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VIA ELECTRONIC DELIVERY

May 25, 2016

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

Commonwealth of Virginia, *ex rel.*
State Corporation Commission
***Ex Parte*: In the matter of receiving input for evaluating the establishment of protocols, a methodology, and a formula to measure the impact of energy efficiency measures**
Case No. PUE-2016-00022

Dear Mr. Peck:

Enclosed are the Comments of Virginia Electric and Power Company for filing in the above-referenced matter.

Should you have any questions, please contact me.

Sincerely,

William H. Baxter II
Senior Counsel

Enclosure

cc: Ashley B. Macko, Esq.
K. B. Clowers, Esq.
Service List

COMMONWEALTH OF VIRGINIA

STATE CORPORATION COMMISSION

Commonwealth of Virginia, *ex rel.*

State Corporation Commission

Case No. PUE-2016-00022

Ex Parte: In the matter of receiving input
for evaluating the establishment of protocols,
a methodology, and a formula to measure
the impact of energy efficiency measures

CASE NO. PUE-2016-00022

COMMENTS
OF
VIRGINIA ELECTRIC AND POWER COMPANY
TO
THE STATE CORPORATION COMMISSION OF VIRGINIA
PURSUANT TO ORDERING PARAGRAPH (5) OF THE
COMMISSION'S SCHEDULING ORDER DATED MARCH 30, 2016

MAY 25, 2016

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Executive Summary

The purpose of these Comments ("Comments") is to present information and detail on (i) existing State Corporation Commission of Virginia ("Commission") demand-side management ("DSM") approval requirements; (ii) Virginia Electric and Power Company's ("Dominion Virginia Power" or the "Company") current DSM cost/benefit and evaluation, measurement and verification ("EM&V") processes; and (iii) responses to the "Objectives" and "Cost/Benefit Questions" posed by the Commission in its March 30, 2016 Scheduling Order in Case No. PUE-2016-00022 (the "Scheduling Order").

Specifically, the Company is filing these Comments pursuant to Ordering Paragraph (5) in the Commission's Scheduling Order directing interested parties or entities to prepare and file comments with the Clerk of the Commission on or before May 25, 2016. Comments are to address the Objectives and/or Cost/Benefit Questions outlined in the Scheduling Order.

The Company's Comments focus on the following positions:

- The cost/benefit tests as currently defined provide a standardized and acceptable method for determining cost-effectiveness of DSM programs;
- The California Standard Practice Manual definitions of the cost/benefit tests are industry standard;
- Levelized Cost of Energy Saved can be calculated from the cost/benefit results using standard financial techniques;
- Using the net present value ("NPV") from cost/benefit results to determine Levelized Cost of Energy Saved for both program benefits and program costs provides a consistent way to evaluate DSM programs;
- A technical resource manual ("TRM") generally accepted in Virginia would be the best way to standardize an approach to DSM program evaluation and compare ongoing program performance to plans;
- Use of an existing TRM, which is applicable to Virginia and/or has precedent for use in Virginia would be preferable;
- Existing southeastern U.S. and Mid-Atlantic region TRM documents would serve as a good primary reference for DSM program evaluation, have precedent for use in Virginia, and have been developed through a stakeholder process;
- In cases where no TRM or secondary source is available, case-specific approaches would

need to be developed;

- EM&V should follow industry standard approaches in the U.S. Department of Energy's Uniform Methods Project ("UMP") and the International Performance Measurement and Verification Protocol ("IPMVP"); and

- Deemed savings calculations, to the extent available and practical, should provide the basis for comparing actual program results to projected results.

Introduction

These Comments are submitted by Dominion Virginia Power in response to the Commission's March 30, 2016 Scheduling Order in Case No. PUE-2016-00022. The Comments address the existing Commission DSM approval requirements, a description of current Dominion Virginia Power cost/benefit and EM&V processes, and responses to the Objectives and Cost/Benefit Questions noted in the Scheduling Order. As stated therein on page 2:

> The Commission finds that an evaluation ("Evaluation") should be conducted to consider the establishment of: (i) uniform protocols for measuring, verifying, validating, and reporting the impacts of energy efficiency measures; (ii) a methodology for estimating annual kilowatt savings for such energy efficiency measures; and (iii) a formula to calculate the levelized cost of saved energy for such energy efficiency measures (collectively, "Objectives").
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> . . . .
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> Further, since evaluation and verification of energy savings of energy efficiency programs typically are measured against the projected savings included in the cost/benefit analyses, the Commission is of the opinion that the Evaluation also should encompass the methodologies by which utilities calculate the components of the cost/benefit tests in proceedings requesting approval to implement energy efficiency programs. In particular, the Evaluation should consider: (i) whether the application of costs and benefits is consistent across utilities; (ii) whether consistent application of costs and benefits across utilities is necessary or reasonable; and (iii) whether the application of the cost/benefit tests can be improved by enhanced evaluation and verification protocols for estimating savings actually realized (collectively, "Cost/Benefit Questions") (internal footnote omitted).

The Commission also noted, on page 4 of the Scheduling Order, that it seeks input concerning existing measurement and verification protocols and their applicability for Virginia; and appropriate formulae for developing the cost of saved energy resulting from energy efficiency programs and appropriate inputs for such formulae.

As requested by this directive, the Company has prepared these Comments covering the above topics.

Background

The Commission issued the Scheduling Order to address requirements set out in House Bill 1053 and Senate Bill 395 from the 2016 session of the Virginia General Assembly. The bills addressed:

- The establishment of uniform protocols for measuring, verifying, validating and reporting the impacts of energy efficiency measures; and
- A methodology for estimating annual kilowatt savings and a formula to calculate the levelized cost of saved energy for such energy efficiency measures.

The Commission scheduled a public hearing on July 12, 2016 to receive comments on the issues and included additional requirements as part of the Scheduling Order. The Commission characterized the requirements as follows:

I. The first set of requirements was characterized as the **"Objectives."** They include:

(i) Uniform protocols for measuring, verifying, validating, and reporting the impacts of energy efficiency measures;
(ii) A methodology for estimating annual kilowatt savings for such energy efficiency measures; and
(iii) A formula to calculate the levelized cost of saved energy for such energy efficiency measures.

II. The second set of requirements was characterized as the **"Cost/Benefit Questions."** They include:

(i) Whether the application of costs and benefits is consistent across utilities;
(ii) Whether consistent application of costs and benefits across utilities is necessary or reasonable; and
(iii) Whether the application of the cost/benefit tests can be improved by enhanced evaluation and verification protocols for estimating savings actually realized.

Existing Commission DSM Approval Requirements

The current body of law governing DSM in Virginia is comprised of a variety of statutes and rules, including § 56-585.1 A 5 ("Subsection A 5") of the Code of Virginia ("Va. Code" or "Code"); Rules 10 (20 VAC 5-201-10) and 60 (20 VAC 5-201-60) of the Commission's Rules Governing Utility Rate Case Applications and Annual Informational Filings (20 VAC 5-201-10, *et seq.*); the Commission's Rules Governing Utility Promotional Allowances (20 VAC 5-303-10, *et seq.*); the Commission's Rules Governing Cost/Benefit Measures Required for Demand-Side Management Programs (20 VAC 5-304-10, *et seq.*) ("Cost/Benefit Rules"); and directives contained in the Commission's Orders.

In addition, Va. Code § 56-576 provides the relevant definitions, including in pertinent part:

> "*Energy efficiency program*" means a program that reduces the total amount of electricity that is required for the same process or activity implemented after the expiration of capped rates. Energy efficiency programs include equipment, physical, or program change designed to produce measured and verified reductions in the amount of electricity required to perform the same function and produce the same or a similar outcome. Energy efficiency programs may include, but are not limited to, (i) programs that result in improvements in lighting design, heating, ventilation, and air conditioning systems, appliances, building envelopes, and industrial and commercial processes; (ii) measures, such as but not limited to the installation of advanced meters, implemented or installed by utilities, that reduce fuel use or losses of electricity and otherwise improve internal operating efficiency in generation, transmission, and distribution systems; and (iii) customer engagement programs that result in measurable and verifiable energy savings that lead to efficient use patterns and practices. Energy efficiency programs include demand response, combined heat and power and waste heat recovery, curtailment, or other programs that are designed to reduce electricity consumption so long as they reduce the total amount of electricity that is required for the same process or activity . . . .
>
> "*Peak-shaving*" means measures aimed solely at shifting time of use of electricity from peak-use periods to times of lower demand by inducing retail customers to curtail electricity usage during periods of congestion and higher prices in the electrical grid . . . .
>
> "*In the public interest*" for purposes of assessing energy efficiency programs, describes an energy efficiency program if, among other factors, the net present value of the benefits exceeds the net present value of the costs as determined by the Commission upon consideration of the following four tests: (i) the Total Resource Cost Test; (ii) the Utility Cost Test (also referred to as the Program Administrator Test); (iii) the Participant Test; and (iv) the Ratepayer Impact Measure Test. Such determination shall include an analysis of all four tests, and a program or portfolio of programs shall not be rejected based solely on the results of a single test. In addition, an energy efficiency program may be deemed to be "in the public interest" if the program provides measurable and verifiable energy savings to low-income customers or elderly customers.

> "*Measured and verified*" means a process determined pursuant to methods accepted for use by utilities and industries to measure, verify, and validate energy savings and peak demand savings. This may include the protocol established by the United States Department of Energy, Office of Federal Energy Management Programs, Measurement and Verification Guidance for Federal Energy Projects, measurement and verification standards developed by the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE), or engineering-based estimates of energy and demand savings associated with specific energy efficiency measures, as determined by the Commission.

In its April 30, 2012 Order in Dominion Virginia Power's 2011 DSM proceeding (Case No. PUE-2011-00093), the Commission explained that:

> In evaluating Dominion's Application to determine whether its proposals are "in the public interest" under § 56-585.1 A 5 of the Code, we have considered all four tests (Utility Cost, Participant, Ratepayer Impact Measure ("RIM") and Total Resource Cost) discussed by the participants in this case, as well as other relevant factors. We have not used any of the four tests as a sole determining factor in our analysis . . . . In addition, we find that the impact on customers' bills, especially the impact on the bills of customers not participating in these programs, is a relevant factor in our determination of the public interest.[1]

The Commission also noted that "[t]he magnitude of the potential recovery of lost revenues, and the bill increases attendant thereto are among the other relevant factors we consider in evaluating the public interest"[2] and "[w]e find that a program's impact on customer rates in both the near and long term is particularly relevant to our evaluation of the public interest."[3]

Previously, the Commission had indicated that it would "give greatest weight to the RIM test, closely followed by the TRC test and rounded out by consideration of the Participant and Utility Cost tests."[4] Legislation passed in 2012 added a definition of "in the public interest" to Va. Code § 56-576 (as seen above), which directs consideration of all four cost/benefit tests and that "a program or portfolio of programs shall not be rejected based solely on the results of a single test."

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[1] *Application of Virginia Electric and Power Company, For approval to implement new demand-side management programs and for approval of two updated rate adjustment clauses pursuant to § 56-585.1 A 5 of the Code of Virginia*, Case No. PUE-2011-00093, Order, 2012 S.C.C. Ann. Rept. 298, 300 (Apr. 30, 2012).
[2] *Id.* (internal footnote omitted).
[3] *Id.*, 2012 S.C.C. Ann. Rept. at 301.
[4] *Commonwealth of Virginia, State Corporation Commission, Report to the Governor of the Commonwealth of Virginia and the Virginia General Assembly*, "Report: Study to Determine Achievable and Cost-effective Demand-side Management Portfolios Administered by Generating Utilities in the Commonwealth Pursuant to Chapters 752 and 855 of the 2009 Acts of the Virginia General Assembly" (Nov. 15, 2009), at 32, 35.

While this amendment to Va. Code § 56-576 means the Commission cannot solely rely on the results of any one test, the RIM test is the cost/benefit test that most closely tracks the impact of proposed DSM programs on the bills of non-participating customers, and the Commission has repeatedly stressed that the RIM test would be a significant factor in determination of the public interest[5].

Description of Current Dominion Virginia Power DSM Cost/Benefit and EM&V Processes

Cost/Benefit Evaluation

As mentioned above, the Commission's Cost/Benefit Rules also play an important role in the current DSM landscape. Like the Code, these Rules stress that utility applicants filing for approval of a DSM program must "analyze a proposed program from a multi-perspective approach using, at a minimum, the Participants Test, the Utility Cost Test, the Ratepayer Impact Measure Test, and the Total Resource Cost Test."[6] Further, the Cost/Benefit Rules outline "[m]inimum guidelines to provide direction to electric and natural gas utilities in developing applications for approval of DSM programs . . . ."[7] Those guidelines, set forth at 20 VAC 5-304-30 (1) through (7), and the Company's current processes for adherence thereto are as follows:

1. *That the assumptions used in developing projected input data and the models used in the integrated resource planning process should be identified and well-documented. Utility-specific data should be used whenever possible (e.g., unit performance data, end-use load research data, market research data, etc.). In cases where utility-specific data are not available, the assumptions must be clearly defined*;

   The Company uses the Strategist model which is a fully integrated electric utility resource planning model that was developed to aid utilities in performing resource planning analysis. It relies on least-cost planning techniques to perform optimized utility resource assessments. It also integrates DSM evaluation into the resource planning process so that assumptions of cost and benefits are consistent with assumptions for the supply-side resources. The assumptions that the Company uses in the resource planning process are well documented in the annual integrated resource plan ("IRP") that is filed with the Commission, as well as in the applications that the Company files with the Commission for approval of DSM programs and supply-side resources. Using the same model to conduct utility supply-side planning and demand-side analysis facilitates the process of documenting assumptions used in the applications for DSM program approval. The Company's process relies on Company-specific data in the modeling process and in

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[5] *See, e.g., Petition of Virginia Electric and Power Company For approval to implement new demand-side management programs and for approval of two updated rate adjustment clauses pursuant to § 56-585.1 A 5 of the Code of Virginia*, Case No. PUE-2014-00072, Final Order, at 6 n.16 (Apr. 24, 2015) ("The Commission's consideration of the public interest was not based solely on the results of a single factor or a single test.").
[6] 20 VAC 5-304-20.
[7] 20 VAC 5-304-30.

cases where the Company uses external resources for specific model input, the Company strives to document such inputs in the integrated resource plan or DSM filings.

2. *That historic data, if available, should be assessed in developing projected data. Significant departures from historic trends should be explained*;

   The Company's planning process relies heavily on historical trends. The forecasts are produced by running an econometric model using actual load and weather data from the past 20 years along with projected economic data. Expected weather values are developed and then used to produce a weather-normalized forecast. Commodity forecasts for fuel and market prices are generated using both fundamental forecasts that incorporate supply and demand economics as well as shorter term market forecasts that take into account prices from fully functioning and transparent commodity markets. The Company also relies on economic forecasts of key financial drivers which affect the capital markets and return components of the Company's operations. Volatility in recent years in financial markets and in key drivers like fuel prices, market prices for capacity and energy and load growth have increased the level of uncertainty in utility planning assumptions. The Company forecasts and evaluates all of these parameters in great detail each year as part of the Company's IRP process and describes in detail the global assumptions that it uses in its planning process. These same assumptions are used when developing the Company's long-term resource plans, which include the portfolio of DSM resources.

3. *That each projected data series should represent the Company's most current forecast*;

   The Company develops an integrated resource plan on an annual basis. This process includes updating all key assumptions that drive the results of the plan. When developing load forecast adjustments due to DSM programs as well as developing cost/benefit analysis for the DSM programs, the Company uses the most recent IRP data as the basis for its resource planning analysis.

4. *That computer modeling techniques should be used in the development of an integrated resource plan*;

   As referenced above, the Company uses the Strategist computer model to perform integrated resource planning. This model allows the evaluation of supply-side and demand-side programs in an integrated fashion which takes into account the specific attributes of each type of resource and provides output that optimizes the net benefit of all types of resource options.

5. *That estimates of the capital and O&M (operation and maintenance) costs of supply-side options should include realistic projections of the costs of compliance with all promulgated environmental regulations or enacted legislation from which environmental regulations will be promulgated*;

Environmental constraints placed on utility resources plans have been steadily increasing over the recent past. The most recent U.S. Environmental Protection Agency final requirements with respect to carbon dioxide (CO_2) abatement, although currently subject to a stay by the Supreme Court of the United States, have placed unique restrictions on future utility resources and have limited the types of supply-side resources that will meet future environmental requirements. The Company is factoring in these new requirements as well as modifying modeling approaches to account for these new regulations. The Company uses the best data available to develop capital cost as well as operating cost for supply-side options.

6. *That each assumption and/or projected data series should be consistent with all other assumptions and/or projections. Consistency of data should be maintained between all models used within the integrated resource planning process; and*

   Developing annual integrated resource plans allows the Company to maintain consistent assumptions and data series within all of the modules used in the long term resource planning process.

7. *That alternative projections to determine sensitivity to input assumptions should be developed. These alternative projections should be used to perform cost/benefit analysis.*

   The Company runs sensitivity analysis on key parameters that affect the DSM portfolio of programs. These sensitivities include high and low load projections, high and low fuel price projections, and high and low transmission and distribution cost sensitivities.

In more general terms, the DSM program design process begins by soliciting proposals from vendors who have demonstrated their ability to perform DSM program design. Program design includes the development of all of the parameters that are needed to prepare the cost/benefit scores for the program. They include parameters such as:

- Measures to be included in the program,
- Kilowatt (KW) and kilowatt hour (KWh) reductions for each measure,
- Weighted average load shape for all of the measures in a program,
- Cost to implement the measures including marketing, administrative cost and customer incentives, and
- Net-to-gross ratios.

The Company's process to analyze, propose, implement and verify its DSM activities begins with the annual IRP process. DSM programs are viewed as a resource for meeting current and future load imposed on the Company's electrical system by its customers. The Company is responsible for planning and operating an electrical grid that provides electricity at the lowest reasonable cost and in an environmentally acceptable manner.

Utility resource planning is based on least-cost planning concepts that require the utility to forecast the future to decide on the set of resources that will meet future utility load requirements

while also minimizing the cost that the utility must collect from its customers. The objective is to minimize revenue requirements over an appropriate planning horizon while meeting all environmental constraints placed on utility supply-side resources.

Demand-side resources are evaluated by first determining the benefits that a particular DSM program or measure can provide. Benefits are derived from the fact that customers, if provided the right incentive, will alter their normal energy usage patterns in a manner that will lower utility cost and ultimately lower the total amount of dollars the Company must collect from all of its customers.

DSM benefits come primarily from three categories. The first category of benefits comes from reducing the amount of energy customers consume, which lowers the amount of energy the utility has to produce. The benefits come primarily from lower fuel costs. The other two categories are capacity-related and come in the form of avoided capacity cost that results when a DSM program reduces the Company's peak load requirements. Lower peak load requirements allow the utility to defer building new generating capacity to meet future load growth. Lower peak loads will also result in lower expenditures on transmission and distribution facilities to meet expected future customer load growth.

The second part of performing DSM evaluations is to look at the cost of designing and implementing the DSM programs. The benefits from the programs are then used to fund the DSM program. If the benefits of the program outweigh the costs, then the program can be implemented without being subsidized by customers.

The DSM cost/benefit evaluations are accomplished by performing cost/benefit tests. The cost/benefit tests that are currently required in Virginia are derived from the California Standards Practice Manual. They are the Participant Test, Utility Cost Test ("UCT"), Total Resource Cost Test ("TRC Test"), and the Ratepayer Impact Measure Test ("RIM Test"). A version of this manual was first introduced in February 1983 and has been modified over the years to guide California utilities in the development of cost/benefit tests to evaluate DSM programs. The tests are high-level resource planning tests that have been accepted by many jurisdictions in the United States and are recognized in the industry as relevant indicators of cost-effectiveness, although the weightings and interpretations of the tests vary across different jurisdictions. There are four tests; each has a specific purpose and evaluates the benefits and cost for a DSM program from different perspectives. The tests can also viewed as representing the objectives of four different stakeholders in the DSM process. Below is a description of each of the four tests and the stakeholder perspective the test represents.

Participant Test

The Participant test is the measure of the quantifiable benefits and costs to Program participants due to enrollment in a DSM Program. This test indicates whether the Program or measure is economically attractive to the customer. Benefits include the participant's retail bill savings over time plus any incentives offered by the utility. Costs include only the participant's costs. The Participant test is calculated by the following

formula:

$$= \frac{\text{Participant Bill Reduction + Incentives}}{\text{Participant's Cost}}$$

A result of 1.0 or higher indicates that a Program passes the Participant test.

Utility Cost Test

The UCT compares the cost to the utility to implement a Program to the cost that should be avoided as a result of the Program. The UCT measures the net costs and benefits of a Program as a resource option, based on the costs and benefits incurred by the utility, including incentive costs and excluding any net costs incurred by the participant. The UCT is calculated by the following formula:

$$= \frac{\text{Avoided Capacity Benefit + Avoided Energy Benefit}}{\text{Utility Administrative Cost + Utility Incentive Payments}}$$

A result of 1.0 or higher indicates that a Program passes the UCT.

Total Resource Cost Test

The TRC test compares the total costs and benefits to the utility and participants, relative to the costs to the utility and participants. It can also be seen as a combination of the Participant and Utility Cost tests, measuring the impacts to the utility and all program participants as if they were treated as one group. Additionally, this test considers customer incentives as a pass-through benefit to customers and, therefore, does not include customer incentives. The TRC test measures the net costs and benefits of a Program as a resource option based on the total costs and benefits of the Program, including both the participants' and the utility's costs and benefits. The TRC test is calculated by the following formula:

$$= \frac{\text{Avoided Capacity Benefit + Avoided Energy Benefit}}{\text{Utility Administrative Cost + Customer Costs}}$$

A result of 1.0 or higher indicates that a Program passes the TRC test.

The Ratepayer Impact Measure Test

The RIM test considers equity issues related to Programs. This test determines the impact a given DSM Program will have on non-participants and directionally assesses the

impact on customer bills or rates due to changes in utility revenues and operating costs attributed to the Program. A score on the RIM test of greater than 1.0 indicates the Program is beneficial for both participants and non-participants, because it should have the effect of lowering bills or rates even for customers not participating in the Program. Conversely, a score on the RIM test of less than 1.0 indicates the Program is not as beneficial because the costs to implement the Program exceed the benefits shared by all customers, including non-participants. In other words, a RIM score of less than 1.0 indicates that rates or bills of non-participants may rise. The RIM test is calculated by the following formula:

$$= \frac{\text{Avoided Capacity Benefit + Avoided Energy Benefits}}{\text{Utility Administrative Cost + Utility Incentive Payments + Utility Revenue Reductions}}$$

DSM program approval starts with a rigorous cost/benefit evaluation to determine whether a DSM program is in the public interest. The cost/benefit scores evaluate the program design assumptions for a given DSM program on a going-forward basis. That is, projections are made for the cost of the program, the load impacts that might result from the program and the associated cost savings that the utility will see if it implements the program. From the program assumptions, cost/benefit scores for all of the four stakeholder populations are determined. If the cost/benefit score is positive (above 1.0) then it is assumed, if the programs can be implemented as planned, that the program would be beneficial for the particular stakeholder that the test represents.

The Company has developed criteria for determining if the Company will bring a DSM program before the Commission for approval. Specifically, the Company examines the cost/benefit analysis for a given program design; if the cost-effectiveness analysis indicates that the program would be cost beneficial (three of the four tests, Participant, Utility and TRC above 1.0), the program moves to the next step. The Company then reviews the program design in detail and determines whether the program can be practically presented to customers. If the Company has reason to believe that the program design is both cost-effective and viable, then it is included in a petition for approval before the Commission. If a given program does not pass the RIM test, but passes the other tests and has a viable design that demonstrates system benefits, the Company will still consider bringing the program before the Commission for approval. A RIM test below 1.0 indicates that there are potential equity issues with the program. Specifically, a RIM test score below 1.0 indicates that there will be upward pressure on rates if the program is implemented. In this case, participants in the program will see lower bills because of the energy savings provided by the more efficient measure that was adopted by the participant. In these instances, non-participants will see higher bills because their rates will be higher if the program is implemented.

The Company has presented the results of these four cost/benefit tests in all of its DSM

applications before the Commission, starting with the Company's initial DSM proceeding, Case No. PUE-2009-00081.[8] The tests are performed using the Strategist model which uses the California Standard Practice Manual as its basis for defining the test.

The Company believes the Commission is in the best position to hear arguments from all viewpoints represented in a DSM proceeding about the pros and cons of implementing a program with a RIM score below 1.0. The Company evaluates the DSM programs based on all four tests and presents the cost/benefit scores on an individual and portfolio basis for Commission consideration. The Commission, upon hearing from all of the interested participants in a DSM approval case, ultimately determines whether approving a program that has RIM score below 1.0 is in the public interest.

Levelized Cost Calculation

The Senate and House Bills (1053 and 395, respectively) require the Commission to evaluate the establishment of a methodology for calculating levelized cost of energy saved. The Bills and the Commission's Scheduling Order do not specifically state how the calculation of levelized cost of energy saved would be used. The Commission in the past has ordered Dominion Virginia Power to calculate levelized cost of DSM programs and supply-side options, and to include the results in the annual IRP filings. The Company has developed a methodology for computing levelized cost that is internally consistent with the method of determining cost/benefit scores for the individual DSM programs. This is appealing if there are plans to use the levelized cost numbers in a similar fashion as the cost/benefit scores to assess the relative merits of individual DSM programs, although the Company does not advocate for this change.

The DSM cost/benefit scores utilize a discounted cash flow methodology to determine the NPV of both a benefit stream of dollars and a cost stream of dollars due to the DSM program over a specific time period. The Company has used the planning period for its IRP resource planning efforts, which is 25 years, to calculate the NPVs of both cost and benefits of the DSM programs. To determine the cost/benefit ratio of a program, the NPV of the benefits is used as the numerator and NPV of the costs as the denominator:

Benefit/Cost Ratio = Net Present Value of the Program Benefits / Net Present Value of the Program Costs

NPVs can easily be turned into a level stream of costs or benefits over the same time period. A capital cost recovery factor utilizing the same discount factor used when developing the NPVs of the benefit and cost streams will produce a level stream of dollars that produces the same NPV over the study period. Therefore, the first step in developing levelized cost of energy saved is to apply a capital cost recovery factor to the NPV of the benefit stream of dollars and the cost

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[8] *Application of Virginia Electric and Power Company For approval to implement new demand-side management programs and for approval of two rate adjustment clauses pursuant to § 56-585.1 A 5 of the Code of Virginia*, Case No. PUE-2009-00081, Order Approving Demand-Side Management Programs, 2010 S.C.C. Ann. Rept. 362-67 (Mar. 24, 2010).

stream of dollars for the program. The next step is to represent the levelized stream of benefits and costs as a benefit and cost per megawatt hour ("MWh") by dividing the NPV by the appropriate MWh reduction for the program. Because the discounting process takes into account the time value of money, so should the MWh reductions which occur over time. The MWh reductions from the programs should be discounted to take into account the fact that the value of a MWh reduction would be less in future years, just as a dollar would be worth less in future years. The discounted stream of MWh reductions should also be levelized over the study period, and is what is used to determine the levelized cost of saved energy.

"Levelized Cost of Energy Saved" is calculated through the following formula:

Levelized Cost of Energy Saved = (C x (Capital Recovery Factor))/(D)
Capital Recovery Factor[9] = [A* (1 +A)^B]/[(1 +A)^B – 1]

Where:

A = Utility specific discount rate[10]
B = Program Evaluation period in years
C = Net Present value of total program costs in base year dollars for the review period[11]
D = Levelized kilowatt hours saved over the evaluation period[12]

The appeal of using this method to calculate levelized cost of energy saved is that it produces the same result for the cost/benefit ratios as the NPV method that is currently used for calculating cost/benefit ratios for the cost/benefit tests. The two methods are internally consistent and will produce the same results as long as both cost and benefits are used when evaluating DSM cost/benefit scores.

Below is an example of the cost/benefit scores from the Company's 2015 integrated resource plan for the Residential High Efficiency Heat Pump Upgrade Program, as well as the levelized cost and benefits for the program. The Net Present Values of the benefit and cost streams follow the formula in the California Standard Practice Manual and are the industry standard approach to performing cost/benefit analysis. The cost/benefit ratios for the levelized benefit and cost streams are derived from the formula above. As shown below, the cost/benefit ratios using the NPV for the benefits and costs are the same as the levelized cost/benefit ratio using the levelized cost and benefits for the program.

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[9] Capital Cost Recovery Factor is the classic definition of a compound interest calculation to calculate equivalent annual net disbursements.
[10] Utility discount rate should be the utility's weighted average cost of capital and equivalent to the discount rate used in the supply-side evaluation.
[11] NPV based on end of year cash flows.
[12] KWh saved is levelized over study period.

Cost/Benefit ratio using Net Present Value of benefit and cost streams

	UCT	TRC	RIM
NPV Benefits	$ 53,917	$ 53,917	53,917
NPV Cost	$ 16,049	$ 21,677	108,036
C/B Ratio	3.36	2.49	0.50

Cost/Benefit ratios using the levelized benefit and cost streams on a per MWh basis

Levelized Benefit per MWH	$76.72	$76.72	$76.72
Levelized Cost per MWH	$22.84	$30.85	$153.74
C/B Ratio	3.36	2.49	0.50

Evaluation Measurement and Verification (EM&V)

Once a program is approved, the Company's EM&V contractor is engaged to establish data requirements for the program using industry standard approaches for measurement and verification.

For each program, the Company's EM&V contractor develops a plan for the general methodology that will be used to evaluate each program against energy and capacity projections and reviews available data associated with energy and/or capacity savings expected to result from specific application of the program measures. The contractor prepares a Standard Tracking and Engineering Protocols Manual ("STEP manual") – similar to a TRM document – with information specific to the program based on the available data and on the contractor's professional experience and judgment. For example, the Company's 2016 EM&V Report, filed on April 1, 2016 in Case No. PUE-2014-00071, provided the following savings estimation approach for an air source heat pump upgrade under Dominion Virginia Power's Residential Heat Pump Upgrade Program:

Savings Estimation Approach

Gross annual electric energy savings for **time of sale** and **early replacement** units are calculated according to the following equation. The calculation for early replacement units in this manual deviates from that in the Mid-Atlantic TRM 2015, which has two separate approaches to calculate the initial phase savings (existing to efficient savings) and remain phase savings (new baseline to efficient savings). DNV GL conducts a single calculation at the time of the measure installation to determine the measure's annualized savings. That savings is then aggregated with other measure savings and the aggregated value is tracked over time. We do not keep records of that individual participant's savings over time, to discount it at the appropriate time for the new baseline. In the case of early replacement units, DNV GL assumes the baseline to be at the new Federal minimum requirement to be conservative with the savings that are reported.

$$\Delta kWh/year = \frac{FLH_{cool} \times BtuH \times \left(\frac{1}{SEER_{base}} - \frac{1}{SEER_{ee}}\right)}{1{,}000\ W/kW} + \frac{FLH_{heat} \times BtuH \times \left(\frac{1}{HSPF_{base}} - \frac{1}{HSPF_{ee}}\right)}{1{,}000\ W/kW}$$

Gross coincident demand reductions savings for **time of sale** and **early replacement** units are calculated according to the following equation:

[21] Residential Heat Pump Upgrade Program website. https://www.dom.com/library/domcom/pdfs/virginia-power/ways-to-save/residential-heat-pump-upgrade-rebate-form.pdf. Accessed 6/29/2015

[22] Ibid

$$\Delta kW = \frac{BtuH \times \left(\frac{1}{EER_{base}} - \frac{1}{EER_{ee}}\right) \times CF}{1{,}000\ W/kW}$$

Where:

ΔkWh/year = gross annual electric energy savings

ΔkW = gross coincident demand reductions. The above equation is for estimating the summer peak demand reduction. At present, both VA and NC do not consider the winter peak demand in their utility tariff structure. However, when needed, this reference manual can be updated with algorithm on winter peak demand reduction calculation.

FLH_{cool} = annual cooling full load hours (FLH)

FLH_{heat} = annual heating FLH

BtuH = capacity of air source heat pump (1 ton = 12,000 Btu/h). BtuH appearing in energy savings and peak demand reduction equations above refers to the cooling nameplate rated capacity, converted to Btu.

$SEER_{base}$ = seasonal energy efficiency ratio (SEER) of baseline (pre-retrofit) air source heat pump

$SEER_{ee}$ = SEER of efficient (post-retrofit) air source heat pump

$HSPF_{base}$ = heating seasonal performance factor (HSPF) of baseline air source heat pump

$HSPF_{ee}$ = HSPF of efficient air source heat pump

EER_{base} = energy efficiency ratio (EER) of baseline unit

EER_{ee} = EER of efficient unit

CF = summer peak coincidence factor

Input Variables

Table 26: Input Values for Air Source Heat Pump Upgrade Savings Calculations

Component	Type	Value	Unit	Source(s)
FLH_{cool}	Fixed	Richmond, VA = 842; Charlotte, NC = 939; See Table 90	hours/year	Mid-Atlantic TRM 2015, p. 115; ENERGY STAR® calculator[74]
FLH_{heat}	Fixed	Richmond, VA = 789; Charlotte, NC = 744; See Table 90	hours/year	Mid-Atlantic TRM 2015, p. 116
BtuH	Variable	See customer application	Btu/hour	Customer application
		Richmond, VA default = 28,720 Charlotte, NC default = 30,889		Dominion's portfolio of residential energy efficiency programs program[75]
$SEER_{base}$	Fixed	See Table 91 for federal minimum baseline	Btu/watt-hour	Mid-Atlantic TRM 2015, p. 115[76]
$SEER_{ee}$	Variable	See customer application	Btu/watt-hour	Customer application
		Default = 14.5		Dominion program requirements[77]
$HSPF_{base}$	Fixed	See Table 91for federal minimum baseline	Btu/watt-hour	Mid-Atlantic TRM 2015, p. 116[78]
$HSPF_{ee}$	Variable	See customer application	Btu/watt-hour	Customer application
		Default = 8.2		Dominion program requirements[79]

[74] ENERGY STAR®. Heat Pumps "Savings Calculator," Heating Usage, http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=EP. Accessed June 30, 2015.

[75] DNV GL reviewed the customer application data on heat pump size of participants in the Residential AC Cycling Program, Residential Duct Testing Program, Residential Heat Pump Upgrade Program and Residential Heat Pump Tune-Up Programs from program start dates through the end of 2015 (12/31/2015). The average heat pump capacity in VA (2.39 tons or 28,720 BtuH) was calculated using data from 85,412 air source heat pump units enrolled in these programs in Virginia. The average capacity in NC (2.57 tons or 30,889 BtuH) was calculated using data from 5,292 air source heat pump units enrolled in these programs in North Carolina. The average capacity was converted to BtuH using the conversion factor of 12,000 BtuH per ton.

[76] Mid-Atlantic TRM 2015, p. 115. Minimum Federal Standard

[77] https://www.dom.com/heatpumpupgrade. Accessed June 30, 2015.

[78] Mid-Atlantic TRM 2015, p. 115. Minimum Federal Standard

[79] https://www.dom.com/heatpumpupgrade. Accessed June 30, 2015.

EER_{base}	Variable	See Table 91 for federal minimum baseline	Btu/watt-hour	Mid-Atlantic TRM 2015, p. 118[80]
EER_{ee}	Variable	See customer application	Btu/watt-hour	Customer application
		Default value 12.0.		Dominion program requirements[81]
CF	Fixed	0.69	-	Mid-Atlantic TRM 2015, p. 119[82]

[80] The federal Standard does not currently include an EER component. The value is approximated based on the SEER standard (14) and equals EER 11.8. To perform this calculation we are using this formula: (-0.02 * SEER2) + (1.12 * SEER) (from Wassmer, M. (2003). A Component-Based Model for Residential Air Conditioner and Heat Pump Energy Calculations. Masters Thesis, University of Colorado at Boulder).

[81] Estimated from SEER = 15.0 with the help of the following algorithm: EER = (-0.02 * $SEER^2$) + (1.12 * SEER)

[82] Mid-Atlantic TRM 2015, p. 119. Based on BG&E's "Development of Residential Load Profiler for Central Air Conditioners and Heat Pumps" research, the Maryland Peak Definition coincidence factor is 0.69.

Energy savings values and computation approaches in the Company's STEP manual are generally referencing the Mid-Atlantic TRM where possible. Where regional statewide TRM values and approaches are not available, values from other accepted TRMs or methods consistent with the standard EM&V protocols mentioned above should be used. In the example above, for variables such as system size (BtuH) and efficiencies (SEERee and HSPFee) where customer-specific details are not available, the STEP manual indicates that the input value is based on (i) information from customer applications in the Company's portfolio of energy efficiency programs, and (ii) the Mid-Atlantic TRM, p. 115. Development of EM&V plans and STEP manuals are important components of an effective EM&V program.

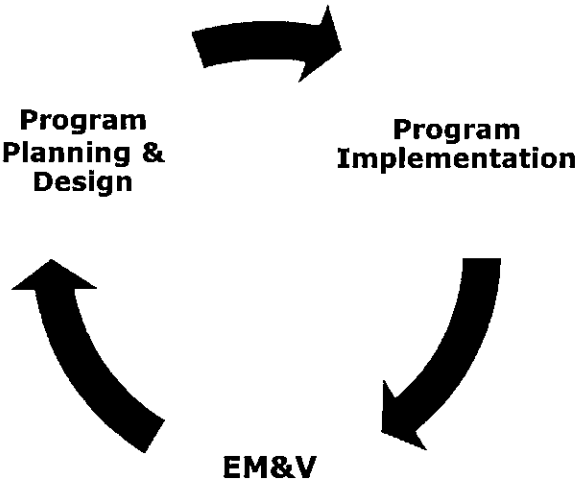
Virginia does not have a state-specific TRM. While such a resource would provide pre-approved methodologies for calculating demand and energy reductions for individual DSM measures, the Company believes that the existing approaches in its STEP manual from accepted sources is sufficiently effective and consistent with industry practice. This approach relies primarily on other regional or state TRMs, the U.S. Department of Energy ("DOE") UMP, IPMVP standards or case-specific approaches as necessary. This approach:

- Establishes a common resource for Dominion Virginia Power's energy and demand savings estimates;
- Ensures all internal parties (*e.g.*, Program Managers, resource planners and implementation vendors) are using the same protocols, input values assumptions and algorithms; and
- Serves as a basis for assessing performance of program implementation progress.

While this approach and the resulting STEP manuals are specific to Company programs, the process behind developing the STEP manual is sound. It follows regionally recognized standard approaches, which should also be a requirement for other utilities in the state that are required to

track program performance toward goals and perform EM&V on Commission-approved DSM programs. It should also be recognized that for the most part, EM&V efforts will be provided by external vendors. While the EM&V standards provide direction for performing EM&V evaluations, different vendors will have specific techniques and processes for compiling and reporting EM&V reports. This need for flexibility among vendors should be recognized if the Commission sets uniform standards for this important part of the DSM process in Virginia.

The DSM program development, approval and evaluation process is designed to provide feedback that can be used to improve the process over time. Best available industry standards are used to perform each of the outlined steps. The following diagram depicts the steps discussed above and provides some insight into the need for standardization in approach across the Virginia utilities.



The process starts with Program Planning and Design. This step includes the development of program parameters that will form the basis of the cost/benefit calculations discussed above. Deemed savings approaches such as those contained in the STEP manual can play an important role in documenting the initial objectives of a DSM program as well as the economic evaluation that determines whether a DSM program is in the public interest. The second step is the implementation of the DSM program. Implementation vendors who have submitted proposals to implement the DSM program according to the program assumptions that were approved by the Commission work with the Company and an EM&V vendor to track the programs' performance through the implementation process. The final step, EM&V, helps determine if a program is delivering the benefits that were part of the original cost/benefit evaluation used when the program was approved. The process is ongoing. Information about customer response, changes in the market for individual DSM measures, and utility operating and energy savings assumptions change over time. The DSM program cycle will make the proper adjustments to keep the DSM program on track or make changes to the future status of the program.

The Company reports on EM&V evaluation on an annual basis. The information that is provided in the EM&V report can be used to update DSM assumptions on a going-forward basis. The Company uses the data to update DSM program assumptions and provides updated going-forward cost/benefit scores for each of the approved programs that have sufficient EM&V data or where program assumptions have significantly changed. Although annual data on program performance are generated, it should be recognized that sufficient time needs to elapse in order to ensure that trends in the data are valid predictors of a DSM program's future benefits and costs. The Company's experience indicates that at least three years of program implementation data may be required for trends to become sufficiently stable to allow the information to be used to update program design assumptions. Relying on data reflective of shorter periods of time may result in adjustments in program assumptions that do not accurately reflect longer-term trends.

Responses to Objectives and Cost/Benefit Questions

"Objectives"

(i) *Uniform protocols for measuring, verifying, validating, and reporting the impacts of energy efficiency measures*

Utilities should follow industry standard practice when developing and implementing EM&V plans. The two prevalent standards are the Uniform Methods Project ("UMP") sponsored by DOE and the International Performance Measurement & Verification Protocol ("IPMVP") standard. The EM&V plan should rely on a Technical Resource Manual that clearly defines the parameters associated with forecasting DSM energy and demand reduction projections as well as forms the basis on how the individual measures of a program are measured and reported. The Company believes its STEP Manual can serve as an effective starting point for developing deemed savings approaches for electric energy efficiency measures.

(ii) *A methodology for estimating annual kilowatt savings for such energy efficiency measures*

The Company recommends that utilities rely primarily on other regional TRMs to the extent that they address the measures in question. For those measures not adequately addressed by a regional TRM, a utility should identify the deemed savings approach that it plans to follow for all measures that are brought to the Commission for approval.

(iii) *A formula to calculate the levelized cost of saved energy for such energy efficiency measures.*

Levelized cost of saved energy is a valid metric in considering DSM programs as long as it is used in conjunction with the levelized benefit of the DSM program. The Company

suggests using the formula presented herein, on page 14, if levelized cost of energy saved is used to evaluate the cost-effectiveness of DSM programs. The formula is internally consistent with the standard cost/benefit ratios produced by following the California Standard Practice Manual and will yield the same results as the standard cost/benefit tests when evaluating DSM programs.

"Cost/Benefit Questions"

(i) Whether the application of costs and benefits is consistent across utilities;

The cost/benefit methodology for DSM programs is outlined in the California Standard Practice Manual. If utilities follow this guideline, then there will be consistency in application of the tests. Dominion Virginia Power uses the Strategist implementation of the cost/benefit tests, which follows the California Standard Practice Manual. The Commission Staff ("Staff") can help inform the Commission as to whether the Virginia utilities consistently follow the California Standard Practice Manual.

(ii) Whether consistent application of costs and benefits across utilities is necessary or reasonable;

The cost/benefit approach using the California Standard Practice Manual guidance would provide a consistent way to evaluate DSM programs for electric utilities as well as facilitate comparison of program assumptions and benefits. Consistent application of the California Standard Practice Manual would facilitate compiling data on the cost-effectiveness of DSM programs within the state, as well as forming a basis for setting statewide targets and reporting requirements for meeting state objectives like the Virginia Energy Plan.

(iii) Whether the application of the cost/benefit tests can be improved by enhanced evaluation and verification protocols for estimating savings actually realized.

The DSM process described above lays out a feedback loop process with steps that are interdependent. The steps complement each other and result in a DSM proposal, implementation and evaluation process that ensures that DSM program projections are sound and produce benefits for a utility's customer base. The program cycle starts with Program Planning and Design where the assumptions of a DSM program are identified. The second step is Program Implementation where DSM programs are set up with the administrative and project management functions to deliver the DSM programs as planned. Finally, there is the EM&V step where the benefits as well as the costs of the programs are monitored and reported to ensure programs produce the benefits that were originally projected. This process as described above represents a process that follows industry standard practice and provides for the best application of the cost/benefit scores. The Company does not propose enhancements to the EM&V process other than the process that is currently followed by the Company. However, the Company is open to

enhancements to its individual EM&V methods for specific programs should that be beneficial to the Commission or the Staff.

Conclusion

In conclusion, the Company has undertaken significant efforts to develop processes and procedures that allow it to continue to develop and grow a cost-effective DSM portfolio. The Company's customers, both residential and non-residential, regularly express interest in increased choices among energy efficiency and peak-shaving offerings. The Company diligently works to identify and develop new ideas and program concepts to study and ultimately bring those programs that are likely to provide viable benefits before the Commission for approval to initiate in the Commonwealth.

The Company proposes that the cost/benefit tests as currently defined by the California Standard Practice Manual provide a standardized and acceptable method for determining cost-effectiveness of DSM programs and are generally accepted as the industry standard. The Company does not currently evaluate the cost-effectiveness of DSM programs using a levelized cost analysis. However, should the Commission move in that direction, Levelized Cost of Energy Saved should be calculated from the cost/benefit NPV results using the formula and assumptions outlined above.

With respect to data inputs for projected savings, a deemed savings approach that is generally accepted in Virginia would be the best way to standardize an approach to DSM program evaluation, and provide the basis for comparing ongoing program performance to plans. The Company has developed a comprehensive document of deemed savings approaches for its programs based on southeast and Mid-Atlantic region TRMs. The Company does not advocate the creation of a new, Virginia-specific TRM due to cost and other considerations and believes its STEP manual can be used as a starting point for developing standardized deemed savings approaches for electric efficiency measures in Virginia. The Company further notes that for those electric efficiency measures not addressed in relevant regional TRM documents, a case-specific approach using EM&V standards discussed above should be used.

Finally, EM&V to determine actual savings should follow industry standard protocols from UMP and IPMVP standards.

Dominion Virginia Power thanks the Commission for the opportunity to submit comments on these important topics and looks forward to further dialogue as appropriate.

Respectfully submitted,

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CERTIFICATE OF SERVICE

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