# 1. INTRODUCTION

The Commonwealth of Virginia currently ranks near the bottom of all states in expenditures on demand-side management (DSM)[1] — comprising more efficient uses of energy (energy efficiency) and the ability of a consumer to respond to scarcity and high costs (demand response) — according to the American Council for an Energy-Efficient Economy (ACEEE) and the Alliance to Save Energy (ASE).[2] This creates a unique opportunity for the Commonwealth to leverage key lessons learned and best practices identified in other jurisdictions to develop efficiently and implement a cost-effective portfolio of DSM program offerings.[3] Such a portfolio could rely on proven DSM technologies and strategies to achieve significant energy savings and peak demand reduction over a relatively short timeframe (*i.e.*, within two-to-three years), as well as over the longer term. In addition, such a portfolio would generate additional benefits by protecting ratepayers against future increases in energy costs, providing system reliability benefits, offering customers the ability to better manage their energy costs, and maintaining a competitive regional economy as businesses increasingly look for locations with robust, diverse energy supplies from demand-side and supply-side resources.

---

[1] For the purposes of this report, DSM refers to energy efficiency, demand response, and innovative electric rates designed to shift energy use from peak demand periods. DSM covers the panoply of activities customers can take to manage their energy use on their side of the meter. The *National Action Plan for Energy Efficiency* defines energy efficiency as "Using less energy to provide the same or improved level of service to the energy consumer in an economically efficient way. The term energy efficiency as used here includes using less energy at any time." The US DOE defines demand response as "Changes in electric usage by end-use customers from their normal consumption patterns in response to changes in the price of electricity over time, or to incentive payments designed to induce lower electricity use at times of high wholesale market prices or when system reliability is jeopardized." As specified in the report *Benefits of Demand Response in Electricity Markets and Recommendations for Achieving Them*, the US DOE identifies two primary types of demand response: (1) Price-based demand response such as real-time pricing (RTP), critical-peak pricing (CPP) and time-of-use (TOU) tariffs, give customers time-varying rates that reflect the value and cost of electricity in different time periods. Armed with this information, customers tend to use less electricity at times when electricity prices are high and (2) Incentive-based demand response programs pay participating customers to reduce their loads at times requested by the program sponsor, triggered either by a grid reliability problem or high electricity prices.

[2] Dan York & Martin Kushler, American Council for an Energy-Efficient Economy, *ACEEE's 3rd National Scoreboard on Utility and Public Benefits Energy Efficiency Programs: A National Review and Update of State-Level Activity*; Report #U054, (Oct. 2005).

[3] Numerous sources exist compiling DSM best practices including the US DOE and US EPA, *National Action Plan for Energy Efficiency*, (July 2006); US EPA, *Clean Energy-Environment Guide to Action: Policies, Best Practices, and Action Steps for States*, (April 2006); and California Best Practices Project Advisory Committee, *National Energy Efficiency Best Practices Study* (Dec. 2004), http://www.eebestpractices.com.

Reservations about DSM that the Virginia State Corporation Commission (SCC) may have had under the price-capped transition to retail competition no longer apply since that transition has been abandoned in the new "reregulation" bill.[4] In particular, the bill:

- Provides incentives for utilities to find renewable forms of energy and establish demand-side management and conservation programs;

- Allows each utility to seek rate adjustment clauses to recover costs of FERC-approved demand response programs and costs of providing incentives for the utility to design and implement demand-side management programs; and

- Directs the SCC to "conduct a proceeding to establish goals for the amount of energy and demand to be reduced by the operation of demand side management, conservation, energy efficiency, and load management programs, and develop a plan for the development and implementation of recommended programs."[5]

More recently Governor Kaine issued Executive Order 48 that directs the Commonwealth's executive Branch to reduce the annual cost of energy purchases from non-renewable sources by at least 20% by fiscal year 2010. These initiatives provide the Commonwealth with an opportunity to integrate cost-effective demand- and supply-side options into system planning processes. Given that Virginia utilities have among the nation's least developed DSM programs and funding, this directive could engender considerable business opportunities for independent vendors of DSM programs and technologies.

A variety of DSM programs that incorporate both energy efficiency (*i.e.*, permanent energy savings) and demand response (*i.e.*, targeted peak demand reduction) goals could be effectively applied in the Commonwealth given Virginia's current economics and demography. These are characterized by population and economic growth[6], a large concentration of commercial data centers, and significant public sector facilities. The list of available program options can be narrowed by focusing on only those DSM strategies and technologies that are most applicable to the Commonwealth's situation and have been proven successful in other jurisdictions. Doing so shows that five DSM programs have the greatest potential to generate energy savings and peak demand reduction, together with corresponding cost savings, over a relatively short timeframe. The programs are described below. Estimated energy savings and peak demand reduction associated with these programs are presented in Section 3.

1. **Residential and Commercial High-Efficiency Lighting Programs** provide financial incentives to end-use customers to offset the incremental costs associated with pre-qualified, high-efficiency lighting systems as well as financial and educational incentives to lighting retailers and specialty contractors to increase promotions and installations of high-efficiency lighting systems.

2. **Residential HVAC Retrofit and Quality Installation Programs** provide financial incentives to end-use customers to offset the incremental capital costs associated with high-efficiency HVAC equipment as well as utility financial and technical assistance to HVAC retailers and specialty

---

[4] Summary as passed House of HB 3068, available at http://leg1.state.va.us/cgi-bin/legp504.exe?ses=071&typ=bil&val=hb3068&Submit=Go (accessed Mar. 19, 2007).

[5] *Id*

[6] Peak demand for Dominion Virginia Power, the Commonwealth's largest electric utility, is expected to increase by 1.8% per year through 2016, from 18,138 MW in 2006 to 21,680 in 2016; Merrill, Hyde. "Proposed Mt Storm-Meadow Brook-Loudoun 500-kV Line: Critical Analysis and Alternatives," confidential internal work product prepared for Bracewell & Giuliani, LLP (March 2007).

contractors to increase promotions and installations of high-efficiency HVAC equipment. These programs could be enhanced by incorporating a demand response protocol that explicitly seeks to induce lower electricity use at times of high market prices or when grid reliability is jeopardized (*i.e.*, times of peak system demand) through the use of air conditioner cycling switches or communicating "smart" thermostats, etc.

3. **Residential and Commercial New Construction Programs** provide financial and technical assistance to home/facility owners to incorporate energy efficiency into the design, construction, and operation of new or renovated homes/facilities. Financial incentives would be available to offset the additional costs associated with the purchase and installation of approved energy-efficient equipment. In addition, technical assistance would be available to help evaluate energy efficiency measures and designs and provide guidance for incorporating new and emerging energy-efficient technologies into projects. Again, these programs could be enhanced by incorporating a demand response protocol that explicitly seeks to reduce electricity use during times of peak system demand by installing appropriate enabling technologies during the design and construction of new and substantially renovated homes/facilities.

4. **Residential and Commercial High-Efficiency Appliance/Office Equipment Programs** provide financial incentives and education to end-use customers to encourage the purchase and use of ENERGY STAR® rated home appliances and office equipment. These programs can be enhanced by establishing partnering arrangements with the ENERGY STAR Program and other national and regional resources and expertise. These types of partnering arrangements can provide tools and strategies to help reduce DSM program costs and expedite implementations. In addition, these types of partnering arrangements can provide the added credibility needed to gain customer buy-in.

5. **Commercial Data Center Efficiency Programs** provide financial and technical assistance to owners and facility managers at large, energy-intensive commercial data centers to incorporate energy efficiency measures into the design, construction, and operation of these types of facilities. These programs would be similar to the new construction program discussed previously; however, the program would have a specific focus on operational enhancements and design elements unique to large-scale commercial data centers. The programs would also seek to use available backup generation capacity at these facilities to develop additional demand response resources.

Variants of these five program types have been deployed in many jurisdictions over the past twenty years and have achieved substantial energy savings and peak demand reductions within planning horizons of less than five years.[7] The benefits of these DSM programs can be enhanced further when combined with innovative rates designed to shift energy use from high-cost periods to lower-cost periods, and other time-differentiated rates that support DSM. Regulators, utility executives, and other industry stakeholders are increasingly pursuing these combined approaches as reflected in recent requests for regulatory approval of advanced metering infrastructure (AMI) and DSM programs designed to incorporate sophisticated enabling technologies to enhance demand responsiveness. The Federal Energy Regulatory Commission (FERC) recently reported that AMI currently has a penetration of about 6% of total installed, electric

---

[7] Examples include the New York State Energy Research and Development Authority, ***New York Energy $mart***[SM] *Program Evaluation and Status Report: Report to the System Benefits Charge Advisory Group*, (May 2006); the New Jersey Office of Clean Energy, *New Jersey's Clean Energy Program 2005 Annual Report*, (2006); Xcel Energy Corporation, *2005 Status Report and Associated Compliance Filings, Minnesota Natural Gas and Electric Conservation Improvement Program*, April 2006; and San Diego Gas & Electric, *Energy Efficiency Programs Annual Summary and Technical Appendix, 2005 Results* (May 2006).

meters in the United States and that system-wide deployments of AMI increased in 2006 and will likely continue to increase in 2007 and 2008.[8] FERC reports further that parts of the United States associated with the ReliabilityFirst Council, which includes the Mid-Atlantic and several Midwestern states, had the highest regional overall AMI penetration rate at 14.7% with Pennsylvania being the national leader with an AMI penetration rate of 52.5%.

The balance of this report is organized as follows:

- Section 2 presents an overview of the economics associated with DSM and discusses DSM achievements to date in select jurisdictions as well as different DSM program administration and funding models.

- Section 3 conservatively estimates DSM benefits that Virginia can reasonably be expected to gain from implementing the five programs discussed above and describes the value of demand response activities in the broader PJM market.

- Section 4 presents a DSM Action Agenda that if implemented will enable the Commonwealth to protect ratepayers from higher energy prices in the future, provide system reliability benefits, improve the quality of the environment, and maintain Virginia's economic competitiveness.[9]

# 2. DSM Economics, Achievements, Administration and Funding

Regulators across the country have endorsed the use of DSM as a cost-effective resource for meeting existing electricity demand and growth in demand. This is demonstrated by the National Association of Regulatory Utility Commissioners (NARUC) resolutions at annual meetings over the past three years in which the NARUC Board endorsed the principal objectives and recommendations of the *National Action Plan on Energy Efficiency* and recommended that commissions seeking to facilitate deployment of cost-effective AMI technologies adopt ratemaking policies that provide utilities with appropriate incentives for reliance upon demand-side resources.[10] In addition, appearing before a U.S. Senate Subcommittee on Energy on behalf of the Edison Electric Institute (EEI), James Rogers, CEO of Duke Power, testified February 12, 2007, that:

- DSM should be viewed as a "fuel source" in its own right alongside conventional generating fuels.

- There is vast, untapped potential for far greater DSM, which could defer the need for dozens of new power plants in the next decade. DSM programs can deliver at a lower cost than new power

---

[8] Federal Energy Regulatory Commission, *Assessment of Demand Response and Advanced Metering*, Staff Report, Docket No. AD-06-2-000, (Aug. 2006).

[9] Energy efficiency users often redirect their energy savings into the local economy, magnifying local benefits. New York State Energy Research and Development Authority, ***New York Energy $mart***$^{SM}$ *Program Evaluation and Status Report: Report to the System Benefits Charge Advisory Group* (May 2004).

[10] In its most recent meeting on February 21, 2007, NARUC passed a resolution to "Remove Regulatory Barriers to the Broad Implementation of Advanced Metering Infrastructure" (AMI); on August 2, 2006, NARUC passed a resolution "Supporting the National Action Plan on Energy Efficiency"; and on November 15, 2005, NARUC adopted a resolution on "Energy Efficiency and Innovative Rate Design."

plants, can be deployed faster than new power plants, and can provide savings over relatively short periods of one-to-three years, as well as over the longer term.

– From an environmental perspective, we should view DSM as a basic building block in reducing the industry's emissions profile.

– The utility regulatory paradigm can be changed to put saving energy on the same level playing field as generating energy.

Economics drive interest in DSM. In most instances, the costs associated with designing and implementing DSM programs are less than the costs associated with developing and constructing traditional supply-side resources. In many cases, well-designed DSM programs are saving energy at an average cost of about one-half of the typical cost of new power sources and about one-third of the cost of natural gas supply, while also contributing to a lower cost energy system for all ratepayers.[11] Overall, states across the U.S. have been able to deliver sizeable amounts of DSM at a cost averaging $0.03/kWh while targeting a minimum of a 1% decrease per year in energy use and peak demand.[12] In contrast, the costs associated with developing and constructing traditional supply-side resources typically range from $0.04/kWh to $0.10/kWh depending on fuel source and region. These costs will likely increase as the country moves toward a carbon-constrained regulatory paradigm.

These economics are compelling. DSM should not be neglected as regulators and resource planners consider options for the future. A resource mix that appropriately incorporates both DSM and supply-side investments represents the best approach to managing electricity prices for the benefit of ratepayers and helping maintain the overall economic competitiveness of the Commonwealth.

Diversification of the resource portfolio can greatly reduce the risks of electricity price spikes and overall volatility, and improve system reliability through mitigation of local transmission constraints. For these reasons, it is not surprising that electric utilities across the country are increasing their commitment to DSM. Regulators and electric utilities in states neighboring the Commonwealth are taking aggressive actions in the areas of energy efficiency and demand response, aligning financial incentives with cost-effective investments in DSM, and installing AMI to foster innovative rate designs and demand response programs:

– Governor Rendell of Pennsylvania recently unveiled an Energy Independence Strategy that will "push Pennsylvania into the top tier of states taking steps to cut consumer energy costs, and significantly expand the alternative fuel, clean energy, and conservation sectors." The first priority of the initiative is to cut energy costs for Pennsylvania consumers by $10 billion over the next 10 years through the use of smart metering strategies and increased household energy efficiency. In particular, "utilities would be required to prove they have aggressively pursued this strategy [smart metering] before getting approval to build new generating plants." Press Release, Office of Governor Rendell, *Governor Rendell unveils Energy Independence Strategy to Save Consumers $10 Billion over 10 years, Reduce Reliance on Foreign Fuels* (Feb., 2007) (on File with author).

– New Jersey passed Executive Order No. 54 to adopt proactive and ambitious goals for the reduction of greenhouse gas emissions. Key aspects of the order include the creation of "an

[11] US DOE and US EPA, *National Action Plan for Energy Efficiency* (July 2006).

[12] State of Delaware, Sustainable Energy Utility Task Force Briefing Book, available at http://www.seu-de.org/documents.html.

Energy Master Plan that will not only require 20 percent of the electricity used in the State to come from Class One renewable energy sources by the Year 2020 but that will reduce future electricity consumption by 20 percent from projected 2020 consumption levels, the adoption of comprehensive appliance and equipment energy efficiency standards, and the establishment in the Department of Treasury of the position of Director of Energy Savings that will coordinate efforts to reduce energy use by State agencies." State of New Jersey, Executive Order #54, Governor Corzine, (Feb. 13, 2007).

- Baltimore Gas & Electric (BGE) announced a major expansion of its DSM programs seeking a 10% reduction in residential sector energy use over 10 years, with potential energy savings in the commercial and industrial sectors expected to be even higher. In addition, BGE is seeking to double its penetration of demand response infrastructure from 220,000 customers to "about 425,000 devices"[13] in a four-year time period with the first year being a pilot phase to test technology and confirm the business case. Press Release, Baltimore Electric & Gas, BGE Co. Announces Smart Energy Savers Programs SM (Jan. 23, 2007).

- PEPCO has filed for an Advanced Metering Initiative in Delaware in advance of making such filings in its other jurisdictions. In addition, both PEPCO and BGE have advised state regulators that they plan on filing a decoupling plan that will better align the financial incentives for utility investments in DSM. (Feb. 2007)

Similar initiatives have recently been proposed in other jurisdictions with several recent examples being:

- In February 2007, Minnesota enacted bipartisan legislation calling for a change in the way utilities account for DSM and setting new standards for DSM accomplishments. This includes changing Minnesota's utility energy conservation program from a spending program to an energy savings program by requiring utilities to reduce their forecast retail sales by 1.5% annually. This would generate a reduction in forecast energy use of 7.5% by 2013.

- Under the terms of the proposed merger agreement governing the acquisition of TXU by an investor group led by Kohlberg Kravis Roberts & Co. and Texas Pacific Group, which was announced in February 2007, the newly privatized company will implement an aggressive demand reduction program through a $400 million investment in conservation and DSM activities over the next five years. The agreement also states that TXU will become a leader in providing electricity from renewable sources by more than doubling its purchase of wind power to more than 1,500 MW and promoting solar power through solar/photovoltaic rebates.

- In September 2006, Illinois amended its Public Utilities Act, to extend real-time pricing to all customers including residential. The two largest utilities in Illinois (ComEd and Ameren) have already taken steps to make these rates available and have hired implementation contractors to administer the residential real-time program applicable to all residential customers.

## 2.1 DSM Achievements

These recent developments build on more than two decades of experience with successful DSM programs, broaden and expand these efforts, and capture the energy savings and peak demand reduction

[13] Baltimore Gas & Electric Company, Demand Side Management (Energy Efficiency/Conservation and Demand Response Infrastructure) and Advanced Metering Infrastructure; Supplement to P.S.C. Md. E-6, filed with the Public Service Commission of Maryland on Jan. 23, 2007 (P.4).

that energy efficiency and demand response respectively offer. A review of DSM achievements to date across North America reveals that well-designed DSM programs can generate substantial, cost-effective energy savings and peak demand reduction. Exhibit 1 shows DSM results, spending (adjusted for revenue), and savings (adjusted for annual electricity sales) for selected states that have developed and implemented DSM programs similar to those proposed for the Commonwealth. These results are based on data filed with regulatory authorities and have undergone rigorous evaluation to ensure their validity. It is important to note that the results presented in Exhibit 1 are conservative values in that they do not include the impact of changes in building codes and appliance standards that occur separately from DSM program offerings, nor load reductions from demand response programs run by the Independent System Operators (ISOs) operating in New York (NYISO), New Jersey (PJM), and Maine (NE-ISO). These results are not included because they are produced separately from the utility DSM program results that are reported in the referenced regulatory filings; however, numerous studies have shown that utility DSM programs often drive new code development and appliance standards as well as participation in ISO demand response programs.

**Exhibit 1. Annual 2005 DSM Results for Selected States and Provinces[14]**

| State/Province | Year Started[15] | Annual Energy Savings (GWh) | Annual Peak Demand Reduction (MW) | DSM Spending as % of Revenue | GWh Savings as % of 2005 Sales | MW Savings as % of 2005 Peak Demand |
|---|---|---|---|---|---|---|
| California | 1974 | 2,597 | 495 | 1.6 | 1.4 | 1.1% |
| New York | 1996 | 1,369 | 288 | 1.1 | 0.9 | 0.7% |
| Texas | 2000 | 509 | 181 | 0.3 | 0.2 | 1.0% |
| British Columbia | 2002 | 449 | N/A | 2.7 | 0.9 | N/A |
| Minnesota[16] | 1980 | 441 | 160 | 1.9 | 0.8 | 1.4% |
| New Jersey | Early 1980s | 378 | 73 | 1.0 | 0.3 | 0.2% |
| Wisconsin | Mid 1980s | 221 | 38 | 0.8 | 0.3 | 0.2% |
| Vermont | 2000 | 57 | 9 | 2.4[17] | 1.0[18] | 0.5% |
| Manitoba Hydro | 1979 | 50 | 8 | 2.1 | 0.3 | 0.2% |
| Maine | 2002 | 29 | N/A | 0.6 | 0.2 | N/A |

[14] Regulatory filings as noted in Section 5, References

[15] Daniel Violette & Richard Sedano, Demand-Side Management: Determining Appropriate Spending Levels And Cost-Effectiveness Testing, Appendix A: Summaries By Jurisdiction, *Prepared for:* Canadian Association of Members of Public Utility Tribunals (CAMPUT) (Jan. 30, 2006).

[16] Based on results from Xcel Energy (MN), Minnesota Power, Otter Tail, and Interstate Power & Light whose sales represented over 90% of total 2005 electricity sales in Minnesota.

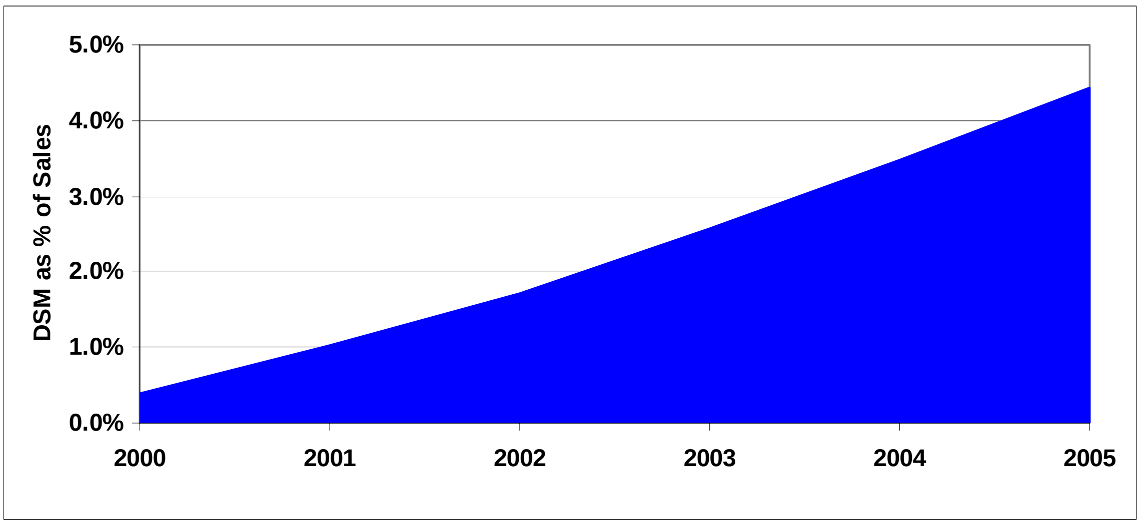
[17] Vermont has recently increased its spending on DSM as a percent of electric utility revenue to over three percent of revenues.

[18] This is an annual value for calendar year 2005; Exhibit 2 shows that cumulative energy savings from 2000 – 2005 as a percent of 2005 energy sales exceeds four percent.

*N/A = Do not target or track demand savings*

The results shown in Exhibit 1 are annual values that do not consider the cumulative (*i.e.*, year-to-year) impacts that accrue over the lifetimes of the conservation measures. For example, Vermont's 57 GWh of energy savings and 9 MW of peak demand reduction in 2005 translate into lifetime economic benefits resulting from the installed DSM measures of approximately $30 million with forecast net benefits of approximately $7 million after removing program administration and participant costs and leveraged third-party investments. These results accumulate and can contribute considerably to the supply/demand balance. As shown in Exhibit 2 below, energy savings in Vermont have steadily increased since 2000 and when considered cumulatively contributed nearly 5% of total Vermont electricity use in 2005 (the last year for which data are available).

**Exhibit 2. Efficiency Vermont Energy Savings as % of Total Vermont Electricity Use[19]**




## 2.2 DSM Program Administration and Funding

Different models have been developed for administering DSM programs. Referring back to the jurisdictions presented in Exhibit 1, the DSM programs in Maine, New York, Vermont, and Wisconsin are administered centrally by a state agency, and New Jersey is moving toward a similar model. The two Canadian provinces, Manitoba and British Columbia, are both served by one integrated electric utility that is a Crown Corporation and both provinces sell power to other provinces and/or the United States.

Similarly, there are a number of different approaches to DSM funding. In most areas, load management and demand response programs are recovered directly through rates. Efficiency programs are generally funded by customers' rate payments or through a system benefits charge (SBC). Some areas take a hybrid approach to efficiency funding, using both SBCs and rate charges, and one state, California, funds efficiency through both a SBC and through utility procurement budgets. Regardless of the specific approach taken, DSM efforts are ultimately funded by ratepayers.

---

[19] Efficiency Vermont 2005 Annual Report Summary, www.efficiencyvermont.com/stella/filelib/2005%20summary/revised.pdf., and Retail Sales of Electricity to Ultimate Customer by End-Use Sector by State, Energy Information Administration, DOE (Report released on Feb. 16, 2007) www.eia.doe.gov/cheaf/electricity/epm/table5-4a.html

When DSM is funded through rates, the charges are determined by regulators during rate cases and may appear as a per-unit surcharge on transmission or supply. This approach may be used in restructured markets (Illinois, Ontario, and Texas) as well as vertically-integrated, traditional markets (British Columbia, Iowa, Minnesota, and Washington). In Pennsylvania, the recently unveiled Energy Independence Strategy will be capitalized by a SBC on electric power consumers.[20]

SBCs are known by a variety of names (*e.g.*, a public goods charge in California; a public purpose charge in Oregon). In most cases, SBCs were instituted by statute during a state's restructuring process, with legislated funding levels. Some SBCs may have certain restrictions placed on them. In Oregon, for example, specific percentages of SBC funding must be spent on categories like schools and low-income customers, and in California, the SBC also funds renewable energy programs. The establishment of a SBC generally reflects legislative intent to preserve the continuity of DSM programs, which might otherwise be discontinued in a restructured market that allows for retail competition. One exception is Vermont, where the SBC was developed during restructuring discussions. In that case, the state chose to adopt the SBC funding mechanism while continuing the vertical integration of its utilities.

DSM costs can be expensed or capitalized. A number of jurisdictions use dual approaches to DSM funding. In California, meeting the state's DSM goals requires funding over and above the SBC, and the regulator has authorized funding of DSM through utilities' procurement budgets. Wisconsin maintains a SBC, and recovers some expenses through rates as well. Connecticut and Massachusetts have a SBC that funds electric DSM, while gas costs recovery occurs in rates. Oregon and Vermont use SBC funds for programs through statewide DSM implementers (Energy Trust of Oregon and Efficiency Vermont), and use rate recovery for DSM implemented by utilities.

Most jurisdictions expense their DSM costs. British Columbia is the only jurisdiction that capitalizes all expenses, although some states capitalize a portion of DSM expenses, such as demand response programs (New Jersey) or some amount of gas DSM (Vermont, Oregon). Utilities generally collect funds earmarked for DSM and hold them in deferral accounts, from which expenses are drawn as needed. Accounts are balanced periodically. In states where DSM is implemented by a statewide entity (New York, Oregon, Vermont), funds are dispensed to the program implementer or held in escrow until needed.

A variety of performance incentives are used to encourage DSM in 10 jurisdictions. Connecticut, Massachusetts, Minnesota, Ontario, and Vermont offer performance incentives for DSM. Four jurisdictions allow some sort of lost revenue recovery, either for all electric DSM (Connecticut), for gas DSM (Ontario, Massachusetts), or for a portion of electric DSM (Vermont). One state, California, has removed utilities' disincentives to delivering DSM by decoupling[21] profits from sales volumes for both gas and electric sectors. Oregon has decoupled profits from sales volumes for one gas utility. British Columbia reports the use of performance-based regulation, and Washington imposes fines on one utility for failing to meet savings targets.

---

[20] The SBC "…is proposed at $0.0005 per kWh of electricity used (five-hundredths-of-a-cent or .5 mills). This charge would cost the average residential customer 45 cents per month, the average commercial customer about $3.00 per month and the average industrial customer $74 per month. For large industrial customers, the fee would be capped at a maximum of $10,000 per year." Press Release, office of Governor Rendell, Governor Rendell Unveils Energy Independence Strategy to Save Customers $10 Billion over 10 Years, Reduce Reliance on Foreign Fuels. (Feb. 1, 2007) (on file with author).

[21] "Decoupling" is the term used to describe ways in which regulators have separated or "decoupled" a utility's earnings from sales volumes. This can be done by making earnings or profits a function of some secondary indicator such as the number of customers served rather than the volume of sales to those customers. So long as earnings or profits remain tied to sales volumes, power sellers — whether incumbent utilities or new entrant competitors — logically will resist energy efficiency and demand response programs.

A 1995 study reported that "current practice in DSM incentives varies widely"[22] and that remains true today. Connecticut, Massachusetts, Minnesota, and Ontario offer incentives to utilities to implement DSM programs. Vermont only provides incentives to the central agency. Both Connecticut and Massachusetts offer incentives for a range of achievement of goals, between 70 and 130% of the target for Connecticut and between 75 and 110% of the target for Massachusetts. Minnesota will provide incentives once 91% of the goal has been achieved, whereas Ontario provides a simple incentive of 5% of net of total resource cost (TRC)[23] benefits. In Massachusetts utility shareholders may earn up to 5% after tax return on the annual DSM expenditures, subject to the level of performance achieved by the programs, to ensure that various goals are met.

# 3. DSM POTENTIAL -- OPTIONS FOR THE COMMONWEALTH

This section presents conservative estimates of DSM (*i.e.*, energy efficiency and demand response) potential for the Commonwealth assuming programs similar to those discussed in Section 1 – Residential and Commercial High-Efficiency Lighting Programs, Residential HVAC Retrofit and Quality Installation Programs, Residential and Commercial New Construction Programs, Residential and Commercial High-Efficiency Appliance/Office Equipment Programs, and Commercial Data Center Efficiency Program – are implemented. The section also presents a discussion of the value of demand response activities in the greater PJM market of which the Commonwealth is a part. It is important to note that these estimates are based on secondary data sources as specified throughout this report. More robust estimates of DSM potential could be developed by a formal baseline market assessment project using industry standard baseline evaluation practices.[24]

## 3.1 DSM Assessment for the Commonwealth

As has been shown in numerous other jurisdictions across North America, well-designed DSM programs incorporating both energy efficiency and demand response strategies represent an effective and affordable option for meeting growing demand for electricity. Summit Blue estimated conservative energy savings and peak demand reduction for the Commonwealth using local energy use characteristics, demographics, and forecast peak demand, and assuming relatively basic DSM strategies comprising both energy efficiency gains and responsive reductions in demand. The following research approach was used to conduct the analysis:

- Review of existing information regarding the Commonwealth's customer base including:

---

[22] While authored a number of years ago, this report remains one of the most informative discussions of DSM incentive issues. *See* S. Stoft, et al., "DSM Shareholder Incentives: Recent Designs and Economic Theory", Lawrence Berkeley Laboratory, LBL-36580 (Jan. 1995).

[23] "Total Resource Cost (TRC)" is one of the primary measures of the cost-effectiveness of DSM programs. It measures the net costs of a DSM program by comparing total program costs (to both participating customers and the utility or competitive power supplier) with benefits, which include the marginal cost of avoided supply (energy and capacity), transmission, and distribution during the period of load reduction. *See* California Energy Commission, California Standard Practice– Economic Analysis of Demand-Side Programs and Projects 18-25 (Oct. 2001).

[24] Should the Commonwealth desire more detailed estimates of the likely benefits of demand-side management program offerings, we recommend that the State Corporation Commission conduct a formal baseline market assessment using industry standard baseline evaluation practices (primarily onsite building inspections and other primary data collection activities). This type of evaluation examines baseline market conditions to: 1) identify DSM technologies that have the highest potential of providing cost-effective peak demand reduction/shifting and/or energy use savings; and 2) quantify the likely impacts and costs associated with the developing DSM programs around the selected technologies.

- Customer counts and average annual energy consumption and peak demand by market segment
- Forecasts of future energy consumption and customer counts by market segment
- Previous DSM planning and potential studies

- Review of additional publicly-available secondary sources including:
  - The Database for Energy Efficiency Resources (DEER)[25]
  - U.S. DOE's Commercial Building Energy Consumption Survey (CBECS) and Residential Energy Consumption Survey (RECS) data
  - *The 2006 Buildings Energy Data Book*[26]
  - U.S. DOE's ENERGY STAR Program
  - Previous studies relevant to the current effort completed by Summit Blue in other regions as well as entities in other jurisdictions

- Development of baseline market profiles for residential and commercial customers. These baseline profiles include current and forecast numbers of customers by market segment, electricity use profiles by segment, and characterizations of existing energy-using equipment and DSM measure saturations

- Development of a spreadsheet model that estimates the aggregate energy savings and peak demand reduction potential associated with the DSM technologies deemed to be most applicable to the Commonwealth as well as the associated program implementation costs and overall cost-effectiveness assuming program designs similar to those discussed in Section 1

- A limited benchmarking assessment of other utilities' DSM programs to ensure that the DSM potential estimates developed for the Commonwealth were reasonable and appropriate.

As can be seen in Exhibit 3–Exhibit 5, DSM has the potential to generate substantial energy and monetary savings in the Commonwealth even if focused primarily on only standard types of DSM technologies, such as efficient lighting, HVAC, building envelope, water heating, and refrigeration measures as well as basic demand response strategies. Note that the energy impacts and costs presented in Exhibit 3 are cumulative annual values; that is, they represent the annual values for 2017, the final year of the ten-year planning horizon.

---

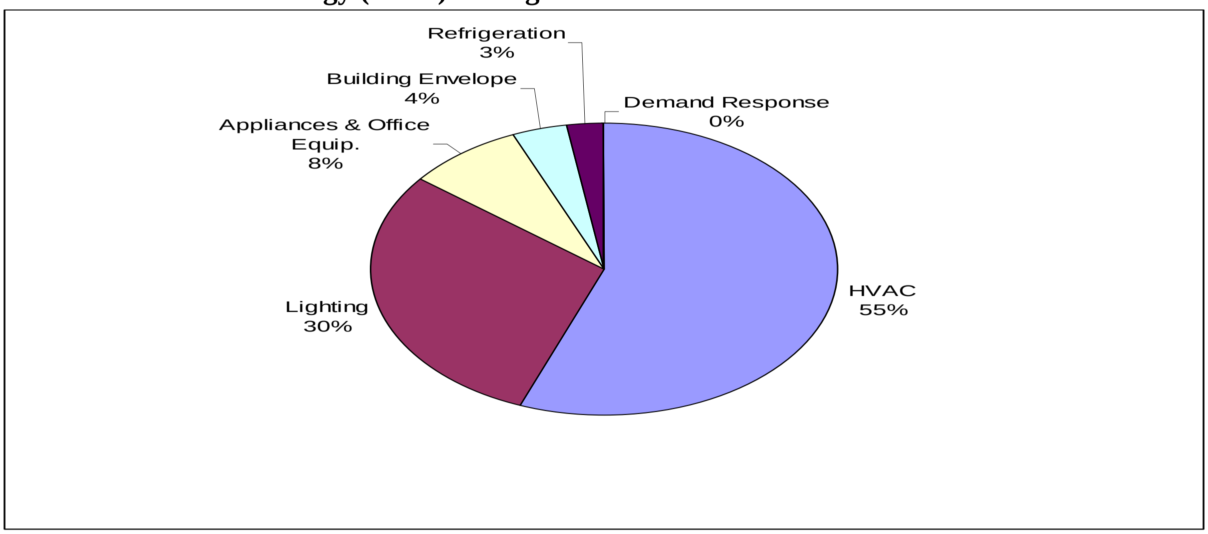
[25] The Database for Energy Efficiency Resources (DEER) has been jointly developed by the California Public Utilities Commission (CPUC) and the California Energy Commission, with support and input from the Investor-Owned Utilities, and other interested stakeholders. The DEER contains well documented information regarding the energy-savings potential, incremental costs, and effective useful lives for residential and non-residential energy efficiency measures.

[26] Prepared for the Buildings Technologies Program and Office of Planning, Budget, and Analysis, Energy Efficiency and Renewable Energy, U.S. Department of Energy by D&R International, September 2006.

**Exhibit 3. Estimated Cumulative Annual DSM Impacts -- Commonwealth of Virginia (2007-2017)[27]**

| DSM Measures | Residential | | | Commercial | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|
| | MW | GWh | Costs ($M) | MW | GWh | Costs ($M) | MW | GWh | Costs ($M) |
| *Energy Efficiency* | | | | | | | | | |
| • HVAC | 1,214 | 3,387 | 1,101 | 376 | 967 | 268 | 1,590 | 4,354 | 1,370 |
| • Lighting | 226 | 724 | 156 | 449 | 1,592 | 207 | 675 | 2,316 | 363 |
| • Appliances & Office Equip. | 115 | 347 | 45 | 93 | 284 | 65 | 208 | 631 | 110 |
| • Building Envelope | | | | 268 | 290 | 276 | 268 | 290 | 276 |
| • Refrigeration | | | | 32 | 201 | 10 | 32 | 201 | 10 |
| *Demand Response* | 1,273 | | 294 | 938 | | 159 | 2,216 | | 453 |
| **TOTAL** | **2,833** | **4,458** | **$1,596** | **2,156** | **3,334** | **$985** | **4,989** | **7,792** | **$2,581** |

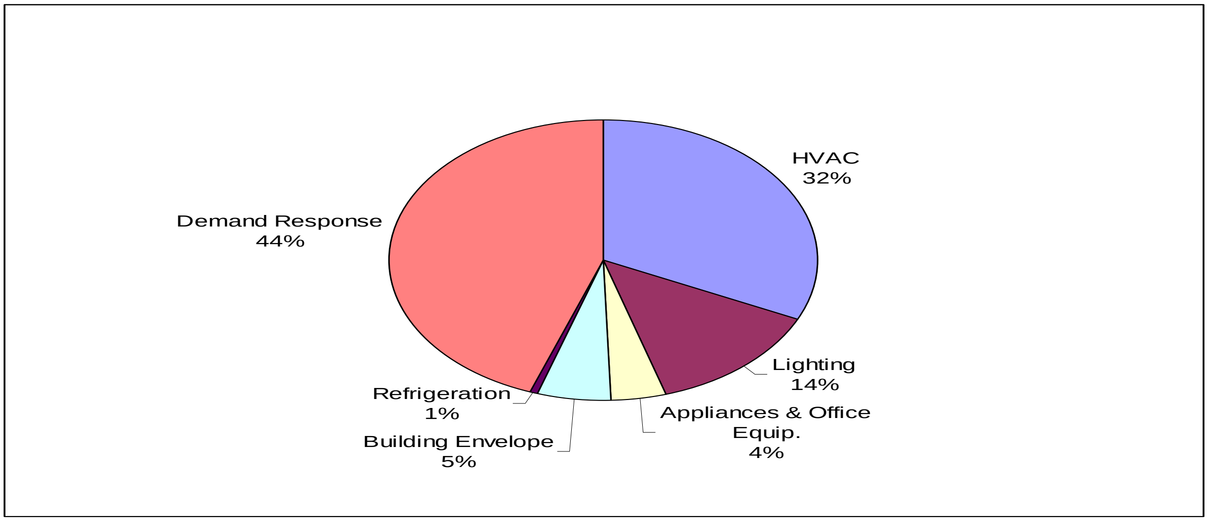
**Exhibit 4. Estimated Energy (GWh) Savings[28]**




[27] Source: Summit Blue Consulting analysis.

[28] *Id*

**Exhibit 5. Estimated Peak Demand (MW) Reduction** [29]




Results from the current assessment suggest that a well-designed portfolio of DSM program offerings including both energy efficiency and demand response strategies could cost effectively reduce the Commonwealth's peak demand by approximately 5,000 MW and its energy consumption forecasts by 7,800 GWh over a ten-year planning horizon. These estimates represent nearly 17% of the Commonwealth's projected 2007 peak demand and nearly 10% of the Commonwealth's projected 2007 energy use. The estimates are well within the ranges presented in evaluations of DSM potential in other jurisdictions, and are likely conservative in that only basic DSM strategies were considered. Additional energy savings and peak demand reductions could likely be achieved through DSM program offerings that overcome barriers to DSM program participation, including customers' lack of experience with high efficiency products, lack of information about available technologies and expected savings, and uncertainty about equipment reliability and performance characteristics.

## 3.2 Demand Response in Wholesale and Retail Markets

Based on a survey of electric utilities nationwide,[30] FERC recommended implementing activities to enable greater use of demand resources in regional transmission planning and operations procedures. The agency concluded that demand response has an important role to play in both wholesale and retail electricity markets. FERC estimated that the potential immediate reduction in peak electric demand that can be achieved from existing demand response resources is between three and seven percent of peak electric demand in most regions.[31] FERC Staff recommended that FERC: 1) explore how to better accommodate demand response in wholesale markets; 2) explore how to coordinate with utilities, state commissions and other interested parties on demand response in wholesale and retail markets; and 3) consider specific proposals for compatible regulatory approaches, including how to eliminate regulatory

---

[29] *Id.*

[30] Federal Energy Regulatory Commission, *Assessment of Demand Response and Advanced Metering*, Staff Report, Docket No. AD-06-2-000, August 2006.

[31] Maryland Public Service Commission, Ten-Year Plan of Electric Companies in Maryland (2006-2015) (P. 70)

barriers to improved participation in demand response, peak reduction, and critical peak pricing programs.[32]

A recent study done for the Mid-Atlantic Distributed Resources Initiative (MADRI) quantified the dollar benefits of demand response in PJM.[33] MADRI was established in 2004 by the public utility commissions of Delaware, the District of Columbia, Maryland, New Jersey and Pennsylvania, along with the U.S. Department of Energy (DOE), U.S. Environmental Protection Agency (EPA), Federal Energy Regulatory Commission (FERC), and the PJM Interconnection. The MADRI study examined the effects of reducing electricity use by three percent during the highest use hours for five utility areas—Baltimore Gas & Electric, Delmarva Power, PECO, PEPCO and Public Service Electric & Gas. The study quantified the economic benefits of demand response by comparing prices without and with demand response reduction during the 20 five-hour periods in 2005 with the highest electricity demand for each utility.

As shown in Exhibit 6, findings from the study were that a three percent reduction in peak demand would have generated a 5% – 8% reduction in wholesale electricity prices during the time periods in question. "In addition to reductions in electricity prices, demand response participants were estimated to save $9 million – $26 million for energy annually and another $73 million for capacity charges." Since Virginia is part of the PJM Interconnection, it is reasonable to assume that similar benefits would be realized in the Commonwealth if comparable demand response programs were put in place. Exhibit 6 summarizes the primary study conclusions.

[32] Maryland Public Service Commission, Ten-Year Plan of Electric Companies in Maryland (2006-2015) (P. 76)

[33] Quantifying Demand Response Benefits in PJM, Prepared by the Brattle Group (Jan. 29, 2007) www.energetics.com/madri/pdfs/BrattleGroupReport.pdf

**Exhibit 6. Annual Benefits from 3% Load Reduction in the Top 100 Hours in 5 MADRI Zones**[34]

| | Quantified Benefits in MADRI States | Quantified Benefits in Other PJM States | Un-quantified Benefits | Caveats |
|---|---|---|---|---|
| **Benefits to Non-Curtailed Load** | **$57–182 Million** (energy only)<br>(**5-8%** price reduction in curtailed hours) | **$7-20 Million** (energy only)<br>(**1-2%** price reduction in curtailed hours) | – Capacity price decrease due to reduced demand<br>– Enhanced competitiveness in energy and capacity markets<br>– Real-time vs. day-ahead<br>– Value of reduced volatility<br>– Insurance against extreme events<br>– Avoided T&D costs | – Probably significantly offset in long-run equilibrium as capacity and capacity prices adjust; "long-run" might not be so long<br>– Load shifting and demand elasticity offset some benefit in short-term |
| **Energy Benefits to Curtailed Load** | **$9-26 Million**<br>(**$85-234/MWh** price reduction in curtailed hours) | n/a | n/a | – Based on simplifying assumptions regarding the value of load that is curtailed |
| **Capacity Benefits to Curtailed Load** | **$73 Million**<br>(long term reduction in capacity needed to meet reserve adequacy requirements)<br>(assuming **$58/kW-Yr**) | n/a | n/a | – Based on generic long-run cost of avoided capacity<br>– Ignores cost of equipment and demand response program administration |
| **Total Annual Benefits** | **$138-281 Million** | **$7-20 Million** | – Additional benefits to non-curtailed load could be large | – Includes both the solid economic efficiency gains to curtailed load and the less robust benefits to non-curtailed loads |

[34] Quantifying Demand Response Benefits in PJM, Prepared by the Brattle Group (Jan. 29, 2007) www.energetics.com/madri/pdfs/BrattleGroupReport.pdf

# 4. CONCLUSION AND ACTION AGENDA

Demand for electricity is increasing throughout the Commonwealth due to population growth, increasing per capita energy consumption, and other factors. In order to meet current and anticipated energy needs, the Commonwealth should consider both supply- and demand-side solutions. The potential for cost-effective energy savings and peak demand reduction delivered through well-designed DSM programs using proven energy efficiency and demand response technologies and strategies is substantial within the Commonwealth and worthy of consideration by system planners, regulators, and lawmakers as they deliberate the optimal resource portfolio to satisfy future demand.

## 4.1 Action Agenda

State legislatures, both within the PJM Interconnection and across North America (*e.g.*, Pennsylvania, New Jersey, Minnesota, Illinois), have taken action in 2007 by setting DSM targets and promoting AMI and innovative time-differentiated rates that are much more ambitious than current proposals in the Commonwealth. In order to avoid falling further behind its peers, the Commonwealth should act now to apply key lessons learned and adopt DSM best practices pioneered in other jurisdictions.[35] Such a portfolio could rely on DSM technologies and strategies to achieve significant energy savings and peak demand reduction over a relatively short timeframe (*i.e.*, within three years). In addition, such a portfolio would provide additional benefits by protecting ratepayers against future increases in energy costs, enhancing overall system reliability, providing customers the ability to manage their energy costs, and maintaining a competitive regional economy as businesses increasingly look for locations with robust, diverse energy supplies from demand-side and supply-side resources.

This is a critical time for the Commonwealth as large-scale electric infrastructure investments are being considered throughout the region. Investments not made on the demand-side now, may be lost forever as growing energy needs are met through higher cost supply and transmission investments. The Commonwealth needs to use the powers of the State Corporation Commission or of the State Legislature to:

- Set DSM targets and provide incentives for demand response programs, innovative rates, and advanced metering technology.

- Set targets for 1% reductions per year in forecast energy consumption and peak demand growth, goals that are well within reach of Dominion Virginia Power, the largest utility in the Commonwealth.

- Address financial disincentives for utility investment in DSM. This generally includes cost recovery of investments in DSM and related infrastructure, treatment of lost margins on fixed costs (not total lost revenues) stemming from reduced sales due to DSM,[36,37] and allowing the

---

[35] Numerous sources exist compiling DSM best practices including the US DOE and US EPA. *See* EPA, et al., *National Action Plan for Energy Efficiency*, (July 2006); EPA, *Clean Energy-Environment Guide to Action: Policies, Best Practices, and Action Steps for States*, (April 2006); and California Best Practices Project Advisory Committee, *National Energy Efficiency Best Practices Study*, (Dec. 2004), www.eebestpractices.com/pdf/BP_Summary.pdf.

[36] A common mistake is to assume that DSM increases energy costs. DSM does not increase energy costs. Even if DSM were to reduce sales so dramatically that fixed costs were not recovered by the utility and the price per kWh were to increase, then the

utility to earn a profit on DSM investments. This will put DSM investments on a par with supply-side generation and transmission investments, and promote the adoption of the most cost-effective resource portfolio.

Now is the time for the Commonwealth of Virginia to address DSM, in terms of both energy efficiency and demand response opportunities, and seize the potential benefits of these important resources. Doing so will protect ratepayers from higher energy prices in the future, provide system reliability benefits, achieve improvements in the quality of the environment, and maintain Virginia's competitive economic standing.

# 5. REFERENCES


Dan York and Martin Kushler, American Council for an Energy-Efficient Economy, *ACEEE 3rd National Scoreboard on Utility and Public Benefits Energy Efficiency Programs: A National Review and Update of State-Level Activity*; Report #U054, (Oct. 2005).

*Application of Virginia Electric and Power Company D/B/A Dominion Virginia Power For A Certificate Of Public Convenience And Necessity For Facilities In Stafford County*: Commonwealth of Virginia State Corporation Commission, Case No. Pue-2006-00091, (Sep. 25, 2006).

BC Hydro *Resource Energy Acquisition Plan 2006*: Revenue Requirements F2007/F2008, Appendix P Energy Efficiency Plan

*BC Hydro Quick Facts* for the year ended March 31, 2006.

Bill Brooks, Frontier Associates. *Overview of Texas' Energy Efficiency Programs*, Presentation delivered Oct. 11, 2006.

The Brattle Group, *Quantifying Demand Response Benefits in PJM*. Prepared for PJM Interconnection, LLC and the Mid-Atlantic Distributed Resources Initiative, (Jan. 29, 2007).

Commonwealth of Virginia State Corporation Commission (SCC) Report Status Report: *The Development of a Competitive Retail Market for Electric Generation within the Commonwealth of Virginia* Pursuant to Section 56-596 of the Code of Virginia September 1, 2006.

Dominion News Releases

- *Dominion Virginia Power Prefers Existing Corridor Route for Northern Virginia 500kV Transmission Line,* February 13, 2007.

- *Dominion Meets Record Winter Peak Demand for Electricity from Customers,* February 7, 2007.

- *Dominion Expected to Have Highest Growth Rate in PJM for Peak Electricity Demand,* Jan. 16, 2007.


---

fewer kWh used by customers would result in a reduction in their overall energy costs more than compensating for any potential increase in the price per kWh.

[37] This can be accomplished by compensating the utility directly for lost revenues based on DSM program accomplishments, or a method known as decoupling can be used which guarantees the utility that it recovers margins on fixed cost and capital investments.

- *Dominion Virginia Power Seeks Bids for Peaking Capacity Or Demand-Side Programs In Northern Virginia,*. November 17, 2006.

- *Dominion Virginia Power's Customers Projected to Save up to $871 Million during Transition to Customer Choice*, November 19, 2002.

- *Senate Bill 1416 and House Bill 3068* (Electricity Reregulation in Virginia H.B. 3068 and S.B. 1416), Dominion web page, accessed Feb. 19, 2007. www.dom.com/about/companies/vapower/rereg.jsp

Efficiency Maine: *Saving Energy for Maine, 2005 Annual Report*.

Efficiency Vermont: *2005 Annual Portrait Report Complete* and *2005 Annual Report Summary* and Annual Reports for the years 2000 – 2004.

Energy Information Administration, US Department of Energy http://www.eia.doe.gov/emeu/reps/enduse/er01_so-atl.html

Energy Information Administration, US Department of Energy *Electric Power Annual 2005 - State Data Tables*, http://www.eia.doe.gov/cneaf/electricity/epa/epa_sprdshts.html

Energy Information Administration (EIA) *Form EIA-861 Final Data File for 2005* http://www.eia.doe.gov/cneaf/electricity/page/eia861.html

Federal Energy Regulatory Commission, *Assessment of Demand Response and Advanced Metering*, Staff Report, Docket No. AD-06-2-000, August 2006.

Hall, Nick, *et al.*, Final Reports *The California 2006-2008 Energy Efficiency Portfolio: A Review of Early IOU Planning Documents*, July 1, 2005, www.energy.ca.gov.

Summary, as passed, *HB 3068,* http://leg1.state.va.us/cgi-bin/legp504.exe?ses=071&typ=bil&val=hb3068

Interstate Power & Light Co. *2004-2005 Minnesota Electric & Gas Conservation Improvement Program, 2005 Electric & Gas Status Report*.

Manitoba Hydro-Electric Board *54th Annual Report for the Year Ended March 31, 2005.*

Manitoba Hydro *Power Smart Annual Review 04-05*.

Maryland Energy Administration *2004 Annual Report*, pp. 1-10. http://www.energy.state.md.us/about/reports/Annual_Report_2004.pdf

Maryland Public Service Commission, Ten-year Plan (2006 – 2015), Prepared for the Maryland Department of Natural Resources in compliance with Section 7-201 of the Maryland Public Utility Companies Article, December 2006.

Merrill, Hyde, "Proposed Mt Storm-Meadow Brook-Loudoun 500-kV Line: Critical Analysis and Alternatives," confidential internal work product prepared for Bracewell & Giuliani, LLP, March 2007.

Minnesota Power Company, *2005 Conservation Improvement Program Status Report*.

New Jersey's *Clean Energy Program Report* submitted to the New Jersey Board of Public Utilities, March 28, 2006, for Reporting Period: Year-to-Date through Fourth Quarter 2005 (January 1, 2005 through December 31, 2005).

New Jersey *Clean Energy Program 2005 Annual Report*.

***New York Energy $mart***$^{SM}$ *Program Evaluation and Status Report*. Report to the System Benefits Charge Advisory Group. Final Report – Summit Blue Consulting, May 2006.

Otter Tail Power Company, *Status Report, 2005 CIP Activities*, April 1, 2006, p. 4-28.

Pacific Gas and Electric Company, *2006 Annual Earnings Assessment Proceeding Volume III: Energy Efficiency Programs Annual Report for 2005 and Energy Efficiency Programs Annual Report for 2005 Technical Appendix*.

*Personal Correspondence* from Sara Van de Grift & Matt Kok, Wisconsin Energy Conservation Corporation.

*Personal correspondence* from Gordon Dunn, Iowa Utilities Board (for MidAmerican Energy Corporation).

PJM Interconnection *Load Forecast Report,* January 2007.

Rose, Kenneth "*A Greener Energy Pasture for Virginia's Economy,*" Presentation at the Virginia Military Institute, October 17, 2006.

San Diego Gas & Electric (a Sempra Company) *Energy Efficiency Programs Annual Summary and Technical Appendix, 2005 Results*, May 2006.

San Diego Gas & Electric (a Sempra Company) *Low Income Energy Efficiency Programs Annual Summary and Technical Appendix, 2005 Results*, May 2006.

Summary, as passed, *SB 1416,* http://leg1.state.va.us/cgi-bin/legp504.exe?ses=071&typ=bil&val=sb1416

*SCC Finds Virginia Coal-Fired Power Plant in the Public Interest; Gives Assurances on Construction Costs,* Virginia State Corporation Commission News Release, November 1, 2006.

Southern California Edison *2006 Energy Efficiency Annual Report: Summary Report 2005 Results & Technical Appendix 2005 Results*, May 2006.

*Staff Investigation on the Restructuring of the Electric Industry*. 2005-01-07 SCC website accessed January 25, 2007, 20VAC5-306-40, Conclusion.

US Census Bureau, *2005 Interim Projections of the Total Population for the United States and States: April 1 2000 to July 1, 2030,* Internet Release Date, April 21, 2005.

US DOE and US EPA, *National Action Plan for Energy Efficiency*, (July 2006).

Daniel Violette & Richard Sedano, *Demand-Side Management: Determining Appropriate Spending Levels and Cost-Effectiveness Testing, Appendix A: Summaries By Jurisdiction*, Prepared for Canadian Association of Members of Public Utility Tribunals (CAMPUT), January 30, 2006.

Weldon Cooper Center, University of Virginia, Press Release, *Northern Virginia Growth Leads State,* Jan. 25, 2006.

Wisconsin Energy Conservation Corporation, *Business Programs Annual Report, 1 July 2005 to 30 June 2006.*

Xcel Energy Corporation, *2005 Status Report and Associated Compliance Filings, Minnesota Natural Gas and Electric Conservation Improvement Program*, April 3, 2006, p. 5.

York, D. and Kushler, M. *Exploring the Relationship between Demand Response and Energy Efficiency: A Review of Experience and Discussion of Key Issues*. ACEEE Report U052, (March 2005).