PUBLIC VERSION

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 Next Phase of the Gas System Modernization Program and Associated Cost Recovery Mechanism ("GSMP II")	))))))	**BPU Docket No. GR17070776**

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

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BPU DOCKET NO. GR17070776

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 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 policy, program design, and economic impact issues associated with the Gas System Modernization Program II ("GSMP II") proposal filed by Public Service Electric and Gas Company ("PSE&G" or "the Company") on July 27, 2017. My testimony will address a number of issues associated with the GSMP II proposal, with a particular emphasis on the economic and regulatory policy issues. Mr. Edward McGee, an independent engineering consultant for ACG, will address the specific engineering issues associated with the Company's proposals.

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

A. Yes. I have prepared 29 schedules in support of my direct testimony that were prepared by me or under my direct supervision.

Q. ARE THERE ANY OTHER RATE COUNSEL WITNESSES ADDRESSING THE COMPANY'S PROPOSAL?

A. Yes. In addition to myself and Mr. McGee, Rate Counsel is also sponsoring the testimony of Ms. Andrea Crane who will address a number of accounting and revenue requirement issues and Mr. Kevin O'Donnell who will address cost of capital and financial issues.

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 proposal
- Section IV: Board's Infrastructure Investment and Recovery Rule (IRR)
- Section V: Overview of the Company's materials composition, replacement rates and leak reduction performance
- Section VI: The Company has not shown a need for the GSMP II
- Section VII: GSMP II design deficiencies relative to Commission infrastructure tracker mechanisms
- Section VIII: The GSMP II program will not result in positive net economic benefits
- Section IX: Conclusions and recommendations

II. Summary of Findings and Recommendations

Q. WOULD YOU PLEASE SUMMARIZE YOUR PRIMARY FINDINGS AND RECOMMENDATION REGARDING THE COMPANY'S GSMP II PROPOSAL?

A. The Company has not shown a need for the proposed GSMP II. The Company's proposed GSMP II is very large, will result in significant rate impacts as proposed, and its associated cost recovery mechanism suffers from a number of program design deficiencies. In addition, the Company's proposed GSMP II appears to be misguided and does not correctly focus on the most serious current problems that require attention. Instead the Company is proposing a type of "replace all" approach with the overall goal of system modernization. As detailed in the testimony of Mr. McGee, the Company's proposed replacement program incorrectly prioritizes the replacement of all cast iron and unprotected steel mains in a manner different from the hazard index approach used in the GSMP I. The GSMP II contains certain wholesale replacement approaches, targeting certain mains (such as Elevated Pressure Cast Iron ("EPCI") mains) with a potential to leak or break, rather than a program targeted to mains with prior breaks or to mains

with major safety problems. Moreover, the Company's proposed GSMP II program goes beyond the replacements currently made under the approved GSMP I. Therefore, I recommend that the Board reject the Company's proposed GSMP II.

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

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

1) The GSMP II should be limited to three years and include the replacement of Utilization Pressure Cast Iron ("UPCI") and unprotected steel mains and the associated services as well as the installation of excess flow values and abandonment of district regulators where necessary. The program should include the replacement of approximately 370 miles of UPCI and unprotected steel mains and associated services.

2) No costs associated with replacement of elevated pressure ("EP") cast iron mains, meters, or the relocation of inside meter sets to outside should be included in the program. Program costs should also exclude the replacement of plastic and protected steel mains and the costs associated with EPCI bell joint encapsulation.

3) Replacement prioritization should be on the most risky pipe/most leak prone pipe. In order to be a true extension of the GSMP I, the replacement under GSMP II should be limited to the same replacement activities approved in the GSMP I program. The program should follow the prioritization based on the hazard-index method recommended by Mr. McGee.

4) The program should include performance standards and benchmarks and penalties for failing to meet these performance standards. This would include:

   a. An annual reduction in leaks so that the Company is able to meet or exceed its total open leak carry-forward targets. The first year target should be set at the average number of open leaks the Company has experienced over the past five years. For each year, after the first year, the leak carry forward cap should be reduced by 1 percent each year for the duration of the GSMP II program. As detailed in the testimony of Mr. McGee.

   b. A penalty if the Company fails to meet this target. In the first two years of its program, the Company should be required to notify the Board and Rate Counsel and schedule a conference to discuss any failure to the leak reduction target. If this failure extends to a three year period, then the Company would

reduce its return on equity ("ROE") by 50 basis points until it is able to achieve the leak reduction target.

5) The inclusion of a net total O&M offset of $150,000 per year associated with the leak reductions.

6) The cost of the program should be limited to $650 million over a three year period. The costs should be $1.75 million per mile.[1] This represents 24 percent of the Company's original GSMP proposal request. Costs beyond $650 million may be recovered through a base rate case, if the costs are found to be prudent by the Board.

7) A rate impact cap of two percent of total revenues per year should be established as detailed in the testimony of Andrea Crane.

8) Reporting requirements and Minimum Filing Requirement should be similar to those in effect for the current GSMP I.

III. Overview of Company Proposal

Q. HOW IS THE COMPANY'S CURRENT INFRASTRUCTURE REPLACEMENT PROPOSAL RELATED TO THE ONE APPROVED BY THE BOARD ON NOVEMBER 16, 2015.

A. The Company is proposing to continue the work it initially started in the GSMP I. This "original" GSMP I program was designed to facilitate an accelerated gas distribution infrastructure replacement and safety program. The GSMP I was based upon a three year replacement and investment strategy and included an accelerated cost recovery mechanism. The Company's GSMP I program began in 2016 and included: the accelerated replacement of utilization pressure cast iron ("UPCI") and unprotected steel mains and associated unprotected steel services, the installation of excess flow values ("EVFs") and the elimination of district regulators where necessary.[2] The Company's GSMP I also included the costs required to uprate the UPCI system. However, the approved GSMP I program excluded the costs associated with the replacement of high pressure

[1] Company Response to Data Request RCR-A-0002, Attachment RCR-A_0002_Exhibit1.19-1.20 Workpaper.xlsx.
[2] 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, p. 3.

cast iron mains, meter replacements, and the additional costs associated with the relocation of inside meters to the outside.[3] The program was designed to replace 400 miles of UPCI and unprotected steel mains.[4] The GSMP I Settlement provided that the Company was to maintain a base level of capital spending ("stipulated base") of $85 million per year which would not be recovered through the GSMP I cost recovery mechanism.[5] This stipulated base spending was to include the replacement of cast iron (UP and EP), the replacement of unprotected steel mains and services, the costs associated with uprating the UPCI system if applicable, elimination of district regulators, installation of excess flow valves, and the costs associated with moving meters inside to outside.[6] Under the stipulated base the Company was to replace a minimum of 110 miles of cast iron and unprotected steel mains over the three-year program period.[7] If this amount was under spent in any year then the Company was to expend any remaining amount without receiving cost recovery from ratepayers.[8] The current GSMP is set to expire on December 31, 2018.[9]

Q. DESCRIBE THE COMPONENTS OF THE COMPANY'S CURRENT PROPOSAL.

A. The GSMP II proposal is envisioned to be an extension to and expansion of the GSMP I program. The Company is proposing a five-year program, starting in January 2019, with a total

[3] 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, p. 3.
[4] 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, p. 3.
[5] 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, p. 6.
[6] 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, p. 7.
[7] 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, p. 7.
[8] 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, p. 7.
[9] 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, p. 3.

investment amount that as proposed would not be capped but is estimated at $2.68 billion.[10] According to the Company, the GSMP II program is designed to: replace cast iron mains, unprotected steel mains and services; address the abandonment of district regulators; rehabilitate large diameter elevated pressure cast iron; upgrade UPCI portions of the system to EPCI; replace limited amounts of protected steel and plastic mains; and relocate inside meter sets to the outside.[11] The Company anticipates that the program will result in the replacement of approximately 1,000 miles of cast iron main, 200 miles of unprotected steel main, and 50 miles of UP cathodically protected steel and plastic main; the abandonment of 266 district regulators; the replacement of 99,200 unprotected steel services; the reinforcement of approximately 4,000 EPCI bell joints; and the relocation of approximately 70,900 inside meter sets to the outside.[12] The Company is also proposing to invest as base spending an additional ten percent of the total proposed program investment which would be recovered in a base rate proceeding and not through the proposed accelerated recovery mechanism.[13] The Company states that this investment will improve the reliability and safety of its gas distribution system in a cost effective manner, reduce greenhouse gas emissions, and stimulate the economy.[14]

Q. HOW DOES THE COMPANY PROPOSE TO PRIORITIZE REPLACEMENT UNDER THE GSMP II?

A. The Company plans to prioritize the UPCI, EPCI, and unprotected steel replacement through a similar, yet modified, Hazard Index prioritization ranking methodology it used in the GSMP I program. This Hazard Index is a composite index number that can be used to

[10] Company Petition at ¶5.
[11] Company Petition at ¶4.
[12] Company Petition at ¶5.
[13] Direct Testimony of Wade E. Miller, 12:3-5.
[14] Company Petition at ¶8 and ¶10.

rank order replacements. The index number is estimated from a predictive model that integrates leak history with environmental conditions, building types, and account asset information (i.e., pipe diameter and operating pressure).[15] The Company is also using a grid ranking prioritization approach in which the Company has mapped its distribution system into over 500 grids where each grid measures one square mile.[16] Each map grid is evaluated using the hazard index and then ranked from highest to lowest hazard and placed into A, B, C, and D priority grid categories.[17] While the Company states that "the top 10 Priority A grids" will be ranked based strictly on the hazard value, the remaining Priority A grids with a "similar hazard value" will be prioritized by joint and service leak history.[18]

Q. HOW DOES THIS PROGRAM COMPARE TO OTHER PSE&G INFRASTRUCTURE PROGRAMS?

A. The GSMP II proposal is significantly larger than both the natural gas component of the Energy Strong Program and the currently ongoing GSMP I. For instance, the gas portion of the Energy Strong program was comprised of $400 million in infrastructure investments targeted at improving gas system resiliency. A good portion of this program also included the replacement of priority facilities. The final Energy Strong program was developed from a settlement between parties, and was approved by the Board on May 21, 2014.[19] PSE&G's current GSMP I, as previously stated also resulted from a settlement agreement which was approved by the Board on November 16, 2015, in Docket No. GR15030272.[20] The GSMP I was approved for a three year

[15] Direct Testimony of Wade E. Miller 43:20 through 44:2
[16] Direct Testimony of Wade E. Miller, 47:16-18.
[17] Direct Testimony of Wade E. Miller, 47:1-8.
[18] Direct Testimony of Wade E. Miller 50:18-21.
[19] 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, p. 5.
[20] 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.

term for the accelerated replacement of UPCI and unprotected steel mains and services with a total program investment of $650 million.[21] The approved program costs excluded the costs associated with the replacement of high pressure cast iron mains, meters, and the additional costs associated with the relocation of inside meters to the outside.[22]

Q. HOW WOULD THE COSTS OF THE GSMP PROGRAM BE RECOVERED FROM RATEPAYERS?

A. The Company proposes to recover the revenue requirements associated with the proposal through semi-annual base rate roll-in filings using the same cost recovery method as the gas portion of the Company's Energy Strong program, purportedly remaining consistent with the recently adopted BPU Infrastructure Investment and Recovery ("IIR") regulations and the existing GSMP I, where applicable.[23]

Q. WHAT ARE THE SPECIFIC ROLL-IN FILING PERIODS?

A. According to the Company, the first base roll-in filing will not occur until December 31, 2019, for rates effective June 1, 2020.[24] From then, the Company states that:

> Filings will be made at the end of June and December of each year, for rate changes related to plant in service August 31 of the same year and February 28 (or 29) of the subsequent year, respectively. Those filings would be updated through a second filing that would be due September 15 and March 15, respectively, and that would provide actual data through August 31 and February 28 (or 29), respectively. Under this proposal, the rate adjustment following the June filing would be implemented on the first of December, and the rate adjustment following the December filing would be implemented on the first of June.

[21] 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, p. 3.
[22] 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, p. 3.
[23] Company Petition at ¶27.
[24] Company Petition at ¶28

Because there is no firm date for completion of this close-out work, the Company is proposing a final roll-in no later than July 15, 2024 with all actual data for rates effective October 1, 2024. [25]

Q. DOES THE GSMP II PROPOSAL INCLUDE A SPECIFIC SUNSET DATE?

A. No. However, the Company notes that it will take approximately five years for the totality of its GSMP II investments to be completed.[26] The Company's proposal also states that the prudence of the expenditures in GSMP II will be reviewed as part of PSE&G's subsequent base rate case(s) following the roll-ins, identical to the approach under the Energy Strong Program and GSMP I.[27] Following the base rate case, to be filed no later than November 1, 2017, the Company proposes that it will file its next base rate case no later than five years after the commencement of work for GSMP II, anticipated to be December 31, 2023.[28]

Q. HAS THE COMPANY PROVIDED ANY ESTIMATES OF ITS ANNUAL GSMP II REVENUE REQUIREMENT?

A. Yes. A summary of those estimates has been provided in Schedule DED-1 which shows that the GSMP II program is the largest gas distribution system program the Company has proposed to date.[29] The Company currently estimates a cumulative total program revenue requirement increase of $305.6 million over the next five years.

[25] Company Petition at ¶29; Direct Testimony of Stephen Swetz, pp. 9.
[26] Company Petition at ¶8.
[27] Company Petition at ¶31.
[28] Company Petition at ¶31; 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, p. 19. The base rate case that was to be filed by November 1, 2017 was actually filed with the Board on January 12, 2018.
[29] While the Company's Energy Strong Program proposal has been the largest electric and gas program proposal to date with an estimated total cost of $3.9 billion, the gas infrastructure investment portion represented $1.2 billion and the electric infrastructure investment was estimated to be $2.7 billion. The Company's proposed GSMP II is over two times the estimated gas infrastructure investments proposed to be made under the Energy Strong Program.

Q. HAS THE COMPANY PROVIDED ANY ESTIMATES OF THE BILL IMPACTS ASSOCIATED WITH THE GSMP II PROPOSAL?

A. Yes. A summary of the estimated bill impacts has been provided in Schedule DED-2. As shown in Schedule DED-2 the average residential heating customer with an annual use of 1,010-therms would see annual bill increases ranging from $24.54 to $40.38 resulting in a total bill increase of over $169 for the entire five year program. Furthermore, the average residential heating customer would see bill increases ranging from 2.84 percent to 4.68 percent on an annual basis when compared to current rates, resulting in a total increase of 19.62 percent at the end of the five year program.

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

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

A. On January 16, 2018, the Board issued Infrastructure Investment and Recovery ("IIR") Rules for New Jersey utilities. The purpose of the IIR 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.[30]

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

[30] 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.

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

- 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
- The installation of gas Excess Flow Valves where existing gas service line replacements require them, excluding Excess Flow Valves installed upon customer request pursuant to 49 CFR 192.383.[31]

However, it should be noted that these projects are just an example of the types of projects that may qualify under the IIR 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.[32]

Q. IS THERE ANY OTHER SPECIFIC INFORMATION THAT THE UTILITY IS TO INCLUDE IN ITS IIR PROPOSAL?

A. Yes. The Company is to include detailed information by major categories of expenditures its projected annual capital expenditure budgets for a five-year period, as well as include by major

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

categories of expenditures 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 estimates, in-service dates, and any applicable cost-benefit analysis for each project. The Company is also to 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.[33]

Q. DOES THE COMPANY'S GSMP II PROPOSAL COMPLY WITH THE BOARD'S IIR RULES?

A. No, not entirely although it should be noted that the Company filed its proposal prior to any rules being approved. The Company's proposal lacks a number of program description details that are required as part of the Board's rules such as a detailed budget, a description of project objectives, and details on in-service dates. Additionally, the Company has not provided a detailed engineering report or a cost-benefit analysis for its proposed projects.

V. Analysis of the Company's Pipe Composition and Leak Rates

Q. PLEASE EXPLAIN WHY COMPARISONS OF UTILITY FACILITIES COMPOSITION, REPLACEMENT, AND LEAKS ARE USEFUL IN EVALUATING ACCELERATED INFRASTRUCTURE INVESTMENT PROGRAM AND COST RECOVERY REQUESTS.

[33] Id., N.J.A.C. 14:3-2A.5.

A. These comparisons can be useful in assessing the need for a special rate recovery mechanism as well as past utility replacement and leak performance under traditional regulation. These statistics can also be useful in formulating performance metrics and incentives should a regulator decide to move forward with some form of replacement tracker mechanism.

Q. PLEASE EXPLAIN THE PRIMARY REASON WHY STATES HAVE ADOPTED THE USE OF ACCELERATED RATE RECOVERY MECHANISMS FOR PIPELINE REPLACEMENT.

A. Over the past decade, there has been increasing public and policy awareness of the role that leaks can play in leading to safety-related incidents. Most of this increasing awareness is the result of a number of unfortunate high-profile accidents that have occurred across the U.S. While not all of these high-profile incidents were the result of leaks from these priority facilities, the incidents served as a policy catalyst for increasing regulatory attention to all aspects of the pipeline industry's integrity management practices, including accelerated priority facilities replacements.

Q. WHAT DO YOU MEAN BY PRIORITY FACILITIES?

A. Priority facilities are usually those associated with facilities that are comprised of pipe materials that were installed decades ago and are no longer being installed, such as cast iron and unprotected steel mains and unprotected steel service lines. In some instances, the definition of priority facilities can be expanded to certain types of equipment or couplings that create leak-related challenges.

Q. PLEASE DISCUSS THE OPERATIONAL CHALLENGES THAT CAN ARISE FROM CAST IRON FACILITIES.

A. Cast iron was a common material type used in early evolving natural gas distribution systems. Cast iron mains and services were generally installed during a period prior to the 1970s.[34] While many of these pipes continue to operate reasonably well, they can become brittle over time and can experience breaks, particularly for smaller diameter pipes in extreme weather conditions. Cast iron pipes can also be subject to "graphitization" where the pipe degrades to a softer material that tends to flake and is also subject to potential breaks and cracks.[35]

Q. PLEASE DISCUSS THE OPERATIONAL CHALLENGES THAT CAN ARISE FROM UNPROTECTED BARE STEEL FACILITIES.

A. Unprotected,[36] and uncoated steel pipes and services are known as unprotected bare steel facilities. Bare steel pipe was used extensively in natural gas distribution systems until about the 1960's when plastic pipe became more common.[37] These bare steel facilities are subject to corrosion that can cause them to develop pits, holes, and hot spots that, in turn, can compromise pipe integrity leading to natural gas leaks.[38] These pipes were installed extensively throughout the U.S. before the availability of plastic pipes and, ultimately, the use of protective coatings and electrical (cathodic) protection. It was not until 1971 that federal safety mandates required all steel pipe to be installed with protective coatings and cathodic protection.[39]

Q. ARE THESE PRIORITY FACILITIES UNIFORMLY DISTRIBUTED ACROSS ALL U.S. NATURAL GAS UTILITIES?

[34] According to the U.S. Department of Transportation, cast iron pipe was gradually superseded by ductile iron pipe, which is a direct development, with most existing manufacturing plants transitioning to the new material during the 1970s and 1980s. There is currently almost no new manufacture of cast iron pipe. Available at: https://opsweb.phmsa.dot.gov/pipeline_replacement/cast_iron_inventory.asp.
[35] https://opsweb.phmsa.dot.gov/pipeline_replacement/cast_iron_inventory.asp.
[36] Unprotected steel pipelines are pipes that do not have cathodic protection.
[37] https://opsweb.phmsa.dot.gov/pipeline_replacement/bare_steel_inventory.asp.
[38] https://opsweb.phmsa.dot.gov/pipeline_replacement/bare_steel_inventory.asp.
[39] See, https://opsweb.phmsa.dot.gov/pipeline_replacement/bare_steel_inventory.asp.

A No. As I noted earlier, most of these priority mains, particularly those associated with cast iron facilities, tend to be located in the older natural gas utility systems of the Northeast and Mid-Atlantic regions of the country.

Q. HAVE YOU PREPARED AN ANALYSIS OF THE COMPANY'S CURRENT AND HISTORIC PIPELINE INVENTORY, PIPELINE REPLACEMENT RATES, AND LEAK PERFORMANCE?

A. Yes. I have prepared a series of schedules (Schedule DED-3 to Schedule DED-22) that examine the Company's inventory of cast iron and unprotected steel mains and unprotected steel services, its replacement rates on both of these types of facilities, and the leaks incurred on both types of assets. I have also provided a number of comparisons of the trends in the Company's priority facilities to those of a group of regional natural gas distribution utilities.

Q. WHAT IS THE SOURCE OF THE DATA YOU USED FOR YOUR ANALYSIS?

A. I utilized data from the U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration ("PHMSA"), Office of Pipeline Safety ("OPS," generally "OPS data"). The OPS collects a variety of information from pipeline operators under its jurisdiction in accordance with federal pipeline safety regulations. This annual data is required by 49 CFR 191.11, which states that "…each operator of a distribution pipeline system shall submit an annual report for that system on Department of Transportation Form RSPA F 7100.1-1. This report must be submitted each year, no later than March 15, for the preceding calendar year."[40] Some of the information submitted in this report is provided to the public, including the "Distribution, Transmission, and Liquid Annual Data" that was used in this analysis. Some of the data I utilized, particularly data associated with some summary statistics, were provided by the Company.

[40] 49 CFR 191.11.

Q. WHAT TIME PERIOD DID YOU USE FOR YOUR ANALYSIS?

A. I used a 25 year time period spanning from 1992 to the year with the most recently available information (2016). This long period of time allows for an adequate historic comparison over what could be interpreted as various different positive and negative changes in the natural gas industry, public and regulatory policy, and in the economy.

Q. HOW DID YOU DEFINE THE REGIONAL UTILITY COMPARISON GROUP?

A. I followed a two-step process. The first step identifies all natural gas utilities in the Mid-Atlantic region and sorts them, from largest to smallest, by residential delivery volumes and number of customers. The second step attempts to select an equal number of utilities that are larger and smaller than the Company, in such a manner that places the Company at, or very near, the median of the distribution of utilities selected (i.e., an equal number of both larger and smaller-sized distribution utilities). However, because the Company is the largest in the region, I selected 15 companies with sales and customers comparable in size to the Company. A table comparing these utilities and their number of customers and sales has been provided in Schedule DED-3.

Q. DOES THE COMPANY HAVE A LARGE NUMBER OF CAST IRON MAINS?

A. Yes. Schedule DED-4 provides a materials break-down of the Company's distribution mains. The 2016 inventory of the Company's mains indicate they are comprised of: unprotected steel (5.6 percent); cast iron (21.2 percent) cathodically protected steel (27.2 percent); and plastic (46.0 percent). The schedule shows that the Company has a relatively high share of cast iron mains relative to its other pipeline material types. Schedule DED-5 compares the Company's cast iron pipeline shares to other regional Mid-Atlantic utilities. The comparison shows that the Company's share of cast iron mains is large relative to most other comparable utilities.

Q. DOES THE COMPANY HAVE A LARGE SHARE OF UNPROTECTED STEEL MAINS COMPARED TO OTHER MID-ATLANTIC GAS UTILITIES?

A. No. Schedule DED-6 provides a comparison of unprotected steel main inventory compared to regional utilities. The 2016 inventory of the Company's unprotected steel mains represents only 5.6 percent of its total distribution mains. The schedule shows that the Company has a relatively low share of unprotected steel mains relative to its other regional utilities. The comparison shows that the Company's share of unprotected steel mains is smaller than half of the other regional utilities.

Q. HAVE YOU COMPARED THE COMPANY'S LEAK INVENTORY WITH OTHER REGIONAL UTILITIES?

A. Yes. Schedule DED-7 compares the Company's total leak inventory at the end of the year with other regional utilities average leak inventory on an indexed basis. The Company's leak inventory (from all types of leaks) has fallen since its peak in 2004. However, the relative position of the Company's leak inventory compared to 1992 is consistently higher than the relative leak inventories of other regional utilities in every year since 1996. Further, regional utilities have seen a steady and consistent decrease in their relative leak inventories in every year since 2010. PSE&G's leak inventory for the years 2010 through 2013 were higher than the corresponding inventories for any of the years 2006 through 2009. While, on average, the leak inventory has decreased since 2010, the Company's leak inventory for 2016 was still higher than it was in 2009, and significantly higher on a relative basis to the average inventory in the regional utility group.

Q. HAVE YOU COMPARED THE COMPANY'S CAST IRON LEAK INVENTORY TRENDS WITH OTHER NEW JERSEY GAS UTILITIES?

A. Yes. Schedule DED-8 provides a comparison of the Company's leak inventory with other New Jersey utilities. The schedule shows that the Company's leak inventory performance was better relative to other New Jersey utilities from the period between 2007 and 2010. Starting in 2011, however, the Company's leak inventory performance has degraded relative to other New Jersey utilities. This appears to be due to the fact that other in-state utilities have generally seen consistent improvements in their leak inventories starting in 2009 and continuing through to 2016. The Company on the other hand has seen negligible improvements in leak inventories since 2006. In fact, the Company's leak inventory for 2016 was still higher than it was in 2009, and significantly higher on a relative basis to the average inventory of other New Jersey utilities.

Q. HAVE YOU COMPARED THE CAUSES OF THE COMPANY'S MOST RECENT LEAK REPAIRS WITH THOSE OF OTHER UTILITIES?

A. Yes. Schedule DED-9 compares the composition of the Company's leak repairs with other New Jersey and regional gas utilities. The chart shows that for the Company, natural forces are the biggest concern in terms of type of leak. According to PHSMA, natural force damage includes earth movement, landslides, and subsidence, including earthquakes; heavy rains and flooding; high winds, tornadoes, or hurricanes; temperature extremes such as when cold weather causes frost heaves or frozen instrumentation lines; and lightning.[41] For the regional utilities, and other New Jersey utilities, corrosion is the main concern. Leaks caused by excavation, materials or welds, and equipment failures are generally consistent across all three groups.

Q. HAS THE COMPANY PROVIDED ANY DETAILED STATISTICS ON ITS CAST IRON MAIN LEAKS AND BREAKS?

[41] Department of Transportation, Pipeline & Hazardous Safety Materials Administration, Fact Sheet: Natural Force Damage, https://primis.phmsa.dot.gov/comm/FactSheets/FSNaturalForce.htm.

A. Yes. The Company provided some specific statistics on its total cast iron inventory, leaks and the number of breaks associated with its cast iron mains over the past five years. Schedule DED-10 CONFIDENTIAL provides a comparison of the Company's cast iron mains inventory to its annual cast iron breaks. Schedule DED-11 CONFIDENTIAL provides a comparison of the Company's cast iron replacements and its annual cast iron breaks, while Schedule DED-12 CONFIDENTIAL shows the historic trends in the leak rates per mile of cast iron pipes versus its number of cast iron breaks. [redacted]

Q. HAS THE COMPANY PROVIDED ANY DETAILED STATISTICS ON ITS HISTORICAL MAIN REPLACEMENTS?

A. Yes, Schedule DED-13 shows the Company's historical main replacements for the period 1997-2016. As shown in schedule DED-13, prior to 2009 the Company made all of its pipe replacements, averaging over 61 miles per year, through normal or "base" capital spending recoverable through the traditional base rate case process. However, in 2009 the Company began its accelerated infrastructure replacement program and while total replacement increased as a result of the accelerated infrastructure replacement programs over the period 2009-2016, the amount of base replacements dropped by nearly half averaging only 26.5 miles per year.

Q. LET'S TURN TO YOUR ANALYSIS OF THE COMPANY'S SERVICE LINES REPLACEMENT TRENDS. PLEASE DISCUSS THE COMPANY'S SERVICE LINE INVENTORY MATERIAL COMPOSITION.

A. Schedule DED-14 examines the Company's service line inventory by materials type for 2016. The Company's current service line inventory is made up primarily of plastic (68 percent), followed by protected steel (19 percent), and non-protected steel (13 percent). Schedule DED-15 compares the Company's leak prone[42] steel service line shares to other regional Mid-Atlantic utilities. The analysis shows that the Company's leak prone steel service line shares are relatively higher, yet not the highest, in the selected Mid-Atlantic utility group. Schedule DED-16 compares the Company's relative corrosion-related leak rates per total service lines and per leak prone service lines to other regional Mid-Atlantic utilities. The analysis shows that the Company's corrosion-related leaks per total service lines and corrosion related leaks per leak prone service lines compare relatively well to other regional utilities.

Q. HAVE YOU COMPARED THE CAUSES OF THE COMPANY'S MOST RECENT SERVICE LEAK REPAIRS WITH THOSE OF OTHER UTILITIES?

A. Yes. Schedule DED-17 compares the composition of the Company's leak repairs with other New Jersey and regional gas utilities. The chart shows, that for the Company, corrosion is the biggest concern in terms of causes of leaks. For the regional utilities, and other New Jersey utilities, corrosion and equipment failure appear to be the main concerns. Leaks caused by excavation, materials or welds, and incorrect operations are generally consistent across all three groups.

Q. HOW DO THE COMPANY'S SERVICE LINE REPLACEMENT RATES COMPARE TO OTHER REGIONAL UTILITIES?

[42] Leak prone steel services are defined as services without cathodic protection or cathodically protected but uncoated services.

A. The Company's leak prone steel service line replacement rates compare well with other utilities, particularly relative to the last five years. Schedule DED-18 shows that the Company exceeded the relative leak prone steel service replacement rate for other regional utilities since 2007, with the exception of 2013 and 2014.

Q. HOW DO THE COMPANY'S UNPROTECTED STEEL SERVICE LINE REPLACEMENTS COMPARE TO OTHER NEW JERSEY GAS UTILITIES?

A Schedule DED-19 shows that the Company's leak prone steel replacement rates compare well on a relative basis to other New Jersey gas utilities for the years 2008 through 2011. However, since 2011, the Company's leak prone steel service replacements have greatly fallen short of those for other New Jersey gas utilities on a relative basis.

Q. HOW DO THE COMPANY'S UNPROTECTED STEEL SERVICE REPLACEMENT RATES COMPARE WITH ITS HISTORIC CORROSION-RELATED LEAKS?

A. These compare relatively well, as seen in Schedule DED-20. As noted earlier, the Company's leak prone steel service replacement rates were higher since 2008 compared to historic replacement levels. Corrosion-related leaks had been falling considerably since about 2004 before increasing again in 2012. However, leaks have risen by 66 percent over the more recent 2012-2016 period.

Q. HOW DO THE COMPANY'S CORROSION-RELATED LEAKS COMPARE WITH OTHER REGIONAL UTILITIES INCLUDING THOSE IN NEW JERSEY?

A Schedule DED-21 shows that the Company's corrosion-related leaks for its service lines has been slightly higher than the regional utility average since the year 2000. Schedule DED-22 provides the same comparison against New Jersey gas utilities. PSE&G's service line corrosion-

related leaks have historically been higher than the New Jersey utility average since the year 2000 with the exception of 2012 where the Company's relative leaks fell below those of other state utilities.

Q. WHAT CONCLUSIONS DO YOU REACH FROM THESE MAINS AND SERVICES LINE COMPARISONS?

A. I reach the following conclusions:

1) Despite having implemented a number of accelerated replacement programs the Company has, and continues to report, a relatively high proportion of cast iron mains relative to its total mains inventory.

2) The Company does not have a large amount of unprotected steel main inventory compared to its peers.

3) The Company's cast iron replacement proposals (in mileage terms) would put it in a position of replacing pipe at levels (and rates) considerably higher (orders of magnitude higher) than what it has done historically. For instance, since 1997 the Company's highest number of miles replaced in one year has been 209 miles in 2016. Now, it proposes to replace approximately 250 miles of main not just in one year, but consistently across a five-year period.

4) The Company reports a relatively higher level of leaks in inventory than other regional utilities, but comparable to other New Jersey gas utilities. New Jersey gas utilities, however, have been reducing their leak inventory at rates far greater than PSE&G over the past five years and on average have performed better than the Company's leak performance since 2012. Further, the Company's unprotected steel service leaks have been increasing since 2012.

VI. The Company Has Not Shown the Need for its GSMP II Proposal

Q. DO YOU THINK THE COMPANY'S CURRENT INVENTORY, REPLACEMENT RATE AND LEAK INVENTORY TRENDS SUPPORT THE GSMP II PROPOSAL?

A. No. First, the Company has a relatively low level of unprotected steel mains inventory compared to other regional utilities and unprotected steel service line replacement performance and leak rate trends appear to be comparable to those of other regional utilities. There is no special policy need, at least from the trends shown in the OPS data, to develop some new cost recovery

mechanism to change this current rate of unprotected steel mains replacement. Second, while the Company does have a relatively high share of cast iron mains, its prior replacement trends for those mains has been relatively lackluster. The Company's relatively slow rate of replacement calls into question its ability to replace cast iron pipe over the course of the proposed GSMP II program at rates considerably faster than it has over the past 20 years. As shown in DED-13, the most miles of main the Company has replaced in the last 20 years was 209 miles in 2016, which is still 20 percent below the 250 miles of main the Company is proposing to replace per year under the GSMP II. In fact, it has taken the Company roughly 18 years to replace the same mileage of pipe it now proposes to replace in five. Thus, there appears to be no merit in approving a new GSMP proposal, as it is questionable if the Company is even able to achieve this level of replacement in a safe and efficient manner.

Q. HAS THE COMPANY PROVIDED ANY COMPELLING POLICY RATIONALE FOR THE GSMP II PROPOSAL AND ITS CORRESPONDING COST RECOVERY MECHANISM?

A. No, at least not from a policy perspective and particularly relative to the Company's more recent pipeline replacement performance. The Company's proposed GSMP II appears to be misguided and, as noted by Mr. McGee, does not correctly focus on the most serious current problems that require attention. Instead, the Company is proposing a type of "replace all" approach. Additionally, the GSMP II is a very large program that goes beyond the replacement activities of the GSMP I, and if approved as proposed by the Company it will result in significant rate impacts over the five years of the program. Mr. McGee will discuss the engineering-related deficiencies of the program. However, from a policy perspective, the GSMP II proposal suffers from deficiencies including the fact that the Company has provided little to no estimated benefits

or cost-benefit analyses to support its proposal other than the annual avoided O&M expenses associated with leak repairs, leak rechecks, winter survey, and regulator inspection maintenance.

Q. PLEASE EXPLAIN WHY THE COMPANY'S PROGRAM APPEARS TO BE MISGUIDED.

A. Unlike other accelerated infrastructure programs approved by the Board, in which safety was the primary driver, the Company's proposed extension of the GSMP does not appear to focus on safety as the primary concern necessitating the proposed replacements under the GSMP II. Although the Company references the Department of Transportation's "Call to Action" as a reason for the need for the program;[43] the Company's proposed GSMP II's primary focus appears to be modernization of its system rather than safety. The Company has explicitly stated that the goal of the program is modernization[44] and that the GSMP II is "more than a replacement program it is a modernization program" which includes some enhanced safety components such as installing excess flow values on services.[45] Further, the Company has included in its program accelerated recovery of replacements that should be made as part of the Company's base replacements recovered through a base rate case. The Company appears to be shifting investments that would be made during the normal course of business into the GSMP II for special ratemaking treatment and cost recovery.

Q. COULD THE COMPANY'S PROPOSED GSMP II REPLACEMENTS BE UNDERTAKEN AS PART OF ITS NORMAL BASE SPENDING?

A. Yes, the Company's proposed GSMP II does not appear to be primarily safety focused rather it has an overreaching goal of modernization. As previously stated, the Company's

[43] Direct Testimony of Wade E. Miller, 7:7-10.
[44] Company's response to RCR-ENG-0007.
[45] Company's response to RCR-ENG-0017.

proposed GSMP II goes beyond the replacements currently being undertaken under the GSMP I. Additionally, as discussed by Mr. McGee, the Company appears to have shifted its prioritization methodology in order to include additional pipe materials because the UPCI breaks and leaks on the system have become scarce. The Company is currently undertaking a number of the types of replacements proposed for the GSMP II as part of both its normal base spending and the stipulated base spending approved under the GSMP I, and the Company states that it will continue these same types of replacements as part of its normal base spending under GSMP II.[46] Therefore, there appears to be no difference or extenuating circumstance as to why the replacements under the GSMP II could not be undertaken as part of the Company's normal replacements.[47] For instance, as part of the settlement in the Company's 2006 rate case, PSE&G was to "establish an upper performance limit standard of leaks per HP-CI mile and report a comparison of actual to standard leak rates annually."[48] As the result of that settlement the Company has a regulatory obligation to meet its upper performance target and reinforce EPCI bell joints as part of its normal base spending. However, the Company would now like to include for accelerated cost recovery the reinforcement of these EPCI bell joints in order for the Company to meet this compliance requirement.[49] Further, the Company states that even if the EPCI bell joint rehabilitation program is included in the GSMP II it will not guarantee compliance with the performance requirements every year.[50] Thus it is apparent that the Company's request for accelerated cost recovery for the proposed replacements under the GSMP II is to shift costs and risks from the Company and its shareholders onto ratepayers.

[46] Company's response to RCR-POL-0066.
[47] Company's response to RCR-POL-0066.
[48] Company's response to RCR-POL-0069.
[49] Company's response to RCR-POL-0069.
[50] Company's response to RCR-POL-0069.

Q. FROM A POLICY PERSPECTIVE IS THERE A NEED TO FURTHER ACCELERATE THE REPLACEMENTS UNDER THE GSMP II?

A. No, not from a policy perspective. The GSMP II as stated previously does not appear to be driven by safety but instead the focus is to modernize PSE&G's gas distribution system. The Company has indicated that the reason that they have decided to accelerate the replacements made under the GSMP from 30 years to 20 years is not due to safety concerns. The Company stated that the reason for accelerating the time period of the program is to "accelerate the benefits".[51] Moreover, Mr. McGee also states that from an engineering perspective further accelerating the time period for replacement is not necessary.

VII. Program Selection Deficiencies Relative to Common Infrastructure Replacement Mechanisms

Q. HAVE ANY OTHER STATE COMMISSIONS APPROVED COST RECOVERY MECHANISMS THAT ALLOW NATURAL GAS DISTRIBUTION UTILITIES TO RECOVER THE COSTS OF THEIR ACCELERATED REPLACEMENT ACTIVITIES?

A. Yes. Pipeline replacement 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, less frequent instances, these infrastructure replacement programs have been extended to include the accelerated replacement of mechanical or other type of couplings. Schedule DED-23 provides a map of the states that have allowed utilities to implement and use various types of replacement cost trackers

[51] Company's response to RCR-ENG-0017.

as a means of recovering the costs associated with their accelerated pipeline replacement activities. To date, there are 36 states that allow for the use of pipeline cost recovery mechanisms.[52]

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

A. No. Approved 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-24 presents a table that outlines the major components of each currently-approved natural gas distribution infrastructure cost recovery mechanisms. The remainder of this section of my testimony will compare various aspects of the Company's infrastructure cost recovery mechanism to those approved in other parts of the country and New Jersey.

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,[53] the Energy Strong program, and the GSMP I, 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:

[52] The District of Columbia also allows for an infrastructure cost recovery rate mechanism.
[53] 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.

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.[54]

2) Cost recovery is limited to only investments associated with reducing safety-related leaks on priority mains and services.[55]

3) There are benchmarks and performance measures that are tied to program returns.[56]

4) Rates of return have been adjusted to recognize the changes in the capital markets since the Company's last base rate case.[57]

[54] 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; 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.

[55] 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.

[56] 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.

[57] 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.

5) The cost recovery mechanisms include a number of ratepayer protection mechanisms such as O&M offsets and expenditure caps,[58] and clear sunset provisions with rate case filing requirements.[59]

Q. DOES THE COMPANY'S GSMP II PROPOSAL SUFFER FROM ANY PROGRAM DESIGN DEFICIENCIES RELATIVE TO OTHER APPROVED INFRASTRUCTURE TRACKER MECHANISMS?

A. Yes. The Company's GSMP II 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) Program prioritization that does not focus on the most at-risk pipe;

3) Limited performance metrics and proposed leak reduction targets that are not adequate;

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

5) No rate mitigation provisions (such as a cap on capital expenditures or a cap on rate impacts for ratepayers) that are common with other tracker mechanisms.

Q. WOULD YOU PLEASE ADDRESS THE FIRST DEFICIENCY?

[58] 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.

[59] 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.

A. Yes. The proposed GSMP II is a very large and expensive program, costing over $1,490 on a per customer basis.[60] The Company's proposal expands well beyond the scope of the currently-approved GSMP I, as well as the currently-approved infrastructure replacement programs of other New Jersey natural gas utilities. Moreover, it appears that the Company's proposed program investment is uncapped as the Company has indicated in discovery that the program investments are just "estimates" and "will not agree to limit or cap these amounts".[61] The currently-approved New Jersey infrastructure programs focus on the replacement of utilization pressure cast iron and unprotected steel mains, and related work. The Company's proposal would expand this scope by adding other material types such as plastic and cathodically-protected steel and by adding EPCI mains. The Company is further proposing to implement an EPCI joint reinforcement program as part of its GSMP II program.[62]

Q. WOULD YOU PLEASE ADDRESS THE SECOND DEFICIENCY REGARDING PROGRAM PRIORITIZATION?

A. Yes, as previously stated the Company appears to have revised its prioritization method to not only utilize the Hazard Index approach it used in the GSMP I but to also include a grid ranking prioritization approach that includes other factors for prioritization such as joint and leak history.[63] It appears that the Company is proposing a "replace all" approach and has added this additional ranking measure in order to identify other mains and infrastructure that may not necessarily be the most at risk. The issues with PSE&G's prioritization methodology are discussed in more detail in

[60] The cost per customer is calculated using the total program investment of the GSMP II of $2.68 billion and dividing by the Company's total number of customers of 1,800,000.
[61] Company's response to RCR-POL-0037.
[62] Direct Testimony of Wade E. Miller, 6:13-16.
[63] Company's response to RCR-POL-0029.

Mr. McGee's testimony. Essentially, the Company is proposing a replacement methodology that does not focus on replacing the most "at-risk" infrastructure.

Q. WOULD YOU PLEASE ADDRESS THE THIRD DEFICIENCY?

A. Yes. The Company's proposal includes limited performance metrics and benchmarks. This is a problem since the GSMP II replacement investments are purportedly designed primarily to minimize natural gas leaks, which in turn should lead to improved safety and reliability, thereby potentially: (1) reducing the occurrence of safety-related incidents; (2) reducing lost and unaccounted for commodity gas; and (3) reducing repair and maintenance costs associated with leaking pipes and equipment. However, the only performance metric that the Company is proposing in this proceeding is to reduce its current open leak inventory by 80 percent over the five years following the date of Board approval and a minimum of 20 percent each year in the first two years except if extraordinary circumstances such as extreme weather, acts of war or terrorism, or other *force majeure* prevent the achievement of the annual reduction. The Company states that its commitment does not include incremental, new, post-approval leaks which will not be counted in such metric.[64]

Q. ARE THE COMPANY'S LEAK REDUCTION COMMITMENTS ADEQUATE?

A. No, since the commitment has limitations and omits important performance penalty provisions. For instance, the Company's commitment should include all leaks, including incremental new leaks. This is particularly important considering that as shown in the peer group analysis I have conducted, the Company's overall leaks do not appear to be getting any better even though these various infrastructure programs are purported to decrease the occurrence of leaks on the Company's systems. Although in the past in other infrastructure replacement programs the

[64] Direct Testimony of Wade E. Miller, 81:13-18.

New Jersey utilities have limited the leak reduction target to exclude incremental new leaks after a set date, it has become apparent that the exclusion of incremental leaks has eliminated any real "threat" or penalty. By excluding incremental new leaks in the performance standard, the Company has been able to limit the number of leak reductions required by the performance standard to a relatively small level of leaks that are open at a particular point in time, resulting in an ineffective performance metric. Although the inclusion of incremental new leaks in the performance standard is different from the current GSMP I and past New Jersey utilities' programs, as shown in my analysis the Company's leaks have been increasing over time, therefore a more stringent performance standard appears to be necessary. Mr. McGee will also discuss the deficiencies of this leak reduction performance metric in his testimony. In addition, the Company's performance metric omits any penalty if the Company does not achieve the proposed leak reductions.

Q. HOW ARE RATEPAYERS IMPACTED BY THE OMISSION OF PERFORMANCE STANDARD PENALTIES AND A COMPREHENSIVE LEAK REDUCTION TARGET?

A. The omission of any meaningful performance penalties shifts integrity management performance risk away from the Company and onto ratepayers since the Company is unlikely to be penalized if any of these benefits fail to materialize. From past experience in the implementation of many infrastructure programs in New Jersey, Rate Counsel has become increasingly more cognizant that the omission of any performance penalty can tend to disconnect performance and cost recovery. Further, the failure to utilize comprehensive standards or benchmarks within a cost tracker mechanism can shift the regulatory burden of prudence away from the utility and towards ratepayers. In the past, utilities made investments and were required

to show these investments were prudently incurred before they were entered into rates (i.e., that the investments were reducing leaks and/or O&M expenses associated with repairing leaks). The omission of a performance-tied penalty, which can serve as a *de facto* prudence threshold, shifts the burden of proof to ratepayers to show performance deficiencies such as failures to achieve leak reductions or cost savings.

Q. HOW DO BENCHMARKS AND PERFORMANCE STANDARDS HELP TO LINK COST RECOVERY TO PERFORMANCE?

A. Benchmarks and 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 REPLACEMENT TRACKERS INCLUDE PENALTY MECHANISMS FOR FAILURE TO MEET THESE PERFORMANCE TARGETS?

A. Yes. NJNG, SJG and ETG have agreed through their various mechanisms that tie the allowed rate for return on investments in their respective cost recovery mechanisms to leak performance. If performance falls below a given agreed-upon level, these utilities generally will

earn a proportionately lower return on investment[65] associated with their replacement activities. For instance, the Company's GSMP I program includes a provision that requires it, within the first two years of its program, to notify the Board and Rate Counsel and schedule a conference to discuss any failure to meet its agreed-upon leak reduction target. If this failure extends to a three year period, then the Company will forego cost recovery of its tracker-related investments until such time as that performance improves.

Q. DO YOU HAVE ANY RECOMMENDATIONS FOR A PENALTY SHOULD THE COMPANY FAIL TO MEET ITS LEAK REDUCTION TARGET?

A. Yes. The Company's leaks have been increasing over recent years indicating that perhaps a more stringent performance standard appears to be necessary. Therefore, it is recommended that if the Company fails to meet the leak reduction target in the first two years of its program, the Company should be required to notify the Board and Rate Counsel and schedule a conference to discuss any failure to the leak reduction target. If this failure extends to a three year period, then the Company would reduce its return on equity ("ROE") by 50 basis points until it is able to achieve the leak reduction target.

Q. PLEASE EXPLAIN THE COMPANY'S FOURTH PROGRAM DESIGN DEFICIENCY WHICH OMITS AN O&M COST SAVINGS ADJUSTMENT.

A. The GSMP II proposal does not include any O&M cost savings adjustments despite the fact that the Company identifies a cumulative total of approximately $4.3 million in O&M savings

[65] 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.

associated with leak repairs, leak rechecks, winter survey, and regulator station inspection and maintenance from 2020 to 2024.[66] On average, this equates to over $862,000 of O&M savings associated with the program per year.

Q. SHOULD THE COMPANY'S GSMP II GAS COST RECOVERY MECHANISM REFLECT THESE POTENTIAL COST SAVINGS?

A. Yes. Most natural gas infrastructure cost tracker requests are predicated on the belief that the accelerated replacement of priority mains and services will result in lower leaks. These lower leaks, in turn, will result in O&M cost savings since fewer repairs, equipment, and personnel will need to be dedicated to leak repairs relative to the level usually included in base rates. Failure to account for these savings will simply lead to a windfall to the Company and its shareholders. Further, the inclusion of an O&M cost savings offset will encourage operating and investment efficiencies since only those mains/services with the higher potentials for avoided emissions will be prioritized.

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

[66] Company's response to RCR-A-0002, Attachment RCR-A_0002_Exhibit1.19-1.20 Workpaper.xlsx.

period; or 2) exclude any "incremental operation and maintenance expenses" in future infrastructure filings.[67]

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

A. Yes. Schedule DED-28 shows that 26 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 98 utilities that currently have periodic cost recovery mechanisms for their infrastructure replacement programs. Thus, some 26.5 percent, a relatively large share, for the currently-active infrastructure tracker mechanisms have O&M offset provisions.

Q. DO YOU HAVE ANY RECOMMENDATIONS REGARDING AN O&M OFFSET?

A. Yes, similar to other New Jersey utilities' infrastructure replacement programs, the Company's GSMP II should include an O&M offset associated with the reduction in leaks as a result of the program. The recommended O&M offset should be $150,000 per year which is based

[67] 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.

on the replacement of 370 miles of UPCI and unprotected steel main and associated services over a three year period. However, if the Board is to approve the Company's GSMP II as proposed then I recommend that an O&M offset of $862,000 per year be implemented. Additionally, it is recommended that the Company track all O&M savings associated with the GSMP II. The Company should report O&M savings to the Board and Rate Counsel as part of its recently filed and future base rate case proceedings, and provide a complete explanation of the procedures used to ensure that these savings have been included in the cost of service or rates.

Q. DOES THE GSMP II PROPOSAL INCLUDE ANY RATEPAYER SAFEGUARDS?

A. No. The Company's GSMP II proposal does not contain ratepayer protection mechanisms that are often found in approved infrastructure tracker mechanisms. These protections include, but are not limited to: caps on expenditures; recovery limitations on the amount of capital expenditures and annual rate impacts; a well-defined set of criteria for determining the investments included in the plan; and cost savings or other offsets resulting from the plan.[68] Schedule DED-24, identifies common program design characteristics for other natural gas utility infrastructure trackers and it also identifies ratepayer protection mechanisms included in these plans.

Q. DOES THE COMPANY'S GSMP II PROPOSAL INCLUDE A HARD INFRASTRUCTURE INVESTMENT CAP?

[68] *See, for instance,* Department of Public Utilities, In re: Petition of Bay State Gas Company, pursuant to G.L. c. 164, § 94 and 220 C.M.R. § 5.00 et seq., for Approval of a General Increase in Gas Distribution Rates Proposed in Tariffs M.D.P.U. Nos. 70 through 105, and for Approval of a Revenue Decoupling Mechanism, D.P.U. 09-30. Order Dated October 30, 2009; Department of Public Utilities, In re: Petition of Massachusetts Electric Company and Nantucket Electric Company, pursuant to G. L. c. 164, § 94, and 220 C.M.R. § 5.00 et seq., for a General Increase in Electric Rates and Approval of a Revenue Decoupling Mechanism, D.P.U. 09-39. Order Dated November 30, 2009; Department of Public Utilities, In re: Petition of Boston Gas Company, Essex Gas Company and Colonial Gas Company, each d/b/a National Grid, pursuant to G.L. c. 164, § 94 and 220 C.M.R. § 5.00 et seq., for Approval of a General Increase in Gas Distribution Rates, a Targeted Infrastructure Recovery Factor, and a Revenue Decoupling Mechanism, D.P.U. 10-55. Order Dated November 2, 2010; In the Matter of Petition of New England Gas Company, pursuant to G.L. c. 164, § 94 and 220 C.M.R. § 5.00 et seq., for Approval of a General Increase in Gas Distribution Rates, a Targeted Infrastructure Recovery Factor, and a Revenue Decoupling Mechanism, set forth in the following tariffs: M.D.P.U. Nos. 1002B and 1003A through 1024A, D.P.U. 10-114. Order Dated March 31, 2011.

A. No. The Company has indicated that it will not agree to limit or cap the investments associated with the GSMP II.[69] Infrastructure tracker mechanisms that exclude some type of expenditure cap can run the risk of overcapitalization and/or capital investment inefficiencies. This is particularly important for a program as large as GSMP II where a 20 percent cost overrun for a $2.68 billion dollar program could lead to as much as $536 million in additional, unanticipated investment.

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

A. No. 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's proposal does not include a rate impact cap despite the fact that the order of magnitude for these impacts could be quite significant. Schedule DED-24 also shows that several states have adopted rate impact caps as part of their natural gas capital tracker mechanisms.

[69] Company's response to RCR-POL-0037.

Q. IS ACCELERATED COST RECOVERY NEEDED FOR THE COMPANY TO MAKE NECESSARY INVESTMENTS?

A. No, it does not appear that accelerated cost recovery is necessary for the Company to make its needed replacements. The Company has stated in discovery that if its cost recovery mechanism is rejected it will not make all the program replacements as proposed in this filing.[70] The Company's statement appears to indicate that some of the proposed replacements are not immediately necessary and do not require accelerated cost recovery. However, the Company does indicate that if the GSMP II is rejected, it would still make the following infrastructure investments: replacement of cast iron and unprotected steel main and services with plastic and coated cathodically protected steel; installation of excess flow valves where required by code; upgrades to low pressure mains and services to higher pressure as part of the replacement programs where operationally feasible; and relocation of inside meters outside of premises in conjunction with main and service replacement projects where operationally feasible.[71]

Q. DO YOU HAVE ANY RECOMMENDATIONS REGARDING THE LEVEL OF PROGRAM INVESTMENTS IF THE GSMP II IS APPROVED?

A. Yes. If the Board were to approve the Company's GSMP II, then I would recommend that the program investment be capped at $650 million over a three year program term. This program cap is based on a cost per mile of $1.75 million which would result in the total replacement of 370 miles of UPCI and unprotected steel mains. This cost per mile is based on the Company's own cost estimates for the replacement of UPCI and unprotected steel main facilities under GSMP II.[72]

VIII. The Proposed GSMP II will Result in Negative Net Economic Benefits

[70] Company's response to RCR-POL-0016.
[71] Company's response to RCR-POL-0016.
[72] Company's response to RCR-A-0002, Attachment RCR-A_0002_Exhibit1.19-1.20 Workpaper.xlsx.

A. Overview

Q. WOULD YOU PLEASE EXPLAIN HOW LARGE UTILITY INITIATIVES LIKE THE PROPOSED GSMP II CAN AFFECT A STATE ECONOMY?

A. Yes. Large capital expenditure programs, like the GSMP II, can lead to both positive and negative economic impacts. For instance, the capital investments and expenditures associated with the GSMP II will directly lead to a number of construction, engineering, and other employment opportunities within the New Jersey economy. In addition, GSMP II could also generate operational benefits, such as offsetting O&M costs and reducing leaks, which would be passed onto ratepayers. Both these construction benefits and operational benefits can generate ripple effects (or "multiplier" effects) on the New Jersey economy. These "indirect" and "induced" economic benefits come from supporting business services as well as increased consumer spending from new employment and increased disposable income.

Q. CAN ANY NEGATIVE IMPACTS ARISE FROM A BIG CAPITAL INTENSIVE INITIATIVE LIKE THE GSMP?

A. Yes. Negative impacts arise from the fact that the program is not free, and has to be paid for by ratepayers through increases in utility rates. The rate increases required to fund the GSMP II would ultimately reduce household disposable income and induce increased costs on New Jersey businesses and industries. A reduction in household income, or an increase in business costs, reduces the amount of money spent on goods and services which in turn can lead to negative ripple or multiplier effects for the New Jersey economy.

Q. HOW DO YOU DETERMINE THE OVERALL "NET" ECONOMIC BENEFITS OF SOMETHING LIKE THE GSMP II?

A. The net economic impact is the difference between (a) the positive economic impacts created by the program's construction and operational benefits and (b) the negative economic impacts associated with the project's rate increases. In other words, the net economic impact informs as to whether the decrease in economic activity from the project's costs (i.e. rate impacts) are greater than the increase in economic benefits. The full range of costs and benefits, including their corresponding multiplier effects, are considered in this calculation. A schematic of how this impact works is provided in Schedule DED-25.

Q. HAS THE COMPANY IDENTIFIED ANY ECONOMIC BENEFITS THAT IT BELIEVES WILL ARISE FROM THE GSMP II?

Yes. The Company has provided an overview of program benefits.[73] These benefits include a number of "qualitative benefits" including improved safety and reliability, reduced greenhouse gas emissions, and increased ability to use higher-efficiency appliances.[74] The Company does not provide an estimated value associated with these qualitative benefits. In addition, the Company presents a number of "quantitative benefits" including avoided costs associated with the program.[75]

B. Cost-Benefit Analysis

Q. WOULD YOU PLEASE DISCUSS THE AVOIDED O&M ESTIMATES THE COMPANY PROVIDES AS A COST-BENEFIT ANALYSIS?

A. Yes. The Company's analysis cannot be referred to as a comprehensive cost-benefit analysis since it only estimates one form of benefit, the annual avoided O&M expenses associated with leak repairs, leak rechecks, winter survey, and regulator inspection maintenance. The Company's analysis also displays the avoided annual capital costs associated with leak repair

[73] Direct Testimony of Wade E. Miller, 66:14 to 75:14.
[74] Direct Testimony of Wade E. Miller, 66:18 to 67:2.
[75] Direct Testimony of Wade E. Miller 73:10-12; and 74:4, Exhibit 1.19.

services, encapsulated utilization pressure joints, and encapsulated high-pressure joints. In total, the Company's "cost-benefit analysis" shows avoided O&M costs of $4.3 million and avoided capital costs of $52.2 million for the first five years of the program.[76]

Q. CAN YOU EXPLAIN WHY THE COMPANY'S COST-BENEFIT ANALYSIS IS METHODOLOGICALLY DEFICIENT?

A. The Company's purported "cost-benefit analysis" does not represent a comprehensive analysis of the costs and the benefits associated with the proposed GSMP II program. The Company has not provided a cost benefit analysis that includes a specific side-by-side traditionally formulated cost-benefit calculation. The Company's analysis does not attempt to identify and quantify the costs and benefits of the GSMP II proposal, instead it only calculates the estimated O&M savings that could occur if the GSMP II is approved as proposed.

Q. HAVE YOU CONDUCTED AN ANALYSIS OF THE NET ECONOMIC BENEFITS THAT WILL RESULT FROM THE GSMP II?

A. Yes. I have developed estimates of the total net economic benefits associated with the GSMP II. This net economic impact analysis includes both positive economic impacts associated with the construction and energy savings as well as the negative economic impacts associated with the rate increases. These costs and benefits are used in conjunction with IMPLAN economic analysis modeling software to estimate the multiplier effects. These indirect multiplier effects are the result of two types of impacts: indirect and induced. The indirect impacts are the additional expenditures made by firms in response to the initial direct "shock" to the economy. The induced impacts are further economic impacts created from the incomes or losses generated by the direct

[76] Company's response to RCR-A-0002, Attachment RCR-A_0002_Exhibit1.19-1.20 Workpaper.xlsx.

and indirect impacts. Combined, the direct, indirect, and induced impacts comprise the total impact that an expenditure has on the economy.

Q. PLEASE DESCRIBE THE IMPLAN MODEL.

A. 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."[77] 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."[78] The commodity flows between industries are what drive the economic 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").[79]

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

[77] Lindall, Scott A., and Douglas C. Olson. "The IMPLAN input-output system." *Stillwater MN* (1996).
[78] IMPLAN Professional User Guide (2004), Minnesota IMPLAN Group, Inc., 3 ed, p. 74.
[79] Hartgen, David T. Traffic Congestion in North Carolina. Status, Prospects and Solutions. March 2007.

states including Arizona, Wisconsin, Nebraska, Colorado, Texas, and Washington.[80] In fact, the Clean Energy States Alliance cites IMPLAN as an appropriate model for evaluating the benefits and costs of an RPS.[81] 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.[82] 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[83] as well as the MAG-PLAN Alaska model.[84] I personally have worked with IMPLAN in estimating economic impacts of similar infrastructure investments for over 15 years. IMPLAN has also been used to model a number of non-energy based natural resource impacts by federal agencies such as the U.S. Department of Transportation ("USDOT") and the U.S. Department of Agriculture ("USDA").[85]

Q. HOW IS YOUR NET BENEFITS ANALYSIS ORGANIZED?

A. The following subsections of my testimony discuss the individual components of my net benefits analysis. The first subsection addresses the construction related benefits associated with the Company's GSMP II proposal. These benefits are usually related to the large, but one-time capital expenditures associated with the replacement activities being proposed in the Company's plan. The second subsection addresses the operational benefits of the GSMP II program. These

[80] 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.
[81] Clean Energy States Alliance. Evaluating the Benefits and Costs of a Renewable Portfolio Standard. A Guide for State RPS Programs. May 2012, p.15.
[82] Edward J. Bloustein School of Planning and Public Policy, Rutgers University. *Economic Impacts of Energy Infrastructure Investment.* October 2010.
[83] 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.
[84] U.S. Department of the Interior: Bureau of Ocean Energy Management. *MAG-PLAN Alaska Update.* May 2012.
[85] 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.

operational benefits, while meaningful, are usually much smaller than large capital investments that often include large amounts of equipment procurement and construction activities. Operational benefits, however, are usually not restricted to a fixed period of time (the construction and development period) and often last over the life of the replacements or equipment upgrades. The third subsection quantifies the economic impacts associated with the rate increases that will be needed to finance the GSMP II program. Rate increases usually have negative regional economic impacts, other things being equal, since they displace the use of income for purchases in the regional economy to paying natural gas bills designed to fund this program. The fourth subsection addresses the environmental benefits associated with the GSMP II program and these benefits usually arise from the reduced GHG emissions that come from replacement programs of this nature. Lastly, the final subsection will tally up all the economic benefits and all the economic costs to come up with a "net" economic benefits estimate for the GSMP II program.

B. Construction Related Benefits

Q. HAVE YOU PREPARED ANY ESTIMATES OF THE POSITIVE, CONSTRUCTION-RELATED ECONOMIC BENEFITS LIKELY TO ARISE FROM THE COMPANY'S GSMP II PROPOSAL?

A. Yes. I have taken the expenditure timeline provided by the Company,[86] and adjusted that annual construction profile based on the share of expenditures that are expected to occur in state.[87] These estimated in-state expenditures are then used to "shock" the appropriate IMPLAN sectors

[86] Company's Response to RCR-POL-0077, LMO Breakdown - CONFIDENTIAL.xlsx.

[87] New Jersey, like any other state, purchases a wide variety of goods and services from outside of the state. These out-of-state expenditures are often referred to as "leakages" in regional economic impact analysis. The share of in-state expenditures is based on sector-specific in-state expenditure profiles included in IMPLAN economic analysis modeling software. These in-state expenditure profiles are based upon what is commonly referred to as a set of Regional Purchasing Coefficients ("RPCs") included in the IMPLAN model. These RPCs simply estimate the percent of any given industry's/sector's demand met by in-state suppliers/producers.

of the New Jersey economy. The positive economic impacts associated with the construction of the GSMP II proposal program are presented in Schedule DED-26, and show that the program will lead to an increase in NPV output of $3.56 billion, will increase total employment over the entire period of the program by almost 14,925 job years, will increase labor income by an NPV $950.88 million and will provide an additional NPV $1.48 billion in value added to the New Jersey economy.

C. Operational Benefits

Q. DID THE COMPANY ESTIMATE ANY OPERATIONAL BENEFITS ASSOCIATED WITH PROPOSED GSMP II?

A. Yes. As noted earlier, the Company quantitatively estimated Company avoided O&M expenses that will result from the proposed GSMP II.[88] These benefits result from reduced O&M costs associated with modern plastic and protected steel materials compared with existing unprotected steel.

Q. HAVE YOU INCORPORATED THESE BENEFITS INTO YOUR ANALYSIS?

A. Yes. I incorporated the Company's estimates of O&M savings into my analysis. In addition, I estimated another benefit that the Company did not quantify, that is the non-environmental benefit of reducing leaks by applying the average differential between New Jersey city gate natural gas prices and wholesale Henry Hub natural gas prices since the year 2000 to projected Henry Hub natural gas prices included within the Energy Information Administration's ("EIA") most recent Annual Energy Outlook ("AEO").

[88] Direct Testimony of Wade E. Miller, Exhibit 1.19.

Q. HAVE YOU PREPARED ANY ESTIMATES OF THE VALUE OF THE OPERATIONAL BENEFITS LIKELY TO ARISE FROM THE COMPANY'S GSMP II PROPOSAL?

A. Yes. As shown in Schedule DED-27, I have estimated direct, indirect and induced benefits associated with these operational benefits. The operational savings associated with the GSMP II will eventually be realized by ratepayers in the form of lower rates as the Company's operating costs decrease relative to current levels. Therefore, to estimate these benefits, I allocated the direct benefits in the same manner that I allocated the rate increases caused by the GSMP II described later. As shown in Schedule DED-27, the positive economic impacts associated with the operational benefits of the GSMP II will lead to an increase in NPV output of $125.29 million, and will increase total employment over the entire period of the program by 2,193 job years. Additionally, these benefits will increase labor income by $76.27 million (NPV) and provide an additional $95.21 million (NPV) in value added to the New Jersey economy. These economic benefits would occur over the full depreciable life of the installed facilities under the Company's program.

D. Rate Impacts

Q. PLEASE DISCUSS THE RESULTS OF YOUR RATE IMPACT ANALYSIS.

A. The results of my rate impact analysis have been provided in Schedule DED-28. Similar to my analysis on the economic benefits, I present both the annual rate impacts associated with the Company's GSMP II and the multiplier impacts associated with reduced disposable income for residential customers and increased costs for commercial and industrial customers associated with higher bills. The total economic impact of these rate increases are anticipated to be $5.82 billion in reduced economic output on an NPV basis and a reduction of total New Jersey employment of

approximately 73,000 job-years. Thus, the GSMP II will have a significant negative impact on the New Jersey economy that needs to be considered in conjunction with project benefits.

E. Environmental Benefits

Q. ARE THERE ANY OTHER QUANTIFIABLE BENEFITS ASSOCIATED WITH THE PROGRAM THAT ARE NOT INCORPORATED DIRECTLY INTO THE ECONOMIC IMPACT MODEL?

A. Yes, the Company states that the GSMP II has the potential for "significant" reductions in greenhouse gas emissions ("GHG")[89] and estimates a reduction of 199,000 metric tons of CO2 equivalent emissions for the "continued five year program" [90], and a cumulative annual reduction of approximately 599,000 metric tons of CO2 equivalent emissions at the completion of all cast-iron and unprotected steel replacement and rehabilitation.[91] Specifically, these benefits are associated with reduced methane emissions on the Company's gas distribution system occurring as the Company replaces older, leak-prone, unprotected steel assets with newer plastic and protected steel facilities. The Company estimated reduced methane emissions from reduced leaks on the Company's system by comparing the default factors for replaced versus new distribution system materials outlined by the Environmental Protection Agency's mandatory greenhouse gas reporting.[92] While the value of these reduced greenhouse gases can be considered when assessing the costs and benefits of the program, these are not incorporated into economic impact model presented above.

Q. IS THERE ANY DEFICIENCY IN THE COMPANY'S ESTIMATE OF ENVIRONMENTAL BENEFITS ARISING FROM THE GSMP II?

[89] Direct Testimony of Wade E. Miller, 72:5-6.
[90] Direct Testimony of Wade E. Miller, 72:16-18.
[91] Direct Testimony of Wade E. Miller, 73:2-4.
[92] Direct Testimony of Wade E. Miller, 72:6-7; and 40 CFR 98, Table W-7.

A. Yes. The Company importantly only provides an estimate of gross methane emission reductions, without providing a quantified impact this reduction will impart to the Company or Company ratepayers in terms of monetary benefits. I have taken these estimated emission reductions and applied the most recent clearing price shown in the Regional Greenhouse Gas Initiative ("RGGI") auction of $3.80 per ton[93] to provide a monetary benefit associated with the estimated methane emission reductions. This results in monetized environmental benefits of approximately $834,078 per year once all proposed improvements are complete.

Q. HOW DOES THE INCORPORATION OF ENVIRONMENTAL BENEFITS AFFECT THIS ANALYSIS?

A. The estimated monetary benefit of reduced GHG emissions associated with the proposed GSMP II is $834,078 per year, or an NPV of less than $12 million, or less than one-half of one percent of the estimated net contraction of New Jersey economic output found by my analysis. Therefore, environmental benefits from the proposed program do not materially affect the conclusion of my economic impact analysis.

F. Net Economic Benefit Results

Q. WILL THE GSMP RESULT IN POSITIVE NET ECONOMIC BENEFITS?

A. No, and this overall negative net benefit is provided in Schedule DED-29. As I noted earlier, the net economic impacts of the program provided in this schedule represent the difference between the total benefits associated with the project (construction expenditures, environmental benefits) and the total costs associated with the project (rate impacts, reduced economic activity). The results of this analysis show that the Program is likely to lead to a net contraction of New Jersey economic output of $2.76 billion (NPV basis) and a reduction in New Jersey employment

[93] See, Regional Greenhouse Initiative Auction 38 results at: https://www.rggi.org/market/co2_auctions/results.

by 55,890 job-years. Likewise, the proposed GSMP II is estimated to reduce labor income in New Jersey by $2.52 billion (NPV basis) and economic value added by $2.85 billion (NPV basis).

IX. Conclusion and Recommendations

Q. WOULD YOU PLEASE SUMMARIZE YOUR PRIMARY FINDINGS AND RECOMMENDATION REGARDING THE COMPANY'S GSMP II PROPOSAL?

A. The Company has not shown a need for the proposed GSMP II. The Company's proposed GSMP II is very large, will result in significant rate impacts as proposed, and its associated cost recovery mechanism suffers from a number of program design deficiencies. In addition, the Company's proposed GSMP II appears to be misguided and does not correctly focus on the most serious current problems that require attention. Instead the Company is proposing a type of "replace all" approach with the overall program goal of system modernization. As detailed in the testimony of Mr. McGee, the Company's proposed replacement program incorrectly prioritizes the replacement of all cast iron and unprotected steel mains in a manner different from the hazard index approach used in the GSMP I. The GSMP II contains certain wholesale replacement approaches, targeting certain mains (such as EPCI mains) with a potential to leak or break, rather than a program targeted to mains with prior breaks or to mains with major safety problems. Moreover, the Company's proposed GSMP II program goes beyond the replacements currently made under the approved GSMP I. Therefore, I recommend that the Board reject the Company's proposed GSMP II.

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

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

1) The GSMP II should be limited to three years and include the replacement of Utilization Pressure Cast Iron ("UPCI") and unprotected steel mains and the associated services as well as the installation of excess flow values and abandonment of district regulators where necessary. The program should include the replacement of approximately 370 miles of UPCI and unprotected steel mains and associated services.

2) No costs associated with replacement of elevated pressure ("EP") cast iron mains, meters, or the relocation of inside meter sets to outside should be included in the program. Program costs should also exclude the replacement of plastic and protected steel mains and the costs associated with EPCI bell joint encapsulation.

3) Replacement prioritization should be on the most risky pipe/most leak prone pipe. In order to be a true extension of the GSMP I, the replacement under GSMP II should be limited to the same replacement activities approved in the GSMP I program. The program should follow the prioritization based on the hazard-index method recommended by Mr. McGee.

4) The program should include performance standards and benchmarks and penalties for failing to meet these performance standards. This would include:

   a. An annual reduction in leaks so that the Company is able to meet or exceed its total open leak carry-forward targets. The first year target should be set at the average number of open leaks the Company has experienced over the past five years. For each year, after the first year, the leak carry forward cap should be reduced by 1 percent each year for the duration of the GSMP II program. As detailed in the testimony of Mr. McGee.

   b. A penalty if the Company fails to meet this target. In the first two years of its program, the Company should be required to notify the Board and Rate Counsel and schedule a conference to discuss any failure to the leak reduction target. If this failure extends to a three year period, then the Company would reduce its return on equity ("ROE") by 50 basis points until it is able to achieve the leak reduction target.

5) The inclusion of a net total O&M offset of $150,000 per year associated with the leak reductions.

6) The cost of the program should be limited to $650 million over a three year period. The costs should be $1.75 million per mile.[94] This represents 24 percent of the Company's original GSMP proposal request. Costs beyond $650 million may be recovered through a base rate case, if the costs are found to be prudent by the Board.

[94] Company Response to Data Request RCR-A-0002, Attachment RCR-A_0002_Exhibit1.19-1.20 Workpaper.xlsx.

7) A rate impact cap of two percent of total revenues per year should be established as detailed in the testimony of Andrea Crane.

8) Reporting requirements and Minimum Filing Requirement should be similar to those in effect for the current GSMP I.

Q. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY FILED ON JANUARY 19, 2018?

A. Yes it does. However, I reserve the right to supplement my testimony if any updated or additional information becomes available during the course of this proceeding.

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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

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 &
Florida Solar Energy Industries Association, 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.

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.

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2. "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. Synder. *Science of the Total Environment* 618 (2018): 1547-1559.
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5. "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*.
6. "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.
7. "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).
8. "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.
9. "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*)
10. "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.
11. "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.

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13. "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.

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15. "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.

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

18. "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.

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PUBLICATIONS: PEER REVIEWED PROCEEDINGS

1. "Hydraulic Fracturing: A Look at Efficiency and the Environmental Effects of Fracking" (2014). With Emily C. Jackson. *Environmental Science and Technology: Proceedings from the 7th International Conference on Environmental Science and Technology*. Volume1 of 2: edited by George A. Sorial and Jihua Hong. (Houston, TX: American Science Press, ISBN: 978-0976885368): 42-46.

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3. "Technology Based Ethical Issues Surrounding the California Energy Crisis." (2002). With Robert F. Cope III and John Yeargain. *Proceedings of the Academy of Legal, Ethical, and Regulatory Issues*. September: 17-21.

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.

7. "New Paradigms for Power Engineering Education." (1997). With Fred I. Denny. *Proceedings of the International Association of Science and Technology for Development*. October: 499-504.

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.

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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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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.

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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.

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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.

PUBLICATIONS: BOOK REVIEWS

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.

15. “Competitive Bidding as a Means of Securing Opportunities for Efficiency.” (2004). With Elizabeth A. Downer. *Electricity and Natural Gas* 21 (4): 15-21.

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.

17. “The Challenges Associated with a Nuclear Power Revival: Its Past.” (2004). With K.E. Hughes II. *Oil, Gas and Energy Quarterly*. 53 (1): 193-211.

18. “Deregulation of Generating Assets and The Disposition of Excess Deferred Federal Income Taxes: A ‘Catch-22’ for Ratepayers.” (2004). With K.E. Hughes II. *Oil, Gas and Energy Quarterly*. 52: 873-891.

19. “Will Competitive Bidding Make a Comeback?” (2004). With K.E. Hughes II. *Oil, Gas and Energy Quarterly*. 52: 659-674

20. “An Electric Utility’s Exposure to Future Environmental Costs: Does It Matter? You Bet!” (2003). With K.E. Hughes II. *Oil, Gas and Energy Quarterly*. 52: 457-469.

21. “White Paper or White Flag: Do FERC’s Concessions Represent A Withdrawal from Wholesale Power Market Reform?” (2003). With K.E. Hughes II. *Oil, Gas and Energy Quarterly*. 52: 197-207.

22. “Clear Skies” or Storm Clouds Ahead? The Continuing Debate over Air Pollution and Climate Change” (2003). With K.E. Hughes II. *Oil, Gas and Energy Quarterly*. 51: 823-848.

23. “Economic Displacement Opportunities in Southeastern Power Markets.” (2003). With Dmitry V. Mesyanzhinov. *USAEE Dialogue*. 11: 20-24.

24. "What’s Happened to the Merchant Energy Industry? Issues, Challenges, and Outlook" (2003). With K.E. Hughes II. *Oil, Gas and Energy Quarterly*. 51: 635-652.

25. "Is There a Role for the TVA in Post-Restructured Electric Markets?" (2002). With K.E. Hughes II. *Oil, Gas and Energy Quarterly*. 51: 433-454.

26. “The Role of Alaska North Slope Gas in the Southcentral Alaska Regional Energy Balance.” (2002). With William Nebesky and Dmitry Mesyanzhinov. *Natural Gas Journal*. 19: 10-15.

27. “Standardizing Wholesale Markets For Energy.” (2002). With K.E. Hughes II. *Oil, Gas and Energy Quarterly.* 51: 207-225.

28. “Do Economic Activities Create Different Economic Impacts to Communities Surrounding the Gulf OCS?” (2002). With Williams O. Olatubi. *IAEE Newsletter*. Second Quarter: 16-20.

29. “Will Electric Restructuring Ever Get Back on Track? Texas is not California.” (2002). With K.E. Hughes II. *Oil, Gas and Energy Quarterly.* 50: 943-960.

30. “An Assessment of the Role and Importance of Power Marketers.” (2002). With K.E. Hughes II. *Oil, Gas and Energy Quarterly. 50: 713-731.*

31. “The EPA v. The TVA, et. al. Over New Source Review.” (2001) With K.E. Hughes, II. *Oil, Gas and Energy Quarterly*. 50:531-543.

32. "Energy Policy by Crisis: Proposed Federal Changes for the Electric Power Industry." (2001). With K.E. Hughes II. *Oil, Gas and Energy Quarterly*. 50:235-249.

33. "A is for Access: A Definitional Tour Through Today's Energy Vocabulary." (2001). With K.E. Hughes II. *Oil, Gas and Energy Quarterly*. 49:947-973.

34. "California Dreaming: Are Competitive Markets Achievable?" (2001). With K.E. Hughes II. *Oil, Gas and Energy Quarterly*. 49: 743-759.

35. "Distributed Energy Must Be Watched As Opportunity for Gas Companies." (2001). With Martin Collette, and Ritchie D. Priddy. *Natural Gas Journal*. January: 9-16.

36. "Clean Air, Kyoto, and the Boy Who Cried Wolf." (2000). With K.E. Hughes II. *Oil, Gas and Energy Quarterly*. December: 529-540.

37. "Energy Conservation Programs and Electric Restructuring: Is There a Conflict?" (2000). With K.E. Hughes II. *Oil, Gas and Energy Quarterly*. September: 211-224.

38. "The Post-Restructuring Consolidation of Nuclear-Power Generation in the Electric Power Industry." (2000) With K.E. Hughes II. *Oil, Gas and Energy Quarterly*. 49: 751-765.

39. "Issues and Opportunities for Small Scale Electricity Production in the Oil Patch." (2000). With Ritchie D. Priddy. *American Oil and Gas Reporter*. 49: 78-82.

40. "Distributed Energy Resources: The Next Paradigm Shift in the Electric Power Industry." (2000). With K.E. Hughes II *Oil, Gas and Energy Quarterly*. 48:593-602.

41. "Coming to a neighborhood near you: the merchant electric power plant." (1999). With K.E. Hughes II. *Oil, Gas, and Energy Quarterly.* 48:433-441.

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44. "Reliability or profit? Why Entergy quit the Southwest Power Pool." (1998). With Fred I. Denny. *Public Utilities Fortnightly*. February 1: 30-33.

45. "Electric utility mergers and acquisitions: a regulator's guide." (1996). With Kimberly H. Dismukes. *Public Utilities Fortnightly.* January 1.

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16. *The Impact of Legacy Lawsuits on Conventional Oil and Gas Drilling in Louisiana*. (2012). Baton Rouge, LA: LSU Center for Energy Studies, 62 pp.

17. *Diversifying Energy Industry Risk in the GOM: Post-2004 Changes in Offshore Oil and Gas Insurance Markets*. (2011) With Christopher P. Peters. U.S. Department of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico Region, New Orleans, LA. OCS Study BOEM 2011-054. 95pp.

18. *OCS-Related Infrastructure Fact Book. Volume I: Post-Hurricane Impact Assessment*. (2011). U.S. Department of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico Region, New Orleans, LA. OCS Study BOEM 2011-043. 372 pp.

19. *Fact Book: Offshore Oil and Gas Industry Support Sectors*. (2010). U.S. Department of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico Region, New Orleans, LA. OCS Study BOEM 2010-042. 138pp.

20. *The Impacts of Greenhouse Gas Regulation on the Louisiana Economy*. (2011). With Michael D. McDaniel, Christopher Peters, Kathryn R. Perry, and Lauren L. Stuart. Louisiana Greenhouse Gas Inventory Project, Task 3 and 4 Report. Prepared for the Louisiana Department of Economic Development. Baton Rouge, LA: LSU Center for Energy Studies, 134 pp.

21. *Overview of States' Climate Action and/or Alternative Energy Policy Measures*. (2010). With Michael D. McDaniel, Christopher Peters, Kathryn R. Perry, and Lauren L. Stuart. Louisiana Greenhouse Gas Inventory Project, Task 2 Report. Prepared for the Louisiana Department of Economic Development. Baton Rouge, LA: LSU Center for Energy Studies, 30 pp.

22. *Louisiana Greenhouse Gas Inventory*. (2010). With Michael D. McDaniel, Christopher Peters, Kathryn R. Perry, Lauren L. Stuart, and Jordan L. Gilmore. Louisiana Greenhouse

Gas Inventory Project, Task 1 Report. Prepared for the Louisiana Department of Economic Development. Baton Rouge, LA: LSU Center for Energy Studies, 114 pp.

23. *Opportunities for Geo-pressured Thermal Energy in Southwestern Louisiana*. (2010). Report prepared on behalf of Louisiana Geothermal, L.L.C, 41 pp.

24. *Economic and Energy Market Benefits of the Proposed Cavern Expansions at the Jefferson Island Storage and Hub Facility*. (2009). Report prepared on behalf of Jefferson Island Storage and Hub, LLC, 28 pp.

25. *The Benefits of Continued and Expanded Investments in the Port of Venice*. (2009). With Christopher Peters and Kathryn Perry. Baton Rouge, LA: LSU Center for Energy Studies. 83 pp.

26. *Examination of the Development of Liquefied Natural Gas on the Gulf of Mexico*. (2008). U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA OCS Study MMS 2008-017. 106 pp.

27. *Gulf of Mexico OCS Oil and Gas Scenario Examination: Onshore Waste Disposal*. (2007). With Michelle Barnett, Derek Vitrano, and Kristen Strellec. OCS Report, MMS 2007-051. New Orleans, LA: U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico Region.

28. *Economic Impact Analysis of the Proposed Lake Charles Gasification Project*. (2007). Report Prepared on Behalf of Leucadia Corporation.

29. *The Economic Impacts of New Jersey's Proposed Renewable Portfolio Standard.* (2005) Report Prepared on Behalf of the New Jersey Division of Ratepayer Advocate.

30. *The Importance of Energy Production and Infrastructure in Plaquemines Parish*. (2006). Report Prepared on Behalf of Project Rebuild Plaquemines.

31. *Louisiana's Oil and Gas Industry: A Study of the Recent Deterioration in-State Drilling Activity*. (2005). With Kristi A.R. Darby, Jeffrey M. Burke, and Robert H. Baumann. Baton Rouge, LA: Louisiana Department of Natural Resources.

32. *Comparison of Methods for Estimating the NO_x Emission Impacts of Energy Efficiency and Renewable Energy Projects Shreveport, Louisiana Case Study*. (2005). With Adam Chambers, David Kline, Laura Vimmerstedt, Art Diem, and Dmitry Mesyanzhinov. Golden, Colorado: National Renewable Energy Laboratory.

33. *Economic Opportunities for a Limited Industrial Retail Choice Plan in Louisiana*. (2004). With Elizabeth A. Downer and Dmitry V. Mesyanzhinov. Baton Rouge, LA: Louisiana State University Center for Energy Studies.

34. *Economic Opportunities for LNG Development in Louisiana*. (2004). With Elizabeth A. Downer and Dmitry V. Mesyanzhinov. Baton Rouge, LA: Louisiana Department of Economic Development and Greater New Orleans, Inc.

35. *Marginal Oil and Gas Production in Louisiana: An Empirical Examination of State Activities and Policy Mechanisms for Stimulating Additional Production*. (2004). With Dmitry V. Mesyanzhinov, Jeffrey M. Burke, Robert H. Baumann. Baton Rouge, LA: Louisiana Department of Natural Resources, Office of Mineral Resources.

36. *Deepwater Program: OCS-Related Infrastructure in the Gulf of Mexico Fact Book.* (2004). With Louis Berger Associates, University of New Orleans National Ports and Waterways

Institute, and Research and Planning Associates. MMS Study No. 1435-01-99-CT-30955. U.S. Department of the Interior, Minerals Management Service.

37. *The Power of Generation: The Ongoing Benefits of Independent Power Development in Louisiana.* With Dmitry V. Mesyanzhinov, Jeffrey M. Burke, and Elizabeth A. Downer. Baton Rouge, LA: LSU Center for Energy Studies, 2003.

38. *Modeling the Economic Impact of Offshore Oil and Gas Activities in the Gulf of Mexico: Methods and Application.* (2003). With Williams O. Olatubi, Dmitry V. Mesyanzhinov, and Allan G. Pulsipher. Prepared by the Center for Energy Studies, Louisiana State University, Baton Rouge, LA. OCS Study MMS2000-0XX. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA.

39. *An Analysis of the Economic Impacts Associated with Oil and Gas Activities on State Leases*. (2002) With Robert H. Baumann, Dmitry V. Mesyanzhinov, and Allan G. Pulsipher. Baton Rouge, LA: Louisiana Department of Natural Resources, Office of Mineral Resources.

40. *Alaska In-State Natural Gas Demand Study*. (2002). With Dmitry Mesyanzhinov, et.al. Anchorage, Alaska: Alaska Department of Natural Resources, Division of Oil and Gas.

41. *Moving to the Front of the Lines: The Economic Impacts of Independent Power Plant Development in Louisiana*. (2001). With Dmitry Mesyanzhinov and Williams O. Olatubi. Baton Rouge, LA: Louisiana State University, Center for Energy Studies.

42. *The Economic Impacts of Merchant Power Plant Development in Mississippi.* (2001). Report Prepared on Behalf of the US Oil and Gas Association, Alabama and Mississippi Division. Houston, TX: Econ One Research, Inc.

43. *Energy Conservation and Electric Restructuring in Louisiana*. (2000). With Dmitry Mesyanzhinov, Ritchie D. Priddy, Robert F. Cope III, and Vera Tabakova. Baton Rouge, LA: Louisiana State University, Center for Energy Studies.

44. *Assessing the Environmental and Safety Risks of the Expanded Role of Independents in Oil and Gas E&P Operations on the U.S. Gulf of Mexico OCS.* (1996). With Allan Pulsipher, Omowumi Iledare, Dmitry Mesyanzhinov, William Daniel, and Bob Baumann. Baton Rouge, LA: Louisiana State University, Center for Energy Studies.

45. *Restructuring the Electric Utility Industry: Implications for Louisiana.* (1996). With Allan Pulsipher and Kimberly H. Dismukes. Baton Rouge, LA: Louisiana State University, Center for Energy Studies.

GRANT RESEARCH

1. Co-investigator. Estimating offshore Gulf of Mexico carbon capture, sequestration, and utilization opportunities. With Southern States Energy Board, Advanced Resources International, Argonne Laboratories, University of Alabama, University of South Carolina, and Oklahoma State University. U.S. Department of Energy, National Energy Technology Laboratory. $731,031 (LSU share of $4.0 million project, three years, in progress).

2. *Principal Investigator*. Understanding MISO long term infrastructure needs and stakeholder positions. Midcontinent Independent System Operator. Total Project: $9,500, six months. Status: In Progress.

3. *Principal Investigator*. Offshore oil and gas activity impacts on ecosystem services in the

Gulf of Mexico. With Brian F, Snyder. U.S. Department of the Interior, Bureau of Ocean Energy Management. Total Project: $240,982, two years. Status: In Progress.

4. *Principal Investigator*. Economic Impacts of the Bayou Bridge pipeline. With Gregory B, Upton, Jr., Energy Transfer Corporation. $9,900. Status: Completed.

5. *Co-Principal Investigator*. Gulf coast energy outlook and analysis. (2016). With Gregory B. Upton and Mallory Vachon. Regions Bank. Total funding: $20,000, one year. Status: Completed.

6. *Principal Investigator*. GOM energy infrastructure trends and factbook update. (2016). With Gregory B. Upton and Mallory Vachon. U.S. Department of the Interior, Bureau of Ocean Energy Management ("BOEM"). Total funding: $224,995, two years. Status: In progress.

7. *Principal Investigator*. Examining Louisiana's Industrial Carbon Sequestration Potential. Phase 2: Follow-up and estimation. (2016). With Brian F. Snyder. Southern States Energy Board. Total Project: $69,990, three months. Status: Completed.

8. *Principal Investigator*. Examining Louisiana's Industrial Carbon Sequestration Potential. Phase 1: Scoping and Identification. (2016). With Brian F. Snyder. Southern States Energy Board. Total Project: $29,919, three months. Status: Completed.

9. *Principal Investigator*. Energy efficiency building codes for Louisiana. (2016). With Brian F. Snyder. Louisiana Department of Natural Resources. Total Project: $50,000, one year. Status: Completed.

10. *Principal Investigator*. An update of Louisiana's combined heat and power potentials, current utilizations, and barriers to improved operating efficiencies. (2016). Louisiana Department of Natural Resources. Total Project: $90,000, one year. Status: Completed.

11. *Principal Investigator*. Combined Heat and Power Stakeholder Meeting. (2016). Southeastern Energy Efficiency Council. Total Project $9,160, two months. Status: Completed.

12. *Co-Investigator*. "Expanding Ecosystem Service Provisioning from Coastal Restoration to Minimize Environmental and Energy Constraints" (2015). With John Day and Chris D'Elia. Gulf Research Program. Total Project: $147,937. Status: Completed.

13. *Principal Investigator*. "Coastal Marine Institute Administrative Grant" (2104). U.S. Department of the Interior. Total Project $45,000. Status: Completed.

14. *Principal Investigator*. "Analysis of the Potential for Combined Heat and Power (CHP) in Louisiana." (2013). Louisiana Department of Natural Resources. Total Project: $90,000. Status: Completed.

15. *Co-Investigator*. "CNH: A Tale of Two Louisianas: Coupled Natural-Human Dynamics in a Vulnerable Coastal System" (2013) With Nina Lam, Margaret Reams, Kam-Biu Liu, Victor Rivera, and Kelley Pace. National Science Foundation. Total Project: $1.5 million. Status: In Progress (Sept 2012-Feb 2017).

16. *Principal Investigator*. "Examination of Unconventional Natural Gas and Industrial Economic Development" (2012). America's Natural Gas Alliance. Total Project: $48,210. Status: Completed.

17. *Principal Investigator*. "Investigation of the Potential Economic Impacts Associated with

Shell's Proposed Gas-To-Liquids Project" (2012). Shell Oil Company, North America. Total Project: $76,708. Status: Completed.

18. *Principal Investigator*. "Analysis of the Federal Wind Energy Production Tax Credit." American Energy Alliance. Total Project: $20,000. Status: Completed.

19. *Principal Investigator*. "Energy Sector Impacts Associated with the Deepwater Horizon Oil Spill." Louisiana Department of Economic Development. Total Project: approximately $50,000. Status: Completed.

20. *Principal Investigator*. "Economic Contributions and Benefits Support by the Port of Venice." Port of Venice Coalition. Total Project: $20,000. Status: Completed.

21. *Principal Investigator.* "Energy Policy Development in Louisiana." Louisiana Department of Natural Resources. Total Project: $150,000. Status: Completed.

22. *Principal Investigator.* "Preparing Louisiana for the Possible Federal Regulation of Greenhouse Gas Regulation." With Michael D. McDaniel. Louisiana Department of Economic Development. Total Project: $98,543. Status: Completed.

23. *Principal Investigator*. "OCS Studies Review: Louisiana and Texas Oil and Gas Activity and Production Forecast; Pipeline Position Paper; and Geographical Units for Observing and Modeling Socioeconomic Impact of Offshore Activity." (2008). With Mark J. Kaiser and Allan G. Pulsipher. U.S. Department of the Interior, Minerals Management Service. Total Project: $377,917 (3 years). Status: Completed.

24. *Principal Investigator*. "State and Local Level Fiscal Effects of the Offshore Petroleum Industry." (2007). With Loren C. Scott. U.S. Department of the Interior, Minerals Management Service. Total Project: $241,216 (2.5 years). Status: Completed.

25. *Principal Investigator*. "Understanding Current and Projected Gulf OCS Labor and Ports Needs." (2007). With Allan. G. Pulsipher, Kristi A. R. Darby. U.S. Department of the Interior, Minerals Management Service. Total Project: $169,906. (one year). Status: Completed.

26. *Principal Investigator*. "Structural Shifts and Concentration of Regional Economic Activity Supporting GOM Offshore Oil and Gas Activities." (2007). With Allan. G. Pulsipher, Michelle Barnett. U.S. Department of the Interior, Minerals Management Service. Total Project: $78,374 (one year). Status: Awarded, In Progress.

27. *Principal Investigator*. "Plaquemine Parish's Role in Supporting Critical Energy Infrastructure and Production." (2006). With Seth Cureington. Plaquemines Parish Government, Office of the Parish President and Plaquemines Association of Business and Industry. Total Project: $18,267. Status: Completed.

28. *Principal Investigator*. "Diversifying Energy Industry Risk in the Gulf of Mexico." (2006). With Kristi A. R. Darby. U.S. Department of the Interior, Minerals Management Service. Total Project: $65,302 (two years). Status: Awarded, In Progress.

29. *Principal Investigator*. "Post-Hurricane Assessment of OCS-Related Infrastructure and Communities in the Gulf of Mexico Region." (2006). U.S. Department of the Interior, Minerals Management Service. Total Project Funding: $244,837. Status: In Progress.

30. *Principal Investigator*. "Ultra-Deepwater Road Mapping Process." (2005). With Kristi A. R. Darby, Subcontract with the Texas A&M University, Department of Petroleum Engineering. Funded by the Gas Technology Institute. Total Project Funding: $15,000.

Status: Completed.

31. *Principal Investigator*. "An Examination of the Opportunities for Drilling Incentives on State Leases." (2004). With Robert H. Baumann and Kristi A. R. Darby. Louisiana Office of Mineral Resources. Total Project Funding: $75,000. Status: Completed.

32. *Principal Investigator*. " An Examination on the Development of Liquefied Natural Gas Facilities on the Gulf of Mexico." (2004). With Dmitry V. Mesyanzhinov and Mark J. Kaiser. U.S. Department of the Interior, Minerals Management Service. Total Project Funding $101,054. Status: Completed.

33. *Principal Investigator*. "Examination of the Economic Impacts Associated with Large Customer, Industrial Retail Choice." (2004). With Dmitry V. Mesyanzhinov. Louisiana Mid-Continent Oil and Gas Association. Total Project Funding: $37,000. Status: Completed.

34. *Principal Investigator*. "Economic Opportunities from LNG Development in Louisiana." (2003). With Dmitry V. Mesyanzhinov. Metrovision/New Orleans Chamber of Commerce and the Louisiana Department of Economic Development. Total Project Funding: $25,000. Status: Completed.

35. *Principal Investigator*. "Marginal Oil and Gas Properties on State Leases in Louisiana: An Empirical Examination and Policy Mechanisms for Stimulating Additional Production." (2002). With Robert H. Baumann and Dmitry V. Mesyanzhinov. Louisiana Office of Mineral Resources. Total Project Funding: $72,000. Status: Completed.

36. *Principal Investigator*. "A Collaborative Investigation of Baseline and Scenario Information for Environmental Impact Statements." (2002). With Dmitry V. Mesyanzhinov and Williams O. Olatubi. U.S. Department of Interior, Minerals Management Service. Total Project Funding: $557,744. Status: Awarded, In Progress.

37. *Co-Principal Investigator*. "An Analysis of the Economic Impacts of Drilling and Production Activities on State Leases." (2002). With Robert H. Baumann, Allan G. Pulsipher, and Dmitry V. Mesyanzhinov. Louisiana Office of Mineral Resources. Total Project Funding: $8,000. Status: Completed.

38. *Principal Investigator*. "Cost Profiles and Cost Functions for Gulf of Mexico Oil and Gas Development Phases for Input Output Modeling." (1998). With Dmitry Mesyanzhinov and Allan G. Pulsipher. U.S. Department of Interior, Minerals Management Service. Total Project Funding: $244,956. Status: Completed.

39. *Principal Investigator*. "An Economic Impact Analysis of OCS Activities on Coastal Louisiana." (1998). With Dmitry Mesyanzhinov and David Hughes. U.S. Department of Interior, Minerals Management Service. Total Project Funding: $190,166. Status: Completed.

40. *Principal Investigator*. "Energy Conservation and Electric Restructuring in Louisiana." (1997). Louisiana Department of Natural Resources." Petroleum Violation Escrow Program Funds. Total Project Funding: $43,169. Status: Completed.

41. *Principal Investigator*. "The Industrial Supply of Electricity: Commercial Generation, Self-Generation, and Industry Restructuring." (1996). With Andrew Kleit. Louisiana Energy Enhancement Program, LSU Office of Research and Development. Total Project Funding: $19,948. Status: Completed.

42. *Co-Principal Investigator*. "Assessing the Environmental and Safety Risks of the Expanded Role of Independents in Oil and Gas E&P Operations on the U.S. Gulf of Mexico 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

1. "The changing nature of Gulf of Mexico energy infrastructure." (2017). Session 3B: New Directions in Social Science Research. 27th Gulf of Mexico Region Information Technology Meetings. U.S. Department of the Interior, Bureau of Ocean Energy Management, Environmental Studies Program. New Orleans, LA. August 24.
2. "Capacity utilization, efficiency trends, and economic risks for modern CHP installations." (2017). U.S. Department of Energy, 2017 Industrial Energy Technology Conference, New Orleans, LA June 21.
3. "The Impact of Infrastructure Cost Recovery Mechanisms on Pipeline Replacements and Leaks." (2015). With Gregory Upton. Southern Economic Association Meeting 2015. New Orleans, Louisiana. November 23.
4. "The Impact of Infrastructure Cost Recovery Mechanisms on Pipeline Replacements and Leaks" (2015). With Gregory Upton. 38th IAEE International Conference, Antalya, Turkey. May 26.
5. "Modifying Renewables Policies to Sustain Positive Economic and Environmental Change" (2015). IEEE Annual Green Technologies ("Greentech") Conference. April 17.
6. "The Gulf Coast Industrial Investment Renaissance and New CHP Development Opportunities." (2014). Industrial Energy and Technology Conference, New Orleans, Louisiana. May 20.
7. "Estimating Critical Energy Infrastructure Value at Risk from Coastal Erosion" (2014). With Siddhartha Narra. American's Estuaries: 7th Annual Summit on Coastal and Estuarine Habitat Restoration. Washington, D.C., November 3-6.
8. "Economies of Scale, Learning Curves, and Offshore Wind Development Costs" (2012). With Gregory Upton. Southern Economic Association Annual Conference, New Orleans, LA November 17.
9. "Analysis of Risk and Post-Hurricane Reaction." (2009). 25th Annual Information Transfer Meeting. U.S. Department of the Interior, Minerals Management Service. January 7.
10. "Legacy Litigation, Regulation, and Other Determinants of Interstate Drilling Activity Differentials." (2008). With Christopher Peters and Mark Kaiser. 28th Annual USAEE/IAEE North American Conference: Unveiling the Future of Future of Energy Frontiers. New Orleans, LA, December 3.
11. "Gulf Coast Energy Infrastructure Renaissance: Overview." (2008). 28th Annual USAEE/IAEE North American Conference: Unveiling the Future of Future of Energy Frontiers. New Orleans, LA, December 3.
12. "Understanding the Impacts of Katrina and Rita on Energy Industry Infrastructure." (2008). American Chemical Society National Meetings, New Orleans, Louisiana. April 7.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

ACADEMIC SEMINARS AND PRESENTATIONS

1. "Air Emissions Regulation and Policy: The Recently Proposed Cross State Air Pollution Rule and the Implications for Louisiana Power Generation." Lecture before School of the

Coast & Environment. November 5, 2011.

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

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

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

5. "Hurricane Impacts on Energy Production and Infrastructure." Presentation Before the 53rd Mineral Law Institute, Louisiana State University. April 7, 2006.

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

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

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

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

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

PROFESSIONAL AND CIVIC PRESENTATIONS

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

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

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

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

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

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

7. "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.

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

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

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

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

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

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

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

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

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

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

18. "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.

19. "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.

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

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

22. "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.

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

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

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

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

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

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

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

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

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

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

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

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

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

36. "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.

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

38. "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.

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

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

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

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

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

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

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

46. "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.

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

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

49. "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.

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

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

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

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

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

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

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

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

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

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

60. "Natural Gas & Electric Power Coordination Issues and Challenges." (2013). Utilities State

Government Organization Conference, Pointe Clear, Alabama. July 9.

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

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

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

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

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

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

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

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

69. "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.

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

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

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

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

74. "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.

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

76. "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.

77. "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.

78. "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.

79. "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.

80. "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.

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

82. "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.

83. "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.

84. "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.

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

86. "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.

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

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

89. "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.

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

91. "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.

92. "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.

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

94. "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.

95. "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.

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

97. "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.

98. "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.

99. "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.

100. "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.

101. "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.

102. "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.

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

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

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

106. 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.

107. "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.

108. "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.

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

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

111. "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.

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

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

114. "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.

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

116. "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

117. "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.

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

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

120. "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.

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

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

123. "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.

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

125. "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.

126. "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.

127. "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.

128. "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.

129. "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.

130. "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.

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

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

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

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

135. "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.

136. "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.

137. "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.

138. "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.

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

140. “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.

141. “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.

142. “LNG—A Premier.” (2006). Presentation Given to the U.S. Department of Energy’s “LNG Forums.” Los Angeles, California. June 1, 2006.

143. “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.

144. “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.

145. “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.

146. “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.

147. “LNG—A Premier.” Presentation Given to the U.S. Department of Energy’s “LNG Forums.” Astoria, Washington. April 28, 2006.

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

149. 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.

150. 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

151. 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.

152. “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

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

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

155. “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.

156. “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.

157. “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.

158. “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.

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

160. “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.

161. “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.

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

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

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

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

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

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

168. “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.

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

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

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

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

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

174. “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.

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

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

177. 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.

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

179. “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.

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

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

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

183. “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.

184. “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.

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

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

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

188. "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.

189. "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.

190. "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.

191. "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.

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

193. "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.

194. "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.

195. "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.

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

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

198. "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.

199. "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.

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

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

202. "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.

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

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

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

206. "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.

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

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

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

210. 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.

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

212. "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.

213. "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.

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

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

216. "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.

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

218. "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.

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

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

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

222. "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.

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

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

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

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

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

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

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

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

231. 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.

232. 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. 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.

2. 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.

3. 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.

4. 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.

5. 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.

6. 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.

7. 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.

8. 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.

9. 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.

10. 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.

11. 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.

12. 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.

13. 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.

14. 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.

15. 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.

16. 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.

17. 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.

18. 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.

19. 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.

20. 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.

21. 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.

22. 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.

23. 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.

24. 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.

25. 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.

26. 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.

27. 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.

28. 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.

29. 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.

30. 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.

31. 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.

32. 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.

33. 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.

34. 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.

35. 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.

36. 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.

37. 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.

38. 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.

39. 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

40. 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.

41. 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.

42. 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.

43. 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.

44. 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.

45. 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.

46. 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.

47. 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.

48. 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.

49. 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.

50. 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.

51. 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.

52. 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.

53. 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.

54. 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.

55. 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.

56. 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.

57. 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.

58. 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.

59. 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.

60. 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)

61. 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.

62. 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.

63. 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.

64. 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.

65. 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.

66. 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.

67. 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.

68. 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.

69. 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.

70. 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.

71. 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.

72. 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.

73. 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.

74. 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.

75. 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.

76. 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.

77. 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.

78. 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.

79. 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.

80. 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.

81. 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.

82. 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.

83. 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.

84. 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)

85. 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)

86. 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.

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

88. 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.

89. 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).

90. 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.

91. 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.

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

93. 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.

94. 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.

95. 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.

96. 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)

97. 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.

98. 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.

99. 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.

100. 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).

101. 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.

102. 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.

103. 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.

104. 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)

105. 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.

106. 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.

107. 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).

108. 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.

109. 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.

110. 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

111. 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.

112. 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.

113. 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.

114. 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.

115. 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.

116. 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.

117. 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)

118. 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.

119. 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.

120. 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.

121. 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.

122. 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.

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

124. 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.

125. 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).

126. 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.

127. 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.

128. 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.

129. 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.

130. 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.

131. 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.

132. 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.

133. 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.

134. 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.

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

136. 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.

137. 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.

138. 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.

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).

Table of Schedules

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GSMP II Annual Revenue Requirement by Roll-In Period

Roll-in Filing		Revenue Requirement
Roll-in 1	$	41,151,000
Roll-in 2	$	31,707,000
Roll-in 3	$	30,809,000
Roll-in 4	$	31,766,000
Roll-in 5	$	30,859,000
Roll-in 6	$	31,745,000
Roll-in 7	$	30,909,000
Roll-in 8	$	32,412,000
Roll-in 9	$	44,199,000
Total	**$**	**305,557,000**

Source: Direct Testimony of Stephen Swetz, Schedule SS-GSMPII-3.

GSMP II Monthly Bill Impact

	RSG		GSG		LVG	
	Average Monthly Bill	Monthly Bill Increase	Average Monthly Bill	Monthly Bill Increase	Average Monthly Bill	Monthly Bill Increase
Current	$ 71.89		$ 161.13		$ 2,493.87	
Year 1	$ 75.26	$ 3.37	$ 166.39	$ 5.27	$ 2,552.18	$ 58.31
Year 2	$ 78.14	$ 2.89	$ 170.91	$ 4.52	$ 2,602.01	$ 49.83
Year 3	$ 81.03	$ 2.89	$ 175.44	$ 4.53	$ 2,651.68	$ 49.67
Year 4	$ 83.95	$ 2.92	$ 180.01	$ 4.57	$ 2,701.71	$ 50.04
Year 5	$ 86.00	$ 2.05	$ 183.20	$ 3.19	$ 2,736.53	$ 34.82
Total Monthly Bill Increase (5-year)		**$ 14.11**		**$ 22.08**		**$ 242.66**

	TSG-F		TSG-NF		CIG	
	Average Monthly Bill	Monthly Bill Increase	Average Monthly Bill	Monthly Bill Increase	Average Monthly Bill	Monthly Bill Increase
Current	$ 30,848.80		$ 55,852.94		$ 108,294.09	
Year 1	$ 31,459.24	$ 610.44	$ 56,573.96	$ 721.02	$ 109,803.51	$ 1,509.42
Year 2	$ 31,983.16	$ 523.92	$ 57,190.48	$ 616.53	$ 111,094.57	$ 1,291.07
Year 3	$ 32,507.02	$ 523.85	$ 57,804.32	$ 613.83	$ 112,381.28	$ 1,286.71
Year 4	$ 33,039.89	$ 532.88	$ 58,423.21	$ 618.89	$ 113,681.21	$ 1,299.93
Year 5	$ 33,412.29	$ 372.40	$ 58,854.25	$ 431.05	$ 114,587.63	$ 906.42
Total Monthly Bill Increase (5-year)		**$ 2,563.50**		**$ 3,001.31**		**$ 6,293.54**

Source: Direct Testimony of Stephen Swetz, Schedule SS-GSMPII-6.

GSMP II Annual Bill Impact

	RSG		GSG		LVG	
	Average Annual Bill	Annual Bill Increase	Average Annual Bill	Annual Bill Increase	Average Annual Bill	Annual Bill Increase
Current	$ 862.68		$ 1,933.50		$ 29,926.41	
Year 1	$ 903.06	$ 40.38	$ 1,996.72	$ 63.22	$ 30,626.15	$ 699.74
Year 2	$ 937.70	$ 34.64	$ 2,050.91	$ 54.19	$ 31,224.07	$ 597.92
Year 3	$ 972.36	$ 34.66	$ 2,105.30	$ 54.39	$ 31,820.10	$ 596.03
Year 4	$ 1,007.42	$ 35.06	$ 2,160.12	$ 54.82	$ 32,420.54	$ 600.44
Year 5	$ 1,031.96	$ 24.54	$ 2,198.40	$ 38.28	$ 32,838.35	$ 417.81
Total Annual Bill Increase (5-year)		**$ 169.28**		**$ 264.90**		**$ 2,911.94**

	TSG-F		TSG-NF		CIG	
	Average Annual Bill	Annual Bill Increase	Average Annual Bill	Annual Bill Increase	Average Annual Bill	Annual Bill Increase
Current	$370,185.57		$670,235.28		$1,299,529.09	
Year 1	$377,510.87	$ 7,325.30	$678,887.46	$ 8,652.18	$1,317,642.08	$ 18,112.99
Year 2	$383,797.95	$ 6,287.08	$686,285.79	$ 7,398.33	$1,333,134.88	$ 15,492.80
Year 3	$390,084.18	$ 6,286.23	$693,651.81	$ 7,366.02	$1,348,575.37	$ 15,440.49
Year 4	$396,478.70	$ 6,394.52	$701,078.47	$ 7,426.66	$1,364,174.54	$ 15,599.17
Year 5	$400,947.51	$ 4,468.81	$706,251.03	$ 5,172.56	$1,375,051.58	$ 10,877.04
Total Monthly Bill Increase (5-year)		**$ 30,761.94**		**$ 36,015.75**		**$ 75,522.49**

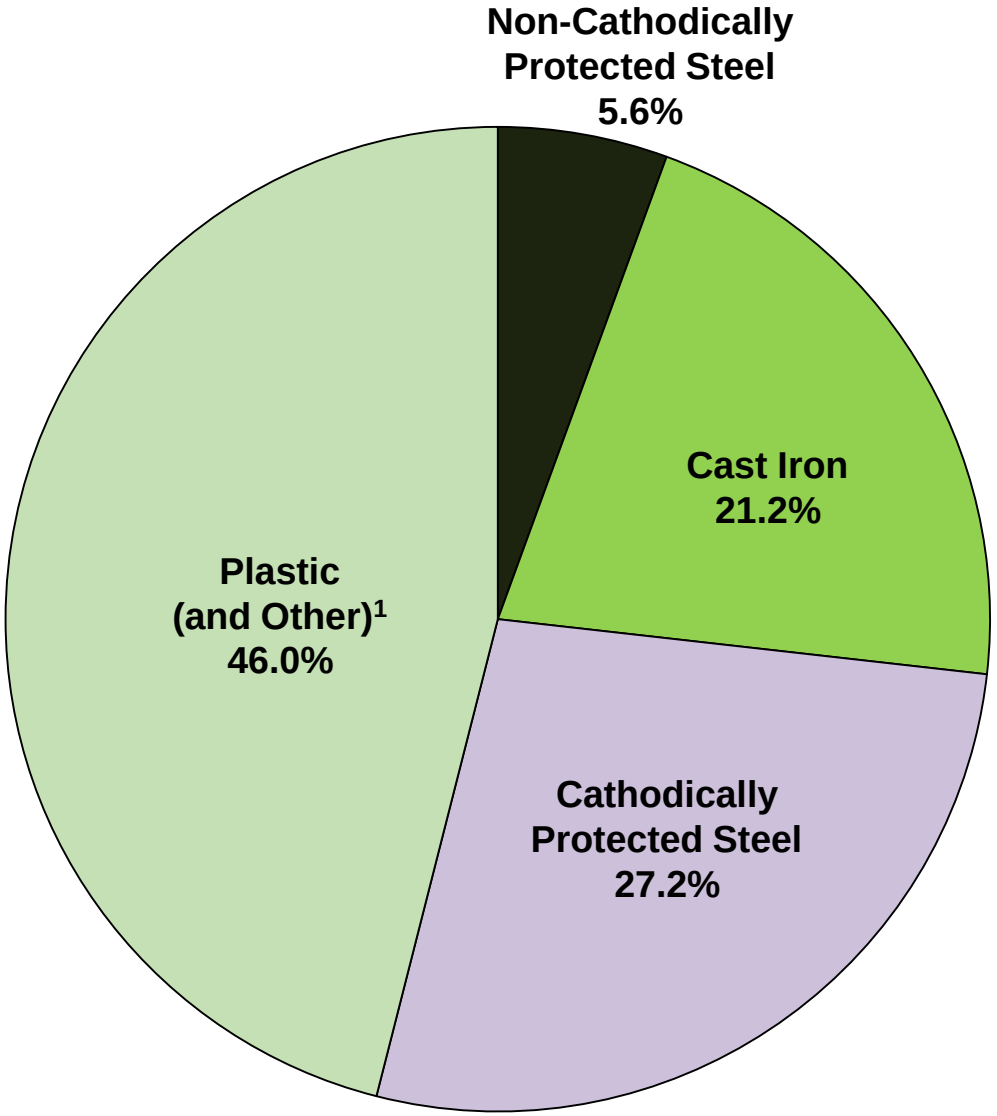
Source: Direct Testimony of Stephen Swetz, Schedule SS-GSMPII-6.

Regional Utility Comparison Group, 2016

	Total Customers	Number of Customers			Percent of Total Customers			Total Sales (Mcf)	Percent of Total Sales		
		Residential	Commercial	Industrial	Residential	Commercial	Industrial		Residential	Commercial	Industrial
					----------(%)----------				----------(%)----------		
Public Service Electric and Gas	1,816,754	1,652,478	157,930	6,346	91.0%	8.7%	0.3%	275,512,336	47.0%	39.9%	13.1%
Regional Utilities:											
NY State Electric & Gas (NY)	264,817	233,880	30,345	592	88.3%	11.5%	0.2%	50,633,551	39.6%	37.0%	23.4%
South Jersey Gas (NJ)	375,301	350,322	24,518	461	93.3%	6.5%	0.1%	46,898,814	49.4%	25.7%	24.9%
Elizabethtown Gas (NJ)	285,690	262,920	22,676	94	92.0%	7.9%	0.0%	45,699,494	46.4%	29.3%	24.4%
Rochester Gas & Electric (NY)	310,641	286,902	23,071	668	92.4%	7.4%	0.2%	48,117,330	51.1%	34.6%	14.3%
UGI Utilities (PA)	386,355	346,756	38,264	1,335	89.8%	9.9%	0.3%	84,703,487	26.8%	31.0%	42.1%
Peoples Natural Gas (PA)	624,822	581,187	43,264	371	93.0%	6.9%	0.1%	107,185,428	46.3%	25.8%	27.9%
Columbia Gas Distribution (PA)	426,248	388,830	37,149	269	91.2%	8.7%	0.1%	70,470,266	42.0%	29.9%	28.1%
PECO Energy (PA)	514,131	469,935	43,385	811	91.4%	8.4%	0.2%	81,298,202	45.4%	23.7%	30.9%
Washington Gas Light (MD)	467,036	440,199	26,837	-	94.3%	5.7%	0.0%	64,823,392	54.4%	45.6%	0.0%
Baltimore Gas & Electric (MD)	667,896	623,647	43,220	1,029	93.4%	6.5%	0.2%	83,678,203	44.8%	42.4%	12.8%
New Jersey Natural Gas (NJ)	525,454	487,743	37,664	47	92.8%	7.2%	0.0%	60,943,675	68.4%	29.2%	2.4%
National Fuel Gas (NY)	528,903	492,981	35,503	419	93.2%	6.7%	0.1%	83,979,305	54.7%	25.9%	19.3%
Niagara Mohawk (NY)	608,833	563,241	45,365	227	92.5%	7.5%	0.0%	106,347,613	43.7%	31.1%	25.2%
Consolidated Edison (NY)	1,077,150	944,108	132,994	48	87.6%	12.3%	0.0%	210,661,675	42.5%	56.7%	0.8%
National Grid (NY)	1,849,471	1,740,352	104,986	4,133	94.1%	5.7%	0.2%	242,669,563	67.7%	31.0%	1.3%

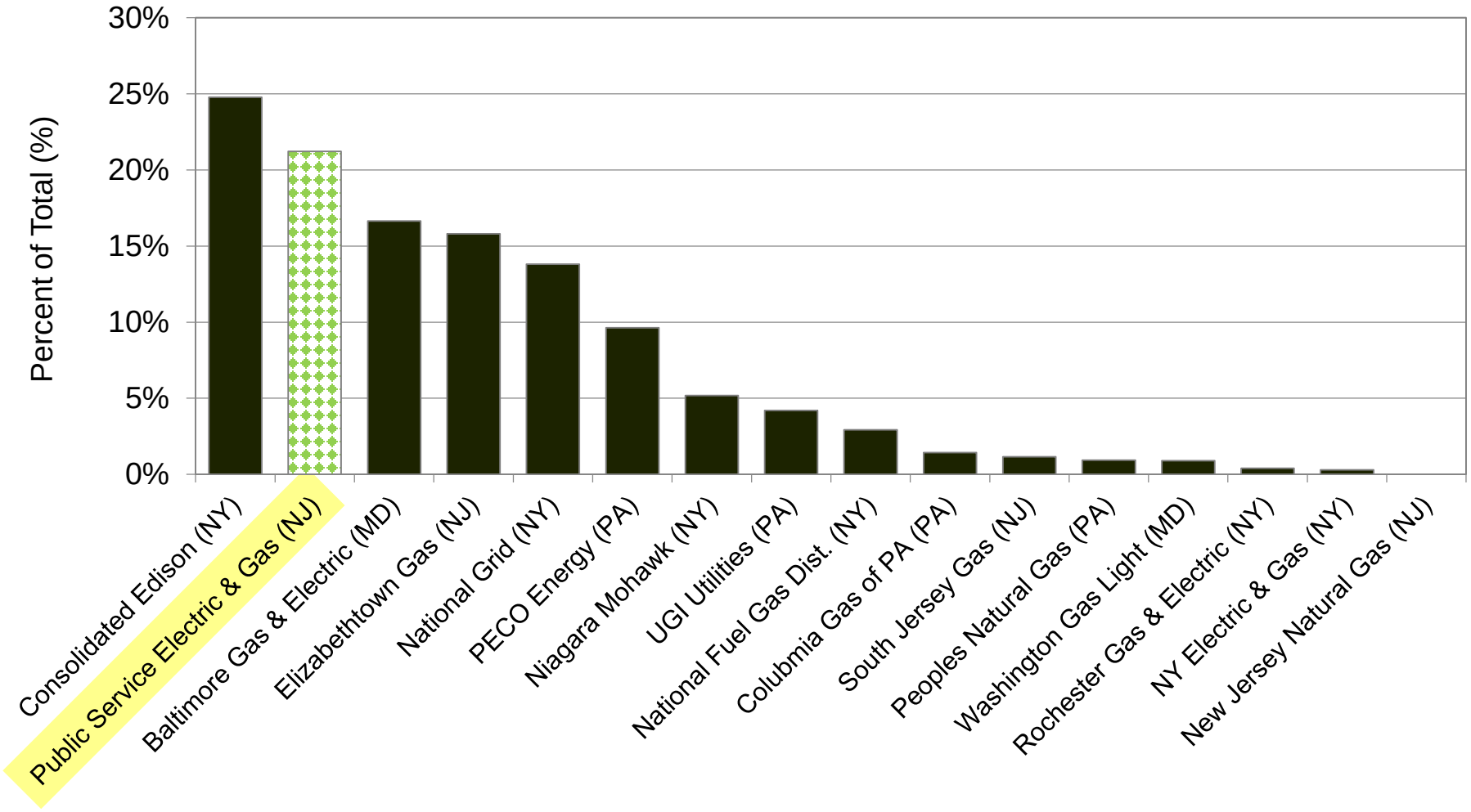
Source: Energy Information Administration, U.S. Department of Energy.

Composition of Public Service Electric & Gas Distribution Mains, 2016



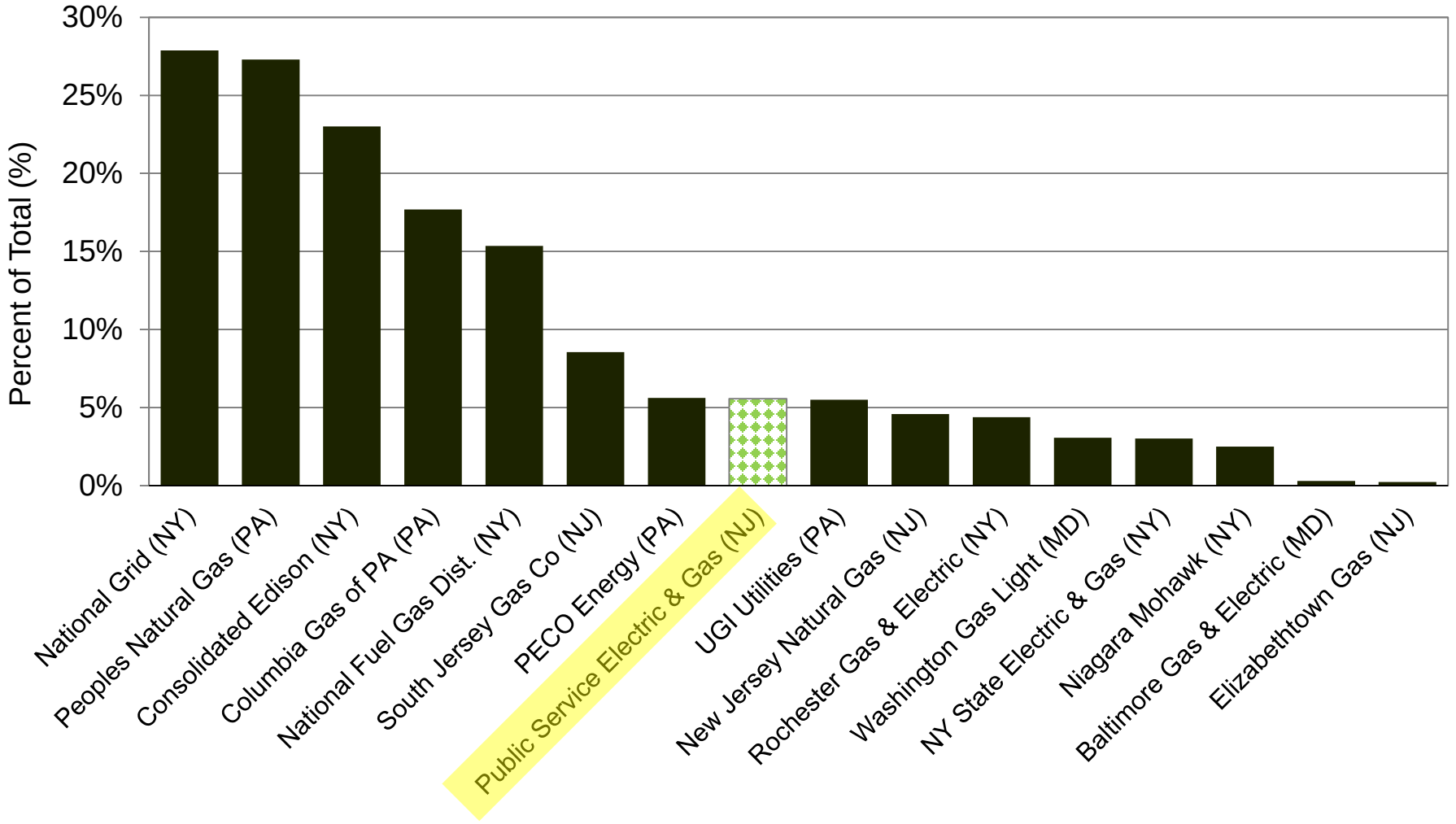
Note: [1] Other includes 0.6 miles of "Copper" main and 2.7 miles of "Other" main.
Source: U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration, Office of Pipeline Safety.

Cast Iron Main as a Percent of Total
Public Service Electric & Gas and Regional Utilities



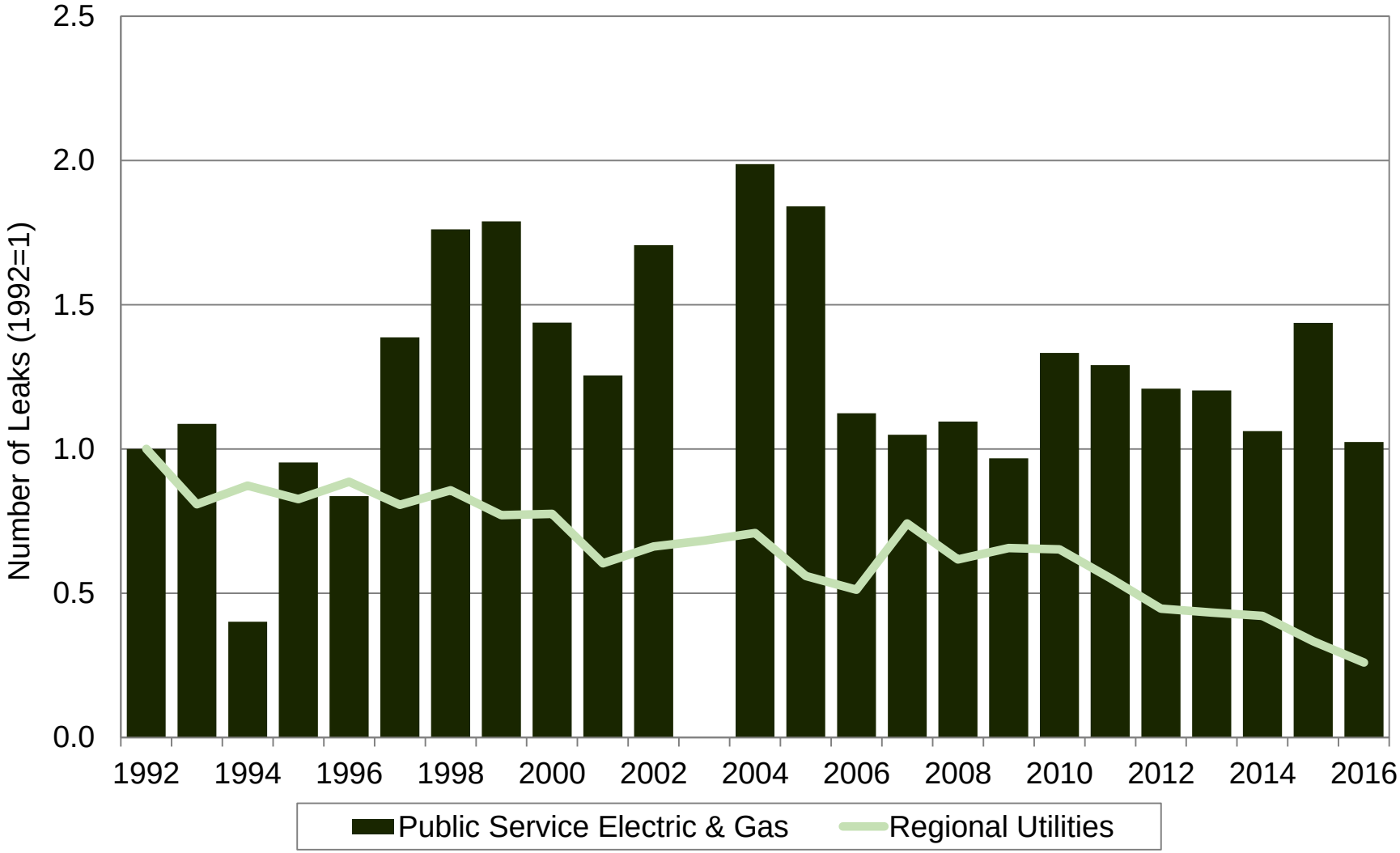
Source: U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration, Office of Pipeline Safety (2016 Inventory).

Unprotected Steel Main as a Percent of Total
Public Service Electric & Gas and Regional Utilities



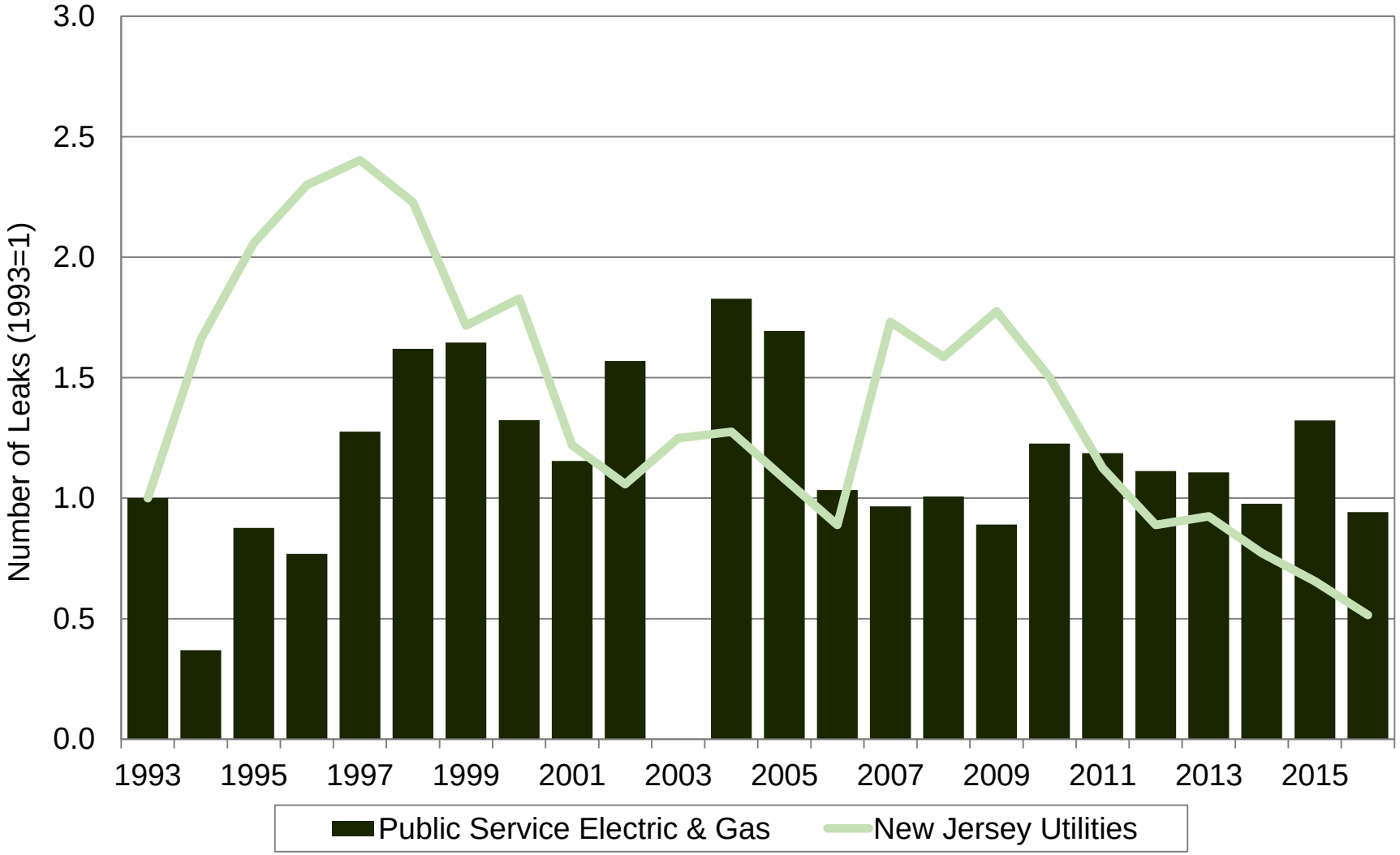
Source: U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration, Office of Pipeline Safety (2016 Inventory).

Number of Known System Leaks at End of Year
Public Service Electric & Gas and Regional Utilities



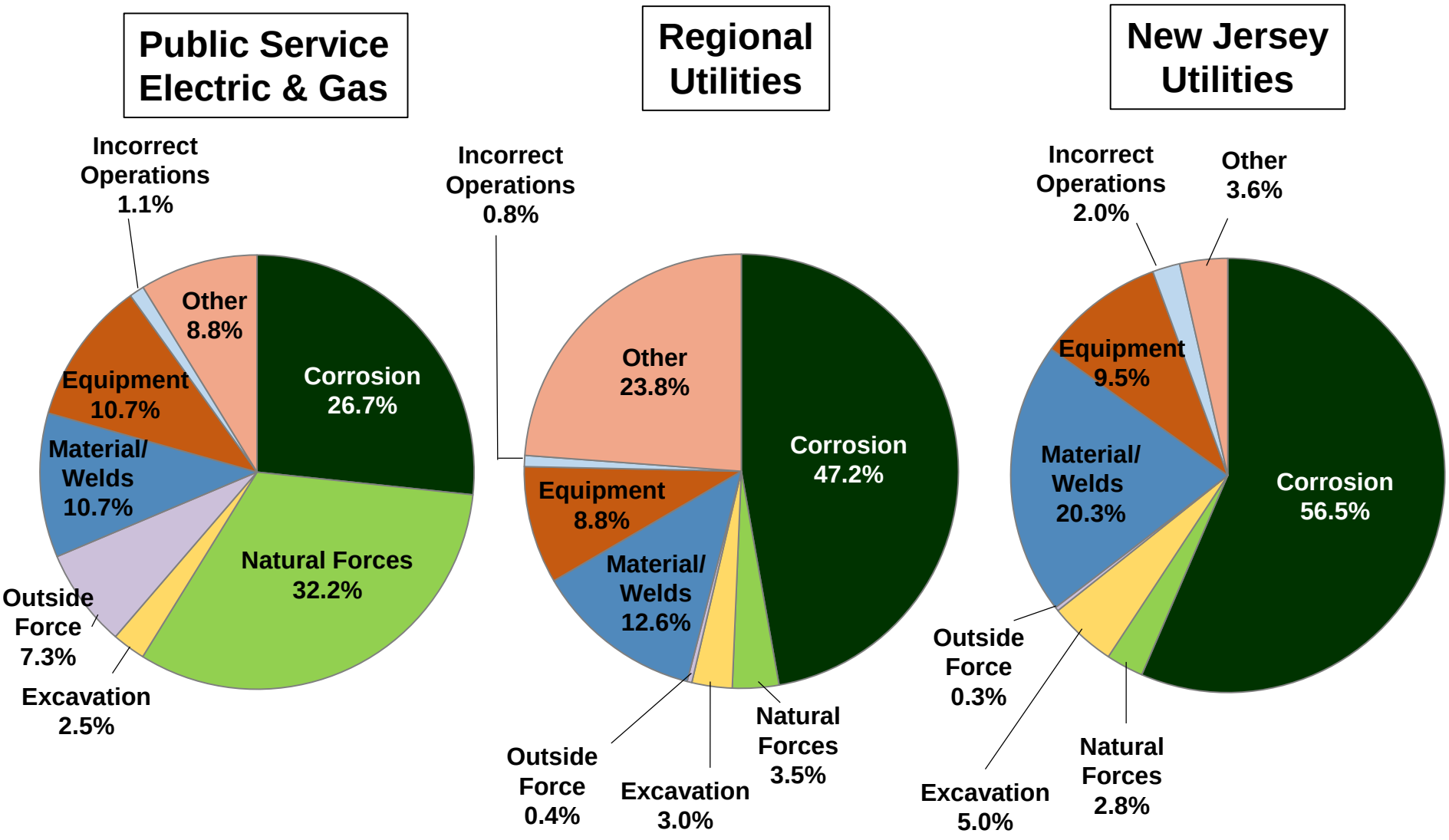
Note: Leak data for Public Service Electric & Gas was not reported in 2003. The statistics included in this chart are indexed to a common year, 1992 (i.e., replacement levels for all utilities equal 1.0 in that year). The 2014-2016 values for Peoples Natural Gas have increased because of its acquisition of Equitable Gas Company.
Source: U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration, Office of Pipeline Safety.

Number of Known System Leaks at End of Year
Public Service Electric & Gas and New Jersey Utilities



Note: 1993 was used as the starting index date for this schedule. New Jersey utilities include South Jersey Gas, New Jersey Natural Gas and Elizabethtown Gas. Leak data for Public Service Electric & Gas was not reported in 2003. The statistics included in this chart are indexed to a common year, 1993 (i.e., replacement levels for all utilities equal 1.0 in that year).
Source: U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration, Office of Pipeline Safety.

Comparison of Mains Leak Repairs by Type, 2016



Note: Totals may not sum to 100% due to rounding. New Jersey Utilities include New Jersey Natural Gas, South Jersey Gas, and Elizabethtown Gas.
Source: U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration, Office of Pipeline Safety.

Miles of Cast Iron and Cast Iron Breaks
Public Service Electric & Gas

Source: Confidential Response to Requests RCR-POL-0005, Attachment “Chart 2 CI Repl + Break History 1971-2015”.

Cast Iron Replacements and Cast Iron Breaks
Public Service Electric & Gas

Source: Confidential Response to Requests RCR-POL-0005, Attachment “Chart 2 CI Repl + Break History 1971-2015”.

Leaks per Mile of Cast Iron Main
Public Service Electric & Gas

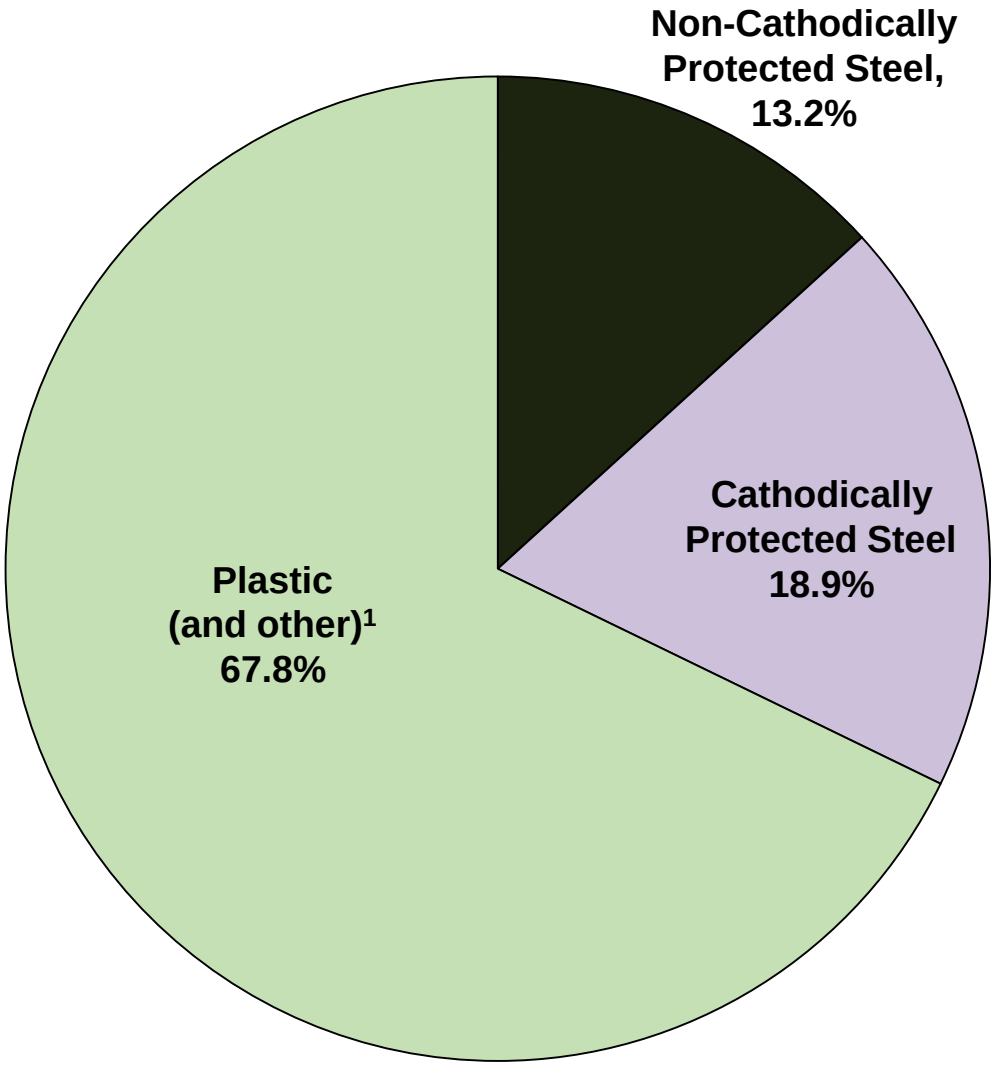
Source: Confidential Response to Requests RCR-POL-0005, Attachment “Chart 2 CI Repl + Break History 1971-2015”.

Public Service Electric & Gas Historical Main Replacements 1997-2016

Year	Accelerated Programs				Base Replacement	Total Replacement
	CIP	CIP II	Energy Strong	GSMP I		
1997					48	48
1998					58	58
1999					61	61
2000					60	60
2001					70	70
2002					73	73
2003					46	46
2004					54	54
2005					69	69
2006					62	62
2007					59	59
2008					80	80
2009	76				24	100
2010	119				23	142
2011	5	19			13	37
2012		27			29	56
2013		1			7	8
2014			98		2	100
2015			136		29	165
2016			6	118	85	209
Total	**200**	**47**	**240**	**118**	**952**	**1557**
Avg. Per Year Per Program	67	16	80	118	47.6	77.9
Average Per Year Pre Accelerated Programs					61.7	61.7
Average Per Year Post Accelerated Programs					26.5	102.1

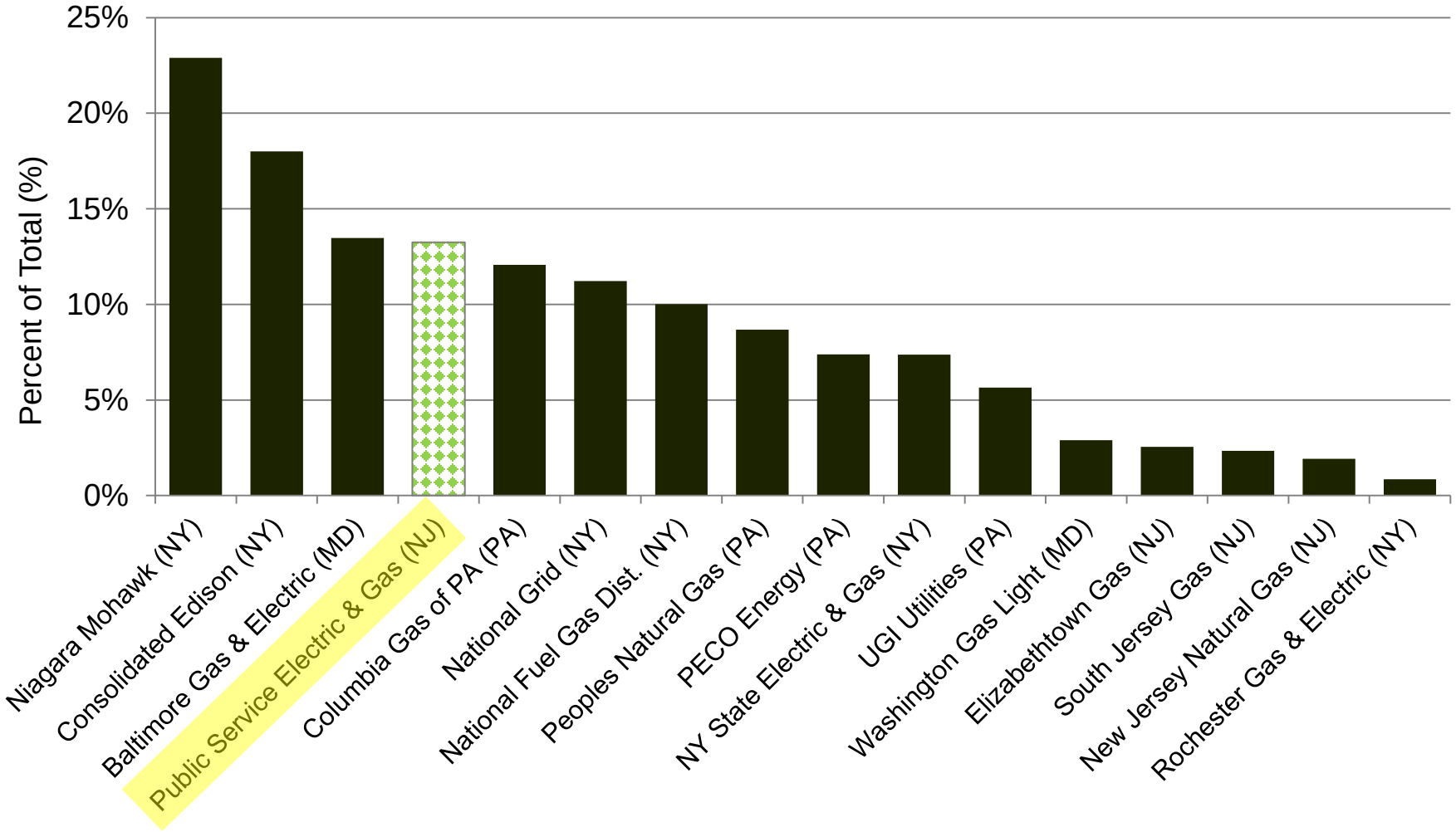
Source: Company's response to RCR-POL-0063.

Composition of Public Service Electric & Gas Distribution Services, 2016



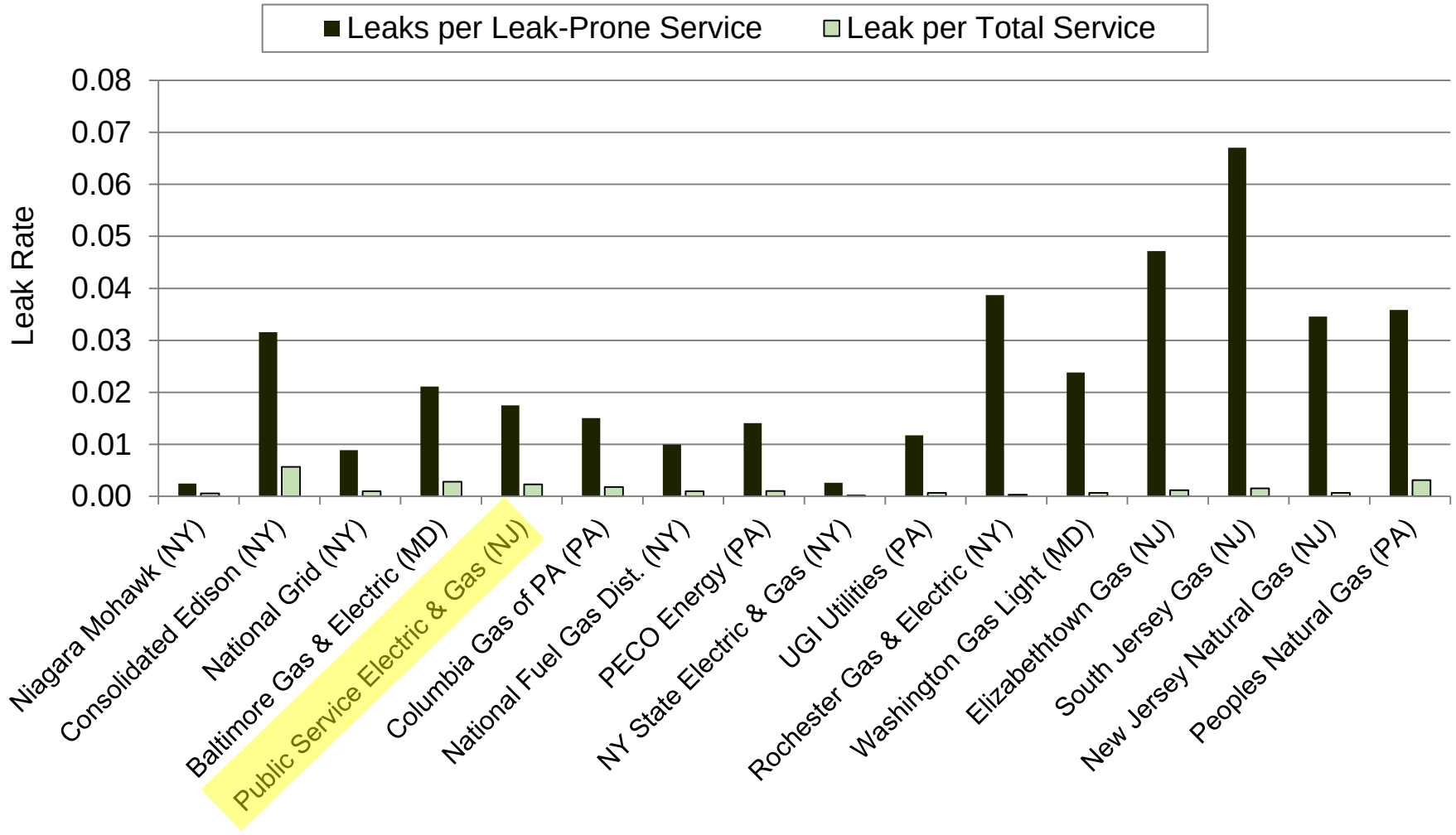
Note: [1] Other includes 2.6% of "Copper" services.
Source: U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration, Office of Pipeline Safety.

Leak Prone Steel Services as a Percent of Total Public Service Electric & Gas and Regional Utilities



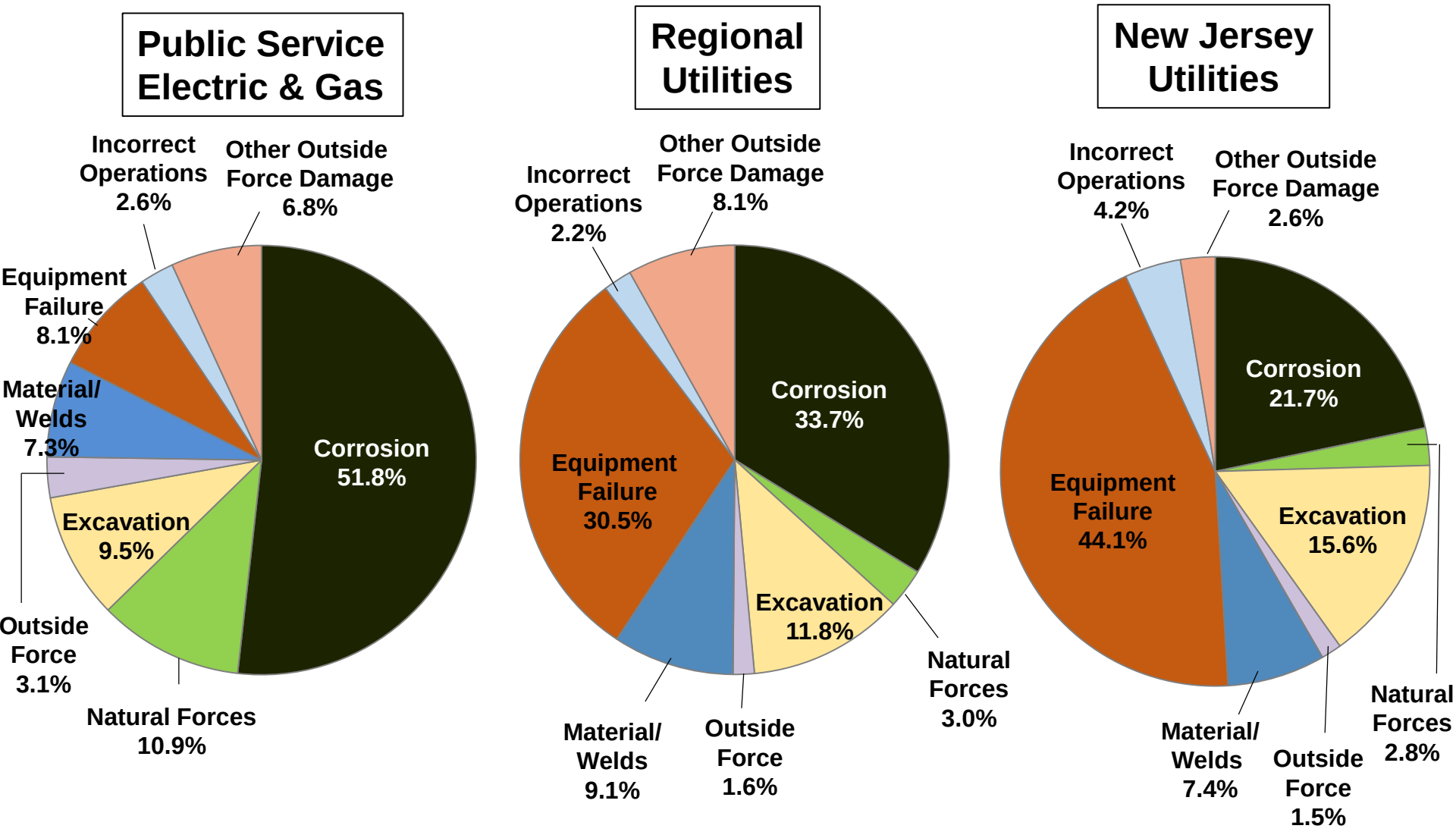
Note: Companies in the graph are ranked by "Bare Steel Service as a Percent of Total Services." Leaks are defined as corrosion-related only. Leak prone steel services are defined as services without cathodic protection or cathodically protected but uncoated services.
Source: U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration, Office of Pipeline Safety.

Number of Leaks per Service Line
Public Service Electric & Gas and Regional Utilities, 2016



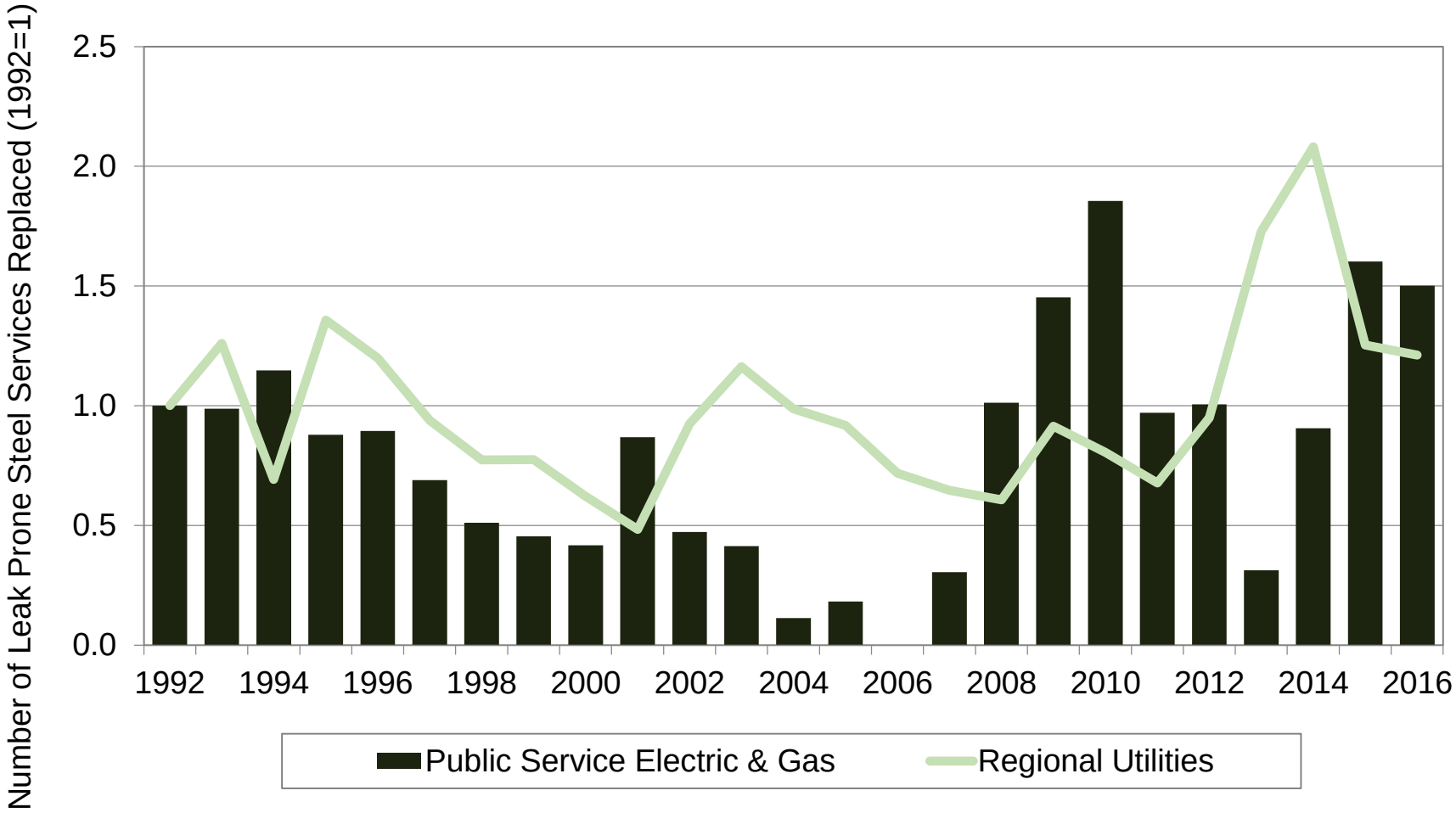
Note: Companies in the graph are ranked by "Bare Steel Service as a Percent of Total Services." Leaks are defined as corrosion-related only.
Source: U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration, Office of Pipeline Safety.

Comparison of Service Leak Repairs by Type, 2016



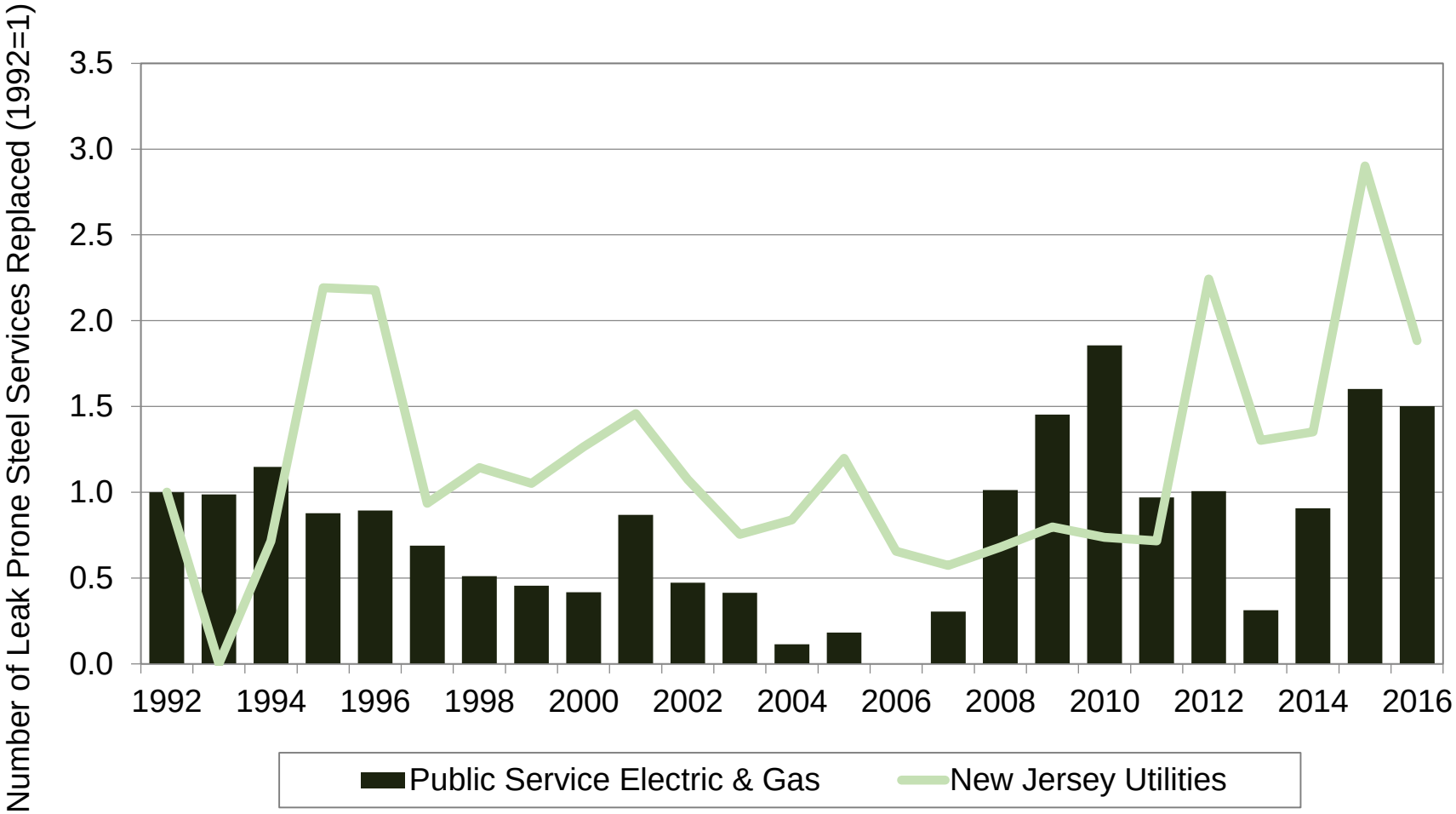
Note: Totals may not sum to 100% due to rounding. New Jersey Utilities include New Jersey Natural Gas, South Jersey Gas, and Elizabethtown Gas.
Source: U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration, Office of Pipeline Safety.

Replacement of Leak Prone Steel Services
Public Service Electric & Gas and Regional Utilities



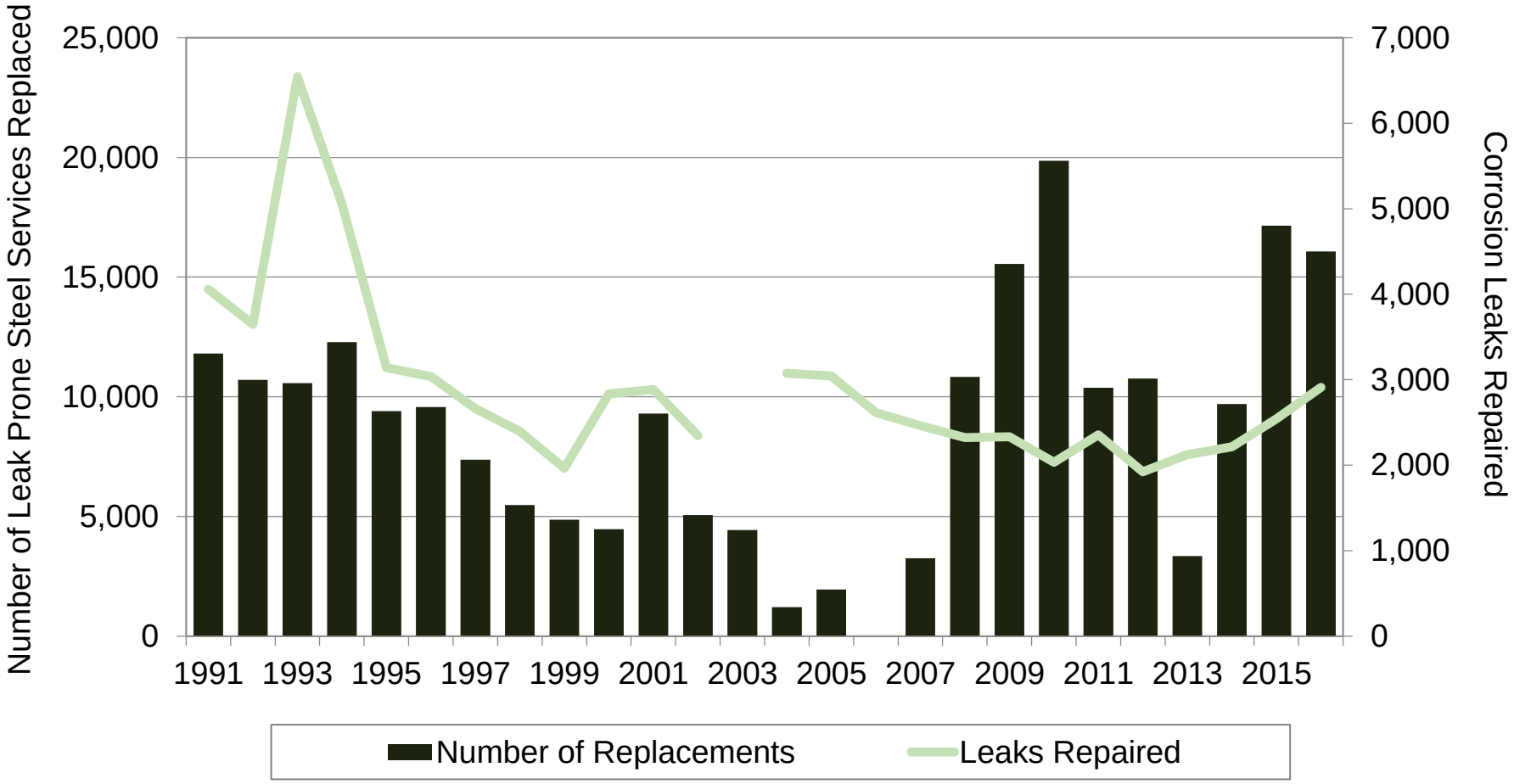
Note: There was no reported change in Public Service Electric & Gas' number of bare steel services between 2005 and 2006; therefore there were no replacements. The statistics included in this chart are indexed to a common year, 1992 (i.e., replacement levels for all utilities equal 1.0 in that year). The 2014-2016 values for Peoples Natural Gas have increased because of its acquisition of Equitable Gas Company.
Source: U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration, Office of Pipeline Safety.

Replacement of Leak Prone Steel Services
Public Service Electric & Gas and New Jersey Utilities



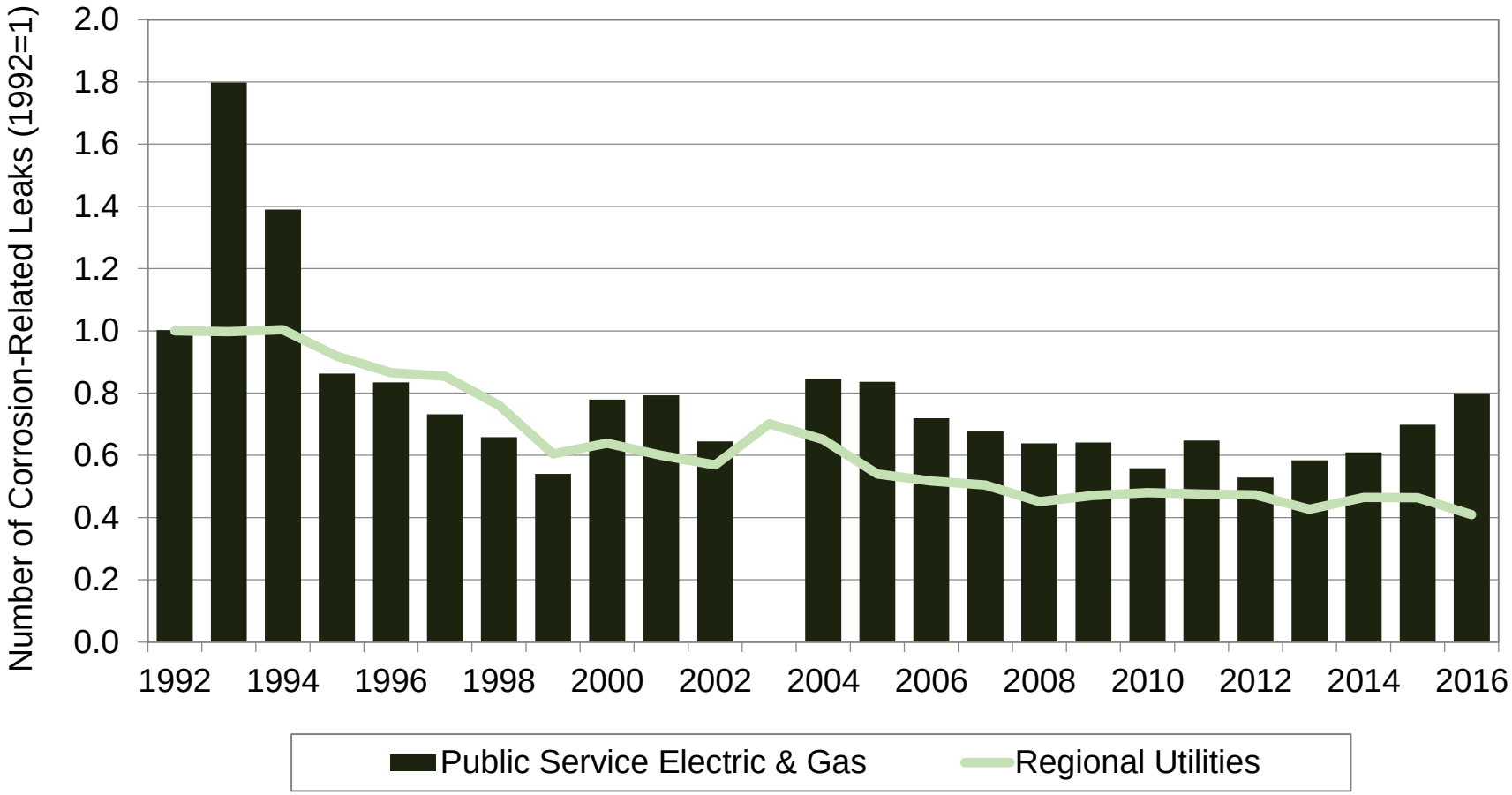
Note: There was no reported change in Public Service Electric & Gas' number of bare steel services between 2005 and 2006; therefore there were no replacements. The statistics included in this chart are indexed to a common year, 1992 (i.e., replacement levels for all utilities equal 1.0 in that year).
Source: U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration, Office of Pipeline Safety.

Replacement of Leak Prone Steel Services and Corrosion Leaks Repaired, Public Service Electric & Gas



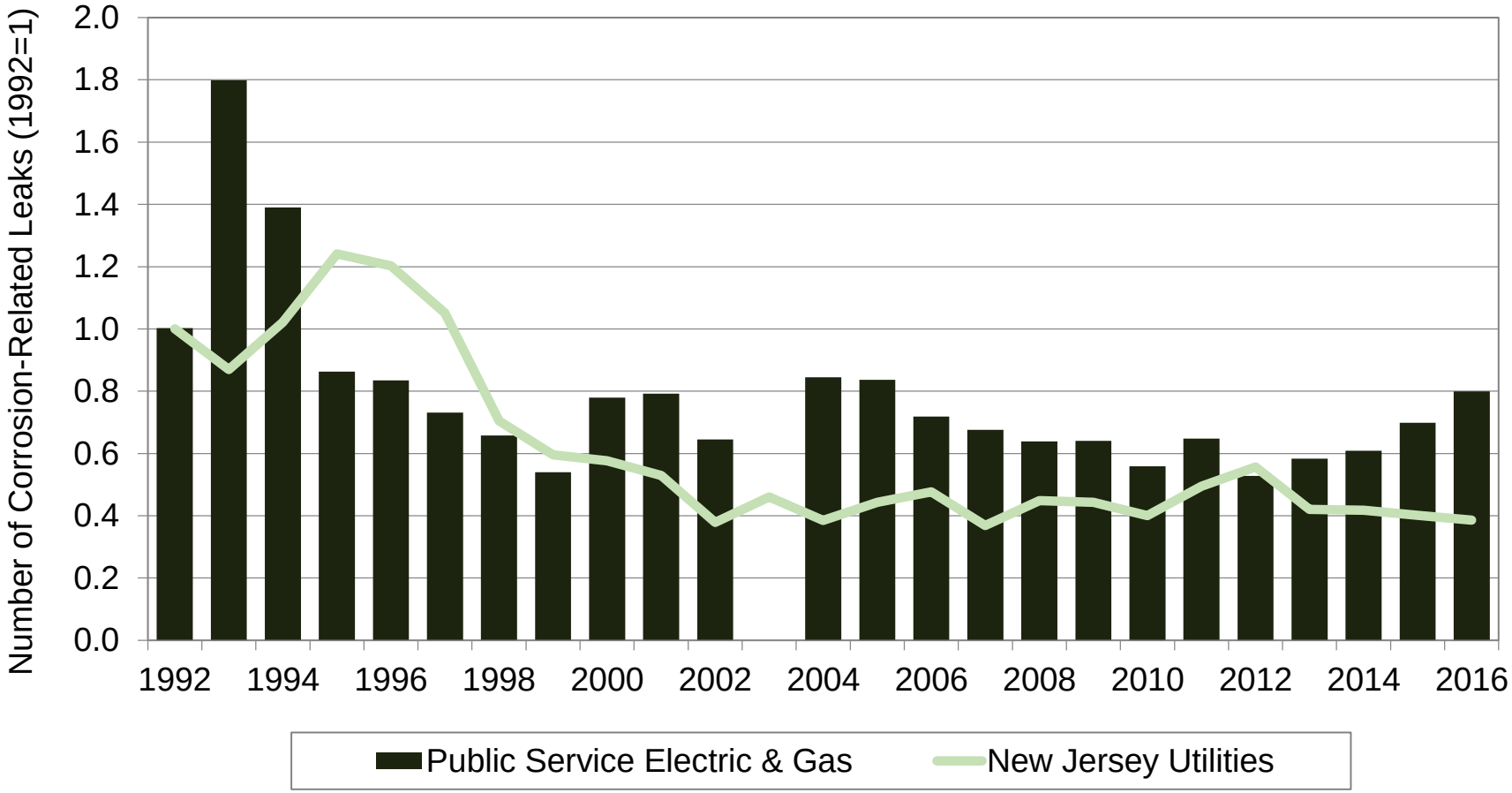
Note: There was no reported change in Public Service Electric & Gas' number of bare steel services between 2005 and 2006; therefore there were no replacements. Leaks are defined as corrosion-related only. Public Service Electric & Gas did not report any leaks in 2003.
Source: U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration, Office of Pipeline Safety.

Number of Service Leaks due to Corrosion
Public Service Electric & Gas and Regional Utilities



Note: Leaks are defined as corrosion-related only. Public Service Electric & Gas did not report any leaks in 2003. The statistics included in this chart are indexed to a common year, 1992 (i.e., replacement levels for all utilities equal 1.0 in that year).
Source: U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration, Office of Pipeline Safety.

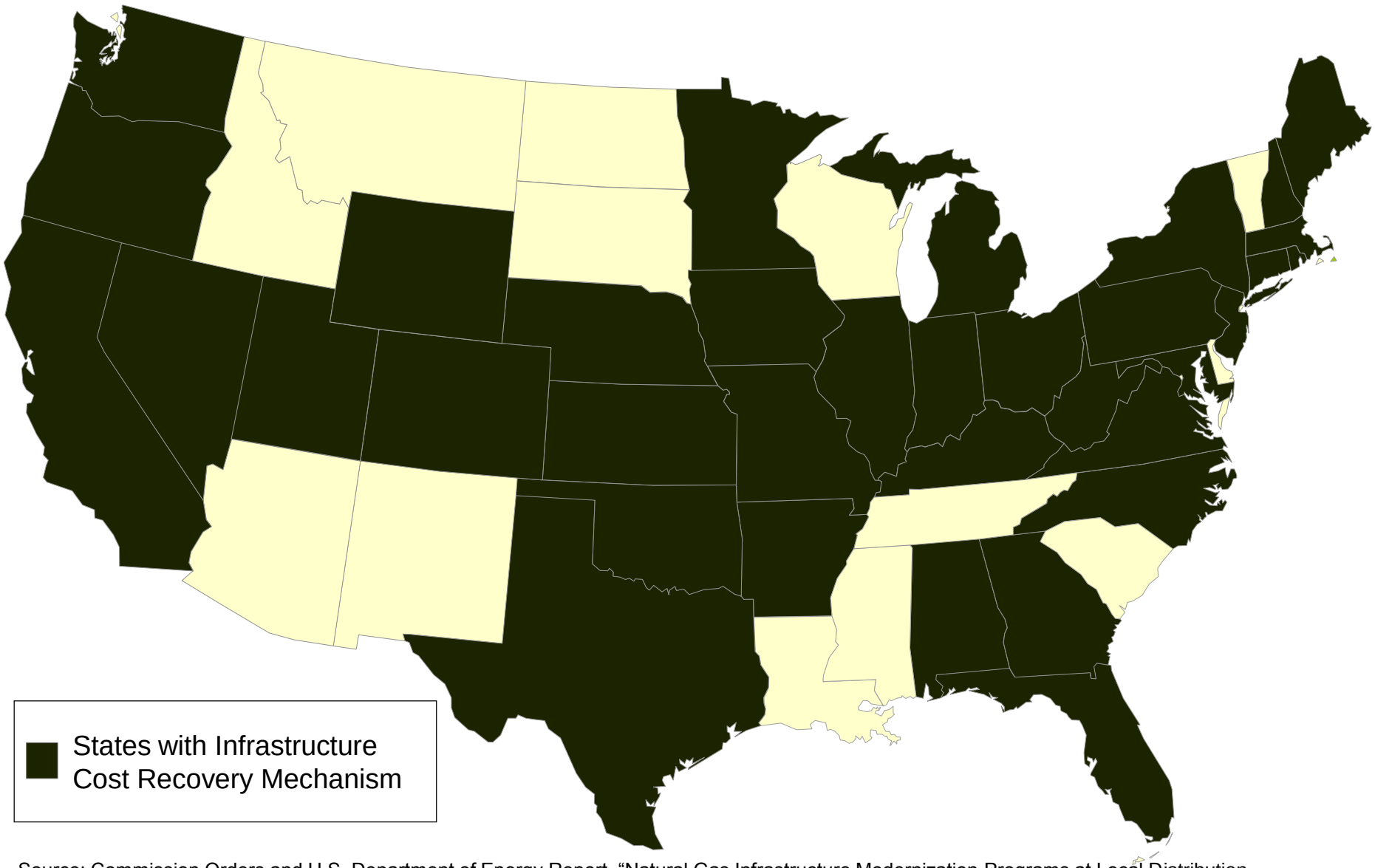
Number of Service Leaks due to Corrosion
Public Service Electric & Gas and New Jersey Utilities



Leaks are defined as corrosion-related only. Public Service Electric & Gas did not report any leaks in 2003. New Jersey Utilities include New Jersey Natural Gas, South Jersey Gas, and Elizabethtown Gas. The statistics included in this chart are indexed to a common year, 1992 (i.e., replacement levels for all utilities equal 1.0 in that year).

Source: U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration, Office of Pipeline Safety.

States with Gas Infrastructure Cost Recovery Rate Mechanisms



Source: Commission Orders and U.S. Department of Energy Report, “Natural Gas Infrastructure Modernization Programs at Local Distribution Companies: Key Issues and Considerations,” 2017.

Reliability Infrastructure 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	12/20/12	Order	Pipeline Modernization Program	2012-2014	XXX								
FL	Florida Public Utilities Company	Gas	9/24/12	Order	Gas Reliability Infrastructure Program	2013-2023									
IN	NIPSCO	Gas	4/30/14	Order	Transmission, Distribution, and Storage System	7 years	XXX	XXX							
KS	Midwest Energy	Gas	5/28/09	Order	Gas System Reliability Surcharge	n.a.	XXX								
KY	Louisville Gas and Electric Company	Gas	12/20/12	Order	Gas Line Tracker	2013-2017									
KY	Duke Energy Kentucky	Gas	2/2/16	Settlement	Accelerated Service Line Replacement Program	2016-2020	XXX								
LA	Entergy Gulf States	Gas	1/27/15	Order	Gas Infrastructure Investment Recovery Rider	2014-2024		XXX							
MA	Fitchburg Gas and Electric Company d/b/a Unitil	Gas	4/30/15	Order	Gas System Enhancement Adjustment Factor	20 years	XXX		XXX				XXX		
MD	Baltimore Gas & Electric Company	Gas	1/29/14	Order	Infrastructure System Replacement Surcharge	5 years	XXX					XXX			
MN	Xcel Energy	Gas	1/27/15	Order	Infrastructure System Replacement Surcharge	5 years			XXX						
MO	Union Electric Company/AmerenUE	Gas	2/26/08	Order	Infrastructure System Replacement Surcharge	n.a.	XXX								

Source: Commission Orders and U.S. Department of Energy Report, “Natural Gas Infrastructure Modernization Programs at Local Distribution Companies: Key Issues and Considerations,” 2017.

Reliability Infrastructure 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
NH	Northern Utilities, Inc./Unitil	Gas	7/21/92	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	5/21/14	Settlement	Electric and Gas System Hardening Program	5 years		XXX						XXX	
NJ	Public Service Electric & Gas	Electric/Gas	11/16/15	Settlement	Gas System Modernization Program	3 years		XXX						XXX	
NY	National Grid - Niagara Mohawk	Gas	9/17/07	Order	Capital Tracker	2008-2012		XXX	XXX	XXX					XXX
NY	National Grid- KEDNY and KEDLI	Gas	12/16/16	Order	Gas Safety and Reliability Surcharge	2017-2021				XXX					
NY	Cond Ed	Gas	1/25/17	Order	Safety and Reliability Surcharge Mechanism	2018-2021		XXX		XXX					
OR	Avista	Gas	3/10/11	Settlement	Incremental Rate Adjustment	2012-2013				XXX		XXX			
PA	PECO	Gas	9/3/15	Order	Distribution System Improvement Charge	10 years	XXX								
RI	National Grid	Gas	9/12/11	Order	Infrastructure, Safety, and Reliability Provision/	Annually									
WA	Pugent Sound Energy	Gas	10/30/14	Order	Pipeline Infrastructure Replacement Program	2 years							XXX		

Source: Commission Orders and U.S. Department of Energy Report, “Natural Gas Infrastructure Modernization Programs at Local Distribution Companies: Key Issues and Considerations,” 2017.

Reliability Infrastructure 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
Gas-Only Utilities															
AL	Mobile Gas Service Corporation	Gas	11/27/95	Order	Cast Iron Main Replacement Factor	30 years									
AR	CenterPoint Energy Arkla	Gas	5/31/06	Settlement	Main Replacement Program Rider	2006-2026							XXX		
AR	Arkansas Oklahoma Gas	Gas	7/25/14	Settlement	System Safety Enhancement Rider	n.a.							XXX		
AR	SourceGas Arkansas	Gas	7/7/14	Settlement	Main Replacement Program Rider	20 years							XXX		
AZ	Southwest Gas	Gas	1/6/12	Settlement	Customer-Owned Yard Line Cost Recovery Mechanism	reset annually									
CA	Southwest Gas	Gas	6/17/14	Order	Infrastructure Reliability and Replacement Programs	n.a.									
CO	Colorado Natural Gas, Inc.	Gas	3/18/11	Settlement	Capital Expenditure Rider	2011-2014		XXX						XXX	
CO	Public Service Co. of Colorado	Gas	7/8/11	Settlement	Pipeline System Integrity Adjustment	2012-2018		XXX	XXX	XXX					
CO	Atmos Energy	Gas	11/4/15	Settlement	System Safety Integrity Rider	2016-2018	XXX								
DC	Washington Gas Light	Gas	12/16/09	Settlement	Vintage Coupling Replacement and	7 years		XXX							
DC	Washington Gas Light	Gas	1/29/15	Settlement	Accelerated Pipe Replacement Program	5 years									
FL	Florida City Gas	Gas	9/15/15	Order	Safety, Access, and Facility Enhancement Program	10 years				XXX					
FL	Peoples Gas System	Gas	9/18/12	Order	Cast Iron/Bare Steel Pipe Replacement Rider	2013-2023									
FL	Florida Division of Chesapeake Utilities Corporation	Gas	9/24/12	Order	Gas Reliability Infrastructure Program	2013-2023									
GA	Liberty Utilities (formerly Atmos Energy)	Gas	12/14/00	Order	Accelerated Pipe Replacement Program	15-20 years							XXX		

Source: Commission Orders and U.S. Department of Energy Report, “Natural Gas Infrastructure Modernization Programs at Local Distribution Companies: Key Issues and Considerations,” 2017.

Reliability Infrastructure 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	3/15/13	Order	Capital Infrastructure Investment Automatic	n.a.				XXX					
IL	Ameren Illinois	Gas	1/6/15	Order	Qualifying Infrastructure Plant		XXX								
IL	Nicor Gas Company	Gas	7/30/14	Order	Qualifying Infrastructure Plant		XXX								
IL	Peoples Gas Light and Coke Company	Gas	1/7/14	Order	Qualifying Infrastructure Plant		XXX								
IL	Peoples Gas Light and Coke Company	Gas	1/21/10	Order	Infrastructure Cost Recovery Rider	2010-2030	XXX						XXX		
IN	Vectren North - Indiana Gas	Gas	2/13/08	Settlement	Distribution Replacement Adjustment	20 years		XXX	XXX	XXX		XXX			
IN	Vectren South - SIGECO	Gas	8/1/07	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	7/15/08	Settlement	Gas System Reliability Surcharge	n.a.	XXX								
KS	Kansas Gas Service	Gas	12/18/08	Order	Gas System Reliability Surcharge	n.a.	XXX								
KY	Atmos Energy	Gas	5/28/10	Settlement	Pipe Replacement Program Rider	n.a.							XXX		
KY	Columbia Gas	Gas	10/26/09	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	10/30/09	Order	Targeted Infrastructure Recovery Factor	15-20 years	XXX		XXX				XXX		XXX
MA	Bay State Gas d/ba Columbia Gas of Massachusetts	Gas	4/30/15	Order	Gas System Enhancement Adjustment Factor	20 years	XXX		XXX				XXX		
MA	Berkshire Gas	Gas	4/30/15	Order	Gas System Enhancement Adjustment Factor	20 years	XXX		XXX				XXX		

Source: Commission Orders and U.S. Department of Energy Report, “Natural Gas Infrastructure Modernization Programs at Local Distribution Companies: Key Issues and Considerations,” 2017.

Reliability Infrastructure 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	4/30/15	Order	Gas System Enhancement Adjustment Factor	25 years	XXX		XXX				XXX		
MA	National Grid Gas	Gas	11/2/10	Order	Targeted Infrastructure Recovery Factor	10 years	XXX		XXX				XXX		
MA	National Grid Gas-Boston Gas Company	Gas	4/30/15	Order	Gas System Enhancement Adjustment Factor	20 years	XXX		XXX				XXX		
MA	National Grid Gas-Colonial Gas Company	Gas	4/30/15	Order	Gas System Enhancement Adjustment Factor	8 years	XXX		XXX				XXX		
MA	Liberty Utilities-New England Gas	Gas	3/31/11	Order	Targeted Infrastructure Recovery Factor	15 years	XXX		XXX				XXX		
MA	Liberty Utilities-New England Gas	Gas	4/30/15	Order	Gas System Enhancement Adjustment Factor	20 years	XXX		XXX				XXX		
MD	Columbia Gas of Maryland	Gas	8/18/14	Order	Infrastructure System Replacement Surcharge	5 years	XXX								
MD	Washington Gas Light	Gas	3/21/14	Order	Infrastructure System Replacement Surcharge	5 years	XXX								
ME	Northern Utilities, Inc./Unitil	Gas	7/30/10	Settlement	Cast Iron Replacement Program	2011-2027	XXX		XXX		XXX		XXX		XXX
MI	DTE Gas Company (formerly Michigan Consolidated Gas Company)	Gas	4/16/13	Order	Infrastructure Recovery Mechanism	2013-2017							XXX		
MI	Semco Energy	Gas	12/22/11	Settlement	Main Replacement Program Rider	2012-2017				XXX			XXX		
MI	Semco Energy	Gas	12/22/11	Settlement	Main Replacement Program Rider	2016-2020		XXX		XXX			XXX		
MS	Atmos Energy	Gas	9/8/15	Order	System Integrity Rider	n.a.									
MO	Liberty Utilities (formerly Atmos Energy)	Gas	10/31/08	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	2/26/04	Order	Infrastructure System Replacement Surcharge	n.a.	XXX								
NC	Piedmont Natural Gas	Gas	12/17/13	Settlement	Safety Capital Investment	Annually									
NE	SourceGas Distribution LLC	Gas	6/25/13	Order	Pipeline Replacement Charge	n.a.	XXX								

Source: Commission Orders and U.S. Department of Energy Report, “Natural Gas Infrastructure Modernization Programs at Local Distribution Companies: Key Issues and Considerations,” 2017.

Reliability Infrastructure 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
NH	Liberty Utilities (formerly EnergyNorth)	Gas	7/12/07	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	8/21/13	Settlement	Accelerated Infrastructure Replacement Program	2013-2017		XXX		XXX		XXX			XXX
NJ	Elizabethtown Gas	Gas	7/23/14	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	7/23/14	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	8/20/14	Settlement	Storm Hardening and Reliability Program	2014-2017		XXX		XXX		XXX			
NV	Southwest Gas Corporation	Gas	9/7/11	Settlement	Strip Reliability Plan	n.a.				XXX		XXX			
NY	Corning Natural Gas	Gas	1/25/11	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	5/30/02	Settlement	Accelerated Main Replacement Program	Annually	XXX			XXX		XXX	XXX		
OH	Columbia Gas of Ohio	Gas	12/3/08	Settlement	Infrastructure Replacement Program Rider	5 years	XXX		XXX	XXX	XXX		XXX		
OH	Vectren Ohio	Gas	1/7/09	Settlement	Distribution Replacement Rider	5 years	XXX			XXX			XXX		
OK	Oklahoma Natural Gas	Gas	8/31/07	Settlement	Integrity Management Program	Annually						XXX			
OR	NW Natural	Gas	3/1/09	Settlement	System Integrity Program	2009-2021		XXX	XXX				XXX		
PA	Columbia Gas of Pennslyvania	Gas	5/22/14	Order	Accelerated Main Replacement Program	17 years	XXX								
PA	UGI-Central Penn Gas	Gas	9/11/14	Order	Accelerated Main Replacement Program	14 years	XXX								

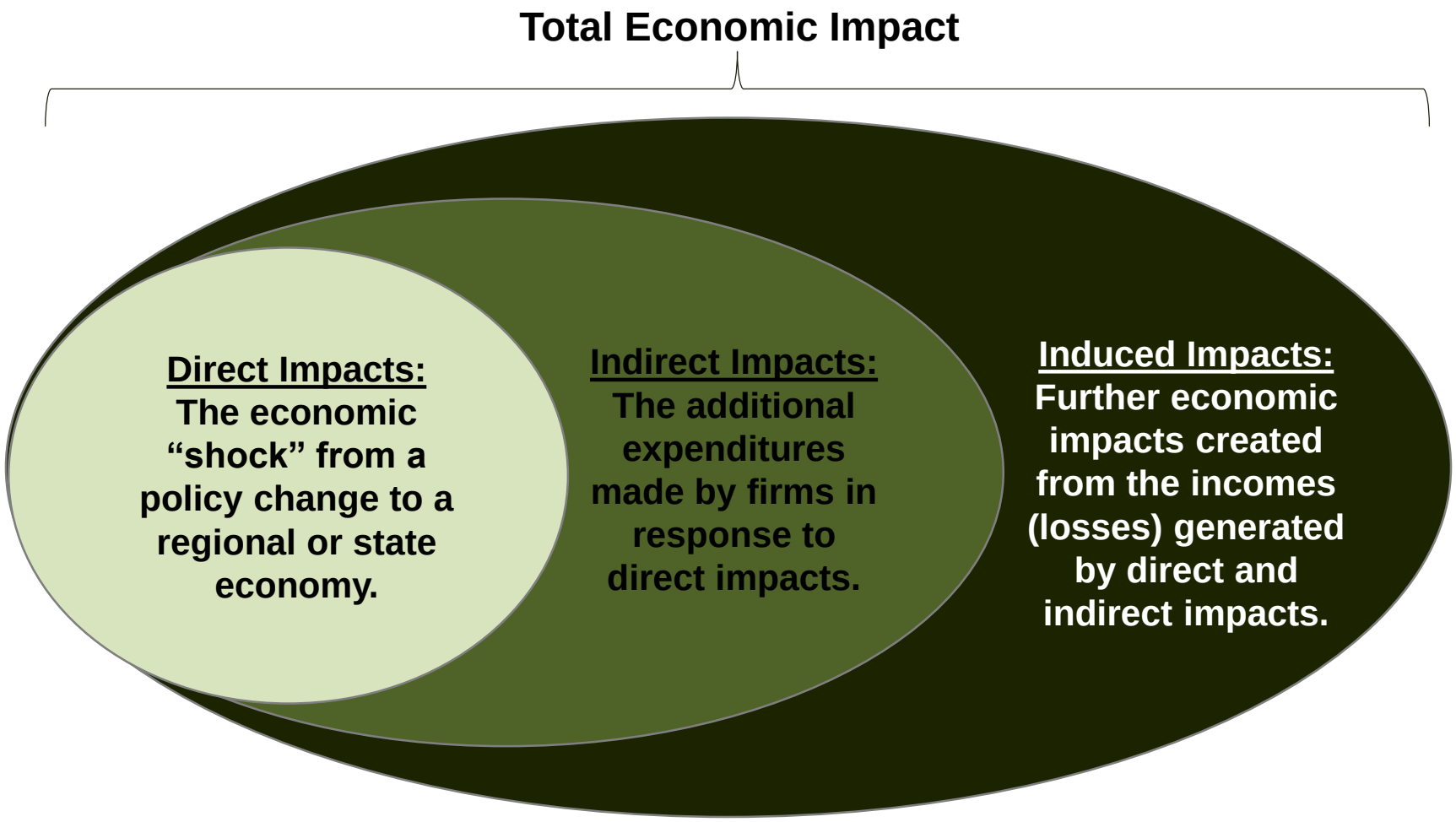
Source: Commission Orders and U.S. Department of Energy Report, "Natural Gas Infrastructure Modernization Programs at Local Distribution Companies: Key Issues and Considerations," 2017.

Reliability Infrastructure Cost Recovery Mechanisms

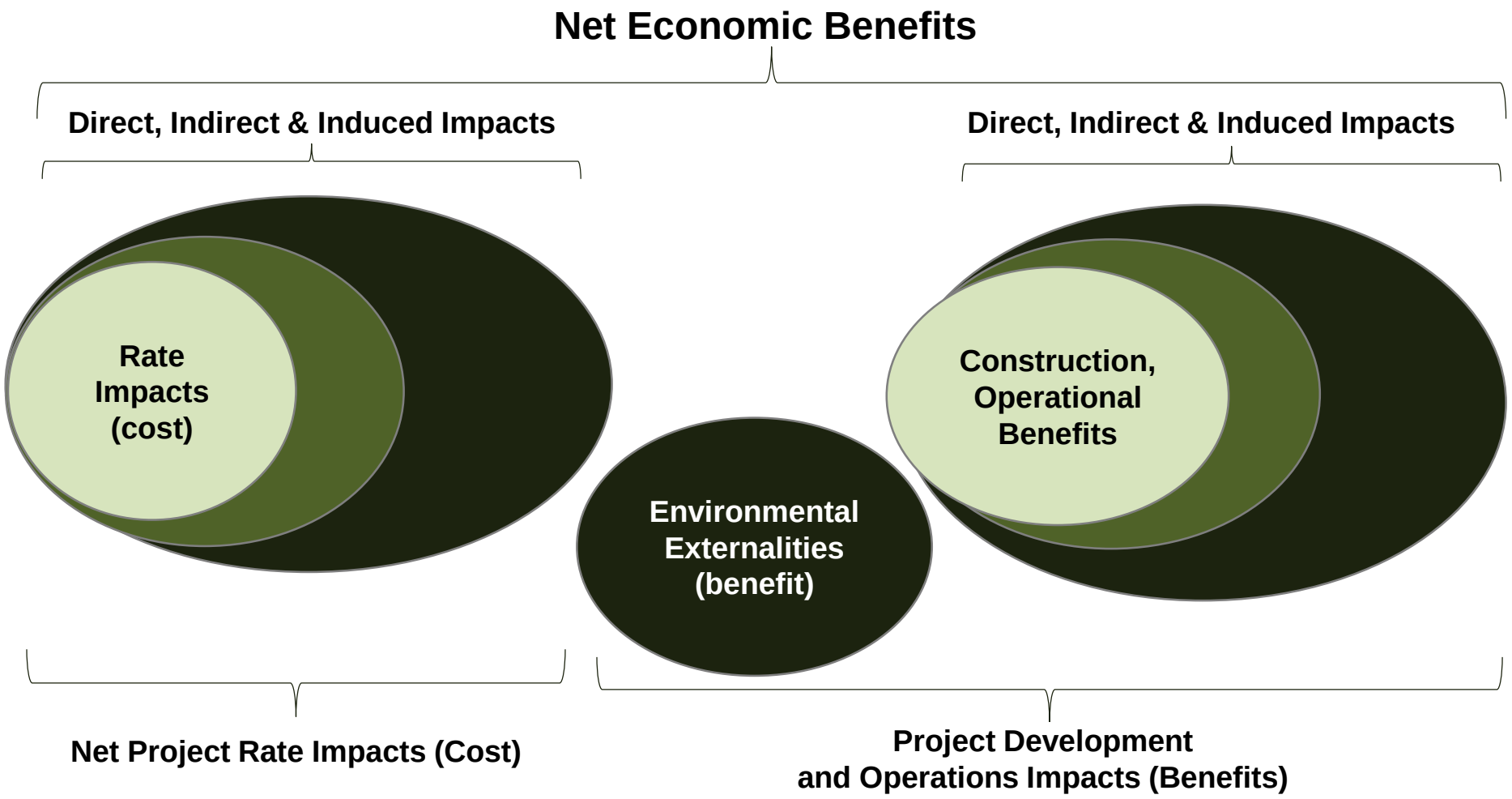
State	Company	Recovery Mechanism - Gas/ Electric	Date of Decision	Decision Type	Mechanism	Term/ Period	Limited Recovery / Revenue Cap	Expenditures Limited / Capped	Deferrals	Carrying Charges on Investment	Carrying Charges on Deferrals	Deferral-Based Cost Recovery	O&M Offset	Reduced Rate of Return	Reliability Benchmarks
PA	UGI-Penn Natural Gas	Gas	9/11/14	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	5/23/13	Order	Distribution System Improvement Charge	5 years	XXX								
PA	Peoples TWP	Gas	8/21/14	Order	Distribution System Improvement Charge	n.a.	XXX								
PA	Equitable Gas	Gas	7/16/13	Order	Distribution System Improvement Charge	9 years	XXX								
TN	Piedmont Natural Gas	Gas	5/13/14	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	6/3/10	Settlement	Infrastructure Replacement Adjustment	3 years		XXX		XXX		XXX			
VA	Atmos Energy	Gas	8/21/12	Settlement	SAVE Plan/Rider	2012-2015		XXX							
VA	Washington Gas Light	Gas	4/21/11	Order	SAVE Plan/Rider	2011-2014		XXX		XXX					
VA	Columbia Gas of Virginia	Gas	11/28/11	Order	SAVE Plan/Rider	2012-2016		XXX		XXX					
VA	Virginia Natural Gas, Inc.	Gas	6/25/12	Order	SAVE Plan/Rider	2012-2016		XXX		XXX					
VA	Virginia Natural Gas, Inc.	Gas	3/17/16	Order	SAVE Plan/Rider-Extension	2016-2021		XXX		XXX					
WA	Cascade Natural Gas	Gas	10/30/13	Order	Pipeline Infrastructure Replacement Program	2 years	XXX						XXX		
WV	Mountaineer Gas Company	Gas	12/23/15	Settlement	Infrastructure Replacement and Expansioin Program	5 years									
WV	Hope Gas (Dominion Hope)	Gas	2/4/16	Settlement	Pipeline Replacement and Expansion Pilot Program	2016-2018									
WY	Black Hills Energy	Gas	8/4/16	Settlement	Pipeline Safety and Integrity Mechanism	2016-2021									

Source: Commission Orders and U.S. Department of Energy Report, “Natural Gas Infrastructure Modernization Programs at Local Distribution Companies: Key Issues and Considerations,” 2017.

Net Economic Impacts Analysis



Net Economic Impacts Analysis



Construction Impacts: Output

Economic Impacts (Construction) - Output (million $)				
	Total			
Decade	Direct	Indirect	Induced	Total
2019	$ 290.94	$ 90.68	$ 98.31	$ 479.94
2020	435.81	135.83	147.26	718.91
2021	436.66	136.10	147.55	720.31
2022	436.38	136.01	147.46	719.85
2023	445.48	138.83	150.52	734.84
2024	114.21	35.61	38.60	188.42
Total	**$ 2,159.50**	**$ 673.05**	**$ 729.72**	**$ 3,562.26**
NPV	**$ 1,778.78**	**$ 554.39**	**$ 601.07**	**$ 2,934.24**

Source: Company's Response to RCR-POL-77; IMPLAN.

Construction Impacts: Employment

Economic Impacts (Construction) - Employment (job-years)				
	Total			
Decade	Direct	Indirect	Induced	Total
2019	909	477	624	2,011
2020	1,362	715	935	3,012
2021	1,365	716	937	3,018
2022	1,364	716	936	3,016
2023	1,392	730	956	3,079
2024	357	187	245	790
Total	**6,749**	**3,541**	**4,634**	**14,925**

Source: Company's Response to RCR-POL-77; IMPLAN.

Construction Impacts: Labor Income

Economic Impacts (Construction) - Labor Income (million $)				
	Total			
Decade	Direct	Indirect	Induced	Total
2019	$ 82.43	$ 37.73	$ 35.36	$ 155.53
2020	123.48	56.52	52.97	232.97
2021	123.72	56.63	53.08	233.43
2022	123.64	56.60	53.04	233.28
2023	126.21	57.77	54.14	238.12
2024	32.37	14.82	13.89	61.07
Total	**$ 611.84**	**$ 280.07**	**$ 262.49**	**$ 1,154.40**
NPV	**$ 503.97**	**$ 230.70**	**$ 216.21**	**$ 950.88**

Source: Company's Response to RCR-POL-77; IMPLAN.

Construction Impacts: Value Added

Economic Impacts (Construction) - Value Added (million $)				
	Total			
Decade	Direct	Indirect	Induced	Total
2019	$ 131.48	$ 49.69	$ 60.74	$ 241.91
2020	196.96	74.43	90.98	362.37
2021	197.34	74.57	91.16	363.07
2022	197.21	74.53	91.10	362.84
2023	201.31	76.08	92.99	370.38
2024	51.62	19.51	23.85	94.99
Total	**$ 975.92**	**$ 368.81**	**$ 450.83**	**$ 1,795.55**
NPV	**$ 803.86**	**$ 303.78**	**$ 371.35**	**$ 1,478.99**

Source: Company's Response to RCR-POL-77; IMPLAN.

Operational Benefits: Output

Economic Impacts (Operational Benefits) - Output (million $)				
	Total			
Decade	Direct	Indirect	Induced	Total
2019	$ 0.58	$ 0.07	$ 0.41	$ 1.05
2020-2029	42.35	4.80	30.05	77.20
2030-2039	49.63	5.62	35.21	90.47
2040-2049	49.63	5.62	35.21	90.47
2050-2059	49.63	5.62	35.21	90.47
2060-2069	49.63	5.62	35.21	90.47
2070-2079	49.63	5.62	35.21	90.47
2080-2086	34.74	3.94	24.65	63.33
Total	**$ 325.81**	**$ 36.92**	**$ 231.18**	**$ 593.90**
NPV	**$ 68.73**	**$ 7.79**	**$ 48.77**	**$ 125.29**

Source: ACG Cost-Benefit Analysis; IMPLAN.

Operational Benefits: Employment

Economic Impacts (Operational Benefits) - Employment (job-years)				
	Total			
Decade	Direct	Indirect	Induced	Total
2019	1	0	3	4
2020-2029	70	27	188	285
2030-2039	82	32	220	334
2040-2049	82	32	220	334
2050-2059	82	32	220	334
2060-2069	82	32	220	334
2070-2079	82	32	220	334
2080-2086	58	22	154	234
Total	**540**	**209**	**1,444**	**2,193**

Source: ACG Cost-Benefit Analysis; IMPLAN.

Operational Benefits: Labor Income

Economic Impacts (Operational Benefits) - Labor Income (million $)				
	Total			
Decade	Direct	Indirect	Induced	Total
2019	$ 0.47	$ 0.02	$ 0.15	$ 0.64
2020-2029	34.25	1.81	10.93	47.00
2030-2039	40.14	2.13	12.81	55.07
2040-2049	40.14	2.13	12.81	55.07
2050-2059	40.14	2.13	12.81	55.07
2060-2069	40.14	2.13	12.81	55.07
2070-2079	40.14	2.13	12.81	55.07
2080-2086	28.09	1.49	8.97	38.55
Total	**$ 263.49**	**$ 13.95**	**$ 84.12**	**$ 361.56**
NPV	**$ 55.58**	**$ 2.94**	**$ 17.75**	**$ 76.27**

Source: ACG Cost-Benefit Analysis; IMPLAN.

Operational Benefits: Value Added

Economic Impacts (Operational Benefits) - Value Added (million $)				
	Total			
Decade	Direct	Indirect	Induced	Total
2019	$ 0.51	$ 0.04	$ 0.25	$ 0.80
2020-2029	37.21	2.92	18.54	58.67
2030-2039	43.60	3.42	21.72	68.75
2040-2049	43.60	3.42	21.72	68.75
2050-2059	43.60	3.42	21.72	68.75
2060-2069	43.60	3.42	21.72	68.75
2070-2079	43.60	3.42	21.72	68.75
2080-2086	30.52	2.39	15.21	48.12
Total	**$ 286.26**	**$ 22.46**	**$ 142.61**	**$ 451.33**
NPV	**$ 60.39**	**$ 4.74**	**$ 30.08**	**$ 95.21**

Source: ACG Cost-Benefit Analysis; IMPLAN.

Rate Impacts: Output

Economic Impacts (Rates) - Output (million $)				
	Total			
Decade	Direct	Indirect	Induced	Total
2020-2029	$ (2,285.85)	$ (259.01)	$ (1,621.97)	$ (4,166.83)
2030-2039	(2,517.25)	(285.23)	(1,786.16)	(4,588.63)
2040-2049	(2,090.81)	(236.91)	(1,483.58)	(3,811.30)
2050-2059	(1,664.38)	(188.59)	(1,180.99)	(3,033.96)
2060-2069	(1,237.94)	(140.27)	(878.41)	(2,256.62)
2070-2079	(811.51)	(91.95)	(575.82)	(1,479.28)
2080-2086	(238.13)	(26.98)	(168.97)	(434.08)
Total	**$ (10,845.87)**	**$ (1,228.93)**	**$ (7,695.90)**	**$ (19,770.70)**
NPV	**$ (3,191.99)**	**$ (361.68)**	**$ (2,264.94)**	**$ (5,818.61)**

Source: Direct Testimony of Stephen Swetz, Schedules SS-GSM II-2 – SS-GSMPII-4 and associated workpapers; IMPLAN.

Rate Impacts: Employment

Economic Impacts (Rates) - Employment (job-years)				
	Total			
Decade	Direct	Indirect	Induced	Total
2020-2029	(3,788)	(1,467)	(10,133)	(15,387)
2030-2039	(4,171)	(1,616)	(11,159)	(16,945)
2040-2049	(3,464)	(1,342)	(9,268)	(14,074)
2050-2059	(2,758)	(1,068)	(7,378)	(11,204)
2060-2069	(2,051)	(795)	(5,488)	(8,333)
2070-2079	(1,345)	(521)	(3,597)	(5,463)
2080-2086	(395)	(153)	(1,056)	(1,603)
Total	**(17,971)**	**(6,962)**	**(48,078)**	**(73,008)**

Source: Direct Testimony of Stephen Swetz, Schedules SS-GSM II-2 – SS-GSMPII-4 and associated workpapers; IMPLAN.

Rate Impacts: Labor Income

Economic Impacts (Rates) - Labor Income (million $)				
	Total			
Decade	Direct	Indirect	Induced	Total
2020-2029	$ (1,848.63)	$ (97.89)	$ (590.17)	$ (2,536.69)
2030-2039	(2,035.77)	(107.80)	(649.91)	(2,793.48)
2040-2049	(1,690.90)	(89.54)	(539.81)	(2,320.25)
2050-2059	(1,346.03)	(71.28)	(429.72)	(1,847.02)
2060-2069	(1,001.16)	(53.01)	(319.62)	(1,373.79)
2070-2079	(656.29)	(34.75)	(209.52)	(900.56)
2080-2086	(192.58)	(10.20)	(61.48)	(264.26)
Total	**$ (8,771.36)**	**$ (464.47)**	**$ (2,800.23)**	**$ (12,036.06)**
NPV	**$ (2,581.45)**	**$ (136.70)**	**$ (824.12)**	**$ (3,542.27)**

Source: Direct Testimony of Stephen Swetz, Schedules SS-GSM II-2 – SS-GSMPII-4 and associated workpapers; IMPLAN.

Rate Impacts: Value Added

Economic Impacts (Rates) - Value Added (million $)				
	Total			
Decade	Direct	Indirect	Induced	Total
2020-2029	$ (2,008.41)	$ (157.56)	$ (1,000.56)	$ (3,166.53)
2030-2039	(2,211.72)	(173.51)	(1,101.84)	(3,487.07)
2040-2049	(1,837.04)	(144.11)	(915.19)	(2,896.34)
2050-2059	(1,462.36)	(114.72)	(728.53)	(2,305.61)
2060-2069	(1,087.69)	(85.33)	(541.87)	(1,714.88)
2070-2079	(713.01)	(55.93)	(355.21)	(1,124.16)
2080-2086	(209.23)	(16.41)	(104.23)	(329.88)
Total	**$ (9,529.46)**	**$ (747.58)**	**$ (4,747.43)**	**$ (15,024.46)**
NPV	**$ (2,804.57)**	**$ (220.02)**	**$ (1,397.19)**	**$ (4,421.77)**

Source: Direct Testimony of Stephen Swetz, Schedules SS-GSM II-2 – SS-GSMPII-4 and associated workpapers; IMPLAN.

Net Economic Impacts: Output

Decade	Economic Impacts - Output (million $) Total Direct	Indirect	Induced	Total
2019	$ 291.52	$ 90.74	$ 98.72	$ 480.99
2020-2029	(374.95)	328.16	(960.52)	(1,007.30)
2030-2039	(2,467.62)	(279.60)	(1,750.95)	(4,498.17)
2040-2049	(2,041.18)	(231.28)	(1,448.36)	(3,720.83)
2050-2059	(1,614.75)	(182.96)	(1,145.78)	(2,943.49)
2060-2069	(1,188.31)	(134.65)	(843.19)	(2,166.15)
2070-2079	(761.88)	(86.33)	(540.61)	(1,388.81)
2080-2086	(203.39)	(23.05)	(144.32)	(370.76)
Total	**$ (8,360.57)**	**$ (518.97)**	**$ (6,735.00)**	**$ (15,614.53)**
NPV	**$ (1,344.48)**	**$ 200.50**	**$ (1,615.10)**	**$ (2,759.09)**

Source: IMPLAN.

Net Economic Impacts: Employment

Decade	Economic Impacts - Employment (job-years) Total			
	Direct	Indirect	Induced	Total
2019	910	477	627	2,015
2020-2029	2,122	1,624	(5,935)	(2,188)
2030-2039	(4,089)	(1,584)	(10,939)	(16,611)
2040-2049	(3,382)	(1,310)	(9,048)	(13,740)
2050-2059	(2,676)	(1,036)	(7,158)	(10,870)
2060-2069	(1,969)	(763)	(5,268)	(7,999)
2070-2079	(1,262)	(489)	(3,377)	(5,129)
2080-2086	(337)	(131)	(902)	(1,369)
Total	**(10,682)**	**(3,212)**	**(42,000)**	**(55,890)**

Source: IMPLAN.

Net Economic Impacts: Labor Income

Decade	Economic Impacts - Labor Income (million $) Total			
	Direct	Indirect	Induced	Total
2019	$ 82.90	$ 37.76	$ 35.51	$ 156.17
2020-2029	(1,284.97)	146.26	(352.11)	(1,490.82)
2030-2039	(1,995.63)	(105.67)	(637.10)	(2,738.41)
2040-2049	(1,650.76)	(87.41)	(527.00)	(2,265.18)
2050-2059	(1,305.89)	(69.15)	(416.90)	(1,791.95)
2060-2069	(961.02)	(50.89)	(306.80)	(1,318.72)
2070-2079	(616.15)	(32.63)	(196.71)	(845.49)
2080-2086	(164.49)	(8.71)	(52.51)	(225.71)
Total	**$ (7,896.03)**	**$ (170.44)**	**$ (2,453.62)**	**$ (10,520.10)**
NPV	**$ (2,021.89)**	**$ 96.94**	**$ (590.16)**	**$ (2,515.11)**

Source: IMPLAN.

Net Economic Impacts: Value Added

Decade	Economic Impacts - Value Added (million $) Total			
	Direct	Indirect	Induced	Total
2019	$ 131.99	$ 49.73	$ 60.99	$ 242.71
2020-2029	(1,126.76)	164.47	(591.93)	(1,554.22)
2030-2039	(2,168.11)	(170.09)	(1,080.12)	(3,418.32)
2040-2049	(1,793.44)	(140.69)	(893.46)	(2,827.59)
2050-2059	(1,418.76)	(111.30)	(706.80)	(2,236.86)
2060-2069	(1,044.08)	(81.91)	(520.15)	(1,646.14)
2070-2079	(669.41)	(52.51)	(333.49)	(1,055.41)
2080-2086	(178.71)	(14.02)	(89.03)	(281.75)
Total	**$ (8,267.28)**	**$ (356.32)**	**$ (4,153.99)**	**$ (12,777.59)**
NPV	**$ (1,940.32)**	**$ 88.50**	**$ (995.76)**	**$ (2,847.57)**

Source: IMPLAN.