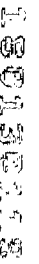


Virginia State Corporation Commission eFiling CASE Document Cover Sheet



Case Number (if already assigned)	PUR-2017-00126
Case Name (if known)	Petition of Appalachian Power Company for approval of a rate adjustment clause, the EE-RAC, pursuant to § 56-585.1 A 5 c of the Code of Virginia and for approval of new energy efficiency programs
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January 23, 2018

VIA ELECTRONIC FILING

Mr. Joel H. Peck, Clerk
c/o Document Control Center
State Corporation Commission
Tyler Building – First Floor
1300 East Main Street
Richmond, Virginia 23219

RE: Petition of Appalachian Power Company for approval of a rate adjustment clause, the EE-RAC, pursuant to § 56-585.1 A 5 c of the Code of Virginia and for approval of new energy efficiency programs

Case No. PUR-2017-00126

Dear Mr. Peck:

Attached for filing in the above-referenced matter is the Direct Testimony of Jeffrey Loiter, which is being submitted on behalf of Appalachian Voices (“Environmental Respondents”). Included with this testimony are Mr. Loiter’s one-page summary and one attachment. This filing is being completed electronically, pursuant to the Commission’s Electronic Document Filing system.

If you should have any questions regarding this filing, please contact me at (434) 977-4090.

Regards,

A handwritten signature in cursive script that reads "William C. Cleveland".

William C. Cleveland

cc: Parties on Service List
Commission Staff

WITNESS DIRECT TESTIMONY SUMMARY
Docket PUR-2017-00126

Witness: Jeffrey Loiter, on behalf of Environmental Respondent
Title: Partner, Optimal Energy Inc.

Summary:

Witness Loiter addresses the design and cost-effectiveness of Appalachian Power Company's (or "Company's") proposal to implement six new energy efficiency programs. He also addresses the proposed continuation of two additional programs. The first section of the testimony provides a short summary of the performance of the Company's existing programs to date and the Company's progress towards the State's energy goals. Mr. Loiter notes that the failure of the Company's portfolio to make substantial progress towards those goals results in the loss of substantial economic benefits to Virginians.

In his second section, Mr. Loiter address the issue of energy efficiency program cost-effectiveness in more detail, with emphasis on the appropriateness of various tests, particularly the Ratepayer Impact Measure (RIM) test. He also discusses other metrics that the Commission could use to assess the programs, including the levelized cost of energy and direct bill impacts. For each of these, he presents the results of applying these metrics to the proposed portfolio.

The third section of testimony presents Mr. Loiter's review of the design and characteristics of the continuing and proposed programs. Mr. Loiter pays particular attention to the cost of each program and how potentially incorrect assumptions regarding efficient lighting in the residential sector may overstate the cost-effectiveness of the Efficient Products, eScore, and Multifamily Direct Install (MFDI) programs. He also notes a missed opportunity to derive greater savings from the eScore and MFDI programs which could be realized by coordinating with gas utility programs, to maximize the value of each customer site-visit. With respect to the Small Business Direct Install program, Mr. Loiter questions the reasonableness of some assumptions for a measure that drives a large portion of the projected savings.

Although the cost-effectiveness of some of the programs may be overstated, Mr. Loiter concludes that in his view they would remain cost-effective if the issues he notes were addressed. Furthermore, the programs represent well-established and well-known programmatic approaches for energy efficiency, and therefore should be approved by the Commission.

COMMONWEALTH OF VIRGINIA
STATE CORPORATION COMMISSION

PETITION OF APPALACHIAN)
POWER COMPANY)
for approval of a rate adjustment clause,) Case No. PUR-2017-00126
the EE-RAC, pursuant to § 56-585.1 A 5 c)
of the Code of Virginia and for approval)
of new energy efficiency programs.)
)

Direct Testimony of

Jeffrey Loiter

On Behalf of
Environmental Respondent

January 23, 2018

Q. Please state your name and business address.

A. My name is Jeffrey Loiter and my business address is Optimal Energy, Incorporated, 10600 Route 116, Hinesburg, Vermont, 05461.

Q. On whose behalf are you testifying?

A. I am testifying on behalf of Appalachian Voices (“Environmental Respondent”), who are represented by the Southern Environmental Law Center (“SELC”) in this proceeding.

Q. Mr. Loiter, by whom are you employed and in what capacity?

A. I am a Partner in Optimal Energy, Inc., a consultancy specializing in energy efficiency and utility planning. In this capacity, I direct and perform analyses, author reports and presentations, manage staff, and interact with clients to serve their consulting needs. My clients include state energy offices and efficiency councils, utilities and third-party program administrators, and non-governmental organizations. For example, I participate on the consultant team supporting the work of the Massachusetts Energy Efficiency Advisory Council, which guides the development of energy efficiency plans by the state’s investor-owned gas and electric utilities and energy providers and monitors the implementation of these plans. I have recently begun providing similar services to the newly-formed Delaware Energy Efficiency Advisory Council.

Q. Please summarize your work experience and educational background.

A. I have over 20 years of consulting experience in environmental policy, energy, and natural resource issues. For the past 11 years, I have been engaged in a variety of work at Optimal Energy related to energy efficiency program design

and analysis. For example, I prepared two documents for inclusion in EPA’s *National Action Plan for Energy Efficiency (NAPEE)*: a guidebook on conducting efficiency potential studies, and a handbook describing the funding and administration of clean energy funds.¹

In my capacity as a Partner at Optimal, I also advise clients on efficiency program design and implementation. I have assisted with the design and development of statewide and utility-specific efficiency programs in Maine, Maryland, New York, Massachusetts, and Tennessee. I currently support program implementation and on-going program design and development for Orange and Rockland Utilities in New York and the Connecticut Municipal Electric Energy Cooperative. I have submitted written testimony to and/or testified before public utility commissions in Arkansas, Kansas, Kentucky, Maryland, Ohio, Virginia, and West Virginia on topics such as demand-side management, integrated resource planning, and efficiency as a resource in state energy plans.

Prior to joining Optimal Energy in 2006, I was a Senior Associate at Industrial Economics, Inc. in Cambridge, Massachusetts, where I supported state, federal, and international governmental clients with analysis on topics of environmental policy and natural resources damages. I have a *B.S. with distinction* in Civil and Environmental Engineering from Cornell University and an *M.S.* in Technology and Policy from the Massachusetts Institute of Technology.

¹ These documents can be found at http://www.epa.gov/cleanenergy/documents/suca/potential_guide.pdf and http://epa.gov/cleanenergy/documents/clean_energy_fund_manual.pdf, respectively.

Q. Have you previously testified before the Virginia State Corporation Commission (“the Commission” or “SCC”)?

A. Yes. I have testified before the SCC or provided pre-filed direct testimony on behalf of Environmental Respondents in the following cases: PUE 2009-00023, PUE-2011-00092, PUE-2011-00093, PUE-2012-00100, PUE-2012-00128, PUE-2013-00072, PUE-2013-00097, PUE-2014-00039, PUE-2014-00071, PUE-2015-00035, PUE-2015-00036, PUE-2016-00049, PUE-2016-00050, and PUE-2016-00111.

Q: How is your testimony organized?

A: My testimony is organized into the following sections:

- I. The Company’s Proposed DSM Programs in Context
- II. Cost-Effectiveness of Existing and Proposed DSM Programs
- III. Assessing the Existing and Proposed DSM Programs
- IV. Summary of Findings and Recommendations

Q. Are you submitting attachments along with your testimony?

A. Yes. I have attached my resume as Attachment JML-1.

Q. What actions do you recommend the SCC take in this proceeding?

A: I recommend that the Commission:

- Approve the Company’s petition to continue the two existing programs and to approve the proposed new programs, with the exception of the Bring-Your-Own-Thermostat program, for which I am not making a recommendation regarding approval.

- Direct the Company to provide better consolidated information on the performance of existing programs in future filings, whether these are requesting new programs or continuations of existing

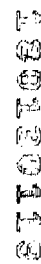
I. The Company's Proposed DSM Programs in Context

Q: Can you briefly summarize the filing, as you understand it?

A: Appalachian Power Company ("Company") is requesting approval to continue two existing demand side management (DSM) programs and to add six new programs to their portfolio. The Company is also requesting that the costs of implementing these programs be recovered through an existing energy efficiency rate adjustment clause (EE-RAC). The filing presents information on the nature of these programs, their projected costs and savings, and their cost-effectiveness.

Q: How does this fit within their overall portfolio?

A: If I understand correctly, the eight programs included in this filing will represent the entirety or nearly the entirety of the Company's DSM portfolio from 2019 to 2021. Existing programs for which the Company did not request extensions will terminate at the end of 2018. These are a C&I Prescriptive Program (which will largely be replaced by new programs), the Home Performance Program (which will be replaced by the new eScore Program), and the Manufactured Homes Program. According to the testimony of Mr. Bacon, Schedule 1, a Low Income Weatherization Program and a Peak Reduction Program are currently active; no end date is given so it is unclear when their approved delivery period will expire.



Q: What is the past performance of these programs?

A: Answering this question requires referring to material outside of the current filing.

While Mr. Bacon gives a short update on the progress of the existing programs, and his Schedule 46A reports on program spending through mid-2017, he does not present any quantitative data on the energy savings resulting from this spending. Fortunately, these data may be found in evaluation reports submitted to the Commission under Docket PUE-2014-00039, the proceeding in which they were approved.

Excluding the Low Income Weatherization Assistance Program that is current under consideration by the Commission in a separate docket, the Company's programs generated realized gross savings of roughly 26,900 MWh and net savings of 20,800 MWh. Savings from the C&I program represent nearly two-thirds of these savings.

Q: How does that compare with the Company's projections?

A: Material from the original filing for these programs indicates planned savings for these programs of roughly 42,700 MWh. Assuming this was on a "gross" basis, the Company realized a little less than two-thirds of the planned savings.

Q: What about the cost of delivering those programs?

A: Again, excluding the Low Income WAP, total spending in calendar year 2016 was approximately \$3.9 million, including the Company's margins. This results in an average cost of approximately \$150 per annual MWh.

Q: How have those results, in terms of energy savings and costs, affected APCo's customer's bills?

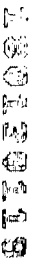
A: The bill savings for residential customers alone is likely in the range of \$1 million, based on information provided in Witness Marshall's Schedule 2. The savings for C&I customers, with even greater energy reductions, may exceed \$1.5 million.

Q: Can you provide a summary of the project costs and energy impacts of the proposed portfolio?

A: Yes. The proposed portfolio continues the trend from the past two years of increased program budgets. The projected budget for active and approved programs is forecast to about \$5.7 million for the 12-month period ending in mid-2018 [Bacon, Schedule 46A, p. 1]. For calendar year 2019, the current filing proposes total spending of approximately \$9.4 million. Along with this increase in spending comes an increase in projected savings, from the previously mentioned 42,600 MWh to about 56,700 MWh annually.

Q: How do these projected savings compare to the Company's overall sales?

A: For comparison, the Company's sales are roughly 13 million MWh annually, excluding exempt customers [Marshall, Schedule 46N, pp 1-2]. This means that the proposed savings for one program year represent roughly 0.4% of annual sales. Over three years, total savings would reach roughly 1.3% of annual sales.



Q: Does Virginia have any goals or targets for energy efficiency savings that are relevant here?

A: Yes, the 2014 Virginia Energy Plan specifies a goal of a 10% reduction in energy consumption by 2022 (previously 2020), as compared to 2006 sales. Although I do not have comparable 2006 sales data, assuming that there has been relatively slow growth since that time, the savings may represent 0.5% using the 2006 baseline. For the three years of programs the Company is requesting to implement, total savings would be about 1.5% of sales. Adding the savings generated since program launch may bring the total savings to about 2% of sales by 2020. That is, the Company is on a trajectory to achieve just one-fifth of the state's energy savings goals.

Q: But the goal is just an arbitrary number, why does it matter if they don't reach the goal?

A: I wouldn't characterize the goal as arbitrary. As the authors of the Virginia Energy Plan note, energy efficiency and energy conservation more broadly can result in "increased financial capital, national and personal security, environmental quality, human comfort and health benefits, reduced energy costs, and maximized profits."² By falling short of the state goal, the Company's customers and indeed all Virginians are not receiving the benefits that energy efficiency can provide.

² *Virginia Energy Plan*. Produced by the Commonwealth of Virginia Department of Mines, Minerals and Energy. October 1, 2014. p. 9-1]

Q: Can you explain in more detail what you mean by the term “benefits?”

A: Energy efficiency generates positive outcomes in a number of ways. Most obvious in the short term, using less energy means lower energy bills. Efficiency also reduces the peak electric demand on both distribution and transmission networks. This has immediate cost savings by reducing energy losses (which increase as load increases) and longer term cost savings by avoiding the need to expand or upgrade the networks. Reduced consumption means reduced generation, which reduces pollutant emissions from oil, coal, natural gas, and biomass fired power plants. Some of these reductions have direct economic value, such as with sulfur dioxide emissions that incur an economic cost under system set up to combat acid rain. Others do not result in immediate cost savings to the utility or the customer, but certainly reduce the costs of adverse health effects resulting from poor air quality or polluted water ways.

Q: What size of impact are we talking about here?

A: We can make an estimate using information provided by the Company. Witness Bacon’s Schedule 4 shows the net present value (NPV) of the Company’s proposed portfolio of DSM programs. The top row of the table, labelled TRC, has a value of \$33.8 million. This represents the amount by which the lifetime economic benefits to Virginians from programs exceeds the costs, and is based only on tangible energy savings and emissions reductions with a market price. Moreover, this is only for the low savings planned by the Company. While five times the savings (to reach the ten percent target) would probably not result in five times the net benefits, it would certainly be a meaningful increase. I do not

think it is a stretch to say that the Company failing to achieve the savings target means that Virginians are at least \$50 million worse off than they could have been.

Q: Now, in that statement, you pointed to a particular row of values in Bacon's Schedule 4, labelled "TRC." Does that refer to the Total Resource Cost test?

A: That is my interpretation, yes. The Total Resource Cost test is one of the standard approaches to assessing the cost-effectiveness of energy efficiency programs.

Q: The Company presents the results of cost-effectiveness analysis under several different tests, as shown on Schedule 4. Can you please explain the different components of those tests and how they compare to one another?

A: Yes, I would be glad to, because cost-effectiveness is one of the key metrics used by Commissions, utilities, and other stakeholders to assess energy efficiency programs.

II. Cost-Effectiveness of Existing and Proposed DSM Programs

Q: Please start by giving an over-view of the concept of cost-effectiveness

A: As the Commissioners know, when we say something is cost-effective, we mean that its monetary or economic benefits outweigh its monetary or economic costs. This can be expressed in two ways. The total costs can be subtracted from the total benefits, resulting in a net benefits number, somewhat akin to the bottom line of a business. A positive net benefit means the economy and its citizens, businesses, and government entities have more economic wealth than before. The other common way to express cost-effectiveness is by the ratio of benefits to costs. If this ratio is greater than 1, benefits exceed costs and again, wealth

increases. The virtue of the benefit-cost ratio (“BCR”) is that it makes comparing things of different magnitude easier. For example, a program with a large budget and corresponding large savings might have a smaller benefit-cost ratio than a program with smaller budgets and smaller savings. The larger program would, on the other hand, have greater net benefits in dollar terms. This fact should not be overlooked. Bacon’s Schedule 4 presents both the net benefits and the BCR for each program and for the portfolio as a whole. In addition to the net benefits of \$33.8 million (again, just looking at the TRC row for now), the top-most table on the page presents the BCR for the portfolio of 1.9. This implies that the total costs of the program are roughly \$37.6 million and the total benefits about \$71.4 million. Subtracting the two gives the net benefits figure (\$33.8 million), and dividing benefits by costs gives the ratio (1.9).

Q: And are those the benefits resulting from just the three years of program activity and spending for which the Company is requesting approval?

A: I believe so. Referring to Mr. Bacon’s Schedule 4, he reports a UCT B/C ratio of 3.0 and net benefits of \$46.8 million. This implies NPV utility costs of \$24.4 million, which is reasonable given the nominal three-year budget of \$27.3 million (Bacon 46A). I would like to add that this is the most appropriate way to report cost-effectiveness results. Understanding the costs and benefits that flow from the three years of proposed program activity for which the Company is requesting approval is the correct basis for making decisions about the impact of the programs on the Company’s customers.

Table 29. Conceptual Overview of the CaSPM Cost-Effectiveness Tests

Test	Perspective	Key Question Answered	Summary Approach
Utility Cost	The utility system	Will utility system costs be reduced?	Includes the costs and benefits experienced by the utility system
Total Resource Cost	The utility system plus participating customers	Will utility system costs plus program participants' costs be reduced?	Includes the costs and benefits experienced by the utility system, plus costs and benefits to program participants
Societal Cost	Society as a whole	Will total costs to society be reduced?	Includes the costs and benefits experienced by society as a whole.
Participant Cost	Customers who participate in an efficiency program	Will program participants' costs be reduced?	Includes the costs and benefits experienced by the customers who participate in the program
Rate Impact Measure	Impact on rates paid by all customers	Will utility rates be reduced?	Includes the costs and benefits that will affect utility rates, including utility system costs and benefits plus lost revenues

Q: What are results for the Company's programs?

A: As shown on Bacon Schedule 4, all of the proposed programs have positive net benefits and BCR's greater than 1 for the TRC test, UCT, and PCT. Only one program has positive net benefits under the RIM test, the Bring-Your-Own-Thermostat (BYOT) program. Note that the BYOT program is a demand response program, rather than an efficiency program. I will not address the merits of this program in my testimony.

Q: So if most of these programs do not show net benefits under the RIM test, should the Commission reject them as not cost-effective?

A: No, I do not believe that negative net benefits or a BCR < 1 on the RIM test should categorically exclude a program. In fact, I think it should be given very little, if any weight, because it does not, in my view, provide much in the way of useful information to Commissioners who are justifiably concerned with rate increases. I think it is far more instructive to consider the actual rate impacts, in

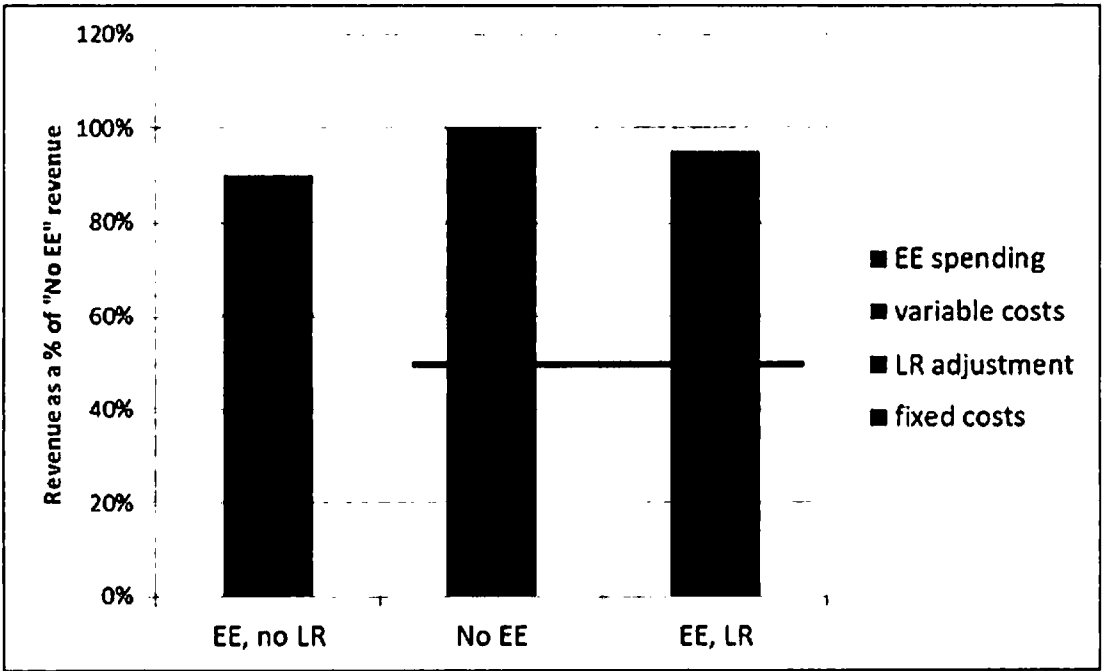
cents per kWh or dollars per month that will result from efficiency programs’
reduction in sales and fixed cost recovery for the utility.

Q: Is it typical that efficiency programs fail to pass the RIM test, and if so, why?

A: Yes, it is typical. Efficiency programs result in lower cost recovery for the utility when their sales are lower than projected during a prior case before the load reductions from the program. In the RIM test, these lost revenues are included as a cost of the program, under the theory that if the utility is allowed to recover these lost revenues through another mechanism, this represents a cost to ratepayers. But it is incorrect to consider lost revenues a cost of efficiency programs.

Q: Why shouldn’t lost revenues be considered a cost of DSM?

A: As I have testified in previous dockets, lost revenues recovered from ratepayers are monies that would have been recovered from ratepayers in the absence of the efficiency programs. The figure below illustrates this graphically.



scenario where efficiency programs are not implemented and sales remain at forecast levels.

Q: It sounds like you're saying that, without lost revenues, the utilities suffer a net economic loss from DSM programs?

A: That's correct. If the Company does not pursue lost revenue recovery for load reductions that are supported by robust evaluation, measurement, and verification (EM&V), it is in the Company's interest to minimize the amount of lost revenues from DSM programs (assuming the Company's savings claims are accurate). This, in turn, means the Company will minimize spending on DSM, to minimize lost revenue. In effect, the failure to recover lost revenues thwarts the pursuit of the Commonwealth's energy efficiency goals. The best way to achieve robust and widespread deployment of efficiency programs—and to achieve the Commonwealth's energy savings goals—is to remove the economic disincentive for utilities to pursue DSM. Awarding lost revenues removes that disincentive and makes the utilities whole.

Q: If the RIM test is not useful for determining whether a particular program is cost-effective, what tests have VA SCC and other commissions typically emphasized or used to assess DSM programs?

A: Many states use the TRC, although there are differences in the range of benefits that are included in this test, based on different opinions regarding the boundaries of the "system" or economy within which the costs and benefits are included. Other states use the UCT, or sometimes a combination of two or more tests. In many previous discussions before the Commission here in Virginia, we have

discussed the statute/legislation that states that no single test should be used to reject a program, to which the Commission has responded by indicating that they consider the results of all of tests.

Q: How should cost-effectiveness be determined for purposes of this docket?

A: I think the Commission should continue to consider the results of the TRC, UCT, and to a lesser extent, the PCT. With respect to rate impacts, particularly for non-participants, I believe looking at the results of the bill impact analysis is useful. For example, in this case, the estimated bill impacts are less than 0.2% for all customer classes. [Marshall Schedule 2] For a residential customer using 1,000 kWh per month, this is 20 cents more per month. A moderately-sized business using 50,000 kWh month would face an extra \$10 on their monthly bill. Thinking about these impacts in the context of the millions of dollars of economic benefit that would result from implementing the programs is, in my view, a valuable exercise.

Q: Are there other potential metrics that can be used to assess the Company's proposed DSM programs?

A: Yes. As has been discussed previously before this Commission, the cost of saved energy or levelized cost of energy saved is an alternative metric that can be used.

Q: Please explain the term "cost of saved energy."

A: The cost of saved energy is simply the cost of taking an action to reduce energy usage divided by some measure of the energy saved. It is typically considered from the utility or program administrator point of view, because that is the entity with the responsibility of procuring energy for its customers. It can be expressed

either in terms of cost per first-year energy savings or cost per life-time energy savings. Cost per first-year savings is commonly used with the efficiency industry, but the cost per-lifetime unit of savings is more intuitive for many people, as it can be compared with the cost of supply from traditional generation or the market price of power purchases.

For example, program costs in 2019 for the Company’s proposed Small Business Direct Install Program are estimated to be \$882 thousand [Bacon Schedule 46A]. In that year, the program will generate incremental annual savings of 8,162 MWh, giving a cost of saved energy of approximately 11 cents per annual kWh. Depending on the assumed effective life of the measures installed through the program (sometimes called “measure life”), the cost per lifetime kWh could be as low as 1 cent per kWh, but this calculation does not take into account differences in timing of costs and savings, nor any discount rates for these. As I will discuss later, this raises a red flag for me, one that the TRC ratio for the program (2.0) does not. It is for this reason the cost of savings is one of the first calculations I make when reviewing an efficiency program or DSM strategy.

Q: What does the term “levelized” refer to?

A: The term “levelized” refers to accounting for differences in the timing of both the costs and energy impacts resulting from efficiency or other energy resources. Levelized cost of energy (LCOE) is a common metric for comparing various supply side generating options. It represents, in real dollars, the cost of building and operating a generating plant over an assumed financial life and duty cycle.

Q: What methodology should be employed to evaluate the levelized cost of energy saved?

A: There are a variety of methods. For example, a report prepared by the Lawrence Berkeley Laboratories for the U.S. Department of Energy presents a simple and straightforward approach to calculate the levelized cost of energy saved by an efficiency program in a particular year, using the standard capital recovery factor calculated based on the measure life of the savings.⁴

Q: What role can the levelized cost analysis provide in evaluating the cost-effectiveness of the Company's proposed programs?

A: The levelized cost of energy for efficiency programs provides a simple comparison to the Company's overall generating portfolio, specific generating assets, and market power purchases. If the levelized cost of energy from an efficiency program is less than the Company's average marginal costs or power available through market purchases, then the Company's revenue requirement will be reduced, thus lowering overall bills for customers. In this way it is similar to, but simpler than, the utility cost test.

Q: Did the Company report the levelized cost of saved energy in their filing?

A: No, but a calculation of this value appears in their discovery responses, in Staff 2-015 Attachment 1. I do not, however, think the Company's calculation is correct.

Q: Can you elaborate?

A: The Company calculates the levelized cost of saved energy from each measure in each program. For example, standard 5.5 watt LED lamps available through the

⁴ Billingsley et al. *The Program Administrator Cost of Saved Energy for Utility Customer-Funded Energy Efficiency Programs*, Prepared for the U.S. Department of Energy by Ernest Orlando Lawrence Berkeley National Laboratory (Mar. 2014).

eScore program have a cost of \$45 per MWh, or 4.5 cents per kWh. I believe this calculation is correct. When the Company calculates the overall levelized cost of each program, though, they take an average of the individual measure costs, weighted by the total measure cost. This is incorrect for two reasons. First, for the levelized cost of energy to be a valuable comparison to the other options available to the Company to meet their customer’s energy needs, any comparison should be based on only that portion of the cost incurred by the Company. The measure-level calculation seems to do so. More importantly, weighting by cost is itself incorrect. The mathematically correct way to determine the unit cost of some collection of goods with different individual costs is by dividing the total cost by the total number of goods. In this case, the number of goods is the energy savings.

Q: Have you applied this methodology to the Company’s programs, and if so, what is the result?

A: Yes, I did. The results are shown in the table below. The corrected levelized cost is sometimes higher and sometimes lower than the Company’s value.

<i>Program</i>	<i>Company's Levelized Cost (cents per kWh)</i>	<i>Corrected Levelized Cost (cents per kWh)</i>
eScore	1.7	2.3
Efficient Products	1.1	0.9
Appliance Recycling	4.2	4.2
Multifamily Direct Install	1.9	2.4
C&I Lighting	1.0	1.1
C&I Standard	1.8	1.3
SBDI	5.5	2.5

Q: What conclusion do you draw from these results?

A: I think the most important comparison I can draw is to the Company’s tariffs; all of the programs cost less than then 4.4 cents per kWh generation charge to

residential standard rate customers, and far less than then 6.5 cents when the current fuel factor rider is included. This is further evidence that efficiency is the least cost resource available to the Company, one that should be pursued more vigorously.

III. Assessing the Existing and Proposed DSM Programs

Q: Do you have any comments on the two programs that the Company is requesting be continued, the Efficient Products and Appliance Recycling Programs?

A: Yes. I think it is particularly important to review the Efficient Products Program (EPP), as it represents 60% of the projected savings in the residential sector and 20% of the savings in the portfolio overall. It is also the most cost-effective program from a Total Resource perspective. I have three comments, two of which are applicable to the entire portfolio. First, Witness Bacon notes in his testimony on page 14, lines 6 to 13, that “net-to-gross values consistent with those realized in the 2016 Evaluation Report were used in the analysis.” I reviewed the calculations in Staff 2-015 Attachment 1, and this appears to be true as far as the calculation of cost-effectiveness results for the Efficient Products Program and all of the other programs in the portfolio. This is an appropriate use of the evaluation results. On the other hand, the net-to-gross (NTG) values do not appear to have been applied to the projected energy and demand savings reported throughout the filing. The estimates appear to be reported as gross savings.

Q: Why is it important to note whether the savings are reported in net terms or gross terms?

A: First, it is important that the Commission and other stakeholders understand the basis of the projected savings so accurate comparisons can be made. For example, the many evaluation reports conducted on the Company’s programs report both realized gross and net savings.⁵ To assess the success of these programs, one should be comparing “apples to apples.” The Company should be particularly interested in this, because achieving the projected gross savings of the programs using the net realized savings is an uphill battle. Comparisons to similar programs delivered by other utilities, including sister affiliates of the Company’s parent AEP, are only meaningful if the basis is understood. Finally, from a resource planning perspective, it is critical to know how much of the portfolio savings is above and beyond natural efficiency that may already be embedded in the load forecast. The portfolio in this filing has an overall NTG of just under 80%. This means the project gross savings could be as much as 25% greater than would be realized by the grid.

Q: So to sum up, the Company did apply the NTG ratios to the cost-effectiveness analysis, but not to the savings analysis?

A: That is correct. I would also point out that with the Efficient Products Program, the Company did not apply the results of the recent evaluation to the program in all cases. The evaluation report [see footnote 5] found an NTG of 70% for lighting measures. This value was used for all lighting measures in the proposed

⁵ See, for example, *Evaluation of Residential Efficient Products Program, January 2016 through December 2016*. Prepared for Appalachian Power Company by ADM Associates, Inc. March 2017.

through” the market (and if that is allowed), many incandescent and halogen lamp types will disappear from retailer shelves within a year or two. Even if the underlying EISA legislation is repealed or modified, the pace of the global lighting market, including lamp performance standards in other countries including the European Union, will effectively mean the end of inefficient lamps for many key residential lamp types far before 2035.

Q: What would be the impact on the programs’ cost-effectiveness if the analysis used a shorter measure life?

A: The program was robustly cost-effective as analyzed by the Company, so even halving the measure life would not prevent it from being cost-effective.

Q: Do you have any comments on the proposed new programs?

A: Yes, I have some comments on each of the programs. My first comment is that two of the other programs aimed at residential customers, the Multifamily Direct Install and the eScore Program, also include substantial savings from LED lighting measures, and also make the same assumptions regarding EUL that I just described. These two programs are not as robustly cost-effective as the Efficient Products program, but the effect of revising the EUL is tempered by the fact that they also derive a smaller portion of their savings from these measures. As a result, they too would remain cost-effective with this change.

Q: Let's start with the proposed new programs for residential customers. The Company has proposed a new program called "eScore" to replace the Home Performance program.

A: While the eScore program model is somewhat forward-looking, it is unfortunate that the Company is proposing to reduce funding for residential customer home improvements. For the 12-month period from July 1, 2017 through June 30, 2018, the Home Performance program's budget is projected at over \$1.9 million. The current filing estimates a budget for the new eScore program in 2019 of \$1.6 million.

Q: Is the eScore budget properly allocated to the different cost categories?

A: It's difficult to tell given the lack of detailed descriptions of program activities and of the cost categories. In Year 1 (2019), the highest cost category is for Contractor Program Costs at about \$700 thousand, but the exact nature of the services provided is not sufficiently detailed to adequately assess this cost allocation. In 2020 and 2021, contractor costs drop to \$419 thousand and \$405 thousand, respectively. While one might assume that some of this difference is due to first-year start-up costs, no explanation is provided for this steep decline. Additionally, it is not clear how the labor component of direct install measures is tracked. Ideally, the majority of program budgets flow to customers in the form of incentives or services. If the labor costs associated with the direct install measures are included in the Contractor cost, it is harder to assess how well a program is achieving this goal.

Q: Regardless of the extent to which the reported incentive budget captures all payments and services provided to the customer, do you have other comments on the program costs?

A: The incentive budget (and in fact, every cost category except contractor costs) is flat over the three years at about \$601 thousand, representing 38% of the entire program budget in 2019, and 48% and 49% in 2020 and 2012, respectively. As I noted earlier, one would typically assume an increase in incentive activity as an enhanced program like eScore hits its stride and both trade ally and customer participation increases, but that does not seem to be the case.

Q: The program's annual savings are also similarly flat over the three years?

A: Yes. One would expect an upward trend in savings as the new program design rolls out and both trade allies and customers become more familiar with, and more interested in, the program's offerings. In turn, this would result in higher participation rates and increases on program annual savings. However, the projected savings do not exhibit this upward trend.

Q: Are the EM&V budgets adequate?

A: No. First, the EMV& budgets are spread fairly evenly over the three years. This does not reflect how these funds would likely be expended. One would expect the process and impact evaluation activities to be completed toward the end the three-year program timeframe, though getting some initial feedback on the revised program design would be useful. However, the total EM&V budget of \$130,000 is insufficient to perform an impact and process evaluation for this type of

program, let alone allow for additional process efforts following the roll out of the revised program design.

Q: What about the Promotion budget?

A: At only \$25 thousand a year, only 2% of the total annual budget, the promotion budget is likely insufficient. As a point of comparison, from June 30, 2016 to July 1, 2017, actual Home Performance Promotion expenditures were \$137 thousand, although the projected expenditures for the remainder of that program's life are lower.

Q: What is the impact of an insufficient promotion budget?

A: For many of these programs—particularly those that rely on customer willingness to engage with the program beyond a simple retail purchase—persuasive, clear, and timely information is needed to ensure broad participation. To the extent that the Company feels that it can easily meet the participation targets in this proposal with minimal promotion, I would suggest that that means program spending should be increased to capture more of the available savings potential.

Q: Turning to the program design, what comments, if any, do you have?

A: My primary comment is that by focusing solely on customers with electric heat and/or domestic hot water, opportunities for energy savings from natural gas and other fossil fuels are wasted. That is, if an auditor is going to be in the home, efforts should be made to reduce the customer's energy consumption regardless of fuel. This can be accomplished in part by coordinating delivery with the customer's gas utility, when applicable. This is a proven successful approach in other jurisdictions, even when a different utility provides the other fuel. This

coordination and delivery does not need to be complicated. In Connecticut, for example, the gas company contributes to covering the cost of the audit and, when measures that save gas are implemented, provides an additional incentive. From the customer’s perspective, though, they are being served by one program. On the program side, additional layers of administration can be avoided, as well as the added “acquisition cost” of each customer by a second program.

Q: Does the program’s QA/QC process seem appropriate and sufficient?

A: Likely not. While the Nichols testimony refers to on-site visits as part of the EM&V process, this will not provide needed, timely feedback following implementation of the new program design. There is also mention of “on-site inspections performed by the Company’s program implementation contractor.” While this might be appropriate for assessing QA/QC for major measures installed by other contractors not employed by the Program Contractor (e.g., an insulation contractor), it may not provide sufficient, unbiased feedback on the initial assessment and direct install activities provided by the Energy Advisors, who are to be recruited, trained and employed by the Program Contractor.

Q: The other new residential program is the Multifamily Direct Install (MFDI) Program. What are your comments on this program?

A: I have many of the same comments as with the eScore program. There are again higher Contractor Program Costs for year 1, but again, it is not clear how the labor component of direct install measures are categorized. Moreover, the program is again projected to have flat participation and savings over time, where

an increase in incentive activity the new program hits its stride and achieves higher levels of participation. But my largest concern is with the program design.

Q: Please continue.

A: Although the program will present building managers and/or owners with information on “opportunities for deeper savings and common area measures” after a walk-through audit, the program only provides no-cost direct install measures for lighting and hot water heating savings. Most substantial measures like HVAC equipment upgrades, air sealing, and insulation measure appear to fall outside the program. This is a major lost opportunity for the program. Getting a foot in the door is one of the most difficult aspects of programs targeting the building shell and major systems. Letting the customer go out on their own to pursue the identified efficiency measures wastes the effort of getting them to participate in the first place.

Q: What could the Company do to remedy this?

A: I think there are two opportunities. First, to the extent that owners of multifamily buildings are eligible to participate in the C&I sector programs, there should be close coordination across the programs. Second, because some multifamily properties will have non-electric sources of hot water and space heating, the Company should coordinate efforts with the regional gas utility to provide measures that will save both electricity and gas, as I explained with the eScore residential program.

Q: You were concerned about the EM&V budget for the eScore program. Do you have the same concern for the MFDI program?

A: Yes. Programs that involve field work and direct installation require more intensive EM&V, particular in their early years, to ensure accurate savings estimates and high quality work. I do not think that the total EM&V budget is sufficient to perform an adequate impact evaluation.

Q: What about the Promotion budget?

A: At only \$15,000 a year, which is only 1% of the total annual budget, the promotion budget is likely insufficient. Some of this depends on how “Promotion” is defined. One would expect that a key activity for the Program Contractor would be to identify and do outreach to property management firms, building owners, and condo and co-op associations. The multifamily sector can be very heterogeneous in its building types and ownership make-up. The utility’s promotion efforts will need to be cognizant of this challenge.

Q: Let’s turn now to the programs for commercial and industrial customers. Starting with the C&I Lighting program, what comments do you have?

A: Appropriately, the program is promoting nearly all LED lighting products, with a few linear fluorescent measures that represent less than 10% of proposed savings. Overall, though, the incentives being offered are very low, averaging about 20% of measure cost. This is too low to prompt customers into early retirement of functioning fixtures, and therefore the program will only capture efficiency upgrades in new construction and renovation markets. I am also not in favor of providing a flat rebate based on energy savings (in this case, 5 cents per annual

kWh saved). The lighting measures have different costs, effective useful lifetimes, market niches, and operating characteristics. As such their value to both the utility and to the customer will vary substantially. The incentives should reflect these differences. One way to do that would be to move more of this program to an “upstream” delivery model, where the Company provides financial incentives at the wholesale or distributor level. This lowers the cost of the product to the customer, reduces administrative requirements, and generally results in greater participation.

Q: What other programs is the Company offering C&I customers?

A: The Company also is proposing a C&I program to promote non-lighting measures, call C&I Standard. Previously, these measures were available along with lighting measures as part of the Company’s C&I Prescriptive Program. The Company did not explain the reasoning behind dividing the program into two pieces, but delivering the programs together is typically more efficient. This would eliminate administrative overlap, particularly with the implementation contractors. With respect to the promoted measures, they are all reasonable to include in the program, but I am confused by one of the Company’s statements. The program description says that the program targets “measures where the unit energy savings can be reliably predicted.” [Nicholls, Schedule 1, p. 18] In my view, this is not the case for many of the measures listed. For example, the first measure listed is for variable frequency or variable speed pumps and fans related to materials processing (as opposed to HVAC). These systems are usually unique in their construction, operating patterns, and energy consumption. They almost

always require EM&V approaches involving pre- and post-installation on-site metering. This is not to say that these should not be promoted. I applaud the Company for targeting C&I measures beyond lighting, and encourage them to ensure accurate and thorough estimates of the resulting energy savings.

Q: The last C&I program is the Small Business Direct Install (SBDI), correct?

A: Yes. This is a new program designed to address market segment that has traditionally been under-served by C&I programs. Unfortunately, I have serious concerns about the program design. To begin with, 35% of projected savings come from a single measure: low flow pre-rinse spray valves in food service business. This is certainly a measure worth including in the program and has been part of efficiency portfolios for many years, but relying on it to carry such a large portion of the program's savings seems misplaced. This is compounded by the fact that this measure has the lowest cost per unit of energy saved within the program: an annual cost of less than one cent per kWh.

Q: Do you see any problems with the Company's estimates?

A: I believe they have done the savings calculation correctly as per the Mid-Atlantic TRM, but they are assuming that each year they can replace 200 units in full-service restaurants, and that all of those units replace older spray valves that use twice as much water as the current federal standard. These assumptions are aggressive, and to the extent any prove incorrect, savings will be lower, potentially by a substantial amount. In the worst case, simply removing this measure from the program increases the cost per annual unit of energy saved by the program overall increases from 11 cents per annual kWh to nearly 17 cents.

But even without the low flow pre-rinse spray valves, the program is remarkably inexpensive, whether at 11 cents per kWh or 17. This is in contrast with every other SBDI program with which I'm familiar. The least expensive SBDI program I am aware of are those delivered in New York, which in past years were limited to between 30 and 35 cents per kWh by that state's Public Service Commission. In other states such as Massachusetts and Rhode Island, costs for this type of program range up to 50 cents per kWh.

Q: Why is this usually an expensive program to deliver?

A: Largely due to the significant time and expense required to identify qualifying businesses, target them with messaging and marketing, and convince them to begin engaging with the program through an on-site audit. Most businesses contacted will not respond or decline to participate. Even when a business enters the program, sending trained commercial facility auditors into the field is expensive. Furthermore, the program usually provides incentives of more than 50% of the measure cost, often in the range of 70%. While the average incentive in the proposed program is 70%, the incentive for most measures is 50%, or slightly less. I am concerned that promoting some measures for free while result in very little uptake on the measures with lower incentives. Better to provide a similar level of incentive for most measures, so as not to bias customers towards only the cheapest options.

IV. Summary of Findings and Recommendations

Q: You have noted several potential issues with the Company’s analysis and program delivery methods. Should the Commission approve these programs?

A: Yes. Most of my criticisms relate to the analysis of projected energy savings and program expenditures, although I have also made a couple of important observations regarding potential over-estimates of the former. Despite this, the programs should remain cost-effective even if my critiques are addressed and corrected. Second, the Company is not proposing to launch an extensive portfolio of untested initiatives. Their proposal represents what I view as “basic” efficiency programs. The real need is to learn from these programs, develop the market for efficiency products and services in the Company’s testimony, and grow the level of spending and savings over time to better capture the benefits of efficiency for all Virginians.

Q: Does this conclude your testimony?

A: Yes.

Attachment JML-1

REPRESENTATIVE PROJECT EXPERIENCE

Connecticut Municipal Electric Energy Cooperative, Conservation and Load Management Consulting (2006-present)

Optimal has provided energy efficiency consulting services to the Connecticut Municipal Electric Energy Cooperative (CMEEC) since the inception of their conservation and load management programs. Mr. Loiter contributes to the full range of these services, including program planning, program savings analysis and reporting, developing incentive and delivery strategies, and managing CMEEC's participation in the ISO-NE Forward Capacity Market. The latter has included drafting M&V plans specifying procedures for meeting all ISO-specified M&V rules and developing a web-based data tracking and reporting system. Mr. Loiter also helps CMEEC develop strategy for and manage participation in new FCM auctions and arranges for required annual certification reviews.

Delaware Department of Natural Resources and Environmental Control, Energy Efficiency Advisory Council Program Development and Support (2015-present)

Optimal Energy provides broad program planning, analysis, and strategic guidance to the Delaware Energy Efficiency Advisory Council as it begins developing a new model for joint utility and public-sector delivery of energy efficiency services, with the objective of dramatically increasing energy savings and demand reductions in that state. In support of the Council, Mr. Loiter drafted Council organizing documents and regulations specifying evaluation, measurement, and verification (EM&V) procedures and standards. He also provided the Council with proposed electric and gas energy savings targets as supported by an earlier potential study.

Orange and Rockland Utilities, Energy Efficiency Program Consulting (2006-present)

Optimal Energy supports program implementation and on-going program design and development for Orange and Rockland Utilities, a subsidiary of Consolidated Edison, Inc. Mr. Loiter managed the preparation of a DSM plan and Commission filings for this client during the initial phases of the New York State Energy Efficiency Resource Standard. Prior to that, he led the commercial sector component of an electric and gas potential study for the utility, which included on-site customer audits and residential surveys.

New York State Department of Public Service, Generic Environmental Impact Statement and Supplement (2014-2016)

As part of proceedings on Reforming the Energy Vision (REV) and the Clean Energy Fund (CEF), Optimal contributed to a Generic Environmental Impact Statement (GEIS) by describing alternative energy supply resources, the potential scale of their use under two future scenarios, and the magnitude of possible negative environmental impacts that would result. Mr. Loiter led a team researching several technologies, including energy efficiency, customer-sited renewables, combined heat and power, alternative rate structures, and energy storage. The research led to estimates of the potential scale and impact of these solutions to New York's future energy challenges.

British Columbia Utility Commission, DSM Filing Technical Support (2012-2013)

In support of staff of the BCUC, Optimal Energy reviewed three utility filings related to DSM programs, cost-recovery, and performance-based ratemaking. Mr. Loiter led a team that reviewed the filings, drafted interrogatories, and provided information regarding the appropriateness of program designs, measure-level costs and savings estimates, and cost-effectiveness inputs such as discount rates and avoided costs.

Maryland Energy Administration, EmPOWER Maryland Filing Reviews (2008-2009)

As part of efforts to reduce per-capita electric and natural gas under the 2008 EmPOWER Maryland Energy Efficiency Act, the Maryland Energy Administration was responsible for reviewing and commenting on utility-delivered energy efficiency programs and for designing and implementing its own state-wide efficiency portfolio. Mr. Loiter contributed to both of these efforts, appearing before the Public Service Commission on two occasions.

REPRESENTATIVE PUBLICATIONS

“Collaboration that Counts: The Role of State Energy Efficiency Stakeholder Councils,” (with D. Sosland, M. Guerard, and J. Schlegel), *2012 ACEEE Summer Study on Energy Efficiency in Buildings*, Pacific Grove, CA, August 2012.

“Persistence and Cost of Behavioral Programs,” presented at National Association of State Utility Consumer Advocates Mid-Year Meeting, Charleston, SC, June 2012.

“Impending EISA Lighting Standards: Impacts on Consumers and Energy Efficiency Lighting Programs,” presented at National Association of Regulatory Utility Commissioners Annual Meeting (with M. DiMascio), Atlanta, GA, November 2010.

“From Resource Acquisition to Relationships: How Energy Efficiency Initiatives Can Work Effectively with Large Commercial & Industrial Customers,” (with E. Belliveau, J. Kleinman, D. Gaherty, and G. Eaton), *2008 ACEEE Summer Study on Energy Efficiency in Buildings*, Pacific Grove, CA, August 2008.

National Action Plan for Energy Efficiency (2007). *Guide for Conducting Energy Efficiency Potential Studies*. Prepared by Philip Mosenthal and Jeff Loiter, Optimal Energy, Inc. December.

Loiter J.M and V. Norberg-Bohm (1999), “Technology policy and renewable energy: public roles in the development of new technologies,” *Energy Policy* Vol.27 no.85-97

CERTIFICATE OF SERVICE

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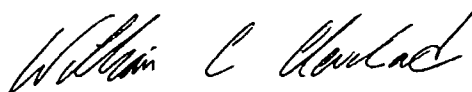
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