

2009 SUMMARY

In its most recent assessment of infrastructure needs, the American Society of Civil Engineers graded the nation’s electrical infrastructure as a “D+” based on deficiencies in existing generation and distribution capacities. The 2009 national report cites difficulties in siting and permitting new generation and transmission systems; congestion on the existing distribution grid, and inability to conduct proper maintenance due to overloaded systems as reasons for the poor grade.

The report notes that while national electrical demand grew by 25% since 1990, transmission capacity has decreased by 30%, projections are that \$1.5-2 trillion dollars are needed to upgrade the nation’s transmission and distribution network over the next 20 years, (2030 timeframe). **Our high-tech society requires reliable, resilient power supplies, currently outages and grid stability problems are estimated to cost our nation \$25-180 billion dollars annually.** Clearly substantial investments are required to sustain our vital electrical networks and support our technology driven economy.

Virginia’s rising energy demand follows national trends. Generating capacity grew by 470 megawatts (MW) per year or 2.5% during the 1990s, while from 2000 to 2007, capacity grew by 295 MW per year (1.3%). At this rate, Virginia will need nearly 3,000 MW of new capacity by 2017 just to keep up with increases in demand. This does not include the need to upgrade and replace existing power plants one of which dates back 65 years. According to Virginia Department of Environmental Quality (DEQ) statistics, the average age of existing power plants is 20 years old. Based on a per megawatt basis, Virginia’s generating capacity is 30 years old, indicating major renovations and replacement of our existing power plants will likely be required in the next 20 years. Concerns about the use of coal and greenhouse gas emissions will further impact this capacity and need for upgrades to incorporate clean coal technologies on these power plants.

Reg Num	Plant Name	Region	Facility County Description	Service Type	Unit Type	Capacity Megawatts	Approx. Year Plant Will Begin Operation	Operating Status
73xxx	NOVA Power LLC	NRO	Manassas	Baseload	Turbine	600	2012	Planned
52154	ODEC Cypress Creek Power Station	PRO	Surry County	Baseload	Ext. Comb.	1500	2016	Planned
32004	Dominion (VA Electric & Power Co.)	BRRO	Buckingham County	Baseload	Turbine	830	2011	Under Construction
11526	Dominion (VA Electric & Power Co.)	SWRO	Wise County	Baseload	Ext. Comb.	580	2012	Under Construction
81391	Dominion (VA Electric & Power Co.)	VRO	Warren County	Baseload	Turbine	580	-	Planned

Electricity Generating Facilities Planned in Virginia, 2009 – (Source: Virginia DEQ, 2009)

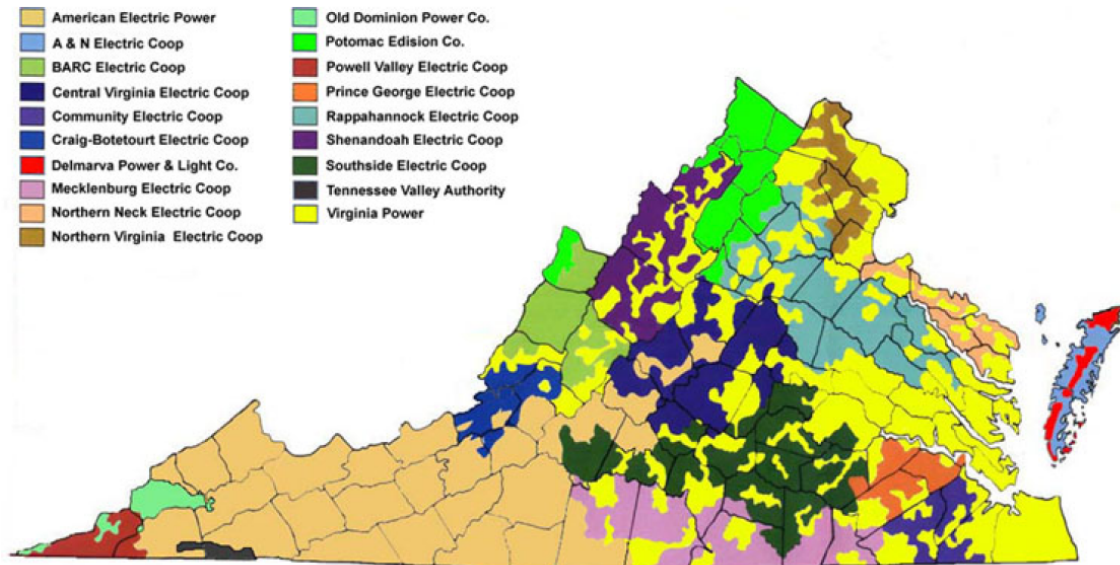
In 2007 Virginia ranked as the 14th highest electrical energy user in the nation. **Although only 62% of Virginia’s generating capacity is coal and nuclear powered, over 80% of Virginia’s electrical energy is produced by coal and nuclear baseline sources.** Approximately half of the coal used in the state is obtained from Virginia mines; the majority of remaining coal is obtained from West Virginia and Kentucky. Increasing global concerns about the impact of coal use, and local concerns about the environmental impact to land, water and air resources is expected to significantly impact Virginia’s ability to meet future energy demands with this fuel source.

Investment in providing alternative energy sources to consumers is critical to sustaining Virginia’s future demands. With 80 percent of our electricity generated in-state, loss of in-state generating capacity will require significant transmission grid improvements to enable cost-effective delivery to consumers. **Funding of these alternative sources and grid improvements is projected to increase electrical rates by 5 to 7 percent annually, representing a 50 to 70 percent increase in electrical power rates over the next 10 years.** Rates have already risen 15% from 1997 to 2007. The state has set a goal of obtaining 15% of Virginia’s electrical sources from renewable sources by 2022, currently renewable sources provide less than 4% of Virginia’s energy needs. Use of renewable sources and clean coal technology will further accelerate rate increases as these technologies are not as cost-effective as conventional power production methods with some reports estimating clean coal technology increases production costs by 60-80%.

INTRODUCTION AND BACKGROUND

Energy production, transmission and use in Virginia is regulated by the State Corporation Commission (SCC) and the Virginia Department of Mines, Minerals and Energy (DMME). The SCC is responsible for regulatory oversight of electrical production, distribution and rate setting in accordance with federal and state statutes. The DMME primarily is tasked with mineral resource management and state energy conservation.

There are five primary investor owned utilities, thirteen electric cooperatives, and one government corporation (The TVA) providing power in Virginia. The geographic distribution of these systems is shown in the figure below, (American Electric Power now operates as Appalachian Power in Virginia):



Distribution of Electrical Utility Service Areas in Virginia – (Source: VETP/VCCER/SCC, 1999)

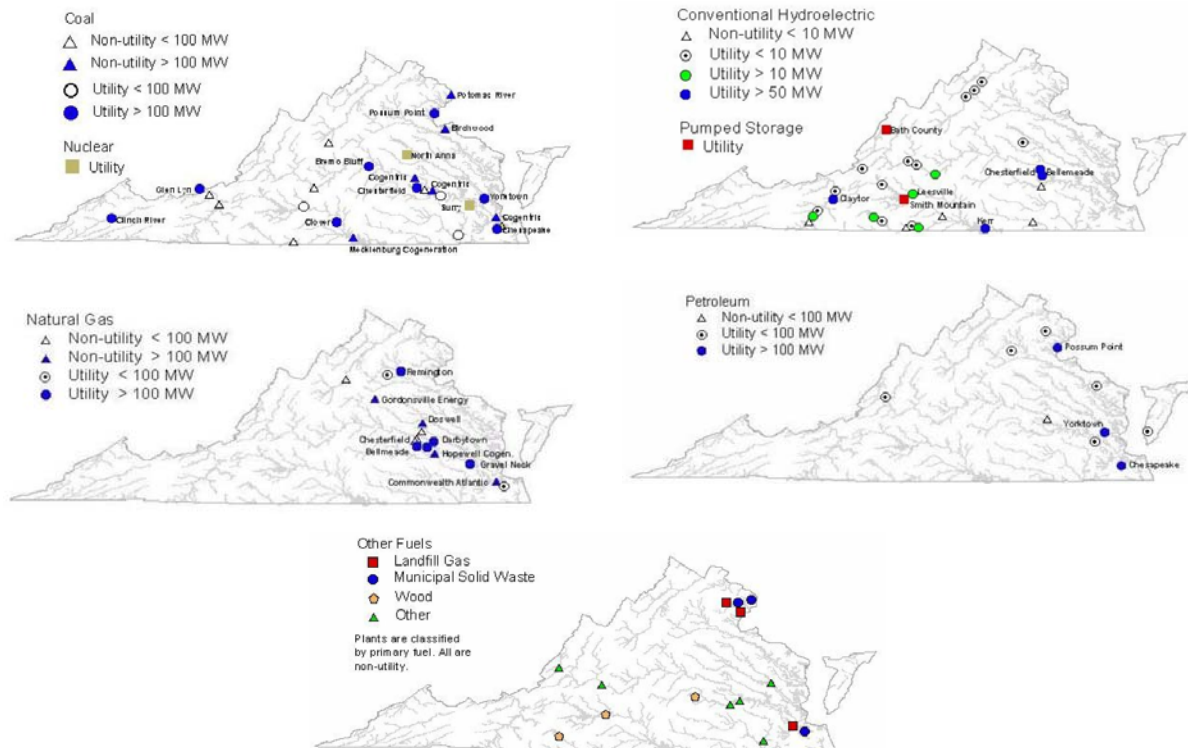
These providers enable Virginia to have the 17th most cost-effective electrical rates in the nation, 7.12 cents/kWhr according average state electrical rates reported in 2007. Revised rankings are due in January, 2010 but preliminary data shows costs rose to an average of 7.93 and 9.02 cents/kWhr in 2008 and 2009 respectively. **This indicates an average rate increase of 27% over this two year period. In evaluating potential application of more stringent demand side management protocols on electrical**

utilities, in 2009 the SCC noted that average residential customers consuming 1,000 kWhrs/month experienced rate increases between 22.84 percent to 60.52 percent in the period from January 2006 and August 2009. Although these new protocols would result in significant reductions in energy use, the SCC decide the economic impacts of such regulations were not cost effective at this time.

CONDITION AND ADEQUACY

Virginia’s population in 2020 and 2030 is estimated to grow to 8.92 million and 9.83 million residents respectively, a 21% increase over the 2009 population of 7.77 million. Even with improved conservation efforts, this increase in population will create higher electrical demands. Recognizing this in September of 2007 Governor Kaine released the Virginia Energy Plan (VEP), which set goals to reduce greenhouse gas (GHG) emissions by 30%; increase in-state energy production by 20% and reduce the rate of demand growth by 40%, using 2006 as a baseline year.

The 2007 VEP acknowledges that Virginia is poised to violate electric reliability standards as early as 2011 and notes the state will need nearly 5,100 MW of additional electrical supplies in the next 10 years if per capita consumption continues to trend with 2007 rates. Even with 10% increases in statewide efficiencies and conservation, Virginia will still need to add nearly 2,400 megawatts of capacity within the next 10 years. This additional capacity will also require significant transmission and distribution improvements to reach consumers in Northern Virginia, Hampton Roads, and Central Virginia. The following figures from the *Virginia Energy Patterns and Trends* (VEPT) website maintained by the Virginia Center for Coal and Energy Research (VCCER) at Virginia Tech which show the location and generating capacity of various power plants by fuel source in Virginia:



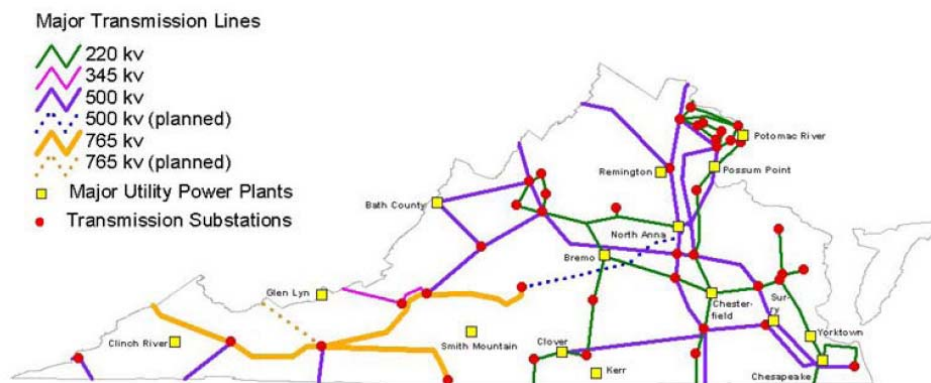
Power Generating Plants in Virginia by Fuel Type – (Source: VETP/VCCER/EIA, 2009)

As of 2009, the SCC has approved 2,352 MW of gas-fired generation for construction and has applications for nearly 7,000 MW of additional natural gas fired generation on file for approval. These “peaking plants” are designed to run intermittently during periods of high electrical demand. Dominion Virginia Power (DVP) is nearly 50% complete on construction of the 585 MW *Virginia City Hybrid Energy Center*, a clean coal baseline power project in Wise County, Virginia (projected cost of \$1.8B). This project is scheduled to go on line in 2012. DVP has also filed an application to install an additional 1,520 MW nuclear unit at the North Anna Power Station, (cost undetermined at this time, but based on industry construction cost range of \$3,000-4,000/kW, costs are expected to be in the range of \$4-5B for the North Anna improvements). The earliest this additional reactor will be on-line is in 2017, given the lengthy review process for permitting new nuclear power units in the U.S.

Nuclear power presents some significant advantages over other generating sources as green house gas emissions are negligible and generating costs are low, offsetting the higher costs of initial construction. Production data for the North Anna facility indicates electrical production cost (i.e. fuel and facility O&M expenses) was 1.38 cents/kWh in 2006, (which was approximately 50% of the average production cost at conventional fossil fuel plants; 35% of the cost of production with renewable energy sources; and 20% of the cost of natural gas fired production that year). **Nuclear power is also beneficial in that it provides stable, base load generating capacity and is not subject to weather patterns or crop yields which can significantly impact the renewable market and reduces our dependence on fossil fuels.**

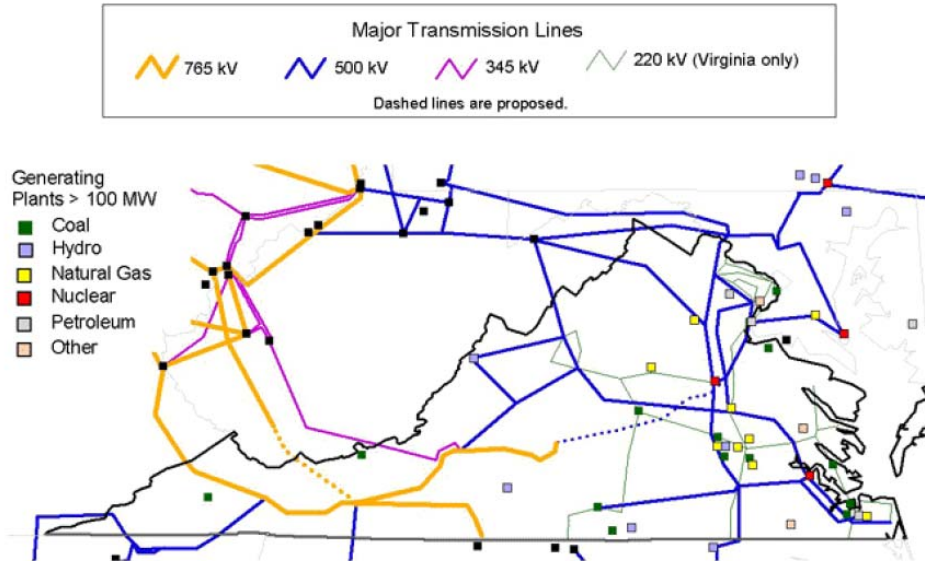
Currently, Dominion Virginia Power (DVP) has 132 major transmission projects programmed in Virginia between 2008 and 2018 to improve grid reliability and capacity. **Transmission and distribution reliability came to the forefront in 2004 when Hurricane Isabel disrupted power to over 6.5 million Virginians.** This disruption was the worst in Virginia’s history and sponsored federal authorities to require improved vegetation management along power line right-of-ways. The SCC took this even further, and conducted a study to determine the cost of locating existing power lines underground to protect them from damage. At the time it was estimated this approach would cost some \$80B, and was therefore determined to be impractical. The SCC did however mandate improved management of network poles and transmission towers to reduce impacts to these critical assets during adverse weather events.

The backbone of Virginia’s transmission system are the 765 kV transmission lines in the western-Virginia service area of American Electric Power and the 500 kV and smaller transmission lines across the state as shown on the figure below, (from the VEPT website). Bulk power is moved through the state on these large transmission lines. An intricate network of smaller, lower-voltage lines distributes the power from these larger power lines to power consumers in urban and rural areas.



Virginia In-State Electrical Transmission Lines – (Source: VETP/VCCER, 2009)

Virginia's electrical network is an integral component of the regional transmission system, which serves a number of important functions. On average about 80% of the electrical energy used by Virginia consumers was generated in-state, while about 20% was imported over the interstate transmission network shown below:



Regional Electrical Transmission Lines and Generating Plants – (Source: VETP/VCCER, 2009)

This regional transmission network helps keep Virginia's electric rates low as these lines permit connection to low-cost hydropower generation on the Ohio and Kanawha Rivers and inexpensive coal generation facilities in West Virginia and Kentucky. Both Appalachian Power and Dominion Virginia Power, operate coal-fired plants in these states that periodically supply power to Virginia consumers.

This regional connection enables Virginia utilities to participate in wholesale power markets, fostering access to cost effective supplies and allowing in-state generators to sell excess power to customers outside the Commonwealth. This interconnection also enables transmission through Virginia to power demands in the Mid-Atlantic region, providing enhanced reliability to our neighboring states. This capability generates revenues for power companies in Virginia increasing the economic benefit of these systems to Virginia.

Most importantly, the interconnectivity of the transmission network provides some insurance against power disruptions from state to state and within Virginia. This duality of service is a critical aspect of electrical reliability and most localities in Virginia are supplied with power by several transmission lines.

Managing these interconnections and improving delivery efficiencies is a key component of recent "smart grid" initiatives. These initiatives are focused on minimizing transmission losses between generating capacity and end users, and ensuring least expensive sources are utilized to supply consumers. Full implementation of this technology in Virginia is currently limited by available funding although DVP is poised to heavily invest in this technology to reduce the need to build additional generating capacity and improve transmission line reliability.

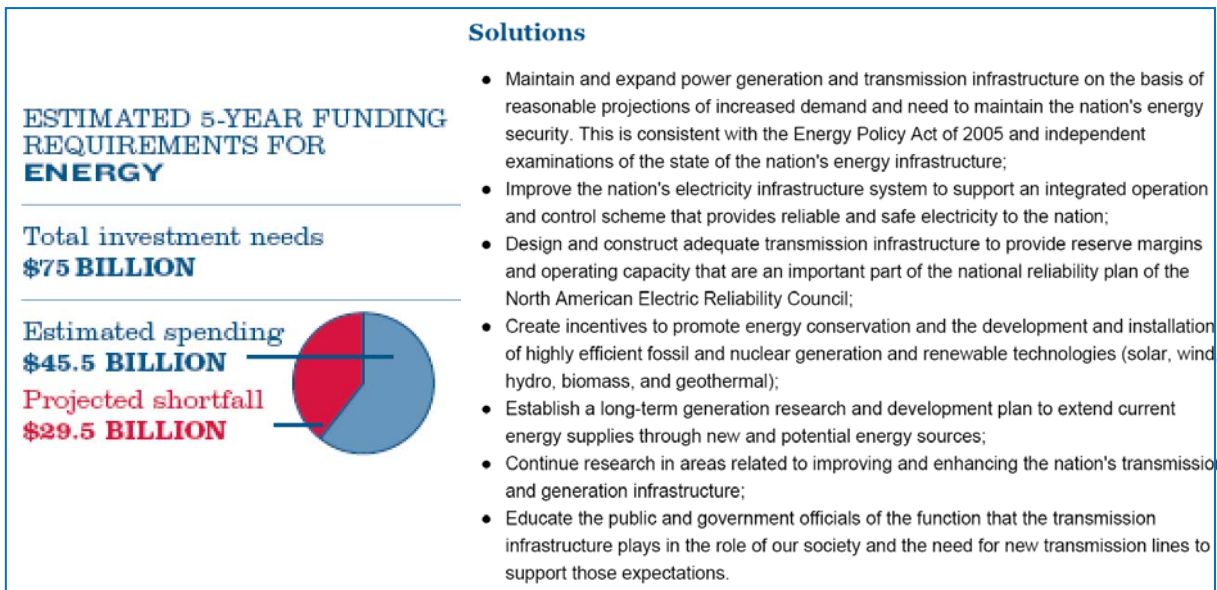
INVESTMENT NEEDS AND FUNDING DEDICATED

As previously mentioned, electrical rates in Virginia have been rising precipitously over the past ten years, with a 27% increase in the two year period between 2007 and 2009 alone. The SCC continues to review utility company costs and allows rate adjustments per state regulations.

This includes two new surcharges effective in 2010 to enable DVP to recover costs associated with the construction of the new coal plant in Wise County and the natural gas plant in Buckingham County. These new surcharges are expected to raise \$73 million for the Buckingham project and \$174 million for the Wise County plant in 2010. Additional rate changes for increased fuel costs and other operating expenses are routinely filed with the SCC to reflect changes in operating expenses. These are separate from utilities base rates which are also subject to change on an annual basis. DVP currently has a request in to the SCC for a baseline rate adjustment which will be reviewed in early 2010.

It is apparent that utility companies in Virginia are under immense pressure to deliver reliable, clean, sustainable energy to consumers. The cost of providing increased capacity has significant rate effects and further efforts to promote energy efficiency and conservation are critical to deferring the need for additional power plants.

The ASCE National Report Card has identified similar concerns at a nationwide level with Energy Infrastructure, identifying the requirement for sustained funding as a major deficiency nationwide as shown below. **The national report estimates \$75 billion in capital improvements will be needed to maintain the current level of service of our electrical grid over the next 5 years.**



ASCE 2009 National Infrastructure Report Card Needs – Energy Category (Source: 2009 ASCE IRC)

BASIS OF GRADE

Assigning an overall grade to Virginia's energy infrastructure is based on evaluation of the resiliency, reliability, current and future capacity, sustainability and economic needs of Virginia's utilities:

Rating of Virginia's Energy Infrastructure			
Category	Percent of Systems Meeting Goals	Percent Compliance Desired	Rating
Resiliency	75%	100%	Fair (C+)
Reliability	75%	100%	Fair (C+)
Current and Future Capacity	25%	90%	Poor (D+)
Economic Needs and Sustainability	50%	80%	Poor (D+)

Virginians enjoy affordable electrical supplies which promote a healthy business climate and high quality of life. Unfortunately these systems are aging and investments are barely sufficient to keep up with growing demands, even with mandatory conservation goals under consideration.

Recapitalization of our existing assets is critical if we are to sustain Virginia's growth and protect our high quality resources. With emerging pressures of climate change and air pollution major concerns at the state, national and global level, we need to shift to alternate energy sources that are safe, reliable and cost effective.

These challenges limit the performance of Virginia's Energy infrastructure and we have therefore assigned a "C" average for this 2009 Virginia Infrastructure Report Card. This compares favorably with the national ranking of Energy infrastructure which is ranked as a "D+" as described below and reflects relatively low electrical rates and sustainable power resources in Virginia.

Energy Progress has been made in grid reinforcement since 2005 and substantial investment in generation, transmission, and distribution is expected over the next two decades. Demand for electricity has grown by 25% since 1990. Public and government opposition and difficulty in the permitting processes are restricting much needed modernization. Projected electric utility investment needs could be as much as \$1.5 trillion by 2030.



ASCE 2009 National Infrastructure Report Card Summary – Energy Category (Source: 2009 ASCE IRC)

CONCLUSIONS, RECOMMENDATIONS AND POLICY OPTIONS

Virginia relies heavily on its electrical system for basic needs such as heating homes (50% of residences in Virginia are electrically heated), and reliable and affordable electrical supplies stimulate economic growth and prosperity in the Commonwealth. We must take action now to preserve this competitive advantage and maximize the performance of our existing assets while we build the infrastructure to sustain another 50 years of growth.

Some key recommendations to assist Virginia in achieving this goal include:

- **Fund energy conservation and efficiency objectives outlined in the 2007 Virginia Energy Plan**
- **Invest in energy efficiency improvements at state and institutional buildings that will pay for themselves in less than fifteen years**
- **Develop revolving loan fund for localities to access low interest loans and grants to implement facility improvements that reduce energy use in accordance with federal criteria. Enable localities to leverage federal grant monies with this revolving loan fund**
- **Adopt sustainable statewide building code with recommended square footages based on occupancies to limit building footprints**
- **Develop residential energy incentives to promote development of smaller and more efficient homes**
- **Assist utility providers with use of E-911 information to coordinate severe weather preparations and response including shared access to state and federal geospatial data**
- **Utilize the Division of Forestry and USDA Forest Service resources to provide public outreach and education on the importance of tree management around utility lines**
- **Promote and explore on-shore and offshore wind power opportunities, streamline permitting as feasible**
- **Explore, promote and develop Virginia's on shore and off shore natural gas resources**
- **Monitor science of carbon sequestration and potential effects on water and land resources to confirm viability of sequestration efforts**

REFERENCES AND CREDITS

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The Virginia Department of Mines Minerals and Energy: <http://www.dmme.virginia.gov/DE/VAEnergyPlan>

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