issues.” Presentation before the Louisiana Department of Economic Development. Baton Rouge, LA, July 3, 2001.

207. "The Economic Impacts of Merchant Power Plant Development In Mississippi." Presentation before the Mississippi Public Service Commission. Jackson, Mississippi, March 20, 2001.

208. "Energy Conservation and Electric Restructuring." With Ritchie D. Priddy. Presentation before the Louisiana Department of Natural Resources. Baton Rouge, Louisiana, October 23, 2000.

209. "Pricing and Regulatory Issues Associated with Distributed Energy." Joint Conference by Econ One Research, Inc., the Louisiana State University Distributed Energy Resources Initiative, and the University of Houston Energy Institute: "Is the Window Closing for Distributed Energy?" Houston, Texas, October 13, 2000.

210. "Electric Reliability and Merchant Power Development Issues." Technical Meetings of the Louisiana Public Service Commission. Baton Rouge, LA. August 29, 2000.

211. "A Introduction to Distributed Energy Resources." Summer Meetings, Southeastern Association of Regulatory Utility Commissioners (SEARUC). New Orleans, LA. June 27, 2000.

212. Roundtable Moderator/Discussant. Mid-South Electric Reliability Summit. U.S. Department of Energy. New Orleans, Louisiana. April 24, 2000.

213. "Electricity 101: Definitions, Precedents, and Issues." Energy Council's 2000 Federal Energy and Environmental Matters Conference. Loews L'Enfant Plaza Hotel, Washington, D.C. March 11-13, 2000.

214. "LSU/CES Distributed Energy Resources Initiatives." Los Alamos National Laboratories. Office of Energy and Sustainable Systems. Los Alamos, New Mexico. February 16, 2000.

215. "Distributed Energy Resources Initiatives." Louisiana State University, Center for Energy Studies Industry Associates Meeting. Baton Rouge, Louisiana. December 15, 1999.

216. "Merchant Power Opportunities in Louisiana." Louisiana Mid-Continent Oil and Gas Association (LMOGA) Power Generation Committee Meetings. Baton Rouge, Louisiana. November 10, 1999.

217. Roundtable Discussant. "Environmental Regulation in a Restructured Market" The Big E: How to Successfully Manage the Environment in the Era of Competitive Energy. PUR Conference. New Orleans, Louisiana. May 24, 1999.

218. "The Political Economy of Electric Restructuring In the South" Southeastern Electric Exchange, Rate Section Annual Conference. New Orleans, Louisiana. May 7, 1999.

219. "The Dynamics of Electric Restructuring in Louisiana." Joint Meeting of the American Association of Energy Engineers and the International Association of Facilities Managers. Metairie, Louisiana. April 29, 1999.

220. "The Implications of Electric Restructuring on Independent Oil and Gas Operations." Petroleum Technology Transfer Council Workshop: Electrical Power Cost Reduction Methods in Oil and Gas Field Operations. Lafayette, Louisiana, March 24, 1999.

221. "What's Happened to Electricity Restructuring in Louisiana?" Louisiana State University, Center for Energy Studies Industry Associates Meeting. March 22, 1999.

222. "A Short Course on Electric Restructuring." Central Louisiana Electric Company. Sales and Marketing Division. Mandeville, Louisiana, October 22, 1998.

223. “The Implications of Electric Restructuring on Independent Oil and Gas Operations.” Petroleum Technology Transfer Council Workshop: Electrical Power Cost Reduction Methods in Oil and Gas Field Operations. Shreveport, Louisiana, October 13, 1998.

224. “How Will Utility Deregulation Affect Tourism.” Louisiana Travel Promotion Association Annual Meeting, Alexandria, Louisiana. January 15, 1998.

225. “Reflections and Predictions on Electric Utility Restructuring in Louisiana.” With Fred I. Denny. Louisiana State University, Center for Energy Studies Industry Associates Meeting. November 20, 1997.

226. “Electric Utility Restructuring in Louisiana.” Hammond Chamber of Commerce, Hammond, Louisiana. October 30, 1997.

227. “Electric Utility Restructuring.” Louisiana Association of Energy Engineers. Baton Rouge, Louisiana. September 11, 1997.

228. “Electric Utility Restructuring: Issues and Trends for Louisiana.” Opelousas Chamber of Commerce, Opelousas, Louisiana. June 24, 1997.

229. “The Electric Utility Restructuring Debate In Louisiana: An Overview of the Issues.” Annual Conference of the Public Affairs Research Council of Louisiana. Baton Rouge, Louisiana. March 25, 1997.

230. “Electric Restructuring: Louisiana Issues and Outlook for 1997.” Louisiana State University, Center for Energy Studies Industry Associates Meeting, Baton Rouge, Louisiana, January 15, 1997.

231. “Restructuring the Electric Utility Industry.” Louisiana Propane Gas Association Annual Meeting, Alexandria, Louisiana, December 12, 1996.

232. “Deregulating the Electric Utility Industry.” Eighth Annual Economic Development Summit, Baton Rouge, Louisiana, November 21, 1996.

233. “Electric Utility Restructuring in Louisiana.” Jennings Rotary Club, Jennings, Louisiana, November 19, 1996.

234. “Electric Utility Restructuring in Louisiana.” Entergy Services, Transmission and Distribution Division, Energy Centre, New Orleans, Louisiana, September 12, 1996

235. “Electric Utility Restructuring” L ouisiana Electric Cooperative Association, Baton Rouge, Louisiana, August 27, 1996.

236. “Electric Utility Restructuring -- Background and Overview.” Louisiana Public Service Commission, Baton Rouge, Louisiana, August 14, 1996.

237. “Electric Utility Restructuring.” Sunshine Rotary Club Meetings, Baton Rouge, Louisiana, August 8, 1996.

238. Roundtable Moderator, “Stakeholder Perspectives on Electric Utility Stranded Costs.” Louisiana State University, Center for Energy Studies Seminar on Electric Utility Restructuring in Louisiana, Baton Rouge, May 29, 1996.

239. Panelist, “Deregulation and Competition.” American Nuclear Society: Second Annual Joint Louisiana and Mississippi Section Meetings, Baton Rouge, Louisiana, April 20, 1996.

EXPERT WITNESS, LEGISLATIVE, AND PUBLIC TESTIMONY; EXPERT REPORTS,

RECOMMENDATIONS, AND AFFIDAVITS

1. Expert Testimony. Docket No. ER18010029 and GR18010030. (2018). *In the Matter of the Petition of Public Service Electric and Gas Company for Approval of an Increase in Electric and Gas Rates and for Changes in the Tariffs for Electric and Gas Service, B.P.U.N.J. No. 16 Electric and B.P.U.N.J No. 16 Gas, and for Changes in Depreciation Rates, Pursuant to N.J.S.A. 48:2-18, N.J.S.A. 48:2-21 and N.J.S.A. 48:2-21.1, and for Other Appropriate Relief.* Issues: rate proposal, revenue decoupling, regulatory policy, cost benchmarking.

2. Expert Testimony. Docket No. 17-071-U. (2018). Before the Arkansas Public Service Commission*. In the Matter of the Application of Black Hills Energy Arkansas, Inc. for Approval of a General Change in Rates and Tariffs*. Issues: cost of service, rate design, billing determinates.

3. Expert Testimony. Docket No. 17-010-FR. (2018). Before the Arkansas Public Service Commission. *In the Matter of the Formula Rate Plan Filing of CenterPoint Energy Resources Corp. D/B/A CenterPoint Energy Arkansas Gas Pursuant to APSC Docket No. 15-098-U.* Issues: cost of service, rate design, alternative regulation, formula rate plan.

4. Expert Testimony. Case No. PU-17-398. (2018). Before the North Dakota Public Service Commission. *In the Matter of the Application of Otter Tail Power Company for Authority to Increase Rates for Electric Utility Service in North Dakota*. Issues: cost of service, marginal cost of service, and rate design.

5. Expert Testimony. Docket No. 20170179-GU. (2018). Before the Florida Public Service Commission. *In re: Petition for rate increase and approval of depreciation study by Florida City Gas.* On Behalf of the Citizens of the State of Florida. Issues: policy issues concerning long-term gas capacity procurement.

6. Expert Testimony. Docket No. 18-KCPE-095-MER. (2018). Before the Kansas Corporation Commission. *In the Matter of the Joint Application of Great Plains Energy Incorporated, Kansas City Power & Light Company, and Westar Energy, Inc. for Approval of the Merger of Westar, Inc. and Great Plains Energy Incorporated.* On the Behalf of the Kansas Electric Power Cooperative, Inc. Issues: merger/acquisition policy, financial risk, and ring-fencing.

7. Expert Testimony. Docket No. GR17070776. (2018). Before the New Jersey Board of Public Utilities. In the Matter of the Petition of Public Service Electric and Gas Company for Approval of the Next Phase of the Gas System Modernization Program and Associated Cost Recovery Mechanism ("GSMP II"). Issues: economic impact, infrastructure replacement program rider, pipeline replacement, leak rate comparisons and cost benefit analysis.

8. Expert Affidavit. Case No. 18-489. (2018). Before the Civil District Court for the Parish of Orleans, State of Louisiana. *Bayou Bridge Pipeline, LLC versus The White Castle Lumber and Shingle Company Limited and Jeanerette Lumber & Shingle CO. L.L.C.* Issues: economic impact of crude oil pipeline development.

9. Expert Testimony. Docket No. 16-036-FR. (2017). Before the Arkansas Public Service Commission. *In the Matter of the Formula Rate Plan Filings of Entergy Arkansas, Inc., Pursuant to APSC Docket No. 15-015-U*. On behalf of the Office of the Arkansas Attorney

General Leslie Rutledge. Issue: cost of service, rate design, alternative regulation, formula rate plan.

10. Expert Testimony. Docket No. 2017-AD-0112. (2017). Before the Mississippi Public Service Commission. *In re: Encouraging Stipulation of Matters in Connection with the Kemper County IGCC Project*. On Behalf of the Mississippi Public Utilities Staff. Issues: financial analysis, rates and cost trends, economic impacts of proposal.

11. Expert Testimony. Case No. 2017-00179. (2017). Before the Public Service Commission, Commonwealth of Kentucky. *Electronic Application of Kentucky power Company For (1) A General Adjustment of Its Rates for Electric Service; (2) An Order Approving Its 2017 Environmental Compliance Plan; (3) An Order Approving Its Tariffs and Riders; (4) An Order Approving Accounting Practices to Establish a Regulatory Asset or Liability Related to the Big Sandy 1 Operation Rider; and (5) An Order Granting All Other Required Approvals and Relief.* Issues: rate design, revenue allocation, economic development.

12. Expert Testimony. Docket No. 17-010-FR. (2017). Before the Arkansas Public Service Commission. *In the Matter of the Formula Rate Plan Filing of CenterPoint Energy Resources Corp. D/B/A CenterPoint Energy Arkansas Gas Pursuant to APSC Docket No. 15-098-U.* Issues: cost of service, rate design, alternative regulation, formula rate plan.

13. Expert Testimony. Formal Case No. 1142. (2017). Before the Public Service Commission of the District of Columbia. *In the Matter of the Merger of AltaGas Ltd. and WGL Holdings, Inc.* On Behalf of the Office of the People's Counsel. Issues: merger/acquisition policy, financial risk, ring-fencing, and reliability.

14. Expert Testimony. D.P.U. 17-05. (2017). Before the Massachusetts Department of Public Utilities. *Petition of NSTAR Electric Company and Western Massachusetts Electric Company each d/b/a Eversource Energy for Approval of an Increase in Base Distribution Rates for Electric Service Pursuant to G.L. c. 164, § 94 and 220 C.M.R. § 5.00*. On Behalf of the Massachusetts Office of the Attorney General Office of Ratepayer Advocacy. Issues: performance-based ratemaking, multi-factor productivity estimation.

15. Deposition and Testimony. (2017) Before the Nebraska Section 70, Article 13 Arbitration Panel. *Northeast Nebraska Public Power District, City of South Sioux City Nebraska; City of Wayne, Nebraska; City of Valentine, Nebraska; City of Beatrice, Nebraska; City of Scribner, Nebraska; Village of Walthill, Nebraska, vs. Nebraska Public Power District.* On the Behalf of Baird Holm LLP for the Plaintiffs. Issues: rate discounts; cost of service; utility regulation, economic harm.

16. Expert Testimony. Docket No. 16-052-U. (2017). Before the Arkansas Public Service Commission. *In the Matter of the Application of the Oklahoma Gas and Electric Company for Approval of a General Change in Rates, Charges and Tariffs.* On the Behalf of the Office of Arkansas Attorney General Leslie Rutledge. Issues: cost of service, rate design, alternative regulation, formula rate plan.

17. Expert Testimony. Docket No. 16-KCPE-593-ACQ. (2016). Before the Kansas Corporation Commission. *In the Matter of the Joint Application of Great Plains Energy Incorporated, Kansas City Power & Light Company, and Westar Energy, Inc. for Approval of the Acquisition of Westar, Inc. by Great Plains Energy Incorporated.* On the Behalf of the Kansas Electric Power Cooperative, Inc. Issues: merger/acquisition policy, financial risk, and ring-fencing.

18. Expert Testimony. Formal Case No. 1139. (2016). Before the Public Service Commission of the District of Columbia. *In the Matter of the Application of Potomac Electric Power Company for Authority to Increase Existing Retail Rates and Charges for Electric Distribution Service.* On the Behalf of the Office of the People's Counsel for the District of Columbia. Issues: cost of service, rate design, alternative regulation.

19. Expert Affidavit. Docket No. CP15-558-000 (2016). Before the United States of America Federal Energy Regulatory Commission. *PennEast Pipeline Company, LLC*. Affidavit and Reply Affidavit. On the Behalf of the New Jersey Division of Rate Counsel. Issues: pipeline capacity, peak day requirements.

20. Expert Testimony. Docket No. RPU-2016-0002. (2016). Before the Iowa Utilities Board. *In re: Iowa American Water Company application for revision of rates.* On behalf of the Citizens of the State of Florida. Issue: revenue stabilization mechanism, revenue decoupling.

21. Expert Testimony. Docket No. 15-015-U. (2016). Before the Arkansas Public Service Commission. *In the Matter of the Formula Rate Plan Filings of Entergy Arkansas, Inc., Pursuant to APSC Docket No. 15-015-U*. On behalf of the Office of the Arkansas Attorney General Leslie Rutledge. Issue: formula rate plan evaluation.

22. Expert Testimony. Docket Nos. 160021-EI, 160061-EI, 160062-EI, and 160088-EI. (2016). Before the Florida Public Service Commission. *In re: Petition for rate increase by Florida Power & Light Company (consolidated).* On behalf of the Office of Consumer Advocate, Iowa Department of Justice. Issue: load forecasting.

23. Expert Testimony. Docket Nos. 160021-EI, 160061-EI, 160062-EI, and 160088-EI. (2016). Before the Florida Public Service Commission. *In re: Petition for rate increase by Florida Power & Light Company (consolidated).* On behalf of the Citizens of the State of Florida. Issue: off-system sales incentives.

24. Expert Testimony. Project No. 5-103. (2016). United States of America Federal Energy Regulatory Commission. *Confederated Salish and Kootenai Tribes Energy Keepers, Incorporated*. On behalf of the Flathead, Mission, and Jocko Valley Irrigation Districts and the Flathead Joint Board of Control of the Flathead, Mission, and Jocko Valley Irrigation Districts.

25. Expert Testimony. Docket No. 15-098-U. (2016). Before the Arkansas Public Service Commission. *In the Matter of the Application of CenterPoint Energy Resources Corp. d/b/a CenterPoint Energy Arkansas Gas for a General Change or Modification in its Rates, Charges and Tariffs.* On behalf of the Office of the Arkansas Attorney General. Issues: formula rate plan, cost of service and rate design.

26. Expert Testimony. BPU Docket No. GM15101196. (2016). *In the Matter of the Merger of Southern Company and AGL Resources, Inc*. On behalf of the New Jersey Division of Rate Counsel. Issues: merger standards of review, customer dividend contributions, synergy savings and costs to achieve, ratemaking treatment of merger-related costs.

27. Expert Testimony. Docket No. 15-078-U. (2015). Before the Arkansas Public Service Commission. *In the Matter of the Joint Application of SourceGas Inc., SourceGas LLC, SourceGas Holdings LLC and Black Hills Utility Holdings, Inc. for all Necessary Authorizations and Approvals for Black Hills Utility Holdings, Inc. to Acquire SourceGas*

Holdings LLC. On behalf of the Office of the Arkansas Attorney General. Issues: public policy and regulatory policy associated with the acquisition.

28. Expert Testimony. Docket No. 15-031-U. (2015). Before the Arkansas Public Service Commission. *In the Matter of the Application of SourceGas Arkansas Inc. for an Order Approving the Acquisition of Certain Storage Facilities and the Recovery of Investments and Expenses Associated Therewith.* On behalf of the Office of the Arkansas Attorney General. Issues: cost-benefit analysis, transmission cost analysis, and a due diligence analysis.

29. Expert Testimony. Docket No. 15-015-U. (2015). Before the Arkansas Public Service Commission. *In the Matter of the Application of Entergy Arkansas, Inc. for Approval of Changes in Rates for Retail Electric Service.* On behalf of the Office of the Arkansas Attorney General. Issues: economic development riders and production plant cost allocation.

30. Expert Testimony. Docket No. 7970. (2015). Before the Vermont Public Service Board. *Petition of Vermont Gas Systems, Inc., for a certificate of public good pursuant to 30 V.S.A.§ 248, authorizing the construction of the "Addison Natural Gas Project" consisting of approximately 43 miles of new natural gas transmission pipeline in Chittenden and Addison Counties, approximately 5 miles of new distribution mainlines in Addison County, together with three new gate stations in Williston, New Haven, and Middlebury, Vermont*. On behalf of AARP-Vermont. Issues: net economic benefits of proposed natural gas transmission project.

31. Expert Testimony. File No. ER-2014-0370 (2015). Before the Public Service Commission of the State of Missouri. *In the Matter of Kansas City Power & Light Company for Authority Implement A General Rate Increase for Electric Service*. On behalf of the Missouri Office of the People's Counsel. Issues: customer charges, rate design, revenue distribution, class cost of service, and policy and ratemaking considerations in connection with electric vehicle charging stations.

32. Expert Testimony. File No. ER-2014-0351 (2015). Before the Public Service Commission of the State of Missouri. *In the Matter of The Empire District Electric Company for Authority To File Tariffs Increasing Rates for Electric Service Provided to Customers In the Company's Missouri Service Area*. On behalf of the Missouri Office of the People's Counsel. Issues: customer charges, rate design, revenue distribution, and class cost of service.

33. Expert Testimony. D.P.U. 14-130 (2015). Before the Massachusetts Department of Public Utilities. *Petition of Fitchburg Gas and Electric Light Company d/b/a Unitil for approval by the Department of Public Utilities of the Company's 2015 Gas System Enhancement Program Plan, pursuant to G.L. c. 164, § 145, and for rates effective May 1, 2015.* On behalf of the Attorney General's Office. Issues: ratepayer protections, cost allocations, rate design, performance metrics.

34. Expert Testimony. D.P.U. 14-131 (2015). Before the Massachusetts Department of Public Utilities. *Petition of The Berkshire Gas Company for approval by the Department of Public Utilities of the Company's Gas System Enhancement Program Plan for 2015, pursuant to G.L. c. 164, § 145, and for rates effective May 1, 2015*. On behalf of the Attorney General's Office. Issues: ratepayer protections, cost allocations, rate design, performance metrics.

35. Expert Testimony. D.P.U. 14-132 (2015). Before the Massachusetts Department of Public

Utilities. *Petition of Boston Gas Company and Colonial Gas Company d/b/a National Grid for approval by the Department of Public Utilities of the Companies' Gas System Enhancement Program for 2015, pursuant to G.L. c. 164, § 145, and for rates effective May 1, 2015*. On behalf of the Attorney General's Office. Issues: ratepayer protections, cost allocations, rate design, performance metrics.

36. Expert Testimony. D.P.U. 14-133 (2015). Before the Massachusetts Department of Public Utilities. *Petition of Liberty Utilities for approval by the Department of Public Utilities of the Company's Gas System Enhancement Program Plan for 2015, pursuant to G.L. c. 164, § 145, and for rates effective May 1, 2015*. On behalf of the Attorney General's Office. Issues: ratepayer protections, cost allocations, rate design, performance metrics.

37. Expert Testimony. D.P.U. 14-134 (2015). Before the Massachusetts Department of Public Utilities. *Petition of Bay State Gas Company d/b/a Columbia Gas of Massachusetts for approval by the Department of Public Utilities of the Company's Gas System Enhancement Program Plan for 2015, pursuant to G.L. c. 164, § 145, and for rates to be effective May 1, 2015*. On behalf of the Attorney General's Office. Issues: ratepayer protections, cost allocations, rate design, performance metrics.

38. Expert Testimony. D.P.U. 14-135 (2015). Before the Massachusetts Department of Public Utilities. *Petition of NSTAR Gas Company for approval by the Department of Public Utilities of the Company's Gas System Enhancement Program Plan for 2015, pursuant to G.L. c. 164, § 145, and for rates to be effective May 1, 2015*. On behalf of the Attorney General's Office. Issues: ratepayer protections, cost allocations, rate design, performance metrics.

39. Expert Report. Docket No. X-33192 (2015). Before the Louisiana Public Service Commission. *Examination of the Comprehensive Costs and Benefits of Net Metering in Louisiana.* On behalf of the Louisiana Public Service Commission. Issues: cost-benefit, cost of service, rate impact.

40. Expert Testimony. F.C. 1119 (2014). Before the District of Columbia Public Service Commission. *In the Matter of the Merger of Exelon Corporation, Pepco Holdings, Inc., Potomac Electric Power Company, Exelon Energy Delivery Company, LLC, and new Special Purpose Entity, LLC*. On behalf of the Office of the People's Counsel. Issues: economic impact analysis, reliability, consumer investment fund, regulatory oversight, impacts to competitive electricity markets.

41. Expert Report. Civil Action 1:08-cv-0046 (2014). Before the U.S. District Court for the Southern District of Ohio. *Anthony Williams, et al., v. Duke Energy International, Inc., et al.* On behalf of Markovits, Stock & DeMarco, Attorneys & Counselors at Law. Issues: public utility regulation, electric power markets, economic harm.

42. Expert Testimony. D.P.U. 14-64 (2014). Before the Massachusetts Department of Public Utilities. *NSTAR Gas Company/HOPCO Gas Services Agreement. On behalf of the Office of the Public Advocate*. Issues: certain ratemaking features associated with the proposed Gas Service Agreement.

43. Expert Testimony. Docket Nos. 14-0224 and 14-0225 (2014). Before the Illinois Commerce Commission. *In the Matter of the Peoples Gas Light and Coke Company and North Shore Gas Company Proposed General Increase in Rates for Gas Service (consolidated)*. On behalf of the People of the State of Illinois. Issues: test year expenses, cost benchmarking analysis, pipeline replacement, and leak rate comparisons.

44. Expert Testimony. Docket 8191 (2014). Before the Vermont Public Service Board. *In Re: Petition of Green Mountain Power Corporation for Approval of a Successor Alternative Regulation Plan.* On the behalf of AARP-Vermont. Issues: Alternative Regulation.

45. Expert Testimony. Docket No. 2013-00168 (2014). Before the Maine Public Utilities Commission. *In the Matter of the Request for Approval of an Alternative Rate Plan (ARP 2014) Pertaining to Central Maine Power Company*. On behalf of the Office of the Public Advocate. Issues: class cost of service study, marginal cost of service study, revenue distribution and rate design.

46. Expert Testimony. D.P.U. 13-90 (2013). Before the Massachusetts Department of Public Utilities. *Petition of Fitchburg Gas and Electric Light Company (Electric Division) d/b/a Unitil to the Department of Public Utilities for approval of the rates and charges and increase in base distribution rates for electric service.* On behalf of the Office of the Ratepayer Advocate. Issues: capital cost adjustment mechanism and performance-based regulation.

47. Expert Testimony. BPU Docket Nos. EO13020155 and GO13020156. (2013). Before the State of New Jersey Board of Public Utilities. *I/M/O The Petition of Public Service Electric & Gas Company for the Approval of the Energy Strong Program.* On behalf of the Division of Rate Counsel. Issues: economic impact, infrastructure replacement program rider, pipeline replacement, leak rate comparisons and cost benefit analysis.

48. Expert Testimony. D.P.U. 13-75 (2013). Before the Massachusetts Department of Public Utilities. *Investigation by the Department of Public Utilities on its Own Motion as to the Propriety of the Rates and Charges by Bay State Gas Company d/b/a Columbia Gas of Massachusetts set forth in Tariffs M.D.P.U. Nos. 140 through 173, and Approval of an Increase in Base Distribution Rates for Gas Service Pursuant to G.L. c. 164, § 94 and 220 C.M.R. § 5.00 et seq., filed with the Department on April 16, 2013, to be effective May 1, 2013*. On the Behalf of the Office of the Attorney General, Office of Ratepayer Advocacy. Issues: Target infrastructure replacement program rider, pipeline replacement, and leak rate comparisons; environmental benefits analysis; O&M offset; and cost benchmarking analysis.

49. Expert Testimony. Docket No. 13-115 (2013). Before the Delaware Public Service Commission. *In the Matter of the Application of Delmarva Power & Light Company FOR an Increase in Electric Base Rates and Miscellaneous Tariff Changes* (Filed March 22, 2013). On the Behalf of Division of the Public Advocate. Issues: pro forma infrastructure proposal, class cost of service study, revenue distribution, and rate design.

50. Expert Testimony. Formal Case No. 1103 (2013). Before the Public Service Commission of the District of Columbia. *In the Matter of the Application of the Potomac Electric Power Company for Authority to Increase Existing Retail Rates and Charges for Electric Distribution Service*. On the Behalf of the Office of the People's Counsel of the District of Columbia. Issues: Pro forma adjustment for reliability investments.

51. Expert Testimony. Case No. 9326 (2013). Before the Public Service Commission of Maryland. *In the Matter of the Application of Baltimore Gas and Electric Company for Adjustments to its Electric and Gas Base Rates*. On the Behalf of the Maryland Office of the People's Counsel. Issues: Electric Reliability Investment ("ERI") initiatives, pro forma gas infrastructure proposal, tracker mechanisms, class cost of service study, revenue distribution, and rate design

52. Rulemaking Testimony. (2013). Before the Louisiana Tax Commission. Examination of Louisiana Assessors' Association Well Diameter Analysis, economic development policies regarding midstream assets and industrial development.

53. Expert Testimony. Case No. 9317 (2013). Before the Public Service Commission of Maryland. *In the Matter of the Application of Delmarva Power & Light Company for Adjustments to its Retail Rates for the Distribution of Electric Energy*. Direct, and Surrebuttal. On the Behalf of the Maryland Office of the People's Counsel. Issues: Grid Resiliency Charge, tracker mechanisms, pipeline replacement, class cost of service study, revenue distribution, and rate design.

54. Expert Testimony. Case No. 9311 (2013). Before the Public Service Commission of Maryland. *In the Matter of the Application of Potomac Electric Power Company for an Increase in its Retail Rates for the Distribution of Electric Energy*. Direct, and Surrebuttal. On the Behalf of the Maryland Office of the People's Counsel. Issues: Grid Resiliency Charge, tracker mechanisms, pipeline replacement, class cost of service study, revenue distribution, and rate design.

55. Expert Testimony. Docket No. 12AL-1268G (2013). Before the Public Utilities Commission of the State of Colorado. *In the Matter of the Tariff Sheets Filed by Public Service Company of Colorado with Advice No. 830 – Gas. Answer*. On the Behalf of the Colorado Office of Consumer Counsel. Issues: Pipeline System Integrity Adjustment, tracker mechanisms, pipeline replacement and leak rate comparisons.

56. Expert Testimony. BPU Docket No. EO12080721 (2013). Before the New Jersey Board of Public Utilities. *In the Matter of the Public Service Electric & Gas Company for Approval of an Extension of Solar Generation Program*. On the Behalf of the New Jersey Division of Rate Counsel. Direct, Rebuttal, Surrebuttal. Issues: solar energy market design, solar energy market conditions, solar energy program design and net economic benefits.

57. Expert Testimony. BPU Docket No. EO12080726 (2013). Before the New Jersey Board of Public Utilities. *In the Matter of the Petition of Public Service Electric & Gas Company for Approval of a Solar Loan III Program.* On the Behalf of the New Jersey Division of Rate Counsel. Direct, Rebuttal and Surrebuttal. Issues: solar energy market design, solar energy market conditions, solar energy program design.

58. Expert Testimony. BPU Docket No. EO11050314V. (2012). Before the New Jersey Board of Public Utilities. *In the Matter of the Petition of Fishermen's Atlantic City Windfarm, LLC for the Approval of the State Waters Project and Authorizing Offshore Wind Renewable Energy Certificates*. On the Behalf of the New Jersey Division of Rate Counsel. December 17, 2012. Issues: approval of offshore wind project and ratepayer financial support for the proposed project.

59. Expert Testimony. D.P.U. 12-25. (2012). Before the Massachusetts Department of Public Utilities. *In the Matter of Bay State Gas Company d/b/a/ Columbia Gas Company of Massachusetts Request for Increase in Rates*. On the Behalf of the Office of the Attorney General, Office of Ratepayer Advocacy. Issues: Target infrastructure replacement program rider, pipeline replacement and leak rate comparisons.

60. Expert Testimony. Docket Nos. UE-120436, et.al. (consolidated). (2012). Before the Washington Utilities and Transportation Commission. *Washington Utilities and Transportation Commission v. Avista Corporation D/B/A Avista Utilities*. On the Behalf of the Washington Attorney General, Office of the Public Counsel. Issues: Revenue

Decoupling, lost revenues, tracker mechanisms, attrition adjustments.

61. Expert Testimony. Case No. 9286. (2012) Before the Public Service Commission of Maryland. *In Re: Potomac Electric Power Company ("Pepco") General Rate Case*. On the Behalf of the Maryland Office of the People's Counsel. Issues: Capital tracker mechanisms/reliability investment mechanisms, reliability issues, regulatory lag, class cost of service, revenue distribution, rate design.

62. Expert Testimony. Case No 9285. (2012) Before the Public Service Commission of Maryland. *In Re: the Delmarva Power and Light Company General Rate Case*. On the Behalf of the Maryland Office of the People's Counsel. Issues: Capital tracker mechanisms/reliability investment mechanisms, reliability issues, regulatory lag, class cost of service, revenue distribution, rate design.

63. Expert Testimony. Docket Nos. UE-110876 and UG-110877 (consolidated). (2012). Before the Washington Utilities and Transportation Commission. *Washington Utilities and Transportation Commission v. Avista Corporation D/B/A Avista Utilities*. On the Behalf of the Washington Attorney General, Office of the Public Counsel. Issues: Revenue Decoupling, lost revenues, tracker mechanisms.

64. Expert Testimony. BPU Docket No. EO11050314V. (2012). Before the New Jersey Board of Public Utilities. *In the Matter of the Petition of Fishermen's Atlantic City Windfarm, LLC for the Approval of the State Waters Project and Authorizing Offshore Wind Renewable Energy Certificates*. On the Behalf of the New Jersey Division of Rate Counsel. February 3, 2012. Issues: approval of offshore wind project and ratepayer financial support for the proposed project.

65. Expert Testimony. Docket No. NG 0067. (2012). Before the Public Service Commission of Nebraska. *In the Matter of the Application of SourceGas Distribution, LLC Approval of a General Rate Increase*. On the Behalf of the Public Advocate. January 31, 2012. Issues: Revenue Decoupling, Customer Adjustments, Weather Normalization Adjustments, Class Cost of Service Study, Rate Design.

66. Expert Testimony. Docket No. G-04204A-11-0158. (2011). Before the Arizona Corporation Commission. On the Behalf of the Arizona Corporation Commission Staff. *In the Matter of the Application of UNS Gas, Inc. for the Establishment of Just and Reasonable Rates and Charges Designed to Realize a Reasonable Rate of Return on the Fair Value of Its Arizona Properties*. Issues: Revenue Decoupling; Class Cost of Service Modeling; Revenue Distribution; Rate Design.

67. Expert Testimony. Formal Case Number 1087. (2011). Before the Public Service Commission of the District of Columbia. On the Behalf of the Office of the People's Counsel of the District of Columbia. *In the Matter of the Application of Potomac Electric Power Company for Authority to Increase Existing Retail Rates and Charges for Electric Distribution Service*. Issues: Regulatory lag, ratemaking principles, reliability-related capital expenditure tracker proposals.

68. Expert Affidavit. Case No. 11-1364. (2011). *The State of Louisiana, the Louisiana Department of Environmental Quality, and the Louisiana Public Service Commission v. United States Environmental Protection Agency and Lisa P. Jackson.* Before the United States Court of Appeals for the District of Columbia Circuit. On the behalf of the State of Louisiana, the Louisiana Department of Environmental Quality, and the Louisiana Public Service Commission. Issues: Impacts of environmental costs on electric utilities,

compliance requirements, investment cost of mitigation equipment, multi-area dispatch modeling and plant retirements.

69. Expert Affidavit. Docket No. EPA-HQ-OAR-2009-0491. (2011). Before the U.S. Environmental Protection Agency. *Federal Implementation Plans: Interstate Transport of Fine Particulate Matter and Ozone and Correction of SIP Approvals*. On the Behalf of the Louisiana Public Service Commission. Issues: Impacts of environmental costs on electric utilities, compliance requirements, investment cost of mitigation equipment, multi-area dispatch modeling and plant retirements.

70. Expert Testimony. Case No. 9296. (2011). Before the Maryland Public Service Commission. *On the Behalf of the Maryland Office of People's Counsel. In the Matter of the Application of Washington Gas Light Company for Authority to Increase Existing Rates and Charges and Revise its Terms and Conditions for Gas Service*. Issues: Infrastructure Cost Recovery Rider; Class Cost of Service Modeling; Revenue Distribution; Rate Design.

71. Expert Testimony. Docket No. G-01551A-10-0458. (2011). Before the Arizona Corporation Commission. On the Behalf of the Arizona Corporation Commission Staff. *In the Matter of the Application of Southwest Gas Corporation for the Establishment of Just and Reasonable Rates and Charges Designed to Realize A Reasonable Rate of Return on the Fair Value of its Properties throughout Arizona*. Issues: Revenue Decoupling; Class Cost of Service Modeling; Revenue Distribution; Rate Design.

72. Expert Testimony. Docket No. 11-0280 and 11-0281. (2011). Before the Illinois Commerce Commission. On the Behalf of the Illinois Attorney General, the Citizens Utility Board, and the City of Chicago, Illinois. *In re: Peoples Gas Light and Coke Company and North Shore Natural Gas Company*. Issues: Revenue Decoupling and Rate Design. (Direct and Rebuttal)

73. Expert Testimony. D.P.U. 11-01. (2011). Before the Massachusetts Department of Public Utilities. On the Behalf of the Office of the Attorney General, Office of Ratepayer Advocacy. *Petition of the Fitchburg Electric and Gas Company (Electric Division) for Approval of A General Increase in Electric Distribution Rates and Approval of a Revenue Decoupling Mechanism*. Issues: Capital Cost Rider, Revenue Decoupling.

74. Expert Testimony. D.P.U. 11-02. (2011). Before the Massachusetts Department of Public Utilities. On the Behalf of the Office of the Attorney General, Office of Ratepayer Advocacy. *Petition of the Fitchburg Electric and Gas Company (Gas Division) for Approval of A General Increase in Electric Distribution Rates and Approval of a Revenue Decoupling Mechanism*. Issues: Pipeline Replacement Rider, Revenue Decoupling.

75. Expert Affidavit. Docket No. EL-11-13 (2011). Before the Federal Energy Regulatory Commission. Petition for Preliminary Ruling, Atlantic Grid Operations. On the Behalf of the New Jersey Division of Rate Counsel. Issues: Offshore wind generation development, offshore wind transmission development, ratemaking treatment of development costs, transmission development incentives.

76. Expert Opinion. Case No. CI06-195. (2011). Before the District Court of Jefferson County, Nebraska. On the Behalf of the City of Fairbury, Nebraska and Michael Beachler. In re: Endicott Clay Products Co. vs. City of Fairbury, Nebraska and Michael Beachler. Issues: rate design and ratemaking, time of use and time differentiated rate structures, empirical analysis of demand and usage trends for tariff eligibility requirements.

77. Expert Testimony. D.P.U. 10-114. (2010). Before the Massachusetts Department of Public Utilities. On the Behalf of the Office of the Attorney General, Office of Ratepayer Advocacy. Petition of the New England Gas Company for Approval of A General Increase in Electric Distribution Rates and Approval of a Revenue Decoupling Mechanism. Issues: infrastructure replacement rider.

78. Expert Testimony. D.P.U. 10-70. (2010). Before the Massachusetts Department of Public Utilities. Petition of the Western Massachusetts Electric Company for Approval of A General Increase in Electric Distribution Rates and Approval of a Revenue Decoupling Mechanism. On the Behalf of the Office of the Attorney General, Office of Ratepayer Advocacy. Issues: Revenue decoupling; infrastructure replacement rider; performance-based regulation; inflation adjustment mechanisms; and rate design.

79. Expert Testimony. G.U.D. Nos. 998 & 9992. (2010). Before the Texas Railroad Commission. In the Matter of the Rate Case Petition of Texas Gas Services, Inc. On the Behalf of the City of El Paso, Texas. Issues: Cost of service, revenue distribution, rate design, and weather normalization.

80. Expert Testimony. B.P.U Docket No. GR10030225. (2010). Before the New Jersey Board of Public Utilities. In the Matter of the Petition of New Jersey Natural Gas Company for Approval of Regional Greenhouse Gas Initiative Programs and Associated Cost Recovery Mechanisms Pursuant to N.J.S.A. 48:3-98.1. On the Behalf of the Department of the Public Advocate, Division of Rate Counsel. Issues: solar energy proposals, solar securitization issues, solar energy policy issues.

81. Expert Testimony. D.P.U. 10-55. (2010). Before the Massachusetts Department of Public Utilities. Investigation Into the Propriety of Proposed Tariff Changes for Boston Gas Company, Essex Gas Company, and Colonial Gas Company. (d./b./a. National Grid). On the Behalf of the Office of the Attorney General, Office of Ratepayer Advocacy. Issues: Revenue decoupling; pipeline-replacement rider; performance-based regulation; partial productivity factor estimates, inflation adjustment mechanisms; and rate design.

82. Expert Testimony. Cause No.43839. (2010). Before the Indiana Utility Regulatory Commission. In the Matter of Southern Indiana Gas and Electric Company d/b/a/ Vectren Energy Delivery of Indiana, Inc. (Vectren South-Electric). On the behalf of the Indiana Office of Utility Consumer Counselor (OUCC). Issues: revenue decoupling, variable production cost riders, gains on off-system sales, transmission cost riders.

83. Congressional Testimony. Before the United States Congress. (2010). U.S. House of Representatives, Committee on Natural Resources. Hearing on the Consolidated Land, Energy, and Aquatic Resources Act. June 30, 2010.

84. Expert Testimony. Before the City Counsel of El Paso, Texas; Public Utility Regulatory Board. (2010). On the Behalf of the City of El Paso. In Re: Rate Application of Texas Gas Services, Inc. Issues: class cost of service study (minimum system and zero intercept analysis), rate design proposals, weather normalization adjustment, and its cost of service adjustment clause, conservation adjustment clause proposals, and other cost tracker policy issues.

85. Expert Testimony. Docket 09-00183. (2010). Before the Tennessee Regulatory Authority. In the Matter of the Petition of Chattanooga Gas Company for a General Rate Increase, Implementation of the EnergySMART Conservation Programs, and Implementation of a Revenue Decoupling Mechanism. On the Behalf of Tennessee Attorney General,

Consumer Advocate & Protection Division. Issues: revenue decoupling and energy efficiency program review and cost effectiveness analysis.

86. Expert Testimony and Exhibits. Docket No. 10-240. (2010). Before the Louisiana Office of Conservation. In Re: Cadeville Gas Storage, LLC. On the Behalf of Cardinal Gas Storage, LLC. Issues: alternative uses and relative economic benefits of conversion of depleted hydrocarbon reservoir for natural gas storage purposes.

87. Expert Testimony. Docket No. 09505-EI. (2010). Before the Florida Public Service Commission. In Re: Review of Replacement Fuel Costs Associated with the February 26, 2008 outage on Florida Power & Light's Electrical System. On the Behalf of the Florida Office of Public Counsel for the Citizens of the State of Florida. Issues: Replacement costs for power outage, regulatory policy/generation development incentives, renewable and energy efficiency incentives.

88. Expert Testimony. Docket 09-00104. (2009). Before the Tennessee Regulatory Authority. In the Matter of the Petition of Piedmont Natural Gas Company, Inc. to Implement a Margin Decoupling Tracker Rider and Related Energy Efficiency and Conservation Programs. On the Behalf of the Tennessee Attorney General, Consumer Advocate & Protection Division. Issues: revenue decoupling, energy efficiency program review, weather normalization.

89. Expert Testimony. Docket Number NG-0060. (2009). Before the Nebraska Public Service Commission. In the Matter of SourceGas Distribution, LLC Approval for a General Rate Increase. On the Behalf of the Nebraska Public Advocate. October 29, 2009. Issues: revenue decoupling, inflation trackers, infrastructure replacement riders, customer adjustment rider, weather normalization rider, weather normalization adjustments, estimation of normal weather for ratemaking purposes.

90. Expert Report and Deposition. Before the 23rd Judicial District Court, Parish of Assumption, State of Louisiana. On the Behalf of Dow Hydrocarbons and Resources, Inc. September 1, 2009. (Deposition, November 23-24, 2009). Issues: replacement and repair costs for underground salt cavern hydrocarbon storage.

91. Expert Testimony. D.P.U. 09-39. Before the Massachusetts Department of Public Utilities. (2009). Investigation Into the Propriety of Proposed Tariff Changes for Massachusetts Electric Company and Nantucket Electric Company (d./b./a. National Grid). On the Behalf of the Office of the Attorney General, Office of Ratepayer Advocacy. Issues: Revenue decoupling; infrastructure rider; performance-based regulation; inflation adjustment mechanisms; revenue distribution; and rate design.

92. Expert Testimony. D.P.U. 09-30. Before the Massachusetts Department of Public Utilities. (2009). In the Matter of Bay State Gas Company Request for Increase in Rates. On the Behalf of the Office of the Attorney General, Office of Ratepayer Advocacy. Issues: Revenue decoupling; target infrastructure replacement program rider; revenue distribution; and rate design.

93. Expert Testimony. Docket EO09030249. (2009). Before the New Jersey Board of Public Utilities. In the Matter of the Petition of Public Service Electric and Gas Company for Approval of a Solar Loan II Program and An Associated Cost Recovery Mechanism. On the Behalf of the Department of the Public Advocate, Division of Rate Counsel. Issues: solar energy market design, renewable portfolio standards, solar energy, and renewable financing/loan program design.

94. Expert Testimony. Docket EO0920097. (2009). Before the New Jersey Board of Public Utilities. In the Matter of the Verified Petition of Rockland Electric Company for Approval of an SREC-Based Financing Program and An Associated Cost Recovery Mechanism. On the Behalf of the Department of the Public Advocate, Division of Rate Counsel. Issues: solar energy market design; renewable energy portfolio standards; solar energy.

95. Expert Rebuttal Report. Civil Action No.: 2:07-CV-2165. (2009). Before the U.S. District Court, Western Division of Louisiana, Lake Charles Division. Prepared on the Behalf of the Transcontinental Pipeline Corporation. Issues: expropriation and industrial use of property.

96. Expert Testimony. Docket EO06100744. (2008). Before the New Jersey Board of Public Utilities. In the Matter of the Renewable Portfolio Standard – Amendments to the Minimum filing Requirements for Energy Efficiency, Renewable Energy, and Conservation Programs and For Electric Distribution Company Submittals of Filings in connection with Solar Financing (Atlantic City Electric Company). On the Behalf of the Department of the Public Advocate, Division of Rate Counsel. Issues: Solar energy market design; renewable energy portfolio standards; solar energy. (Rebuttal and Surrebuttal)

97. Expert Testimony. Docket EO08090840. (2008). Before the New Jersey Board of Public Utilities. In the Matter of the Renewable Portfolio Standard – Amendments to the Minimum filing Requirements for Energy Efficiency, Renewable Energy, and Conservation Programs and For Electric Distribution Company Submittals of Filings in connection with Solar Financing (Jersey Central Power & Light Company). On the Behalf of the Department of the Public Advocate, Division of Rate Counsel. Issues: Solar energy market design; renewable energy portfolio standards; solar energy. (Rebuttal and Surrebuttal)

98. Expert Testimony. Docket UG-080546. (2008). Before the Washington Utilities and Transportation Commission. On the Behalf of the Washington Attorney General (Public Counsel Section). Issues: Rate Design, Cost of Service, Revenue Decoupling, Weather Normalization.

99. Congressional Testimony. (2008). Senate Republican Conference: Panel on Offshore Drilling in the Restricted Areas of the Outer Continental Shelf. September 18, 2008.

100. Expert Testimony. Appeal Number 2007-125 and 2007-299. (2008). Before the Louisiana Tax Commission. On the Behalf of Jefferson Island Storage and Hub, LLC (AGL Resources). Issues: Valuation Methodologies, Underground Storage Valuation, LTC Guidelines and Policies, Public Purpose of Natural Gas Storage. July 15, 2008 and August 20, 2008.

101. Expert Testimony. Docket Number 07-057-13. (2008). Before the Utah Public Service Commission. In the Matter of the Application of Questar Gas Company to File a General Rate Case. On the Behalf of the Utah Committee of Consumer Services. Issues: Cost of Service, Rate Design. August 18, 2008 (Direct, Rebuttal, Surrebuttal).

102. Rulemaking Testimony. (2008). Before the Louisiana Tax Commission. Examination of Replacement Cost Tables, Depreciation and Useful Lives for Oil and Gas Properties. Chapter 9 (Oil and Gas Properties) Section. August 5, 2008.

103. Legislative Testimony. (2008). Examination of Proposal to Change Offshore Natural Gas Severance Taxes (HB 326 and Amendments). Joint Finance and Appropriations

Committee of the Alabama Legislature. March 13, 2008.

104. Public Testimony. (2007). Issues in Environmental Regulation. Testimony before Gubernatorial Transition Committee on Environmental Regulation (Governor-Elect Bobby Jindal). December 17, 2007.

105. Public Testimony. (2007). Trends and Issues in Alternative Energy: Opportunities for Louisiana. Testimony before Gubernatorial Transition Committee on Natural Resources (Governor-Elect Bobby Jindal). December 13, 2007.

106. Expert Report and Recommendation: Docket Number S-30336 (2007). Before the Louisiana Public Service Commission. In re: Entergy Gulf States, Inc. Application for Approval of Advanced Metering Pilot Program. Issues: pilot program for demand response programs and advanced metering systems.

107. Expert Testimony. Docket EO07040278 (2007). Before the New Jersey Board of Public Utilities. In the Matter of the Petition of Public Service Electric & Gas Company for Approval of a Solar Energy Program and An Associated Cost Recovery Mechanism. On the Behalf of the Department of the Public Advocate, Division of Rate Counsel. Issues: renewable energy market development, solar energy development, SREC markets, rate impact analysis, cost recovery issues.

108. Expert Testimony: Docket Number 05-057-T01 (2007). Before the Utah Public Service Commission. In the Matter of: Joint Application of Questar Gas Company, the Division of Public Utilities, and Utah Clean Energy for Approval of the Conservation Enabling Tariff Adjustment Options and Accounting Orders. On the behalf of the Utah Committee of Consumer Services. Issues: Revenue Decoupling, Demand-side Management; Energy Efficiency policies. (Direct, Rebuttal, and Surrebuttal Testimony)

109. Expert Testimony (Non-sworn rulemaking testimony) Docket Number RR-2008, (2007). Before the Louisiana Tax Commission. In re: Commission Consideration of Amendment and/or Adoption of Tax Commission Real/Personal Property Rules and Regulations. Issues: Louisiana oil and natural gas production trends, appropriate cost measures for wells and subsurface property, economic lives and production decline curve trends.

110. Expert Report, Recommendation, and Proposed Rule: Docket Number R-29213 & 29213-A, ex parte, (2007). Before the Louisiana Public Service Commission. In re: In re: Investigation to determine if it is appropriate for LPSC jurisdictional electric utilities to provide and install time-based meters and communication devices for each of their customers which enable such customers to participate in time-based pricing rate schedules and other demand response programs. On the behalf of the Louisiana Public Service Commission Staff. Report and Recommendation. Issues: demand response programs, advanced meter systems, cost recovery issues, energy efficiency issues, regulatory issues.

111. Expert Report, Recommendation, and Proposed Rule: Docket Number R-29712, ex parte, (2007) Before the Louisiana Public Service Commission. In re: Investigation into the ratemaking and generation planning implications of nuclear construction in Louisiana. On the behalf of the Louisiana Public Service Commission Staff. Report and Recommendation. Issues: nuclear cost power plant development, generation planning issues, and cost recovery issues.

112. Expert Testimony, Case Number U-14893, (2006). Before the Michigan Public Service

Commission. In the Matter of SEMCO Energy Gas Company for Authority to Redesign and Increase Its Rates for the Sale and Transportation of Natural Gas In its MPSC Division and for Other Relief. On the behalf of the Michigan Attorney General. Issues: Rate Design, revenue decoupling, financial analysis, demand-side management program and energy efficiency policy. (Direct and Rebuttal Testimony).

113. Expert Report, Recommendation, and Proposed Rule: Docket Number R-29380, ex parte, (2006). Before the Louisiana Public Service Commission. In re: An Investigation Into the Ratemaking and Generation Planning Implications of the U.S. EPA Clean Air Interstate Rule. On the behalf of the Louisiana Public Service Commission Staff. Report and Recommendation. Issues: environmental regulation and cost recovery; allowance allocations and air credit markets; ratepayer impacts of new environmental regulations.

114. Expert Affidavit Before the Louisiana Tax Commission (2006). On behalf of ANR Pipeline, Tennessee Gas Transmission and Southern Natural Gas Company. Issues: Competitive nature of interstate and intrastate transportation services.

115. Expert Affidavit Before the 19th Judicial District Court (2006). Suit Number 491, 453 Section 26. On behalf of Transcontinental Pipeline Corporation, et.al. Issues: Competitive nature of interstate and intrastate transportation services.

116. Expert Testimony: Docket Number 05-057-T01 (2006). Before the Utah Public Service Commission. In the Matter of: Joint Application of Questar Gas Company, the Division of Public Utilities, and Utah Clean Energy for Approval of the Conservation Enabling Tariff Adjustment Options and Accounting Orders. On the behalf of the Utah Committee of Consumer Services. Issues: Revenue Decoupling, Demand-side Management; Energy Efficiency policies. (Rebuttal and Supplemental Rebuttal Testimony)

117. Legislative Testimony (2006). Senate Committee on Natural Resources. Senate Bill 655 Regarding Remediation of Oil and Gas Sites, Legacy Lawsuits, and the Deterioration of State Drilling.

118. Expert Report: Rulemaking Docket (2005). Before the New Jersey Bureau of Public Utilities. In re: Proposed Rulemaking Changes Associated with New Jersey's Renewable Portfolio Standard. Expert Report. The Economic Impacts of New Jersey's Proposed Renewable Portfolio Standard. On behalf of the New Jersey Office of Ratepayer Advocate. Issues: Renewable Portfolio Standards, rate impacts, economic impacts, technology cost forecasts.

119. Expert Testimony: Docket Number 2005-191-E. (2005). Before the South Carolina Public Service Commission. On behalf of NewSouth Energy LLC. In re: General Investigation Examining the Development of RFP Rules for Electric Utilities. Issues: Competitive bidding; merchant development. (Direct and Rebuttal Testimony).

120. Expert Testimony: Docket No. 05-UA-323. (2005). Before the Mississippi Public Service Commission. On the behalf of Calpine Corporation. In re: Entergy Mississippi's Proposed Acquisition of the Attala Generation Facility. Issues: Asset acquisition; merchant power development; competitive bidding.

121. Expert Testimony: Docket Number 050045-EI and 050188-EI. (2005). Before the Florida Public Service Commission. On the behalf of the Citizens of the State of Florida. In re: Petition for Rate Increase by Florida Power & Light Company. Issues: Load forecasting; O&M forecasting and benchmarking; incentive returns/regulation.

122. Expert Testimony (non-sworn, rulemaking): Comments on Decreased Drilling Activities in Louisiana and the Role of Incentives. (2005). Louisiana Mineral Board Monthly Docket and Lease Sale. July 13, 2005

123. Legislative Testimony (2005). Background and Impact of LNG Facilities on Louisiana. Joint Meeting of Senate and House Natural Resources Committee. Louisiana Legislature. May 19, 2005.

124. Public Testimony. Docket No. U-21453. (2005). Technical Conference before the Louisiana Public Service Commission on an Investigation for a Limited Industrial Retail Choice Plan.

125. Expert Testimony: Docket No. 2003-K-1876. (2005). On Behalf of Columbia Gas Transmission. Expert Testimony on the Competitive Market Structure for Gas Transportation Service in Ohio. Before the Ohio Board of Tax Appeals.

126. Expert Report and Testimony: Docket No. 99-4490-J, *Lafayette City-Parish Consolidated Government, et. al. v. Entergy Gulf States Utilities, Inc. et. al*. (2005, 2006). On behalf of the City of Lafayette, Louisiana and the Lafayette Utilities Services. Expert Rebuttal Report of the Harborfront Consulting Group Valuation Analysis of the LUS Expropriation. Filed before 15th Judicial District Court, Lafayette, Louisiana.

127. Expert Testimony: ANR Pipeline Company v. Louisiana Tax Commission (2005), Number 468,417 Section 22, 19th Judicial District Court, Parish of East Baton Rouge, State of Louisiana Consolidated with Docket Numbers: 480,159; 489,776;480,160; 480,161; 480,162; 480,163; 480,373; 489,776; 489,777; 489,778;489,779; 489,780; 489,803; 491,530; 491,744; 491,745; 491,746; 491,912;503,466; 503,468; 503,469; 503,470; 515,414; 515,415; and 515,416. In re: Market structure issues and competitive implications of tax differentials and valuation methods in natural gas transportation markets for interstate and intrastate pipelines.

128. Expert Report and Recommendation: Docket No. U-27159. (2004). On Behalf of the Louisiana Public Service Commission Staff. Expert Report on Overcharges Assessed by Network Operator Services, Inc. Before the Louisiana Public Service Commission.

129. Expert Testimony: Docket Number 2004-178-E. (2004). Before the South Carolina Public Service Commission. On behalf of Columbia Energy LLC. In re: Rate Increase Request of South Carolina Electric and Gas. (Direct and Surrebuttal Testimony)

130. Expert Testimony: Docket Number 040001-EI. (2004). Before the Florida Public Service Commission. On behalf of Power Manufacturing Systems LLC, Thomas K. Churbuck, and the Florida Industrial Power Users Group. In re: Fuel Adjustment Proceedings; Request for Approval of New Purchase Power Agreements. Company examined: Florida Power & Light Company.

131. Expert Affidavit: Docket Number 27363. (2004). Before the Public Utilities Commission of Texas. Joint Affidavit on Behalf of the Cities of Texas and the Staff of the Public Utilities Commission of Texas Regarding Certified Issues. In Re: Application of Valor Telecommunications, L.P. For Authority to Establish Extended Local Calling Service (ELCS) Surcharges For Recovery of ELCS Surcharge.

132. Expert Report and Testimony. Docket 1997-4665-PV, 1998-4206-PV, 1999-7380-PV, 2000-5958-PV, 2001-6039-PV, 2002-64680-PV, 2003-6231-PV. (2003) Before the Kansas Board of Tax Appeals. (2003). In the Matter of the Appeals of CIG Field Services

Company from orders of the Division of Property Valuation. On the Behalf of CIG Field Services. Issues: the competitive nature of natural gas gathering in Kansas.

133. Expert Report and Testimony: Docket Number U-22407. Before the Louisiana Public Service Commission (2002). On the Behalf of the Louisiana Public Service Commission Staff. Company examined: Louisiana Gas Services, Inc. Issues: Purchased Gas Acquisition audit, fuel procurement and planning practices.

134. Expert Testimony: Docket Number 000824-EI. Before the Florida Public Service Commission. (2002). On the Behalf of the Citizens of the State of Florida. Company examined: Florida Power Corporation. Issues: Load Forecasts and Billing Determinants for the Projected Test Year.

135. Public Testimony: Louisiana Board of Commerce and Industry (2001). Testimony on the Economic Impacts of Merchant Power Generation.

136. Expert Testimony: Docket Number 24468. (2001). On the Behalf of the Texas Office of Public Utility Counsel. Public Utility Commission of Texas Staff's Petition to Determine Readiness for Retail Competition in the Portion of Texas Within the Southwest Power Pool. Company examined: AEP-SWEPCO.

137. Expert Report. (2001) On Behalf of David Liou and Pacific Richland Products, Inc. to Review Cogeneration Issues Associated with Dupont Dow Elastomers, L.L.C. (DDE) and the Dow Chemical Company (Dow).

138. Expert Testimony: Docket Number 01-1049, Docket Number 01-3001. (2001) On behalf the Nevada Office of Attorney General, Bureau of Consumer Protection. Petition of Central Telephone Company-Nevada D/b/a Sprint of Nevada and Sprint Communications L.P. for Review and Approval of Proposed Revised Performance Measures and Review and Approval of Performance Measurement Incentive Plans. Before the Public Utilities Commission of Nevada.

139. Expert Affidavit: Multiple Dockets (2001). Before the Louisiana Tax Commission. On the Behalf of Louisiana Interstate Pipeline Companies. Testimony on the Competitive Nature of Natural Gas Transportation Services in Louisiana.

140. Expert Affidavit before the Federal District Court, Middle District of Louisiana (2001). Issues: Competitive Nature of the Natural Gas Transportation Market in Louisiana. On behalf of a Consortium of Interstate Natural Gas Transportation Companies.

141. Public Testimony: Louisiana Board of Commerce and Industry (2001). Testimony on the Economic and Ratepayer Benefits of Merchant Power Generation and Issues Associated with Tax Incentives on Merchant Power Generation and Transmission.

142. Expert Testimony: Docket Number 01-1048 (2001). Before the Public Utilities Commission of Nevada. On the Behalf of the Nevada Office of the Attorney General, Bureau of Consumer Protection. Company analyzed: Nevada Bell Telephone Company. Issues: Statistical Issues Associated with Performance Incentive Plans.

143. Expert Testimony: Docket 22351 (2001). Before the Public Utility Commission of Texas. On the Behalf of the City of Amarillo. Company analyzed: Southwestern Public Service Company. Issues: Unbundled cost of service, affiliate transactions, load forecasting.

144. Expert Testimony: Docket 991779-EI (2000). Before the Florida Public Service Commission. On the Behalf of the Citizens of the State of Florida. Companies analyzed:

Florida Power & Light Company; Florida Power Corporation; Tampa Electric Company; and Gulf Power Company. Issues: Competitive Nature of Wholesale Markets, Regional Power Markets, and Regulatory Treatment of Incentive Returns on Gains from Economic Energy Sales.

145. Expert Testimony: Docket 990001-EI (1999). Before the Florida Public Service Commission. On the Behalf of the Citizens of the State of Florida. Companies analyzed: Florida Power & Light Company; Florida Power Corporation; Tampa Electric Company; and Gulf Power Company. Issues: Regulatory Treatment of Incentive Returns on Gains from Economic Energy Sales.

146. Expert Testimony: Docket 950495-WS (1996). Before the Florida Public Service Commission. On the Behalf of the Citizens of the State of Florida. Company analyzed: Southern States Utilities, Inc. Issues: Revenue Repression Adjustment, Residential and Commercial Demand for Water Service.

147. Legislative Testimony. Louisiana House of Representatives, Special Subcommittee on Utility Deregulation. (1997). On Behalf of the Louisiana Public Service Commission Staff. Issue: Electric Restructuring.

148. Expert Testimony: Docket 940448-EG -- 940551-EG (1994). Before the Florida Public Service Commission. On the Behalf of the Legal Environmental Assistance Foundation. Companies analyzed: Florida Power & Light Company; Florida Power Corporation; Tampa Electric Company; and Gulf Power Company. Issues: Comparison of Forecasted Cost-Effective Conservation Potentials for Florida.

149. Expert Testimony: Docket 920260-TL, (1993). Before the Florida Public Service Commission. On the Behalf of the Florida Public Service Commission Staff. Company analyzed: BellSouth Communications, Inc. Issues: Telephone Demand Forecasts and Empirical Estimates of the Price Elasticity of Demand for Telecommunication Services.

150. Expert Testimony: Docket 920188-TL, (1992). Before the Florida Public Service Commission. On the Behalf of the Florida Public Service Commission Staff. Company analyzed: GTE-Florida. Issues: Telephone Demand Forecasts and Empirical Estimates of the Price Elasticity of Demand for Telecommunication Services.

REFEREE AND EDITORIAL APPOINTMENTS

Contributor, 2014-Current, *Wall Street Journal*, *Journal Reports*, Energy

Editorial Board Member, 2015-2017, *Utilities Policy*

Referee, 2014-Current, *Utilities Policy*

Referee, 2010-Current, *Economics of Energy & Environmental Policy*

Referee, 1995-Current, *Energy Journal*

Contributing Editor, 2000-2005, *Oil, Gas and Energy Quarterly*

Referee, 2005, *Energy Policy*

Referee, 2004, *Southern Economic Journal*

Referee, 2002, *Resource & Energy Economics*

Committee Member, IAEE/USAEE Student Paper Scholarship Award Committee, 2003

PROPOSAL TECHNICAL REVIEWER

California Energy Commission, Public Interest Energy Research (PIER) Program (1999).

PROFESSIONAL ASSOCIATIONS

American Economic Association, American Statistical Association, Southern Economic Association, Western Economic Association, International Association of Energy Economists ("IAEE"), United States Association of Energy Economics ("USAEE"), the National Association for Business Economics ("NABE"), and the Energy Bar Association (National and Louisiana Chapter; current Board member of LA chapter).

HONORS AND AWARDS

National Association of Regulatory Utility Commissioners (NARUC). Best Paper Award for papers published in the *Journal of Applied Regulation* (2004).

Baton Rouge Business Report, Selected as "Top 40 Under 40" (2003).

Omicron Delta Epsilon (1992-Current).

Interstate Oil and Gas Compact Commission (IOGCC) "Best Practice" Award for Research on the Economic Impact of Oil and Gas Activities on State Leases for the Louisiana Department of Natural Resources (2003).

Distinguished Research Award, Academy of Legal, Ethical and Regulatory Issues, Allied Academics (2002).

Florida Public Service Commission, Staff Excellence Award for Assistance in the Analysis of Local Exchange Competition Legislation (1995).

TEACHING EXPERIENCE

Energy and the Environment (Survey Course)

Principles of Microeconomic Theory

Principles of Macroeconomic Theory

Lecturer, Environmental Management and Permitting. Lecture in Natural Gas Industry, LNG and Markets.

Lecturer, Electric Power Industry Environmental Issues, Field Course on Energy and the Environment. (Dept. of Environmental Studies).

Lecturer, Electric Power Industry Trends, Principles Course in Power Engineering (Dept. of Electric Engineering).

Lecturer, LSU Honors College, Senior Course on "Society and the Coast."

Continuing Education. Electric Power Industry Restructuring for Energy Professionals.

"The Gulf Coast Energy Situation: Outlook for Production and Consumption." Educational Course and Lecture Prepared for the Foundation for American Communications and the Society for Professional Journalists, New Orleans, LA, December 2, 2004

"The Impact of Hurricane Katrina on Louisiana's Energy Infrastructure and National Energy Markets." Educational Course and Lecture Prepared for the Foundation for American Communications and the Society for Professional Journalists, Houston, TX, September 13, 2005.

"Forecasting for Regulators: Current Issues and Trends in the Use of Forecasts, Statistical, and Empirical Analyses in Energy Regulation." Instructional Course for State Regulatory Commission Staff. Institute of Public Utilities, Kellogg Center, Michigan State University. July 8-9, 2010.

"Regulatory and Ratemaking Issues with Cost and Revenue Trackers." Michigan State University, Institute of Public Utilities. Advanced Regulatory Studies Program. September 29, 2010.

"Demand Modeling and Forecasting for Regulators." Michigan State University, Institute of Public Utilities. Advanced Regulatory Studies Program. September 30, 2010.

"Demand Modeling and Forecasting for Regulators." Michigan State University, Institute of Public Utilities, Forecasting Workshop, Charleston, SC. March 7-9, 2011.

"Regulatory and Cost Recovery Approaches for Smart Grid Applications." Michigan State University, Institute of Public Utilities, Smart Grid Workshop for Regulators. Charleston, SC. March 7-11, 2011.

"Regulatory and Ratemaking Issues Associated with Cost and Expense Adjustment Mechanisms." Michigan State University, Institute of Public Utilities, Advanced Regulatory Studies Program. Lansing, Michigan. September 28, 2011.

"Utility Incentives, Decoupling, and Renewable Energy Programs." Michigan State University, Institute of Public Utilities, Advanced Regulatory Studies Program. Lansing, Michigan. September 29, 2011.

"Regulatory and Cost Recovery Approaches for Smart Grid Applications." Michigan State University, Institute of Public Utilities, Smart Grid Workshop for Regulators. Charleston, SC. March 6-8, 2012.

"Traditional and Incentive Ratemaking Workshop." New Mexico Public Utilities Commission Staff. Santa Fe, NM October 18, 2012.

"Traditional and Incentive Ratemaking Workshop." New Jersey Board of Public Utilities Staff. Newark, NJ. March 1, 2013.

"Natural Gas Issues and Recent Market Trends." Michigan State University Institute of Public Utilities, GridSchool Regulatory Studies Program, East Lansing, Mich., March 29, 2017.

"Gas Supply Planning and Procurement: Regulatory Overview and issues." Michigan State University Institute of Public Utilities, Basic Regulatory Studies Program, East Lansing, Mich., Aug 17, 2017.

"Natural Gas Supply Issues and Challenges." Michigan State University Institute of Public Utilities, Basic Regulatory Studies Program, East Lansing, Mich., Aug 17, 2017.

"Incentives, Risk and Changes in the Nature of Regulation." Michigan State University Institute of Public Utilities, Basic Regulatory Studies Program, East Lansing, Mich., Aug 18, 2017.

"Traditional and Alternative Forms of Regulation: Background and Overview." Michigan State University Institute of Public Utilities, Advanced Regulatory Studies Program, East Lansing, Mich., October 2, 2017.

"Traditional and Alternative Forms of Regulation: Utility and policy motivations for risk and change." Michigan State University Institute of Public Utilities, Advanced Regulatory Studies Program, East Lansing, Mich., October 2, 2017.

"Traditional and Alternative Forms of Regulation: Incentives and Formula Based Methods." Michigan State University Institute of Public Utilities, Advanced Regulatory Studies Program, East Lansing, Mich., October 2, 2017.

THESIS/DISSERTATIONS COMMITTEES

Active:
1 Thesis Committee Memberships (Environmental Studies)
2 Ph.D. Dissertation Committee (Economics)
Completed:
8 Thesis Committee Memberships (Environmental Studies, Geography)
4 Doctoral Committee Memberships (Information Systems & Decision Sciences, Agricultural and Resource Economics, Economics, Education and Workforce Development).
2 Doctoral Examination Committee Membership (Information Systems & Decision Sciences, Education and Workforce Development)
1 Senior Honors Thesis (Journalism, Loyola University)

LSU SERVICE AND COMMITTEE MEMBERSHIPS

Committee Member, Energy Education Curriculum Committee. E.J. Ourso College of Business. LSU (2016-Current).

Chairman, LSU Energy Initiative/LSU Energy Council (2014-Current).

Co-Director & Steering Committee Member, LSU Coastal Marine Institute (2009-2014).

CES Promotion Committee, Division of Radiation Safety (2006).

Search Committee Chair (2006), Research Associate 4 Position.

Search Committee Member (2005), Research Associate 4 Position.

Search Committee Member (2005), CES Communications Manager.

LSU Graduate Research Faculty, Associate Member (1997-2004); Full Member (2004-2010); Affiliate Member with Full Directional Rights (2011-2014); Full Member (2014-current).

LSU Faculty Senate (2003-2006).

Conference Coordinator. (2005-Current) Center for Energy Studies Conference on Alternative Energy.

LSU CES/SCE Public Art Selection Committee (2003-2005).

Conference Coordinator. Center for Energy Studies Annual Energy Conference/Summit. (2003-Current).

Conference Coordinator. Center for Energy Studies Seminar Series on Electric Utility Restructuring and Wholesale Competition. (1996-2003).

Co-Chairman, Review Committee, Louisiana Port Construction and Development Priority Program Rules and Regulations, On Behalf of the LSU Ports and Waterways Institute. (1997).

LSU Main Campus Cogeneration/Turbine Project, (1999-2000).

LSU InterCollege Environmental Cooperative. (1999-2001).

LSU Faculty Senate Committee on Public Relations (1997-1999).

LSU Faculty Senate Committee on Student Retention and Recruitment (1999-2003).

PROFESSIONAL SERVICE

Board Member (2018). Energy Bar Association, Louisiana Chapter.

Program Committee Member (2017). Gulf Coast Power Association Conference. New Orleans, LA.

Program Committee Member (2016). Gulf Coast Power Association Conference. New Orleans, LA.

Program Committee Member (2015). Gulf Coast Power Association Workshop/Special Briefing. "Gulf Coast Disaster Readiness: A Past, Present and Future Look at Power and Industry Readiness in MISO South."

Advisor (2008). National Association of Regulatory Utility Commissioners ("NARUC"). Study Committee on the Impact of Executive Drilling Moratoria on Federal Lands.

Steering Committee Member, Louisiana Representative (2008-Current). Southeast Agriculture & Forestry Energy Resources Alliance. Southern Policies Growth Board.

Advisor (2007-Current). National Association of State Utility Consumer Advocates ("NASUCA"), Natural Gas Committee.

Program Committee Chairman (2007-2008). U.S. Association of Energy Economics ("USAEE") Annual Conference, New Orleans, LA

Finance Committee Chairman (2007-2008). USAEE Annual Conference, New Orleans, LA

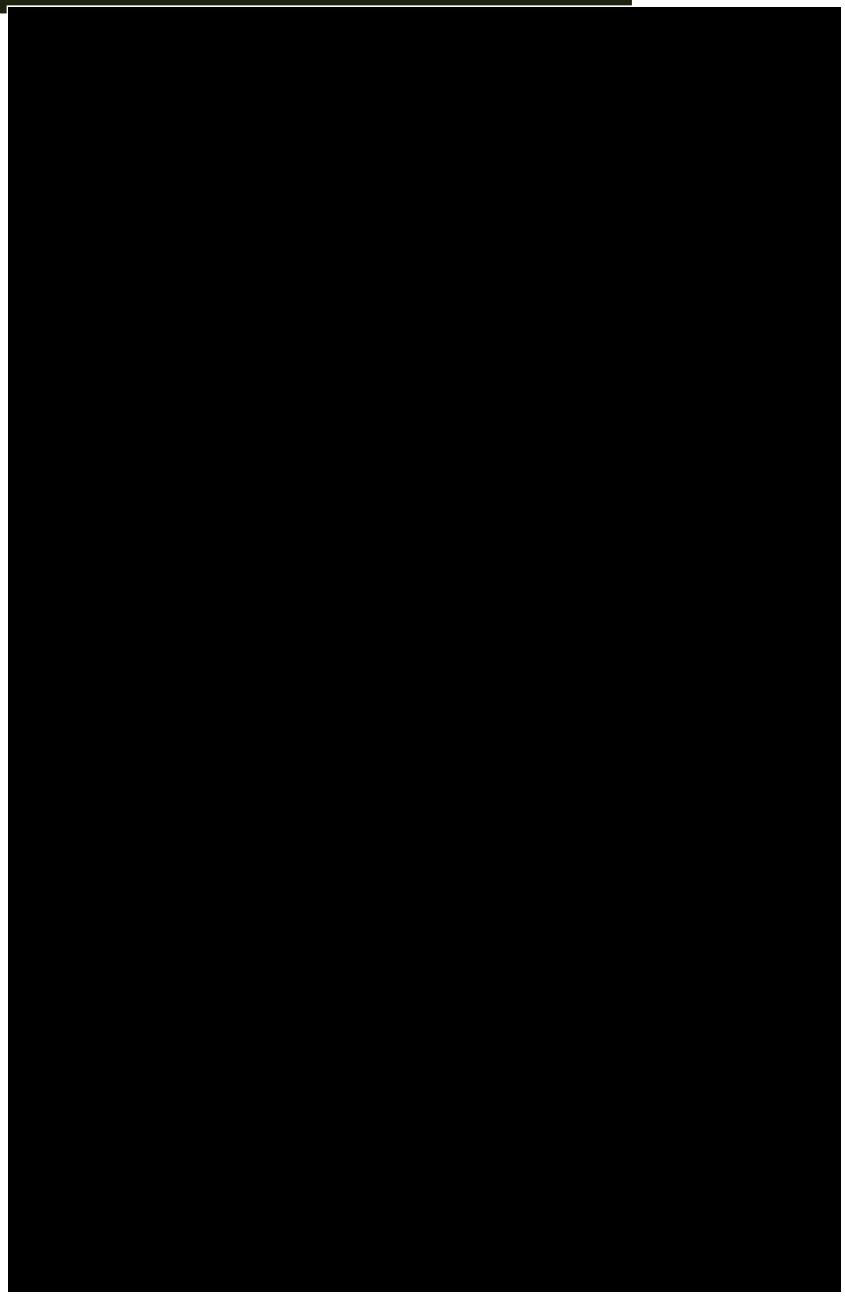
Committee Member (2006), International Association for Energy Economics ("IAEE") Nominating Committee.

Founding President (2005-2007) Louisiana Chapter, USAEE.

Secretary (2001) Houston Chapter, USAEE.

Advisor, Louisiana LNG Buyers/Developers Summit, Office of the Governor/Louisiana Department of Economic Development/Louisiana Department of Natural Resources, and Greater New Orleans, Inc. (2004).

Nautilus Offshore Wind
Project Area Map

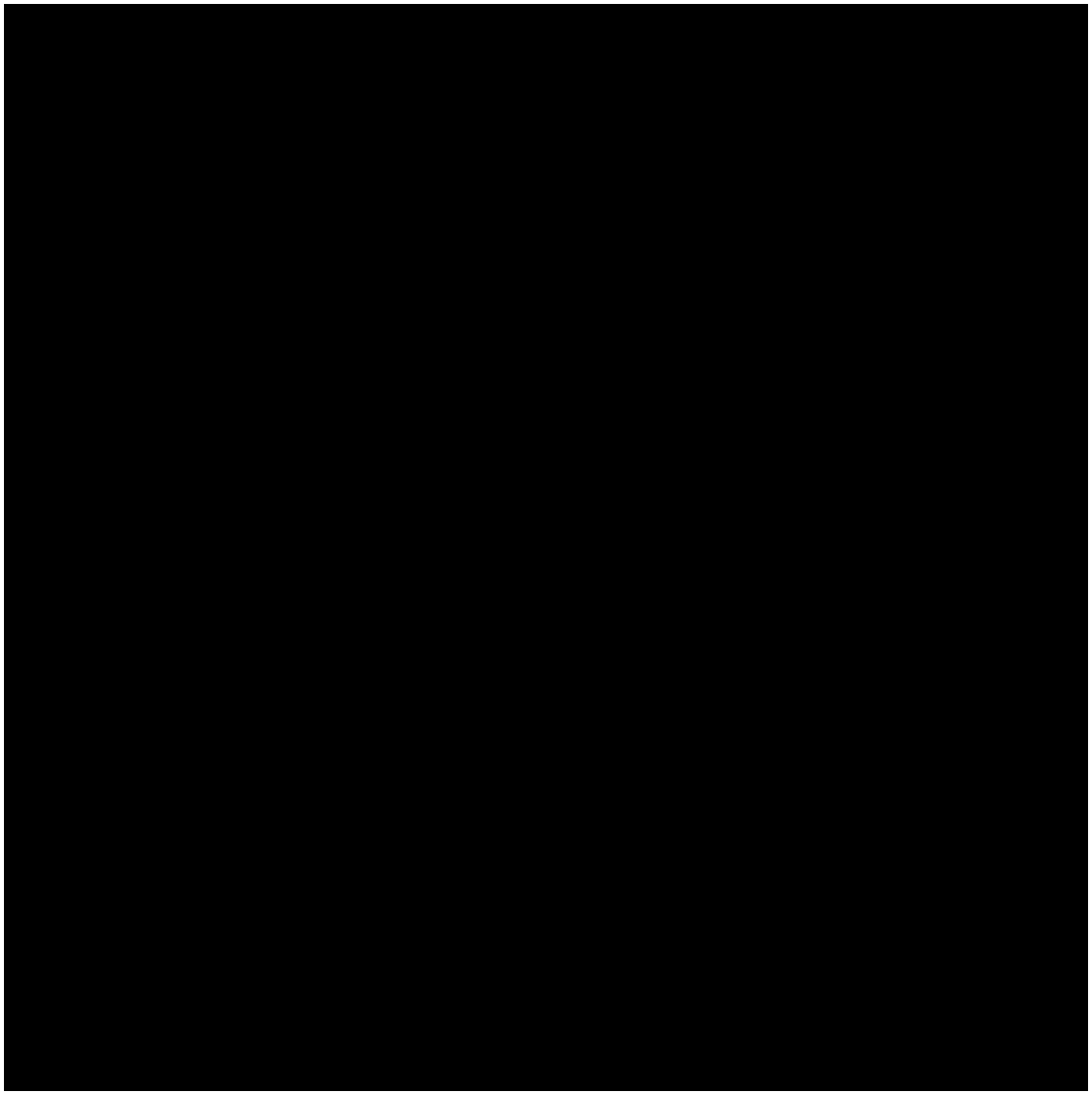


Source: Company Petition, Appendix B, Attachment 27.

Nautilus Offshore Wind
Project Implementation Plan

Source: Company Petition, Appendix B, Attachment 29.

Nautilus Offshore Wind
Summary of Project Costs

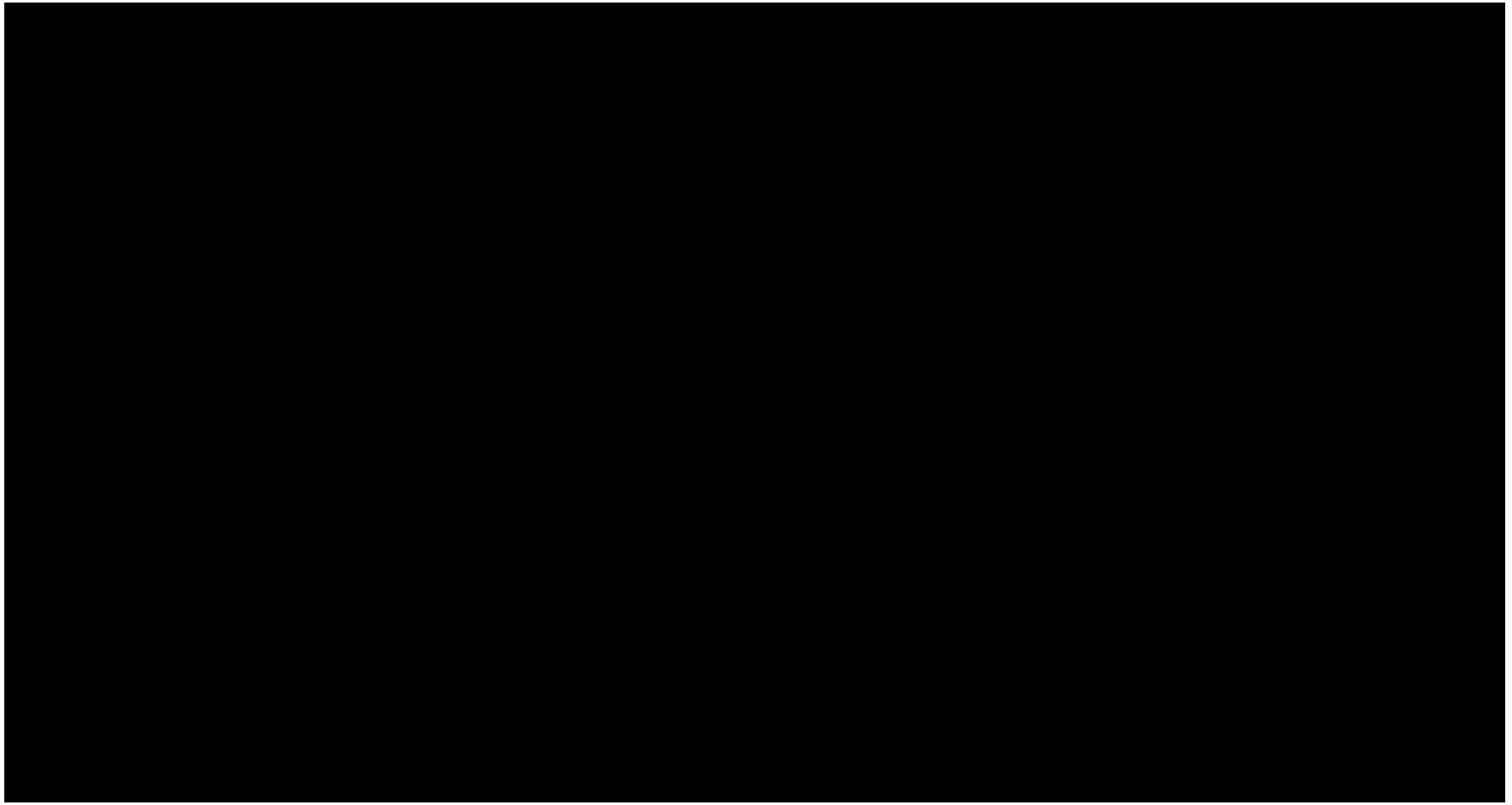


Source: Company Petition, Appendix B, Attachment 59.

Nautilus Offshore Wind
Annual OREC Revenue and Offsets

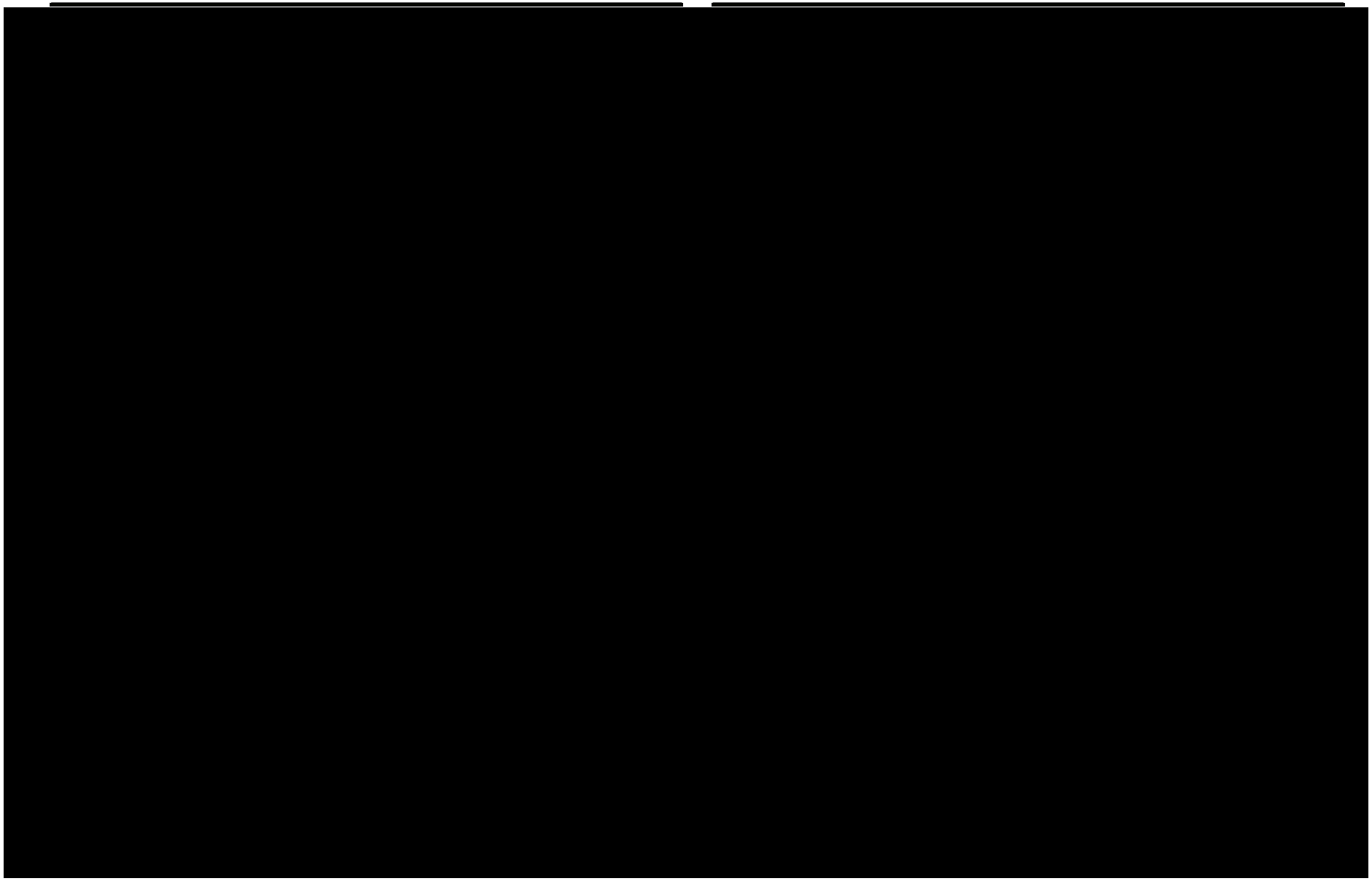
Source: Company Petition, Appendix B, Attachment 72 and Attachment 73.

Nautilus Offshore Wind
Net Benefit Analysis Results



Source: Company Petition, Appendix B, Attachment 72 and Attachment 73.

Comparison of Nautilus Proposal to Other Completed/Operational OSW Projects



Source: Company Petition, Appendix B, Attachment 59; International Monetary Fund, Exchange Rate Archive, https://www.imf.org/external/np/fin/data/param_rms_mth.aspx; and, 4C Offshore, http://www.4coffshore.com/.

Comparison of Nautilus Proposal to Other Completed/Operational OSW Projects with Same Turbine

[redacted]

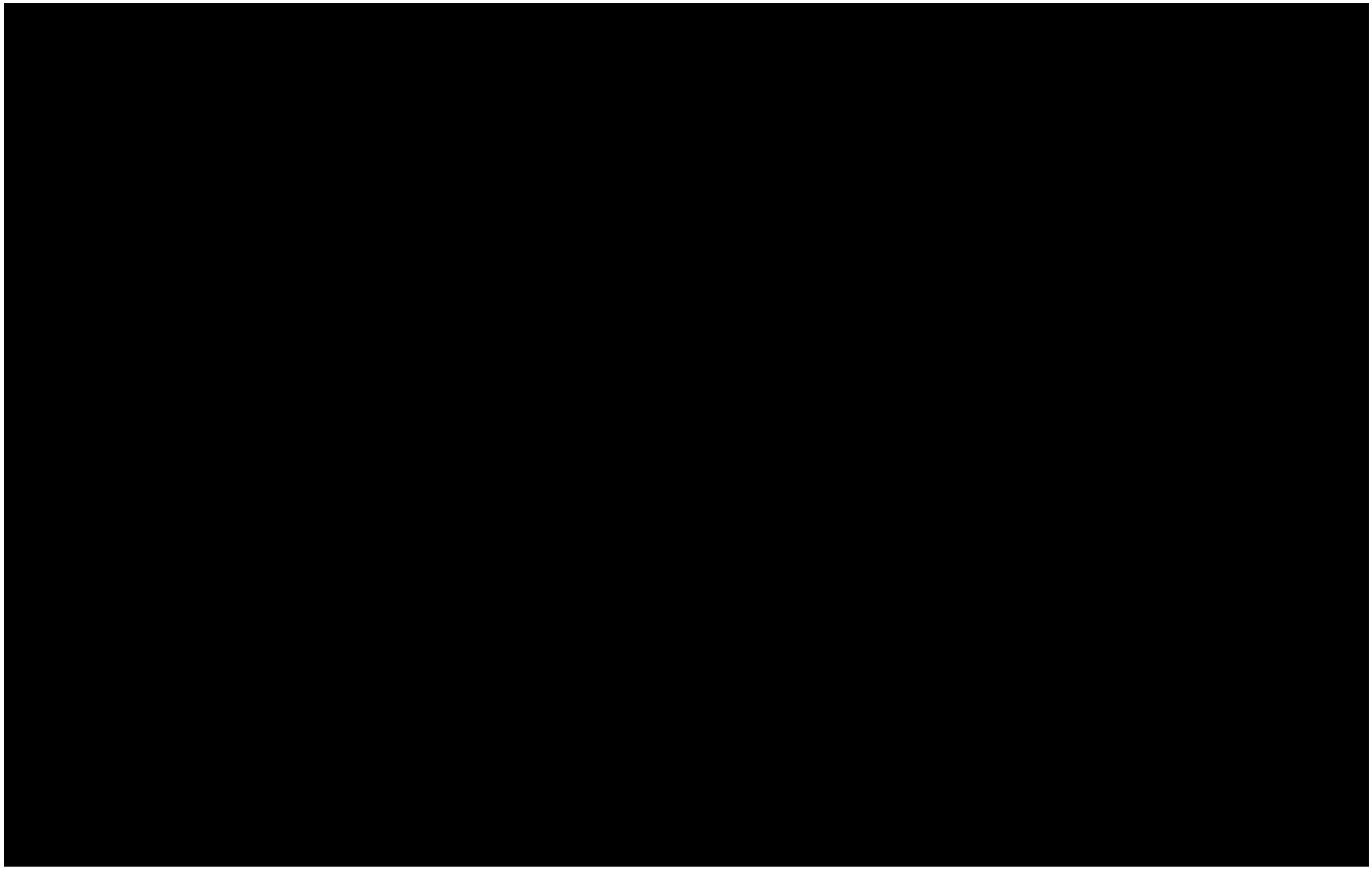
Source: Company Petition, Appendix B, pages 22-24; Appendix B, Attachment 59; International Monetary Fund, Exchange Rate Archive, https://www.imf.org/external/np/fin/data/param_rms_mth.aspx; and 4C Offshore, http://www.4coffshore.com/.

Recently Approved/Awarded U.S. OSW Projects

State	Project	Capacity (MW)	Project Cost (million $)	per Capacity Cost ($/kW)	Difference from Nautilus ($/kW)	Project Cost at Nautilus Capacity Cost (million $)
New Jersey	Nautilus	[redacted]				
Massachusetts	Vineyard Wind	800	$ 1,560.0	$ 1,950	[redacted]	
Maryland	U.S. Wind	248	$ 1,375.0	$ 5,544	[redacted]	
Maryland	Skipjack	120	$ 720.0	$ 6,000	[redacted]	
New York	South Fork	90	$ 740.0	$ 8,222	[redacted]	
Rhode Island	Block Island	30	$ 290.0	$ 9,667	[redacted]	

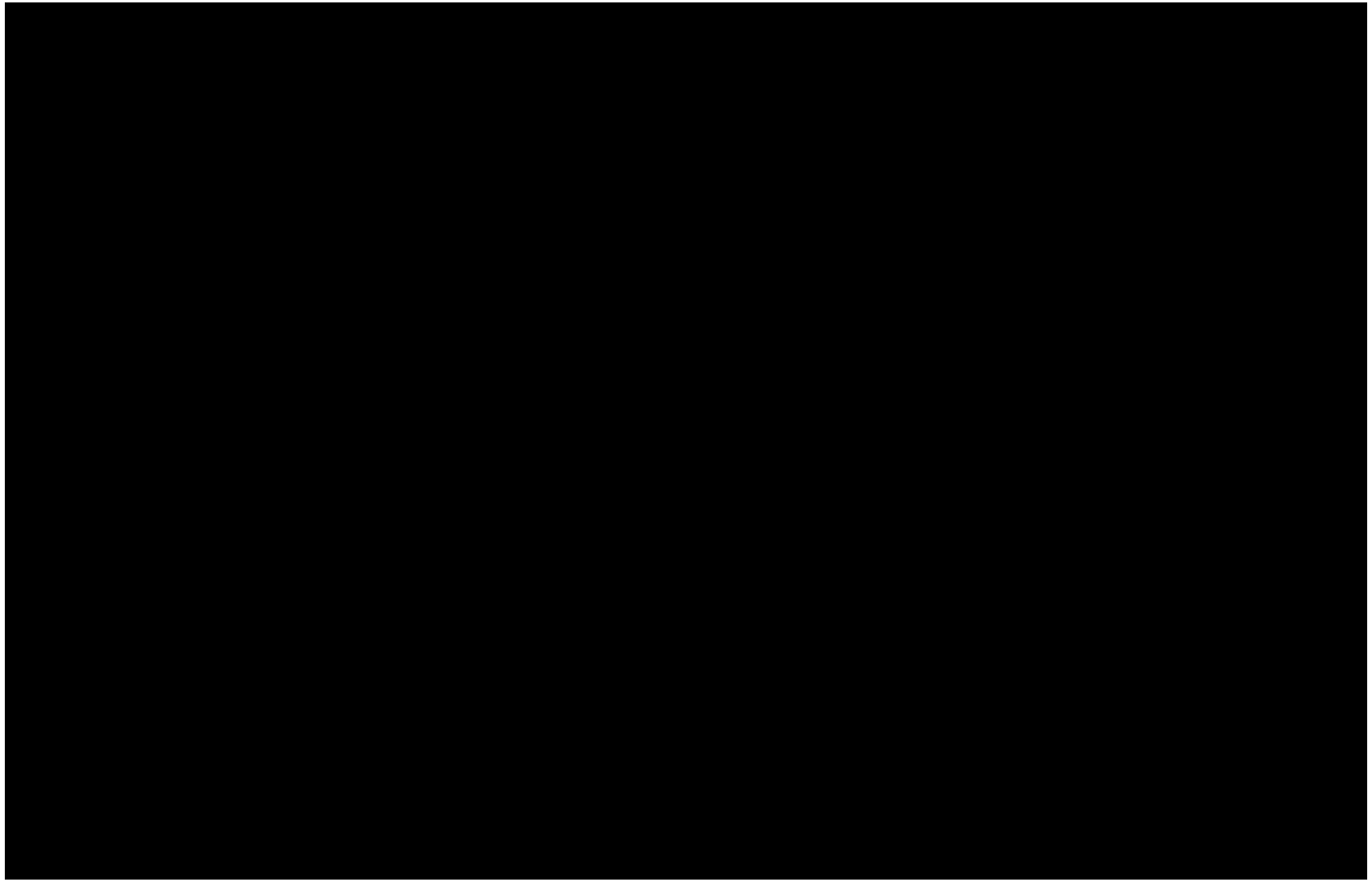
Note: The total project cost for Vineyard Wind has not been disclosed; the project cost here is estimated using a reported levelized price of $84 per MWh.
Source: Company Petition, Appendix B, Attachment 72; In re: Petitions for Approval of Proposed Long-Term Contracts for Offshore Wind Energy Pursuant to Section 83C of Chapter 188 of the Acts of 2016, DPU 18-76, 18-77, 18-78. Massachusetts Department of Energy Resources. August 1, 2018. Available at: https://macleanenergy.com/category/83c/; Maryland PSC. 2017. Maryland PSC awards ORECS to two offshore wind developers. May 11. Available at: https://www.psc.state.md.us/wp-content/uploads/PSC-Awards-ORECs-to-US-Wind-Skipjack.pdf; In the matter of the applications of U.S. Wind, Inc. and Skipjack Offshore Energy, LLC for a proposed offshore wind project(s) pursuant to the Maryland Offshore Wind Energy Act of 2013. Maryland Public Service Commission. Order No. 88192. May 11, 2017; Cardwell, D. 2017. Nation's largest offshore wind farm will be build off Long Island. New York Times. January 25. Available at: https://www.nytimes.com/2017/01/25/business/energy-environment/long-island-power-authority-offshore-wind.html; In re: Review of amended power purchase agreement between Narragansett Electric Company d/b/a National Grid and Deepwater Wind Block Island LLC pursuant to R.I. general laws §39-26.1-7; and Deepwater Wind. 2015. First U.S. offshore wind project to reach financial close milestone. Press Release. March 2. Available at: http://dwwind.com/press/block-island-wind-farm-now-fully-financed/.

Comparison of Nautilus Proposal to Typical OSW Development Costs, All Capacity Levels



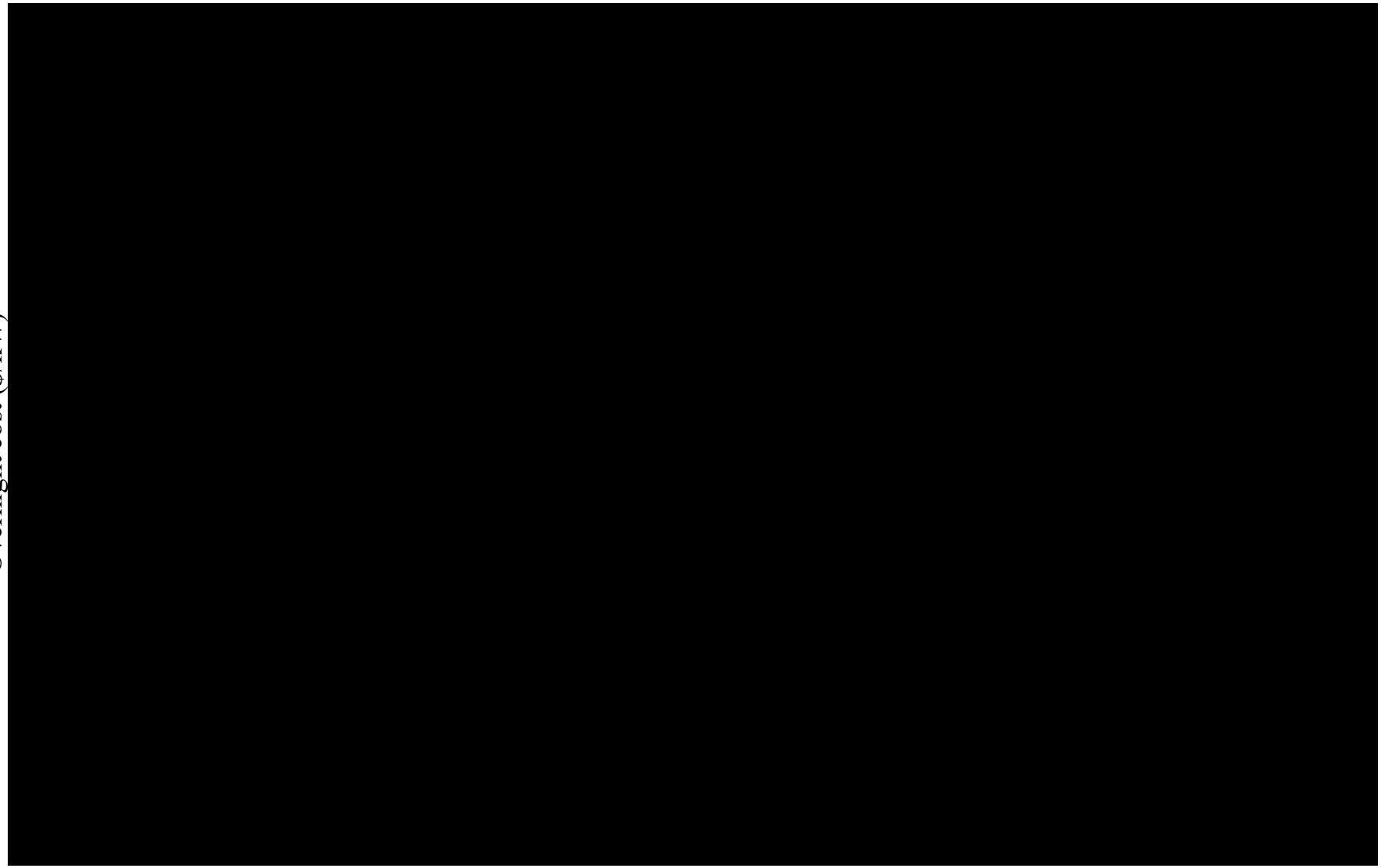
Note: Hywind Demo and Hywind II Windfarms are outliers and thus excluded.
Source: 4 C Offshore, http://www.4coffshore.com/.

Comparison of Nautilus Proposal to Typical OSW Development Costs, Less than 100 MW



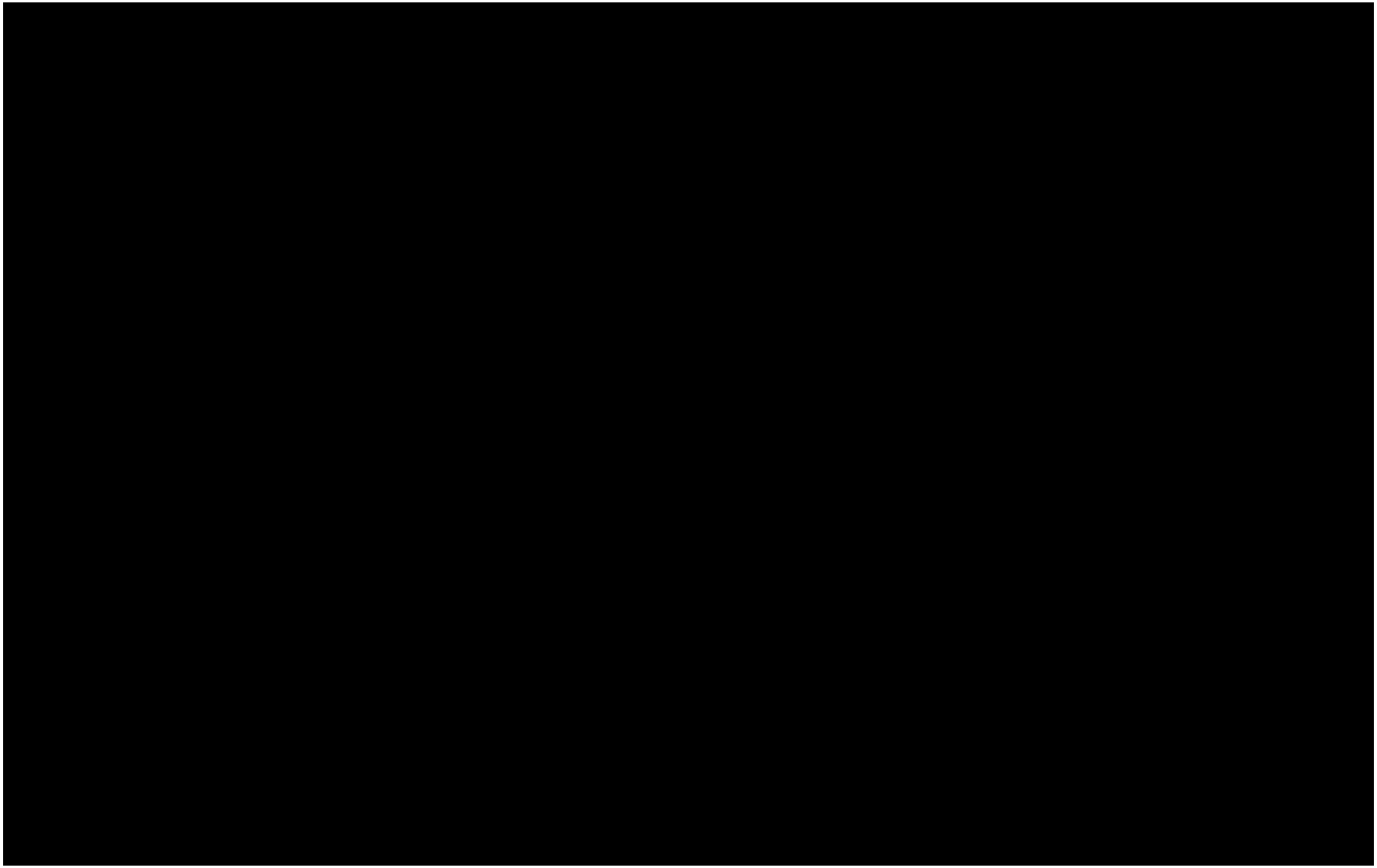
Note: Hywind Demo and Hywind II Windfarms are outliers and thus excluded.
Source: 4 C Offshore, http://www.4coffshore.com/.

Comparison of Nautilus Proposal to Typical OSW Development Costs, All Capacity Levels



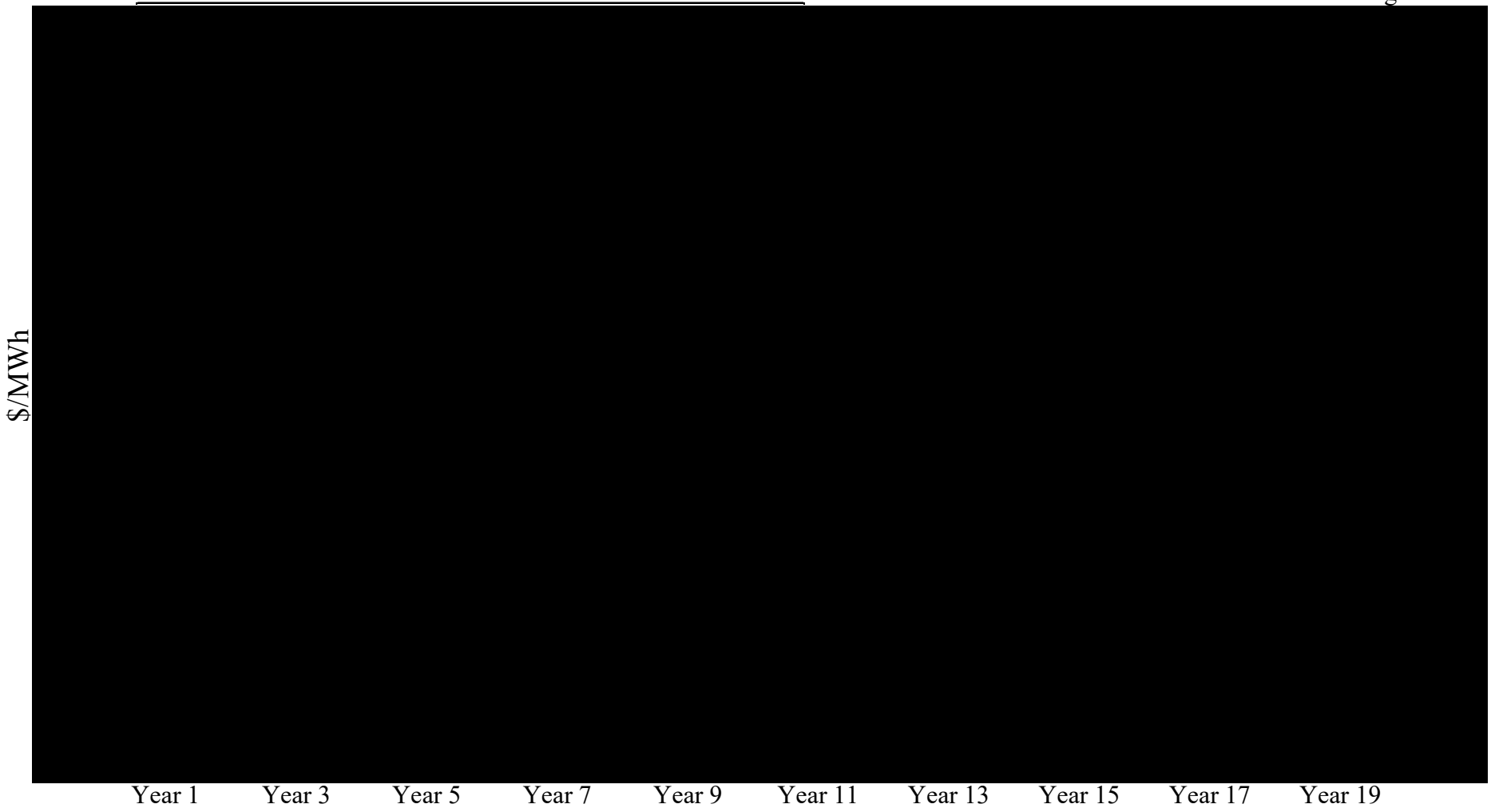
Note: Hywind Demo and Hywind II Windfarms are outliers and thus excluded.
Source: 4 C Offshore, http://www.4coffshore.com/.

Comparison of Nautilus Proposal to Typical OSW Development Costs, Less than 100 MW



Note: Hywind Demo and Hywind II Windfarms are outliers and thus excluded.
Source: 4 C Offshore, http://www.4coffshore.com/.

Comparison of Prices, Other State PPAs



Note: Details of the New York PPA are unknown; an escalation factor of three percent per year is assumed. Source: Company Petition, Appendix B, Attachment 72; In re: Petitions for Approval of Proposed Long-Term Contracts for Offshore Wind Energy Pursuant to Section 83C of Chapter 188 of the Acts of 2016, DPU 18-76, 18-77, 18-78. Massachusetts Department of Energy Resources. August 1, 2018. Available at: https://macleanenergy.com/category/83c/; Maryland PSC. 2017. Maryland PSC awards ORECS to two offshore wind developers. May 11. Available at: https://www.psc.state.md.us/wp-content/uploads/PSC-Awards-ORECs-to-US-Wind-Skipjack.pdf; In the matter of the applications of U.S. Wind, Inc. and Skipjack Offshore Energy, LLC for a proposed offshore wind project(s) pursuant to the Maryland Offshore Wind Energy Act of 2013. Maryland Public Service Commission. Order No. 88192. May 11, 2017; Cardwell, D. 2017. Nation's largest offshore wind farm will be build off Long Island. New York Times. January 25. Available at: https://www.nytimes.com/2017/01/25/business/energy-environment/long-island-power-authority-offshore-wind.html; In re: Review of amended power purchase agreement between Narragansett Electric Company d/b/a National Grid and Deepwater Wind Block Island LLC pursuant to R.I. general laws §39-26.1-7.

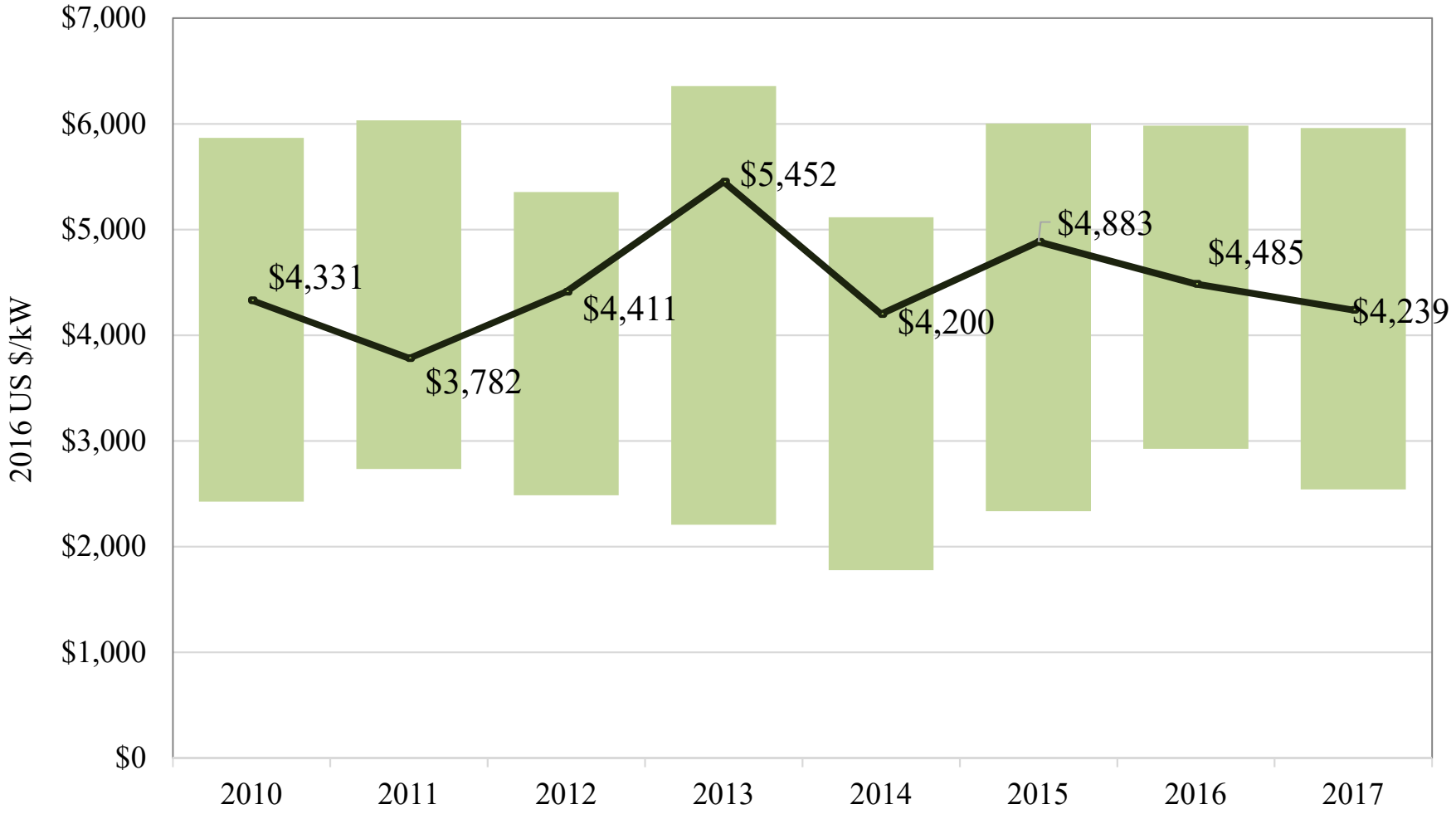
Estimated OREC Using Alternative Cost

Source: Company Petition, Appendix B, Attachment 59.

Implied Rate of Return Using Alternative Cost

Source: Company Petition, Appendix B, Attachment 59.

Weighted-Average Total Installed Cost for Offshore Wind



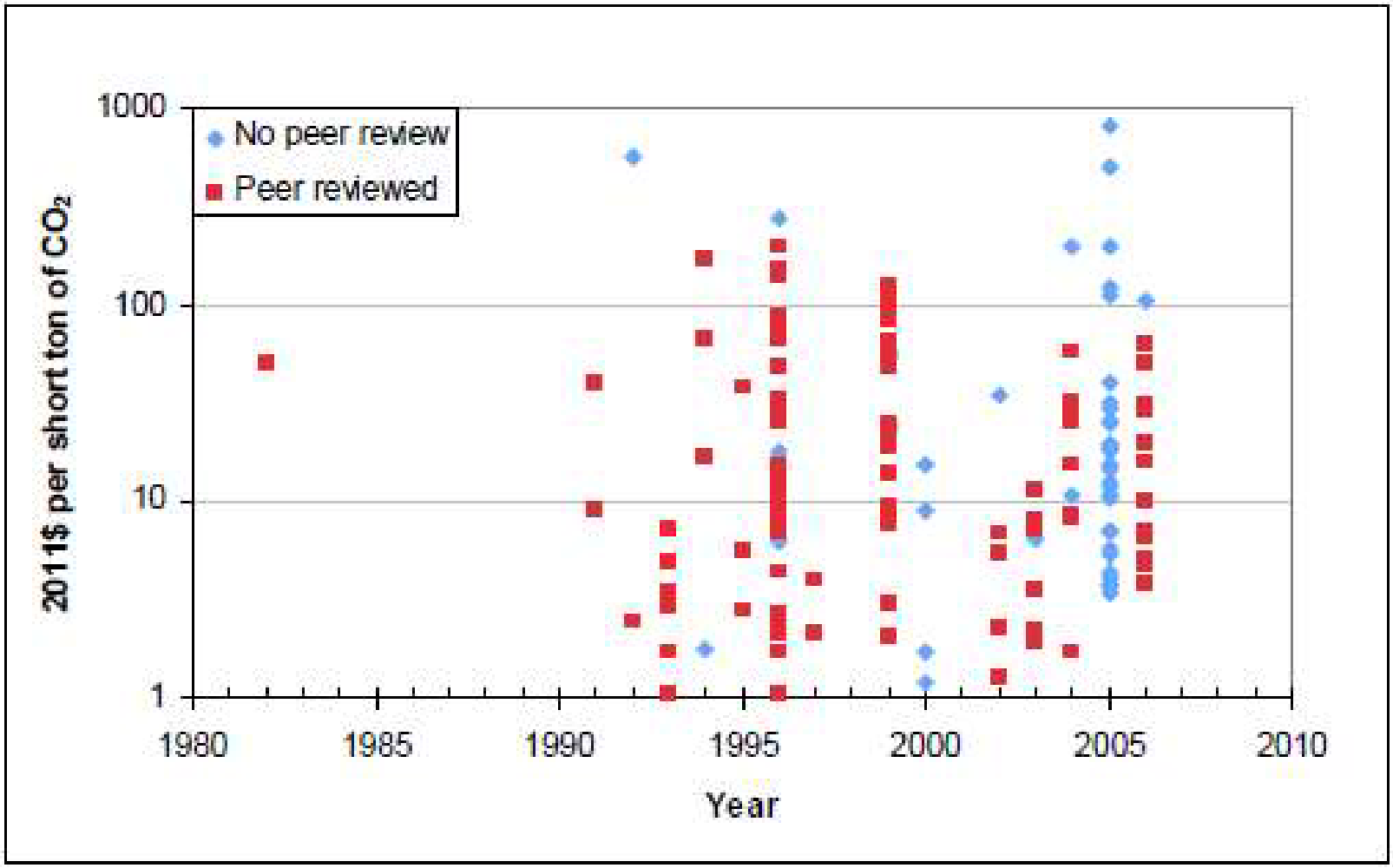
Source: IRENA (2018), Renewable Power Generation Costs in 2017, International Renewable Energy Agency. Available at: http://www.irena.org/publications/2018/Jan/Renewable-power-generation-costs-in-2017.

Human Health Effects of Ambient Ozone and $PM_{2.5}$

Category	Specific Effect	Effect has been Quantified	Effect has been Monetized
Reduced Incidence of Mortality from Exposure to Ozone	Premature mortality based on short-term study estimates (all ages)	✔	✔
	Premature mortality based on long-term study estimates (age 30-99)	–	–
Reduced Incidence of Morbidity from Exposure to Ozone	Hospital admissions - respiratory causes (age > 65)	✔	✔
	Hospital admissions - respiratory causes (age < 2)	✔	✔
	Emergency department visits for asthma (all ages)	✔	✔
	Minor restricted-activity days (age 18-65)	✔	✔
	School absence days (age 5-17)	✔	✔
	Decreased outdoor worker productivity (age 18-65)	–	–
	Other respiratory effects (e.g., premature aging of lungs)	–	–
	Cardiovascular and nervous system effects	–	–
	Reproductive and developmental effects	–	–
Reduced Incidence of Premature Morality from Exposure to $PM_{2.5}$	Adult premature mortality based on cohort study estimates and expert elicitation estimates (age > 25 or age > 30)	✔	✔
	Infant mortality (age < 1)	✔	✔
Reduced Incidence of Morbidity from Exposure to $PM_{2.5}$	Non-fatal heart attacks (age > 18)	✔	✔
	Hospital admissions—respiratory (all ages)	✔	✔
	Hospital admissions—cardiovascular (age > 20)	✔	✔
	Emergency room visits for asthma (all ages)	✔	✔
	Acute bronchitis (age 8-12)	✔	✔
	Lower respiratory symptoms (age 7-14)	✔	✔
	Upper respiratory symptoms (asthmatics age 9-11)	✔	✔
	Asthma exacerbation (asthmatics age 6-18)	✔	✔
	Lost work days (age 18-65)	✔	✔
	Minor restricted-activity days (age 18-65)	✔	✔
	Chronic Bronchitis (age > 26)	–	–
	Emergency room visits for cardiovascular effects (all ages)	–	–
	Strokes and cerebrovascular disease (age 50-79)	–	–
	Other cardiovascular effects (e.g., other ages)	–	–
	Other respiratory effects (e.g., pulmonary function, non-asthma ER visits, non-bronchitis chronic diseases, other ages and populations)	–	–
	Reproductive and developmental effects (e.g., low birth weight, pre-term births, etc.)	–	–
	Cancer, mutagenicity, and genotoxicity effects	–	–

Source: U.S. Environmental Protection Agency. 2015. Regulatory Impact Analysis for the Proposed Cross-State Air Pollution Rule (CSAPR) Update for the 2008 Ozone National Ambient Air Quality Standards (NAAQS), page 6-5.

Estimates of the Societal Cost of Carbon, 1982 – 2006



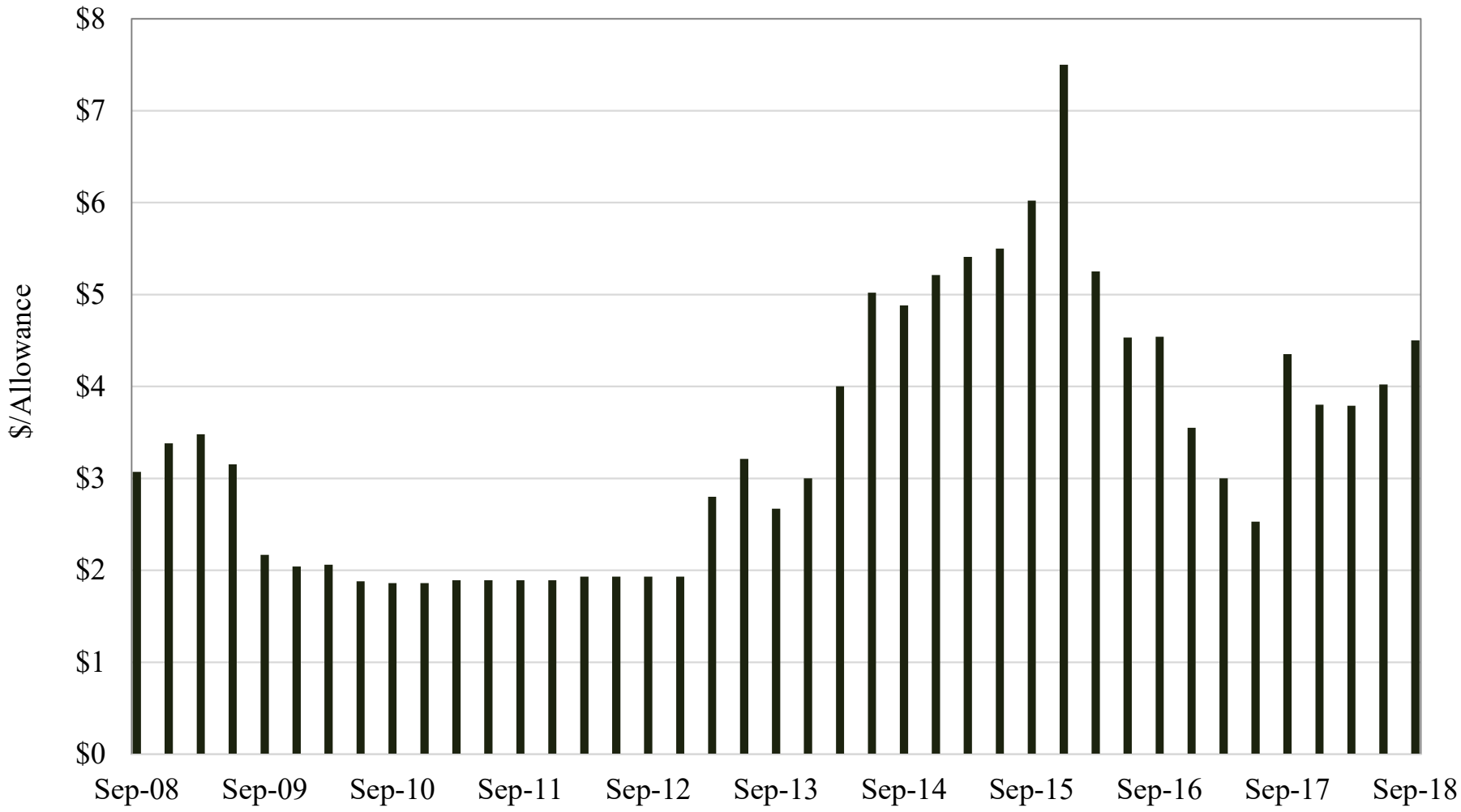
Source: Included in Avoided Energy Supply Costs in New England: 2011 Report. Synapse Energy Economics. August 11, 2011; Originally in:
Tol, Richard S.J. The Social cost of Carbon: Trends, Outliers and Catastrophes. Economics E-Journal. Vol 2, 2008-25.
August 12, 2008.

Social Cost of CO2, 2010-2050

Year	Discount Rate 5% Average	Discount Rate 3% Average	Discount Rate 2.5% Average	High Impact (95th Percentile at 3%)
	(2007$ per metric ton of CO_2)			
2010	10	31	50	86
2015	11	36	56	105
2020	12	42	62	123
2025	14	46	68	138
2030	16	50	73	152
2035	18	55	78	168
2040	21	60	84	183
2045	23	64	89	197
2050	26	69	95	212

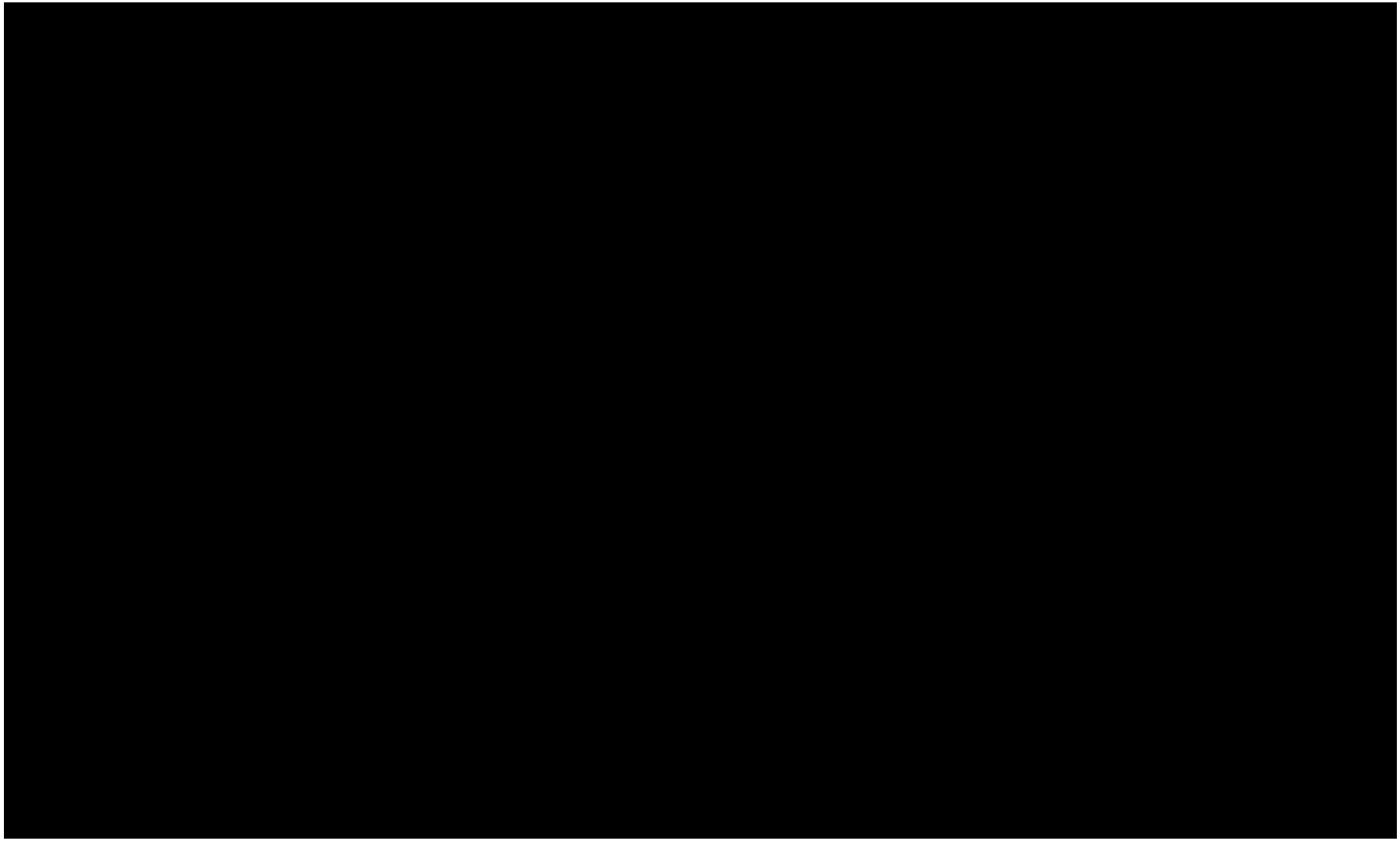
Source: Interagency Working Group on Social Cost of Greenhouse Gases, United States Government. 2016. Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866, p. 4. Available at: https://www.epa.gov/sites/production/files/2016-12/documents/sc_co2_tsd_august_2016.pdf

RGGI Auction Clearing Prices, 2008 – 2018



Source: Regional Greenhouse Gas Initiative, Allowance Prices and Volumes. Available at: https://www.rggi.org/Auctions/Auction-Results/Prices-Volumes.

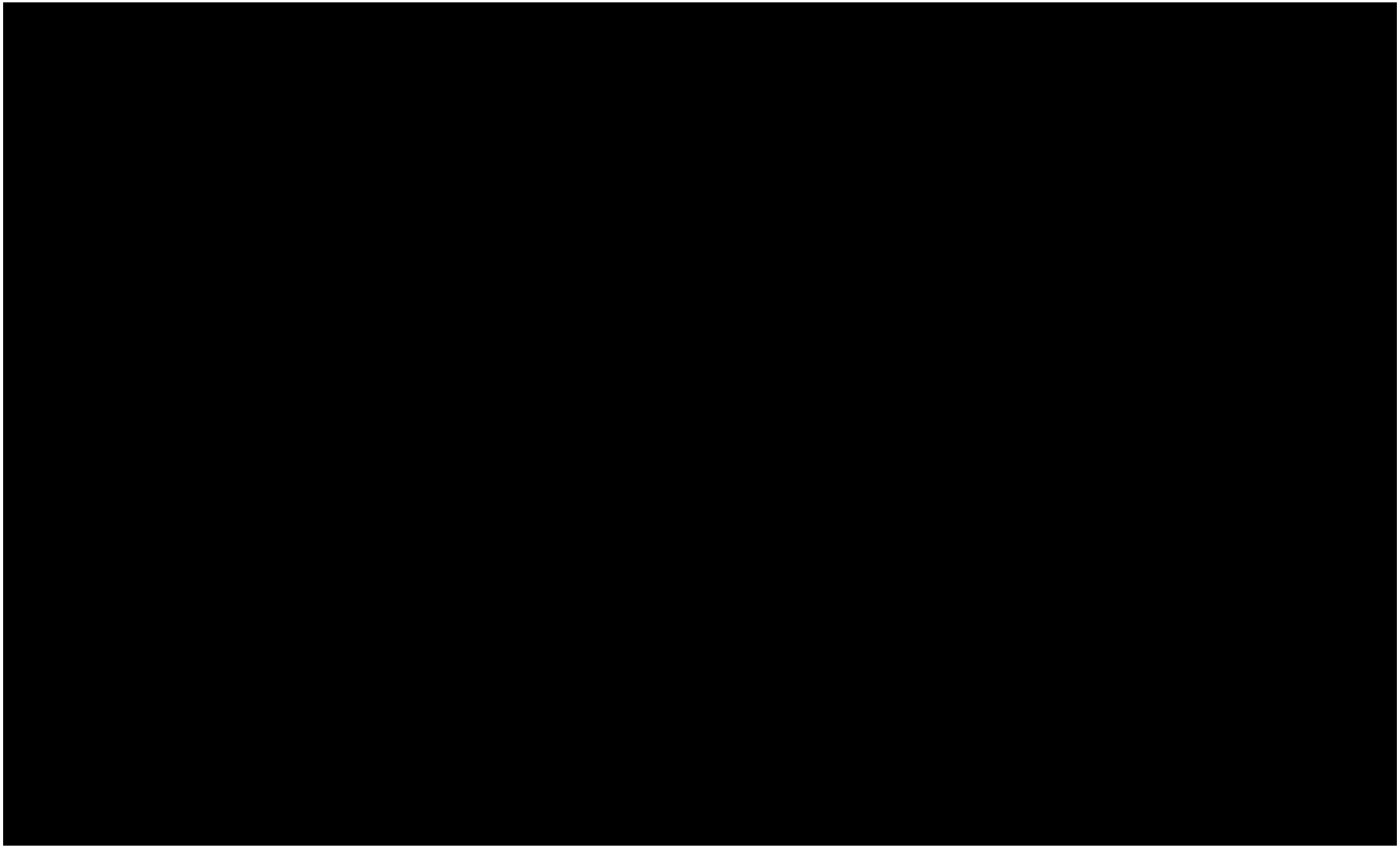
Comparison of Company Wholesale Electric Price Forecast and Alternative Price Forecast (Annual Average)



Source: Company Petition, Appendix B, Attachment 72; and Center for Energy, Economic & Environmental Policy. 2018. Energy Efficiency Cost-Benefit Analysis Avoided Cost Assumptions. March 13, 2018. Available at: http://www.njcleanenergy.com/files/file/Library/Market%20Research/Avoided%20Cost%20Memo%20(3-13-18).pdf.

Comparison of Company Wholesale Electric Revenue and Alternative Wholesale Electric Revenue

Million $



Source: Company Petition, Appendix B, Attachment 72; and Center for Energy, Economic & Environmental Policy. 2018. Energy Efficiency Cost-Benefit Analysis Avoided Cost Assumptions. March 13, 2018. Available at: http://www.njcleanenergy.com/files/file/Library/Market%20Research/Avoided%20Cost%20Memo%20(3-13-18).pdf.

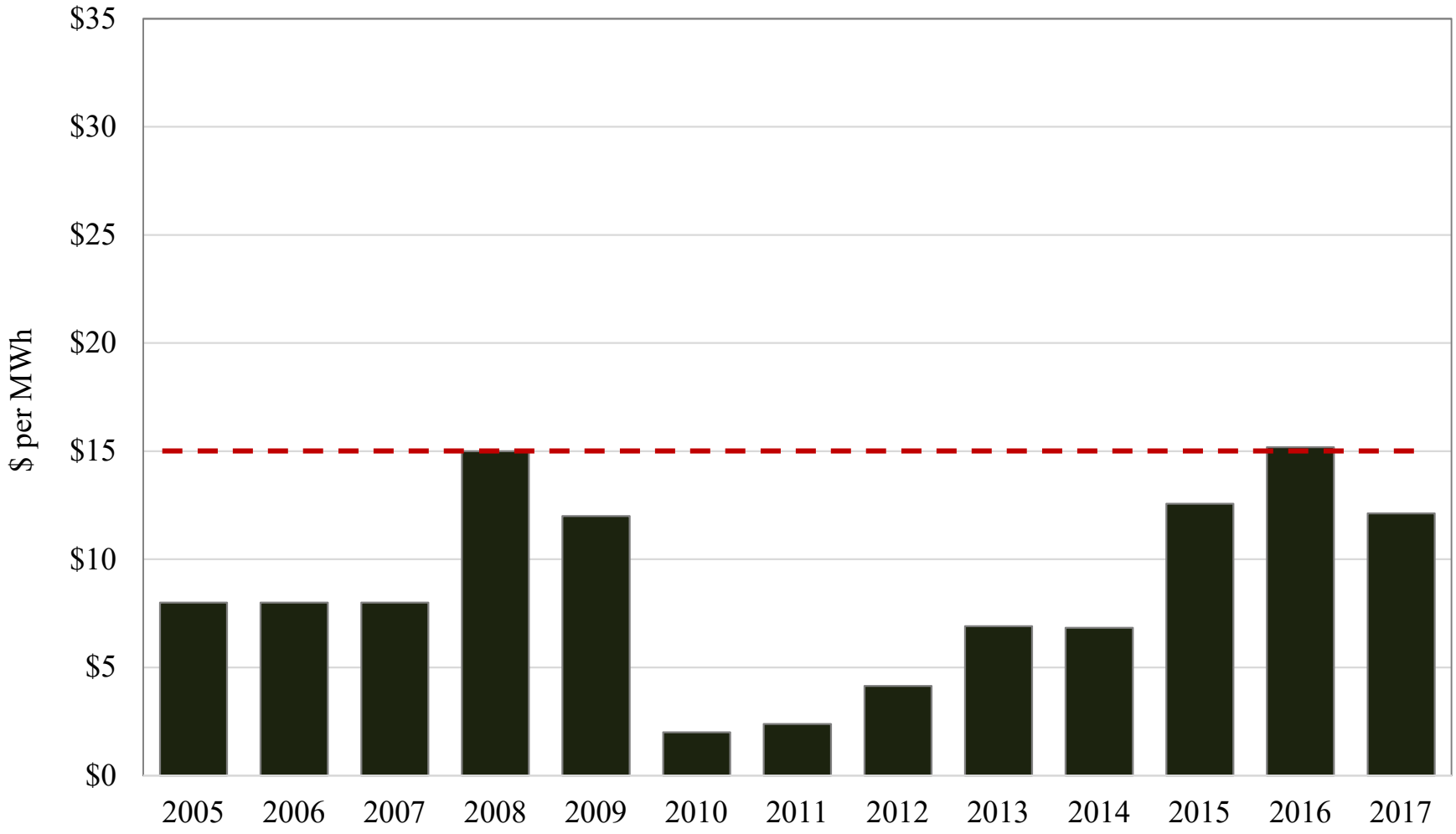
Comparison of Company Capacity Revenues and Alternative Capacity Revenues

Source: Company Petition, Appendix B, Attachment 72; and Center for Energy, Economic & Environmental Policy. 2018. Energy Efficiency Cost-Benefit Analysis Avoided Cost Assumptions. March 13, 2018. Available at: http://www.njcleanenergy.com/files/file/Library/Market%20Research/Avoided%20Cost%20Memo%20(3-13-18).pdf.

Company Forecast of Class I REC Prices

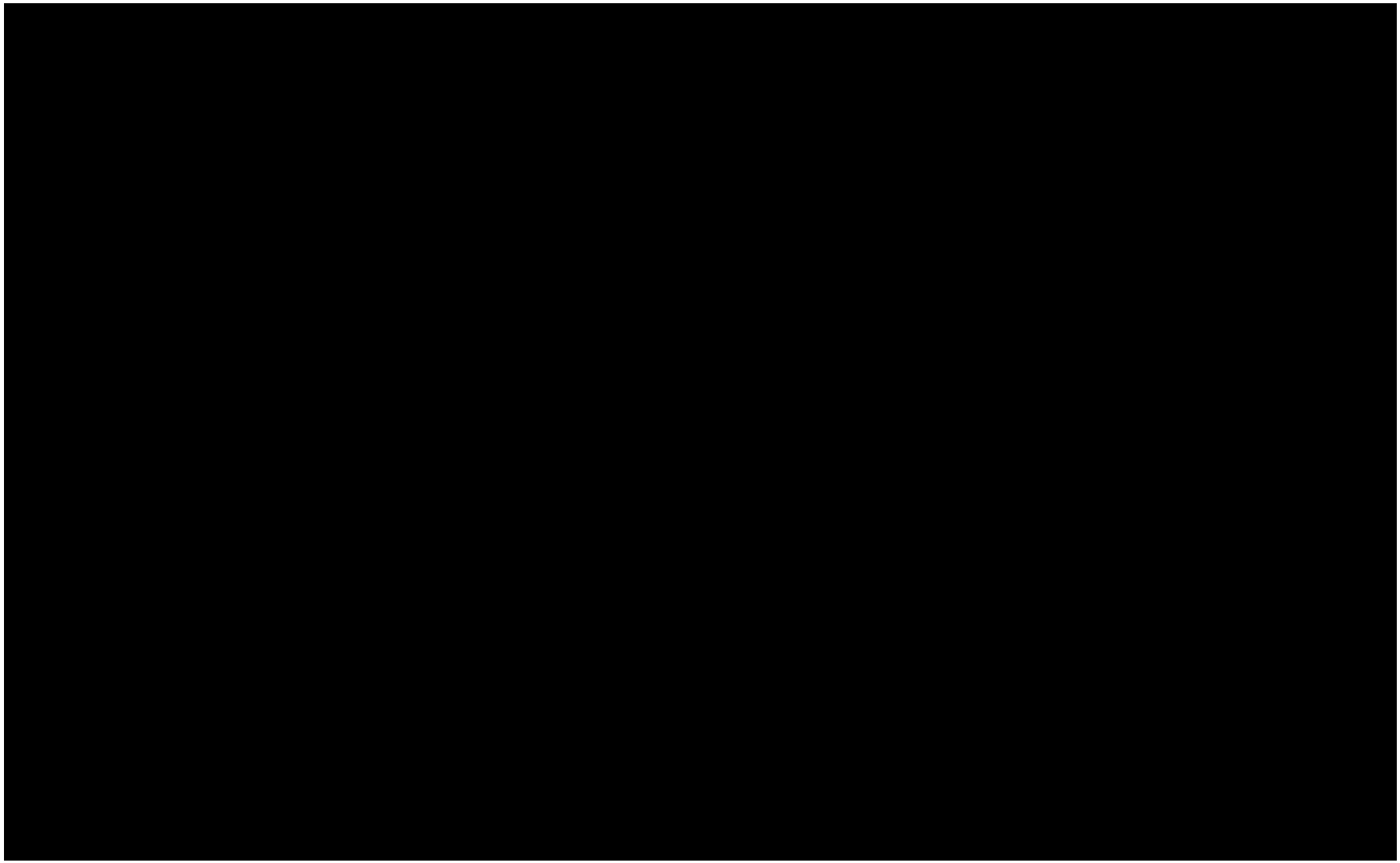
Source: Company Petition, Appendix B, Attachment 72.

Actual Historic New Jersey Class I REC Prices



Source: New Jersey Clean Energy RPS Compliance Reports.
Available at: http://www.njcleanenergy.com/files/file/rps/EY17/NJ%20RPS%20Compliance%20EY%202017%20Final%20Results%2011_2_17.pdf.

Actual Historic New Jersey Class I REC Prices and Company Forecast Class I REC Prices



Source: New Jersey Clean Energy RPS Compliance Reports.
Available at: http://www.njcleanenergy.com/files/file/rps/EY17/NJ%20RPS%20Compliance%20EY%202017%20Final%20Results%2011_2_17.pdf; Company response to Discovery Request RCR-RE-5; and Company Petition, Appendix B, Attachment 72.

Company Avoided Class I REC Benefit and Alternative Class I REC Benefit

Source: Company Petition, Appendix B, Attachment 72; and Center for Energy, Economic & Environmental Policy. 2018. Energy Efficiency Cost-Benefit Analysis Avoided Cost Assumptions. March 13, 2018. Available at: http://www.njcleanenergy.com/files/file/Library/Market%20Research/Avoided%20Cost%20Memo%20(3-13-18).pdf.

Summary of Study Results

Study	Author(s)	Focus of Study	Price Adder	Focuses on Wind?	Focuses on Offshore Wind?	Year Published
Net Metering in Mississippi	Stanton et al., Synapse Energy	Specific to net metering; no specific energy source	10%	–	–	2014
Analysis of New England fixed-price electricity contracts	Hornby et al., Synapse Energy	Natural gas and fuel oil	8-10%	✔	✔	2013
PacifiCorp Resource Plan	Rocky Mountain Power	Large overview of all types of energy	9.60%	✔	–	2013
Solar PV cost-benefit study in New Jersey and Pennsylvania[1]	Stanton et al., Synapse Energy	Specific to net metering; no specific energy source	7.5-18%	–	–	2014
Analysis of natural Gas, fixed-price contracts	Bolinger et al., Lawrence Berkley National Labs.	Natural gas, fixed-price model	17-24%	–	–	2002
Analysis of fixed-price contracts for residential customers in Ohio	Walden Labs	Fixed-price model; coal model before new administration	8%	–	–	2013
Vermont Guidelines on Program Screening	Vermont Public Service Board	Natural gas, fuel oil, general renewable portfolio	10%	–	–	2015
Oregon Guidelines on Program Screening[1]	Stanton et al., Synapse Energy	Specific to net metering; no specific energy source	10%	–	–	2014
Value of EE to Reduce Wholesale Price Volatility[2]	Baatz, Barrett, Stickles	Review of PJM structure	14%	–	–	2018

Note: [1]This study is based upon Net Metering in Mississippi by Synapse Energy.
[2]This is a review of PJM as a whole and is not specific to NJ or offshore wind; however, it does mention natural gas volatility.
Source: Company Petition, Appendix B, page 90.

Volatility Hedge Analysis

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2008-2018 Totals	2010-2018 Annual Average
Average Price ($/MWh)	$ 66.29	$ 37.01	$ 44.72	$ 42.77	$ 33.06	$ 36.52	$ 48.45	$ 33.34	$ 27.52	$ 29.39	$ 37.60	**$ 39.77**	
Standard Deviation ($/MWh)	$ 38.56	$ 17.10	$ 26.14	$ 28.97	$ 20.64	$ 20.60	$ 65.58	$ 27.78	$ 14.73	$ 17.38	$ 36.27	**$ 33.14**	
Count above OREC price	18	-	4	18	13	12	114	20	-	3	30	**232**	
Net Market-OREC ($/year)	$ 21,318	$ -	$ 4,753	$ 51,384	$ 16,308	$ 22,325	$ 566,459	$ 36,673	$ -	$ 16,780	$ 57,918	**$ 793,917**	**$96,567**
Monthly Average ($)	$ 1,777	$ -	$ 396	$ 4,282	$ 1,359	$ 1,860	$ 47,205	$ 3,056	$ -	$ 1,398	$ 4,826	**$ 66,160**	**$8,047**

Source: PJM, Settlements Verified Hourly LMPs. Available at: http://dataminer2.pjm.com/feed/rt_da_monthly_lmps/definition.

Comparison of Company Net Benefit Analysis and Net Benefit Analysis using Alternative Discount Rate

Source: Company Petition, Appendix B, Attachment 72.

Comparison of Company CBA and Alternative CBA

Source: Company Petition, Appendix B, Attachment 72.

Comparison of Company CBA and Alternative CBA with No ITC

Source: Company Petition, Appendix B, Attachment 72.

Comparison of Company's Current (Nautilus) and Prior (FACW) Benefit Estimates

Source: Company Petition, Appendix B, Attachment 72; and In Re Petition of Fishermen's Atlantic City Windfarm, LLC for the Approval of the State Waters Wind Project and Authorizing Offshore Wind Renewable Energy Certificates, Docket No. EO11050314V, Amended Application, Appendix D, Optimized Project C-B Analysis.xlsx.