STATE OF NEW JERSEY
BOARD OF PUBLIC UTILITIES

In the Matter of the Petition of Public Service Electric and Gas Company for Approval of the Second Energy Strong Program (Energy Strong II)	**)** **)** **)** **)**	**BPU Docket Nos. EO18060629 and GO18060630**

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

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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 a number of economic and regulatory gas policy issues included in the Energy Strong II ("ES II") proposal filed by the Public Service Electric and Gas Company ("PSE&G" or "the Company") on June 8, 2018. My testimony will focus on the cost-benefit analysis ("CBA") prepared by the Company, as well as a number of regulatory gas policy issues associated with the ES II proposal.

Testimony on behalf of Rate Counsel is also being filed by Edward A. McGee, of Acadian Consulting Group, Andrea Crane, of the Columbia Group, Maximilian Chang and Charles Salamone of Synapse Energy Economics, Inc., and by Kevin O'Donnell of Nova Energy Consultants. Mr. McGee is testifying on gas program issues, Andrea Crane is testifying on accounting and cost recovery issues, Mr. Chang and Mr. Salamone are testifying on electric program issues, and Mr. O'Donnell is testifying on cost of capital issues.

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

A. Yes. I have prepared 10 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:

- Section II: Summary of Recommendations
- Section III: Overview of Company's Energy Strong II Proposal
- Section IV: Board's Infrastructure Investment and Recovery Rules
- Section V: Program Cost-Benefit Analysis
- Section VI: The Company has not shown a need for its ES II natural gas program proposals
- Section VII: Program Design Deficiencies
- Section VIII: Conclusions and Recommendations

II. Summary of Recommendations

Q. PLEASE SUMMARIZE YOUR CONCLUSIONS AND RECOMMENDATIONS REGARDING THE COMPANY'S PROPOSED ES II PROGRAM?

A. The Board should reject the Company's ES II program proposal. The Company's proposed ES II Program is very large, will result in significant rate impacts as proposed, and its associated gas cost recovery mechanism suffers from a number of program design deficiencies. The Company's CBA also suffers from a number of deficiencies that underscore the questionable nature of the ES II program. The Company's proposed ES II Program fails the CBA and, if approved, as proposed the program will result in net negative economic benefits. The Company has not shown a need for its proposed ES II Program as it relates to its gas infrastructure subprograms, particularly the proposed Curtailment Resiliency subprogram. As detailed in the testimony of Mr. McGee, a number of the proposed pipeline extensions under the Curtailment Resiliency subprogram may never actually be used. Therefore, I recommend that the Board reject the Company's proposed ES II program.

Q. PLEASE SUMMARIZE THE RESULTS OF YOUR CBA/ECONOMIC IMPACT ANALYSIS OF THE COMPANY'S ES II PROGRAM.

A. The negative impacts associated with the $1.89 billion (on a net present value or "NPV" basis) in rate increases that are likely to arise from the ES II proposal outweigh any positive impacts that may arise from the ES II Program's construction and development activities. The net economic impacts of the program show that the Company's ES II proposal is likely to lead to a net contraction of New Jersey economic output of $2.55 billion (NPV basis) and a reduction of total New Jersey employment by almost 70,000 job-years over the life of the assets.

Q. PLEASE SUMMARIZE YOUR RECOMMENDATIONS REGARDING THE LEVEL OF GAS CAPITAL BASE SPENDING THAT SHOULD BE ALLOWED IF THE ES II PROGRAM IS APPROVED?

A. Consistent with the GSMP II approval, I recommend the Company should at a minimum maintain an annual baseline capital spend of $155 million over the five year term of the ES II program.[1] In addition to this minimum baseline capital spend, the Company should make additional baseline capital investments of at least 10 percent of any approved ES II program total expenditures, to be recovered in a traditional base rate case proceeding.

Q. CAN YOU PLEASE SUMMARIZE THE GAS PROGRAM DESIGN DEFICIENCIES ASSOCIATED WITH THE COMPANY'S PROPOSED COST RECOVERY MECHANISM?

A. The Company's Energy Strong proposal suffers from a number of deficiencies that include the following:

[1] 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"), Docket No. GR17070776, Decision and Order Approving Stipulation. March 22, 2018, Stipulation, p. 9.

1) An expansive set of costs not commonly included in any other New Jersey infrastructure cost recovery mechanisms;

2) No firm ES-II program-specific performance metrics;

3) No cost savings associated with lower operation and maintenance ("O&M") expenses; and

4) No rate mitigation provisions such as a cap on capital expenditures that are common with other tracker mechanisms.

Q. DO YOU HAVE ANY RECOMMENDATIONS SHOULD THE BOARD DECIDE TO APPROVE SOME PORTION OF THE COMPANY'S ES II PROPOSAL?

A. Yes. I recommend that the Board modify the Company's ES II should it decide to accept some portion of the plan. These modifications include:

- A limitation on total program (or subprogram) capital expenditures to just include those capital investments offered in this filing. Any capital expenditures in excess of this level can be considered for rate recovery at the time of the Company's next full base rate case.
- Utilization of program benchmarks for any electric and natural gas subprograms that are ultimately approved by the Board as part of the final program.
    - Electric program performance goals should be tied to the System Average Interruption Duration Index ("SAIDI") and System Average Interruption Frequency Index ("SAIFI") improvements identified in the Company's CBA.
    - A set of penalties, on a per-outage basis, should be applied to each of the approved natural gas programs that are comparable to the value of lost load ("VoLL") "benefits" identified by the Company in their CBA.
- Inclusion of an O&M cost credit equal to the estimated savings included in the Company's individual electric and natural gas subprograms.

- Inclusion of a rate impact cap equal to no more than a one percent increase in base rates consistent with the recommendation made under the Energy Strong I program.

III. Overview of Company Proposal

Q. PLEASE DESCRIBE THE COMPANY'S ES II PROPOSAL AND THE INITIAL ENERGY STRONG PROGRAM?

A. The Company is proposing the ES II program as an extension to its originally-approved Energy Strong ("ES I") program.[2] The purpose of the original ES I plan was to improve the Company's preparedness, reliability, and safety during a major storm.[3] The ES I program was originally comprised of two electric subprograms: an Electric Delivery Hardening Program and an Electric Delivery Infrastructure Resiliency Program. The ES I program also included two natural gas subprograms: a Metering and Regulation ("M&R") Flood Mitigation program and the Utilization Pressure Cast Iron pipeline replacement program in which the Company proposed to replace 750 miles of cast iron mains and 40,000 bare steel services.[4] The Company's originally-proposed ES I program was based upon a proposed $3.94 billion investment in electric and gas infrastructure system upgrades to enhance reliability during a major storm.[5] Ultimately, this

[2] Company Petition p. 2 at ¶3.
[3] In the Matter of the Board's Review of the Utilities' Response to Hurricane Irene, Docket No. EO11090543, Board Order, January 23, 2013. In the Matter of the Board's Establishment of a Generic Proceeding to Review Costs, Benefits and Reliability Impacts of Major Storm Event Mitigation Efforts, Docket No. AX13030197, Board Order, March 20, 2013.
[4] In the Matter of the Petition of Public Service Electric and Gas Company for Approval of the Energy Strong Program, Docket Nos. EO13020155 and GO13020156, Company Petition at ¶¶101 – 102 and 110; Direct Testimony of Jorge L. Cardenas, 39:891-896.
[5] In the Matter of the Petition of Public Service Electric and Gas Company for Approval of the Energy Strong Program, Docket Nos. EO13020155 and GO13020156, Company Petition at ¶10, Filed February 20, 2013.

request was considerably reduced, to an amount not to exceed $1.22 billion[6] through a settlement with the parties to that proceeding, which was ultimately approved by the Board.[7] A summary of the Company's original ES I proposal, and the final settlement amount, is provided in Schedule DED-1.

Q. PLEASE SUMMARIZE THE ES II PROPOSAL.

A. The Company's ES II proposal is based on a $2.5 billion "estimated" investment designed to "enhance safety, reliability, and/or resiliency" of its electric and natural gas delivery system over a five-year period.[8] The Company justifies this investment by stating that its program is designed to comply with the Board's rules on Infrastructure Investment Programs ("IIPs").[9] The Company claims that its ES II program will benefit customers by providing a safer, more modern system that accommodates new technologies, providing an electric system that can integrate and manage larger quantities of distributed energy resources and other innovations.[10] The Company states that its gas subprograms will provide increased resiliency and modernization of its gas distribution system.[11]

Q. HOW WILL THE COSTS OF THE ES II PROGRAM BE RECOVERED FROM RATEPAYERS?

A. The Company proposes to recover the costs associated with its ES II proposal through adjustments to base rates to electricity and natural gas distribution customers that will be updated

[6] A total of $1.0 billion was approved to be recovered through the special rate making mechanism and the remaining $220 million the Company would seek recovery in the Company's base rate case. See: In the Matter of the Petition of Public Service Electric and Gas Company for Approval of the Energy Strong Program, Docket Nos. EO13020155 and GO13020156, Order Approving Stipulation of Settlement, May 21, 2014, Stipulation, p. 8.
[7] In the Matter of the Petition of Public Service Electric and Gas Company for Approval of the Energy Strong Program, Docket Nos. EO13020155 and GO13020156, Order Approving Stipulation of Settlement, May 21, 2014.
[8] Company Petition p. 2 at ¶4.
[9] Company Petition p. 2 at ¶3.
[10] Company Petition p. 8 at ¶8.
[11] Company Petition p. 8 at ¶8; and Direct Testimony of Wade E. Miller, 3:2-13.

on a semi-annual basis as outlined in the Board's Infrastructure Investment and Recovery ("IIP") rules. [12] This affords the Company the ability to recover program investment costs on a much more accelerated basis relative to traditional rate of return regulation that would require these program investments to only be rolled into base rates as part of the approval of a full base rate proceeding. The Company states that its first rate filings will occur in September 2020 for electric rates and March 2022 for gas rates.[13]

Q. DOES THE ES II PROPOSAL INCLUDE AN ANNUAL REVIEW PROCESS?

A. Yes. The Company states that Board Staff and Rate Counsel will have an opportunity to review each rate adjustment filing to ensure that the revenue requirements and proposed rates are being calculated in accordance with the Board's Order approving the Program and the IIP rules.[14] The Company further states that an actual prudence review would occur as part of PSE&G's subsequent base rate case and that any imprudently incurred capital expenditures would be subject to refund as a part of that proceeding.[15]

Q. WHAT SPECIFIC PROGRAMS ARE INCLUDED IN THE COMPANY'S PROPOSED ENERGY STRONG PROGRAM?

A. The Company's states that its proposed ES II plan is designed to enhance safety, reliability, and/or resiliency through four electric and two gas subprograms.[16] The Company's proposal also includes a request for a periodic cost recovery mechanism on a semi-annual basis for electric and gas, consistent with the IIP regulations and will use the same approach as it did

[12] Company Petition p. 9 at ¶12.
[13] Company's Petition p. 10 at ¶13.
[14] Company's Petition p. 11 at ¶16.
[15] Company's Petition p. 11 at ¶16.
[16] Company Petition p.2 at ¶4.

for PSE&G's Energy Strong program for electric investments.[17] The Company estimates a total investment of $2.502 billion, with total electric distribution-related investments of $1.503 billion and natural gas distribution related investments of $0.999 billion.[18] Annual total capital investments and expenses for each program component and sub-component are summarized in Schedule DED-2.

Q. PLEASE DISCUSS THE ELECTRIC DISTRIBUTION RELATED COMPONENT OF THE COMPANY'S ES II PROPOSAL.

A. The Company's electric distribution-related investments are comprised of four subprograms: (1) Station subprogram consisting of flood mitigation and life-cycle upgrades, estimated cost of $906 million (or 36.2 percent) of the ES II Program; (2) Outside Plant Higher Design and Construction Standards Subprogram, estimated cost of $345 million (or 13.8 percent) of the ES II Program; (3) Contingency Reconfiguration Subprogram, estimated cost of $145 million (or 5.8 percent) of the ES II Program; (4) Grid Modernization Subprogram, estimated cost of $107 million (or 4.3 percent) of the ES II Program.[19]

Q. PLEASE DISCUSS THE NATURAL GAS DISTRIBUTION RELATED COMPONENTS OF THE COMPANY'S ES II PROPOSAL.

A. The Company's gas portion of the ES II program consists of two subprograms: (1) the Curtailment Resiliency Subprogram with an estimated cost of $863 million (or 34.5 percent) of ES II; and (2) the M&R Upgrade Subprogram, estimated investment of $136 million (or 5.4 percent) of ES II program expenditures.[20] The Company under its Curtailment Resiliency Subprogram is proposing five distribution facility projects that it states would provide increased

[17] Company Petition p.9 at ¶12.
[18] Company Petition p.2 at ¶4.
[19] Company Petition, pp. 2-6 at ¶5.
[20] Company Petition, pp. 6-7 at ¶6.

resiliency by moving gas supplies across the PSE&G service territory between areas served by the different pipeline systems.[21] The Company is also proposing as part of its Curtailment Resiliency Subprogram to construct an additional Liquefied Natural Gas ("LNG") facility that would inject additional gas into the system in a time of curtailment.[22] The Company under its M&R Station Upgrade Subprogram is proposing to rebuild and modernize seven gas M&R stations as well as hardening at least two stations that the Company states are located in recognized flood zones.[23] The Camden, East Rutherford, Central, Paramus, Westampton, Mount Laurel, and Hillsborough M&R stations are included in the proposed subprogram.[24] Two of the seven stations in the subprogram, Camden and East Rutherford, are located in 100-year flood zones.[25]

Q. HAS THE COMPANY PROVIDED ANY ESTIMATED ANNUAL REVENUE REQUIREMENTS FOR ITS ES II PROPOSAL?

A. The Company has only provided a five year revenue requirement estimate, for its electric and gas programs, which are summarized in Schedule DED-3. The schedule shows that if the ES II proposal is approved in its current form, and at its current levels of investment, electric and natural gas delivery rates will likely increase by $38.4 million in 2021, $78.5 million in 2022, $58.9 million in 2023, $99.2 million in 2024; or by a total of $275.1 million over the next four years.

Q. HOW DOES THIS PROPOSED ES II INVESTMENT COMPARE TO THE OTHER COMPANY-SPECIFIC INVESTMENT PROGRAMS?

[21] Company Petition, pp. 6-7 at ¶6.
[22] Company Petition, pp. 6-7 at ¶6.
[23] Company Petition, p. 7.
[24] Company Petition, p. 7.
[25] Direct testimony of Wade E. Miller, p.29:20-21.

A. It is important that the Board understand that the ES II program is not being proposed in a vacuum. This program is part of a host of other programs that have been proposed, and approved (in part) by the Board. These programs include: (1) the ES I Program ($1.22 billion); (2) the Gas System Modernization Program ("GSMP") ($650 million)[26]; (3) GSMP II Program ($1.575 billion)[27]; (4) the Solar Loan Program ("SLI"); (5) the Solar for All ("SFA") Program ($840.4 million)[28]; (6) the three proposed Clean Energy Future Programs ($3.941 billion)[29]; and (7) the Zero Emissions Certificate ("ZEC") Program (estimated $300 million/year requested).[30]

All told, these increased program investments, on a cumulative basis, lead to a large funding obligation for PSE&G's ratepayers. The Board needs to consider this cumulative rate burden, particularly as it relates to some of the Company's ES II subprograms that have less than stellar cost-benefit results. This is something I will discuss in greater detail, later in my testimony. These increases, coupled with the increases anticipated from the Company's GSMP II program and New Jersey's renewable energy programs could result in significant rate

[26] In the Matter of Public Service Electric and Gas Company for Approval of a Gas System Modernization Program and Associated Cost Recovery Mechanism, Docket No. GR15030272, Decision and Order Approving Stipulation, November 16, 2015, p. 3.

[27] 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"), Docket No. GR17070776, Decision and Order Approving Stipulation. March 22, 2018. p. 4.

[28] In the Matter of the Petition of Public Service Electric and Gas Company for Approval of Changes in its Electric Green Programs Recovery Charge and its Gas Green Programs Recovery Charge ("2017 PSE&G Green Programs Cost Recovery Charge Filing"), Docket Nos. ER17070724 and GR17070725, Order Approving Stipulation, October 29, 2018, pp. 3-4.

[29] In the Matter of the Petition of Public Service Electric and Gas Company for Approval of its Clean Energy Future-Energy Efficiency ("CEF-EE") Program on a regulated basis, BPU Docket Nos. GO18101112 and EO18101113, filed October 11, 2018, p. 13.; In the Matter of the Petition of Public Service Electric and Gas Company for Approval of its Clean Energy Future- Electric Vehicle and Energy Storage ("CEF-EVES") Program on a regulated basis, BPU Docket No.EO18101111, filed October 11, 2018, p.3.; and In the Matter of the Petition of Public Service Electric and Gas Company for Approval of its Clean Energy Future-Energy Cloud ("CEF-EC") Program on a regulated basis, BPU Docket No.EO18101115, filed October 11, 2018, p. 6.

[30] I/M/O The Implementation of L. 2018, C.16 Regarding the Approval Establishment of a Zero Emission Certificate Program for Tariff Eligible Nuclear Power Plants. BPU Docket No. EO18080899. Comments on Behalf of the Division of Rate Counsel. p. 16. https://www.nj.gov/rpa/docs/EO18080899_Zero_Emmission_Certificate_Program_Rate_Counsel_PUBLIC_VERSION_Comments_1_31_19_Redacted_With_Attach.pdf

increases over the next several years. I will discuss these potential rate impacts in greater detail in the economic impact section of my testimony.

IV. Board's Infrastructure Investment and Recovery Rule (IIP)

Q. BRIEFLY DESCRIBE THE BOARD'S RECENTLY ADOPTED INFRASTRUCTURE INVESTMENT AND RECOVERY RULE.

A. On January 16, 2018, the Board issued the IIP Rules for New Jersey utilities. The purpose of the IIP is to establish a procedure under which a utility can seek the Board's approval for accelerated recovery of projects to construct, install, or remediate utility plant and facilities related to reliability, resiliency, and/or safety to provide safe and adequate service. The Board has stated that the rule is intended to create a financial incentive for utilities to accelerate the levels of these types of investments.[31]

Q. DO THE BOARD'S RULES PROVIDE EXAMPLES OF THE TYPES OF NATURAL GAS INFRASTRUCTURE PROJECTS THAT MAY BE ELIGIBLE FOR ACCELERATED RECOVERY?

A. Yes, according to the Board's rule the following projects are eligible for accelerated recovery:

- Incremental and non-revenue producing projects related to safety, reliability, and/or resiliency;
- The replacement of gas Utilization Pressure Cast Iron mains with elevated pressure mains and associated services;
- The replacement of mains and services that are identified as high risk in a gas utility's Distribution Integrity Management Plan; and

[31] Adopted New Rules, N.J.A.C. 14:3-2A, Infrastructure Investment and Recovery, 50 N.J.R. 630(a) (Jan. 16, 2018), N.J.A.C. 14:3-2A.1.

- The installation of gas Excess Flow Valves ("EFVs") where existing gas service line replacements require them, excluding EFVs installed upon customer request pursuant to 49 CFR 192.383.[32]

Q. IS THIS AN EXHAUSTIVE LIST OF ELIGIBLE INVESTMENTS?

A. No. This list is just an example of the types of projects that may qualify under the IIP Rule and replacement and recovery are not necessarily guaranteed. Regarding the list of eligible projects, the Board stated in its response to public comments:

> The list of gas main replacements and the language are just examples of what can qualify under the proposed subchapter. It is not a definitive list and other infrastructure, such as unprotected steel mains and services could be included. This could also include cast iron main replacement at any pressure. The petitions will be evaluated individually and their benefits reviewed. The EFVs language was crafted to specifically support the new Federal regulations.[33]

The Board also stated that "the definition of "resiliency" needs to be flexible enough to allow for variations of projects within each utility sector" and that any substitution of eligible projects should be considered on a "case by case basis".[34]

Q. WHAT INFORMATION HAS TO BE PROVIDED IN AN INFRASTRUCTURE FILING BEFORE THE BOARD?

A. Utilities are required to include detailed information by major categories of expenditures, its projected annual capital expenditure budgets for a five-year period, as well as information on actual annual capital expenditures for the previous five-years. Additionally, the Company's filing should include an engineering evaluation and report identifying the specific projects to be included in the proposed program, with descriptions of project objectives, detailed cost

[32] Id., N.J.A.C. 14:3-2A.2
[33] Id., N.J.A.C. 14:3-2A.2, p. 7, Board's Response to Comment 43.
[34] Id., N.J.A.C. 14:3-2A.2, p. 6, Board's Response to Comment 42.

estimates, in-service dates, and any applicable cost-benefit analysis for each project. The Company must also include the proposed annual baseline spending levels which are to occur during the program period as well as a proposal as to when the utility will file its next base rate case. Finally, the Company is supposed to provide details on the revenue requirement necessary to implement its proposed program and the estimated rate impact that the proposed program will have on customers.[35]

Q. DO THE BOARD'S IIP RULES HAVE ANY NORMAL CAPITAL SPENDING PROGRAM REQUIREMENTS?

A. Yes. In addition to the requirement that IIP work be incremental to a utility's normal base capital spending, the IIP rules require a utility to make capital investments of at least 10 percent on similar projects of any approved IIP and that these capital expenditures will be made in the normal course of business and recovered in a base rate proceeding, and will not be subject to the recovery mechanism.[36] The Board clarified this requirement in response to comments on the proposed IIP rules stating:

> The Board believes that infrastructure investment through this subchapter should supplement, not supplant, current utility spending that ensures that it is able to provide safe adequate and proper service. If a utility proposes a program under this rule, then an additional amount of 10 percent of the cost of the petitioned program should be done in their capital projects. Additionally, N.J.A.C. 14:3-2A.3(d) specifically states that expenditures for programs/projects proposed under this rule are above and beyond their planned capital programs "as determined by the Board."

[35] Id., N.J.A.C. 14:3-2A.5.
[36] N.J.A.C. 14:3-2A.2(c).

Therefore, this is not intended to replace planned capital spending by the utility, but augment it.[37]

Q. DO YOU HAVE ANY RECOMMENDATIONS REGARDING THE LEVEL OF GAS CAPITAL BASE SPENDING THAT SHOULD BE ALLOWED IF THE ES II PROGRAM IS APPROVED?

A. Yes. Consistent with the GSMP II approval, the Company should at a minimum maintain an annual baseline capital spend of $155 million over the five year term of the ES II program.[38] In addition to this minimum baseline capital spend the Company should make additional baseline capital investments of at least 10 percent of any approved ES II program total expenditures, to be recovered in a traditional base rate case proceeding.

V. Program Cost-Benefit Analysis ("CBA")

Q. DID THE COMPANY PROVIDE A COST BENEFIT ANALYSIS ("CBA") TO SUPPORT ITS ES II PROPOSAL?

A. Yes. The Company has developed two separate CBAs to support its ES II electric and natural gas subprogram proposals, respectively. Both CBAs have been developed within a similar framework. Program costs are calculated as the sum of the total program investment dollars. Any program cost efficiencies, such as O&M savings, enter the CBA as a ratepayer credit, or benefit. Total program benefits are estimated based upon the VoLL avoided from the individual electric and natural gas programs. The overall VoLL itself is the product of (a) the "unit benefit" of the avoided lost load measured as the dollar value per avoided lost load (in customer minutes) and (b) outages, measured as the minutes of avoided lost loads. In other

[37] Adopted New Rules, N.J.A.C. 14:3-2A, Infrastructure Investment and Recovery, 50 N.J.R. 630(a) (Jan. 16, 2018), N.J.A.C. 14:3-2A.1, Board's response to comments 40 and 41.

[38] 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"), Docket No. GR17070776, Decision and Order Approving Stipulation. March 22, 2018, Stipulation, p. 9.

words, the VoLL is equal to the lost load minutes times the per-unit value of that lost load. A summary of the Company's CBA findings, by major sub-program, are provided in Schedule DED-4.

Q. EXPLAIN THE COMPANY'S ELECTRIC SUBPROGRAM CBA.

A. The Company develops separate cost and benefit estimates for each of its proposed electric and natural gas sub-programs. The costs are primarily related to the investment costs of each subprogram while the benefits are primarily relegated to estimates of the electric outages that will be avoided through each sub-program investment. The Company then calculates benefit-cost ratios to determine if each sub-program's benefits are greater than its costs. Any subprogram with a benefit-cost ratio equal to, or greater than one, suggests that the subprogram has benefits that are at least equal to or greater than program costs and can be said to "pass" its CBA. Any subprogram with a benefit-cost ratio less than one, can be said to "fail" its CBA. The further away this result is from one, the greater the test "failure." The Company estimates that all of its electric subprograms pass a CBA, with the exception of its Substation Upgrade subprogram. The Company also estimates that one program, the Contingency Reconfiguration Strategies subprogram will lead to very large benefits relative to its costs with a benefit cost ratio of almost 13.[39]

Q. HOW DID THE COMPANY DEVELOP A UNIT-VALUE FOR THE AVOIDED LOST LOADS ASSOCIATED WITH ITS PROPOSED ELECTRIC SUB-PROGRAMS?

A. One of the "core" components of the Company's electric sub-program CBA is the unit benefit values it takes from a 2015 study conducted by the Lawrence Berkeley National

[39] Direct Testimony of the Cost Benefit Analysis Panel Energy Strong II Program-Electric, Attachment 5, p. 7.

Laboratories ("LBNL").[40] The monetary benefit included in the Company's CBA is based on VoLL reliability factors that are included in the report. These VoLL unit values are multiplied by total avoided customer interruptions from each subprogram in order to arrive at a specific subprogram monetary benefit. This benefit is then compared to program costs in order to estimate overall subprogram benefit-cost ratios.

Q. EXPLAIN THE COMPANY'S NATURAL GAS SUBPROGRAM CBA.

A. Similar to the Company's electric CBA, the costs of the Company's gas CBA are primarily related to the investment costs of each subprogram while the benefits are primarily relegated to estimates of natural gas outages that will be avoided through each subprogram investment. The Company has two natural gas subprograms, the Curtailment Resiliency subprogram and the M&R Station Upgrade subprogram. The Company's proposed Curtailment Resiliency subprogram passes its CBA resulting in a benefit to cost ratio of 1.3.[41] However, the Company's proposed M&R Station Upgrade subprogram fails the Company's CBA resulting in a benefit to cost ratio of only 0.26.[42]

Q. HOW DID THE COMPANY DEVELOP A UNIT-VALUE FOR THE AVOIDED LOST LOADS ASSOCIATED WITH ITS NATURAL GAS SUBPROGRAMS?

A. The Company under its Curtailment Resiliency subprogram CBA analysis assumed one outage event occurs during the winter with a 10-day duration at an average daily temperature of

[40] Direct Testimony of the Cost Benefit Analysis Panel Energy Strong II Program-Electric, Attachment 5, Schedule-BV-ESII-ELEC-4, p. 27.
[41] Direct Testimony of the Cost Benefit Analysis Panel Energy Strong II Program-Gas, Attachment 6, Schedule-BV-ESII-GAS-5, p. 54, Figure 9.
[42] Direct Testimony of the Cost Benefit Analysis Panel Energy Strong II Program-Gas, Attachment 6, Schedule-BV-ESII-GAS-5, p. 66, Figure 11.

30^0F. This is followed by 30 days to restore gas service to 95 percent of PSE&G's customers.[43] The Company estimated the unit-value for the avoided lost loads or VoLL for PSE&G's residential customers is at the Company's current residential gas tariff rate which the Company equates to $6.23 per customer per day.[44] The Company's Commercial and Industrial ("C&I") VoLL was estimated based on value of direct business impacts from an outage using the C&I's contribution to the Gross State Product ("GSP"), and is estimated at approximately $2,475 per day per firm C&I customer.[45]

Q. EXPLAIN THE DEFICIENCIES ASSOCIATED WITH THE COMPANY'S ELECTRIC AND NATURAL GAS CBA.

A. The Company's CBA suffers from a number of deficiencies that underscore the questionable nature of the ES II program. These deficiencies include:

- Two large subprograms fail even under the Company's own analysis.
- The Company's CBA fails to tie estimated benefits to sub-program performance metrics.
- The Company uses a faulty VoLL for evaluating ES II electricity subprograms.
- The Company uses a faulty VoLL for evaluating ES II natural gas subprograms.
- The Company's CBA fails to appropriately account for ratepayer impacts.
- The Company's CBA potentially overstates weather-related events and their related outage minutes.

A. <u>Subprogram CBA Failure</u>

[43] Direct Testimony of the Cost Benefit Analysis Panel Energy Strong II Program-Gas, Attachment 6, Schedule-BV-ESII-GAS-5, p. 6.
[44] Direct Testimony of the Cost Benefit Analysis Panel Energy Strong II Program-Gas, Attachment 6, Schedule-BV-ESII-GAS-5, p. 46.
[45] Direct Testimony of the Cost Benefit Analysis Panel Energy Strong II Program-Gas, Attachment 6, Schedule-BV-ESII-GAS-5, p. 47.

Q. PLEASE IDENTIFY THE TWO SUBPROGRAMS THAT FAIL THE COMPANY'S OWN CBA.

A. Two of the subprograms included in the Company's CBA fail to produce benefits that are equal to or greater than their respective costs: these two programs include the Substation Upgrade subprogram (electric) and the M&R Station Upgrade (natural gas) subprogram. The Substation Upgrade subprogram CBA result is 0.73 which is less than a value of 1.0, indicating that the program "fails" its CBA.[46] The M&R Station Upgrade CBA result is very low, measuring 0.26, far below a value of 1.0 needed for the natural gas subprogram to pass.[47] The Company continues to suggest, despite these results, that both subprograms should remain as part of the ES II since (a) the overall portfolio of programs included in the CBA yield benefits in excess of their costs and (b) there are a number of "qualitative benefits" that are associated with the overall program, and its individual subprograms, that justify the entirety of the Company's ES II proposal.[48]

Q. DO YOU AGREE THAT "EXCESS" BENEFITS ASSOCIATED WITH ONE SUBPROGRAM'S CBA CAN BE "CARRIED OVER" TO OFFSET ANOTHER SUBPROGRAM'S DEFICIENCY?

A No. The problem with this analysis is that it allows certain individual programs to fail their respective cost-benefit ratios on an individual basis if there are other individual programs that generate ratios large enough to "swap-out" these negative results. If the cost-benefit ratios of the subprograms with "negative results" are omitted from the CBA for the ES II program, the overall results of the program will change and could potentially improve. The Board should

[46] Direct Testimony of the Cost Benefit Analysis Panel Energy Strong II Program-Electric, Attachment 5, p. 7.
[47] Direct Testimony of the Cost Benefit Analysis Panel Energy Strong II Program-Gas, Attachment 6, Schedule-BV-ESII-GAS-5, p. 66, Figure 11.
[48] Direct Testimony of the Cost Benefit Analysis Panel Energy Strong II Program-Gas, 6:1-11.

reject program components that have negative CBA results even if the overall "portfolio" of recommended programs is positive.

B. Failure to Include Performance Metrics

Q. DOES THE COMPANY ESTIMATE THAT ITS PROGRAMS WILL RESULT IN CONSIDERABLE VOLL BENEFITS?

A Yes. The Company estimates that its electric subprograms will result in over $4 billion[49] in benefits and that its gas subprograms will result in over $1.1 billion[50] in benefits, for a collective total of over $5 billion in total benefits. Yet, despite these incredibly large benefit estimates, the Company has not offered any degree of future performance assurance on either program. There are simply no ramifications for the Company if, after a five-year, ten-year or fifteen-year period, the actual benefits of these proposals turn out to be considerably less than the program costs. This places 100 percent of the performance risk of the proposed ES II program onto both the Board, and ultimately, New Jersey ratepayers. This is both inequitable and inefficient and overstates the CBA results by a considerable margin.

Q. PLEASE EXPLAIN HOW THIS OMISSION OF PERFORMANCE STANDARDS IMPACTS THE CBA RESULTS.

A. The omission of any performance standards overstates the benefits included in the Company's CBA since those future benefits cannot be verified with any reasonable degree of certainty. This deficiency is akin to attempting to finance a large energy infrastructure project with the promise, but not guarantee, of a future revenue stream from an unidentified customer or set of customers in the future. It is incredibly difficult in today's energy marketplace to finance a $2.5 billion energy infrastructure project without a high degree of project benefit certainty (i.e.,

[49] Direct testimony of the Cost-Benefit Panel - Electric, p. 7 table.
[50] Direct testimony of the Cost-Benefit Panel – Gas, 3:16.

revenue) usually in the form of long-term capacity contracting. Yet, the Company wishes the Board to require ratepayers to fund its expansive energy infrastructure program based upon promises of very high benefits without any form of longer-term performance-related assurances.

Q. SHOULD THE BOARD INCLUDE ANY OF THE VOLL BENEFITS IN ITS ANALYSIS OF THE COMPANY'S PROPOSED ES II PROGRAM?

A. No, not unless the Company is willing to commit to some type of performance measure and even then, the benefits included in the CBA should be restricted to those that are specifically backed by these performance standards. The alternative CBA that I will discuss in more detail later in this section of my testimony, omits these VoLL benefits as well as provides a CBA that could be used to justify some level of program expenditures if, and only if, the Company were required to assume a comparable degree of performance risk.

C. <u>Faulty Electric Subprogram VoLL</u>

Q. ARE THERE ANY ISSUES WITH THE VOLL VALUES THAT THE COMPANY HAS UTILIZED IN ITS ELECTRIC CBA?

A Yes. As noted earlier, the Company has not estimated PSE&G nor New Jersey-specific VoLL reliability factors, but instead uses values that are included in a 2015 "metastudy" (a "study of studies" or survey) conducted by LBNL.[51] The 2015 LBNL study itself is an update of an analysis and report published in 2009 on behalf of LBNL by Freeman, Sullivan & Co (now Nexant). The 2009 LBNL report analyzed the results from 28 customer value of service reliability studies conducted by ten U.S. electric utilities from 1989 to 2005.[52] The results of the

[51] Direct Testimony of the Cost Benefit Analysis Panel Energy Strong II Program-Electric, Attachment 5, Schedule-BV-ESII-ELEC-4, p. 29.

[52] Sullivan, M., Mercurio, M., and Schellenberg, J. 2009. Estimated value of service reliability for electric utility customers in the United States. Prepared for Office of Electricity Delivery and Energy Reliability, U.S. Department of Energy. June 2009, p. xiii.

value of service studies were combined into a single meta-database and regression models were used to estimate customer damage functions. The customer damage functions are then applied to calculate customer interruption costs for residential, commercial and industrial customers by season and time of day.[53]

Q. HOW DOES THE 2015 LBNL REPORT DIFFER FROM THE 2009 REPORT?

A. The 2015 report includes a number of improvements from the 2009 report. These consist mainly of: (1) incorporating more recent utility interruption cost studies; (2) enabling the models to provide cost estimates for outages lasting longer than eight hours; and (3) subjecting the econometric model to rigorous cross-validation techniques.[54]

Q. DOES THE 2015 LBNL REPORT IDENTIFY THE INTERRUPTION COST STUDIES THAT ARE INCLUDED IN THE META-DATASET?

A. Yes. The 2015 LBNL Report provides an inventory of the interruption cost studies that are incorporated in the meta-dataset. This inventory is provided in Schedule DED-5. The 2015 LBNL Report uses the same data collected for the 2009 study, plus two additional studies conducted in 2011 and 2012. These two new studies, highlighted in Schedule DED-5, are from utilities already included in the original meta-dataset, one in the Southeast and one in the West.[55]

Q. DO BOTH LBNL STUDIES (2009, 2015) ACKNOWLEDGE THAT THERE ARE LIMITATIONS TO THEIR GENERALIZATION AND USE?

A. Yes. Both the 2009 study and the 2015 LBNL study emphasize that there are limitations as to how the data from the meta-analysis should be used. The studies state that certain

[53] Ibid.
[54] Sullivan, M., Schellenberg, J., and Blundell, M. 2015. Updated value of service reliability estimates for electric utility customers in the United States. Ernest Orlando Lawrence Berkeley National Laboratory. January 2015, p. xi.
[55] Sullivan, M., Schellenberg, J., and Blundell, M. 2015. Updated value of service reliability estimates for electric utility customers in the United States. Ernest Orlando Lawrence Berkeley National Laboratory. January 2015, pp. 16-17.

significant variables in the data are "confounded", meaning that it is impossible to determine the impact that certain variables have on customer interruption costs independently. Specifically, the reports state:

> First, certain very important variables in the data are confounded among the studies we examined. In particular, region of the country and year of the study are correlated in such a way that it is impossible to separate the effects of these two variables on customer interruption costs. **Thus, for example, it is unclear whether the higher interruption cost values for the southwest are purely the result of the hot summer climate in that region or whether those costs are higher in part because of the particular economic and market conditions that prevailed during the year when the study for that region was done**.[56]

Both studies also further state that there is more correlation between region and scenario characteristics because the study sponsors were "interested in measuring interruption costs for conditions that were important for planning their specific systems."[57] This means that interruption conditions described in the surveys for a specific region "tended to focus on periods of time when interruptions were more problematic for that region."[58]

Q. ARE THERE ANY OTHER ISSUES WITH THE USE OF THE RESULTS OF THIS STUDY?

[56] Sullivan, M., Schellenberg, J., and Blundell, M. 2015. Updated value of service reliability estimates for electric utility customers in the United States. Ernest Orlando Lawrence Berkeley National Laboratory. January 2015, p. 48; and Sullivan, M., Mercurio, M., and Schellenberg, J. 2009. Estimated value of service reliability for electric utility customers in the United States. Prepared for Office of Electricity Delivery and Energy Reliability, U.S. Department of Energy. June 2009, p. xxvii, emphasis added.

[57] Sullivan, M., Schellenberg, J., and Blundell, M. 2015. Updated value of service reliability estimates for electric utility customers in the United States. Ernest Orlando Lawrence Berkeley National Laboratory. January 2015, p. 48; and Sullivan, M., Mercurio, M., and Schellenberg, J. 2009. Estimated value of service reliability for electric utility customers in the United States. Prepared for Office of Electricity Delivery and Energy Reliability, U.S. Department of Energy. June 2009, p. xxvii.

[58] Ibid. Estimated value of service reliability for electric utility customers in the United States. Prepared for Office of Electricity Delivery and Energy Reliability, U.S. Department of Energy. June 2009, p. xxvii.

A. Yes. The reports also note that further limitations exist in that the surveys that formed the basis of the studies examined were limited to certain regions of the country. In fact, there is no data available for the mid-Atlantic region or the Northeast. The 2015 LBNL Report states:

> **The absence of interruption cost information for the northeast/mid-Atlantic region is particularly troublesome because of the unique population density and economic intensity of that region.** It is unknown whether, when weather and customer compositions are controlled, the average interruption costs from this region are different than those in other parts of the country.[59]

As shown in Schedule DED-5, of the 15 surveys, five are from the Southeast, five are from the West, two are from the Midwest and Northwest, and one is from the Southwest. And, of the more than 70,000 commercial and industrial observations, over 70 percent are from the Southeast and Western regions of the U.S. Additionally, of the more than 34,000 residential observations, over 70 percent are also from the Southeast and West.[60]

Q. ARE THERE OTHER LIMITATIONS TO THE DATA USED IN THE 2015 LBNL STUDY?

A. Yes. As shown in Schedule DED-5, 12 of the 15 surveys used to form the meta-database are over 15 years old, and more than half of the surveys (8) are over 20 years old. Only three surveys can be considered contemporaneous, and these surveys are from utilities in the Southeast and the Western regions of the county.[61] Two newer surveys from the Western region are from the same utility. Notably, the 2015 report states that:

[59] Sullivan, M., Schellenberg, J., and Blundell, M. 2015. Updated value of service reliability estimates for electric utility customers in the United States. Ernest Orlando Lawrence Berkeley National Laboratory. January 2015, p. 48, emphasis added.
[60] Sullivan, M., Schellenberg, J., and Blundell, M. 2015. Updated value of service reliability estimates for electric utility customers in the United States. Ernest Orlando Lawrence Berkeley National Laboratory. January 2015, pp. 16-17.
[61] Ibid.

> [T]he outdated vintage of the data presents concerns that, in addition to the limitations above, underscore the need for a coordinated, nationwide effort that collects interruption cost estimates for many regions and utilities simultaneously, using a consistent survey design and data collection method.[62]

Q. ARE THERE ANY METHODOLOGICAL ISSUES ASSOCIATED WITH USING THESE LBNL VALUES?

A. Yes. The LBNL surveys are based upon estimates of what is commonly referred to as customer willingness to pay ("WTP")[63] which is the maximum price a consumer is willing to pay for a good or service. The challenge with using WTP-based values is that numerous studies have shown that WTP measures are often overstated because there is an inherent bias in survey responses where customers indicate they are willing to pay more than they actually would. In other words, respondents tend to state that they will pay for a good when in fact they will not, or they will actually pay less, when placed in a similar purchase decision.[64]

Q. CAN THIS BIAS INFLUENCE CBA STUDY RESULTS LIKE THE ONE PROVIDED BY THE COMPANY IN THIS PROCEEDING?

A Yes. WTP can be affected by consumers' "projection bias," meaning that consumers may not be able to accurately predict the future conditions that influence their current decisions (e.g., grocery shopping on an empty stomach, or ordering clothes from a catalog during cold weather).[65] Similarly, consumers tend to overstate the importance of items and how it will affect

[62] Id. at p. 48.
[63] Sullivan, M., Schellenberg, J., and Blundell, M. 2015. Updated value of service reliability estimates for electric utility customers in the United States. Ernest Orlando Lawrence Berkeley National Laboratory. January 2015, p. iv.
[64] Whitehead, J.C. and Cherry, T.L. 2004. Mitigating the hypothetical bias of willingness to pay: a comparison of ex-ante and ex-post approaches. Prepared for the 2004 Southern Economic Association Meetings, New Orleans, LA, November 2004.
[65] See Briz, T., Drichoutis, A.C. and House, L. 2015. Examining projection bias in experimental auctions: the role of hunger and immediate gratification. *Agricultural Food and Economics*, 3:22. December 2015. See also: Loewenstein, G., O'Donoghue, T., and Rabin, M. 2003. Projection bias in predicting future utility. *The Quarterly*

their happiness. Research also shows that WTP is typically overstated because consumers overstate others' WTP with some studies suggesting that this bias can be as large as 40 percent.[66] The cause of this bias is often difficult to isolate and can be attributable to the widespread tendency to overestimate others' WTP unrelated to any single cause.[67] Thus, the simple use of a WTP-based analysis is going to have an upward bias on study results: the issue is likely not whether there is an upward bias, but the degree to which that upward bias is present.

Q DO YOU THINK THE BOARD SHOULD DISCOUNT ANY CBA RESULTS USING THESE TYPE OF WTP ESTIMATES?

A. Yes, the Board should highly discount the benefit estimates that are included in the Company's CBA. Admittedly, the LBNL-based VoLL estimates can be informative in examining potential electricity reliability and resiliency investment benefits particularly if the program under investigation is financially limited. The ES II program, however, is not a financially-limited program – it is large and expansive, amounting to as much as $2.5 billion in investment. Further, the Company has not used this as one of several indicia of benefits but uses the LBNL-based VoLL estimates as the "core" of its CBA.[68] The LBNL estimates are simply too unreliable, are highly variable, likely suffer from a considerable upward bias, and are based upon values that are not associated with the mid-Atlantic region of the U.S., much less New Jersey. The Board should highly discount, if not disregard, all of these LBNL-based benefits in making a decision on the ES II program or any of its program components.

Journal of Economics, Volume 118, Issue 4, 1 November 2003, Pages 1209–1248, https://doi.org/10.1162/003355303322552784.

[66] Frederick, S. 2012. Overestimating others' willingness to pay. *Journal of Consumer Research*. Vol. 30. June 2012.

[67] Matthews, W.J., Gheorghiu, A.I. and Mitchell, M.J. 2016. Why do we overestimate others' willingness to pay? *Judgement and Decision Making.* Vol. 11, No. 1. January 2016, pp. 21-39.

[68] Direct Testimony of the Cost Benefit Analysis Panel Energy Strong II Program-Electric, Attachment 5, Schedule-BV-ESII-ELEC-4, p. 27.

D. Faulty Natural Gas Subprogram VoLL

Q. HOW DOES THE COMPANY VALUE THE RESIDENTIAL BENEFITS OF THE PROPOSED CURTAILMENT RESILIENCY PROJECTS?

A. The Company's residential benefit estimates are twofold. First, the Company calculates a per household VoLL estimate and second, the Company adds to that estimate a number of additional benefits representing several outage-related avoided costs. The VoLL is the product of lost natural gas usage (created by an outage) and the Company's retail natural gas price. The other outage-related avoided costs include estimates for household temporary (electric) space heating, temporary housing, and lost wages.

Q. HOW ARE THE AVOIDED SPACE HEATING COSTS ESTIMATED?

A. The Company assumes that one-half of all residential customers affected by the outage who have natural gas-fueled space heating (approximately 93 percent of affected residential customers) will each buy two space heaters at a price of $60 each for a total cost of $9.0 million. The Company assumes that these space heaters will have a load of 1.6 kW and be run for 16 hours per day, costing $14.2 million in electricity at 15 cents per kWh. The basis for this avoided usage estimate is entirely assumed: the Company provides no supporting documentation for this potential electricity usage estimate.[69]

Q. WHAT ASSUMPTIONS DOES THE COMPANY MAKE IN ITS VALUATION OF AVOIDED TEMPORARY HOUSING COSTS?

A. The Company assumes that 10 percent of affected residential customers with natural gas-fueled space heating will seek alternative housing at a per diem rate of $191 per day for a total avoided cost of $70.5 million. The Company references IRS guidelines for per diems to justify

[69] Direct testimony of the Cost Benefit Analysis Panel-Gas, Attachment 6, Schedule-BV-ESII-GAS-5, p. 50, Table 8.

the $191 per diem figure. While the housing unit costs are provided and documented, the Company provides no justification for the assumed portion of customers seeking alternative housing nor does the Company provide any documentation for the temporary housing duration.[70]

Q. WHAT ASSUMPTIONS DOES THE COMPANY MAKE IN ITS VALUATION OF AVOIDED LOST WAGES AND PRODUCTIVITY?

A. The Company assumes that hourly workers make on average $20 per hour, 25 percent of affected residential customers work within the outage "footprint," 50 percent of the workers affected make under $49,500 per year, and 80 percent of workers making less than $49,500 are paid by the hour. The assumed wage rate and percentage of workers making less than $49,500 are sourced to the US Census. No justification or source is provided for the other assumptions. The Company then calculates lost wages based upon these assumptions as well as 2016 census data on the number of income earners in each household.[71]

Q. IS THE COMPANY'S METHODOLOGY APPROPRIATE?

A. No. The Company estimates the residential VoLL as the forgone retail natural gas service revenue due to lost sales during the outage. This approach, however, has nothing to do with the theoretical determinants of a customers' willingness to pay and should be dismissed by the Board. In fact, the method used by the Company in the ES II filing differs considerably from that used in its ES I filing which had more theoretic appeal, despite several faulty calculation errors.[72]

[70] Ibid.
[71] Direct testimony of the Cost Benefit Analysis Panel-Gas, Attachment 6, Schedule-BV-ESII-GAS-5, p. 50, Table 8; and Company response to data request RCR-POL-61, attachment RCR-POL_0061_BV PSEG Gas Analysis 2-1-18 – Final.xlsx".
[72] In the Matter of the Petition of Public Service Electric and Gas Company for Approval of the Energy Strong Program, Docket Nos. EO13020155 and GO13020156, Supplemental Direct Testimony of David E. Dismukes, filed January 10, 2014.

Q. EXPLAIN HOW THE COMPANY ESTIMATES C&I CUSTOMER BENEFITS FOR ITS NATURAL GAS CURTAILMENT PROGRAM?

A. The Company utilizes what it defines as the lost "value added" associated with interrupted C&I loads. "Value added" is defined as the market value of a given industry's goods or services less the cost of the inputs used to produce that good or service.[73] Over the entire economy, value added is the sum of the economic value created by all firms in the economy, and is represented in the Company's analysis as New Jersey's gross state product. Value added is one component of input-output ("I-O") modeling and is mathematically calculated as the sum of employee compensation, proprietary income, other property type income, and taxes on production and imports.[74] The Company estimates that the average value added for the Company's natural gas C&I customers is $2,475 per day.[75] Thus, if these C&I customers lose gas service for a day, the New Jersey economy will lose approximately $2,475 per day per C&I customer.

Q. DO YOU FIND THE COMPANY'S METHODOLOGY FOR ESTIMATING VALUE ADDED REASONABLE?

A. No. The Company's analysis assumes 100 percent of the value added for the C&I customers impacted by an outage is permanently lost.[76] This assumption is not reasonable. To see this, consider an industrial firm that manufactures 100 units of output per day to meet the demand of its customers located not only in New Jersey, but in other parts of the U.S. If the firm has to shut down for a day due to the unavailability of natural gas service, 100 percent of that

[73] Robert H. Frank and Ben S. Bernanke. Principles of Macroeconomics. *5e*. p. 101.
[74] Cheney, Phil. "Overview of Value Added Data" *Implan Data Sources and Methodology*. https://implanhelp.zendesk.com/hc/en-us/articles/115009674488-Overview-of-Value-Added-Data
[75] Direct testimony of the Cost Benefit Analysis Panel-Gas, Attachment 6, Schedule-BV-ESII-GAS-5, p. 47.
[76] Company response to data request RCR-POL-61, attachment RCR-POL_0061_BV PSEG Gas Analysis 2-1-18 – Final.xlsx".

decreased economic activity is likely not permanently lost. A more likely scenario is that the firm will have to increase production in the days, weeks, and potentially even years after the event in order to make up for this lost production. In addition, there is also a good possibility that economic activity could, for some limited period of time, increase to levels higher than pre-outage-related normals given regional restoration activities, the influx of private insurance reimbursements, and federal assistance funds, among other sources of capital and economic activity. This is not to suggest that major disasters are economic "boons" to regional economies, but the net longer-run economic impact that these disasters can have on a state or regional economy is often difficult to quantify. While longer-run steady state economic activity could, in theory, fall below prior-outage levels, it is likely that those steady-state reductions are nowhere near the 100 percent reduction in value added assumed in the Company's analysis.

Q. HAS EMPIRICAL RESEARCH CONFIRMED THAT FIRMS DO NOT SEE A 100 PERCENT DECREASE IN ECONOMIC ACTIVITY RESULTING FROM EXOGENOUS DISASTERS?

A. Yes, this concept has been researched in academic literature and is referred to as the concept of economic resilience. Specifically, economic resilience refers to the inherent ability and adaptive responses individual businesses and regional markets have to avoid potential losses.[77] Research conducted following the 1994 Northridge Earthquake found that although 8.3 percent of the area's electricity service was lost for a day, direct output losses attributable to the outage amounted to only 1.9 percent of a single day's output in Los Angeles County,

[77] *See* Rose, Adam and Shu-Yi Liao (2005), "Modeling Regional Economic Resilience to Disasters: A Computable General Equilibrium Analysis of Water Service Disruptions," Journal of Regional Science, Vol. 45:1, pp. 75-112; *See also*, Rose, Adam (November 1, 2009), "Economic Resilience to Disasters," CREATE Research Archive, pp. 8-9.

meaning that direct economic resilience to this natural disaster was 77.1 percent.[78] Subsequent research into the Northridge Earthquake found similarly high resilience factors of 95 and 79.3 percent.[79] A more recent study examining resilience in the aftermath of the September 11, 2001, attacks on the World Trade Center found that direct business interruptions losses were about 72 percent lower than they would have been if all tenants in the World Trade Center area of lower Manhattan had gone out of business. This means that about 72 percent of economic activity was preserved as businesses relocated within the New York City Metropolitan area.[80]

Q. DO YOU BELIEVE THE COMPANY'S CUSTOMERS WOULD BE SIMILARLY RESILIENT TO THE EFFECTS OF ITS HYPOTHESIZED GAS OUTAGE?

A. Yes. The effects of a temporary gas transmission outage would certainly be no more severe than the disasters I just described. To assume that all customers affected by a natural gas outage will lose the entire value of their productivity for the duration of the outage, and will never recover that lost productivity, is very unreasonable. The actual value added lost due to the Company's hypothesized outage would likely be some small fraction of what the Company has estimated.

Q. WHAT ARE YOUR RECOMMENDATIONS REGARDING THE COMPANY'S NATURAL GAS SUBPROGRAM BENEFIT ESTIMATES?

A. The Board should disregard the natural gas subprogram benefit estimates provided by the Company. These estimates are based upon unreasonable and/or unsupportable assumptions about both residential and C&I VoLL. Further, overall benefits are a function of both the number of outage "incidents" and the VoLL associated with each incident. Moreover, Mr. McGee has

[78] Rose, Adam (November 1, 2009), "Economic Resilience to Disasters," CREATE Research Archive, p. 25.
[79] Ibid.
[80] Rose, Adam (November 1, 2009), "Economic Resilience to Disasters," CREATE Research Archive, p. 26.

noted in his testimony that the bidirectional flow of gas on interstate pipelines make the outage assumptions made by the Company for the natural gas curtailment program highly unlikely, further rendering the Company's benefit estimates overstated.

E. Ratepayer Impacts

Q. HAS THE COMPANY APPROPRIATELY ACCOUNTED FOR RATEPAYER IMPACTS IN ITS CBA?

A No. The Company's analysis fails to take into account the fact that the rate increases needed to fund the ES II program will lead to a certain level of negative economic impacts on the New Jersey economy. This results in a decrease in New Jersey economic activity as resources are diverted from general economic activity for households, businesses, and industries and towards the funding of the ES II program.

Q. DOES THE COMPANY'S ANALYSIS INCLUDE OVERALL PROGRAM INVESTMENTS AS A "COST" IN THE CBA?

A Yes, but the inclusion of these program expenditures does not appropriately account for the impact that the overall change in rates will have for the Company's ratepayers and how those impacts ripple through the New Jersey economy. I have used this approach in several prior Board proceedings and this approach was recognized as appropriate in the Board's decision in the recent Nautilus offshore wind ("OSW") proceeding.[81] In fact, it was Nautilus' failure to provide a transparent representation of its rate and economic impacts that served as an important basis for the Board's decision to reject the OSW proposal.[82]

[81] In the Matter of Consideration of the State Water Wind Project and Offshore Wind Renewable Energy Certificate, Docket No. QO18080843, Order, December 18, 2018.
[82] Id. at p. 16.

Q. HAVE YOU CONDUCTED AN ALTERNATIVE CBA THAT TAKES INTO ACCOUNT RATEPAYER IMPACTS?

A. Yes. Later in my testimony I will present the results of my alternative CBA that takes into account ratepayer impacts and makes a number of corrections and changes to the Company's CBA to provide the Board with a more appropriate representation of the ES II program costs and benefits.

F. <u>Weather-related outage events</u>

Q. IS THE COMPANY'S CBA BASED UPON SOME QUESTIONABLE ASSUMPTIONS ABOUT WEATHER-RELATED OUTAGES?

A Yes. The Company's CBA relies on a number of questionable assumptions about the number of interruptions that can be expected to occur in the future. Specifically, the Company appears to be overestimating the number of interruptions related to major events that can be expected to occur in the future.

Q. HOW DOES THE COMPANY FORECAST FUTURE MAJOR EVENT-RELATED ELECTRIC OUTAGES?

A. The Company assumes that in future years, the annual number of interruptions due to major events will be equal to the annual average number of major event-related interruptions over the past seven years. However, this average is biased upward due to the inclusion of 2010 and 2011, in which two Nor'easters and Hurricane Irene occurred. The average number of major event-related interruptions over the past seven years is 171.[83] However, the average number of major event-related interruptions over the past five years is 86, a reduction of almost 50

[83] Includes events at all voltages.

percent.[84] The effect of those two years is even more dramatic when looking at customer minutes interrupted ("CMI").[85] The annual average CMI related to major events from 2010 to 2016 was almost 398 million. However, the annual average CMI related to major events from 2012 to 2016 was only 40 million, nearly 90 percent less.[86]

Q. WHAT EFFECT DOES THIS POTENTIAL OVERESTIMATION OF FUTURE MAJOR EVENTS HAVE ON THE COMPANY'S ESTIMATED BENEFITS?

A. The estimated CMI reductions resulting from the Higher Outside Plant Design and Construction Standards subprogram and the Contingency Reconfiguration subprogram are both heavily dependent on the forecasted number of major event-related extended interruptions. Specifically, the portion of avoided CMI due to major event-related interruptions is overstated by nearly 100 percent. The Company estimates that the Higher Outside Plant Design and Construction Standards subprogram will decrease CMI related to major events by 25.4 million per year and the Contingency Reconfiguration subprogram will decrease CMI related to major events by 41.4 million.[87] However, after adjusting the "Major Event Forecast Factor" in the Company's analysis to reflect a five year major event average rather than a seven year average, the reduction in major event-related CMI for the Higher Outside Plant Design and Construction Standards subprogram drops to 12.8 million per year and the reduction in major event-related CMI for the Contingency Reconfiguration subprogram drops to 20.8 million per year.

[84] Company response to data request RCR-POL-0061, Attachment "RCR-POL-0061_ESII – Circuit Details for Openwire Analysis – rev 5.xlsx".
[85] Minutes of interruption across all customers. For example, if two customers are interrupted for one minute each, the CMI is two minutes.
[86] Company response to data request RCR-POL-0061, Attachment "RCR-POL-0061_PSE_G CMI Trend - ESII.xlsx".
[87] Schedule-BV-ESII-ELEC-4

Q. ARE THE MAJOR EVENT-RELATED OUTAGE RATES EXPERIENCED IN 2010 AND 2011 RELATIVELY COMMON?

A. No. The Company's SAIDI including major events was 372.41 in 2010 and 922.11 in 2011. When excluding 2012, due to Hurricane Sandy, the next-highest SAIDI in the fifteen-year period from 2003 to 2017 is 144.63 in 2008, over 61 percent less than the 2010 SAIDI, and over 84 percent less than the 2011 SAIDI.[88] Similarly, the Company's SAIFI including major events was 1.2 in 2010 and 1.65 in 2011, which was even higher than the Company's SAIFI in 2012, when Sandy occurred. The Company's next-highest SAIFI exclusive of Sandy occurred in 2006, and was 1.06, over 11 percent less than the 2010 SAIFI and over 35 percent less than the 2011 SAIFI.[89] The average SAIDI exclusive of 2012 for 2003 through 2017 is 155.93, and the average SAIFI is 0.88.

Q. WHAT DOES A CHANGE IN THESE WEATHER-RELATED OUTAGE ASSUMPTIONS MEAN FOR THE COMPANY'S CBA?

A. The Company's CBA is not only highly sensitive to the VoLL estimates but also the number of weather-related outages. The Board needs to recognize the very sensitive nature of the Company's CBA results and that they are not very robust relative to minor changes in weather-related outage assumptions.

G. Alternative CBA

Q HAVE YOU PREPARED AN ALTERNATIVE CBA?

[88] Company response to data request RCR-ENG-E-0004; and Re: In the Matter of the Petition of Public Service Electric & Gas Company for Approval of the Energy Strong Program. New Jersey Board of Public Utilities Docket Nos. EO13020155 and GO13020156. Company response to data request RCR-E-124.
[89] Ibid.

A Yes. I have prepared two CBAs that take a more complete accounting of the program costs and benefits, one of which excludes VoLL-related benefits and the other including a smaller level of highly discounted VoLL-related benefits. Both analyses include the benefits that are created by ES II program expenditures in terms of the additional jobs and economic impacts created by the program's investments. Both analyses also include the direct ratepayer impacts and the economic ripple impacts associated with those rate increases. The results from these analyses are provided in Schedule DED-6 and DED-7.

Q. HOW DID YOU ESTIMATE THE ECONOMIC IMPACTS ASSOCIATED WITH PROGRAMS INVESTMENTS AND RATE IMPACTS?

A. I utilized the IMPLAN economic impact model using New Jersey-specific data to estimate the economic impacts associated with the ES II program's investment dollars and rate impacts. The IMPLAN model was originally developed by the U.S. Forestry Service for use in developing its five-year resource management plans; hence the name "IMPLAN" or "impact analysis for planning." Over the years, the IMPLAN modeling framework was privatized, with MIG, Inc. (formerly "Minnesota IMPLAN Group, Inc.") serving as the corporation responsible for the production, maintenance, and improvement of the modeling framework and data. The model itself is based upon "input-output accounting [that] describes commodity flows from producers to intermediate and final consumers."[90] IMPLAN has data on 536 sectors and constructs Social Accounting Matrices ("SAMs") to describe "all commodity flows, not only purchases and production of sales and commodities, but also transfer payments to and from institutions."[91] The commodity flows between industries are what drive the economic

[90]Lindall, Scott A., and Douglas C. Olson. "The IMPLAN input-output system." *Stillwater MN* (1996).
[91] IMPLAN Professional User Guide (2004), Minnesota IMPLAN Group, Inc., 3 ed, p. 74.

multipliers. IMPLAN utilizes data from a number of sources including the Bureau of the Census, Bureau of Labor Statistics, and the Bureau of Economic Analysis ("BEA").[92]

Q. IS IMPLAN A WELL-RESPECTED MODEL FOR EXAMINING REGIONAL ECONOMIC IMPACTS, PARTICULARLY THOSE ASSOCIATED WITH ENERGY INDUSTRIES?

A. Yes. The IMPLAN model is not only well-respected, but also has been used extensively in modeling economic impacts of energy-related projects. For example, IMPLAN has been used to estimate the employment and gross state product impacts of renewable portfolio standards in states including Arizona, Wisconsin, Nebraska, Colorado, Texas, and Washington.[93] In fact, the Clean Energy States Alliance cites IMPLAN as an appropriate model for evaluating the benefits and costs of a RPS.[94] The Edward J. Bloustein School of Planning and Public Policy at Rutgers University also cites IMPLAN as a model that can be used to estimate economic impacts of energy infrastructure investments.[95] IMPLAN has also been utilized by the U.S. Department of the Interior's Bureau of Ocean Energy Management ("BOEM") in estimating economic impacts of holding lease sales in the Gulf of Mexico[96] as well as the MAG-PLAN Alaska model.[97] I personally have worked with IMPLAN in estimating economic impacts of similar infrastructure investments for over 20 years. IMPLAN has also been used to model a number of non-energy

[92] Hartgen, David T. Traffic Congestion in North Carolina. Status, Prospects and Solutions. March 2007.
[93] Ernest Orlando Lawrence Berkeley National Laboratory. Weighing the Costs and Benefits of State Renewables Portfolio Standards: A Comparative Analysis of State-Level Policy Impact Projections. May 2007. Table 3 on page 24.
[94] Clean Energy States Alliance. Evaluating the Benefits and Costs of a Renewable Portfolio Standard. A Guide for State RPS Programs. May 2012, p.15.
[95] Edward J. Bloustein School of Planning and Public Policy, Rutgers University. *Economic Impacts of Energy Infrastructure Investment.* October 2010.
[96] U.S. Department of the Interior: Mineral Management Service Gulf of Mexico OCS Region. Gulf of Mexico OCS Oil and Gas Lease Sales: 2003-2007. Final Environmental Impact Statement. Volume I: Chapters 1-10.
[97] U.S. Department of the Interior: Bureau of Ocean Energy Management. *MAG-PLAN Alaska Update.* May 2012.

based natural resource impacts by federal agencies such as the U.S. Department of Transportation ("USDOT") and the U.S. Department of Agriculture ("USDA").[98]

Q. PLEASE DISCUSS THE RESULTS FROM YOUR FIRST CBA.

A. My first CBA is provided in DED-6 and shows that none of the Company's ES II subprograms have benefit-cost ratios of more than one if the VoLL benefits from the LBNL study and the Company's gas CBA are excluded. The VoLL benefits have been excluded from this analysis since the Company has provided no performance-related benchmarks to assure some level of future ratepayer benefits. As I noted earlier, if these benefits cannot be assured, at least in some fashion, then they need to be excluded from the CBA used to evaluate the ES II program's merits.

Q. CAN YOU DESCRIBE THE COLUMNS REPRESENTING THE VARIOUS COSTS AND BENEFITS INCLUDED IN SCHEDULES DED-6 AND DED-7?

A Yes. I have provided the economic costs and benefits associated with the ES II program using several economic measures of activity. The first measure is referred to as "output" which is the sum of all final goods and services activity estimated to arise in New Jersey from the ES II program. The substation program, for instance, is estimated to generate as much as $1 billion in positive economic activity in the state. These benefits arise through the construction activities that are part of the substation program itself and all the "ripple" impacts those construction activities have on supporting industries. The costs of the substation program are anticipated to have approximately $2.2 billion in negative economic impact mostly arising from the increased rates needed to fund the subprogram. Other economic measures included in the table include

[98] U.S. Department of Transportation. Analyzing the Economic Impact of Transportation Projects Using RIMS II, IMPLAN, and REMI. 2000.
See http://www.nrcs.usda.gov/wps/portal/nrcs/detail/null/?cid=nrcs143_009732.

employment levels, labor income, and value-added (which can be thought of as a proxy of state gross domestic product or "GDP").

Q. PLEASE DISCUSS THE RESULTS FROM YOUR SECOND CBA.

A. The results from my second CBA are developed in a fashion that estimates the minimum benefit level, in terms of avoided outages, needed to bring each subprogram (excluding the M&R and substation subprograms) into cost-effectiveness (a CBA value of at least one). I have excluded the M&R and electric substation subprograms since they did not pass the Company's own CBA, as well as the curtailment resiliency subprogram, whose VoLL estimation is very flawed, as I have discussed elsewhere in my testimony. This minimum benefit is then translated into a performance standard for the Company for its electric subprograms. The performance standard for the electric subprogram is based upon an improvement in the Company's SAIDI and SAIFI statistics relative to a baseline projection and is provided in Schedule DED-8.

Q. WHY HAVE YOU PROVIDED THIS SECOND CBA?

A. The second CBA provides the Board with a basis for approving parts of the Company's ES II program if the Company is also required to guarantee a certain level of performance. Without this performance guarantee, the Board cannot assure that any degree of program benefits will arise to compensate ratepayers for the considerably large negative economic implications of the rate increases needed to fund the Company's proposed ES II program. If the Company is not willing to support a performance guarantee at this level, then its overall ES II program will fail its CBA (as shown in my first alternative CBA) and needs to be rejected by the Board.

VI. <u>The Company Has Not Shown the Need for its ES II Natural Gas Program Proposals</u>

Q. HAS THE COMPANY PROVIDED ANY COMPELLING POLICY RATIONALE FOR ITS ES II NATURAL GAS PROGRAM PROPOSALS?

A. No. The Company's proposed ES II natural gas proposals appear to be both unneeded and likely to result in very questionable ratepayer benefits. One of the sub-program proposals, the M&R station replacements and upgrades, fails the Company's own CBA by a considerably large margin (0.26). Further, the Curtailment Resiliency subprogram includes a number of pipeline extension proposals that, as Mr. McGee notes in his testimony, may very well never be needed.

Q. WILL THE COMPANY PURSUE THE CURTAILMENT RESILIENCY PROGRAM IF THE BOARD REJECTS THE ES II PROPOSAL?

A. No. The Company has explicitly noted that it will not purse the development of the proposed pipeline extensions that are part of the Curtailment Resiliency subprogram if the ES II program is rejected.[99] On its face, this raises questions about the overall need for these pipeline extension investments since the Company refuses to develop these natural gas assets despite its regulatory obligation to provide safe, reliable and economic natural gas service.

Q. IS THE COMPANY'S PROPOSED CURTAILMENT PROGRAM BEYOND THE SCOPE OF THE BOARD'S INITIAL INTENTIONS AND SUBSEQUENT APPROVAL OF THE ENERGY STRONG PROGRAM?

A. Yes. The Company's curtailment sub-program is not consistent with the Board's overarching policy goals of facilitating the development of infrastructure dedicated exclusively to resiliency, reliability, and storm preparedness. Even the Company recognizes the distractive nature of its Curtailment Resiliency subprogram:

[99] Company's response to RCR-A-0001.

> The Gas Curtailment sub-program **was not conceived as a program to improve preparedness efforts during a major storm; improve communications during a major storm; improve restoration and response time during a major storm; improve system operations post a major storm; and improve reliability issues during a major storm**. Rather, it is intended to provide resiliency in the event of upstream pipeline supplier curtailments and to avoid sustained impact on or interruption of service resulting from conditions beyond the control of the utility, as stated in the definition of a Major Storm Event in the Board Order.[100]

Q SHOULD THE BOARD REJECT THE COMPANY'S PROPOSED CURTAILMENT RESILIENCY PROGRAM?

A. Yes. The need for this program is questionable and it is clearly outside of the scope of the Board's approval of Energy Strong I. There is no pressing regulatory policy need to utilize an accelerated form of cost recovery to facilitate these questionable investments. Mr. McGee will further discuss the need and engineering rationale for rejecting this Curtailment Resiliency Subprogram.

Q. HOW DOES THE COMPANY'S CURRENTLY-PROPOSED M&R PROGRAM RELATE TO ITS ES I PROPOSAL?

A. As noted earlier, the Company's original ES I proposal was an expansive initiative comprised of as much as $3.94 billion in program investments, 30 percent or ($1.18 billion) was dedicated to natural gas-related sub-programs alone. In the ES I program settlement, the Company's natural gas-related sub-programs were trimmed down considerably from an original proposal of $1.18 billion to final settlement amount of $400 million. The Company's original ES I proposal included $140 million in M&R station rebuilds/upgrades. However, only 8 of the

[100] Company's response to RCR-POL-0039, emphasis added.

10 proposed rebuilds/upgrades[101] were included into the Board-approved settlement. In this filing (ES II), the Company is attempting to bring back two of the M&R station rebuilds/upgrades (the Camden and East Rutherford stations) that were excluded from the original proposal, at a total investment cost of $37.1 million.[102] The Company is adding five additional substation upgrades/rebuilds to these two projects that were not proposed under the original ES I program. In total, the Company's M&R station upgrades total $136 million under the ES II program.

Q. HAS THE COMPANY MADE A NUMBER OF M&R STATION UPGRADES, AS PART OF ITS BASE CAPITAL SPEND, SINCE THE TIME OF THE ES I PROGRAM APPROVAL?

A. No. Over the last nine years (2010-2019) the Company has made upgrades and investments to ten M&R stations for a total investment cost of $38.2 million.[103] However, only one of these stations, the Sayreville M&R station, was upgraded as part of the Company's normal capital spending. The remaining nine stations were all upgraded as part of an infrastructure investment program with accelerated cost recovery, the Capital Investment Program ("CIP") (1 station) or Energy Strong I (8 stations).[104] There does not appear to be any extenuating circumstance as to why the Company cannot make M&R investments as part of normal capital expenditures other than the fact that it has the ability to request accelerated cost recovery for these investments under the Boards IIP rules.[105]

[101] The Company proposed 10 projects which also included a number of peak shaving facilities.
[102] Company's response to RCR-POL-0058, Attachment RCR-POL_0058_Costs And Miles Installed by Project.xlsx.
[103] Company's response to RCR-POL-0040, Attachment Infrastructure $ and Units.xls.
[104] Company's response to RCR-POL-0042.
[105] Company's response to RCR-POL-0053.

Q. COULD THE COMPANY'S PROPOSED ES II M&R UPGRADE SUBPROGRAM BE UNDERTAKEN AS PART OF ITS NORMAL BASE SPENDING?

A. Yes, and it appears that the Company intended to replace or upgrade at least three of its proposed M&R station upgrades (Camden, East Rutherford, and Central stations) as normal base spending over the next 15-20 years.[106] The Company specifically noted that it would rebuild the Camden station within the next three to five years as part of its normal base spend.[107] The Company goes further and has noted in this proceeding that the remaining four stations would be upgraded on an "as needed basis" in the future.[108] Therefore, there appears to be no difference or extenuating circumstance as to why the M&R station improvements under the proposed ES II could not be undertaken as part of the Company's normal replacements since the Company has admittedly, already considered such a replacement strategy.[109] Mr. McGee will further address the proposed M&R station investments proposed to be made under the ES II program.

Q. SHOULD THE BOARD APPROVE THIS M&R SUBPROGRAM?

A. No. The Company should be required to conduct these upgrades, to the extent they are needed, through its normal base capital expenditures. There is no pressing regulatory policy need to utilize an accelerated form of cost recovery to facilitate these upgrades. Mr. McGee will further discuss the need and engineering rationale for rejecting this subprogram.

VII. Program Selection Deficiencies Relative to Common Infrastructure Replacement Mechanisms

Q. ARE ACCELERATED COST RECOVERY MECHANISMS BECOMING MORE COMMON FOR NATURAL GAS UTILITIES?

[106] Direct Testimony of the Cost-Benefit Analysis Panel - Gas Schedule-BVESII-GAS-5, p. 64.
[107] Company's response to RCR-POL-0070.
[108] Company's response to RCR-A-0001.
[109] Company's response to RCR-POL-0070.

A. Yes. These infrastructure cost recovery mechanisms, sometimes called "infrastructure trackers," or "capital tracker" mechanisms, have been adopted by some regulatory commissions for purposes of allowing more immediate cost recovery associated with a utility's replacement of certain priority facilities. To date, these infrastructure tracker mechanisms have been primarily relegated to the replacement of cast iron and unprotected steel facilities. In other instances, these infrastructure replacement programs have been extended to include the accelerated replacement of mechanical or other type of couplings and other types of questionable equipment or materials. Schedule DED-9 provides a map of the states that have allowed utilities to implement and use various types of capital expenditure cost trackers as a means of recovering the costs associated with their infrastructure investments. To date, there are 36 states that allow for the use of cost recovery mechanisms.[110]

Q. IS THE DESIGN OF COST RECOVERY OR SURCHARGE MECHANISMS UNIFORM FOR THOSE STATES THAT HAVE APPROVED GAS INFRASTRUCTURE COST RECOVERY MECHANISMS?

A. No. Approved gas infrastructure cost recovery mechanisms differ in terms of the types of costs allowed for recovery, their sunset or review provisions, their terms, whether or not they include any investment limitations or rate impact caps among other program components. Schedule DED-10 presents a table that outlines the major components of each approved natural gas and electric distribution infrastructure cost recovery mechanisms. The remainder of this section of my testimony will compare various aspects of the Company's gas infrastructure cost recovery mechanism to those approved in other parts of the country and New Jersey.

[110] The District of Columbia also allows for an infrastructure cost recovery rate mechanism.

Q. DOES NEW JERSEY HAVE ANY APPROVED NATURAL GAS INFRASTRUCTURE TRACKERS IN PLACE?

A. Yes. Excluding the Company's various Capital Infrastructure Program ("CIP") programs,[111] the Energy Strong program, and the GSMP I and GSMP II programs, New Jersey currently has a number of other approved natural gas infrastructure trackers in place for New Jersey Natural Gas Company ("NJNG"), Elizabethtown Gas Company ("ETG") and South Jersey Gas Company ("SJG"). Each of these cost recovery mechanisms was approved as part of a settlement between the individual utilities, Board Staff, Rate Counsel, and intervenors, and are based upon a number of important principles:

1) Pipeline replacement costs are generally rolled in to base rates through annual base rate filings, and the costs of the program are later subject to a prudency review in a specified future rate case.[112]

2) Cost recovery is limited to only investments associated with reducing safety-related leaks on priority mains and services.[113]

3) There are benchmarks and performance measures that are tied to program returns.[114]

[111] The CIP programs were developed and implemented in order to enhance the reliability of the Company's distribution system as well as stimulate economic development and job growth in the state.

[112] See, In the Matter of the Public Service Electric and Gas Company for Approval of a Gas System Modernization Program and Associated Cost Recovery Mechanism, Docket No. GR15030272, Order, November 16, 2015, Stipulation and Agreement ¶17-18; In the Matter of the Petition of Public Service Electric and Gas Company for Approval of the Energy Strong Program, Order Approving Stipulation, Docket Nos. EO13020155 and GO13020156 ¶2 and ¶5.

[113] In the Matter of the Petition of New Jersey Natural Gas Company for Approval of the Safety Acceleration and Facility Enhancement Program pursuant to N.J.S.A. 48:2-23, and for Approval of the Associated Recovery Mechanism Pursuant to N.J.S.A. 48:2-21 and N.J.S.A. 2-21.1, BPU Docket GO12030255, Order dated October 23, 2012, p. 4; In the Matter of the petition of South Jersey Gas Company to Implement an Accelerated Infrastructure Replacement Program and Associated Recovery Mechanism Pursuant to N.J.S.A. 48:2-21 and N.J.S.A. 48:2-21.1, BPU Docket No. GO12070670, Order dated February 20, 2013 , p. 3; and In the Matter of the Petition of Pivotal Utility Holdings, Inc. d/b/a Elizabethtown Gas for Approval of an Accelerated Infrastructure Replacement Program and an Associated Cost Recovery Mechanism, BPU Docket No. GO12070693, Order dated August 21, 2013, p. 5 ¶15.

4) Rates of return have been adjusted to recognize the changes in the capital markets since the Company's last base rate case.[115]

5) The cost recovery mechanisms include a number of ratepayer protection mechanisms such as O&M offsets and expenditure caps,[116] and clear sunset provisions with rate case filing requirements.[117]

Q. DOES THE COMPANY'S ES II GAS PROPOSAL SUFFER FROM ANY PROGRAM DESIGN DEFICIENCIES?

A. Yes. The Company's ES II proposal suffers from a number of program design deficiencies that include:

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[114] In the Matter of the Petition of New Jersey Natural Gas Company for Approval of the Safety Acceleration and Facility Enhancement Program pursuant to N.J.S.A. 48:2-23, and for Approval of the Associated Recovery Mechanism Pursuant to N.J.S.A. 48:2-21 and N.J.S.A. 2-21.1, BPU Docket GO12030255, Order dated October 23, 2012, pp. 6-7; In the Matter of the petition of South Jersey Gas Company to Implement an Accelerated Infrastructure Replacement Program and Associated Recovery Mechanism Pursuant to N.J.S.A. 48:2-21 and N.J.S.A. 48:2-21.1, BPU Docket No. GO12070670, Order dated February 20, 2013 , p. 5; and In the Matter of the Petition of Pivotal Utility Holdings, Inc. d/b/a Elizabethtown Gas for Approval of an Accelerated Infrastructure Replacement Program and an Associated Cost Recovery Mechanism, BPU Docket No. GO12070693, Order dated August 21, 2013, p. 10 ¶27.

[115] In the Matter of the Petition of New Jersey Natural Gas Company for Approval of the Safety Acceleration and Facility Enhancement Program pursuant to N.J.S.A. 48:2-23, and for Approval of the Associated Recovery Mechanism Pursuant to N.J.S.A. 48:2-21 and N.J.S.A. 2-21.1, BPU Docket GO12030255, Order dated October 23, 2012, pp. 5-6; In the Matter of the petition of South Jersey Gas Company to Implement an Accelerated Infrastructure Replacement Program and Associated Recovery Mechanism Pursuant to N.J.S.A. 48:2-21 and N.J.S.A. 48:2-21.1, BPU Docket No. GO12070670, Order dated February 20, 2013 , p. 2; and In the Matter of the Petition of Pivotal Utility Holdings, Inc. d/b/a Elizabethtown Gas for Approval of an Accelerated Infrastructure Replacement Program and an Associated Cost Recovery Mechanism, BPU Docket No. GO12070693, Order dated August 21, 2013, p. 7 ¶19.

[116] In the Matter of the Petition of New Jersey Natural Gas Company for Approval of the Safety Acceleration and Facility Enhancement Program pursuant to N.J.S.A. 48:2-23, and for Approval of the Associated Recovery Mechanism Pursuant to N.J.S.A. 48:2-21 and N.J.S.A. 2-21.1, BPU Docket GO12030255, Order dated October 23, 2012, pp. 4-5; In the Matter of the petition of South Jersey Gas Company to Implement an Accelerated Infrastructure Replacement Program and Associated Recovery Mechanism Pursuant to N.J.S.A. 48:2-21 and N.J.S.A. 48:2-21.1, BPU Docket No. GO12070670, Order dated February 20, 2013 , p. 3; and In the Matter of the Petition of Pivotal Utility Holdings, Inc. d/b/a Elizabethtown Gas for Approval of an Accelerated Infrastructure Replacement Program and an Associated Cost Recovery Mechanism, BPU Docket No. GO12070693, Order dated August 21, 2013, p. 7 ¶18.

[117] In the Matter of the Petition of New Jersey Natural Gas Company for Approval of the Safety Acceleration and Facility Enhancement Program pursuant to N.J.S.A. 48:2-23, and for Approval of the Associated Recovery Mechanism Pursuant to N.J.S.A. 48:2-21 and N.J.S.A. 2-21.1, BPU Docket GO12030255, Order dated October 23, 2012, p. 6; In the Matter of the petition of South Jersey Gas Company to Implement an Accelerated Infrastructure Replacement Program and Associated Recovery Mechanism Pursuant to N.J.S.A. 48:2-21 and N.J.S.A. 48:2-21.1, BPU Docket No. GO12070670, Order dated February 20, 2013 , p. 4; and In the Matter of the Petition of Pivotal Utility Holdings, Inc. d/b/a Elizabethtown Gas for Approval of an Accelerated Infrastructure Replacement Program and an Associated Cost Recovery Mechanism, BPU Docket No. GO12070693, Order dated August 21, 2013, p. 8 ¶20.

1) An expansive set of costs not commonly included in any other New Jersey infrastructure cost recovery mechanisms;

2) No firm ES-II program-specific performance metrics;

3) No costs savings associated with lower O&M expenses; and

4) No rate mitigation provisions such as a cap on capital expenditures that are common with other tracker mechanisms.

Q. IS THE SIZE OF THE COMPANY'S ES II GAS PROGRAM PROBLEMATIC?

A. Yes. The natural gas portion of the ES II program is very large and expensive program, amounting to over $0.999 billion, or $555 on a per customer basis.[118] The Company's proposal expands well beyond the scope of the original-approved ES I program approved by the Board, as well as the currently-approved infrastructure programs of other New Jersey natural gas utilities. As noted earlier, even the Company recognizes that the Curtailment Resiliency Subprogram goes far beyond the scope and purpose of the ES I program since it is not intended to increase storm preparedness efforts or reliability issues during a major storm event.[119] Further, and more importantly, the Company's proposal is based on a cost "estimate" that could differ in the future.[120] The Company proposes no investment or program expenditure cap and has indicated cap discussions are more appropriately addressed within the context of a comprehensive settlement on the ES II program, and not as part of any discussion seeking ways to improve upon its proposed ES II program design.[121] This is particularly important because if the ES II proposal were to incur a 10 percent cost overrun for a $2.5 billion dollar program it could lead to as much

[118] The cost per customer is calculated using the total program investment of the Energy Strong II of $0.999 billion and dividing by the Company's total number of gas customers of 1,800,000.
[119] Company's response to RCR-POL-0039.
[120] Company's Petition, p. 2, ¶4, and Company's response to RCR-POL-0024.
[121] Company's response to RCR-POL-0024.

as $250 million in additional unanticipated capital investment, costing ratepayers an additional $17.2 million in revenue requirement.[122]

Q. WOULD AN INFRASTRUCTURE INVESTMENT CAP MEAN THAT THE COMPANY IS INCURRING AN INVESTMENT DISALLOWANCE?

A. No. An investment cap only limits the amount of the investment that is eligible for accelerated recovery, either in total, or in any given year. Ultimately, these amounts will be allowed into rates if prudently incurred, upon review in the following year, or at the time of the Company's next full rate case.

Q. WOULD YOU PLEASE ADDRESS THE SECOND DEFICIENCY?

A. Yes. The Company's proposal does not include any firm ES II program-specific performance metrics despite the fact that the program is purportedly designed to minimize or eliminate outages due to a curtailment event. The Company has also failed to provide any performance metrics or penalties regarding its proposed electric distribution system projects as well. Although the Company claims that there will be reductions to its SAIFI and SAIDI metrics as a result of this program[123] it has not made an explicit commitment to ensure these reductions. The Company only states that it will report its SAIFI and SAIDI metrics as part of its minimum filing requirements and that these can be compared to the Company's previous five-year metrics[124] but there is no guarantee or commitment that an improvement will occur, nor is there any proposed penalty if they do not.

[122] Direct Testimony of Stephen Swetz, Schedule SS-ESII-3. The revenue is calculated using the over investment of $250 million and multiplying by the rate of return of 6.88%.
[123] See Company's response to RCR-ENG-E-0014, RCR-ENG-E-0019, RCR-ENG-E-0023, RCR-ENG-E-0026, RCR-ENG-E-0029.
[124] Company's response to RCR-POL-0009.

Q. HOW ARE RATEPAYERS IMPACTED BY THE OMISSION OF ANY ES II PROGRAM-SPECIFIC PERFORMANCE STANDARDS?

A. The omission of any meaningful performance metrics shifts ES II program performance risk away from the Company and onto ratepayers. This program design failure creates a disconnect between performance and cost recovery making the future prudence evaluation of these investments difficult. Performance standards help to set governing rules and create an objective screen (or threshold) on how utility cost and investment performance will be evaluated. This creates benefits for both parties since utilities have upfront knowledge of the standards to which they will be held for any later review. Likewise, regulators and ratepayers also have a definitive understanding of the anticipated performance improvements that will arise from the utility's integrity-improving activities.

Q. DO OTHER NEW JERSEY GAS INFRASTRUCTURE PROGRAMS INCLUDE PERFORMANCE TARGETS?

A. Yes. However, those programs were largely based on the accelerated cost recovery of aging gas infrastructure for the replacement of cast iron and bare steel pipeline.[125] For instance, in those programs, NJNG, SJG and ETG agreed through their various mechanisms to tie the

[125] In the Matter of the Petition of New Jersey Natural Gas Company for Approval of the Safety Acceleration and Facility Enhancement Program pursuant to N.J.S.A. 48:2-23, and for Approval of the Associated Recovery Mechanism Pursuant to N.J.S.A. 48:2-21 and N.J.S.A. 2-21.1, BPU Docket GO12030255, Order dated October 23, 2012, pp. 6-7; In the Matter of the petition of South Jersey Gas Company to Implement an Accelerated Infrastructure Replacement Program and Associated Recovery Mechanism Pursuant to N.J.S.A. 48:2-21 and N.J.S.A. 48:2-21.1, BPU Docket No. GO12070670, Order dated February 20, 2013 , p. 5; and In the Matter of the Petition of Pivotal Utility Holdings, Inc. d/b/a Elizabethtown Gas for Approval of an Accelerated Infrastructure Replacement Program and an Associated Cost Recovery Mechanism, BPU Docket No. GO12070693, Order dated August 21, 2013, p. 10 ¶27.

allowed rate of return on investments in their respective cost recovery mechanisms to leak performance.[126]

Q. PLEASE EXPLAIN THE COMPANY'S THIRD PROGRAM DESIGN DEFICIENCY.

A. The Company's proposal does not include any O&M cost savings adjustments[127] despite the fact that it has identified as much as 15 percent in O&M savings from its current costs in the M&R station replacements/upgrades.[128]

Q. DO THE APPROVED TRACKERS FOR ANY OTHER NEW JERSEY NATURAL GAS UTILITIES INCLUDE O&M SAVINGS OFFSETS?

A. Yes. In the past, some of the approved natural gas infrastructure trackers approved by the Board include the recognition of some form of O&M savings. In most of these prior infrastructure tracker proceedings, New Jersey's other natural gas utilities have agreed to one of two approaches: 1) defer in a separate regulatory liability account any amount of leak repair O&M costs less than the amount included in base rates. At the time the infrastructure projects are rolled into rate base, the regulatory liability associated with the leak repair will be amortized into rates over a four-year period; or 2) exclude any "incremental operation and maintenance

[126] In the Matter of the Petition of New Jersey Natural Gas Company for Approval of the Safety Acceleration and Facility Enhancement Program pursuant to N.J.S.A. 48:2-23, and for Approval of the Associated Recovery Mechanism Pursuant to N.J.S.A. 48:2-21 and N.J.S.A. 2-21.1, BPU Docket GO12030255, Order dated October 23, 2012, pp. 6-7; In the Matter of the petition of South Jersey Gas Company to Implement an Accelerated Infrastructure Replacement Program and Associated Recovery Mechanism Pursuant to N.J.S.A. 48:2-21 and N.J.S.A. 48:2-21.1, BPU Docket No. GO12070670, Order dated February 20, 2013 , p. 5; and In the Matter of the Petition of Pivotal Utility Holdings, Inc. d/b/a Elizabethtown Gas for Approval of an Accelerated Infrastructure Replacement Program and an Associated Cost Recovery Mechanism, BPU Docket No. GO12070693, Order dated August 21, 2013, p. 10 ¶27.

[127] Company's response to RCR-POL-0038.

[128] Company's response to RCR-POL-0034, Attachment RCR-POL_0034_Avoided O&M and Capital.xlsx.

expenses" in future infrastructure filings.[129] However, most recently as part of the approved settlement for the Company's GSMP II, the Company is to make an explicit O&M savings adjustment to each rate adjustment roll-in of $3,771/mile of main replaced as a result of O&M savings from leak reductions.[130]

Q. DO OTHER NATURAL GAS REPLACEMENT RIDERS INCLUDE AN OFFSET FOR THE RELATED O&M SAVINGS?

A. Yes. Schedule DED-10 shows that 28 utilities' infrastructure riders include an offset for the O&M savings associated with infrastructure replacement investments that reduce leaks, including gas utilities located in Arkansas, Georgia, Illinois, Kentucky, Massachusetts, Maine, Michigan, New Jersey, Ohio, Oregon, and Washington. There are 96 utilities that currently have periodic cost recovery mechanisms for their infrastructure replacement programs. Thus, 29.1 percent, a relatively large share, for approved infrastructure tracker mechanisms have O&M offset provisions.

[129] In the Matter of the Proceeding for Infrastructure Investment and a Cost Recovery Mechanism for All Gas and Electric Utilities, and In the Matter of the Petition of New Jersey Natural Gas Company for Approval of an Accelerated Energy Infrastructure Investment Program Pursuant to N.J.S.A. 48:2-23, and for Approval of Necessary Changes to Gas Rates and Changes in the Company's Tariff for Gas Service Pursuant to N.J.S.A. 48:2-21, BPU Docket Nos. EO090910049, GO09010052, and GR07110889, Decision and Order Approving Stipulation, p. 5; In the Matter of the Petition of New Jersey Natural Gas Company for Approval of an Extension of the Accelerated Energy Infrastructure Investment Program Pursuant to N.J.S.A. 48:2-23 and for Approval of Necessary Changes in the Company's Tariff for Gas Service Pursuant to N.J.S.A. 48:2-21 Et. Seq., BPU Docket Nos. GR07110889 and GR10100793, Decision and Order Approving Stipulation, p. 3; In the Matter of the Petition of New Jersey Natural Gas Company for Approval of the Safety Acceleration and Facility Enhancement Program Pursuant to N.J.S.A. 48:2-23, and for Approval of the Associated Recovery Mechanism Pursuant to N.J.S.A. 48:2-21 and N.J.S.A. 2-21.1, BPU Docket No. GO12030255, Order, p. 6; In the Matter of the Annual Filing of South Jersey Gas Company to Adjust its Capital Investment Recovery Tracker ("CIRT") and for Approval of an Extension of the CIRT Pursuant to N.J.S.A. 48:2-21 and N.J.S.A. 48:2-21.1, and In the Matter of the Petition of South Jersey Gas Company for Approval of Increased Base Tariff Rates and Charges for Gas Service and Other Tariff Revision, BPU Docket Nos. GR10100765 and GR10010035, Decision and Order Approving Stipulation, p.6.; and In the Matter of the Petition of South Jersey Gas Company to Implement an Accelerated Infrastructure Replacement Program and Associated Recovery Mechanism Pursuant to N.J.S.A. 48:2-21 and N.J.S.A. 48:2-21.1, BPU Docket No. GO12070670, Order, p. 5.

[130] 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"), Docket No. GR17070776, Settlement, p. 14.

Q. DOES THIS O&M CREDIT OMISSION EXTEND TO THE COMPANY'S ELECTRIC SUB-PROGRAMS AS WELL?

A. Yes. The Company's analysis identifies as much as $15.1 million reduction in electricity-related O&M costs over the period 2019-2024 that will arise from adoption of its ES II program.[131] An electric O&M credit also needs to be included in the Company's program design, particularly, as I noted earlier, if these are *bona fide* cost reduction opportunities that are included in any CBA used for program approval purposes.

Q. DOES THE COMPANY'S PROPOSAL INCLUDE ANY RATE IMPACT OR BILL IMPACT CAPS?

A. Yes. A rate impact cap is an important ratepayer protection since it limits the impact of a utility's reliability or modernization expenditures on household, business, or industrial customers' natural gas bills to some pre-defined percent. A part of the utility's revenue requirement that is above the fixed percentage cap is either deferred or treated in a fashion consistent with traditional ratemaking practices. The Company states that its filings for rate increases will be "less often" than the proposed semi-annual filings and that the first base rate adjustment filings in the proposed program will be in September 2020 for electric rates and March 2022 for gas rates.[132] However, annual cost recovery filings are preferable and recommended if the ES II Program is approved as is discussed in the Direct Testimony of Ms. Crane.

Q. WHAT ARE YOUR PROGRAM DESIGN RECOMMENDATIONS?

[131] Company's response to RCR-POL-0061, Attachment RCR-POL_0061_PSEG ES2 Cost- Benefit Model - Final - 6-5-18.xlsx.
[132] Company's Petition p. 10 at ¶13.

A. If the Board decides to approve all or part of the Company's ES II program, then the following program design modifications should be part of that approval:

- A limitation on total program (or subprogram) capital expenditures to just those capital investments offered in this filing. Any capital expenditures in excess of this level can be considered for rate recovery at the time of the Company's next full base rate case.
- Utilization of program benchmarks for any electric and natural gas subprograms that are ultimately approved by the Board as part of the final program.
    - Electric program performance goals should be tied to the SAIDI and SAIFI improvements identified in the Company's CBA.
    - A set of penalties, on a per-outage basis, should be applied to each of the approved natural gas programs that are comparable to the VoLL identified by the Company in their CBA.
- Inclusion of an O&M cost credit equal to the estimated savings included in the Company's individual electric and natural gas subprograms.
- Inclusion of a rate impact cap equal to no more than a one percent increase in base rates consistent with the recommendation made under the Energy Strong I program.

VIII. Conclusions and Recommendations

Q. PLEASE SUMMARIZE YOUR CONCLUSIONS AND RECOMMENDATIONS REGARDING THE COMPANY'S PROPOSED ES II PROGRAM?

A. The Board should reject the Company's ES II program proposal. The Company's proposed ES II Program is very large, will result in significant rate impacts as proposed, and its associated gas cost recovery mechanism suffers from a number of program design deficiencies. The Company's CBA also suffers from a number of deficiencies that underscore the

questionable nature of the ES II program. The Company's proposed ES II Program fails the CBA and, if approved, as proposed the program will result in net negative economic benefits. The Company has not shown a need for its proposed ES II Program as it relates to its gas infrastructure subprograms, particularly the proposed Curtailment Resiliency subprogram. As detailed in the testimony of Mr. McGee, a number of the proposed pipeline extensions under the Curtailment Resiliency subprogram may never actually be used. Therefore, I recommend that the Board reject the Company's proposed ES II program.

Q. PLEASE SUMMARIZE THE RESULTS OF YOUR CBA/ECONOMIC IMPACT ANALYSIS OF THE COMPANY'S ES II PROGRAM.

A. The negative impacts associated with the $1.89 billion (on a net present value or "NPV" basis) in rate increases that are likely to arise from the ES II proposal outweigh any positive impacts that may arise from the Program's construction and development activities. The net economic impacts of the program show that the Company's ES II proposal is likely to lead to a net contraction of New Jersey economic output of $2.55 billion (NPV basis) and a reduction of total New Jersey employment by almost 70,000 job-years over the life of the assets.

Q. PLEASE SUMMARIZE YOUR RECOMMENDATIONS REGARDING THE LEVEL OF GAS CAPITAL BASE SPENDING THAT SHOULD BE ALLOWED IF THE ES II PROGRAM IS APPROVED?

A. Consistent with the GSMP II approval, I recommend the Company should at a minimum maintain an annual baseline capital spend of $155 million over the five year term of the ES II program.[133] In addition to this minimum baseline capital spend, the Company should make

[133] 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"), Docket No. GR17070776, Decision and Order Approving Stipulation. March 22, 2018, Stipulation, p. 9.

additional baseline capital investments of at least 10 percent of any approved ES II program total expenditures, to be recovered in a traditional base rate case proceeding.

Q. CAN YOU PLEASE SUMMARIZE THE GAS PROGRAM DESIGN DEFICIENCIES ASSOCIATED WITH THE COMPANY'S PROPOSED COST RECOVERY MECHANISM?

A. The Company's Energy Strong proposal suffers from a number of deficiencies that include the following:

1) An expansive set of costs not commonly included in any other New Jersey infrastructure cost recovery mechanisms;

2) No firm ES-II program-specific performance metrics;

3) No costs savings associated with lower O&M expenses; and

4) No rate mitigation provisions such as a cap on capital expenditures that are common with other tracker mechanisms.

Q. DO YOU HAVE ANY RECOMMENDATIONS SHOULD THE BOARD DECIDE TO APPROVE SOME PORTION OF THE COMPANY'S ES II PROPOSAL?

A. Yes. I recommend that the Board modify the Company's ES II should it decide to accept some portion of the plan. These modifications include:

- A limitation on total program (or subprogram) capital expenditures to just those capital investments offered in this filing. Any capital expenditures in excess of this level can be considered for rate recovery at the time of the Company's next full base rate case.
- Utilization of program benchmarks for any electric and natural gas subprograms that are ultimately approved by the Board as part of the final program.
    - Electric program performance goals should be tied to the SAIDI and SAIFI improvements identified in the Company's CBA.

- A set of penalties, on a per-outage basis, should be applied to each of the approved natural gas programs that are comparable to the VoLL identified by the Company in their CBA.

- Inclusion of an O&M cost credit equal to the estimated savings included in the Company's individual electric and natural gas subprograms.
- Inclusion of a rate impact cap equal to no more than a one percent increase in base rates consistent with the recommendation made under the Energy Strong I program.

Q. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY FILED ON MARCH 1, 2019?

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.

ATTACHMENT

APPENDIX A

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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.

APPENDIX A

PUBLICATIONS: BOOKS AND MONOGRAPHS

1. *Power System Operations and Planning in a Competitive Market*. (2002). With Fred I. Denny. New York: CRC Press.
2. *Distributed Energy Resources: A Practical Guide for Service.* (2000). With Ritchie Priddy. London: Financial Times Energy.

PUBLICATIONS: PEER REVIEWED ACADEMIC JOURNALS

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2. "The feasibility of repurposing natural gas pipelines to transport carbon dioxide: a Louisiana case study and analysis. (2018). With Brian Snyder and Michael Layne. *International Journal of Greenhouse Gas Control*. Forthcoming.
3. "A cash flow model of an integrated industrial CCS-EOR project in a petrochemical corridor: a case study in Louisiana. (2018). With Brian Snyder and Michael Layne. *International Journal of Greenhouse Gas Control*. Forthcoming.
4. "Understanding the challenges of industrial carbon capture and storage: an example in a U.S. petrochemical corridor." (2018). With Brian Snyder and Michael Layne. *International Journal of Sustainable Energy*.
5. "Sea level rise and coastal inundation: a case study of the Gulf Coast energy infrastructure." (2018). With Siddhartha Narra. *Natural Resources*. 9: 150-174.
6. "The energy pillars of society: perverse interactions among human resource use, the economy and environmental degradation." (2018). With Adrian R.H. Wiegman, John W. Day, Christopher F. D'Elia, Jeffrey S. Rutherford, Charles Hall. *BioPhysical Economics and Resource Quality*. 3(2) 1-16.
7. "Modeling the impacts of sea-level rise, oil price, and management strategy on the costs of sustaining Mississippi delta marshes with hydraulic dredging." (2018). with Adrian R.H. Wiegman, John W. Day, Christopher F. D'Elia, Jeffrey S. Rutherford, James T. Morris, Eric D. Roy, Robert R. Lane, and Brian F. Snyder. *Science of the Total Environment* 618 (2018): 1547-1559.
8. "Identifying Vulnerabilities of Working Coasts Supporting Critical Energy Infrastructure." (2016). With Siddhartha Narra. *Water*. 8(1).
9. "Economies of Scale, Learning Effects and Offshore Wind Development Costs" (2015). With Gregory B. Upton, Jr. *Renewable Energy*. 61-66.
10. "Economic impact of Gulf of Mexico ecosystem goods and services and integration into restoration decision-making." (2014) With Shepard, A.N., J.F. Valentine, C.F. D'Elia, D.W. Yoskowitz. *Gulf Science*.
11. "An Empirical Analysis of Differences in Interstate Oil and Natural Gas Drilling Activity." (2012). With Mark J. Kaiser and Christopher J. Peters. *Exploration & Production: Oil and Gas Review*. 30(1): 18-22.

12. "The Value of Lost Production from the 2004-2005 Hurricane Seasons in the Gulf of Mexico." (2009). With Mark J. Kaiser and Yunke Yu. *Journal of Business Valuation and Economic Loss Analysis*. 4(2).

13. "Estimating the Impact of Royalty Relief on Oil and Gas Production on Marginal State Leases in the US." (2006). With Jeffrey M. Burke and Dmitry V. Mesyanzhinov. *Energy Policy* 34(12): 1389-1398.

14. "Using Competitive Bidding As A Means of Securing the Best of Competitive and Regulated Worlds." (2004). With Tom Ballinger and Elizabeth A. Downer. *NRRI Journal of Applied Regulation.* 2 (November): 69-85. (*Received 2005 Best Paper Award by NRRI*)

15. "Deregulation of Generating Assets and the Disposition of Excess Deferred Federal Income Taxes." (2004). With K.E. Hughes II. *International Energy Law and Taxation Review*. 10 (October): 206-212.

16. "Reflections on the U.S. Electric Power Production Industry: Precedent Decisions Vs. Market Pressures." (2003). With Robert F. Cope III and John W. Yeargain. *Journal of Legal, Ethical, and Regulatory Issues*. Volume 6, Number 1.

17. "A is for Access: A Definitional Tour Through Today's Energy Vocabulary." (2001) *Public Resources Law Digest*. 38: 2.

18. "A Comment on the Integration of Price Cap and Yardstick Competition Schemes in Electrical Distribution Regulation." (2001). With Steven A. Ostrover. *IEEE Transactions on Power Systems.* 16 (4): 940 -942.

19. "Modeling Regional Power Markets and Market Power." (2001). With Robert F. Cope. *Managerial and Decision Economics.* 22:411-429.

20. "A Data Envelopment Analysis of Levels and Sources of Coal Fired Electric Power Generation Inefficiency" (2000). With Williams O. Olatubi. *Utilities Policy.* 9 (2): 47-59.

21. "Cogeneration and Electric Power Industry Restructuring" (1999). With Andrew N. Kleit. *Resource and Energy Economics*. 21:153-166.

22. "Capacity and Economies of Scale in Electric Power Transmission" (1999). With Robert F. Cope and Dmitry Mesyanzhinov. *Utilities Policy* 7: 155-162.

23. "Oil Spills, Workplace Safety, and Firm Size: Evidence from the U.S. Gulf of Mexico OCS." (1997). With O. O. Iledare, A. G. Pulsipher, and Dmitry Mesyanzhinov. *Energy Journal* 4: 73-90.

24. "A Comment on Cost Savings from Nuclear Regulatory Reform" (1997). *Southern Economic Journal*. 63:1108-1112.

25. "The Demand for Long Distance Telephone Communication: A Route-Specific Analysis of Short-Haul Service." (1996). *Studies in Economics and Finance* 17:33-45.

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2. "Economic and Policy Issues in Sustaining an Adequate Oil Spill Contingency Fund in the Aftermath of a Catastrophic Incident." (2014). With Stephen R. Barnes and Gregory B. Upton. *Proceedings of the Thirty-seventh AMOP Technical Seminar on Environmental contamination and Response.* June: 506-524.

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4. "Electric Utility Restructuring and Strategies for the Future." (2001). With Scott W. Geiger. *Proceedings of the Southwest Academy of Management*. March.

5. "Applications for Distributed Energy Resources in Oil and Gas Production: Methods for Reducing Flare Gas Emissions and Increasing Generation Availability" (2000). With Ritchie D. Priddy. *Proceedings of the International Energy Foundation – ENERGEX 2000*. July.

6. "Power System Operations, Control, and Environmental Protection in a Restructured Electric Power Industry" (1998). With Fred I. Denny. *IEEE Proceedings: Large Engineering Systems Conference on Power Engineering*. June: 294-298.

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8. "Safety Regulations, Firm Size, and the Risk of Accidents in E&P Operations on the Gulf of Mexico Outer Continental Shelf" (1996). With Allan Pulsipher, Omowumi Iledare, and Bob Baumann. *Proceedings of the American Society of Petroleum Engineers: Third International Conference on Health, Safety, and the Environment in Oil and Gas Exploration and Production*, June.

9. "Comparing the Safety and Environmental Records of Firms Operating Offshore Platforms in the Gulf of Mexico." (1996). With Allan Pulsipher, Omowumi Iledare, Dmitry Mesyanzhinov, William Daniel, and Bob Baumann. *Proceedings of the American Society of Mechanical Engineers: Offshore and Arctic Operations 1996*, January.

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1. "A Collaborative Investigation of Baseline and Scenario Information for Environmental Impact Statements" (2005). *Proceedings of the 23rd Annual Information Technology Meetings*. U.S. Department of the Interior, Minerals Management Service, Gulf Coast Region, New Orleans, LA. January 12, 2005.

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

3. "Competitive Bidding in the Electric Power Industry." (2003). *Proceedings of the Association of Energy Engineers*. December 2003.

4. "The Role of ANS Gas on Southcentral Alaskan Development." (2002). With William Nebesky and Dmitry Mesyanzhinov. *Proceedings of the International Association for Energy Economics: Energy Markets in Turmoil: Making Sense of It All*. October.

5. "A New Consistent Approach to Modeling Regional Economic Impacts of Offshore Oil and Gas Activities." (2002). With Vicki Zatarain. *Proceedings of the 2002 National IMPLAN Users Conference*: 241-258.

6. "Analysis of the Economic Impact Associated with Oil and Gas Activities on State Leases." (2002). With Dmitry Mesyanzhinov, Robert H. Baumann, and Allan G. Pulsipher. *Proceedings of the 2002 National IMPLAN Users Conference*: 149-155.

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8. "Modeling the Economic Impact of Offshore Activities on Onshore Communities." (2000). With Williams O. Olatubi. *Proceedings of the 20th Annual Information Transfer Meeting*. U.S. Department of Interior, Minerals Management Service: New Orleans, Louisiana.

9. "Empirical Challenges in Estimating the Economic Impacts of Offshore Oil and Gas Activities in the Gulf of Mexico" (2000). With Williams O. Olatubi. *Proceedings of the International Association for Energy Economics: Transforming Energy Markets*. August.

10. "Asymmetric Choice and Customer Benefits: Lessons from the Natural Gas Industry." (1999). With Rachelle F. Cope and Dmitry Mesyanzhinov. *Proceedings of the International Association for Energy Economics: The Only Constant is Change* August: 444-452.

11. "Modeling Electric Power Markets in a Restructured Environment" (1998). With Robert F. Cope and Dan Rinks. *Proceedings of the International Association for Energy Economics: Technology's Critical Role in Energy and Environmental Markets*. October: 48-56.

12. "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, Bob Baumann, and Dmitry Mesyanzhinov. *Proceedings of the 16th Annual Information Transfer Meeting*. U.S. Department of Interior, Minerals Management Service: New Orleans, Louisiana: 162-166.

13. "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. *Proceedings of the 15th Annual Information Transfer Meeting*. U.S. Department of Interior, Minerals Management Service: New Orleans, Louisiana.

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2. "The Road Ahead: The Outlook for Louisiana Energy." (2006). In *Commemorating Louisiana Energy: 100 Years of Louisiana Natural Gas Development*. Houston, TX: Harts Energy Publications, 68-72.

3. "Competitive Power Procurement An Appropriate Strategy in a Quasi-Regulated World." (2004). In *Electric and Natural Gas Business: Using New Strategies, Understanding the Issues.* With Elizabeth A. Downer. Edited by Robert Willett. Houston, TX: Financial Communications Company, 91-104.

4. "Alaskan North Slope Natural Gas Development." (2003). In *Natural Gas and Electric Industries Analysis 2003*. With William E. Nebesky, Dmitry Mesyanzhinov, and Jeffrey M. Burke. Edited by Robert Willett. Houston, TX: Financial Communications Company, 185-205.

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6. "The Hydropower Industry of the United States." (2000). With Dmitry Mesyanzhinov. In *Renewable Energy: Trends and Prospects*. Edited by E.W. Miller and A.I. Panah. Lafayette, PN: The Pennsylvania Academy of Science, 133-146.

7. "Electric Power Generation." (2000). In the *Macmillan Encyclopedia of Energy*. Edited by John Zumerchik. New York: Macmillan Reference.

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1. Review of ***Renewable Resources for Electric Power: Prospects and Challenges***. Raphael Edinger and Sanjay Kaul. (Westport, Connecticut: Quorum Books, 2000), pp 154. ISBN 1-56720-233-0. *Natural Resources Forum*. (*2000*).

2. Review of ***Electricity Transmission Pricing and Technology***, edited by Michael Einhorn and Riaz Siddiqi. (Boston: Kluwer Academic Publishers, 1996) pp. 282. ISBN 0-7923-9643-X. *Energy Journal* 18 (1997): 146-148.

3. Review of ***Electric Cooperatives on the Threshold of a New Era*** by Public Utilities Reports. (Vienna, Virginia: Public Utilities Reports, 1996) pp. 232. ISBN 0-910325-63-4. *Energy Journal* 17 (1996): 161-62.

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2. "Unconventional Natural Gas and the U.S. Manufacturing Renaissance" (2013). *BIC Magazine*. Vol. 30: No. 2, p. 76 (March).

3. "Louisiana's Tuscaloosa Marine Shale Development: Emerging Resource and Economic Potentials" (2012). *Spectrum*. January-April: 18-20.

4. "The Impact of Legacy Lawsuits on Louisiana's Conventional Drilling Activity" (2012). *LOGA Industry Report*. Spring 2012: 27-34.

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).

6. "Model Framework Can Aid Decision on Redevelopment." (2008). With Mark J. Kaiser and Yunke Yu. *Oil and Gas Journal*. Vol. 106.26: 49-53 (July 14) (part 2 of 3).

7. "Field Redevelopment Economics and Storm Impact Assessment." (2008). With Mark J. Kaiser and Yunke Yu. *Oil and Gas Journal*. Vol. 106.25: 42-50 (July 7) (part 1 of 3).

8. "The IRS' Latest Proposal on Tax Normalization: A Pyrrhic Victory for Ratepayers," (2006). With K.E. Hughes II. *Oil, Gas and Energy Quarterly*. 55(1): 217-236

9. "Executive Compensation in the Electric Power Industry: Is It Excessive?" (2006). With K.E. Hughes II. *Oil, Gas and Energy Quarterly*. 54(4): 913-940.

10. "Renewable Portfolio Standards in the Electric Power Industry." With K.E. Hughes II. *Oil, Gas and Energy Quarterly*. 54(3): 693-706.

11. "Regulating Mercury Emissions from Electric Utilities: Good Environmental Stewardship or Bad Public Policy? (2005). With K.E. Hughes II. *Oil, Gas and Energy Quarterly*. 54 (2): 401-424

12. "Using Industrial-Only Retail Choice as a Means of Moving Competition Forward in the Electric Power Industry." (2005). With K.E. Hughes II. *Oil, Gas and Energy Quarterly*. 54(1): 211-223

13. "The Nuclear Power Plant Endgame: Decommissioning and Permanent Waste Storage. (2005). With K.E. Hughes II. *Oil, Gas and Energy Quarterly*. 53 (4): 981-997

14. "Can LNG Preserve the Gas-Power Convergence?" (2005). With K.E. Hughes II. *Oil, Gas and Energy Quarterly*. 53 (3):783-796.

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16. "The Evolving Markets for Polluting Emissions: From Sulfur Dioxide to Carbon Dioxide." (2004). With K.E. Hughes II. *Oil, Gas and Energy Quarterly*. 53(2): 479-494.

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GRANT RESEARCH

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OCS." (1996). With Allan Pulsipher, Omowumi Iledare, Dmitry Mesyanzhinov, William Daniel, and Bob Baumann. U.S. Department of Interior, Minerals Management Service, Grant Number 95-0056. Total Project Funding: $109,361. Status: Completed.

ACADEMIC CONFERENCE PAPERS/PRESENTATIONS

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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. "MISO Grid Vision 2033." (2018). 2018 Winter Regulatory and Policymaker Forum. New Orleans, LA, December 11.
2. "Gulf Coast Energy Outlook 2019." (2018). LSU Center for Energy Studies, Baton Rouge, LA, Fall 2018.
3. "How LNG is transforming Louisiana's energy economy." (2018). Louisiana State Bar Association, Public Utility Section. Baton Rouge, LA, November 30.
4. "Overview of Louisiana LNG issues and trends." (2018). Kean Miller Law Firm: Energy and Environmental Practice Group. Baton Rouge, LA, November 28.
5. "Infrastructure and capacity: challenges for development." (2018). Society of Utility and Regulatory Financial Analysts (SURFA) Annual Meeting, New Orleans, LA, April 20.
6. "Louisiana industrial cogeneration trends." (2018). Annual Louisiana Solid Waste Association Conference, Lafayette, LA, March 16.
7. "Gulf Coast industrial development: overview of trends and issues." (2018). Gulf Coast Power Association Meetings, New Orleans, LA, February 8.

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

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

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

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

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

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

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

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

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

17. "The Gulf Coast energy economy: trends and outlook." (ma2017). Society for Municipal Analysts. New Orleans, LA, April 21.

18. "Gulf coast energy outlook." (2017). E.J. Ourso College of Business, Dean's Advisory Council, Energy Committee Meeting. Baton Rouge, LA, March 31.

19. "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.

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

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

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

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

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

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

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

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

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

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

30. "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.

31. "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.

32. "Trends and Issues in Net Metering and Solar Generation." (2015). Louisiana Rural Electric Cooperative Meeting. November 5.

33. "Electric Power: Industry Overview, Organization, and Federal/State Distinctions." (2015). EUCI. October 16.

34. "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.

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

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

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

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

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

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

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

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

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

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

45. "A Survey of Recent Energy Market Changes and their Potential Implications for

Louisiana." (2015). Vistage Group, New Orleans, Louisiana. February 4.

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

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

48. "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.

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

50. "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.

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

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

53. "The Conventional Wisdom Associated with Unconventional Resource Development." (2014). National Association for Business Economics Annual Conference, Chicago, Illinois. September 28.

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

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

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

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

58. "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.

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

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

61. "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.

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

Louisiana. February 6.

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

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

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

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

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

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

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

70. "Future Test Years: Issues to Consider." (2013). National Regulatory Research Institute, Teleseminar on Future Test Years. August 28.

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

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

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

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

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

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

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

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

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

80. "New Industrial Operations Leveraged by Unconventional Natural Gas." (2013) American

Petroleum Institute-Louisiana Chapter. Lafayette, LA, Petroleum Club, January 14.

81. "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.

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

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

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

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

86. "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.

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

88. "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.

89. "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.

90. "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.

91. "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.

92. "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.

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

94. "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.

95. "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.

96. "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.

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

98. "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.

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

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

101. "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.

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

103. "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.

104. "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.

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

106. "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.

107. "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.

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

109. "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.

110. "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.

111. "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.

112. "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.

113. "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.

114. "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.

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

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

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

118. 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.

119. "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.

120. "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.

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

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

123. "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.

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

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

126. "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.

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

LA.

128. "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

129. "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.

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

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

132. "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.

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

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

135. "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.

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

137. "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.

138. "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.

139. "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.

140. "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.

141. "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.

142. "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.

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

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

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

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

147. "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.

148. "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.

149. "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.

150. "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.

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

152. "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.

153. "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.

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

155. "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.

156. "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.

157. "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.

158. "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.

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

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

161. 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.

162. 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

163. 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.

164. "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

165. "Hurricanes and the Outlook for Energy Markets." Presentation before the Baton Rouge Rotary Club. November 9, 2005, Baton Rouge, LA.

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

167. "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.

168. "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.

169. "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.

170. "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.

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

172. "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.

173. "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.

174. "The Outlook for Energy." Lagniappe Studies Continuing Education Course. Baton Rouge, LA. July 11, 2005.

175. "The Outlook for Energy." Sunshine Rotary Club. Baton Rouge, LA. April 27, 2005.

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

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

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

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

180. "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.

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

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

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

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

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

186. "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.

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

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

189. 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.

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

191. "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.

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

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

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

195. "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.

196. "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.

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

198. "Natural Gas Outlook." Presentation before the Louisiana Chemical Association, October 17, 2003, Pointe Clear, Alabama.

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

200. "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.

201. "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.

202. "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.

203. "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.

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

205. "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.

206. "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.

207. "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.

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

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

210. "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.

211. "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.

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

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

214. "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.

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

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

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

218. "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.

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

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

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

222. 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.

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

224. "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.

225. "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.

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

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

228. "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.

229. "How Will Utility Deregulation Affect Tourism." Louisiana Travel Promotion Association Annual Meeting, Alexandria, Louisiana. January 15, 1998.

230. "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.

231. "Electric Utility Restructuring in Louisiana." Hammond Chamber of Commerce, Hammond, Louisiana. October 30, 1997.

232. "Electric Utility Restructuring." Louisiana Association of Energy Engineers. Baton Rouge, Louisiana. September 11, 1997.

233. "Electric Utility Restructuring: Issues and Trends for Louisiana." Opelousas Chamber of Commerce, Opelousas, Louisiana. June 24, 1997.

234. "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.

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

236. "Restructuring the Electric Utility Industry." Louisiana Propane Gas Association Annual Meeting, Alexandria, Louisiana, December 12, 1996.

237. "Deregulating the Electric Utility Industry." Eighth Annual Economic Development Summit, Baton Rouge, Louisiana, November 21, 1996.

238. "Electric Utility Restructuring in Louisiana." Jennings Rotary Club, Jennings, Louisiana, November 19, 1996.

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

240. "Electric Utility Restructuring" L ouisiana Electric Cooperative Association, Baton Rouge, Louisiana, August 27, 1996.

241. "Electric Utility Restructuring -- Background and Overview." Louisiana Public Service Commission, Baton Rouge, Louisiana, August 14, 1996.

242. "Electric Utility Restructuring." Sunshine Rotary Club Meetings, Baton Rouge, Louisiana, August 8, 1996.

243. 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.

244. 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. D2018.2.12. (2018). Before the Public Service Commission of the State of Montana. *In the Matter of NorthWestern Energy's Application for Authority to Increase Retail Electric Utility Service Rates and for Approval of Electric Service Schedules and Rules and Allocated Cost of Service and Rate Design.* Issues: Net-metering, cost of service, revenue distribution, rate design.

2. Expert Testimony. Docket No. 19-SEPE-054-MER. (2018). Before the Kansas Corporation Commission. *In the Matter of the Joint Application of Sunflower Electric Power Corporation and Mid-Kansas Electric Company, Inc. for an Order Approving the Merger of Mid-Kansas Electric Company, Inc. into Sunflower Electric Power Corporation*. Issues: merger impacts, rates, tariffs.

3. Expert Testimony. Docket No. 18-046-FR. (2018). Before the Arkansas Public Service Commission. *In the Matter of the Formula Rate Plan Filings of Oklahoma Gas and Electric Company Pursuant to APSC Docket No. 16-052-U.* Issues: formula rate plan, plant investment and expenses benchmarking analysis, reliability.

4. Expert Testimony. Docket No. 16-036-FR. (2018). 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.* Issues: rate design, reliability, and formula rate

plan.

5. Expert Testimony. Docket No. 2017-AD-0112. (2018). Before the Mississippi Public Service Commission. *In Re: Encouraging Stipulation of Matters in Connection with the Kemper County IGCC Project.* Issues: cost of service and rate design.

6. Expert Affidavit. Docket No. 87011-E. (2018). Before the 16th Judicial District Court Parish of St. Martin State of Louisiana. *Bayou Bridge Pipeline, LLC versus 38.00 Acres, More or Less, Located in St. Martin Parish; Barry Scott Carline, et al.* Issues: economic impacts.

7. Expert Testimony. Docket No. QO18080843. (2018). Before the 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.* Issues: regulatory policy and cost-benefit analyses.

8. Expert Testimony. Docket No. ER18010029 and GR18010030. (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 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.

9. Expert Testimony. Docket No. T-34695. (2018). Before the Louisiana Public Service Commission. *In re: Application for a rate increase on service originating at Grand isle and termination at St. James for Crude Petroleum as currently outlined in LPSC Tariff No. 75.2*. Issues: cost of service, rate design, and alternative regulation.

10. 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.

11. 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.

12. 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.

13. 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.

14. 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.

15. 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.

16. 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.

17. 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.

18. 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.

19. 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.

20. 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.

21. 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.

22. 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.

23. 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.

24. 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.

25. 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.

26. 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.

27. 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.

28. 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.

29. 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.

30. 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.

31. 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.

32. 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.

33. 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.

34. 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.

35. 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.

36. 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.

37. 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.

38. 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.

39. 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.

40. 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.

41. 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.

42. 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.

43. 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.

44. 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.

45. 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.

46. 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.

47. 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.

48. 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.

49. 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.

50. 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.

51. 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.

52. 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.

53. 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.

54. 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.

55. 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.

56. 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.

57. 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.

58. 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.

59. 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

60. 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.

61. 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.

62. 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.

63. 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.

64. 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.

65. 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.

66. 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.

67. 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.

68. 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.

69. 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.

70. 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.

71. 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.

72. 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.

73. 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.

74. 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.

75. 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.

76. 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.

77. 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.

78. 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.

79. 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.

80. 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)

81. 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.

82. 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.

83. 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.

84. 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.

85. 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.

86. 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.

87. 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.

88. 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.

89. 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.

90. 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.

91. 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.

92. 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.

93. 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.

94. 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.

95. 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.

96. 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.

97. 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.

98. 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.

99. 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.

100. 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.

101. 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.

102. 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.

103. 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.

104. 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)

105. 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)

106. 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.

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

108. 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.

109. 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).

110. 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.

111. 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.

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

113. 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.

114. 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.

115. 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.

116. 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)

117. 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.

118. 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.

119. 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.

120. 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).

121. 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.

122. 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.

123. 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.

124. 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)

125. 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.

126. 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.

127. 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).

128. 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.

129. 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.

130. 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

131. 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.

132. 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.

133. 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.

134. 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.

135. 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.

136. 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.

137. 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)

138. 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.

139. 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.

140. 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.

141. 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.

142. 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.

143. Public Testimony: Louisiana Board of Commerce and Industry (2001). Testimony on the Economic Impacts of Merchant Power Generation.

144. 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.

145. 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).

146. 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.

147. 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.

148. 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.

149. 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.

150. 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.

151. 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.

152. 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.

153. 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.

154. 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.

155. Legislative Testimony. Louisiana House of Representatives, Special Subcommittee on Utility Deregulation. (1997). On Behalf of the Louisiana Public Service Commission Staff. Issue: Electric Restructuring.

156. 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.

157. 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.

158. 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).

SCHEDULES

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Summary of ES I Infrastructure Investments

	Proposed Infrastructure Investment Cost		Approved Infrastructure Investment Cost
	First Five Years (Million $)	Total Cost 10-years (Million $)	Total Cost 5-years (Million $)
Electric Delivery Infrastructure Hardening			
1. Station Flood and Storm Surge Mitigation[1]	$ 819	$ 1,678	$ 620
2. Outside Plant Higher Design and Construction Standards	135	135	-
3. Strengthening Pole Infrastructure	105	105	-
4. Rebuilding Backyard Pole Lines	100	100	-
5. Targeted Undergrounding to Mitigate Storm Impacts	76	76	-
6. Relocate Operations Center and Emergency Response Center	15	15	-
Electric Delivery Infrastructure Resilience			
1. Advanced Technologies	$ 251	$ 451	$ 100
2. Contingency Reconfiguration Strategies	200	200	100
Supplemenetal Electric Projects			
1. Emergency Backup Generator / Quick Connect Stockpile	$ 2	$ 2	$ -
2. Municipal Pilot Program	N/A	N/A	-
Total Electric Energy Strong Program	**$ 1,703**	**$ 2,762**	**$ 820**
Gas Delivery Infrastructure Hardening			
1. Metering and Regulating Station Flood and Storm Surge Mitigation	$ 76	$ 140	$ 50
2. Replacement of Utilization Pressure Cast Iron and Associated Services	830	1,040	350
Total Gas Energy Strong Program	**$ 906**	**$ 1,180**	**$ 400**
Total Energy Strong Program Cost	**$ 2,609**	**$ 3,942**	**$ 1,220**

[1] A total of $400 million was approved to be recovered through the special rate making mechanism, and the remaining $220 million was approved to be recovered in the Company's base rate case.

Source: In the Matter of the Petition of Public Service Electric and Gas Company for Approval of the Energy Strong Program, Docket Nos. EO13020155 and GO13020156, Company Petition, Filed February 20, 2013, Attachment 1.

Summary of ES II Proposed Program Costs

Subprogram		Total Cost (Million $)
Electric Subprograms		
Substation	$	906.27
Electric Higher Outside Plant Design Standards		345.00
Electric Contingency Reconfiguration		145.00
Electric Grid Modernization		107.00
Electric Total	**$**	**1,503.27**
Natural Gas Subprograms		
Curtailment Resiliency	$	863.21
M&R Upgrade		136.00
Natural Gas Total	**$**	**999.21**
Program Total	**$**	**2,502.48**

Source: Company's Response to Data Request RCR-A-15, Attachments "RCR-A_0015_Gas ESII Internal External Cost Breakdown.xlsx" and "RCR-A_0015_Electric ESII Internal External Cost Breakdown.xlsx."

ES II Proposed Revenue Requirements

Roll-in:	Roll-in 1	Roll-in 2	Roll-in 3	
Rate Effective Date:	9/1/2022	9/1/2023	9/1/2024	
Plant In Service as of Date:	5/31/2022	5/31/2023	5/31/2024	
Rate Base Balance as of Date:	8/31/2022	8/31/2023	8/31/2024	Total
		($000)		
Gas Rate Base Calculation				
Gross Plant	$ 151,120	$ 115,971	$ 671,077	$ 938,169
Accumulated Depreciation	2,398	1,061	(3,160)	299
Net Plant	153,518	117,033	667,917	938,467
Accumulated Deferred Taxes	(1,465)	(908)	(3,634)	(6,006)
Rate Base	152,053	116,125	664,283	932,461
Rate of Return - After Tax (Schedule WACC)	6.48%	6.48%	6.48%	6.48%
Return Requirement (After Tax)	$ 9,856	$ 7,527	$ 43,057	$ 60,440
Depreciation Exp, net	1,396	967	6,809	9,172
Tax Adjustment	-	-	-	-
Revenue Factor	1.4172	1.4172	1.4172	1.4172
Gas Revenue Requirement	**$ 15,946**	**$ 12,038**	**$ 70,670**	**$ 98,654**

Source: Company's Response to Data Request RCR-A-19, Attachment "Attach 3 - Swetz -WP-SS-ESII-1E - r1.xlsx" and Attachment "Attach 3 - Swetz -WP-SS-ESII-1G - r1.xlsx."

ES II Proposed Revenue Requirements

Roll-in:	Roll-in 1	Roll-in 2	Roll-in 3	Roll-in 4	Roll-in 5	Roll-in 6	Roll-in 7	
Rate Effective Date:	3/1/2021	9/1/2021	3/1/2022	9/1/2022	9/1/2023	3/1/2024	9/1/2024	
Plant In Service as of Date:	11/30/2020	5/31/2021	11/30/2021	5/31/2022	5/31/2023	11/30/2023	5/31/2024	
Rate Base Balance as of Date:	2/1/2021	8/1/2021	2/1/2022	8/1/2022	8/1/2023	2/1/2024	8/1/2024	Total
				($000)				
Electric Rate Base Calculation								
Gross Plant	$ 145,606	$ 151,015	$ 136,028	$ 391,437	$ 394,893	$ 198,868	$ 15,398	$ 1,433,246
Accumulated Depreciation	28,153	20,966	22,481	13,999	20,918	7,247	1,580	115,344
Net Plant	173,759	171,982	158,509	405,436	415,812	206,115	16,978	1,548,590
Accumulated Deferred Taxes	(11,381)	(7,185)	(8,679)	(6,510)	(11,756)	(6,572)	(866)	(52,949)
Rate Base	162,378	164,797	149,831	398,926	404,056	199,543	16,112	1,495,641
Rate of Return - After Tax (Schedule WACC)	6.48%	6.48%	6.48%	6.48%	6.48%	6.48%	6.48%	6.48%
Return Requirement (After Tax)	$ 10,525	$ 10,682	$ 9,712	$ 25,858	$ 26,190	$ 12,934	$ 1,044	$ 96,944
Depreciation Exp, net	3,631	3,045	2,848	6,710	7,582	6,159	431	30,406
Tax Adjustment	(194)	(137)	(146)	(104)	(163)	(62)	(12)	(817)
Revenue Factor	1.3944	1.3944	1.3944	1.3944	1.3944	1.3944	1.3944	1.3944
Electric Revenue Requirement	**$ 19,468**	**$ 18,949**	**$ 17,310**	**$ 45,267**	**$ 46,865**	**$ 26,538**	**$ 2,041**	**$ 176,438**

Source: Company's Response to Data Request RCR-A-19, Attachment "Attach 3 - Swetz -WP-SS-ESII-1E - r1.xlsx" and Attachment "Attach 3 - Swetz -WP-SS-ESII-1G - r1.xlsx."

Results of Company Electric Subprograms
Benefit-Cost Analysis

Subprogram	Costs ($000)	Benefits ($000)	Benefit-Cost Ratio
Substation	$906,000	$ 662,763	**0.73**
Outside Plant, Higher Design and Construction Standards	$345,000	$ 960,356	**2.78**
Contingency Reconfiguration Strategies	$145,000	$1,882,789	**12.98**
Grid Modernization	$134,226	$ 611,981	**4.56**

Source: Direct testimony of the Cost-Benefit Panel - Electric, p. 7.

Results of Company Natural Gas Subprograms Benefit-Cost Analysis

Subprogram	Costs ($000)	Benefits ($000)	Benefit-Cost Ratio
Curtailment Resiliency	$863,000	$1,101,000	**1.28**
M&R Station Upgrades	$136,000	$ 35,000	**0.26**

Source: Direct testimony of the Cost-Benefit Panel - Gas, Schedule BV-ESII-GAS-5, p. 8, Figure 1; Direct testimony of the Cost-Benefit Panel - Gas, Schedule BV-ESII-GAS-5, p. 66, Figure 11.

Inventory of Studies used in Electric Subprograms
VoLL Metastudy

Utility Company	Survey Year	Number of Observations: Medium and Large C&I	Number of Observations: Small C&I	Number of Observations: Residential	Minimum Duration (hours)	Maximum Duration (hours)
Southeast-1	1997	90			0	1
Southeast-2	1993	3,926	1,559	3,107	0	4
Southeast-2	1997	3,055	2,787	3,608	0	12
Southeast-3	1990	2,095	765		0.5	4
Southeast-3	**2011**	**7,941**	**2,480**	**3,969**	**1**	**8**
Midwest-1	2002	3,171			0	8
Midwest-2	1996	1,956	206		0	4
West-1	2000	2,379	3,236	3,137	1	8
West-2	1989	2,025	5		0	4
West-2	1993	1,790	825	2,005	0	4
West-2	2005	3,052	3,223	4,257	0	8
West-2	**2012**	**5,342**	**4,632**	**4,106**	**0**	**24**
Southwest	2000	3,991	2,247	3,598	0	4
Northwest-1	1989	2,210		2,126	0.25	8
Northwest-2	1999	7,091		4,299	0	12

Source: Sullivan, M., Schellenberg, J., and Blundell, M. 2015. Updated value of service reliability estimates for electric utility customers in the United States. Ernest Orlando Lawrence Berkeley National Laboratory. January 2015, pp. 16-17, Table 1-1.

Subprogram Benefit-Cost Ratios

Subprogram	Output			Employment			Labor Income			Value Added		
	Benefits	Costs	Ratio	Benefits	Costs	Ratio	Benefits	Costs	Ratio	Benefits	Costs	Ratio
	------- (million $ NPV) -------			--------- (job-years) ---------			---- (million $ NPV) ----			------ (million $ NPV) ------		
Electric												
Substation Project	$ 1,042.37	$ (2,151.21)	0.48	6,405	(29,963)	0.21	$ 543.66	$ (1,350.42)	0.40	$ 729.13	$ (1,659.85)	0.44
Outside Plant and Higher Construction Standards	392.69	(692.06)	0.57	2,362	(7,838)	0.30	214.08	(434.44)	0.49	281.82	(533.98)	0.53
Contingency Reconfiguration	116.23	(332.25)	0.35	545	(5,200)	0.10	67.81	(208.57)	0.33	87.45	(256.36)	0.34
Grid Modernization	118.05	(165.03)	0.72	676	(1,187)	0.57	67.50	(119.29)	0.57	87.02	(135.48)	0.64
Total	**$ 1,669.34**	**$ (3,340.54)**	**0.50**	**9,988**	**(44,188)**	**0.23**	**$ 893.05**	**$ (2,112.71)**	**0.42**	**$ 1,185.42**	**$ (2,585.66)**	**0.46**
Gas (asset class)												
M&R Upgrades and Distribution Projects	$ 967.22	$ (1,732.53)	0.56	6,618	(38,992)	0.17	$ 447.22	$ (1,110.42)	0.40	$ 612.83	$ (1,347.58)	0.45
LNG Project	215.08	(325.19)	0.66	1,547	(4,920)	0.31	97.78	(208.42)	0.47	134.18	(252.93)	0.53
Total	**$ 1,182.30**	**$ (2,057.71)**	**0.57**	**8,164**	**(43,911)**	**0.19**	**$ 544.99**	**$ (1,318.83)**	**0.41**	**$ 747.00**	**$ (1,600.51)**	**0.47**

Alternative Electric Benefit-Cost Ratios

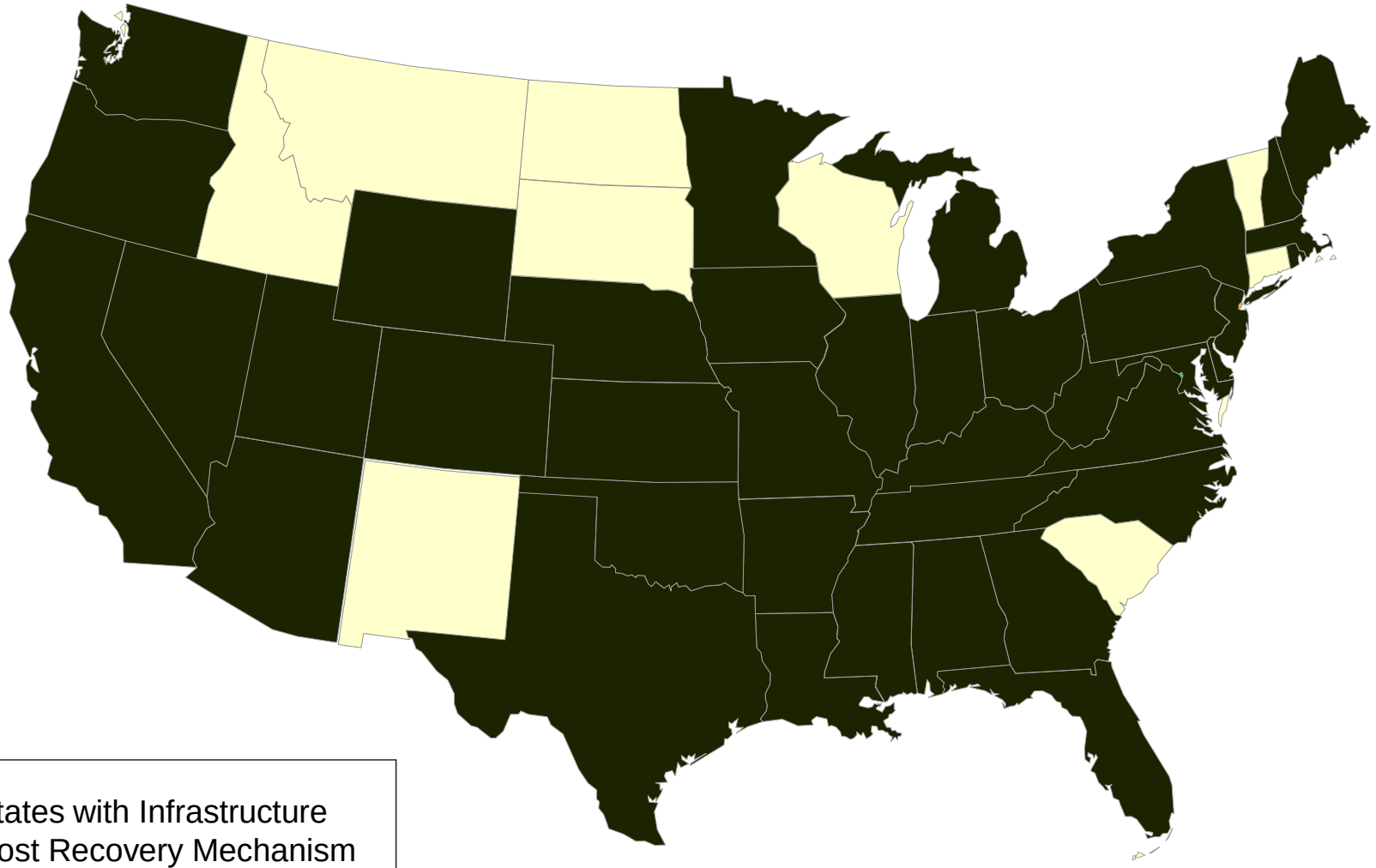
Subprogram	Output			Employment			Labor Income			Value Added		
	Benefits	Costs	Ratio	Benefits	Costs	Ratio	Benefits	Costs	Ratio	Benefits	Costs	Ratio
	------ (million $ NPV) ------			---------- (job-years) ----------			------- (million $ NPV) -------			------ (million $ NPV) ------		
Electric												
Substation Project	$ 2,151.21	(2,151.21)	1.00	12,910	(29,963)	0.43	1,225.24	(1,350.42)	0.91	1,567.88	(1,659.85)	0.94
Outside Plant and Higher Construction Standards	$ 692.06	(692.06)	1.00	3,765	(7,838)	0.48	509.19	(434.44)	1.17	576.20	(533.98)	1.08
Contingency Reconfiguration	$ 332.25	(332.25)	1.00	1,692	(5,200)	0.33	273.06	(208.57)	1.31	294.17	(256.36)	1.15
Grid Modernization	$ 165.03	(165.03)	1.00	1,166	(1,187)	0.98	146.95	(119.29)	1.23	151.32	(135.48)	1.12
Total	**$ 3,340.54**	**$ (3,340.54)**	**1.00**	**19,533**	**(44,188)**	**0.44**	**$ 2,154.44**	**$ (2,112.71)**	**1.02**	**$ 2,589.56**	**$ (2,585.66)**	**1.00**

Electric Reliability Performance Standards

	Historical and Projected		Improvement Necessary for Cost Effectiveness	
	SAIDI	SAIFI	SAIDI	SAIFI
Historical				
2010	372.41	1.20	372.41	1.20
2011	922.11	1.65	922.11	1.65
2012	4,412.07	1.60	4,412.07	1.60
2013	47.34	0.74	47.34	0.74
2014	80.94	0.76	80.94	0.76
2015	81.66	0.69	81.66	0.69
2016	68.65	0.85	68.65	0.85
2017	50.00	0.75	50.00	0.75
Projected				
2018	65.72	0.76	65.72	0.76
2019	**69.39**	**0.76**	**69.39**	**0.76**
2020	**67.08**	**0.76**	**65.06**	**0.75**
2021	**64.17**	**0.78**	**60.13**	**0.75**
2022	**63.27**	**0.76**	**57.21**	**0.73**
2023	**65.93**	**0.76**	**57.85**	**0.72**
2024	**65.97**	**0.77**	**55.87**	**0.71**
2025	65.28	0.77	55.18	0.71
2026	64.92	0.77	54.82	0.71
2027	65.08	0.76	54.98	0.71
2028	65.44	0.77	55.34	0.71
2029	65.34	0.77	55.24	0.71
2030	65.21	0.77	55.11	0.71

Note: Includes reliability improvement due to Higher Outside Plant Design and Construction Standards, Contingency Reconfiguration, and Grid Modernization subprograms only. Projected reliability metrics are estimated using a five year moving average, with improvements phased in over the duration of the program.
Source: Company response to data request RCR-ENG-E-0004; and In the Matter of the Petition of Public Service Electric and Gas Company for approval of the Energy Strong Program. New Jersey Board of Public Utilities Docket Nos. EO13020155 and GO13020156, Company response to data request RCR-ENG-E-124.

States with Gas Infrastructure Cost Recovery Rate Mechanisms



Source: Commission Orders; AGA Natural Gas Rate Round-Up June 2012; AGA Innovative Rates, Non-Volumetric Rates, and Tracking Mechanisms: Current List February 2016; AGA State Infrastructure Replacement Activity May 22, 2015; Natural Gas Infrastructure Modernization Programs at Local Distribution Companies: Key Issues Considerations, January 2017.

Cost Recovery Mechanisms

State	Company	Recovery Mechanism - Gas/ Electric	Date of Decision	Decision Type	Mechanism	Term/ Period	Limited Recovery / Revenue Cap	Expenditures Limited / Capped	Deferrals	Carrying Charges on Investment	Carrying Charges on Deferrals	Deferral-Based Cost Recovery	O&M Offset	Reduced Rate of Return	Reliability Benchmarks
Electric/Gas Utilities															
CA	Pacific Gas and Electric Company	Gas	12/20/2012	Order	Pipeline Modernization Program	2012-2014	XXX								
FL	Florida Public Utilities Company	Gas	9/24/2012	Order	Gas Reliability Infrastructure Program	2013-2023									
IN	NIPSCO	Gas	4/30/2014	Order	Transmission, Distribution, and Storage System	7 years	XXX	XXX							
KS	Midwest Energy	Gas	5/28/2009	Order	Gas System Reliability Surcharge	n.a.	XXX								
KY	Louisville Gas and Electric Company	Gas	12/20/2012	Order	Gas Line Tracker	2013-2017									
KY	Duke Energy Kentucky	Gas	2/2/2016	Settlement	Accelerated Service Line Replacement Program	2016-2020	XXX								
LA	Entergy Gulf States	Gas	1/27/2015	Order	Gas Infrastructure Investment Recovery Rider	2014-2024		XXX							
MA	Fitchburg Gas and Electric Company d/b/a Unitil	Gas	4/30/2015	Order	Gas System Enhancement Adjustment Factor	20 years	XXX		XXX				XXX		
MD	Baltimore Gas & Electric Company	Gas	1/29/2014	Order	Infrastructure System Replacement Surcharge	5 years	XXX					XXX			
MN	Xcel Energy	Gas	1/27/2015	Order	Infrastructure System Replacement Surcharge	5 years			XXX						
MO	Union Electric Company/AmerenUE	Gas	2/26/2008	Order	Infrastructure System Replacement Surcharge	n.a.	XXX								

Source: Commission Orders, AGA Natural Gas Rate Round-Up June 2012, AGA Innovative Rates, Non-Volumetric Rates, and Tracking Mechanisms: Current List February 2016; AGA State Infrastructure Replacement Activity May 22, 2015; Natural Gas Infrastructure Modernization Programs at Local Distribution Companies: Key Issues Considerations, January 2017.

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NH	Northern Utilities, Inc./Unitil	Gas	7/21/1992	Settlement	Bare Steel Replacement Program	1992-2017									
NJ	Public Service Electric & Gas	Electric/Gas	4/28/2009 & 7/14/2011	Settlement	Capital Infrastructure Investment Program	2009-2013			XXX	XXX					
NJ	Public Service Electric & Gas	Electric/Gas	5/21/2014	Settlement	Electric and Gas System Hardening Program	5 years		XXX						XXX	
NJ	Public Service Electric & Gas	Gas	11/16/2015	Settlement	Gas System Modernization Program	3 years		XXX						XXX	
NJ	Public Service Electric & Gas	Gas	5/22/2018	Settlement	Gas System Modernization Program II	5 years	XXX	XXX					XXX		XXX
NY	National Grid - Niagara Mohawk	Gas	9/17/2007	Order	Capital Tracker	2008-2012		XXX	XXX	XXX					XXX
NY	National Grid- KEDNY and KEDLI	Gas	12/16/2016	Order	Gas Safety and Reliability Surcharge	2017-2021				XXX					
NY	Cond Ed	Gas	1/25/2017	Order	Safety and Reliability Surcharge Mechanism	2018-2021		XXX		XXX					
OR	Avista	Gas	3/10/2011	Settlement	Incremental Rate Adjustment	2012-2013				XXX		XXX			
PA	PECO	Gas	9/3/2015	Order	Distribution System Improvement Charge	10 years	XXX								
RI	National Grid	Gas	9/12/2011	Order	Infrastructure, Safety, and Reliability Provision/	Annually									
WA	Pugent Sound Energy	Gas	10/30/2014	Order	Pipeline Infrastructure Replacement Program	2 years							XXX		

Source: Commission Orders, AGA Natural Gas Rate Round-Up June 2012, AGA Innovative Rates, Non-Volumetric Rates, and Tracking Mechanisms: Current List February 2016; AGA State Infrastructure Replacement Activity May 22, 2015; Natural Gas Infrastructure Modernization Programs at Local Distribution Companies: Key Issues Considerations, January 2017.

Cost Recovery Mechanisms

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Gas-Only Utilities															
AL	Mobile Gas Service Corporation	Gas	11/27/1995	Order	Cast Iron Main Replacement Factor	30 years									
AR	CenterPoint Energy Arkla	Gas	5/31/2006	Settlement	Main Replacement Program Rider	2006-2026							XXX		
AR	Arkansas Oklahoma Gas	Gas	7/25/2014	Settlement	System Safety Enhancement Rider	n.a.							XXX		
AR	SourceGas Arkansas	Gas	7/7/2014	Settlement	Main Replacement Program Rider	20 years							XXX		
AZ	Southwest Gas	Gas	1/6/2012	Settlement	Customer-Owned Yard Line Cost Recovery Mechanism	reset annually									
CA	Southwest Gas	Gas	6/17/2014	Order	Infrastructure Reliability and Replacement	n.a.									
CO	Colorado Natural Gas, Inc.	Gas	3/18/2011	Settlement	Capital Expenditure Rider	2011-2014		XXX						XXX	
CO	Public Service Co. of Colorado	Gas	7/8/2011	Settlement	Pipeline System Integrity Adjustment	2012-2018		XXX	XXX	XXX					
CO	Atmos Energy	Gas	11/4/2015	Settlement	System Safety Integrity Rider	2016-2018	XXX								
DC	Washington Gas Light	Gas	12/16/2009	Settlement	Vintage Coupling Replacement and	7 years		XXX							
DC	Washington Gas Light	Gas	1/29/2015	Settlement	Accelerated Pipe Replacement Program	5 years									
FL	Florida City Gas	Gas	9/15/2015	Order	Safety, Access, and Facility Enhancement	10 years				XXX					
FL	Peoples Gas System	Gas	9/18/2012	Order	Cast Iron/Bare Steel Pipe Replacement Rider	2013-2023									
FL	Florida Division of Chesapeake Utilities Corporation	Gas	9/24/2012	Order	Gas Reliability Infrastructure Program	2013-2023									
GA	Liberty Utilities (formerly Atmos Energy)	Gas	12/14/2000	Order	Accelerated Pipe Replacement Program	15-20 years							XXX		

Source: Commission Orders, AGA Natural Gas Rate Round-Up June 2012, AGA Innovative Rates, Non-Volumetric Rates, and Tracking Mechanisms: Current List February 2016; AGA State Infrastructure Replacement Activity May 22, 2015; Natural Gas Infrastructure Modernization Programs at Local Distribution Companies: Key Issues Considerations, January 2017.

Cost Recovery Mechanisms

State	Company	Recovery Mechanism - Gas/ Electric	Date of Decision	Decision Type	Mechanism	Term/ Period	Limited Recovery / Revenue Cap	Expenditures Limited / Capped	Deferrals	Carrying Charges on Investment	Carrying Charges on Deferrals	Deferral-Based Cost Recovery	O&M Offset	Reduced Rate of Return	Reliability Benchmarks
GA	Atlanta Gas Light	Gas	9/3/1998 & 10/6/2009	Settlement & Order	Pipeline Replacement Program Cost Recovery	2009-2022							XXX		
IA	Black Hills Energy	Gas	3/15/2013	Order	Capital Infrastructure Investment Automatic	n.a.				XXX					
IL	Ameren Illinois	Gas	1/6/2015	Order	Qualifying Infrastructure Plant		XXX								
IL	Nicor Gas Company	Gas	7/30/2014	Order	Qualifying Infrastructure Plant		XXX								
IL	Peoples Gas Light and Coke Company	Gas	1/7/2014	Order	Qualifying Infrastructure Plant		XXX								
IL	Peoples Gas Light and Coke Company	Gas	1/21/2010	Order	Infrastructure Cost Recovery Rider	2010-2030	XXX						XXX		
IN	Vectren North - Indiana Gas	Gas	2/13/2008	Settlement	Distribution Replacement Adjustment	20 years		XXX	XXX	XXX		XXX			
IN	Vectren South - SIGECO	Gas	8/1/2007	Settlement	Distribution Replacement Adjustment	20 years		XXX	XXX	XXX		XXX			
KS	Atmos Energy	Gas	5/12/2008 & 12/11/2009	Settlement	Gas System Reliability Surcharge	n.a.	XXX								
KS	Black Hills (formerly Aquila Networks)	Gas	7/15/2008	Settlement	Gas System Reliability Surcharge	n.a.	XXX								
KS	Kansas Gas Service	Gas	12/18/2008	Order	Gas System Reliability Surcharge	n.a.	XXX								
KY	Atmos Energy	Gas	5/28/2010	Settlement	Pipe Replacement Program Rider	n.a.							XXX		
KY	Columbia Gas	Gas	10/26/2009	Settlement	Accelerated Main Replacement Program Rider	n.a.							XXX		
KY	Delta Natural Gas	Gas	10/21/2010 & 8/24/2012	Order	Pipe Replacement Program Surcharge	n.a.							XXX		
MA	Bay State Gas	Gas	10/30/2009	Order	Targeted Infrastructure Recovery Factor	15-20 years	XXX		XXX				XXX		XXX
MA	Bay State Gas d/ba Columbia Gas of Massachusetts	Gas	4/30/2015	Order	Gas System Enhancement Adjustment Factor	20 years	XXX		XXX				XXX		
MA	Berkshire Gas	Gas	4/30/2015	Order	Gas System Enhancement Adjustment Factor	20 years	XXX		XXX				XXX		

Source: Commission Orders, AGA Natural Gas Rate Round-Up June 2012, AGA Innovative Rates, Non-Volumetric Rates, and Tracking Mechanisms: Current List February 2016; AGA State Infrastructure Replacement Activity May 22, 2015; Natural Gas Infrastructure Modernization Programs at Local Distribution Companies: Key Issues Considerations, January 2017.

Cost Recovery Mechanisms

State	Company	Recovery Mechanism - Gas/ Electric	Date of Decision	Decision Type	Mechanism	Term/ Period	Limited Recovery / Revenue Cap	Expenditures Limited / Capped	Deferrals	Carrying Charges on Investment	Carrying Charges on Deferrals	Deferral-Based Cost Recovery	O&M Offset	Reduced Rate of Return	Reliability Benchmarks
MA	Eversource Energy (formerly NSTAR)	Gas	4/30/2015	Order	Gas System Enhancement Adjustment Factor	25 years	XXX		XXX				XXX		
MA	National Grid Gas	Gas	11/2/2010	Order	Targeted Infrastructure Recovery Factor	10 years	XXX		XXX				XXX		
MA	National Grid Gas-Boston Gas Company	Gas	4/30/2015	Order	Gas System Enhancement Adjustment Factor	20 years	XXX		XXX				XXX		
MA	National Grid Gas-Colonial Gas Company	Gas	4/30/2015	Order	Gas System Enhancement Adjustment Factor	8 years	XXX		XXX				XXX		
MA	Liberty Utilities-New England Gas	Gas	3/31/2011	Order	Targeted Infrastructure Recovery Factor	15 years	XXX		XXX				XXX		
MA	Liberty Utilities-New England Gas	Gas	4/30/2015	Order	Gas System Enhancement Adjustment Factor	20 years	XXX		XXX				XXX		
MD	Columbia Gas of Maryland	Gas	8/18/2014	Order	Infrastructure System Replacement Surcharge	5 years	XXX								
MD	Washington Gas Light	Gas	3/21/2014	Order	Infrastructure System Replacement Surcharge	5 years	XXX								
ME	Northern Utilities, Inc./Unitil	Gas	7/30/2010	Settlement	Cast Iron Replacement Program	2011-2027	XXX		XXX		XXX		XXX		XXX
MI	DTE Gas Company (formerly Michigan Consolidated Gas Company)	Gas	4/16/2013	Order	Infrastructure Recovery Mechanism	2013-2017							XXX		
MI	Semco Energy	Gas	12/22/2011	Settlement	Main Replacement Program Rider	2012-2017				XXX			XXX		
MI	Semco Energy	Gas	12/22/2011	Settlement	Main Replacement Program Rider	2016-2020		XXX		XXX			XXX		
MS	Atmos Energy	Gas	9/8/2015	Order	System Integrity Rider	n.a.									
MO	Liberty Utilities (formerly Atmos Energy)	Gas	10/31/2008	Order	Infrastructure System Replacement Surcharge	n.a.	XXX								
MO	Laclede Gas	Gas	6/4/2004 & 7/19/2007	Settlement	Infrastructure System Replacement Surcharge	n.a.	XXX								
MO	Missouri Gas Energy	Gas	2/26/2004	Order	Infrastructure System Replacement Surcharge	n.a.	XXX								
NC	Piedmont Natural Gas	Gas	12/17/2013	Settlement	Safety Capital Investment	Annually									
NC	Public Service Company of North Carolina	Gas	10/28/2016	Settlement	Integrity Management Plant Investment	n.a.		XXX	XXX		XXX				
NE	SourceGas Distribution LLC	Gas	6/25/2013	Order	Pipeline Replacement Charge	n.a.	XXX								

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Cost Recovery Mechanisms

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NH	Liberty Utilities (formerly EnergyNorth)	Gas	7/12/2007	Settlement	Cast Iron Bare Steel Replacement Program	n.a.									
NJ	Elizabethtown Gas	Gas	4/28/2009 & 5/16/2011	Settlement	Utility Infrastructure Enhancement Program	2009-2012				XXX		XXX			
NJ	Elizabethtown Gas	Gas	8/21/2013	Settlement	Accelerated Infrastructure Replacement Program	2013-2017		XXX		XXX		XXX			XXX
NJ	Elizabethtown Gas	Gas	7/23/2014	Settlement	ENDURE Program	1 year		XXX		XXX		XXX			
NJ	New Jersey Natural	Gas	4/28/2009 & 3/30/2011	Settlement	Accelerated Energy Infrastructure Investment	2009-2012				XXX		XXX			
NJ	New Jersey Natural	Gas	10/23/2012 & 9/23/2016	Settlement	Safety Acceleration and Facility Enhancement	2013-2021		XXX		XXX		XXX	XXX		XXX
NJ	New Jersey Natural	Gas	7/23/2014	Settlement	Reinvestment in System Enhancement Program	1 year		XXX		XXX		XXX			
NJ	South Jersey Gas	Gas	4/16/2009 & 3/31/2011 & 9/18/2013	Settlement	Capital Investment Recovery Tracker	2009-2013				XXX		XXX			
NJ	South Jersey Gas	Gas	2/20/2013 & 10/31/2016	Settlement	Accelerated Infrastructure Replacement Program	2013-2020		XXX		XXX		XXX	XXX		XXX
NJ	South Jersey Gas	Gas	8/20/2014	Settlement	Storm Hardening and Reliability Program	2014-2017		XXX		XXX		XXX			
NV	Southwest Gas Corporation	Gas	9/7/2011	Settlement	Strip Reliability Plan	n.a.				XXX		XXX			
NY	Corning Natural Gas	Gas	1/25/2011	Order	Limited Pipeline Replacement Cost Recovery Mechanism	10-15 years from 2012						XXX			XXX
OH	Dominion Energy	Gas	10/15/2008 & 9/14/2016	Order	Pipeline Infrastructure Replacement Program	2009-2021							XXX		
OH	Duke Energy	Gas	5/30/2002	Settlement	Accelerated Main Replacement Program	Annually	XXX			XXX		XXX	XXX		
OH	Columbia Gas of Ohio	Gas	12/3/2008	Settlement	Infrastructure Replacement Program Rider	5 years	XXX		XXX	XXX	XXX		XXX		
OH	Vectren Ohio	Gas	1/7/2009	Settlement	Distribution Replacement Rider	5 years	XXX			XXX			XXX		
OK	Oklahoma Natural Gas	Gas	8/31/2007	Settlement	Integrity Management Program	Annually						XXX			
OR	NW Natural	Gas	3/1/2009	Settlement	System Integrity Program	2009-2021		XXX	XXX				XXX		
PA	Columbia Gas of Pennslyvania	Gas	5/22/2014	Order	Accelerated Main Replacement Program	17 years	XXX								
PA	UGI-Central Penn Gas	Gas	9/11/2014	Order	Accelerated Main Replacement Program	14 years	XXX								

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PA	UGI-Penn Natural Gas	Gas	9/11/2014	Order	Accelerated Main Replacement Program	14 years	XXX								
PA	Philadelphia Gas Works	Gas	4/4/2013 & 1/28/2016	Order	Distribution System Improvement Charge	5 years	XXX								
PA	Peoples Gas Company	Gas	5/23/2013	Order	Distribution System Improvement Charge	5 years	XXX								
PA	Peoples TWP	Gas	8/21/2014	Order	Distribution System Improvement Charge	n.a.	XXX								
PA	Equitable Gas	Gas	7/16/2013	Order	Distribution System Improvement Charge	9 years	XXX								
TN	Piedmont Natural Gas	Gas	5/13/2014	Settlement	Safety Capital Investment	Annually									
TX	Atmos Energy	Gas	2003	Statute	Gas Reliability Infrastructure Program	n.a.						XXX			
TX	CenterPoint Energy	Gas	2003	Statute	Gas Reliability Infrastructure Program	n.a.									
TX	Texas Gas Service	Gas	2003	Statute	Gas Reliability Infrastructure Program	n.a.									
UT	Questar Gas	Gas	6/3/2010	Settlement	Infrastructure Replacement Adjustment	3 years		XXX		XXX		XXX			
VA	Atmos Energy	Gas	8/21/2012	Settlement	SAVE Plan/Rider	2012-2015		XXX							
VA	Washington Gas Light	Gas	4/21/2011	Order	SAVE Plan/Rider	2011-2014		XXX		XXX					
VA	Columbia Gas of Virginia	Gas	11/28/2011	Order	SAVE Plan/Rider	2012-2016		XXX		XXX					
VA	Virginia Natural Gas, Inc.	Gas	6/25/2012	Order	SAVE Plan/Rider	2012-2016		XXX		XXX					
VA	Virginia Natural Gas, Inc.	Gas	3/17/2016	Order	SAVE Plan/Rider-Extension	2016-2021		XXX		XXX					
WA	Cascade Natural Gas	Gas	10/30/2013	Order	Pipeline Infrastructure Replacement Program	2 years	XXX						XXX		
WV	Mountaineer Gas Company	Gas	12/23/2015	Settlement	Infrastructure Replacement and Expansioin Program	5 years									
WV	Hope Gas (Dominion Hope)	Gas	2/4/2016	Settlement	Pipeline Replacement and Expansion Pilot Program	2016-2018									
WY	Black Hills Energy	Gas	8/4/2016	Settlement	Pipeline Safety and Integrity Mechanism	2016-2021									

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