DMME Synopsis of the Energy Efficiency Studies

In support of the Virginia Governor's Executive Committee on Energy Efficiency (GEC), the Virginia Department of Mines, Minerals and Energy (DMME) reviewed several energy efficiency potential studies as well as some research literature to identify opportunities to save electrical energy and meet the Commonwealth's 10% electricity conservation goal. Although each study had slightly different results, DMME found common themes and approaches that the reports share. Although all of these studies suggest that there are substantial opportunities for Virginia to save electricity, there are still some challenges that the stakeholders may wish to explore as they consider policy options.

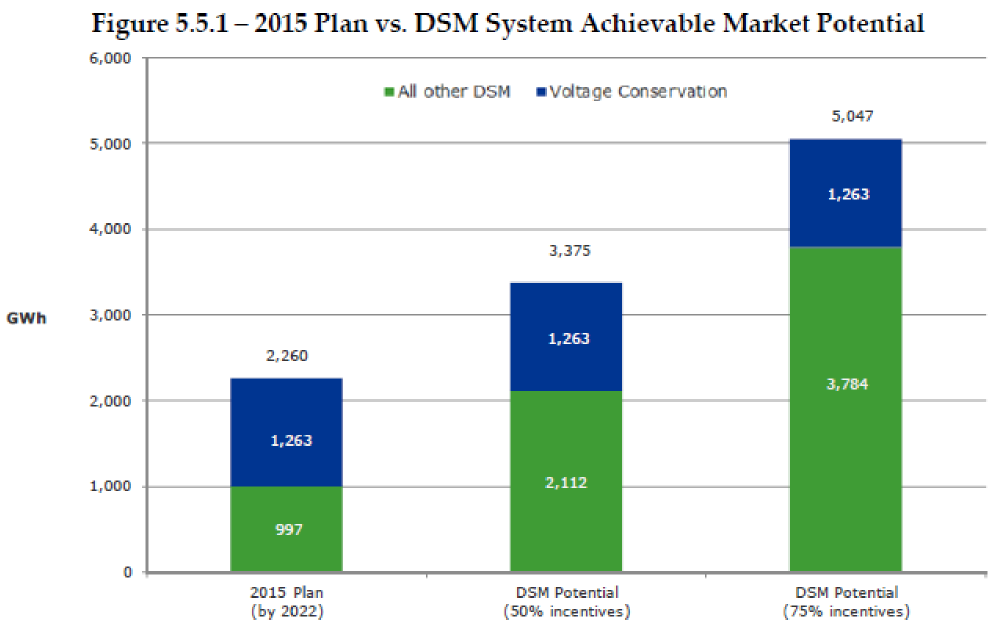
All of the studies report that Virginia has a substantial opportunity to improve electricity efficiency. Measures to save electricity in the Commonwealth have the potential to save ratepayers money and create more jobs by stimulating spending and growing a sector of the economy. Saving electricity can also allow utilities to meet projected load growth by avoiding costly investments in infrastructure and reduce air emissions from some generating facilities. Many measures can generate savings that can be greater than the cost of implementing the measure over a measure's useful life. The policies and programs recommended in many of the reports try to address a phenomenon that the energy efficiency literature calls the energy efficiency gap or paradox, which refers to the notion that individuals as well as firms underinvest in energy efficiency even though the savings that energy efficiency measures achieve over their useful lives often times exceed the upfront costs of implementing those measures.

There are a number of reasons why this gap may exist. The primary reasons cited by economists, researchers and efficiency advocates focus on market failures. Market failures include information availability, principal-agent problems (split incentives problem), credit constraints, and regulatory failures. Some literature identifies more market failures, but generally most of the market failures identified in the literature can fit in any of the broad categories mentioned above. For example, if consumers do not have access to information to inform them of the performance of their building or appliances and lack the access to financing mechanisms to pay the upfront costs of an improvement, consumers will not invest in energy efficiency improvements even though the cumulative savings over the useful life of the measure outweigh the initial costs. This would lead to underinvestment in energy efficiency and contribute to the energy efficiency gap mentioned above. Policy solutions such as technical assistance like energy audits and information campaigns inform individuals and consumers of opportunities. Incentives and rebates can help address split incentives while financing options can address credit constraints and reduce upfront costs, and building codes and standards can correct regulatory failures. These are only a few of the many mechanisms that can be used to address these market failures.

Utility programs can be another effective way to address these market failures. Because individuals interact with their utility much more frequently than they do with their local or state government when they receive their monthly bills, rebate and audit programs may experience higher participation rates because more customers may become aware of these opportunities. In addition, if the utility intends to use electricity conservation as a resource to avoid investing in costly infrastructure, the utility may also have an incentive to encourage conservation as a way to save costs and keep electricity rates low. Some literature identifies regulatory barriers that prevent utilities from making these kinds of investments or growing electricity conservation programs in spite of their potential to save the utility money.

As part of a process to identify more programs to make available to customers, Dominion Virginia Power (Dominion) hired an independent contractor in 2013 to conduct a demand-side management market potential study that consisted of a detailed analysis of the customers in Dominion's service territory and identified conservation measures that could produce substantial electricity conservation (between 2,112 and 3,784 million MWh by 2022). When combined with Dominion's voltage conservation program, the study estimates that the achievable market potential of energy efficiency in Dominion's service territory is 3,375 to 5,047 million MWh by 2022 (Figure 1). That could be as much as about half of Virginia's stated conservation goal for 2020 as expressed in statute and the 2014 Virginia Energy Plan. In its integrated resource plan (IRP) Dominion reported that it issued an RFP earlier this year for "design and implementation services for future programs" that would include the measures identified in the potential study. The IRP states that Dominion will use the results from the RFP "to evaluate the feasibility and cost-effectiveness" of the programs and measures.

Figure 1: Dominion Market Potential Study Results



Even though there is evidence that an energy efficiency gap exists, there are still challenges that energy efficiency poses. All of the studies summarized below rely on ex-ante (before the fact) engineering and economic models to determine savings and economic benefits. Although these models are useful, they are often times untested and contain various assumptions about the real world that may or may not be accurate. For example, calculating projected savings of a measure or program over time depends on a baseline or reference case of what electricity consumption would be in the absence of an efficiency program or measure. Determining such baselines relies on assumptions about weather, building occupancy and consumer behavior that may change when a measure is implemented. As a result, some literature suggests there may be a benefit to collecting data before and after various interventions to conduct field tests on various programs underway. The results from such field tests can inform and refine the assumptions made in some of the ex-ante models and improve policy design and inform decision-making processes going forward.

Virginia Efficiency Studies Summaries:

Virginia State Corporation Commission Report

In 2007, the General Assembly passed legislation (Chapter 933 of the 2007 Acts of Assembly) directing the Virginia State Corporation Commission to convene a proceeding to engage stakeholders to: determine whether the ten percent electricity consumption reduction goal can be achieved cost-effectively, identify the mix of programs that should be implemented to cost-effectively achieve the consumption reduction goal, develop a plan for the development and implementation of recommended programs, determine the entities that could most efficiently deploy and administer various elements of that plan, and estimate the cost of attaining the energy consumption reduction goal.

The staff provided limited analysis as necessary during the course of the proceeding and issued some key findings and recommendations. The staff determined that the 10 percent electricity consumption reduction goal is achievable by 2022. The report presents issues and provides options for potential energy efficiency programs including some alternatives. Regarding administration of the programs, the staff was unable to make a specific recommendation but suggested that it appears that the SCC, the Department of Mines, Minerals and Energy or another third party administrator could efficiently administer the mix of programs. For cost, the SCC notes that the Virginia Energy Plan estimated that achieving the goal could cost $300 million a year between 2008 and 2022, but that the Plan also suggested that conservation costs considerably less than new electricity supply. If this is true, the deployment of electricity conservation would produce resource savings and may not increase electric rates for non-participating ratepayers.

The report contains various working group reports that summarize the key findings of each working group.

Energizing Virginia: Efficiency First (ACEEE)

The American Council for an Energy Efficiency Economy, with assistance from Summit Blue Consulting, ICF International, and Synapse Energy Economics, published a study to inform policymakers and stakeholders of the opportunities for energy efficiency and demand response in Virginia. As part of its energy efficiency cost-effectiveness resource assessment, ACEEE found that as much as 31% of projected electricity consumption in 2025 could come from energy efficiency (44.371 million MWh). For the sum of all measures they estimated a levelized cost of energy of less than four cents per kWh saved. ACEEE's energy efficiency policy analysis considered three scenarios in which a conservation goal was considered as a single policy. The analysis assumes that the utilities would work towards meeting the statutory goal while the state would augment those efforts with building codes, support for combined heat and power, manufacturing incentives, improving efficiency in state and local facilities as well as appliance efficiency standards.

Change Is in the Air: How States Can Harness Energy Efficiency to Strengthen the Economy and Reduce Pollution (ACEEE)

This report by the American Council for an Energy Efficient Economy quantifies the energy, economic, and pollution-reduction impacts of certain energy-saving policies on a state-by-state basis. The policies evaluated were: implementing an energy efficiency savings target of 1.5% per year, enacting national model building codes, constructing combined heat and power systems, and adopting efficiency standards for products and equipment. If Virginia implemented these policies in the year 2020, the state would achieve an annual energy savings of 5.586 million MWh in 2020 and an annual savings of 24.255 million MWh in 2030. By 2030, the study estimates the cost of energy savings will be about $8.6 billion and the cumulative avoided electricity purchases will be $14.8 billion yielding a net savings of $6.2 billion. The costs are expressed in cumulative dollars and are not discounted.

Making the Case for Energy Efficiency: Case Studies of Supportive Utility Regulation (ACEEE)

This study by the American Council for an Energy Efficient Economy examines the financial disincentives that exist that discourage utilities from investing in energy efficiency programs. The paper identifies three major disincentives: 1) the costs of customer energy efficiency programs, 2) lost revenue resulting from customer energy efficiency programs, and 3) investments in energy efficiency avoid the need for a utility to invest in assets that provide a higher financial rate of return according to traditional rate regulation. For these three disincentives, the report identifies three policy solutions that can address each disincentive respectively: 1) cost recovery mechanisms through rate riders or escrow accounting allow for the timely recovery of program costs, 2) revenue decoupling policies that separate a utility's sales from revenues as well as lost-revenue adjustment mechanisms that are rate structures that provide revenue recovery to lost sales resulting directly from energy efficiency programs can address concerns with lost revenue, and 3) providing a financial incentive like a percentage of program costs as a bonus for meeting a prescribed target can provide a financial incentive to meet energy savings targets. The report examines several large utilities with well-established and large energy efficiency programs. Although they find that not all states address all three disincentives, the report concludes that without these frameworks programs would have to work against the financial disincentives mentioned above and that the utilities would be unable to meet their full potential of energy efficiency. Though the establishment of an energy efficiency resources standard is necessary, it needs to be accompanied by policies that address utility financial disincentives for investing in customer energy efficiency programs.

Energy Efficiency Policy Recommendations for the Commonwealth of Virginia (Environment North East)

This paper reviews the current state of energy efficiency policy in Virginia and provides suggestions for near-term policy changes and a longer-term legislative package to improve energy efficiency in the Commonwealth. The report references an earlier nationwide study about best-practices in comprehensive efficiency programs. These programs are designed to address market barriers, failures and other reasons why consumers fail to make energy improvements to their properties even though it is in their economic interest. Three major types of solutions to these failures include: technical assistance and information programs, financial incentives and rebates, and project financing programs. Near-term policy changes identified by ENE include: using the utility cost or total resource cost-effectiveness test instead of the ratepayer impact test when assessing whether programs are cost-effective, conducting a new and updated potential study, engaging stakeholders and working with the State Corporation Commission to adjust or change utility incentives to promote energy efficiency. Longer-term legislative recommendations included having the utilities develop a joint three year energy plan in collaboration with other stakeholders and forming an energy efficiency oversight board to make recommendations and review progress. It also proposes decoupling utility distribution rates from sales. The report finds that achieving an annual reduction in 2020 equal to 1% of 2010 levels would mean about 1.138 million MWh and cost about $455 million annually. The report cites ACEEE's determination that energy efficiency's levelized cost of energy is less than the levelized cost of almost any other electricity generation resource on the supply side.

Progress, Productivity, Prosperity – The Economic Impact of EE Investments in the Southeast (Southeast Energy Efficiency Alliance)

This report summarizes a macroeconomic analysis of the U.S. Department of Energy Better Buildings Neighborhood Programs implemented by the Southeast Energy Efficiency Alliance. These programs were supported by American Recovery and Reinvestment Act funds delivered through multiple DOE grant programs to states. The consultant, Cadmus, who was responsible for the analysis used an IMPLAN model to estimate macroeconomic impacts of energy efficiency investments. Program spending, avoided utility fuel and capacity costs, spending by locally affiliated programs and lenders, and customer contributions to project costs were used as inputs into the model. The model was then used to estimate key macroeconomic indicators (direct, indirect and induced effects): number of jobs created, labor income generated, total operating surplus, and total economic output. The number of jobs created is characterized by full-time equivalents while the labor income generated is the entire cost of employment paid by the employer. This includes salary and benefit payments. The total operating surplus represents all profits, indirect business taxes, and payments to households that were estimated from the model inputs. Given a total investment of $5.4 million, the total effect (a sum of direct, indirect and induced effects) for Virginia was estimated to be: 67.22 jobs created, an estimated labor income of $4.6 million, a total operating surplus of about $8.0 million, and a total economic output of $18.8 million. Table 34 taken below from the Cadmus report summarizes the macroeconomic impacts on a return on investment basis.

Table 34. Returns on Investment, Virginia

Type of Return	Return Per Million Dollars Invested
Jobs (#)	12.49
Labor Income ($)	866,190.44
Value Added ($)	1,481,576.77
Output ($)	3,485,318.33

Energy Efficiency in the South – Virginia State Profile (Georgia Institute of Technology and Duke University)

This profile of Virginia addresses opportunities for Virginia residential, commercial, and industrial customers to save energy by drawing on results from a recent study published by a team of researchers from Duke University and the Georgia Institute of Technology. The study uses a modeling approached that closely follows the National Energy Modeling System (EF-NEMS). The study reports that Virginia houses about 2.6% of the nation's population, 2.8% of the nation's economy and consumes about 2.6% of the energy. Virginia's energy usage per capita is also close to the nation's usage per capita as a whole. The report projects that Virginia's total energy consumption (all sectors) will increase by 14% from 2010 to 2030. Policies aimed at improving energy efficiency in the residential, commercial and industrial sectors have the potential to reduce Virginia's projected consumption of energy in 2030 by an amount equal to 12% of what was consume in 2007. For the residential sector, "more stringent building codes with third party verification, an expanded Weatherization Assistance Program, and retrofit incentives with increased incentive standards could reduce Virginia's projected residential consumption by about 10% in 2020 and 16% in 2030." For the commercial sector, appliances standards and retrofit policies could reduce the projected energy consumption of the commercial sector by 13% in 2020 and 21% in 2030. Plant utility upgrades, process improvements, and combined heat and power policies have the potential to reduce projected energy consumption in the industrial sector by 7.1% in 2020 and 9.7% in 2030. Although for these users the savings are substantial, industrial savings are unlikely to be as significant and savings in the residential and commercial sectors. The vast majority of energy savings for commercial and residential customers will be in electricity usage, but for industrial customers, substantial natural gas savings will also be achieved. The report also estimated economic and employment impacts (see Table 1 below). Electricity and natural gas costs are projected to decline by $1,816 million and $272 million ($2007) respectively in 2020. Gross state product is projected to increase by $178 million in 2020 and $296 million in 2030. The ACEEE calculator used in the study estimated an annual increase in 2020 of 28,500 jobs and an increase of 38,000 jobs in 2030.

Table 1: Economic and Employment Impacts of Energy Efficiency

Indicator	2020	2030
Public Sector Policy Financial Incentives (in million $2007)	765	1,106
Private Sector/Household Productive Investment (in million $2007)	282	336
Change in Electricity Costs (in million $2007)	-1,816	-3,365
Change in Natural Gas Costs (in million $2007)	-$272	-$421
Annual Increased Employment (ACEEE Calculator)	28,500	38,000
Change in Gross State Product (in million $2007)	178	296