**BEFORE THE**
**PUBLIC SERVICE COMMISSION OF MARYLAND**

| | | |
|---|---|---|
| **IN THE MATTER OF THE APPLICATION** | **)** | |
| **OF POTOMAC ELECTRIC POWER COMPANY** | **)** | **CASE NO. 9424** |
| **FOR ADJUSTMENTS TO ITS** | **)** | |
| **ELECTRIC AND GAS BASE RATES** | | |

# Direct Testimony of
# Maximilian Chang

## On Behalf of
## Maryland Office of People's Counsel

## September 28, 2016

**Table of Contents**

## I. INTRODUCTION AND PURPOSE OF TESTIMONY

**Q Please state your name, business address, and position.**

A My name is Maximilian Chang. I am a Principal Associate with Synapse Energy Economics, an energy consulting company located at 485 Massachusetts Avenue, Cambridge, Massachusetts.

**Q Please summarize your work experience and educational background.**

A My experience is summarized in my resume, which is attached as **Attachment MPC 1**. I am an environmental engineer and energy economics analyst who has analyzed energy industry issues for more than seven years. In my current position at Synapse Energy Economics, I focus on economic and technical analysis of many aspects of the electric power industry, including: (1) utility reliability performance and distribution investments, (2) nuclear power, (3) wholesale and retail electricity markets, and (4) energy efficiency and demand response alternatives. I have been an author and project coordinator for the 2011 and 2013 biennial New England Avoided Energy Supply Component reports used by energy efficiency program administrators in the six New England states to evaluate energy efficiency programs.

**Q Please describe Synapse Energy Economics.**

A Synapse Energy Economics is a research and consulting firm specializing in energy and environmental issues, including electric generation, transmission and distribution system reliability, ratemaking and rate design, electric industry restructuring and market power, electricity market prices, stranded costs, efficiency, renewable energy, environmental quality, and nuclear power.

Synapse's clients include state consumer advocates, public utilities commission staff, attorneys general, environmental organizations, federal government agencies, and utilities.

**Q On whose behalf are you testifying in this case?**

A I am testifying on behalf of the Maryland Office of People's Counsel (OPC).

**Q Have you submitted testimony in other recent regulatory proceedings?**

A Yes. I have previously testified before the District of Columbia Public Service Commission, the Massachusetts Department of Public Utilities, and the Maine Public Utilities Commission. I have also filed testimony before the Delaware Public Utilities Commission, Hawaii Public Utilities Commission, New Jersey Board of Public Utilities, and the United States District Court District of Maine.

**Q Have you testified in front of the Maryland Public Service Commission previously?**

A Yes, I have testified before the Commission in Case 9406 regarding Baltimore Gas and Electric's base rate case and before the Commission in Case 9418 regarding Pepco's base rate case.

**Q What is the purpose of your direct testimony?**

A My direct testimony summarizes alternative assumptions and adjustments to Delmarva Power and Light's (the Company or DPL) benefit-to-cost analysis described in the direct testimony of Karen Lefkowitz and other company witnesses. OPC Witnesses Paul Chernick and Peter Lanzalotta have analyzed other aspects of the Company's assumptions and provided me with adjustments to make in the benefit-cost calculations that are summarized in my testimony. The fact that I do not comment on every aspect of the Company's benefit-to-cost analysis and calculations should not be interpreted to mean that I agree with those aspects.

**Q What data did you rely upon to prepare your testimony and exhibits?**

A I relied primarily on the direct testimony, exhibits, and work papers of the Company witnesses. I also relied upon the document record established in the Commission's Case 9207 and the Company's responses to various data requests.

**Q Do you have any data responses to attach to your testimony?**

A Yes. I am attaching cited data responses provided by the Company as Attachment MPC 2.

**Q Was your testimony prepared by you or under your direct supervision?**

**A** Yes.

## II. CONCLUSIONS AND FINDINGS

**Q Please summarize your conclusions and findings regarding the projected costs and benefits of the Company's Advanced Metering Infrastructure (AMI) Initiative.**

**A** The following summarizes my conclusions and findings:

- My analysis indicates that the Company's AMI Initiative has a present value benefit-cost ratio of 0.69 based on: 1) assumptions of benefits and costs described in detail in my testimony and in the testimonies of OPC Witnesses Paul Chernick and Peter Lanzalotta; and 2) the Commission's determination of cost categories in Case 9207. Adjusting the Company's analysis to include more reasonable assumptions and cost categories shows that the benefits from the Initiative are substantially less the Company's projections.

- The uncertainties in the assumptions of benefits in the Company's AMI Initiative are described in detail in Witnesses Chernick's testimonies. Approximately 14 percent ($20.1 million) of the projected total benefits of the AMI Initiative hinge on the Company's assumptions regarding avoided energy and capacity revenues; and conservation voltage reduction benefits. Approximately 25 percent ($38.1 million) of the projected demand side benefits are attributed to the Company's Dynamic Pricing program and 16 percent ($23.9 million) of the projected demand side benefits are attributed to the Company's Energy Management Tool program.

- Based on the findings from our benefit cost analysis showing that the Company's Smart Grid Initiative is not cost-effective, I recommend that the Commission disallow the $34.2.0 million difference between our estimates of costs and benefits of the Company's Smart Grid Initiative.

The $34 million cost disallowance would ensure that the Company's Smart Grid Initiative will cause no harm to ratepayers.

Following the Company's nomenclature, Witness Chernick's testimony provides a detailed analysis of supporting our adjustments to elements of the Company's demand side benefits. Witness Lanzalotta's testimony provides additional analysis regarding our adjustments to the Company's operational benefits.

## III. HISTORY OF DPL AMI DEPLOYMENT

**Q Please describe your understanding of the history of DPL's initial AMI Initiative.**

A In 2009, DPL filed a petition (Case 9207) to deploy advanced metering infrastructure across its electric and gas service territory in order to qualify for Department of Energy (DOE) federal funding under the American Recovery and Reinvestment Act of 2009 (ARRA). In its 2009 filing, DPL estimated that the benefit-to-cost ratio would be 1.67 on a present value revenue requirements (PVRR) basis without the DOE funding, and 2.82 with DOE funding of approximately $31.4 million on a PVRR basis.[1]

In Order 83532, the Commission stated in its order for both Pepco and Delmarva:

> We will require Pepco to deploy and deliver to its customers a cost-effective AMI system. We will require Pepco to demonstrate that the system is cost-effective for its customers as a condition of recovery of its prudently incurred costs and an appropriate rate of return. The applicable standards of prudence and cost effectiveness that we stated in Order No. 83531 for BGE shall apply equally to Pepco in connection with this Proposal It is with this foundation that I analyze the Company's benefit-cost analysis in this proceeding.[2]

Unlike Pepco, DPL did not receive the ARRA funding and in Order 83571, the Commission initially rejected DPL's AMI proposal. In its amended business case

[1] Direct Testimony of George Potts. Case 9207. September 1, 2009. Page 13.
[2] Maryland Public Service Commission. Order 83532. August 13, 2010. Page 2.

of 2010, the Company estimated that the benefit-to-cost ratio would be 1.19 on PVRR basis over 10 years.[3] In Order 83571, the Commission cautioned:

> The Proposal's cost-effectiveness depends in part, however, upon other factors over which the Companies have far less control. The majority of AMI-enabled cost savings projected by the Companies arise from PHI's predictions about the degree to which the dynamic pricing options they propose will motivate customers to reduce electricity usage during Company-declared critical peak demand periods, and about the impact of that reduction on wholesale market prices. But the foundation for the Companies' predictions about these "supply-side benefits" is far from certain, in our view.[4]

Additionally, the Commission noted:

> On the other hand, because Delmarva was not awarded a federal grant, the potential of not realizing a level of cost-effectiveness projected for that Company's AMI project in Maryland is substantially greater than it is for Pepco. Accordingly, before we will authorize Delmarva to commence AMI deployment in its Maryland service territory (which the Company has testified it does not intend to do until approximately mid-2011 in any event) (footnote omitted), we require that Delmarva submit for the Commission's consideration an amended business case consistent with the terms of this Order, as set forth more fully below.[5]

Ultimately, the Commission permitted DPL to proceed with AMI deployment in Order 84890, but the Commission did note in its approval:

> The authorization granted by this Order allows Delmarva to proceed with deployment of its AMI program, but does not constitute a determination as to the prudency of the program's costs. We will not allow Delmarva to recover those costs until we determine, through a base rate case, that it in fact delivered a cost-effective AMI system, the individual and collective benefits of which are worth the ratepayers' investment. In the event that the Proposal, as implemented, falls short of that standard, we will determine what level of cost recovery the public interest requires. Therefore, the risks that the parties identified during the course of proceedings will be borne by Delmarva, not its ratepayers.[6]

[3] Maryland Public Service Commission. Order 84890. May 8, 2012. Page 10.
[4] Maryland Public Service Commission. Order 83571.September 2, 2010. Page 2.
[5] Maryland Public Service Commission. Order 83571.September 2, 2010. Page 4.
[6] Maryland Public Service Commission. Order 84890. May 8, 2012. Page 4.

It is with this foundation that we view our analysis of the Company's AMI efforts.

## IV. COST BENEFIT ANALYSIS OF COMPANY'S CURRENT PETITION

**Q Please summarize the Company's benefit-cost analysis presented in this proceeding.**

A Witness Lefkowitz summarizes the results of the Company's Advanced Meter Initiative benefit-cost analysis on Graph 1 of her direct testimony. The Company projects that its AMI provides a 1.73 benefit to cost ratio on a PVRR basis over the period 2015–2024.[7]

**Q Please discuss the projected costs of the Company's AMI Initiative.**

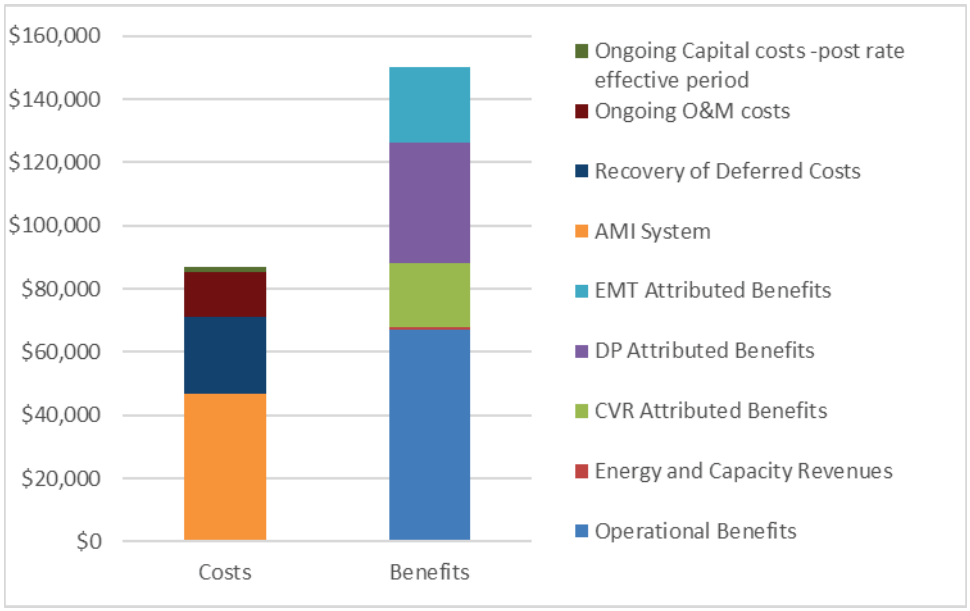
A Witness Lefkowitz estimates the projected cost of the AMI Initiative will be $86.9 million on a present value basis or $106.4 million on a cumulative basis.[8] On a present value basis, the Company's costs consist of $46.8 million in AMI system costs, $24.3 million in deferred costs, $14.3 million ongoing O&M expenses, and $1.5 million in ongoing capital costs.[9]

**Q How do the projected benefits compare to the projected costs in the Company's petition?**

A Witness Lefkowitz estimates that the Company's AMI Initiative will produce $190.7 million in cumulative benefits, with a PVRR of $150.1 million.[10] The Company's estimate reflects 38 benefit and four cost categories. The Company's presentation of its PVRR costs and benefits are summarized in Exhibit MPC 1 below**.** The projected costs are presented in the first bar. The second bar shows the projected benefits attributed to the Company's AMI Initiative.

**Exhibit MPC 1. Reported Costs and Benefits of DPL AMI Initiative (PVRR)**

[7] Values in my analysis are reported to be consistent with the Company's reported numbers and calculations as provided in response to OPC 1-3 Attachment C.
[8] Amended Direct Testimony of Karen Lefkowitz. September 26, 2016. Table A.
[9] Ibid.
[10] Ibid.




**Q Mr. Chang, you provide several benefit-cost ratios in your discussion of the history of the Company's AMI Initiative. Please explain.**

A The Company's presentation of its AMI program has changed based on input assumptions for projected costs and benefits, and actual costs and benefits experienced by the Company during installation. I do note that the Company's estimate of the benefit-to-cost ratio has **increased** from 1.19 when the Commission approved DPL's AMI deployment in 2012 to 1.73 based on current costs and projections. In addition to my testimony, OPC Witnesses Chernick and Lanzalotta both address how and why the Company's projected avoided costs and benefits would be lower using different assumptions.

## V. BENEFITS

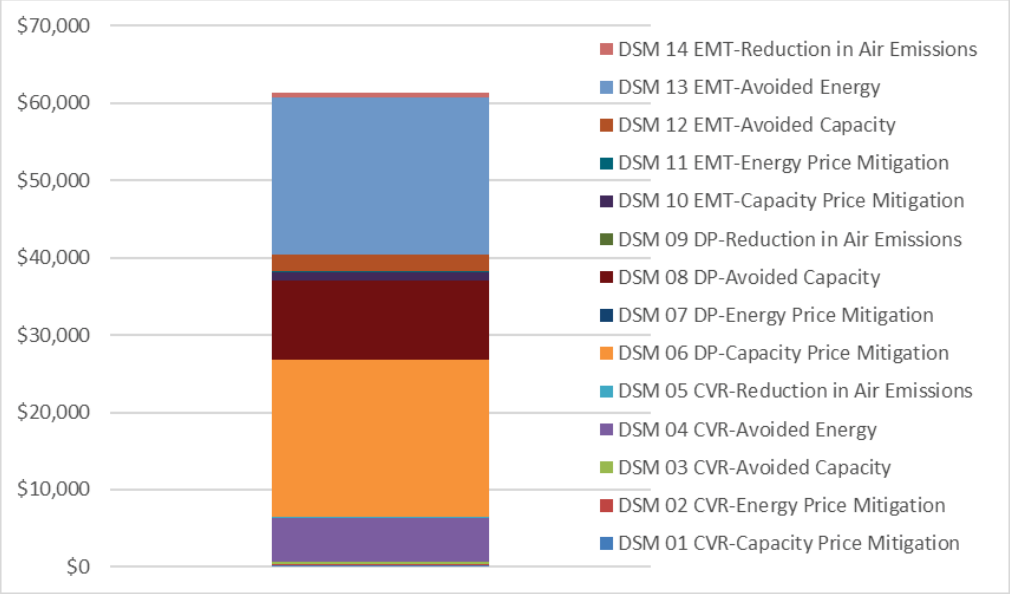
**Q Please discuss the Company's projected AMI Initiative benefits.**

A As shown in Witness Lefkowitz's Table A, the Company categorizes its estimates of benefits into two main categories: 1) demand-side benefits and 2) operational benefits. I describe both benefit categories in more detail below.

**Q Please elaborate upon the Company's projected Advanced Meter Infrastructure Initiative demand-side benefits.**

A The demand-side benefits are projected benefits attributed to savings in the future. The Company estimates that these benefits have a PVRR of $61.3 million of the total $150.1 million claimed by the Company.[11] The demand-side benefits represent approximately 40 percent of the overall total projected AMI Initiative benefits The demand-side benefits, by themselves, result in a benefit-to-cost ratio of 0.7 when compared to the Company's costs.[12]. The Company presents the demand side benefits in 14 individual elements, but they can be consolidated into three main categories 1) conservation voltage reduction (CVR) related benefits, 2) Dynamic Pricing (DP) related benefits, and 3) Energy Management Tool (EMT) related benefits..[13] The Company estimates that the CVR demand side benefits will be $6.4 million, the DP demand side benefits will provide $30.6 million in benefits, and the EMT demand side benefits will provide $24.3 million in benefits. These benefits are summarized in Exhibit MPC 2.[14]

**Exhibit MPC 2. Summary of Present Value of AMI Initiative Demand-Side Benefits**




[11] OPC 1-3. KRL Attachment C. Updated 09-23-16.
[12] Direct Testimony of Karen Lefkowitz. Graph 1.
[13] Direct Testimony of Karen Lefkowitz. Table A.
[14] OPC 1-3, KRL Attachment C.

**Q Is AMI necessary for some of the Company attributable benefits?**

A No, as I discuss in more detail below, AMI is not necessary for the Company to provide enhanced communication to customers regarding their energy usage. AMI enables the Company to provide hourly usage data, but information on energy efficiency and conservation do not necessarily require hourly information. In addition, the Company's CVR program does not necessarily need to rely upon AMI. Utilities have been implementing or analyzing CVR programs well before AMI.[15] Furthermore, the Company has not yet calculated how much CVR impact is due to the existence of AMI.[16] In this proceeding, I have eliminated the DPL CVR benefits because the Company has not provided a reasonable basis for concluding that those benefits will materialize for DPL. Specifically, as described in detail later in this testimony, the Company relies upon CVR factors determined for Pepco MD, not DPL, and does not provide a basis to conclude that the CVR factors would be the same for the two utilities considering the significant differences between the two distribution systems. In addition, I have also eliminated the EMT benefits from my analysis since other utilities have achieved similar energy savings from behavioral programs without AMI deployment.

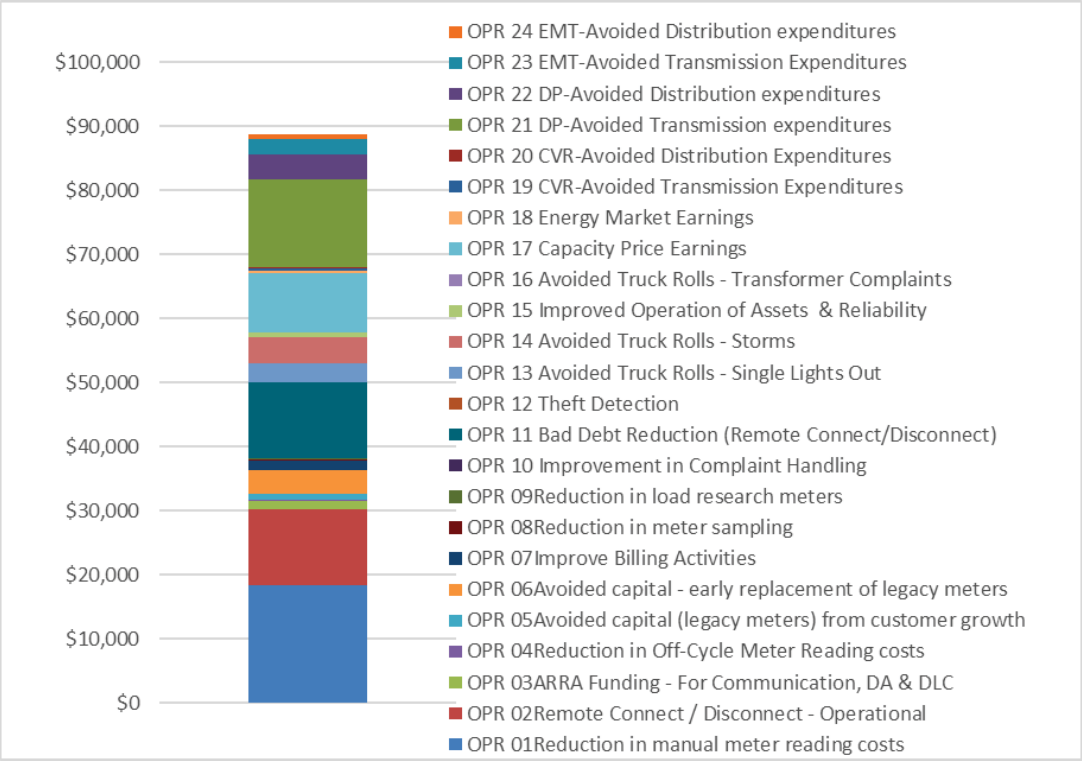
**Q Please elaborate upon the Company's projected AMI Initiative operational-side benefits.**

A The operational-side benefits are projected benefits attributed to savings in the future from avoided distribution service O&M expenses and avoided future meter-related capital expenditures. The Company projects that its AMI Initiative benefits have a present value of $88.8 million ($115.0 million cumulative). The Company's projected operational-side benefits, by themselves, result in benefit-to-cost ratio of 1.02. when compared to the Company's projected AMI Initiative

[15] OPC 18-17, Attachment B.
[16] OPC 4-12. The Company refers back to Schedule AF-2 in its response. The cited Brattle analysis note: "Therefore, we drop customers who are enrolled in Opower, CVR, and DSM programs to be able to truly isolate the DPL MD EMT program impact." (Schedule AF-2, page 6).

present value cost of $86.9 million.[17] These benefits are summarized in Exhibit MPC 3.

**Exhibit MPC 3 Summary of Present Value of AMI Initiative Operational Benefits**




## VI. EMT BENEFITS SHOULD NOT BE INCLUDED

**Q Please summarize why you recommend that the EMT benefits should not be included in the Company's analysis.**

A While the EMT program has generated energy and capacity savings, these savings should not be attributed to the Company's AMI initiative, since these savings could have been achieved without any of the AMI investments made by the Company. One of the primary component of the Company's EMT program is the availability of customer information over the internet. The Company currently provides customer comparisons through its EmPower Maryland behavioral program and provides other forms of customer information that does not

[17] Direct testimony of Karen Lefkowitz. Table A.

necessarily require AMI. Other utilities without AMI have achieved similar savings without AMI, since AMI only provides hourly information to customers.

**Q Does the Company contend that the EMT program result in energy savings?**

A Yes. The Company attributes approximately $23.2 million of demand side and $3.2 million in operational benefits on a PVRR basis to its EMT program that it contends is enabled by the installation of AMI meters across its territory. The Company's witness, Dr. Faruqui attributes an average reduction of 1.55%in electricity usage associated with the activation of the approximately 208,000 AMI meters and EMT tools available on the Company's website.[18]

**Q Does the Company report the number of customers who log into the web-based EMT by quarter?**

A Yes, the Company noted in its response to OPC 4-2 and OPC 4-3 that it reports the number of customers that access the web-based EMT on a quarterly basis as part of the quarterly smart grid metrics under Case 9207.[19, 20] The exhibit below summarizes the number of "unique" customers that have accessed the web-based EMT and the number of customers that have received high usage reports for each quarter since 2014 as reported by the Company.

[18] Direct testimony of Ahmad Faruqui. July 20, 2016. 3:10-12.
[19] OPC 4-2.
[20] OPC 4-3.

**Exhibit MPC 4 Number of customers accessing web-based EMT and receiving usage reports relative to number of AMI meters by quarter.**


**Q What does the exhibit show?**

**A** The exhibit shows that relative to the number of AMI meters deployed, on average the number of unique customers that access the web-based EMT is approximately 16,265 since 2014 and approximately 18,348 since 2015. The Company defines "unique visitors" as both new and returning customers, so that a customer that logs on at least once per quarter would show up in the chart.[21] Not shown in the exhibit, the Company also reports the approximate average amount of time spent on the EMT for residential customers under Metric 32. In the last year, the metric indicates that the average time spent on the website is one minute for the 8% of customers that access the EMT.[22] The fact that approximately 90

[21] DPL. *Quarterly Advanced Metering Infrastructure Performance Metrics Report.* Case 9207. Metric 30 definition.
[22] AMI quarterly reports.

percent of the Company's customers do not access and therefore do not spend time in the EMT website on a quarterly basis suggests that the web-based EMT is not the primary source of energy conservation information for customers.

**Q Are there other forms of communication that the Company could implement in lieu of the Energy Management Tool?**

**A** Instead of the EMT, the Company could mail out home energy reports that provide comparison of a customer's usage relative to their peers. In fact, under the EmPower Maryland program, the Company does provide energy report information to 96,612 reported participants.[23]

> The Behavior Program, which primarily consists of providing Home Energy Reports to customers, continues to provide energy savings. The Home Energy Reports are also used to promote other EmPOWER programs as well as deliver customer-oriented messaging.[24]

In 2015, the Company reported mailing a total of 450,279 home energy reports.[25, 26]

**Q Have Home Energy Reports been implemented where smart meters have not been installed?**

**A** Yes. Other utilities without smart meters frequently provide home energy reports HERs to their customers. For example, Massachusetts has not yet installed smart meters, yet both National Grid and NSTAR (now Eversource) have implemented the similar HERs as DPL's Opower program. National Grid began implementing its program in 2009, while NSTAR began its program in 2010.[27, 28] Examples of other utilities that have implemented HERs without smart meters include

[23] DPL. Delmarva Power and Light EmPOWER Maryland- Second 2015 Semi-Annual EE&C and Demand Response Report July 1, 2015- December 31, 2015. Case 9156. Page A-2.
[24] Ibid. Page 28.
[25] DPL. Delmarva Power and Light EmPOWER Maryland- First 2015 Semi-Annual EE&C and Demand Response Report January 1, 2015- June 30, 2015. Case 9156. Page 30.
[26] DPL. Delmarva Power and Light EmPOWER Maryland- Second 2015 Semi-Annual EE&C and Demand Response Report July 1, 2015- December 31, 2015. Case 9156, Page 28.
[27] https://ngma.opower.com/ei/app/index.html.
[28] https://energyreportsma.opower.com.

Connecticut Power and Light, Southern Maryland Electric Cooperative (SMECO) and Potomac Edison (PE).

**Q What are savings seen in other utilities.**

In general, the DPL estimated EMT savings fall toward the high end of the typical range of savings from HERs of 1 to 2 percent.[29] The Company projects savings of 1.55 percent that are attributable to the EMT program.[30] For example, the weighted average electricity savings rate for HERs in Massachusetts is 1.52 percent, as shown in Exhibit MPC 5 below. As noted above, the Massachusetts utilities have not implemented widespread smart meters. Connecticut Light & Power's (now Eversource) pilot HER program generated 1.7 percent savings in the first year and 1.8 percent savings in the second year without smart meters.[31] In Maryland, SMECO and Potomac Edison have reported savings of approximately 1.4 percent.[32]

[29] *Id,* page 3. "In other studies, this type of information has stimulated customers to reduce their energy use, creating average energy savings in the 1% to 2% range, depending on local energy use patterns."
[30] Direct testimony of Ahmad Faruqui. July 20, 2016. 3:10-12.
[31] NMR Group, Inc., Tetra Tech, Hunt Allcott. *Evaluation of the Year 1 CL&P Pilot Customer Behavior Program Final Report,* March 4, 2013, available at http://www.neep.org/sites/default/files/resources/FINAL%20CLP%20Behavioral%20Year%201%20Program%20Report%20030613.pdf and NMR Group, Inc., Tetra Tech. *Evaluation of the Year 2 CL&P Pilot Customer Behavior Program (R2) Final Report,* August 8, 2014, available at http://www.energizect.com/sites/default/files/Evaluation%20of%20Year%202%20CL%26P%20Pilot%20Behavior%20Pgm%20(R2),%20Final%20Report,%208-8-14.pdf.
[32] Calculations for SMECO based on reported sales from EIA form 861 and SMECO's Semi-Annual Q3/Q4 Report, (ML 164134). Potomac Edison reports 1.4 percent savings in its 2015 Semi-Annual EmPOWER Maryland Report for the period of January 1 – June 30 (Case No. 9153), dated July 31, 2015 (ML 172112).

**Exhibit MPC 5. Savings Rates for Home Energy Reports in Massachusetts**

| Cohort | Percentage Savings* | Participants |
|---|---|---|
| NGRID Group 2009 | 2.37% | 24,005 |
| NGRID Group 2010 | 1.58% | 65,170 |
| NGRID Group 2010 Added | 2.32% | 23,805 |
| NGRID Group 2011 | 2.51% | 99,446 |
| NGRID Group 2011 Added | 1.57% | 60,605 |
| NGRID Group 2012 | 2.20% | 86,898 |
| NGRID Group 2012 Dual | 1.56% | 12,621 |
| NGRID Group 2013 | 1.31% | 324,002 |
| NGRID Group 2013 Email | 0.50% | 46,105 |
| NGRID Group 2014 | 0.90% | 94,874 |
| NSTAR Group 2010 Dual | 0.20% | 18,660 |
| NSTAR Group 2011 Dual | 0.56% | 8,451 |
| NSTAR Group 2012a | 2.16% | 55,857 |
| NSTAR Group 2012b | 2.06% | 17,033 |
| NSTAR Group 2013 Dual | 1.29% | 37,801 |
| NSTAR Group 2013b | 1.12% | 65,798 |
| NSTAR Group 2013 Dual | 1.57% | 20,991 |
| NSTAR Group 2014 | 0.79% | 8,637 |
| **Average** | **1.48%** | |
| **Weighted Average** | **1.52%** | |

*All savings are after the channeling adjustment (which removes double-counting with other programs)

*Source: Navigant Consulting, Inc. and Illume Advising, LLC, Memorandum to the Massachusetts Program Administrators and Energy Efficiency Advisory Council regarding the Massachusetts Cross-Cutting Behavioral Program Evaluation Opower Results, March 2015, available at http://ma-eeac.org/wordpress/wp-content/uploads/Behavior-Program-Impact-Evaluation-Memo.pdf.*

**Q Have the AMI-enabled tools available through the Energy Management Tool platform enhanced energy savings?**

A No, it appears that the Company's web-based online portal has low customer engagement levels as I have shown. Such low engagement numbers imply that the incremental impact of the AMI EMT on-line tools is small. Finally, other than

hourly energy usage data, the tools available on the Company's web portal do not appear to require AMI capabilities.

**Q If the savings from the EMT program could have been achieved without the AMI Initiative, should they be included in the Company's cost-effectiveness analysis?**

No. I recommend that both the costs and the benefits of the Company's EMT program be removed from the Company's cost-effectiveness analysis. This would reduce the EMT demand-related benefits by $24.3 million. In addition to removing these benefits, I recommend that the costs associated with the EMT program should also be removed.

**Q Have you estimated the costs attributable to the EMT that should be removed?**

**A** Yes. Since the Company's response to OPC 1-3 and OPC 13-38 did not include detailed EMT specific historical and forward costs, I estimated the costs associated with the EMT program based on the cost of BGE's SEM program relative to BGE's total costs in Case 9406. In that case, the SEM program represented approximately 7.44 percent of the total BGE Smart Grid Initiative cost. Therefore, I have applied the same percentage to DPL in the absence of more detailed information. This adjustment reduces the Company's AMI costs by $6.4 million on a present value basis.

## VII. CVR BENEFITS SHOULD BE EXCLUDED

**Q Please summarize why you recommend that the CVR benefits should not be included in the Company's analysis.**

**A** Unlike Case 9406 and 9418, the Company does not utilize a CVR factor that is specific to DPL. In fact, Dr. Faruqui describes how he calculated a CVR factor specific to DPL, but then choses to use a CVR factor for Pepco because the CVR factors for DPL are not statistically significant.[33] I understand that Witness

[33] Direct testimony of Ahmad Faruqui. July 20, 2016. At 16:8 to 21:22.

Lanzalotta will also address differences between the Pepco and DPL distribution system that makes it inappropriate to apply a Pepco CVR factor to DPL.

**Q Please describe Dr. Faruqui's summary of the DPL CVR methodology.**

**A** Dr. Faruqui describes his interactions with DPL's engineers to determine the control and treatment substations for DPL's CVR program.[34] Dr. Faruqui indicates that DPL's engineers matched load and customer profiles but did not quantify load characteristics of each of the CVR factors.[35, 36]

**Q Why was it important for the DPL engineers to match load and customer profiles between treatment and control substations?**

**A** As noted in the Company's response to OPC 30-9, there are many factors that could affect a CVR program. These factors include, but are not limited to: customer load mix, transformer and conductor characteristics, voltage control schemes.[37]

**Q What were the findings?**

**A** Dr. Faruqui indicates the DPL CVR findings for both peak and non-peak were not statistically significant and at the low range of typical CVR factors.

**Q What are his recommendations?**

**A** Notwithstanding the results calculated specifically for DPL, Dr. Faruqui recommends the adoption of Pepco MD's CVR factors.

> However, due to aforementioned data issues, the sample size for the Delmarva Power CVR analysis was smaller than ideal and this led to CVR impact estimates which were not statistically significant. Therefore, I recommend defaulting to the estimated impacts estimated in the Pepco CVR study. [38]

[34] Ibid. 14:13-14.
[35] Ibid. 14:17-19.
[36] OPC 30-11
[37] OPC 30-9
[38] Direct Testimony of Ahmed Faruqui. July 20, 2016. 21:10-13.

**Q Dr. Faruqui's methodology assumes that DPL's service territory and Pepco MD's service territory are similar enough to be comparable. Is this a standard analysis in evaluating CVR studies?**

**A** As others have also noted, utilities have invested in CVR for decades.[39] When asked, Dr. Faruqui indicated that he was unaware of any other utility following his comparative methodology.[40]

**Q What are usual methods to assess CVR?**

**A** Utilities have traditionally utilized an on-off methodology on feeders over an extended time period to assess the impacts of CVR.[41] [42] The on-off methodology controls for factors that would affect energy consumption. Even matched controls need to be carefully determined in order to ensure that that customer and load characteristics are similar between treatment and control substations.[43] Importantly, utilities recognize the importance of a robust and rigorous measurement and verification process that need to be understood by regulators and customers.[44]

**Q Earlier you mentioned several factors that could affect a CVR program. Did the Company indicate that it investigated how specific factors would affect the energy reductions associated from CVR?**

**A** No. The Company acknowledges that these factors could affect the CVR program and that additional engineering or economic metric studies could be conducted to assess the impact of factors (load density, load distribution, end-use, load factor,

---

[39] http://www.brattle.com/system/publications/pdfs/000/005/289/original/AESP_2016_Pepco_MD_CVR_Presentation_5-9-16.pdf?1463672324

[40] OPC 18-11

[41] OPC 18-17 Attachment A, Slide 13.

[42] OPC 18-17 Attachment C, page 7.

[43] http://www.brattle.com/system/publications/pdfs/000/005/289/original/AESP_2016_Pepco_MD_CVR_Presentation_5-9-16.pdf?1463672324

[44] OPC 18-17. Attachment D, Page 4.

and peak load). However, the Company did not provide any studies assessing the impact of such factors.[45]

**Q What is your recommendation?**

**A** I recommend that the Commission disregard the Company's proposed CVR savings until such time that the Company demonstrates that its purported savings have been verified through a rigorous measurement and verification process to quantify DPL specific CVR factors. As such, I have removed $6.4 million in CVR demand-side benefits and $0.4 million in CVR operational side benefits from the Company's analysis.

**Q Have you estimated the costs attributable to the CVR that should be removed?**

**A** At this time, I have not found an additional estimate for the Company's CVR costs in response to OPC 1-3 and in the Company's Empower MD filings under Case 9156. In the Company's EmPower MD filings, the Company reports CVR savings, but does not report costs associated with the CVR programs since the costs are not recovered under the EmPower MD surcharge.[46] However, I have included $0.2 million in additional transmission and distribution costs for CVR that is described in Witness Chernick's testimony.

## VIII. ADDITIONAL OPERATIONAL BENEFIT ADJUSTMENTS

**Q Did you make adjustments to the Company's projection of benefits associated with avoided capital from avoiding the early replacement of legacy meters (OPR 06)?**

**A** Yes. I believe that the Company has over-stated savings in avoided capital from avoiding the early replacement of legacy meters. In response to OPC 4-5, the Company indicated that it does not need to replace all meters at the end of their

[45] OPC 30-10.
[46] DPL. Delmarva Power and Light EmPOWER Maryland- First 2015 Semi-Annual EE&C and Demand Response Report January 1, 2015- June 30, 2015. Case 9156. Appendix A-2

estimated 40-year life cycle.[47] In addition, the Company provided the annual number of meter exchanges from 2008 to 2015 for failures, obsolescence, or damage in response to OPC 4-6.[48] During this period, the Company exchanged an average of 4,675 meters per year. In its OPR 06 worksheet, the Company used an estimate of 5,187 meters exchanged or 1.96 times the 2,642 meters actually exchanged in 2015.[49] I adjusted the exchange rate in the Company's OPR 06 worksheet to reflect the average number of meter exchanges from 2010 through 2015, which was 4,701 meters. This adjustment reduces the OPR benefits from $3.6 million to $3.3 million on a PV basis. Therefore, I make an adjustment of $0.3 million (rounding) for OPR 06 in my analysis.

**Q Do you make adjustments to the Company's projection of benefits from improved remote connect and disconnect procedures (OPR 02)?**

Yes. It appears that the Company may be overestimating the benefits associated with improved remote connect and disconnect activities. The Company projects the number of future disconnects to be approximately 11,868 per year and the number of future reconnects to be 8,003.[50] The Company's own historical data shows that the total number of disconnects in 2014 and 2015 were much lower at approximately 4,500 and 5,175 events, respectively.[51] The number of reconnects for the two years was 2,712 and 3,499 respectively.[52] The Company does not explain why there is an anticipated increase in disconnect activity by 6,690 and reconnects by 4,504 between 2015 and 2016.[53] When I adjust the projected number of reconnects and disconnect events to be at the average of 2014 through 2016, this reduces overall benefits from $11.9 million to $11.1 million (PV basis). Therefore, I have reduced the PV benefits for OPR 02 by $0.8 million.

[47] OPC 4-5
[48] OPC 4-6
[49] Ibid.
[50] OPC 1-3. Attachment C. OPR 02 worksheet.
[51] Ibid.
[52] Ibid.
[53] It is my understanding that the Commission still requires a field technician to visit the premise at the time of disconnection. However, this visit should not change the number of disconnect activities. The visit is part of the disconnect process.

**Q Do you make adjustments to the Company's projection of benefits from Avoided Truck Rolls (OPR 13 and 14)?**

A Yes, Witness Lanzalotta has made the following adjustments that I have incorporated into my analysis. Specifically, Mr. Lanzalotta has recommended to reduce the Company's Avoided Truck Rolls- Storm (OPR 14) benefits by $2.6 million. Mr. Lanzalotta's testimony provides his analysis for the recommended reduction. However, it is my understanding the Company's errata filing of September 26, 2016 reflects some of this adjustment.

## IX. AMI INITIATIVE COST DETAILS

**Q Do you have concerns regarding the treatment of the Company's bill credits paid to participants of the Company's Peak Energy Savings Credit (PESC) Demand Response program, but collected from ratepayers?**

A Yes, the Company states that bill credits are not included in its cost-effectiveness test since it considers the credits as transfer payments for its Demand Response program.[54] I understand that Witness Chernick's testimony also discusses the issue of ignoring bill credits in the Company's analysis. It is our understanding that all ratepayers will pay for the bill credits to the extent that payments from PJM do not cover the entirety of the cost of the bill credits, while only participants in the PESC program will receive the benefit of the bill credits.

**Q Does the Company's analysis include participant costs?**

A No. The Company's analysis does not incorporate participant costs.[55] The Company's only rationale is that because the analyses in Case 9406 and Case 9418 do not currently include participant costs, therefore they should not include participant costs in their analysis.

**Q Should the Company have included participant costs in its analysis?**

A Yes. In Order 87082, the Commission stated specifically:

[54] OPC 4-8
[55] OPC 4-9.

"As articulated by the Coalition in this proceeding, cost-effectiveness testing must be symmetrical in how it considers both costs and benefits, and thus an inclusion of all participant costs in a test requires the inclusion of all participant benefits – including NEBs"[56]

In the Company's analysis, the costs incurred by participants in its PESC program are ignored. As noted by the Company's witness Dr. Faruqui in a 2016 report on Demand Response programs for Portland General Electric:

> Costs in the cost-effectiveness analysis vary by program type and include:
>
> - Program development
> - Administrative
> - Equipment and installation
> - Operations and maintenance
> - Marketing and recruitment
> - Incentive payments to participants[57]

**Q What do participant cost in the Company's PESC program represent?**

**A** While it is true that the credits are collected from all ratepayers and then paid to a subset of ratepayers who then participate in the program, the program is not costless. The bill credits are intended to compensate participants of the DP program who experience sacrifices during peak pricing periods through thermal discomfort or other changes in behavior. These participants are providing a service to the utility in the form of a load reduction, and consequently the Company is compensating them to provide the load reduction service.

**Q Have other Commissions used bill credits as a proxy for participant costs?**

**A** Yes. Both California and Pennsylvania commissions recognize that the participants in demand reduction programs make sacrifices to consume less electricity during peak periods. The Pennsylvania Commission recognized that the

[56] MD PSC. Order 87082. July 15, 2015. Page 14.
[57] Hledik, R., Faruqui, A., Bressan, L. *Demand Response Market Research* Portland General Electric 2016-2035. January 2016. Page 12. Available at: https://www.portlandgeneral.com/-/media/public/our-company/energy-strategy/documents/2016-02-01-demand-response-market-research.pdf?la=en

bill credits could be a monetary proxy for participant costs.[58] The California Commission recognized that the cost that a ratepayer must incur to participate in a demand response program include capital costs, transaction costs, and the value of services lost. [59] Further the California Commission also recognized that participant costs must be determined in calculating the TRC and participant test.[60]

**Q What have California and Pennsylvania used for the participant cost proxy?**

A The Pennsylvania commission initially used the full cost of bill credits as the proxy value for participant costs.[61] Ultimately, the Pennsylvania Commission determined that 75% of incentive costs represented a proxy for participant costs.[62] The California Commission determined that the maximum value for participant costs would be: incentives + bill reductions – capital costs.[63] In Dr. Faruqui's work for Portland General Electric, he recommends using 50%.[64]

**Q In light of the precedent in other states, what is your recommendation?**

A In our adjustment, we include the full amount of bill incentives in our determination of cost effectiveness to be consistent with our recommendation in Case No. 9406 and in Case No. 9418. Our estimate of bill credits includes $2.5 million in bill credits paid between 2014 and 2015.[65] In addition, we include our estimate of $26.1 million of a PV basis for future bill credits based on the Company's estimate of $4.05 million for bill credits in 2016.[66] In our analysis, we assume that the Company will maintain the $4.05 million per year through the analysis period. Our adjustment for the bill credits as a proxy for participant costs increases the Company's costs by $28.6 million on a PV basis.

[58] Pennsylvania Public Utilities Commission. Order. Docket M-2015-2468992. June 11, 2015. Page 55.
[59] California Public Utilities Commission. Rulemaking 07-01-041. December 21, 2010. Page 38.
[60] Ibid.
[61] Pennsylvania Public Utilities Commission. Page 55.
[62] Ibid.
[63] California Public Utilities Commission. Page 39.
[64] Hledik et al. 2016. Page 12.
[65] OPC 4-10.
[66] Ibid.

**Q Do you have any other cost adjustments to make in your analysis?**

A Yes. As discussed earlier, I have reduced the Company's cost by removing my estimate of EMT costs of $6.4 million on a present value basis from my analysis.

## X. ALTERNATIVE COST-EFFECTIVENESS ESTIMATE

**Q Have you developed an alternative cost-effectiveness estimate for the AMI projects based on OPC's alternative assumptions?**

A Yes. After adjusting the Company's estimates of benefits and costs based on alternative assumptions that OPC Witnesses Chernick, Lanzalotta, and I have made; I have arrived at a benefit-cost ratio of 0.69. This means that the Company's AMI program is not cost-effective based on OPC's analysis.

**Q What adjustments did you make to the Company's estimates of operational benefits?**

A In my alternative analysis I have adjusted the estimates of operational benefits in the following six items (shown in Exhibit MPC 6):

- I have included an adjustment of **$0.79** million for an adjustment to account for reduced operational connect/disconnect benefits (OPR 02) based on the number of historical reconnects and disconnects discussed in my testimony.
- I have included an adjustment of **$0.34** million for an adjustment to account for reduced avoided capital for early replacement of legacy meters (OPR 06) based on the historical number of meter replacements as discussed in my testimony.
- I have included an adjustment of **$2.6** million for the Company's purported benefits for avoided truck rolls storms (OPR 14) based on the recommendation of Witness Lanzalotta.
- Based on the testimony and recommendations of Witness Chernick, I have reduced the Company's Energy and Capacity Market Earnings (OPR 17 and OPR 18) by **$0.4** million.

- I have assumed no benefits associated with the Company's Conservation Voltage Reduction (CVR) transmission and distribution benefits (OPR 19 and OPR 20). This results in a **reduction of $0.6 million** in present value of benefits for CVR related transmission and distribution benefits. Our adjustment in benefits includes an addition in $0.2 million for CVR associated transmission and distribution costs described in Witness Chernick's testimony.

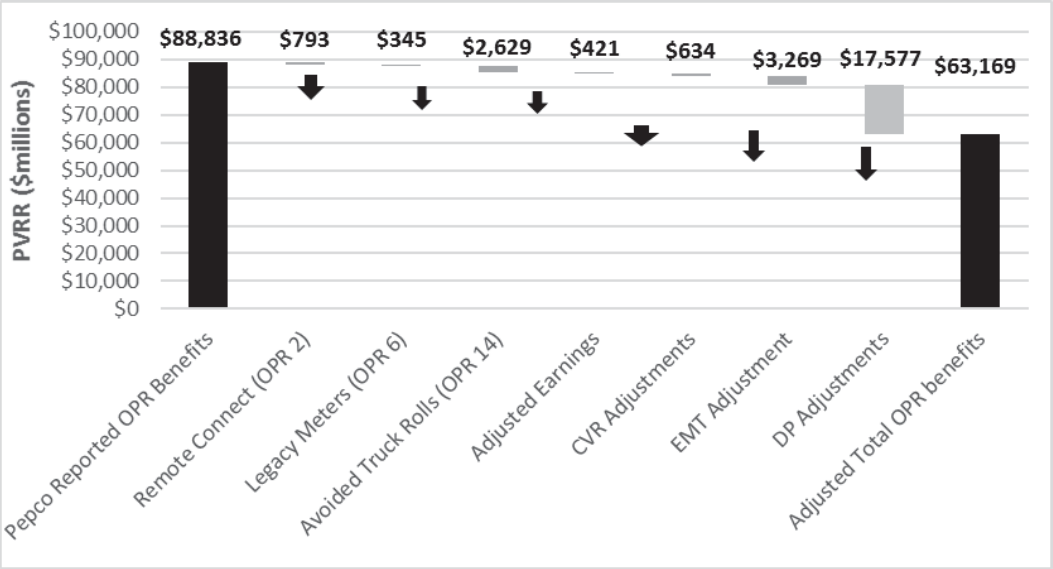
- I have assumed no benefits associated with Dynamic Pricing avoided transmission and distribution (OPR 21 and OPR 22), per the testimony of OPC Witness Chernick. This results in a **reduction of $17.5 million** in present value of benefits.[67] This does not include OPC's adjustments to transmission and distribution reductions from EMT and CVR, described above and below.

- I have assumed no benefits associated with the Energy Management Tool (EMT) transmission benefits (OPR 24). This results in a **reduction of $3.2 million** in present value of benefits for EMT related transmission and distribution benefits.

These adjustments have the effect of reducing the Company's Operational benefits from $88.8 million to $63.2 million as shown below:

[67] Direct Testimony of Paul Chernick.

**Exhibit MPC 6. Adjusted Operational Benefit Estimates (Present Value, millions)**




**Q What adjustments did you make to the Company's estimates of demand side benefits?**

In my alternative analysis I have adjusted the Company's estimates of demand side benefits in the following ways in the following three categories (shown in Exhibit MPC 7):

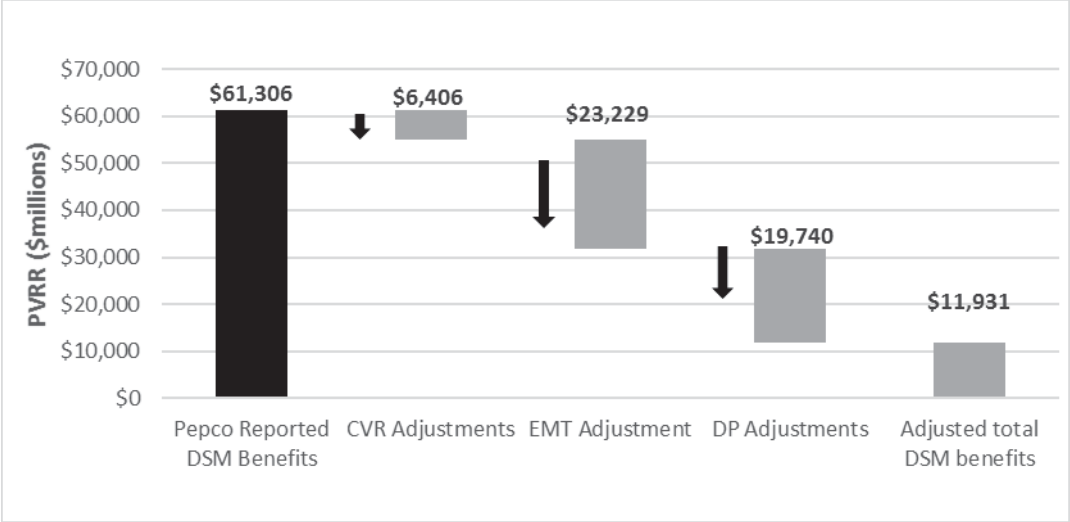
- As discussed in detail earlier, I have assumed no benefits associated with the Company's CVR demand-side benefits (DSM 01, DSM 03, DSM 03, DSM 04, and DSM 05). This results in a **reduction of $6.4** million in present value of benefits.[68]
- I have included my elimination of EMT DSM benefits described in my testimony. This results in a **reduction of $23.2** million in present value of benefits.
- I have included Witness Chernick's adjustment for DSM benefits described in his testimony. This results in a **reduction of $19.7** million in

[68] *Id.*

present value of benefits excluding our adjustments for CVR and EMT noted above.[69]

These adjustments have the effect of reducing the Company's Demand-side benefits from $61.3 million to $11.9 million as shown below:

**Exhibit MPC 7 Adjusted Demand Side Benefit Estimates (Present Value, millions)**




**Q What are your combined benefits after your adjustments?**

A Taken together, our adjusted operational benefits of $63.1 million and adjusted demand side benefits of $11.9 million result in a total adjusted benefit of $75.1 million for the Company's AMI system.

**Q What adjustments did you make to the Company's estimates of costs?**

A In my alternative analysis I have adjusted the estimates of costs in the following ways (shown in Exhibit MPC 8):

[69] In my analysis of the Company's DP peak reductions in 2020-2024, it appears that the Company has assumed to include an escalated capacity amount for the market recognition for its calculation of capacity mitigation. Instead, the Company should have assumed the lower amount based on its calculated load reductions. However, this change does not appear to flow through to the quantification of benefits.

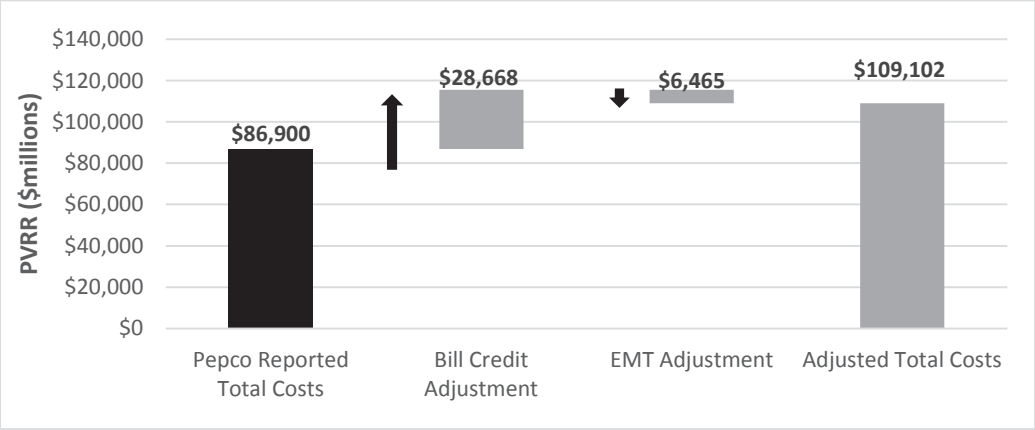
- I have included the cost of DP bill credits, as discussed in my testimony. This results in an increase of $28.6 million in present value of costs.

- In order to be consistent with the exclusion of benefits from the Company's EMT program, I have also removed the costs associated with the program. This results in a reduction of $6.4 million in present value of costs.

- Subject to responses provided by the Company, I have not made any adjustments to the Company's CVR costs other than Witness Chernick's adjustment of $0.07 million at this time.

These adjustments have the effect of increasing the Company's costs from $86.9 million to $109.1 million as shown below:

**Exhibit MPC 8: Adjusted Cost Estimates (Present Value, millions)**




**Q How do your adjustments to benefits and costs affect the benefit-cost ratio of the AMI program?**

A Shown below in Exhibit MPC 9, my adjusted benefits of $75.1 million is lower than my adjusted cost estimate of $109.1 million. This leads to an adjusted benefit-cost ratio of 0.69. This adjusted ratio is significantly less than the 1.8 benefit-cost ratio produced by the Company.[70] Put differently, the Company claims that more than one dollars and eighty cents of benefits are produced for

[70] OPC 1-3. Attachment C.

every dollar invested, whereas my adjustments show that the Company's AMI investment produces 69 cents in benefits for every dollar invested.

**Exhibit MPC 9. Adjusted Benefits and Costs**

| Present Value ($2015 mil) | DPL | Adjusted estimate |
|---|---|---|
| Costs | $86.9 | $109.1 |
| Benefits | $150.1 | $75.1 |
| Net Benefits | $63.2 | -$34.0 |
| Benefit-Cost Ratio | 1.73 | 0.69 |

**Q Is the Company's AMI program beneficial to ratepayers?**

**A** No. The Company's AMI program does not appear to be cost-effective based on our adjustments.

## XI. FINDINGS AND RECOMMENDATIONS

**Q What are your findings?**

**A** The benefit-cost analysis, as adjusted by OPC, shows that the Company's AMI program is not cost-effective. The Company has overstated both demand-side and operational benefits attributable to the AMI program based on the testimony of OPC Witnesses Paul Chernick and Pete Lanzalotta. When I use alternate inputs developed by OPC, the benefit-cost ratio of the Company's AMI Program is 0.69.

**Q What are your recommendations for the Commission?**

**A** I recommend, for the reasons explained in this testimony, that the Commission disallow $34.0 million. This will essentially hold rate-payers harmless.

**Q Does this conclude your testimony?**

**A** It does. However, I reserve my right to update my testimony based upon additional responses from the Company.