ADVANCED ENERGY ECONOMY
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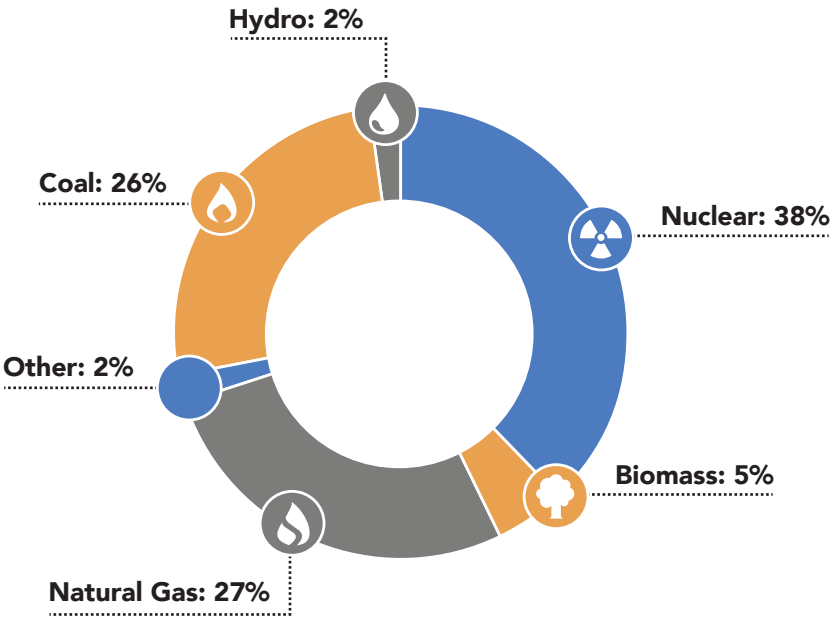
Virginia's Electric Power System and the Clean Power Plan

The U.S. Environmental Protection Agency (EPA) will soon release the final rule for carbon emissions from existing power plants, called the Clean Power Plan (CPP). The final rule represents the next step in the process of carbon regulation that began with the Supreme Court's determination in 2007 that carbon dioxide (CO_2) qualifies as an air pollutant subject to regulation by EPA under the Clean Air Act.[1]

Under Section 111(d) of the Clean Air Act, EPA will set air pollutant standards for each state based on what EPA determines to be the "best system of emission reduction" (BSER). In its proposal, EPA determined the BSER based on state specific potentials for emission reductions from four "Building Blocks" that include both traditional smokestack controls as well as "beyond the fence line" measures, namely improving the efficiency of coal plants, increasing dispatch of existing natural gas plants, deploying renewable and nuclear power generation, and reducing demand by means of energy efficiency.[2]

Although Virginia's emission rate target is set by the Building Blocks, there is no requirement that the Commonwealth use those specific measures for compliance. Rather, in developing a compliance plan to achieve the interim (2020-2029) and final (2030-2032) targets, the Commonwealth is free to use other technologies and policy tools. This gives Virginia an opportunity to design a plan that is best suited to the resources and needs of its unique power system.

Virginia's Generation Mix (2014)



Source: AEE PowerSuite

A Strong Foundation

Virginia has a strong foundation for a compliance plan. The Commonwealth has a diverse fuel mix and is already moving towards cleaner sources of energy. Carbon emissions in the Commonwealth fell 76% from 2005 to 2012, and at an average retail price of 9.25 cents/kWh, electricity in Virginia is cheaper than the national average.[5,6] Two nuclear facilities, North Anna and Surry, produce 38% of the Commonwealth's electricity. Nearly 30% of the Commonwealth's electricity generation comes from natural gas, half of which comes from gas that is extracted in state.[7] Coal generation in Virginia fell from 45% in 2005 to 26% today.[8]

Virginia's electricity market is vertically integrated, having been re-regulated through legislation in 2007. The Commonwealth's investor owned utilities (IOU's) are regulated by the Virginia State Corporation Commission (SCC). Virginia Electric & Power Company services (Dominion) 64% of Virginia's residential customers and is the Commonwealth's largest IOU.[3] Virginia is a member of PJM Interconnection, which recently reported that Virginia could generate net-positive revenue through a market-based regional CPP compliance program.[4]

The Commonwealth has a voluntary but foundational renewable portfolio standard (RPS) and energy efficiency resource standard (EERS), both of which could easily be strengthened to drive further development of these resources.[9] Also, utility-driven investments in smart grid technologies rank the Commonwealth in the top quartile for grid modernization nationally.[10]

These investments are already having an effect: while Virginia ranked among the top 10 states for most reported outages in 2012 and 2013, it was removed from this top 10 list in 2014.[11] Average duration of these outages also declined, from nearly 4 hours to just under an hour and a half between 2013 and 2014.[12] The average number of people affected by the outages also declined by nearly 2,000 people.

Still, more needs to be done. In September 2013, one outage, known as the "Friday the 13th Outage," caused Amazon Web Services to lose power and resulted in significant financial damages. In 2014, a summer storm caused a power outage for 70,000 Fairfax County customers. Outages are not only disruptive but also expensive, with an annual estimated cost to the U.S. economy of $150 billion.[13]

Virginia imports 37% of the electricity it uses from surrounding states, so it is vulnerable to energy decisions made by its neighbors.[14] Governor Terry McAuliffe has made energy independence for Virginia one of the goals of his energy plan.

All these improvements in Virginia's electricity system have helped to lower the Commonwealth's carbon emissions. With a flexible design that allows states to select technologies and services for compliance that best suit the needs of the Commonwealth, the Clean Power Plan will allow Virginia to continue to modernize its electric power system for the benefit of consumers and the economy. In this way, Virginia can further reduce emissions, maintain affordability, and increase reliability.

Proposed Targets for Virginia (from draft Clean Power Plan)			
Adjusted Starting Rate[15]	**Interim Target (average 2020 – 2029)**	**Final Target (2030 – 2032)**	**Total Reduction Required (2032)**
1,302 lbs CO_2/MWh	884 lbs CO_2/MWh	810 lbs CO_2/MWh	492 lbs CO_2/MWh (38%)

The interim and final emission rate targets for Virginia may change in the final rule, but the options for compliance will largely stay the same. Many of the things that the Commonwealth is already doing will help it meet the final emission rate target set by EPA.

On Track to 72% of Proposed Reductions

Virginia has already made changes to its power system that will reduce emissions from the 2012 baseline used by EPA to set the Commonwealth's targets in the draft plan.[16] As described in their most recent integrated resource plans (IRPs), the Commonwealth's two largest utilities, Dominion and Appalachian Power Company (APCO), plan to make even more changes, including implementing a suite of renewable energy and energy efficiency programs, which will alter Virginia's energy mix and associated emissions profile.[17] Planned changes, existing programs, and the maximization of coal-to-gas redispatch will get Virginia 72% of the way towards its proposed emission target.[18,19]

Virginia is on track to achieve 72% of total proposed reductions simply by what it is already doing.

How Advanced Energy Can Help

As Virginia develops its compliance plan, it can consider a host of options provided by advanced energy technologies and services to reduce its carbon emissions and help the Commonwealth achieve other electric system and economic objectives. Many of these strategies are already being successfully implemented in Virginia, and could be scaled up to achieve further emission reductions.

Virginia has both a voluntary RPS goal and EERS goal. Virginia's neighbors, all of which have had stronger policies in place, have experienced even stronger growth. Despite having repealed its RPS this year, West Virginia deployed a total of 585 MW of wind and solar while its RPS was in place, compared to Virginia's 11 MW.[20] North Carolina and Maryland have 208 MW and 272 MW of wind and solar, respectively.

While Virginia's RPS and EERS goals are nonbinding and have yet to realize the type of growth seen in the Commonwealth's neighbors, they nonetheless provide a foundation on which to design a compliance plan. Virginia also recently passed a package of clean energy bills aimed at creating jobs in the renewable and energy efficiency sectors. The bills incentivize solar energy development and expand energy efficiency programs as well as extend income tax credit for clean energy.[21]

Advanced Energy Economy Institute (AEEI) recently conducted a report, "Assessing Virginia's Energy Future," which looked at the impact on Virginia's economy under different CPP compliance scenarios. The report found that "the CPP can lead to substantial direct job creation in Virginia. These employment benefits will be even greater if the Commonwealth adopts a compliance plan that aims to simultaneously increase the Commonwealth's energy self-sufficiency."[22]

Grid Modernization Technologies	
Demand Response	Virginia has the largest comprehensive state-led demand response program in the PJM market.[23] The Virginia Department of Mines, Minerals and Energy (VDMME) participates in a demand response program with California-based EnergyConnect on a performance basis with no set up costs to the Commonwealth. In 2010, the program generated nearly $3.2 million for the 75 participating Commonwealth and local agencies.[24,25] Demand response brings down peak load, which can directly reduce emissions by over 1% nationally, and moderates energy prices for everyone.[26,27]
Advanced Metering Infrastructure (AMI)	Virginia utilities are already deploying AMI such as smart meters in their service territory.[28] These meters improve reliability and reduce operating costs for the utility. In 2014, the Commonwealth ranked in the top quartile on the Grid Modernization Index with 11% AMI deployment.[29] The data and control provided by AMI enables utilities and consumers to better manage energy use, helping to reduce emissions.[30]
Energy Storage	Energy storage allows higher penetration of variable renewables, offsets emissions from older, dirtier plants for meeting peak demand, and relieves grid congestion when demand is high and transmission and distribution equipment losses are highest. As part of its Solar Partnership Program, Dominion installed a solar system with battery storage at Randolph-Macon College in Ashland, Virginia in April 2015.[31]
Distribution Automation	Distribution automation helps optimize voltage conservation and reactive power (needed for motors and transformers to start up), integrate more distributed generation, and increase energy efficiency throughout the system without action on the part of customers. This helps to reduce emissions, and it has the added benefit of improving the reliability of the grid.[32]

Energy Efficiency Policies		
Utility Energy Efficiency	In addition to reducing emissions, energy efficiency can lower energy imports, grow the Commonwealth's economy, and save consumers money. Instituting a mandatory EERS with maximum targets of 1% annual savings would be enough to achieve 62% of the Commonwealth's proposed reductions and save consumers $9.5 billion by 2030.[33]	**Energy Efficiency Policies** **Virginia has a voluntary energy efficiency goal of 10% savings from 2006 levels by 2022. Although it is non-binding, the EERS requires utilities to consider demand-side resources such as energy efficiency in their IRPs. Virginia currently ranked 35th in energy efficiency in 2014.[34]** **While some successful programs have been implemented, the Commonwealth has not widely developed its demand side resources. Consequently, the potential savings from energy efficiency technologies and services are high compared to many other states.**
Energy Service Company (ESCO) services	The non-utility sponsored efficiency savings from the ESCO market are nearly equal in size to utility programs nationally.[35] Continued growth in the ESCO market in Virginia could help the state achieve as much as 17% of its emission reductions while saving local governments, schools, and hospitals over $2 billion.[36]	
Behavioral Efficiency	Using Advanced Metering Infrastructure (AMI) combined with behavioral efficiency services has been shown to reduce energy usage and drive down prices for everyone. Behavioral efficiency in Virginia can achieve 3% of the Commonwealth's proposed reductions and save consumers $730 million by 2030.[37]	

Renewable Energy		
Wind	Although Virginia did not generate any electricity from wind in 2014, the Commonwealth has 6 wind manufacturing facilities employing between 500 and 1,000 people.[38] Utilities in the Commonwealth are actively pursuing on- and offshore wind projects.[39] Virginia's technical potential of 89 GW for offshore wind could produce enough to meet the entire Commonwealth's current generation needs four times over.[40]	**Renewable Energy Policies** **Passed into law in 2007 and expanded in 2009, Virginia's RPS establishes a voluntary target of 15 percent renewable generation by 2025. The RPS allows for existing hydropower, research and development investments, and includes multipliers for solar, wind and animal waste.** **Dominion and APCO both participate in the program. Dominion achieved 68% of its target in 2013.** **Dominion offers the country's first "renewable energy tariff" allowing large customers to identify specific renewable projects, thereby creating competition among generators and helping lower renewable energy prices.[41]**
Solar	Virginia's 14 MW of installed solar capacity is enough to power 1,400 homes. With a technical potential of 1,108 GW, the Commonwealth has plenty of room to grow.[42] Amazon recently announced plans to build an 80 MW solar farm to power some of its data centers.[43] The nascent solar industry brought $15 million in investment in 2014, and employs 1,800 people throughout the value chain.[44]	
Biomass	With 726 MW of capacity in 2012, biomass is Virginia's largest source of non-hydro renewable energy.[45] The Commonwealth is actively pursuing coal plant conversion that use locally produced biomass that helps the Commonwealth achieve compliance with CPP requirements.	

ENDNOTES

1. In the landmark 2007 case Massachusetts vs. EPA, the Supreme Court ruled that carbon dioxide is an air pollutant subject to regulation under the Clean Air Act, and EPA is therefore required to administer guidelines for emission reduction, http://www.supremecourt.gov/opinions/06pdf/05-1120.pdf. Since that ruling, the Supreme Court has upheld EPA's authority to regulate carbon emissions on two separate occasions, including American Electric Power Company vs. Connecticut and in Utility Air Regulatory Group vs. EPA, which upheld EPA's authority to regulate emissions from stationary sources, http://www.supremecourt.gov/opinions/13pdf/12-1146_4g18.pdf and http://www.nytimes.com/2014/04/30/us/politics/supreme-court-backs-epa-coal-pollution-rules.html.
2. For a more in depth look at how the Building Blocks were established and applied to individual states in the Proposed Rule, see EPA TSD: GHG Abatement Measures. http://www2.epa.gov/sites/production/files/2014-06/documents/20140602tsd-ghg-abatement-measures.pdf
3. http://powersuite.aee.net/portal/states/VA/energy_data
4. http://www.pjm.com/~/media/documents/reports/20150302-pjm-interconnection-economic-analysis-of-the-epa-clean-power-plan-proposal.ashx
5. U.S. Electric Power Industry Estimated Emissions by State (EIA-767, EIA-906, EIA-920, and EIA-923) http://www.eia.gov/electricity/data/state/
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14. http://www.dmme.virginia.gov/DE/LinkDocuments/2014_VirginiaEnergyPlan/VEP2014.pdf
15. Includes 5.8% of existing nuclear generation that EPA deems to be at-risk of retirement, and existing 2012 renewable generation.
16. http://powersuite.aee.net/dockets/va-pue-2015-00036 and http://powersuite.aee.net/dockets/va-pue-2015-00035
17. http://www.eia.gov/electricity/monthly/pdf/epm.pdf
18. Planned unit-level coal plant retirements are taken from EIA Monthly, http://www.eia.gov/electricity/monthly/pdf/epm.pdf. The capacity factor for each unit was assumed to be the same as the capacity factor for the entire plant in 2012, the baseline year used by EPA. The average emission rate for the Commonwealth's coal fleet was recalculated without these units and substituted for the starting average coal emission rate in EPA's formula for BSER. Retired coal plant capacity was assumed to be replaced by a combination of energy efficiency and zero-emission resources. Planned coal plant retirements in Virginia total 1,598 MW, including Chesapeake (647.5 MW); Clinch River Unit 3 (238 MW) Glen Lyn Units 5 (100 MW) and 6 (237.5 MW); and Yorktown Units 1 and 2 (188 MW each).
19. Includes planned coal plant retirements, additions, and conversions, existing renewable energy and efficiency programs, the retention of nuclear resources, and the maximization of coal-to-gas re-dispatch which would lower Virginia's emission rate to 988 lbs CO_2/MWh by 2030, 72% of the way towards its target of 810 lbs/MWh http://info.aee.net/virginia-energy-future
20. http://www.acore.org/interactive-report-renewable-energy-in-america
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27. Navigant Consulting, Carbon Dioxide Reductions from Demand Response (Nov. 25, 2014), prepared for the Advanced Energy Management Alliance (AEMA) and included in AEMA's comments to EPA on the Clean Power Plan. http://aem-alliance.org/study-finds-significant-greenhouse-gas-savings-demand-response-group-urges-epa-incorporate-clean-power-plan/
28. http://powersuite.aee.net/portal/states/VA/utilities
29. http://www.gridwise.org/uploads/reports/GWA_14_GridModernizationIndex_11_17_14Final.pdf
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31. http://www.power-eng.com/articles/2015/04/dominion-installs-solar-battery-energy-storage-system-at-virginia-college.html
32. https://www.smartgrid.gov/sites/default/files/doc/files/Distribution Reliability Report - Final.pdf
33. ACEEE State and Utility Pollution Reduction (SUPR) Calculator http://aceee.org/state-and-utility-pollution-reduction-supr
34. http://www.aceee.org/state-policy/scorecard
35. Up 10% from 2013, the U.S. ESCO market produced approximately $611.2 million in revenue in 2014, not including HVAC equipment ($4 billion nationally). The entire ESCO market is expected to continue growing at a rapid pace, reaching $10.6-$15.3 billion in total revenue by 2020. See Advanced Energy

Now 2014 Market Report, http://info.aee.net/advanced-energy-now-2014-market-report
36. ACEEE State and Utility Pollution Reduction (SUPR) Calculator http://aceee.org/state-and-utility-pollution-reduction-supr
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