STATE OF NEW JERSEY
BOARD OF PUBLIC UTILITIES

IN THE MATTER OF THE PETITION OF PUBLIC SERVICE ELECTRIC AND GAS COMPANY FOR APPROVAL OF THE SECOND ENERGY STRONG PROGRAM (ENERGY STRONG II)

BPU Docket Nos. EO18060629 and GO18060630

PUBLIC SERVICE ELECTRIC AND GAS COMPANY
REBUTTAL TESTIMONY
OF THE
COST-BENEFIT ANALYSIS PANEL

April 18, 2019

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I. INTRODUCTION

Q. Please introduce the members of the Cost-Benefit Panel, Energy Strong II Program (the "ESII-CBA Panel" or "Panel").

A. The witnesses comprising the ESII-CBA Panel are Russell A. Feingold, Krystal R. Richart and Andrew L. Trump.

Q. Mr. Feingold, please state your name and business address.

A. My name is Russell A. Feingold, and my business address is 2525 Lindenwood Drive Wexford, Pennsylvania 15090.

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

A. I am a Vice President at Black & Veatch Management Consulting, LLC ("Black & Veatch") and lead its Rates & Regulatory Practice.

Q. Have you testified previously in this proceeding?

A. Yes. On June 8, 2018, on behalf of Public Service Electric & Gas Company ("PSE&G" or "Company"), I submitted direct testimony in support of PSE&G's Petition requesting that the New Jersey Board of Public Utilities ("PBU" or "Board") approve PSE&G's Energy Strong II Program ("ESII" or "Program").

Q. Ms. Richart, please state your name and business address.

A. My name is Krystal R. Richart, and my business address is 11401 Lamar Avenue

Overland Park, KS 66211.

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

A. I am a Manager employed by Black & Veatch.

Q. Have you testified previously in this proceeding?

A. Yes. On June 8, 2018, on behalf of PSE&G, I submitted direct testimony in support of PSE&G's Petition requesting that the Board approve PSE&G's ESII.

Q. Mr. Trump, please state your name and business address.

A. My name is Andrew L. Trump, and my business address is 832 Media Line Road, Newtown Square, Pennsylvania.

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

A. I am currently an independent consultant and was a Director employed by Black & Veatch at the time my direct testimony was submitted to the Board.

Q. Have you testified previously in this proceeding?

A. Yes. On June 8, 2018, on behalf of PSE&G, I submitted direct testimony in support of PSE&G's Petition requesting that the Board approve PSE&G's ESII.

Q. What was the purpose of the Panel's direct testimony in this proceeding?

A. In our direct testimony, we sponsored the cost-benefit analyses ("CBAs") of the electric and gas portions of PSE&G's ESII.

Q. What is the purpose of the Panel's rebuttal testimony?

A. In our rebuttal testimony, we respond to the criticisms raised by the New Jersey Division of Rate Counsel in the direct testimony of Dr. David E. Dismukes concerning the

CBAs for the electric and gas portions of ESII submitted by PSE&G in this proceeding.

II. IDENTIFICATION OF EXHIBITS

Q. Do you sponsor any exhibits in support of your rebuttal testimony?

A. Yes. We have attached the following three (3) exhibits:

1. Exhibit BV-ESII-1 is a diagram of the specification of benefits.

2. Exhibit BV-ESII-2 is a chart of monetary benefits for the Company's electric CBA under less conservative assumptions.

3. Exhibit BV-ESII-3 is a listing of principal reference sources for electric Value of Lost Load ("VoLL") research efforts.

III. SUMMARY

Q. Please summarize your rebuttal testimony.

A. The recommendation of Dr. Dismukes that the Board deny PSE&G's ESII Petition should be rejected. Contrary to the assertions made by Rate Counsel's witness, the Company's CBAs were conducted in a reasonable and acceptable manner that properly describe and estimate the total monetized costs and benefits, and other quantitative and qualitative benefits, of PSE&G's ESII investment plans. The Company's CBAs provide meaningful and acceptable results to the Board for purposes of examining the value these investments will provide to PSE&G's customers.

In addition, contrary to the claims made by Dr. Dismukes, the outage event scenarios identified in the Company's CBAs are well-conceived and accurately parameterize the risks the Company will mitigate through the proposed ESII infrastructure investment plan.

Finally, the reasonableness and acceptability of the Company's CBAs is also supported by the fact that the monetization of benefits in the Company's CBAs is conservative in its estimation of VoLL and other benefits.

The Board should reject Dr. Dismukes' criticisms of the Company's CBA for the following reasons:

1) Dr. Dismukes' use of a benefit-to-cost ratio (BCR) test of 1.0 as a strict "pass" or "fail" measure to evaluate the viability of the Company's proposed ESII investments fails to acknowledge the existence of important quantified, but not monetized and qualitative benefits that can be realized under the Company's proposed ESII.

2) Dr. Dismukes' recommendation to exclude the benefits of the Company's ESII from its CBAs unless there are specific performance metrics and guarantees associated with the future achievement of these benefits is unsound because whether or not performance metrics are imposed has no impact on the reasonableness, quality, comprehensiveness, or results of the CBAs, which stand on their own merits.

3) Dr. Dismukes' claim that the Company's quantification of VoLL-derived benefits is seriously flawed and should either be excluded or highly discounted when used in the Company's electric CBA should be rejected; his criticisms of the VoLL factors (derived by the Lawrence Berkeley National Laboratory in its 2015 Report) and their use in the Company's CBA are incorrect.

4) Dr. Dismukes' claim that the Company's VoLL-derived benefits should be excluded from the Company's gas CBA should be rejected; his criticisms of the methodology used by the Company to derive its residential and commercial and industrial ("C&I") VoLL factors are incorrect.

5) Dr. Dismukes' claim that the Company's quantification of other avoided costs (benefits) is deficient and should be excluded from its gas CBA fails to acknowledge that these costs will be avoided under the types of outage events the Company's ESII investments are meant to mitigate.

6) Dr. Dismukes' claim that the Company's electric outage event scenario that underpins our calculation of outage benefits is unrealistic, leading to exaggerated benefit claims, should also be dismissed; in essence, Dr. Dismukes is simply arguing that the Company should not have relied on outage data from real historical storm events.

The Board should also reject Dr. Dismukes' "alternative CBAs" because of the following deficiencies in how he utilized the IMPLAN Model as the basis of his analysis:

1) Dr. Dismukes' "alternative CBAs" are strictly limited to the consideration and measurement of a narrow set of monetary impacts, and completely ignore any other decision criteria.

2) Dr. Dismukes' use of the IMPLAN Model as a CBA is an incomplete analysis and, therefore, insufficient to support his conclusions because it fails to accept and include any outage-related benefits which constitute the primary purpose of the Company's ESII investments and is a requirement in a properly structured CBA.

3) Certain input assumptions made by Dr. Dismukes for purposes of performing his IMPLAN Model analysis overstate the negative economic activity impacts found in his "alternative CBAs."

IV. THE COMPANY'S CBAs PROVIDE MEANINGFUL, ACCEPTABLE AND CONSERVATIVE RESULTS

Q. Rate Counsel Witness Dismukes claims that the Company's CBA suffers from a number of deficiencies that cause the Company's ESII Proposal to "fail" the CBA. Do you agree with his assertions?

A. No. The Company's electric and gas CBA were conducted in a reasonable and acceptable manner that properly yield estimates and descriptions of the total monetized costs and benefits, and other quantitative but not monetized and qualitative benefits, of PSE&G's ESII investment plans. The CBAs are structured in a manner consistent with industry practice standards. The Company's electric and gas CBA reports are highly transparent and include detailed descriptions of the underlying methodologies, definitions, pertinent industry and academic literature, structural issues in constructing a CBA, conceptual valuation issues surrounding outage damage costs, evaluation of results, sensitivity analyses, an extensive narrative on each ESII subprogram and its benefits, and careful and comprehensive benefit inventories. Both of the Company's CBA reports also include detailed and comprehensive

identification and description of all essential study assumptions.

The Company's CBAs provide meaningful and acceptable results to the Board for purposes of examining the value these investments will provide to PSE&G's electric and gas customers. Based on a close review of the *complete* results of the Company's CBA (i.e., the monetized costs and benefits, the associated BCRs, the non-monetized quantitative and qualitative benefits of the ESII investments and related sensitivities), the Company's ESII investments will provide significant value to its electric and gas customers and should be approved as necessary and prudent by the Board.

Q. To help frame your discussion of the benefit components of a CBA, have you prepared a diagram which provides a specification of the benefits that are relevant when evaluating the value of electric and gas infrastructure investments such as those included in the Company's ESII?

A. Yes. Exhibit BV-ESII-1 to this testimony presents a diagram of the specification of benefits associated with an electric or gas outage event. There are three dimensions to identifying and explaining these benefits: (1) the type of cost avoided (direct or indirect); (2) the type of benefit (monetary, quantified but not monetized, and qualitative); and (3) the timeframe of the outage event. Each of these dimensions and the resulting benefits under the Company's ESII will be discussed in detail in conjunction with our responses to Dr. Dismukes' claims and related arguments presented in his direct testimony. Most importantly, benefits from each of these dimensions should be included in a properly conducted CBA.

Q. A recurring theme in Dr. Dismukes' direct testimony is his claim that the benefits reflected in the Company's CBA results are upwardly biased. How do you respond to his claim?

A. Dr. Dismukes is mistaken for a number of reasons. We will respond specifically to

each of Dr. Dismukes' arguments in the next section of our rebuttal testimony. However, as we will describe below, there are a number of reasons why the benefits and the CBA results of the ESII infrastructure investments are not upwardly biased but are, in fact, conservative in nature.

Q. How are the results of the Company's electric CBA conservative?

A. The results of the Company's electric CBA are conservative because a wide range of benefits have been carefully inventoried, the monetized benefits have been conservatively estimated, and the monetary CBA results are not weighted to incorporate the additional contribution of quantified but not monetized and qualitative benefits within the monetary CBA results.

Furthermore, the Company has rigorously and thoroughly identified the engineering basis of each of the electric ESII subprogram's potential effects on the Company's costs, and on reliability and resiliency improvements. This is evidenced in part in Appendix A of the electric CBA report, the Benefits Matrix, which documents forty (40) separate subprogram impacts and eighty-four (84) specific benefits. Each subprogram's functional dependencies are identified, and the benefit by type is indicated. Furthermore, Appendix B of the report provides extensive documentation on assumptions that drive each of these benefits.

Q. What makes the monetary benefits in the Company's electric CBA conservatively estimated?

A. The Company's electric CBA adopts several conservative assumptions that result in conservative estimates of the monetary benefits:

- Monetary benefits are delayed until the end of the ESII 5-year construction period, even though benefits accrue immediately as each substation or circuit

improvement is completed. As a result, only fifteen (15) years of monetary benefits are included in the CBA results.

- The electric CBA assumes that for any outages lasting 16 hours or more the VoLL factors remain static at the 16-hour threshold level. This assumption ignores the fact that VoLL benefits increase as outage duration increases. This choice in assumptions reduces the VoLL benefits for outages that are greater than 16 hours in duration.
- The estimate of benefits in the electric CBA uses a 20-year forecast period for costs and benefits and takes no account of the fact that many of the assets have very long expected in-service lives of 55 or 60 years.
- The CBA ignores the largest storm event that has occurred in the recent past, namely Superstorm Sandy.

Q. How would the monetary results of the Company's electric CBA change if a less conservative approach was applied to these assumptions?

A. Using less conservative assumptions would have a dramatic effect on the total monetary benefits estimated to result from the Company's electric ESII. Exhibit BV-ESII-2 to this testimony displays the results graphically. The impacts to the net present value ("NPV") result in the Company's electric CBA are as follows:

- Recognizing the monetary benefits as the construction is completed increases the VoLL-related benefits, increasing the NPV result by $330 million.
- Recognizing the long-life of the ESII assets over a 40-year period increases the NPV result by $1.025 billion. This includes additional avoided costs of $94 million and VoLL-related benefits of $931 million.
- Including the effects of Superstorm Sandy within the Company's electric CBA increases the NPV result by approximately $1.087 billion.

Q. How else is the Company's electric CBA conservative in nature?

A. The electric CBA is deliberate and detailed in identifying many specific qualitative benefits. For example, there are fifteen (15) qualitative benefits identified in Appendix A related to outage improvement. These benefits, though difficult to monetarily estimate, represent further improvements in the Company's system reliability and resiliency benefits.

In addition, as explained in the Company's electric CBA report, while the VoLL factors provide monetary estimates of the direct damage costs private parties may incur resulting from outages, they do not account for many other direct and indirect costs. These other costs can be very extensive and are not estimated as part of the monetary results in the Company's electric CBA. The "Additional Outage-Related Impacts" section of the Company's electric CBA report explains these facts and supporting Table 7 lists many examples of these costs.[1] Many of these costs are identified as "indirect" and long-term costs.

Q. Can you further describe the nature of these indirect costs?

A. Yes. In a recent study performed by the FSC Group, indirect costs are explained within the context of electric utility long duration power outage studies:

> "Indirect costs to commercial and industrial customers result from the chain reaction of economic losses stemming from direct costs: interactions between business (e.g., changes in quantities of inputs bought or outputs sold, changes in relative prices) and interactions between consumers and business (e.g., lost wages and reduced spending). Indirect costs are thus incurred not only by people and firms subject to an outage, but also to people and firms outside of the affected areas. Additionally, outage costs associated with public expenditures (e.g., assistance programs, emergency services, loss of taxes), public goods, (e.g., water treatment and injury or loss of life can be considered a part of indirect costs."[2]

Q. What is the potential magnitude of these costs?

A. There are many industry studies that provide ***ranges*** of estimates for indirect benefits. Many of these studies fall within the literature associated with resiliency effects. The FSC Group provided these estimates of ranges that are possible for indirect costs of long-term

[1] Attachment 5 Schedule-BV-ESII-Elec-4, page 31.
[2] FSC Group, Downtown San Francisco Long Duration Outage Cost Study, Prepared for Pacific Gas & Electric Company, March 27, 2013, page 12A-9.

electric power outages:

- Researchers estimate that the indirect costs of the 1977 NYC outage were more than 5 times the direct cost estimate.[3]
- For an extensive San Francisco electric power outage study, the FSC Group concluded that indirect outage costs ranged between 0.5 times and 2.0 times the value of direct outage costs.

This area of estimation can be very complex because of the highly diverse nature of impacts that are evidenced in long-term power outage circumstances.

Q. How are the results of the Company's gas CBA conservative in nature?

A. The results of the gas CBA are conservative for several reasons. As with the electric CBA, a careful inventory of benefits has been included in the gas CBA.[4] Additionally, several assumptions add conservatism to the resulting benefit estimates, including:

- The gas CBA is based on a limited forecast period of 20 years and does not reflect the long-lived nature of the assets. Both the resiliency improvements and the M&R station upgrades will provide benefits for 50-60 years.
- The outage event that is the basis of the resiliency benefit evaluation represents a single event over the long life of the assets. More than one avoided outage incident is possible, thereby increasing the benefits that would be realized.
- The outage event assumed a rapid repair and restoration of the upstream gas transmission system of not more than 10 days. A longer repair period would increase the outage-related benefits.
- The outage duration assumes a period of 30 days to restore service to most of the Company's gas customers. There are many factors that could increase the duration of this restoration period, including the availability of mutual aid crews.
- The residential VoLL factor applied in the gas CBA is conservative by design and is based on customers simply valuing the loss of gas service at the currently effective price charged by the Company under its residential gas tariff.

[3] Ibid, page 12A-5.
[4] See Attachment 6 Schedule-BV-ESII-Gas-5, pages 48-51, 64-65 and Appendix G.

Q. How else is the gas CBA conservative?

A. As with the Company's electric CBA, the gas CBA is deliberate and detailed in identifying many specific qualitative benefits, such as those identified for the Company's M&R stations in Appendix G of the gas CBA report.

In addition, as explained in the Company's gas CBA report, the VoLL factors provide monetary estimates of the direct damage costs private parties may incur resulting from outages. The VoLL excludes many other direct and indirect costs. These other costs can be very extensive and are not estimated as part of the monetary results in the Company's gas CBA. The gas CBA report describes these other costs at page 43:

> For outages, it is also relevant to expand the impacts to beyond just observable costs. Some of the impacts of a gas outage are quantifiable in monetary terms, and hence, economic in nature; whereas other impacts reflect broad, social impacts tied to convenience, personal safety, pain and suffering, security and other less tangible, but very real, values to the customer. Outage impacts are also characterized by *externalities*, which can be either positive or negative; externalities are impacts incurred by others not party to the economic transaction. For example, an outage event may disrupt a harbor or airport and cause supply chain disruptions for manufacturers far outside the immediate region. This is a form of negative "network externalities," -- it is beyond the influence of the manufacturer suffering the damage.[5]

Q. Are these indirect costs of gas system outages like the indirect costs described earlier?

A. Yes, they are similar in many respects in terms of their impact. However, the specific nature of the causes of these losses would be specific to the loss of gas service.

[5] Attachment 6 Schedule-BV-ESII-Gas-5, page 43.

Q. Does the gas CBA attempt to capture the monetary impacts of these long-term indirect costs?

A. No. The gas CBA attempts to capture estimates of the private and direct costs to residents and businesses. The long-term indirect costs explained here are in addition to the private and direct costs that were estimated.

V. RESPONSE TO SPECIFIC ISSUES RAISED BY RATE COUNSEL

A strict "Pass/Fail" test ignores risk reduction and other benefits

Q. At page 17 of his direct testimony, Dr. Dismukes claims that a "pass/fail" test should be applied to the Company's CBA to evaluate the acceptability of PSE&G's proposed infrastructure investment programs under its ESII. Do you believe that such a test is appropriate?

A. No. Dr. Dismukes' use of a BCR test of 1.0 as a strict "pass" or "fail" measure to evaluate the viability of the Company's proposed ESII is deficient because it fails to acknowledge the existence of important quantified, but not monetized and qualitative benefits that can be realized due to the Company's proposed ESII. The simplistic and absolute nature of Dr. Dismukes' approach ignores the value - indeed, the whole point - of conducting a CBA, and obscures the purpose and full value of the utility infrastructure investments being evaluated.

As discussed in the Company's electric CBA report, the strictly monetary BCR, by its very nature, ignores consideration of many significant and important qualitative benefits, such as reduction in risk and safety enhancements that will be created through the Company's electric and gas program investments. Black & Veatch believes that the CBA, and especially the discrete estimate of a specific monetary BCR, is one of several inputs to decision makers about the merits of the Company's electric and gas programs, but it is not

dispositive by itself. For example, a significant portion of PSE&G's proposed investment was chosen based on asset risk management analysis that was guided by a range of criteria, including safety and environmental performance, which help address the chronic and long-term effects of aging equipment and run-to-failure conditions.

Q. Is it feasible to monetize in a CBA all the impacts associated with an infrastructure investment plan such as the Company's ESII?

A. No. While it is true that one of the goals of a CBA is to monetize as many impacts as possible, it is not required that, and rarely possible for, all impacts to be monetized.[6] However, by establishing the proposed monetary-based "pass/fail" test as a strict "bright line" measure, Dr. Dismukes either ignores our observations or fails to acknowledge certain technical limitations inherent in a CBA that make it impossible to monetize all relevant impacts (benefits). He also ignores the role of alternative analytical approaches related to risk evaluation that compliment a formal monetary CBA when the benefit effects cannot be monetized.

Q. How were these technical limitations treated in relationship to the Company's CBA?

A. As explained in Black & Veatch's electric and gas CBA reports, significant attention was devoted to identifying a wide range of cost and benefit impacts of the Company's proposed ESII investments. Creating an "impact inventory" is a very important early step in conducting a proper CBA.[7] The Company's inventory of cost and benefit impacts includes those that cannot reasonably be quantified and/or monetized. This does not mean, however,

[6] See Attachment 5 Schedule-BV-ESII-Elec-4, page 14.
[7] Anthony E. Boardman, David H. Greenberg, Aidan R. Vining, and David L. Weimer, Cost-Benefit Analysis, Concepts and Practice, (Cambridge: Cambridge University Press, 2018), page 8.

that their impacts are not tangible, direct, and reasonably inferable; they certainly cannot be casually dismissed.

Q. Can you provide a reference to this inventory and the classification effort?

A. Yes. We provide extensive details concerning this inventory and classification effort. For example, in Appendix B, Subprogram B-4, we explain the logic for the benefit classification for this specific subprogram: "The reliability of the multiprotocol label switching ("MPLS") circuits is known as compared to the existing fiber network from eight (8) months of available data, but unlike the recloser, plain old telephone service ("POTS") lines, the costs associated with MPLS outages are not specifically quantified due to limited repair data. This benefit is therefore qualitative."[8] This is part of one of the 84 detailed benefit descriptions discussed earlier.

Q. How should we refer to these impacts that are not monetized?

A. The literature on cost-benefit analysis is extensive and provides ample evidence that practitioners consider three types of benefits: (1) monetary benefits; (2) benefits that can be quantified, but not monetized; and (3) qualitative benefits. Furthermore, benefits that can be quantified but not monetized can in some cases be evaluated in terms of cost-effectiveness.

Useful guidance on this concept is provided by the U.S. Federal Government in its direction to federal regulatory agencies, with the purpose of "standardizing the way benefits and costs of Federal regulatory actions are measured and reported." See Circular A-4 issued

[8] Attachment 5 Schedule-BV-ESII-Elec-4, page 92.

by the United States Government's Office of Management and Budget ("OMB").[9]

Q. Can you please provide an example of each type of benefit described above?

A. Yes. An example of a monetary benefit of ESII is the value customers attribute to the Company's ability to avoid or minimize the extent of electric and gas outages (as monetized with the VoLL factors used in the Company's CBA). An example of a benefit that is quantified but not monetized is the reduction in the risk associated with aging electrical substations and circuits through the Company's proposed substation upgrades under its electric ESII. In this case the risk reduction is quantified through a risk score developed by evaluating candidate replacement electric assets, which we discuss further below. Finally, an example of a qualitative benefit is the reduction in the potential for methane releases at M&R stations as these stations are upgraded[10] or the example provided above for the MPLS circuits.

Q. Earlier you mentioned that Dr. Dismukes ignores technical limitations and alternative analytical approaches that are required when performing a CBA. What did you mean by "alternative analytical approaches"?

A. The term "alternative analytical approaches" refers specifically here to the risk-based modeling of PSE&G's electric and gas distribution assets undertaken by Black & Veatch using asset-level Risk Models. Black & Veatch conducted a risk-based assessment of many of the electric and gas distribution system assets to help PSE&G identify and prioritize assets for end-of-life replacement, including the life cycle substation upgrade aspects of the

[9] Office of Management and Budget, Circular A-4, Washington, D.C. 2003. In October 2010 OMB published an agency checklist for regulatory impact analyses required by Executive Order 12866 and OMB Circular A-4. For Circular A-4 see: https://obamawhitehouse.archives.gov/omb/circulars_a004_a-4. For a description of federal requirements related to cost benefit see: Congressional Research Service. Cost-Benefit and Other Analysis Requirements in the Rulemaking Process, 7-5700 www.crs.gov R41974, December 2014.

[10] See Appendix G to the Company's gas CBA report (Attachment 6, Schedule BV-ESII-GAS-5) for a complete listing of these qualitative benefits.

Company's ES II.[11] The risk scores resulting from this modeling efforts help to quantify the relative benefits (i.e., the quantified, but not monetized benefits) associated with the assets proposed by the Company for end-of-life replacement.

The risk scoring approach that the Company has applied to these assets includes numerous "consequence criteria" in categories such as safety and environmental performance. It is inherently difficult to monetize the value of reductions for each of these risks. Rather, the consequence criteria are scored using ordinal scales that denote ranges of impacts from high to low. Improving safety and environmental performance are beneficial even if a specific monetary value cannot be reasonably assigned to them for purposes of conducting the CBA. In both his direct testimony and numeric analysis presented in Schedules DED-6 and DED-7, Dr. Dismukes completely ignores the benefits of risk reduction created by the Company's proposed ESII.

Q. How does the BCR threshold requirement of 1.0 imposed by Dr. Dismukes influence the claims he makes concerning the appropriateness and reasonableness of the Company's ESII?

A. Dr. Dismukes asserts that "[t]wo large subprograms fail even under the Company's own analysis."[12] He cites the separate and individual CBA results for the electric substation and gas M&R station subprograms, which each have separate monetized BCR results less than 1.0. Dr. Dismukes also applies the 1.0 threshold requirement as a fundamental evaluation criterion in his Schedules DED-6 and DED-7, which report the results of the alternative CBAs he prepared. We respond to his use of the 1.0 threshold requirement within

[11] See the direct testimony of William D. Williams (Attachment 4) for a complete explanation of the process used to conduct the risk-based modeling of PSE&G's electric distribution assets.
[12] Page 19, line 12 of David E. Dismukes' direct testimony.

that context later in our rebuttal testimony.

Q. How should non-monetary benefits be treated within the structure of a CBA?

A. Non-monetary benefits (i.e., quantified, but not monetized and qualitative benefits) should be carefully identified, discussed, summarized, and, if meritorious, ultimately included as part of the overall results of the CBA, even if this is done on qualitative terms. As previously stated, this classification process occurs early in the process of conducting the CBA.

Governmental agencies, utility regulators, researchers and utilities have each acknowledged the role of qualitative and non-monetized quantified benefits as part of utility infrastructure investments decision making:

- The OMB provides the following guidance - "A complete regulatory analysis includes a discussion of non-quantified as well as quantified benefits and costs. A non-quantified outcome is a benefit or cost that has not been quantified or monetized in the analysis. When there are important non-monetary values at stake, you should also identify them in your analysis so policymakers can compare them with the monetary benefits and costs. You should categorize or rank the qualitative effects in terms of their importance (e.g., certainty, likely magnitude, and reversibility). You should distinguish the effects that are likely to be significant enough to warrant serious consideration by decision makers from those that are likely to be minor."[13]

- The New York State Public Service Commission ("NYPSC") has promulgated detailed rules on the treatment of costs and benefits for utility energy investments that must be followed by jurisdictional electric utilities when evaluating certain kinds of large grid investments. The resulting guidance includes specific allowances for qualitative benefits.[14]

- Consistent with the NYPSC requirements, Consolidated Edison's Benefit Cost Analysis ("BCA") Handbook identifies, "net non-energy costs" in the following way: "In cases where non-energy impacts are attributable to the specific project or program,

[13] OMB Circular A-4.

[14] New York Public Service Commission, Case No. 14-M-0101 - Proceeding on Motion of the Commission in Regard to Reforming the Energy Vision, Order Establishing the Benefit Cost Analysis Framework, issued and effective: January 21, 2016.

they may be assessed qualitatively."[15]

- The Electric Power Research Institute ("EPRI") Guidebook for Cost/Benefit Analysis of Smart Grid Demonstration Projects, in its definition of benefits, states as follows: defines benefits as follows: "Difficult-to-monetize or difficult-to-quantify impacts may be referred to as benefits, which may be included in a qualitative scoring portion of a cost/benefit analysis."[16]

Q. In your opinion, why do you believe the industry literature on conducting a CBA places emphasis on the accommodation of qualitative benefits?

A. The industry literature places emphasis on this issue because qualitative benefits resulting from infrastructure investments are often very important even though they may be difficult to measure and monetize. Moreover, a CBA "can be thought of as providing a framework for assessing the relative efficiency of policy alternatives."[17] This means that setting policy commonly must address questions concerning non-monetary pursuits involving social welfare considerations, such as quality of life, and the degree of risk associated with our physical environment.

Q. What is the impact of limiting the scope of possible benefits considered in a CBA in a case like this?

A. Limiting the scope of benefits to those that can be monetized undermines the rigorous and comprehensive discovery and evaluation of the impacts of investments under an infrastructure program such as the Company's ESII. If the focus of the CBA is limited to monetary benefits, the stepwise process beginning with the development of the impact inventory would ignore many relevant impacts.[18] This would introduce a harmful bias in the

[15] Benefit Cost Analysis Handbook, ConEdison, New York, N.Y., (2016), page 47.
[16] EPRI, Guidebook for Cost/Benefit Analysis of Smart Grid Demonstration Projects, Revision 1, Measuring Impacts and Monetizing Benefits (1025734) Technical Update, (December 2012), page A-2 - Definitions.
[17] Boardman et al. Ibid, page 28.
[18] In the Company's electric CBA report, (Attachment 5 Schedule-BV-ESII-Elec-4), the impacts inventory is provided as an integral part of both Appendix A – Benefit Matrix and Appendix B, ESII Electric Subprogram Details.

determination of benefits associated with any infrastructure program. This limited focus would also fail to satisfy the requirements of N.J.A.C. 14:3 2A.5(b) that "descriptions of project objectives - including specific expected resilience benefits" be included in the Company's petition.

Q. In your practice of conducting CBAs, have you observed the existence of this type of benefits bias?

A. Yes. Often an electric utility's benefits discovery process for a grid investment will narrow too quickly to those benefits that are strictly monetary in nature. As a facilitator in these discussions, we must challenge the participants to think more expansively about the impacts and hold in abeyance considerations on whether we can quantify and/or monetize them.

Q. Do you believe the structure of the Company's CBA is consistent with industry and governmental standards regarding the recognition of qualitative benefits?

A. Yes, the Company's CBA is consistent with the requirements and guidance of the OMB, NYPSC, EPRI, and other industry guidance on the recognition of qualitative benefits. The Company's CBAs provide itemizations and detailed explanations of both monetary benefits and costs and non-monetized and qualitatively considered impacts. In fact, this observation applies to all the Company's subprograms - not just the two ESII subprograms questioned by Dr. Dismukes.

Moreover, the Company applied professional judgement in determining the nature and magnitude of non-quantifiable benefits. For its Electric Substation subprogram, for example, the Company carefully identified and delineated for purposes of the electric CBA twenty-eight (28) separate major benefits. Ten (10) of these benefits represent approximately $663 million

of monetary benefits. Another eighteen (18) of these benefits are specifically identified as qualitative in nature and difficult to monetize. These benefits are identified in Appendix A – Benefits Matrix, contained in the Black & Veatch electric CBA Report,[19] with the reference rows labeled "SF" and "SU." However, the BCR of 0.7 – which is the monetary CBA component and measure -- does not reflect the additional and substantial value that these eighteen qualitative benefits provide to the Company and its customers.[20]

Q. What are examples of quantified but non-monetized and qualitative benefits for the Company's gas M&R subprogram?

A. As with the electric CBA, the Company's Gas CBA report identifies many qualitative benefits for its M&R Upgrade Subprogram. They include the stations being brought into conformance with PSE&G's current design standards, improving their operating and environmental performance, and reducing noise levels through improved layout, equipment, and building structural materials. These qualitative benefits are also identified on pages 6-7 of our direct testimony discussing the Company's gas CBA.[21] In all, ten (10) major qualitative benefit areas are classified and identified by specific station.[22]

Q. Do you believe the Board's regulations on Infrastructure Investment Programs ("IIP"), N.J.A.C. 14:3-2A, contemplates a strict BCR threshold of 1.0 when conducting a CBA to determine the viability of a utility's proposed infrastructure investments?

A. No. The IIP's CBA requirement is one of several evaluation considerations by the Board. It is part of the engineering and evaluation report criteria requiring the submission of

[19] Attachment 5, Schedule BV-ESII-ELEC-4.
[20] See Appendix A – Benefits Matrix, of the Black & Veatch Electric CBA report (Attachment 5, Schedule BV-ESII-ELEC-4) for a detailed description of the beneficial impacts of the electric ESII categorized as cost-related impacts (i.e., avoided costs), Customer Minutes of Interruption or CMI-related impacts and other impacts (i.e., qualitative benefits).
[21] Direct testimony of the Cost Benefit Analysis Panel Energy Strong II Program – Gas, Attachment 6.
[22] Attachment 6, Schedule BV-ESII-GAS-5, Appendix G, page 93.

"descriptions of project objectives-including the specific expected resilience benefits, detailed cost estimates, in service dates, and any applicable cost-benefit analysis for each project." Additionally, the core purpose of the IIP regulations is to support enhancement of the reliability, safety and/or resiliency of the grid. These regulations provide no instruction or limitations that the relative importance or acceptance of each utility's infrastructure program, subprogram or project should be determined through the application of a strict monetary BCR of 1.0 threshold test.

Q. Do you believe the Board's IIP regulations contemplates a broader consideration of benefits than permitted under a strictly monetary-based BCR of 1.0 threshold test as utilized by Dr. Dismukes?

A. Yes. As noted above, the CBA requirement in the IIP regulations includes the language, "any applicable cost benefit analysis." This language implicitly recognizes there are a variety of forms of a CBA, and a potential variety of important benefits. We also believe the "any applicable" wording is inconsistent with attempts to limit the scope and discovery of meaningful benefits.

Q. What is your overall conclusion concerning the Company's CBA results for the Electric Substation and M&R Upgrade Subprograms in relation to Dr. Dismukes' claims that a strict BCR of 1.0 threshold test is required?

A. Dr. Dismukes' application of a strict BCR of 1.0 threshold test (that is defined without compromise in monetary terms) is not appropriate, does not meet the norms of practice for properly conducting a CBA, and is inconsistent with a reasonable interpretation of the guiding IIP regulations. Rather, the Board should consider the entirety of the CBA results including the role of quantified, but not monetized and qualitative results. The quantified, but not monetized and qualitative benefits - together with the approximately $698 million of monetary

benefits – for these two subprograms provide cumulative benefits that can outweigh the subprograms' direct costs when including the proper and full consideration of benefits.

CBA benefits stand on their own with or without performance metrics and guarantees

Q. Dr. Dismukes claims (at pp. 19, 21-22) that PSE&G's CBAs are flawed because they do not "tie estimated benefits to . . . performance metrics," and that "PSE&G overstates the benefits of its program since, without "performance standards", those future benefits "cannot be verified with any reasonable degree of certainty." Do you agree with these claims?

A. No. First, Dr. Dismukes' proposal to require a benefits performance guarantee should not prejudice the evaluation of benefits in the Company's CBAs. The CBAs should be evaluated on their own merits. Additionally, we understand that PSE&G will adhere to any performance metrics and reporting requirements the Board deems appropriate to measure the effectiveness of the Program. Therefore, it is not true that the Company's results will not be verified. Moreover, it is not necessarily true that the creation of "performance metrics" can or will ensure achievement of future benefits.

Q. From your work in conducting the Company's CBAs, did you identify any bias in the input assumptions and, if so, was it attributable to the lack of performance measures?

A. No. The Black & Veatch team conducting the Company's CBA is not aware of any input assumptions that are biased-upward due to the *lack* of some type of performance accountability. Rather, we specifically focused on ensuring that the Company's CBAs were based on conservative assumptions to enhance the reasonableness of the results.

Q. At page 50 of his direct testimony, Dr. Dismukes claims that, "the omission of any meaningful performance metrics shifts ESII program performance risk away from the Company and onto ratepayers." How do you respond to his claim?

A. This claim is incorrect because it ignores mitigation of the risks customers face today, which will remain unmitigated and will grow without the ESII investments. Today, the Company's electric and gas distribution systems face outage risks and, therefore, its customers also face these risks. These risks are "always present", "24 x 7." ESII is intended to shift these risks away from customers through the proposed resiliency and system hardening investments, lessening customer risks associated with electric and gas outage events.

Q. Why do you believe Dr. Dismukes makes this claim?

A. Because he ignores consideration of any quantified but not monetized reliability and resiliency benefits in his "alternative CBAs," it is our belief that Dr. Dismukes fails to acknowledge the insurance-like aspect of the Company's ESII investments.

In essence, Rate Counsel's approach to calculating benefits in this case ignores the fact that the proper comparison to the investment program under ESII, if it were available, is a financially and legally sound insurance policy available in the market that the Company could purchase and that would cover PSE&G's customers from a wide range of risks related to the system resiliency hazards described in the Company's CBA reports and its direct testimony. This insurance product would have to cover the PSE&G system and its customers for 60 years or more. In the event both minor and major outages are experienced, this insurance policy would have to provide immediate compensation to the Company's customers in a manner and at a level that is acceptable, making them whole on their losses. We know of no such insurance product.

The VoLL benefits used in the Company's CBAs are appropriate

Dr. Dismukes' criticisms of the 2015 LBNL Report are incorrect

Q. Dr. Dismukes also claims that the Company's quantification of VoLL benefits is seriously flawed and should either be highly discounted or excluded when used in the Company's CBA. Specifically, he claims (at page 27) that the VoLL factors used by PSE&G, which are from a well-known 2015 Lawrence Berkeley National Laboratory ("LBNL") Report, are too "unreliable", "variable", and "upwardly biased", and are "inappropriate for use in this part of the United States." Is he correct?

A. Absolutely not. For its electric ESII, the Company applies VoLL factors from a detailed research effort and study conducted by LBNL. Simply stated, Dr. Dismukes has either greatly undervalued or simply ignored the degree of effort, rigor and peer review that has gone into the research supporting the VoLL factors presented in the 2015 LBNL Report and utilized in the Company's electric CBA. The 2015 Report was built on and superseded a prior study published in 2009.[23] It is instructive to cite from the 2015 LBNL Report's abstract explaining the study effort:

> "This report updates the 2009 meta-analysis that provides estimates of the value of service reliability for electricity customers in the United States (U.S.). The meta-dataset now includes 34 different datasets from surveys fielded by 10 different utility companies between 1989 and 2012. Because these studies used nearly identical interruption cost estimation or willingness-to- pay/accept methods, it was possible to integrate their results into a single meta-dataset describing the value of electric service reliability observed in all of them. Once the datasets from the various studies were combined, a two-part regression model was used to estimate customer damage functions that can be generally applied to calculate customer interruption costs per event by season, time of day, day of week, and geographical regions within the U.S. for industrial, commercial, and residential customers."[24]

[23] Michael J. Sullivan, Matthew Mercurio and Josh Schellenberg, Estimated Value of Service Reliability for Electric Utility Customers in the United States, Prepared for Office of Electricity Delivery and Energy Reliability U.S. Department of Energy, Ernesto Orlando Lawrence Berkeley National Laboratory, June 2009.

[24] Michael J. Sullivan, Josh Schellenberg, and Marshall Blundell, Updated Value of Service Reliability Estimates for Electric Utility Customers in the United States, Ernesto Orlando Lawrence Berkeley National Laboratory, January 2015.

Q. Is this research work related to the VoLL valuation methods progressive?

A. Yes. By several indicators this research effort is an on-going, progressive initiative focused on building upon the body of research, analytical methods and models supporting the estimation of interruption costs. In fact, Nexant, Inc. and LBNL recently published a Guidebook[25] for estimating power system interruption costs that relies on the progression of work associated with the 2009 and 2015 studies sponsored by LBNL. The Guidebook reflects the extensiveness of this effort and the significant level of researcher participation from the United States government (Department of Energy, LBNL) and the energy industry.

Q. Are VoLL estimates used in other important ways within the utility industry?

A. Yes. Several organized electric wholesale energy markets within the United States -- including ERCOT and MISO -- rely on VoLL estimates for the determination of certain components of electricity market prices related to ancillary energy products. In fact, according to a study in which it inspected shortage pricing throughout the United States, the Brattle Group concluded that every electric wholesale energy market jurisdiction within the United States "reflect some measure of VoLL in its administrative shortage pricing."[26]

Q. Dr. Dismukes claims that the study limitations cited in the 2015 LBNL report associated with the specific electric VoLL factors used in the Company's electric CBA justify their exclusion from the Company's analysis. Do you agree with his claim?

A. No. Dr. Dismukes has taken several comments made by the study authors out of context and is, thereby, misrepresenting the nature of the VoLL factors – and the

[25] Michael J. Sullivan, Myles T. Collins, Josh Schellenberg and Peter H. Larsen, Estimating Power System Interruption Costs – A Guidebook for Electric Utilities, Nexant, Inc. and Lawrence Berkeley National Laboratory, July 2018.
[26] The Brattle Group, Shortage Pricing in North American Wholesale Electricity Markets, page 2. Also, some literature refers to Value of Service, or VOS instead of VoLL.

mathematical regression model the factors are based upon. The fact is that the VoLL factors used by the Company are based on the best and most complete data available. As the LBNL study authors explain in the 2015 Report, "[to] the knowledge of the authors, this dataset includes nearly all large power interruption cost studies that have been conducted in the U.S."[27]

Q. Does Dr. Dismukes recommend alternative VoLL factors for use in the Company's CBAs or in the "alternative CBAs" he has prepared?

A. No. Throughout his direct testimony and discovery responses, Dr. Dismukes dismisses the reliability and resiliency benefits that comprise the Company's electric CBA, and he offers no alternative factors for use in his "alternative CBAs." In effect, he dismisses completely both the purposes of the statutory IIP requirements and the body of knowledge concerning value-based reliability and resiliency planning. In fact, the VoLL factors the Company has cited and relied upon represent a major contribution to the U.S. electricity industry's significant, long-term research and policy analysis effort to improve value-based reliability and resiliency planning for the power industry.

Q. How does Dr. Dismukes dismiss the reliability of the electric VoLL factors used by the Company?

A. Dr. Dismukes' direct testimony implies that the LBNL 2015 Report represents a minor update of a 2009 study, omitting that these studies form part of a significant and progressive effort stretching several decades as reflected in past EPRI studies (1995, 2015), LBNL studies (2001, 2004, 2009, 2015, 2017, 2018), numerous utility studies and rate cases,

[27] Michael J. Sullivan, Josh Schellenberg, and Marshall Blundell, Updated Value of Service Reliability Estimates for Electric Utility Customers in the United States, Ernesto Orlando Lawrence Berkeley National Laboratory, January 2015, page 16 (footnote 7).

and sponsored work by the U.S. DOE. We have provided a list of reference sources for the principal works associated with this effort in Exhibit BV-ESII-3. Dr. Dismukes ignores that this body of work is supporting value-based reliability planning throughout the U.S. for multiple purposes including: estimating reliability costs to the U.S. economy, establishing the marginal costs of generation capacity to set rates, assessing the economic costs of electric transmission and distribution system and smart grid investments, and improving the design of demand response programs, to name several specific uses.[28]

Q. Does Dr. Dismukes fail to acknowledge some of the improvements included in the 2015 LBNL Report compared to its 2009 Report?

A. Yes. Dr. Dismukes' criticizes the lack of data as a reason why the VoLL factors should be dismissed, whereas the LBNL researchers claim the regression model has evolved with greater explanatory power (2015 versus 2009) leveraging the data that is in fact available, making it more useful to U.S. electric utilities for value-based reliability and resiliency planning purposes. In addition, Dr. Dismukes ignores the fact that users can now access and use the regression model via web access. This speaks to the confidence that DOE, LBNL and the study authors have in the efficacy and usefulness of the regression model and the VoLL factors it generates for value-based reliability and resiliency planning for utility planners throughout the United States.

Q. Does Dr. Dismukes unfairly represent the nature of the 2015 LBNL Report update in other ways?

A. Yes. Dr. Dismukes improperly challenges two new studies incorporated into the

[28] Sullivan, Mercurio, Schellenberg. Estimated Value of Service Reliability for Electric Utility Customers in the United States (LBNL-2132E), Ernest Orlando Lawrence Berkeley Laboratory, June 2009, page xiv.

research reflected in the 2015 Report. In fact, he highlights these two studies on a separate schedule: These two new studies, "highlighted in Schedule DED-5," according to Dr. Dismukes "are from utilities already included in the original meta-dataset."[29] Notwithstanding the fact that the two new studies add explanatory value to the regression model (the output of which are the VoLL factors he criticizes), Dr. Dismukes criticizes the 2015 Report on the simple grounds that the original dataset already includes outage data from the same utilities.

Q. Could the new survey data be useful even if it is associated with utilities that have performed prior studies?

A. Yes. The LBNL researchers point out that these two new studies provide new and original data from "two large interruption cost surveys," with one featuring "several noteworthy methodological improvements" in survey design. Moreover, based on the inclusion of these new studies the LBNL researchers observe that, "for interruptions from 8 to 16 hours, the new model produces estimates that are more reasonable and show gradually increasing costs up to 16 hours."[30] Within the context of explaining the usefulness of these new studies, the authors observe that the resulting complete data base, "now includes 34 different datasets from surveys fielded by 10 different utility companies between 1989 and 2012, totaling over 105,000 observations."

Contrary to Dr. Dismukes' claims that the new studies add no value in improving the VoLL-based estimates, the LBNL authors clearly believe the addition of these studies are important, have substantial and significant merit, were worth the effort to expend public

[29] Direct testimony of David E. Dismukes, page 23, Lines 15-16.
[30] LBNL 2015 Report, page 17.

funds to include and analyze, and enhance the database upon which the Company's electric VoLL factors are based.

Q. Dr. Dismukes appears to take issue (page 24) with the fact that study sponsors were, "interested in measuring interruption costs for conditions that were important for planning their specific systems" and that the interruption conditions described in the surveys for a specific region tended to focus on periods of time when interruptions were more problematical for that region." Should this point be a concern in utilizing the VoLL factors in the Company's electric CBA?

A. No. It is quite reasonable that high quality outage survey data would come from utilities that focused on their specific circumstances and needs. Moreover, in considering this alleged limitation, it is important to appreciate that each study that is drawn upon "measured the same basic underlying concepts"[31] and these involved attributes of the interruption (e.g. duration, frequency, season, time of day), summary of costs, and customer characteristics. In this instance, Dr. Dismukes ignores the study authors' explanation that most of the studies we examined included a summer afternoon interruption, so we could compare that condition among studies."[32] Notably, summer afternoon interruption costs tend to be higher than other periods.[33] Therefore, a portion of Dr. Dismukes' concern is mitigated.

The VoLL factors from the LBNL Report are appropriate to use in New Jersey

Q. Dr. Dismukes points out that the authors of the LBNL Report express concerns about variables in the data being confounded. Should this be a consideration in making the decision to utilize these VoLL factors in the Company's CBA?

A. No. The study authors explain that the region and year of the study variables are

[31] LBNL 2009 Report, page 6.
[32] LBNL 2015 Report, page 48.
[33] LBNL 2015 Report, Table ES-2, page xiii.

correlated in the underlying study data in such a way that it is impossible to separate the effects of these variables on interruption costs. Confounding of independent and dependent variables is a problem commonly encountered when building a regression model. If variables are confounded and this is not identified or recognized it can bias the regression model and lead to the masking of, or the over- or under-estimating of, the strength of an effect. When this "omitted variable bias" is identified, specific steps are recommended to address it to create a regression model of improved statistical power. These include adding the omitted (confounded) variables to the regression or adding proxy variables. We believe that in identifying this effect, the LBNL researchers have addressed it as part of the regression model specification through their use of rigorous statistical techniques.

Q. For this concern raised by Dr. Dismukes to be significant, what do you believe he would have to demonstrate?

A. He would have to demonstrate that this "omitted variable bias" related to the region and year of study variables has not been accounted for or corrected as part of the regression model, or if accounted for, that it has been done in a way that leads to a model of significantly less statistical precision and explanatory power. Dr. Dismukes has not provided this type of demonstration.

Q. At page 25 of his direct testimony, Dr. Dismukes points out that the surveys that formed the basis of the studies were limited to certain regions of the country. Should this be a concern in utilizing the VoLL factors in the Company's CBA?

A. No. The LBNL authors observe that the under-representation of survey data for mid-Atlantic customers is a study limit, but the authors do not suggest that this limit should restrict use of the regression model to any geographical area. Rather, the 2015 Report is clear that,

"[o]nce the datasets from the various studies were combined, a two-part regression model was used to estimate customer damage functions that can be generally applied to calculate customer interruption costs per event by season, time of day, day of week and geographical regions within the U.S for industrial, commercial and residential customer."[34]

Q. At pages 25-26 of his direct testimony, Dr. Dismukes points out that the customer surveys used to form the meta-analysis database are over 15 years old. Should this be a concern in utilizing the VoLL factors in the Company's electric CBA?

A. No. Dr. Dismukes cites language in the LBNL 2015 Report concerning the "outdated vintage of the data." Presumably, he uses this observation in support of his later observation that the LBNL estimates are unreliable and likely suffer from a considerable upward bias. Dr. Dismukes has it backwards. A more meaningful and accurate citation addressing this issue, however, appears on page 18 of the LBNL 2015 Report where the study authors state that the newer data will show that there are increases, not decreases, to interruption costs due to the energy demands of the current economy.

> "[A]nother caveat is that this meta-analysis may not accurately reflect current interruption costs, given that around half of the data in the meta-database is from surveys that are 15 or more years old. To address this issue, the 2009 study included an intertemporal analysis, which suggested that interruption costs did not change significantly throughout the 1990s and early 2000s. However, during the past decade in particular, technology trends may have led to an increase in interruption costs. For example, home and business life has become increasingly reliant on data centers and "cloud" computing, which may have led to an increase in interruption costs for both producers and consumers of these services.

[34] LBNL 2015 Report, page iv.

Dr. Dismukes' criticism of the WTP estimates is overstated

Q. At page 26 of his direct testimony, Dr. Dismukes claims that the LBNL customer surveys are based on Willingness to Pay ("WTP") estimates that are often overstated due to an inherent bias in survey responses (where customers indicate they are willing to pay more than they actually would pay). Should his claim be a concern in using the VoLL factors in the Company's CBA?

A. No, for the reasons we explain below. We do acknowledge that it is a fair observation that WTP surveys can be affected by response bias. However, Dr. Dismukes' claims concerning bias within the WTP survey methods are grossly overstated.

Dr. Dismukes indicates that the utility surveys the LBNL Report relies upon are based on WTP estimates.[35] However, contrary to his belief, the studies that underpin the regression model to derive VoLL factors are a mix of direct interruption cost estimation and willingness-to-pay/accept study types. While both study types use survey-based instruments, interruption cost estimate surveys involve direct cost estimation, as distinct from surveys using WTP estimation techniques, which involve asking customers what they would pay to avoid electric service interruptions. The WTP-based argument made by Dr. Dismukes simply does not apply to both survey approaches.

Q. Are the two survey methods you just discussed applied uniquely to an electric utility's specific customer classes?

A. Yes. Experts agree that there are preferred survey methods based on the specific customer class that you are examining. "Several types of survey-based valuation methods are available for [customer interruption cost] study teams to use. The preferred method depends on which customer class will be the subject of the survey."[36]

[35] See the direct testimony of David E. Dismukes, page 26 (footnote 63) which cites the LBNL 2015 Report, page iv.
[36] Nexant and LBNL Guidebook, 2018, page 18.

Q. In the case of the LBNL meta-analysis and the underlying customer surveys that are related to this bias argument made by Dr. Dismukes, do the WTP and direct cost estimation methods apply to specific customer types?

A. Yes. The interruption cost estimates provided for residential customers in the LBNL Report, that comprise the meta-analysis data, are based on WTP survey methods, whereas the interruption cost estimates provided for C&I customers in the meta-analysis data are based on direct cost estimation surveys.

Q. If Dr. Dismukes' claim that there is upward bias in the WTP-based estimates used to derive the VoLL factors has merit, what proportion of the VoLL reflected in the Company's electric CBA is influenced by this bias?

A. Since only a small percentage (less than 5%) of the VoLL is contributed by residential customers in the Company electric CBA, only a small percentage can be similarly influenced by Dr. Dismukes' claim of upward bias within WTP-based interruption cost estimates.

Q. Is Dr. Dismukes accurate in his claims of WTP bias as it relates specifically to the LBNL regression models and the resulting VoLL factors used by the Company?

A. No. Dr. Dismukes' claims are incorrect for the VoLL factors used for the Company's C&I customers and too speculative in nature for the VoLL factors for residential customers to influence the consideration of the quality of the VoLL factors presented in the LBNL Report for use in the Company's electric CBA. A more reliable discussion on the bias inherent in customer interruption cost ("CIC") studies is offered in the recent Guidebook from Nexant and LBNL to guide survey development in this area. This Guidebook identifies the eight (8) main sources of potential bias in CIC studies: hypothetical, strategic response, utility benefit, status quo, anchoring, survey fatigue, nonresponse, and measurement error.[37] Moreover, as explained in the Guidebook, two (2) of these potential biases can increase estimates, two (2)

[37] Nexant and LBNL Guidebook, 2018, Table 5-1, page 60.

potential biases can decrease estimates, and four (4) potential biases can either increase or decrease the estimates. Several of the biases can potentially affect survey-based methodologies including WTP information solicitation techniques.

Q. Can we determine if the LBNL researchers were able to determine if the underlying CIC studies suffered from these potential biases, or if they were able to solicit information that was not unduly influenced by them?

A. No. On reaching a definitive conclusion on this question, the LBNL researchers noted, "We cannot determine, prime facie, the biases inherent in such self-reports of cost estimates associated with the hypothetical interruption scenarios."[38] However, they did acknowledge that, "there is concern that cost estimates based on hypothetical circumstances *may over or under estimate* the costs that occur under real conditions. There is no empirical evidence one way or another as to whether this concern is justified.[39]

Q. Is Dr. Dismukes accurate in his claims of WTP bias in any form, magnitude and direction?

A. No. Dr. Dismukes' offers claims of bias concerning WTP surveys generally but implicates the LBNL research specifically. We are not aware that he has inspected the specific surveys in question. Furthermore, as explained in the Guidebook, there are many forms of bias specifically relevant to cost estimation related to value of service attributes, not all which pertain to WTP surveys, and not all have an upward direction. Moreover, the Guidebook explains that each form of bias is associated with specific and practical methodologies that can be used to minimize bias: "The previous sections of this Guidebook discussed each of these sources of bias and how to mitigate them while designing and

[38] 2009 LBNL Report, page 6.
[39] 2009 LBNL Report, page xviii.

conducting the study."[40]

In summary, Dr. Dismukes apparently has not inspected the surveys and data in question, nor has he determined whether researchers involved in these surveys addressed specific forms of bias as part of their solicitations. The Board must reject his claims that the survey data nonetheless exhibits specific forms of bias, that it is of a specific direction and magnitude, and that it therefore disqualifies the LBNL research from consideration.

The Residential VoLL factor used in the gas CBA is appropriate

Q. At pages 29 of his direct testimony, Dr. Dismukes criticizes the methodology used by the Company to derive its residential VoLL factor used in its gas CBA, and on that basis, recommends that the VoLL-derived benefits should be disregarded. Do you agree with his criticisms and resulting recommendation?

A. No. Dr. Dismukes criticizes the use of the residential tariff price as the basis for the residential gas VoLL estimates. He argues that, "This approach, however, has nothing to do with the theoretical determinants of a customer's willingness-to-pay and should be dismissed by the Board. In fact, the method used by the Company in the ESII filing differs considerably from that used in its ESI filing which had more theoretic appeal despite several faulty calculation errors."

In making his claim, Dr. Dismukes presumably ignores a fair reading of the Company's gas CBA report. The report makes specific deference to valuation approaches, but also recognizes that the final valuation also depends on many other factors. Its appeal is that it is highly conservative and allows due emphasis to be placed on these other factors. The relevant section is quoted in its entirety:

[40] Nexant/LBNL Guidebook, page 59.

Black & Veatch offers that there are different approaches to measuring VoLL for residential customers facing costs of power interruption. Black & Veatch has noted arguments based on "contingent valuation" WTP arguments, consumer surplus-based arguments, and household income-based arguments. Black & Veatch notes that there are many variables impacting the outage scenario, such as duration, temperature, and restoration duration, all of which also impact the VoLL determination. For all of these reasons, and to provide a reasonable, yet conservative, view of VoLL, the cost-benefit analysis assumes that the customers simply value the loss of gas service at the currently effective price charged under PSE&G's residential gas tariff. The VoLL is, therefore, strictly proportionate to the foregone gas consumption during the outage period.

The assumptions and detailed calculations are presented in Appendix F - VoLL Calculations for PSE&G's Curtailment Resiliency Subprogram. The resulting VoLL during the outage period for PSE&G's residential customers is approximately $25M. On a per customer per day basis, this equates to $6.23. Black & Veatch notes that the VoLL analysis conducted for the ES I Gas Program resulted in a residential VoLL equal to $53 per day per customer, which is many times higher than this current estimate. Black & Veatch's approach to computing VoLL utilizes PSE&G's current gas commodity prices, which have declined over the ensuing 4-year period since the last VoLL analysis was conducted. Higher commodity prices would thus raise this estimate of VoLL.

The Black & Veatch approach makes no claim to limit prices (as part of consumer surplus-based assumptions) and other determinations of foregone gas consumption outside of assuming that in the absence of the outage event the customers would have continued to enjoy the use of the product in an uninterrupted fashion during this period. Most studies indicate, in fact, that a consumer values continued uninterrupted service at a level much higher than tariff prices for the service, recognizing as they do the significant direct and indirect costs and loss of welfare that results in a large and catastrophic event. As such, the Black & Veatch analysis approach is conservative.[41]

Q. How important is the benefit component associated with the residential VoLL to the overall gas CBA result?

A. We recognized that the residential VoLL estimate – even if utilizing a much higher value such as that offered by the Company in its ESI filing of $53/day – yields a very small contribution to the total VoLL benefits associated with the gas outage event.

[41] Attachment 6, Schedule BV-ESII-GAS-5, page 46.

Q. Why is the choice of such a conservative value appropriate?

A. The approach taken – as documented in the Company's gas CBA report -- provides the Board with a meaningful context about different valuation approaches. Furthermore, it explains that, "there are many variables impacting the outage scenario, such as duration, temperature, and restoration duration, all of which also impact the VoLL determination." Therefore, it provides meaningful guidance to the Board about how to weigh and consider the contribution of effects to the overall CBA results. Significant debates about various valuation methods would, in this instance, not yield significant benefit since the greater and more dispositive assumptions compared to the residential VoLL factors are the assumptions used to specify the characteristics of the gas outage event.

The C&I VoLL factor used in the gas CBA is appropriate

Q. At pages 30-32 of his direct testimony, Dr. Dismukes criticizes the methodology used by the Company to derive its C&I VoLL factor used in its gas CBA, and on that basis, recommends that the VoLL-derived benefits should be disregarded. Do you agree with his criticisms and resulting recommendation?

A. No. The gas CBA and its related VoLL for C&I customers does in fact recognize the concern with the assumption that 100 percent of the value added for the C&I customers impacted by a gas outage is permanently lost. For this reason, a downward adjustment was made to the VoLL as the gas CBA report explains:

> Black & Veatch agrees that the "Value Added" concept utilized in PSE&G's ES I proceeding for evaluating the VoLL for C&I customers is a reasonable approach. This is intuitive and assumes that C&I customers will face losses due to their inability to generate economic output if they cannot conduct business during the outage. **Black & Veatch also notes an adjustment that it believes is appropriate. At least one study recognizes differentials amongst customers for their sensitivity to gas use.** These differences implicitly address a wide range of differences associated with these businesses and their actions and recourse in an event of an outage of their gas service. In this study, it was determined that most of the small and medium businesses either

> valued strongly or very strongly continued gas service, but some did not. The cost-benefit analysis relies on specific assumptions concerning intensity of use, thus adjusting the Value Add to recognize that not all customers will be equally affected by the outage. As with residential VoLL estimates, Black & Veatch believes this is conservative and reasonable [42] (emphasis added).

Appendix F – VoLL Calculations for PSE&G Curtailment Resiliency Subprogram[43] – then proceeds to adjust downward the output value by over approximately 20% to "address a wide range of differences associated with these businesses and their actions and recourse in an event of an outage of their gas service."[44] The adjustment corresponds to the proportion of firm and non-firm gas customers served from PSE&G's gas distribution system. In certain respects, this adjustment also recognizes that the Company's gas C&I customers exhibit varying levels of economic resiliency to avoid potential losses from the gas outage event assumed under the Company's gas ESII.

Q. At pages 31-32 of his direct testimony, Dr. Dismukes provides references to academic literature which address the concept of economic resiliency in support of his claim that the Company's gas C&I VoLL estimates are unreasonable. Do you believe these literature references support Dr. Dismukes' claim?

A. No. We believe a closer inspection of the Adam Rose et. al. research on the economic resiliency of businesses during exogenous disasters shows that Dr. Dismukes' reliance on the reported findings is misplaced.

Dr. Dismukes cites the Rose research, and the findings related to the business losses and subsequent recovery in the aftermath of the World Trade Center ("WTC") disaster on September 11, 2001 as support for his need to significantly discount the direct costs estimated using the Company's gas C&I VoLL (for the C&I segment, these direct costs are estimated as

[42] Attachment 6 Schedule-BV-ESII-Gas-5, page 46.
[43] Attachment 6 Schedule-BV-ESII-Gas-5, page 91.
[44] Attachment 6 Schedule-BV-ESII-Gas-5, page 46

$894 million in Appendix F of the Company's gas CBA report). Dr. Dismukes suggests that this severe discount is proper due to the "direct economic resilience" effects estimated by Rose in the literature. Dr. Dismukes explains that the direct business interruption losses related to the WTC tragedy were 72 percent lower than what they would have been if all the WTC tenants had gone out of business. While we are not disputing Rose' findings which Dr. Dismukes is citing, Rose also provides a more thorough explanation of this 72 percent estimate in an article published in 2015:

> "We illustrate the application of the definition with the following case study by Rose et al. (2009), who estimated the national and regional economic impact of the September 11, 2001, terrorist attack on the World Trade Center. The researchers refined available data indicating that more than 95 percent of the businesses and government offices operating in the WTC area survived by relocating, primarily to Mid-town Manhattan or across the river in Northern New Jersey. Had all of these firms gone out of business, the potential direct economic loss in terms of GDP would have been $43 billion. However, relocation was not immediate, taking anywhere from a few days to as long as eight months for the vast majority of firms. Rose et al. (2009) calculated this loss in GDP at $11 billion. They were then able to apply the resilience definition to estimate that the effectiveness of relocation as a resilience tactic in the aftermath of the 9/11 attacks was 72 percent ($43 billion minus $11 billion, divided by $43 billion). In other words, Rose found that there were direct economic losses of $11 billion compared to the hypothetical losses of $43 billion had they gone out of business."[45]

Q. Why is this further commentary of the WTC disaster relevant to the gas C&I VoLL issue?

A. It reveals that Dr. Dismukes offers a faulty comparison with the Company's gas CBA, which makes no claim about hypothetical losses to the total Gross State Product ("GSP") of the effected C&I customers caused by these businesses going out of business. The Company's gas C&I VoLL estimate assumes the temporary loss of business over a gas curtailment event lasting about 45 days over which time these businesses will gradually resume operation.

[45] Rose, Adam, Measuring Economic Resilience: Recent Advances and Future Priorities, Center (CREATE) University of Southern California, September 27, 2015, pages 3-4.

Q. If you were making a claim that the Company's C&I gas customers would all go out of business because of the ESII gas outage event, how would that impact the gas C&I VoLL?

A. We would start with the contribution to the GSP made by all the Company's C&I gas customers within the gas outage event "footprint." This figure can be derived from Appendix F by multiplying $205.7 billion (i.e., the total state product of all the Company's C&I gas customers) by 8.1% (i.e., the percent of the Company's firm C&I gas customers curtailed during the gas outage). This yields an amount of $16.6 billion per year. This amount represents the lost value added if all the Company's C&I gas customers went out of business within the gas outage scenario "footprint." The estimated direct cost (the gas C&I VoLL) of $894 million used in the Company's gas CBA, as presented in Appendix F, is about 5 percent of the total loss in economic value of $16.6 billion.

Q. How should we interpret the Company's measure of direct cost impacts (the gas C&I VoLL) in comparison to this hypothetical "going out of business" loss estimate?

A. For the WTC business tenants, they lost about 28% of their yearly output in the aftermath of 9/11 according to the literature cited. In sharp contrast, for the Company's gas outage event occurring over a 45-day period, we estimate that the Company's C&I gas customers would lose only about 5% of their yearly output ($894 million divided by $16.6 billion) - which is a much more modest claim than that suggested by Dr. Dismukes in citing the ETC figures. This computation demonstrates that the Company's estimate of direct costs of $894 million is a small percentage (5%) of the total GSP for the affected region (PSE&G's service territory). We have not claimed that the direct costs for the Company's C&I gas customers are anywhere near the full value of their business output of $16.6 billion. Yet, this

was the implication from Dr. Dismukes' argument based on his cited measure of resiliency (72%). The more appropriate way to discuss this resiliency measure in conjunction with the Company's CBA results is to simply note that under the Company's gas CBA, 5% of the subject firms' yearly output is lost, whereas in the resiliency literature example the cited amount of 28% (100% – 72% = 28%) was lost. This is the more appropriate way to view the Company's CBA result in relation to the specifically cited literature.

The inclusion of other gas outage-related avoided costs is appropriate

Q. At pages 28-29 of his direct testimony, Dr. Dismukes disputes the manner in which the Company estimates the other outage-related avoided costs associated with a gas outage event. How do you respond to his claim?

A. Dr. Dismukes observes that there is no supporting documentation for several technical factors that the gas CBA has used to support avoided cost estimates pertaining to space heating, temporary housing, and lost wages due to an extended gas outage. However, he ignores the purpose of these estimates and the all-important context in which they are offered. Moreover, his critique is of three avoided cost examples out of numerous other ones that are provided in the Company's gas CBA report. The following is an excerpt from the gas CBA report that explains the purposes of these and other avoided cost estimates that are addressed in the report:

> Care is needed when agglomerating all potential avoided costs and benefits to reach a total benefit value. Notwithstanding this caution, there are additional beneficial impacts beyond the VoLL estimates that are important to consider in the full accounting of cost and benefit effects. Some of these are alluded to briefly in the previous section. Some of these benefits represent costs excluded from the VoLL consideration. Others are public or social costs. Still others represent specific externalities (e.g., costs incurred by other entities should a major outage event occur). Together with VoLL, they reinforce the tremendous scale of impacts and costs businesses and consumers will face in the event of a major outage event. Some of the

> additional benefits identified below have been further estimated and are explicitly included in the benefit-to-cost ratio shown in Figure 1. Others are noted as qualitative benefits as part of Figure 1.[46]

The report then continues by itemizing in a series of bullet points the avoided costs of: construction period impacts, restoration costs, customer costs due to heating, housing and damages, lost wages, long-term business impacts, delays in utility programs, delays in other construction programs, impacts to local government services, additional transportation related costs, costs associated with education and day care, government fees and tax impacts, cascading economic impacts outside the region, loss of gas revenues, public safety impacts, loss of public confidence, and general welfare impacts.

Q. Are the three avoided costs Dr. Dismukes criticizes intended to serve as definitive benefit estimates?

A. No. Dr. Dismukes appears to ignore the explanation that is offered in the gas CBA report specifically concerning these three (and other) cost estimates:

> Black & Veatch acknowledges that the monetary estimates of these impacts are illustrative as some assumptions are speculative. For example, there is no research we are aware of to indicate how many electric space heaters might be purchased by customers facing an extended outage during 30-degree temperatures, or how man will seek temporary housing. (Certainly, many customers would find this to be a financial burden). However, while illustrative in nature, Black & Veatch also believes it is irrefutable that 435,500 customers facing a loss of gas services for an extended, multi-week period will make specific accommodations to secure their personal needs, which in turn will drive these types of costs.[47]

Q. What is the effect of Dr. Dismukes criticism?

A. Dr. Dismukes is effectively broadening his criticism concerning these three avoided costs to suggest to the Board that it should disregard the entirety of the benefits associated

[46] Attachment 6 Schedule-BV-ESII-Gas-5, page 48.
[47] Attachment 6 Schedule-BV-ESII-Gas-5, page 48.

with the Company's Gas subprogram. In doing so, Dr. Dismukes is obscuring the nature of the Company's evidence and its purposes. The purposes are stated explicitly within the gas CBA report, but they appear to be completely ignored by Dr. Dismukes. First, "There are additional beneficial impacts beyond the VoLL estimates that are important to consider in the full accounting of cost and benefit effects." Second, "Together with VoLL, they reinforce the tremendous scale of impacts and costs businesses and consumers will face in the event of a major outage event." Third, the illustrations are offered as evidence, "that 435,500 customers facing a loss of gas services for an extended, multi- week period will make specific accommodations to secure their personal needs, which in turn will drive these types of costs."[48]

Q. Are these impacts similar to the indirect avoided costs you cited earlier?

A. Yes, many are similar, and some are examples of direct costs that would be borne by private individuals. For the indirect costs, however, it is useful for the Board to appreciate that these costs can easily exceed direct and privately borne costs. The three costs criticized by Dr. Dismukes may be very small in comparison to the scale of long-term indirect effects of the gas outage.

The historic time period used for the electric CBA is appropriate

Q. At page 34 of his direct testimony, Dr. Dismukes claims it is unreasonable to include certain years in defining the weather-related outage events used in the Company's electric CBA because it "upwardly biases" the number of outages from major weather events. How do you respond to Dr. Dismukes' claim?

A. We strongly disagree with Dr. Dismukes' claim. The weather has a natural variability

[48] Attachment 6 Schedule-BV-ESII-Gas-5, pages 47 and 50.

and volatility that is difficult to predict. Including the additional years that were of concern to Dr. Dismukes results in a larger, more robust data set of outage-related information due to periodic storms and captures more of the natural variability and volatility. The result is a more reliable estimate of how the Company's electric distribution system is exposed to storm-related hazards.

Q. Why then did you limit the outage event data to a period of seven (7) years for purposes of conducting the Company's electric CBA?

A. We understand that the Company does not have a robust and reliable data set on electric outage conditions by specific circuit suitable to be used in the Company's electric CBA for the years before 2010.

Q. Would use of the last 5 years of outage event data, as argued by Dr. Dismukes, improve the quality of the Company's electric CBA?

A. No. The use of a shorter timeframe would ignore the occurrences of certain storm events, and by doing so would not provide sufficient information about how storms effect the Company's electric distribution system. By including more years of data which encompassed more outage events, the Company is able to evaluate the effects of storms on a larger set of substations, circuits, poles and other assets that are by nature more geographically dispersed, (since storm events have distinct geographic patterns as they move across the service territory).

There are issues with Dr. Dismukes' "alternative CBAs"

Q. Did you examine the IMPLAN Model used by Dr. Dismukes to conduct his "alternative CBAs"?

A. Yes. The Company requested Dr. Dismukes' workpapers for the IMPLAN Model and

submitted data requests to solicit further information on the input assumptions he made. Our examination of this information did provide us with a general understanding of how Dr. Dismukes conducted his IMPLAN modeling activities and structured the multiple Excel spreadsheets which provided the input assumptions and results of his "alternative CBAs."

Q. Please provide your understanding of the "alternative CBAs" discussed by Dr. Dismukes in his direct testimony and summarized in Schedules DED-6 and DED-7.

A. We were able to determine that Dr. Dismukes used the IMPLAN Model to estimate the net economic impacts of the Company's ESII. He first estimated the direct, indirect and induced impacts of the expenditures associated with the Company's proposed investments under ESII. His analysis indicated that the ESII capital outlays and net O&M changes ($1.89B on a NPV basis) will produce jobs and result in multiplier benefits for the New Jersey economy (and presumably elsewhere). Next, Dr. Dismukes estimated the direct, indirect and induced economic impacts that a rate increase associated with the Company's ESII would have on the New Jersey economy. The rate increases are assumed to be recovered from residential, commercial, and industrial consumers and produce a negative economic impact. Based on the resulting economic impacts from the IMPLAN Model, Dr. Dismukes concluded that the long-term negative economic impact from the Company's rate increase would be greater than the positive long-term economic impact from the ESII investments, resulting in an overall or net negative economic impact on the State.

Q. At page 39 of his direct testimony, Dr. Dismukes explains that the IMPLAN Model is a well-respected model for examining regional economic impacts, particularly those associated with energy industries. How do you respond to his characterization?

A. While the IMPLAN Model is recognized as one of several useful input-output models, it does have limits in that it is unable to capture all the benefits associated with infrastructure investments, such as those proposed by the Company under ESII. In fact, the IMPLAN Model cannot compute the very benefits that are the motivation for the Company's ESII—system reliability and resiliency benefits. As a result, any CBA that does not reflect all the benefits of the Company's ESII creates biased results and understated estimates of value.

The limits of the IMPLAN-based CBAs performed by Dr. Dismukes are clearly revealed in his response to the Company's data requests. In his response to PSE&G-RC-DED-3, Dr. Dismukes acknowledged that the IMPLAN-based CBA: a) "excludes the inclusion of risk reduction benefits as identified for PSE&G's substation subprograms."; b) "excludes qualitative benefits"; and c) "…only includes benefits that have an identified monetary benefit." Therefore, the CBA resulting from the IMPLAN analysis prepared by Dr. Dismukes does not include all ESII benefits and, therefore, the resulting BCRs underestimate the true ESII benefits.

Dr. Dismukes' "alternative CBAs" are strictly limited to the consideration and measurement of a narrow set of identified monetary impacts included and parameterized within the IMPLAN Model, which ignores any other decision criteria. For that reason alone, his "alternative CBAs" should be given no weight by the Board.

Q. Are there other ways in which the IMPLAN Model fails to account for these important economic effects?

A. Yes. Dr. Dismukes' evaluation – by dismissing all reliability and resiliency benefits – fails to additionally account for the way a more reliable and resilient electrical grid supports and attracts economic activity. In fact, just as there are negative effects of power outages, including indirect effects, so too are there positive direct and indirect and long-lasting effects of improved electric system reliability and resiliency. For example, businesses will avoid long-term costs for such mitigations as back-up power generation, for example, or will choose to expand operations with the confidence that the power grid can provide reliable service. The IMPLAN Model has no way of capturing these indirect and long-term benefits of improved regional electrical system reliability and resiliency. In contrast, the Company's CBAs estimate the direct reliability and resiliency benefits through the application of the VoLL-based factors.

Q. Do you have any examples of other investments with reliability and resiliency benefits that would not be appropriately valued based on the IMPLAN Model?

A. Yes. One example would be the replacement of cast iron mains. A strict comparison of the cost of installing new plastic main versus the benefit of lower O&M costs from replacement of older cast iron mains would show the replacement as not being cost-beneficial. However, the safety risk of maintaining cast iron mains has been significant enough to result in a national call to action to replace cast iron mains. There is clearly a significant risk reduction-related benefit to replacing cast iron main that is not captured in the IMPLAN Model.

Further, Company witness Wade Miller compared the Company's proposed gas Curtailment Resiliency subprogram to a building installing a sprinkler system. A strict look at the cost of installing a sprinkler system versus the benefits to the economy from the investment would almost certainly result in a net economic loss. Does that mean sprinkler systems should not be installed in office buildings? Of course not. They are not being installed to result in net economic benefits. They are installed as a safety precaution and are undervalued if looked at strictly from a net economic impact perspective.

Q. Are there additional factors or assumptions that contribute to the negative net benefit estimates derived by Dr. Dismukes?

A. Yes. Any estimate of program benefits made using the IMPLAN Model would require an assumption as to the portion of program expenditures that occur within the region of study (New Jersey) or that involve purchases originating outside the study region that constitute "leakages" from the regional economy. It is not readily apparent in the supporting information provided by Dr. Dismukes the percentage of the $1.89 billion in ESII expenditures that he assumed would occur within New Jersey, but it is clear that this was assumed to be a relatively small percentage given that his estimated total output benefits are only $2.85 billion. This is a 1.51 ratio of benefits-to-program cost. On the other hand, the $1.89 billion in program expenditures that are assumed to be recovered through the Company's electric and gas rates are projected by Dr. Dismukes to have a negative economic impact of $5.40 billion, an impact-to-program cost ratio of 2.86.

This unexpected disparity in the resulting multipliers raises important questions on what Dr. Dismukes assumed when establishing his set of inputs for use in the IMPLAN

Model and whether those assumptions caused his results to be skewed to the extent described above.

Q. Based on Dr. Dismukes' above-described treatment of the ESII investments and the related rate impacts in the IMPLAN Model, and the exclusion of any other benefits besides the increased economic activity caused by the ESII investments, do you believe any utility investment evaluated in a similar manner would be able to show a positive economic benefit?

A. No. As Dr. Dismukes explained in his response to PSE&G-RC-DED-2, he "cannot identify any prior testimony addressing the economic impacts of energy infrastructure development that would lead to positive net economic benefits…" for utility programs. This raises the question of whether *any* utility expenditure would be recommended based on the "alternative CBA" method used by Dr. Dismukes. Moreover, it underscores the reality that utility investments are often supported on a range of evaluation decision criteria, including at times through the results of a CBA. These criteria include whether the investment promotes the provision of a safe, adequate, and reliable supply of electricity or natural gas supply to utility customers at the lowest reasonable cost and in an environmentally acceptable manner.

Q. Do you have any response to the assumption made by Dr. Dismukes related to the rate impact associated with ESII?

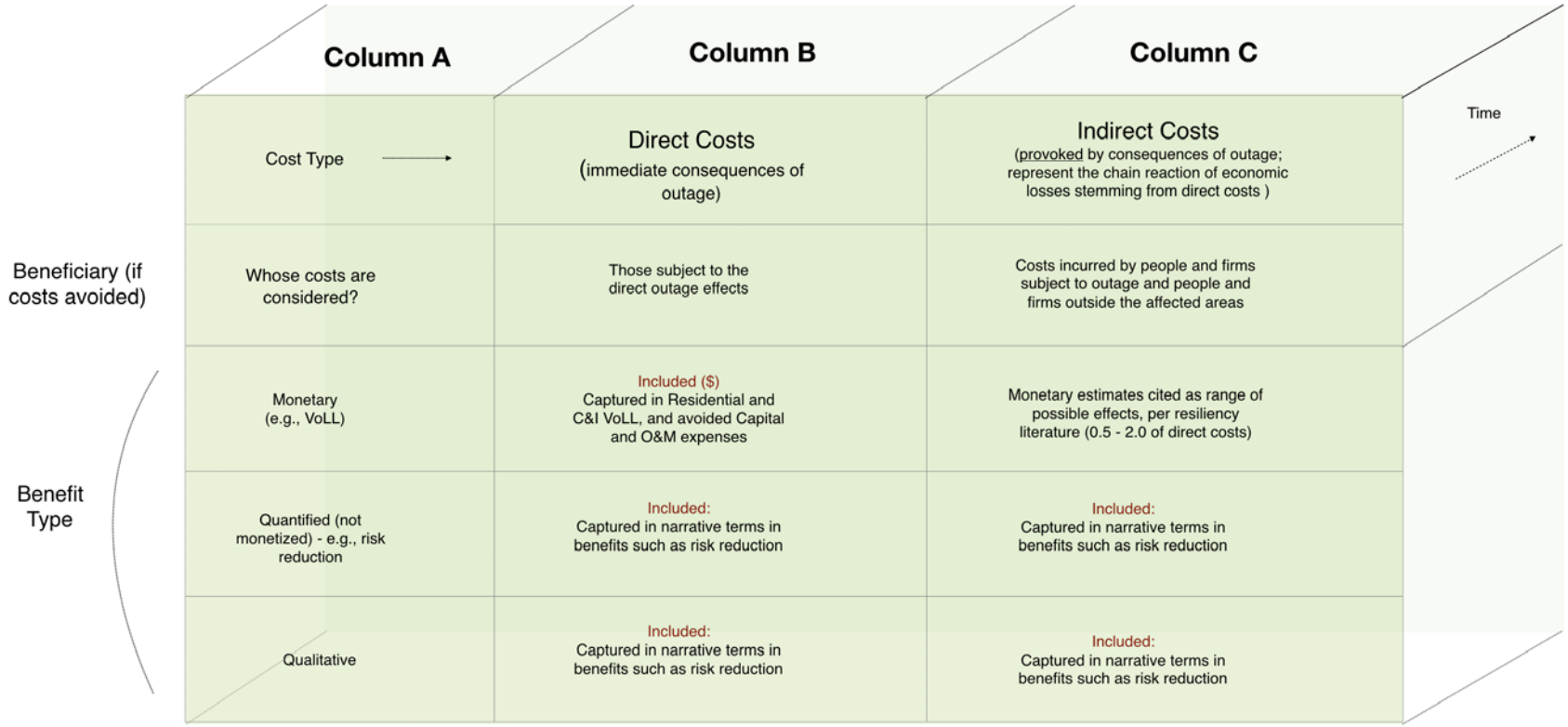
A. Yes. Dr. Dismukes' assumption appears to be faulty because it assumes within the IMPLAN Model that the Company's C&I customers reduce their services or physical productive output provided to and for their customers by the total amount of the net rate increase for ESII. We do not believe this is a fair assumption about the way the economy works in practice. In reality, these customers will engage in adaptive behaviors by attempting to adjust their prices for products and services to account for the increases experienced in the

electric and gas rates they are charged, absorb the increase in their costs of doing business and accept a reduced level of financial performance (and to retain market share), or some combination of these two options. In each of these cases, the level of products and services provided by these C&I customers may not decline and may not cause a decrease in economic activity in the State. This means that Dr. Dismukes has overstated in his "alternative CBAs" the negative economic activity he has attributed to ESII.

Q. Does this complete the Panel's rebuttal testimony?

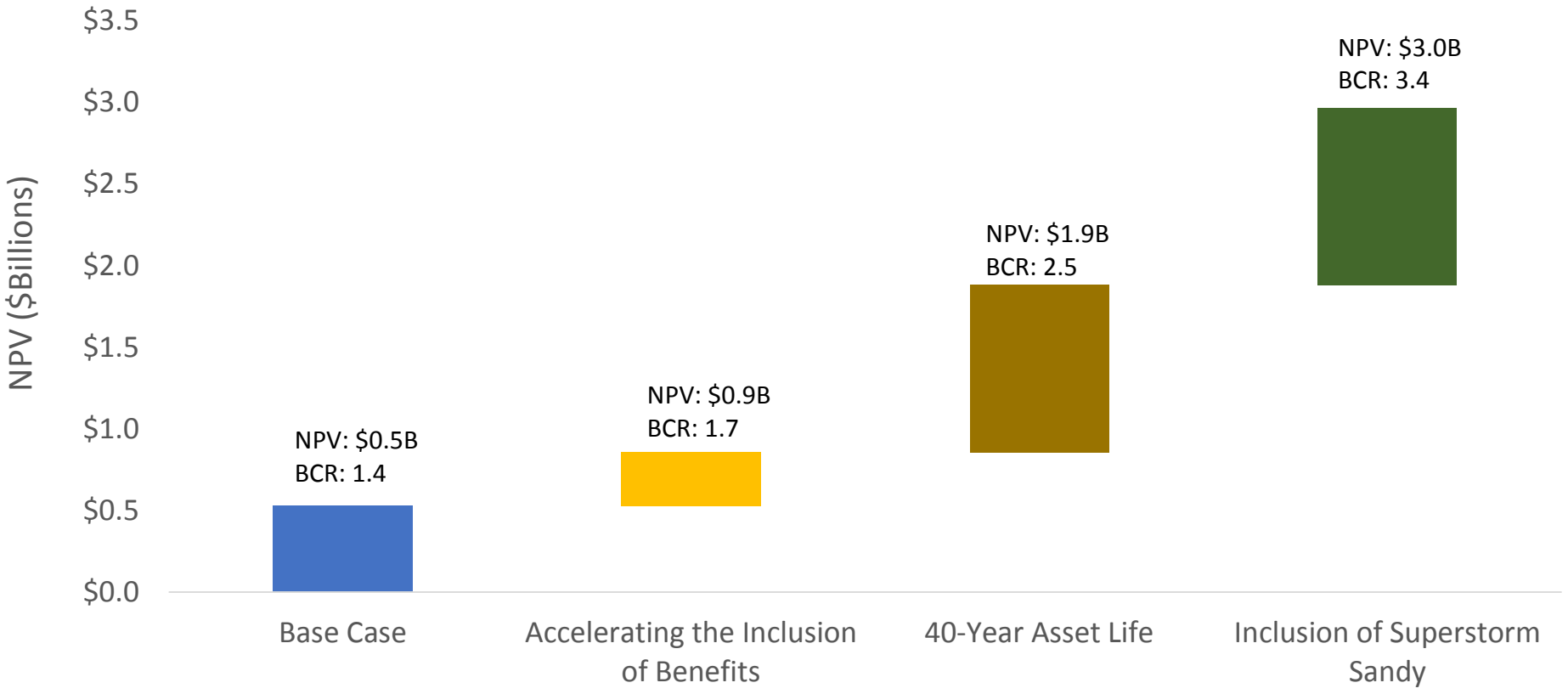
A. Yes.

Benefit Types



- Definitions and typecasting of direct and indirect benefits related to outages taken from Sullivan, M., The FSC Group. Downtown San Francisco Long Duration Outage Cost Study. March 2013. Appendix B, Literature Review. This dichotomy is offered in relation to resiliency scale outage events lasting over 12 hours. Typecasting of monetary, quantified and qualitative taken from Electric and Gas CBA reports.
- The dimension of time is suggested by the authors of the CBA report. This provides an additional dimension of explanatory value about the nature of the direct and indirect cost occurrences. Indirect costs will incur over long periods of time. They are also influenced by adaptive behaviors as outage durations increase.

Monetary Benefits for the Company's Electric CBA Under Less Conservative Assumptions



BCR = Present value benefit-to-cost ratio

LISTING OF PRINCIPAL REFERENCE SOURCES FOR ELECTRIC VALUE OF LOST LOAD (VOLL) RESEARCH EFFORTS

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8. Sullivan, M., Collins, M., Schellenberg, J., *Nexant*, Inc., and Larsen, Peter. "Estimating Power System Interruption Costs: A Guidebook for Electric Utilities," (Prepared for the Office of Electricity Transmission Permitting and Technical Assistance Division U.S. Department of Energy.). Ernest Orlando Lawrence Berkeley National Laboratory. Berkeley, CA, July 2018.
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