VIRGINIA ENERGY PLAN

The Commonwealth of Virginia's 2018 Energy Plan

OFFICE OF THE SECRETARY OF COMMERCE AND TRADE
DEPARTMENT OF MINES, MINERALS AND ENERGY

RECOMMENDED ACTIONS

ANALYSIS OF VIRGINIA'S ENERGY STRUCTURE

INTRODUCTION

The energy industry is a vital economic driver that serves as the foundation for the Commonwealth's ability to grow and thrive. Homes and businesses rely upon stable, reliable, and affordable energy systems. At the same time, there are a number of market and policy shifts that are transforming the industry in ways that cannot and should not be ignored. These include technological advances that are unlocking new opportunities in both the electricity and transportation sectors, customer preferences that are driving the expansion of new business models, a shift toward a reduction in carbon emissions, and a growing focus on the reliability and resiliency of our electric system.

The Commonwealth's 2018 Energy Plan provides both a status update on Virginia's current energy system and a set of recommendations that are both forward-looking and adaptive to enable the energy transformations that are underway. The intention of these recommendations is to support technological advances, create new business opportunities, and allow Virginia's energy markets to grow.

A forward-looking Energy Plan will promote the transition to a more flexible, resilient, affordable, and environmentally responsible energy system.

In the development of this Energy Plan, the Department of Mines, Minerals and Energy (DMME) facilitated a robust stakeholder engagement process. This process included six public listening sessions, a 60-day written comment period during which 988 comments were filed, and a series of facilitated stakeholder engagement meetings.

The recommendations provided in this Energy Plan focus on both the electric sector and the shifts in the transportation sector that touch on or impact the electric sector. There are also important market and policy changes occurring within our energy system regarding the energy production and extraction industries, but those issues are outside the scope of this report.

While the Commonwealth has taken a number of critical steps to enable the deployment of innovative technologies, one key takeaway from the stakeholder engagement process is that Virginia will need to plan for the transformation of our energy system to achieve our most significant policy objectives. This process has already started through enactment of the Grid Transformation and Security Act (Senate Bill 966), which provided important mechanisms to modernize our electric system.

Among other things, the legislation includes language providing the following:

- 5,000 megawatts (MW) of utility-owned and utility-operated wind and solar resources deemed in the public interest;
- 500 MW of rooftop solar resources that are less than 1 MW in size deemed in the public interest;
- $1.1 billion investment in energy efficiency programs by investor-owned utilities; and
- Cost recovery structures for projects that modernize the grid and support the integration of distributed energy resources.

As the objectives of this legislation are implemented in the coming years, it is important for Virginia's regulatory and policy landscape to adapt to these new energy priorities.

Virginia's regulatory structure has historically focused on the traditional power sector model of large, centralized power stations and conventional transmission and distribution infrastructure. However, distributed energy resources such as rooftop solar, smart meters, battery storage, electric vehicles, and other innovative technologies are likely to make up an ever-increasing share of our energy system in the years to come. Yet the regulatory environment has failed to keep up with Virginia's market and policy shifts toward a more distributed and modernized grid. Further, the traditional regulatory structure does not fully incorporate broader objectives such as energy diversification, technological advancements, environmental stewardship, changing customer choices, and economic development or job creation opportunities.

In order to address these regulatory and policy deficiencies, this Energy Plan provides both high-level and detailed recommendations to enable grid modernization to occur in a forward-looking, dynamic, and flexible manner.

First, there are fundamental policy drivers that weave distributed energy resources together. A number of stakeholders provided feedback and recommendations on these intersections, primarily focusing on ***grid modernization*** and the development of a robust regulatory process to accommodate the distributed energy resource investments that will transform our electric grid. This Energy Plan leads with the overarching recommendation that in order to effectively achieve a modern electric grid, Virginia needs a coordinated distribution system planning process.

The Energy Plan then focuses on recommendations regarding five specific policy tracks that are discussed in more detail in the sections that follow:

(1) Solar and Onshore Wind,
(2) Offshore Wind,
(3) Energy Efficiency,
(4) Energy Storage, and
(5) Electric Vehicles and Advanced Transportation.

The recommendations for ***solar and onshore wind*** include achievement of at least 3,000 MW of the 5,000 MW of solar and wind resources deemed in the public interest under Senate Bill 966. This level of solar and wind investment should occur by 2022. The recommendations also include expansion of corporate clean energy offerings, enhanced collaboration on the siting of large solar and wind facilities, and expansion of the net metering program, the power purchase agreement program, and the community solar program. The Energy Plan further includes the recommendation to double the Commonwealth's renewable energy procurement target to 16% by 2022.

The recommendations for ***offshore wind*** focus on supporting the development of the offshore wind resource itself as well as growing the offshore wind supply chain. The Energy Plan includes both support for the 12 MW offshore wind demonstration project and the recommendation to establish a goal that the full 2,000 MW of offshore wind potential in Virginia's wind energy area be developed by 2028.

The recommendations for ***energy efficiency*** apply to Virginia's established energy conservation goal well as potential avenues to deploy additional energy efficiency programs. The recommendations include increasing utility-funded energy efficiency programs to $100 million per year for Dominion Energy and $15 million per year for Appalachian Power Company in furtherance of the energy efficiency investment targets set forth in Senate Bill 966. The recommendations also include expansion of state-sponsored efficiency programs, increasing energy efficiency financing opportunities, additional deployment of combined heat and power (CHP) projects, and establishing effective data management strategies.

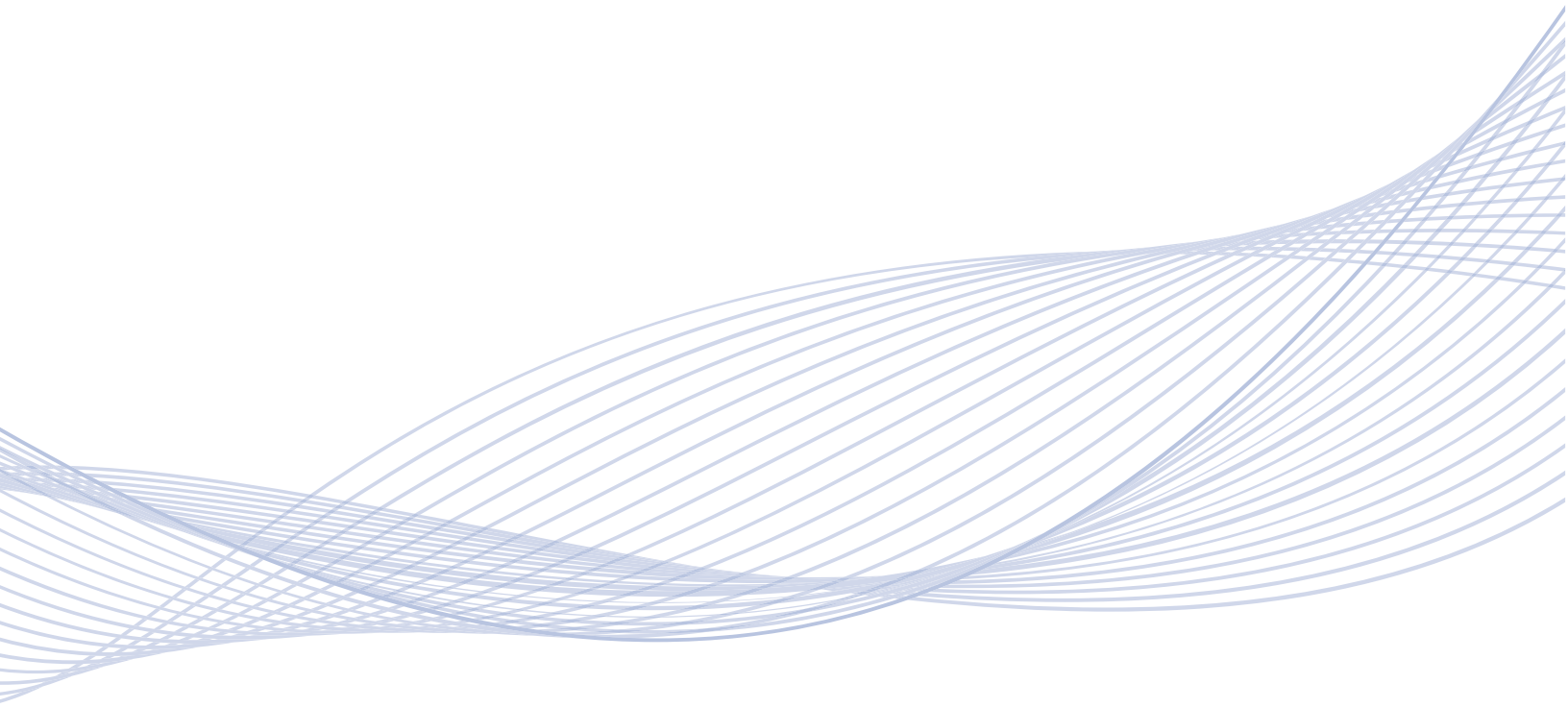
The recommendations for ***energy storage*** focus on the resource as an emerging technology that could dramatically impact the grid of the future. There are a variety of energy storage technologies under development, and the Energy Plan recommends increased collaboration as the Commonwealth moves forward with a comprehensive evaluation of these storage technologies.

The recommendations for ***electric vehicles and advanced transportation*** recognize that shifts in the transportation sector will impact other areas of the energy system, including the electric grid. The electric vehicle recommendations include adopting the Advanced Clean Cars (ACC) program, developing a comprehensive electric vehicle transportation plan, and setting targets for both electric vehicle charging infrastructure and the Commonwealth's vehicle fleet. The advanced transportation recommendations note that the Commonwealth's existing programs to promote alternative fuel vehicles have worked well and should continue forward with additional technical support.

Further, stakeholders provided significant feedback on Governor Northam's proposal to reduce carbon pollution from the electric power sector. This Energy Plan includes a section on the current status of the regulatory program.

Finally, stakeholders provided broad-based recommendations to bolster the resilience of our electric grid and ensure that there are not disproportionate impacts to low-income and minority communities as energy sector investments are made. These policy recommendations touch on a variety of energy resources. Recommendations for these issues are incorporated into various aspects of the sections that follow.

RECOMMENDED ACTIONS



GRID MODERNIZATION

As Virginia's investor-owned utilities make investments to modernize the electric grid, including investments resulting from Senate Bill 966, it is important for the planning process to incorporate a full valuation of the impact of all resources on the grid. A number of stakeholders pointed to the need to develop a comprehensive planning process around grid modernization. One important rationale for a focus on grid modernization is that the transitions in our electricity system include a shift away from large, centralized power stations to more distributed energy resources. The National Association of Regulatory Utility Commissioners describes this transition as follows:

"Traditional electric distribution system planning involves moving electricity generated from centralized power plants, transmitting the electricity over high-voltage transmission lines, and delivering it to end users at the distribution level. In this model, power flows in one direction, from generation to transmission lines, transmission lines to distribution lines, and ultimately to end-users. State and federal regulatory frameworks, utility business models, reliability and operating standards, planning and investment approaches, and wholesale markets have all been designed for this traditional paradigm. However, the electric industry is undergoing a shift toward a two-way power flow among the bulk electric system, the distribution system, end-users, and distributed energy resources (DERs) located both behind the meter and in front of the meter." [1]

Some states that are similarly moving forward with grid modernization planning processes have focused specifically on distributed energy resources.[2] The grid transformation improvements that the Commonwealth is contemplating include a significant focus on the distribution system, but our current resource planning process (Integrated Resource Plan or IRP) does not fully evaluate the integration of these resources. One overarching focus of this Energy Plan is the development of a comprehensive analysis of distributed energy resources.

For the purposes of this recommendation, distributed energy resources include, but are not limited to, rooftop solar, smart meters, energy efficiency programs, energy storage, and electric vehicles and charging infrastructure. As noted in the following sections, this Energy Plan provides specific recommendations relative to each of these distributed energy resources. However, the recommendation to strategically plan for investment in these resources is important to ensure that such investments are accomplished in a way that aligns with the Commonwealth's public policy objectives.

As one stakeholder provided in written comments on the Energy Plan regarding grid modernization:

> *"A more adaptable and dynamic grid has many benefits to Virginians and the Virginia economy. It can more effectively integrate new sources of energy of varying generation capacities from multiple locations. This includes small-scale solar on a consumer's home, energy storage facilities in Southwest Virginia, medium-sized wind farms on ridge tops, and large-scale offshore wind off the Virginia coast. A modern grid can also empower customers to choose how they consume energy and understand what impact that usage has on their wallets. Through an interactive grid, utilities will be able to better respond to consumer needs, minimize impacts of outages, better protect physical assets from weather events, and better protect all grid users with enhanced cybersecurity."* [3]

As the utilities begin to make their first filings before the State Corporation Commission under the Grid Transformation and Security Act, the regulatory process should incorporate the principles of grid modernization through enhanced distribution system planning.

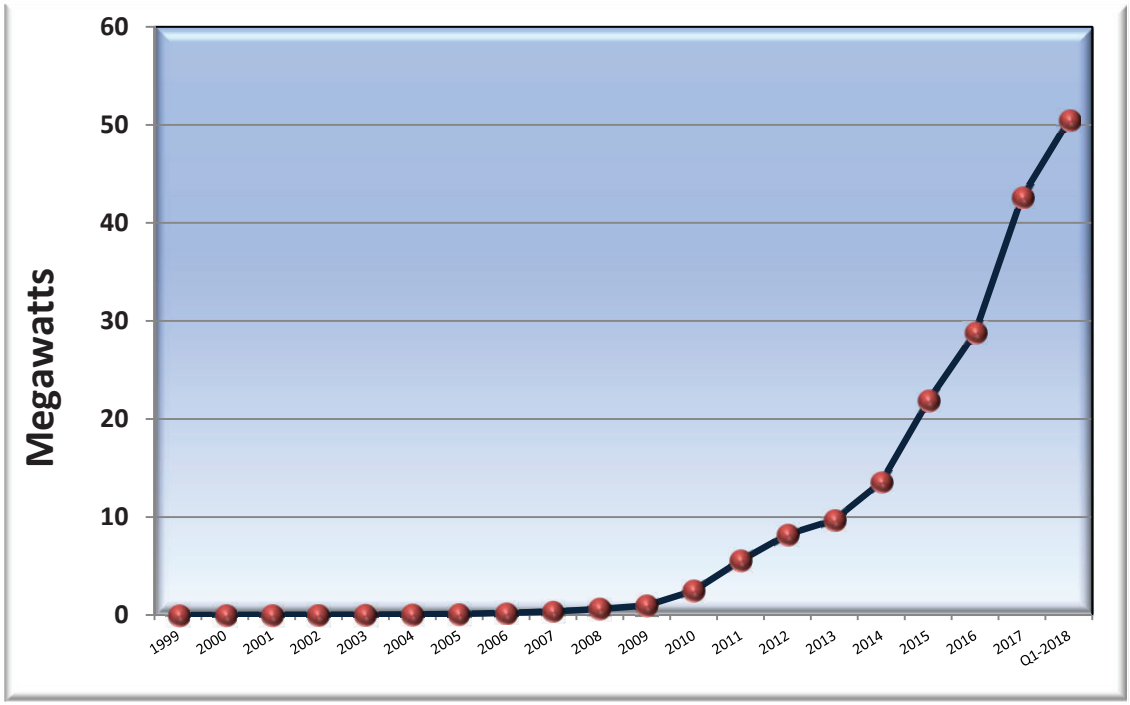
RECOMMENDATION

- ***To ensure that utility investments align with long-term policy objectives and market shifts, Virginia should reform its regulatory process to include distribution system level planning in Virginia's ongoing Integrated Resource Planning requirement.*** Such a process should include a full evaluation of distributed energy resources, and new investments in data management and data collection should be utilized to provide more detail as part of this evaluation. For example, Dominion's first application under Senate Bill 966 includes $450 million to install approximately 2.1 million smart meters and provide a customer information platform. These investments could serve as a significant source of data to the utilities, ratepayers, and the businesses that provide distributed energy resources. New data sources should offer a greater understanding of the various attributes of distributed energy resources, including resiliency, reliability, avoided new capacity, generation portfolio diversification, pollutant reduction, and impacts on peak loads. Importantly, a comprehensive planning process that includes better access to data will help to provide a forward-looking view of Virginia's energy systems that more closely aligns with the energy transformations that are underway.

SOLAR AND ONSHORE WIND

Solar energy deployment has grown significantly in Virginia in recent years. Between 2000 when Virginia's net metering law was enacted and the end of 2009, Virginia had less than one megawatt of net metered renewable energy installed in the Commonwealth. That one megawatt was all in the form of small, distributed solar and wind power systems installed at residences and businesses. Today, the total amount of distributed, net metered solar and small wind has risen to over 50 megawatts.[4]

Figure 1: Net Metered Solar Capacity in Virginia[5]

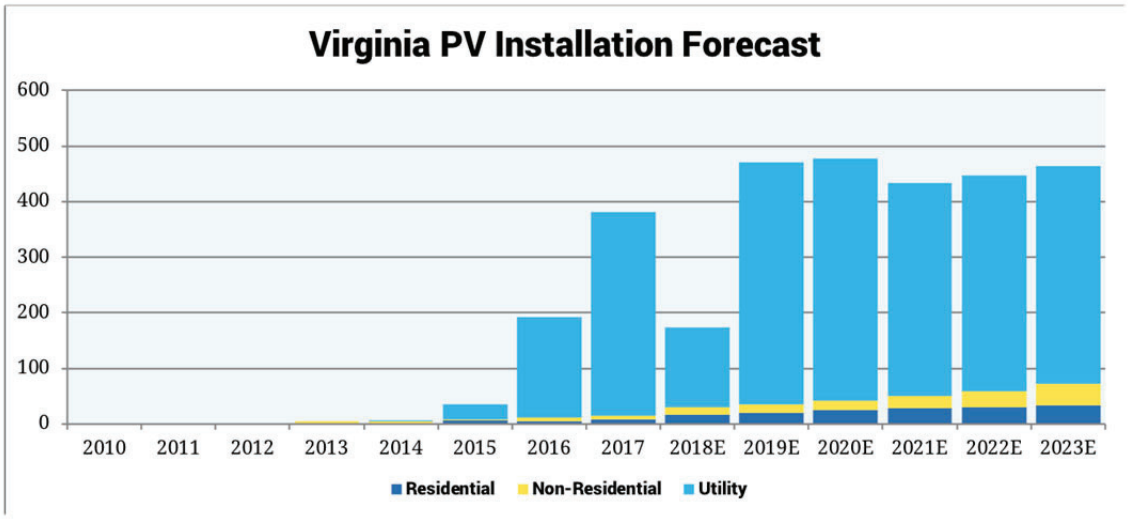


In addition to distributed resources, DEQ issues permits for renewable energy projects with a generation capacity of up to 150 MW under Virginia's "Permit by Rule" (PBR) statute.[6] To date, DEQ has issued 26 permits for solar projects and one wind power project totaling 816 MW, with an additional 58 Notices of Intent to apply in the PBR queue totaling 3,317 megawatts.[7] In addition to our state permitting process, PJM Interconnection lists 116 Virginia solar projects in their own New Services Queue totaling over 10 gigawatts.

The solar industry has the potential to assist significant economic development. According to the Solar Foundation's 2017 Solar Jobs Census, Virginia ranked 21st in the nation in the number of solar jobs, with a total of 3,565 people employed.[8] This was an increase of 10 percent from 2016. These jobs include rooftop installers, engineers, sales and marketing professionals, developers, and electricians. While utility scale projects are largely driving solar growth in Virginia, smaller distributed systems offer significant employment opportunities.

Given the economic development opportunities in the solar sector, solar energy has significant room to grow in the coming years. The Solar Energy Industries Association projects that solar energy will grow by an additional 2,293 MW over the next five years.[9]

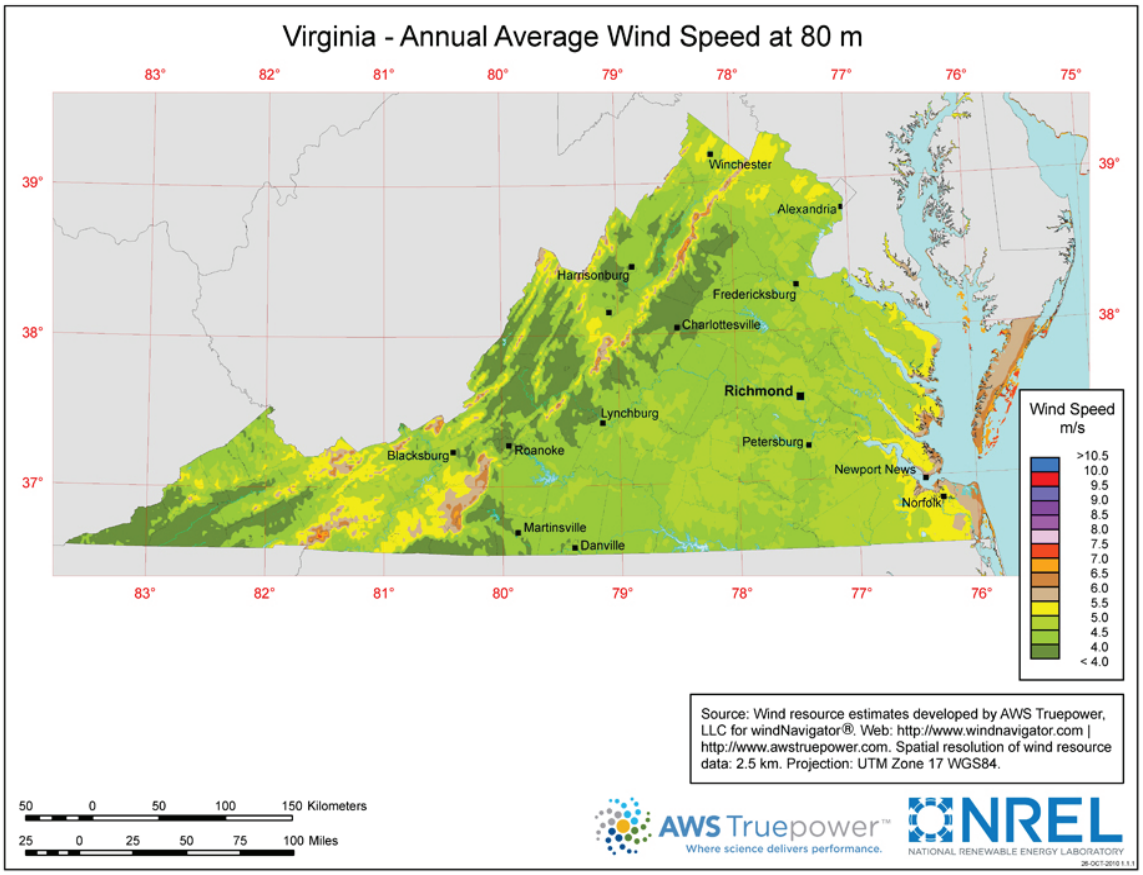
Figure 2: Virginia Photovoltaic (PV) Installation Forecast[10]



While the majority of this growth is projected to be utility scale solar, the nearly vertical growth of distributed solar from 5.7 MW in 2014 to 50.5 MW in 2018 – over 196% growth per year – looks likely to continue beyond the phase-out of the federal Investment Tax Credit beginning at the end of 2019.

As with solar energy, DMME has worked on removing barriers to wind power since the early 2000s. According to the National Renewable Energy Lab (NREL), Virginia's onshore wind potential at 80 meter hub height is 1,739 MW.[11]

Figure 3: Virginia 80 Meter Wind Resource Map[12]



In comparison to distributed (net metered) solar, small scale wind power deployment has seen limited market growth in Virginia, with just 67 small residential systems and 14 nonresidential units totaling 340 kilowatts compared to over 50 megawatts of solar. These systems range in size from one kilowatt up to 50 kilowatts. The last system was installed in 2017. The largest number of installations occurred between 2009 and 2012. This is likely due to incentives from the American Recovery and Reinvestment Act.

On the utility-scale side, there are no wind projects constructed, but there are currently two utility scale wind projects that are permitted. The first project is the Highland New Wind project. The permit for this facility was issued in 2009 and covered nineteen two megawatt turbines (38 megawatts total) along Red Oak Knob and Tamarack Ridge in Highland County. The second project is the Rocky Forge Wind project, a 75.6 megawatt project located in Botetourt County. DEQ approved the PBR application for this project in March of 2017.

The solar and onshore wind recommendations are segmented into a number of policy areas that have generated significant stakeholder engagement in both the regulatory and legislative arenas over the last few years. Senate Bill 966 set forth a stakeholder engagement process that requires the investor-owned utilities to investigate the following four areas: (1) potential improvements to the net energy metering programs as provided under § 56-594 of the Code of Virginia, (2) potential improvements to the pilot programs for community solar development as provided under § 56-585.1:3 of the Code of Virginia, (3) expansion of options for customers with corporate clean energy procurement targets, and (4) impediments to the siting of new renewable energy projects.

Dominion Energy contracted with Meridian Institute to facilitate a stakeholder engagement process to evaluate these four issue areas. The Energy Plan incorporates feedback and recommendations received from this Meridian-facilitated stakeholder process, and the content of Meridian's report is included in Appendix B.

While the stakeholder feedback and the content of the Meridian report were referenced in the development of this Energy Plan, such content does not comprise the full analysis for this section of the report. DMME also hosted independent meetings as well as a public comment process that resulted in a variety of recommendations outside of the four issues provided above. As a result of this comprehensive stakeholder analysis, this report organizes the policy recommendations into two overarching categories: (1) Utility-Scale Investment and (2) Distributed Energy Resources.

The rationale for this organization is that while some issues may overlap, the policy recommendations differ widely depending on the size and scope of the solar or wind energy investment. Utility-scale investments are larger in nature and are traditionally sited in a location that is not proximate to the end use. These investments include both solar and wind resources. The focus of the recommendations for utility-scale investments includes how the investor owned utilities will implement the investments under Senate Bill 966, options for corporate procurement at the utility-scale level, and recommendations for the siting of utility-scale resources.

In comparison, distributed solar resources are smaller in size and are typically (though not always) located at or near the site where the electricity will be consumed. The focus of recommendations for distributed solar resources is on net metering, power-purchase agreements, and community solar.

In addition to utility-scale resources and distributed solar resources, this Energy Plan also includes separate recommendations for the Commonwealth's own lead-by-example strategies.

I. UTILITY-SCALE RESOURCES

Investor-Owned Utility Procurement

As previously discussed, Virginia has significant potential for utility-scale solar. Recognizing this potential, the General Assembly passed legislation in 2015 deeming 500 MW of solar resources in the public interest. Senate Bill 966 expanded upon the 2015 legislation and provides that 5,000 MW of utility-owned and utility-generated wind and solar resources are deemed in the public interest.

In execution of Senate Bill 966, Dominion Energy has made the public commitment that it will have 3,000 megawatts of this commitment under development or in operation by the beginning of 2022. The legislation requires that all of this generation be subject to competitive procurement, and that 25 percent of the generation capacity be procured through power purchase agreements. As Virginia's investor-owned utilities work to implement this level of investment, it is important that the process be open, transparent, and engage various aspects the marketplace.

RECOMMENDATION

- ***Virginia's investor-owned utilities should issue a Request for Proposals (RFP) for the development of solar and wind generation in the Commonwealth. The RFP should be issued annually beginning in 2018, and the RFP should include the procurement of at least 500 megawatts of solar or wind projects each year.*** The RFP should be broad enough to expand the marketplace for renewable energy development in Virginia and transparent enough that the selection of resources is at levels and costs that are reasonable for ratepayers. Some basic principles to enable a cross-section of responses are: to include developers of all sizes and from all geographic locations, and to allow project submissions to be scalable (e.g., a developer may aggregate multiple projects or types of projects). Further, to expand upon the job creation benefits of such installations, the RFP should also encourage the use of Virginia's highly qualified workforce and technical training programs.

Corporate Procurement

One significant aspect of the Commonwealth's energy system transformation is that customer needs are shifting, and a number of corporate customers are requesting access to greater levels of renewable resources. Nationwide, corporate purchasers have contracted for over 13 gigawatts of new renewable energy between 2013 and August 2018, not counting onsite installations.

The first project of this type in Virginia was the Amazon Solar Farm US East located in Accomack County. The power from the project serves Amazon Web Services' data center activities in Virginia. DEQ issued the permit for the 80 MW solar facility in September 2015, and this was the first project approved under the PBR process. The facility went into operation in October 2016 and generates approximately 170,000 mega-watt hours (MWh) of solar power annually. Amazon subsequently followed with five additional Virginia projects that total 180 MW alternating current (AC), including four 20 MW resources and one 100 MW resource. These projects are located in Buckingham County, New Kent County, Powhatan County, Southampton County, and Sussex County.

The Commonwealth next partnered with Microsoft Corporation and Dominion Energy on the Remington Solar Facility, a 20 MW AC solar electric generating facility near the town of Remington in Fauquier County. Constructed as part of a public-private partnership, the project represented a unique opportunity to deploy an innovative approach that allowed the Commonwealth to be a first-mover in placing renewable energy on the electric grid. The structure of the project provided that Dominion Energy develop the facility, the Commonwealth purchase the energy generated from the facility, and Microsoft purchase the renewable attributes of the facility.

The Commonwealth also partnered with the U.S. Navy to construct and operate a 17.6 MW AC solar generating facility on the Naval Air Station Oceana in Virginia Beach. The purchase of this renewable energy occurred via a special kilowatt hour (kWh) charge on Virginia's bulk purchase contract with Dominion Energy. The charge was then distributed to all state agencies that purchase from the state's contract, and the facility provides a stable source of fuel-free energy.

In addition to these specific contractual arrangements, Dominion Energy has also filed a number of tariff structures with the State Corporation Commission. These include an October 2017 filing for approval to establish an experimental and voluntary companion tariff, designated Schedule RF, *Environmental Attributes Purchase From Renewable Energy Facilities*. Schedule RF is available to any customer with new load of at least 30 million kWh annually at one account or in total across multiple accounts within the service territory.

According to the application, Schedule RF will be a voluntary companion tariff to already approved rate schedules. Recovery of costs were not sought in connection with the application. Rather, Dominion Energy deferred cost recovery to future proceedings on a project-specific basis. Facebook intends to power its new data center operations in Virginia with solar energy purchased from Dominion through Schedule RF.

While there are a number of potential contractual arrangements and tariff structures available to customers, a number of stakeholders recommended expanding options for corporate customers.

RECOMMENDATION

- ***Virginia's investor-owned utilities should develop renewable energy purchasing options for customers who do not meet the new load requirements of Schedule RF and should include options for aggregation of accounts within such purchasing structures.*** Such structures should be designed to meet the needs of customers with existing loads or customers with loads below the Schedule RF threshold of 30 million kWh annually. The structure should transparently allocate costs and risks, and it should expand opportunities for aggregation, including providing options for customers with multiple sites located across the Commonwealth. Aggregation could also include targeted programs for bulk power purchase groups in which multiple smaller or medium-sized businesses could collectively purchase the output from a single solar or wind facility. Such pricing options will enable businesses to benefit from the cost reductions associated with economies of scale from these larger renewable generation facilities.

Siting

Virginia is slated to embark on a period of accelerated renewable energy development. This will increase the obligations of local governments and state agencies tasked with land use, permitting, and environmental decision making. To streamline permitting, the Commonwealth currently uses a "Permit by Rule" (PBR) managed by DEQ to permit wind, solar, and biomass based generation resources with a nameplate capacity less than 150 MW. Over the last five years, Virginia has seen a dramatic increase in its installed solar capacity, growing from 17 MW in 2014 to more than 320 MW installed and a total of 750 MW of solar resources permitted through the PBR as of August 2018.

As the renewable industry has grown, stakeholders identified the need for additional staff at DEQ and the Department of Historic Resources, an important partner in the PBR process.

RECOMMENDATION

- ***Expand resources at DEQ to meet the growing demands of the PBR program and to address the large volume of current and anticipated future PBR applications.*** DEQ should also initiate a comprehensive review and overhaul of the PBR regulation to reflect the changing nature of the renewable energy industry and clarify existing ambiguities regarding timelines, responsibilities, and best practices. As part of the review of the PBR process, DEQ should create a path for fast-tracked permitting for projects that meet certain requirements or standards. Further, Virginia should convene a work group to identify the best way to comprehensively approach renewable energy facility siting that includes considerations for environmental justice, impacts to water quality, historic and cultural resources, local land use, and grid infrastructure.

II. DISTRIBUTED ENERGY RESOURCES

Net Metering

Net metering is one of the primary policy drivers for the installation of distributed solar resources from residential, small business, and agricultural stakeholders. Virginia's net metering structure provides that the generation from distributed energy systems, typically solar energy, is credited to a customer's bill at the retail rate. At the end of a twelve month period, the customer may elect to roll over any excess generation or receive a payment for the excess generation at the avoided cost rate. The total net metering program is capped at one percent of each electric distribution company's adjusted Virginia peak load forecast for the previous year.

Residential customers may install net metered facilities that are up to 20 kW in size, but customers must pay a monthly fixed fee in the form of a "standby charge" for systems that are greater than 10 kW in size. The standby charge is based on the measured demand of the customer. Nonresidential customers may install net metered facilities that are up to 1 MW in size, and standby charges are not applied to this class of customers.

In addition to these general system caps, the maximum allowable capacity of an individual net metered system for both residential and non-residential customers is based on the expected annual energy consumption using the customer's previous 12 months of billing history.

Over the last several years, a number of changes to the net metering statute have either been contemplated or implemented. First, the size of allowable facilities increased from 500 kW to 1 MW for non-residential customers. Second, much discussion has occurred around whether and how to increase the total program size beyond one percent of adjusted peak-load, whether customers should be able to install facilities that are larger

than their previous 12 months of energy consumption, how net metered facilities should be priced, and whether standby charges should apply to residential customers with facilities greater than 10 kW. Finally, discussions have also centered around whether the program should be expanded, removed, or redesigned to an alternate structure.

A number of these policy issues are playing out in other forums and need additional stakeholder engagement before a comprehensive solution is developed. The analysis developed as part of the distribution system planning process may offer the data necessary to answer questions regarding some of these policy options, including the pricing structures for net metered facilities or an alternative structure.

As a result of the myriad of issues raised regarding the net metering program, some stakeholders recommended a gradual approach to change. As a general principle, policies should prioritize the preservation of customer choice and the ability for customers to continue to invest in distributed solar resources. Further, any modification should ensure transparency in the development of pricing structures. In lieu of a full analysis at this time, this Energy Plan provides a few specific recommendations relative to the existing net metering program.

RECOMMENDATION

- ***To ensure that the program is not artificially constrained as a more developed review is performed, the General Assembly should raise the current one percent aggregate cap on the net metering program to five percent of each electric distribution company's adjusted Virginia peak-load forecast for the previous year.*** Of the states that allow net metering, eight have capacity limits above one percent, and 21 states have no limit. With the potential for new information from the distribution system level planning described previously, stakeholders should perform a more comprehensive review using more granular data to evaluate any impact the increased level of distributed solar penetration has on the grid to determine whether a limit on the program is necessary. Such information may also be helpful in the determination of additional modifications to the net metering program, such as individual system size and pricing structures.

Power Purchase Agreements

Power purchase agreements (PPAs) enable a customer to enter into a contract with the third-party owner or operator of a generation facility to receive the generation and capacity from that facility. The developer is responsible for the installation, ownership, and maintenance of the renewable energy system on a customer's property, and then sells the electric output to the host customer for a set number of years.

Currently, third-party PPAs are only allowed under a pilot program in the service territories of Dominion Energy and APCo. The pilot programs limit projects to no fewer than 50 kilowatts (with an exception for tax-exempt entities in accordance with § 501(c) of the Internal Revenue Code) and no larger than one megawatt. The aggregate capacity of all third-party renewable generating facilities in Dominion Energy territory is capped at 50 MW. The aggregate capacity in APCo service territory is capped at 7 MW, and the APCo program is limited to nonprofit, private institutions of higher education as defined in § 23.1-100 of the Code of Virginia.

Additionally, Senate Bill 966 provides requirements for investor-owned utilities to purchase solar energy, capacity, and environmental attributes from a third party. As noted previously, the legislation deems both 5,000 MW of utility-owned and utility-operated solar and wind facilities and 500 MW of rooftop solar facilities in the public interest. The legislation provides that 25 percent of the solar generation procured shall be through the purchase from a third party.

RECOMMENDATION

- ***To achieve the goals set forth in Senate Bill 966, Dominion Energy should annually issue a Request for Proposals (RFP) beginning in the Spring of 2019 to procure 150 MW of rooftop solar installations annually, with at least 25% procured through power purchase agreements (PPAs). In addition to the utility purchase of rooftop solar capacity, the caps on the third-party PPA pilot programs should be increased, and the programs should be available in all service territories statewide.*** As the market accelerates, these caps could limit future growth of the programs.

Community Solar

Community solar programs enable multiple customers to participate in and share the economic benefits of a solar energy system. The participants in these programs often want to obtain solar energy, but are unable to install their own on-site solar system. For example, they may be renters or live in a condominium, or their home or business may not lend itself to solar because of tree cover.

Virginia established its first community solar program under Senate Bill 1393 (2017). Under Virginia's utility-sponsored community solar model, the utility owns and maintains the solar facility and then sells the electric output at a specified rate to customers who desire solar energy. The program is limited to solar facilities that are up to 2 MW in size. The pilot program is capped at 10 MW in APCo's service territory and 40 MW in Dominion's service territory.

While the pilot programs are still under development and have yet to be fully implemented, a number of stakeholders pointed out that the programs fall short of models in other states. The primary deficiency stakeholders noted is that the utility owns and operates the facility, rather than other state models which enable third-party ownership.

RECOMMENDATION

- ***As the community solar pilot programs become more fully developed, stakeholders should evaluate whether the limits on the size of the overall programs and on the size of individual facilities should be increased.*** This could enable costs to decrease as customers are better able to take advantage of economies of scale. Additionally, transparency in both pricing and purchasing, including enabling third party developers to build and operate projects, may help drive costs down through competition. Such program reviews should also evaluate other types of community solar models to ensure that a diverse set of customers, including those from disadvantaged and low-income communities, are able to participate.

III. LEAD-BY-EXAMPLE STRATEGIES

The Commonwealth of Virginia has an 8 percent renewable procurement target that was established in 2015 under Governor McAuliffe. This target equates to approximately 110 MW of renewable generation with the goal that 75 percent of this generation will be from utility-owned investment and 25 percent will be contracted via a third-party PPA structure. As part of this goal, the Commonwealth pursued a utility-scale solar contract with the U.S. Navy and Dominion Energy for 17.6 MW alternating current (AC) of solar capacity at Naval Air Station Oceana (described earlier).

Additionally, the University of Virginia (UVA) has contracted a significant amount of additional utility-scale solar. UVA will begin purchasing 100% of the electricity generated by two new utility scale solar facilities in early 2019. Combined, the 17 MW AC Hollyfield and 15 MW AC Puller solar facilities will generate an estimated 70,000 MWh, enough to meet over 20% of the UVA's electrical consumption each year. In addition, UVA contracted for the installation of rooftop solar facilities at five buildings located on their grounds.[13]

The Commonwealth is also in the process of installing smaller, behind-the-meter solar projects at 5 state-owned buildings. Early–adopter agencies involved in these projects include the Department of Forestry (Charlottesville office), the Department of Corrections (Haynesville), the Department of Juvenile Justice (Hanover), the Department of Game and Inland Fisheries (Henrico), and DMME (Big Stone Gap). Combined, these systems will generate approximately 2 MW of solar energy, and the projects are expected to be in service in 2019.

Commitments like these utility-scale and distributed solar resources have been critical contributors to the expansion of renewable energy generation in Virginia.

RECOMMENDATION

- ***Governor Northam should double the Commonwealth's 8 percent renewable energy procurement target to 16% by the end of 2022.*** This target would facilitate the construction of an additional 110 MW of utility-scale and distributed renewable energy resources. In accomplishment of this target, the Commonwealth should complete both on-site PPAs and off-site utility-scale solar and wind projects.

OFFSHORE WIND

IV. DEVELOPMENT OF THE OFFSHORE WIND RESOURCE

The offshore wind industry in the United States is on the cusp of a major boom that could see America become one of the largest offshore wind markets in the world. Virginia's Hampton Roads region offers a number of unique competitive advantages over other offshore wind locations on the East Coast. The Commonwealth is well-positioned to take a leading role in this new industry, but it must be forward-thinking in its policymaking over the coming years.

Virginia has worked to develop the offshore wind sector for over a decade. The Virginia General Assembly created the Virginia Coastal Energy Research Consortium (VCERC) in 2007 to serve as an interdisciplinary study, research, and information resource for the Commonwealth on coastal energy issues.[14] VCERC provides the research and development required for the commercialization and implementation of renewable energy, specifically algal biomass, wave, and offshore wind resources in Virginia.

The Bureau of Ocean Energy Management (BOEM) formed the Virginia Intergovernmental Renewable Energy Task Force in 2009 to determine an acceptable location on the outer continental shelf for leasing and development of offshore wind energy. This 134-member group includes, among others, representatives from federal and state agencies, local government, Virginia Port Authority, NASA Wallops Flight Facility, Department of Defense, and branches of the U.S. military. The Task Force advised BOEM during the establishment of Virginia's Wind Energy Area on considerations to protect ecologically-sensitive areas, minimize space use conflicts, and facilitate the development of the offshore wind resource.

More recently, the Virginia General Assembly created the Virginia Offshore Wind Energy Development Authority (VOWDA) in 2010 to facilitate and support the development of the offshore wind industry and wind-powered electric energy facilities located off Virginia's coast beyond the Commonwealth′s three-mile jurisdictional limit.[15] VOWDA is charged with, among other tasks, identifying existing state, regulatory, or administrative barriers to the development of the offshore wind industry, collecting metocean and environmental data, upgrading port facilities to accommodate the manufacturing and assembly of project components and vessels, and applying to the U.S. Department of Energy for loan guarantees for such projects.

DMME and BOEM contracted with Fugro in 2013 to conduct a regional geophysical survey across Virginia's Wind Energy Area (WEA). The survey and resulting geologic evaluation provided key, fundamental seafloor and subsurface data and geological interpretation that will help promote, plan, and further the goals of a safe, economic, and responsible future commercial development in Virginia's waters.

Additionally, in 2015, Virginia released a comprehensive analysis of Virginia's capabilities to attract supply chain companies that support the installation of offshore wind energy. The Virginia Offshore Wind Port Readiness Study, developed as three separate reports, analyzed the readiness of Virginia's ports and commercial shipyards to accommodate nearly a dozen manufacturing and construction activities necessary to the development of offshore wind generation facilities.[16] The study concluded that five of Virginia's ports offer a high level of potential and are well-placed to handle large-scale activities to support an East Coast offshore wind industry. The study also included an analysis of the direct jobs potential of six main wind-manufacturing processes.

As the projects moved forward, DMME, BOEM, and the Virginia Coastal Zone Management Program also initiated a process in 2015 to collaborate with the recreational and commercial fishing sectors.[17] The goal of this analysis was to identify fishing communities potentially affected by the Virginia WEA, develop accurate, fine-scale maps of key fishing areas in and around the Virginia WEA, and create best management practices regarding communication, design, operation, and environmental monitoring of a commercial wind facility.

In furtherance of the development of the offshore wind resource itself, DMME signed an agreement with BOEM in 2015 for the first offshore research lease in the country. DMME selected Dominion Energy as the designated operator for the lease to enable the construction of the Virginia Offshore Wind Technology Advancement Project (VOWTAP). The VOWTAP consisted of two 6 MW wind turbines on the 2,135-acre research lease site. As the project evolved, Dominion Energy partnered with Danish offshore wind developer Ørsted in 2017 to refine the original plans for what is now called the Coastal Virginia Offshore Wind project (CVOW).

Dominion Energy recently filed for approval of this demonstration project with the State Corporation Commission under provisions of Senate Bill 966 that deems 16 MW of offshore wind energy in the public interest.

The CVOW research and development project will lay the groundwork for potential large-scale commercial development of up to 2,000 MW in Virginia's 112,800-acre WEA.

RECOMMENDATION

- ***As the CVOW project moves forward, Governor Northam should commit to a goal that the full 2,000 MW of offshore wind potential in Virginia's wind energy area be developed by 2028.*** This goal would enable development of a strategy to ensure that Virginia continues to diversify its fuel mix through offshore wind resources. To facilitate the development and execution of a strategy, the Commonwealth should consider creating the Office of Offshore Wind within the Division of Energy at DMME. In addition, Dominion Energy should submit a timeline for the various steps and approvals necessary to accomplish the full build-out of the offshore wind resource. The Commonwealth should continue to work with Dominion Energy, BOEM, the Department of Defense, the Port of Virginia, commercial shipping and fishing interests, and other stakeholders to ensure that all stakeholder concerns are addressed and that the resource can be deployed at the lowest possible cost.

V. DEVELOPMENT OF THE OFFSHORE WIND SUPPLY CHAIN

DMME issued an RFP in May 2018 seeking offshore wind industry expertise to help deploy strategies that will strengthen Virginia's position in attracting the offshore wind supply chain and service industry (Offshore Wind Study). DMME awarded the contract to BVG Associates (BVGA) in July 2018. BVGA and its partners joined the DMME-led Virginia Offshore Wind Team that includes representatives from the Secretary of

Commerce and Trade's office, the Virginia Economic Development Partnership (VEDP), the Virginia Port Authority (VPA), and the Virginia maritime industry. BVGA leveraged the expertise of its North American and global partners — Ramboll, Timmons Group, Greentree Consulting, LLC and the Business Network for Offshore Wind — and will provide a report on how best to leverage Virginia's potential offshore wind advantages.

The report, which is due in October 2018 will: (1) serve as a partnership tool to connect industry prospects with Virginia's robust maritime industry located primarily in Hampton Roads; (2) provide a summary of Virginia's unique advantages; (3) identify offshore wind-related workforce development and business incentive efforts underway; (4) identify business opportunities and make recommendations; and (5) educate state and local economic development and energy policy leaders.

As the demand for renewable energy increases, experts predict that over 14,000 jobs can be created in Virginia in the offshore wind manufacturing, installation, service. and supply industries.[18] Virginia's long history in the maritime trades and its unique location along the eastern seaboard provide opportunities to attract world-class offshore wind development and supply chain companies.

The Northam Administration, alongside state and regional economic development entities, should continue to market its port infrastructure and assets, strategically plan for workforce development needs of the future, and identify and remove barriers to deployment of the resource off Virginia's coast. These actions will send a signal that Virginia is committed to developing its own offshore wind energy resource and also attracting the related industries to its ports and shores.

RECOMMENDATION

- ***As the pending offshore wind report provides specific policy recommendations, the Commonwealth should include the offshore wind industry as a priority in future workforce development and economic development strategic plans.*** A coordinated prioritization of the offshore wind supply chain will send a signal to local and regional partners regarding the crosscutting value that the industry can bring to the Commonwealth. Governor Northam should also initiate regional collaboration with neighboring states, which can help provide greater certainty for the industry as it looks to establish a long-term project pipeline. This may reduce regulatory and administrative burdens for companies as they make investment decisions.

ENERGY EFFICIENCY

Diverse, flexible, and well-capitalized energy efficiency programs are essential to foster an energy efficiency marketplace that will enable Virginia to meet its energy conservation targets. Public benefits associated with energy efficiency include electricity cost savings, jobs and revenue created by the energy efficiency services sector, and reductions in greenhouse gases and other air pollutants.

The Commonwealth has established important goals relative to energy efficiency, including the statewide goal of reducing retail electricity consumption by 10 percent by 2022. In 2017, the General Assembly passed Senate Bill 990, which re-enacted Chapters 888 and 933 and reaffirmed the Commonwealth's commitment to the 10 percent voluntary electric reduction goal. The General Assembly further required that DMME, in consultation with the State Corporation Commission, track and submit an annual assessment of progress toward achieving the 10 percent goal.

The recommendations provided in this section cover both the established statewide targets as well as potential avenues to deploy additional energy efficiency programs. These include increased investments in energy efficiency set forth in Senate Bill 966 (2018), expansion of state-sponsored efficiency programs, new opportunities for energy efficiency financing, and deployment of additional combined heat and power (CHP) projects. Additionally, recommendations for adequate and effective data management will serve as the foundation to measure and track the Commonwealth's ability to achieve efficiencies across the energy sector.

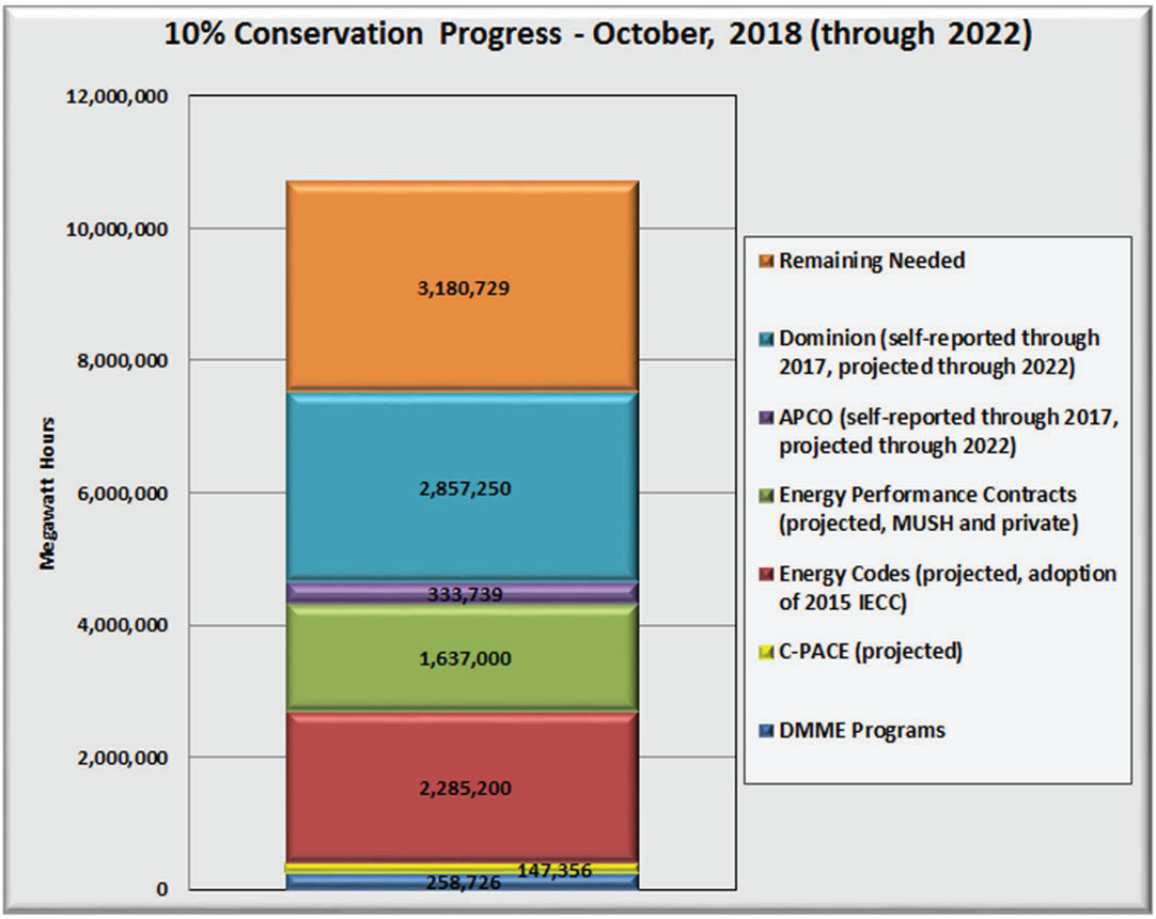
VI. TEN PERCENT TARGET

The Commonwealth's voluntary goal of reducing retail electricity consumption by 10 percent by 2022 using 2006 as a baseline was established in Virginia's first Energy Plan in 2007.[19] Through the prior Governor's Executive Committee on Energy Efficiency, DMME has clarified that the 10 percent goal includes measurable outcomes from efforts on both energy efficiency (doing the same amount of work with less) and energy conservation (reductions in energy use via behavioral changes).

A decade after enactment of the goal, the Commonwealth has identified a pathway to achieve roughly 70 percent of those energy savings. Due to increases in population and new business and industries locating in Virginia, 2016 consumption was up about 5 percent from 2006 levels, which is the baseline year for the 10 percent goal. According to the Energy Information Administration (EIA), 2016 retail electricity consumption in Virginia was approximately 112,280 GWh, ranking 10th highest in the nation.

The following chart sets forth the various programs that are currently in place toward achievement of the 10 percent goal.

Figure 4: Progress on Virginia's Ten Percent Goal



DMME obtained a $300,000 grant from US Department of Energy in 2015 to convene subject matter experts and develop an Energy Efficiency Roadmap (Roadmap) that was published in March of 2018. The Roadmap offers an actionable plan that includes a number of state policy and program proposals that are feasible to implement in the Commonwealth and have good potential to yield significant energy savings.

Recommended policies in the Roadmap include: adopting updated building energy codes; utilizing best practices for Evaluation, Measurement and Verification (EM&V) of utility energy efficiency programs; setting mandatory and steadily increasing energy savings targets for utilities; and enabling local governments to implement mandatory benchmarking programs for large commercial and industrial buildings. Program recommendations include continuing to expand access to Commercial Property Assessed Clean Energy (C-PACE) programs and the state's Energy Savings Performance Contracting (ESPC) program to enable more building energy retrofits for both private and public sector owners.

As noted in the Roadmap, a significant pathway toward greater energy efficiency is through investor-owned utility investment in energy efficiency programs. Senate Bill 966 provides that Dominion Energy will invest $870 million and APCo will invest $140 million between 2018 and 2028 in energy efficiency programs. The legislation further states that at least 5 percent of these ratepayer funded programs should be directed toward low-income, elderly, and disabled persons.

In addition to ratepayer funded programs, the legislation provides that Dominion Energy will expand its shareholder funded energy assistance and weatherization program for low income, elderly, and disabled individuals to $13 million per year and APCo committed to keeping the program at current levels totaling roughly half a million dollars per year. Combined, these investments represent over $1.1 billion in energy efficiency through 2028.

As with other aspects of Senate Bill 966, effective and timely implementation of these targets is important for ratepayers to reap the many benefits that energy efficiency programs will provide.

RECOMMENDATION

- ***To further support achievement of the 10 percent goal, Virginia's utilities should maximize investment in cost-effective energy efficiency programs and portfolios. In the development of these portfolios and in line with the commitments under Senate Bill 966, Dominion Energy should expand investments to $100 million per year by 2019, and should submit a portfolio of programs at this $100 million level annually to the State Corporation Commission. APCo should expand investment to $15 million per year by 2019, and should submit a portfolio of programs at the $15 million level annually to the State Corporation Commission.*** The portfolios that Dominion Energy and APCo submit should be developed through a robust and transparent stakeholder process, as set forth under Senate Bill 966. Such stakeholder process should be guided by an independent facilitator with subject-matter expertise, should meet multiple times per year, and should provide recommendations on the RFP that the investor-owned utilities develop to solicit energy efficiency program offerings.

VII. LEAD-BY-EXAMPLE TARGET

Public sector energy efficiency targets enable the Commonwealth to reduce energy costs while expanding the economic development and job creation opportunities in the energy efficiency sector. Under the previous administration, Governor McAuliffe signed Executive Order 31 (2014) identifying energy efficiency in state government as a priority for the administration and establishing a goal of reducing state government electricity consumption by 15 percent by the end of 2017 (using 2010 as the baseline).

The 15 percent goal, applicable only to state facilities, was defined in a way that confined the goal to executive branch agencies, excluded higher education except for the community college system, and excluded selected other energy users whose power consumption cannot be significantly influenced the Governor's Office or by DMME. The 15 percent goal represents approximately 156 million kilowatt hours (kWh) and was intended to contribute to Virginia's statewide voluntary 10 percent goal.

While the aggregated electric energy consumption for state facilities has increased by approximately 6.5 percent since 2010, much of that can be attributed to growth. When attempting to normalize for growth, using only electric accounts that are active for every year since 2010, the aggregated electric energy consumption has actually declined by over 5% compared to 2010. Furthermore, when eliminating accounts that exhibited unusual year-over-year energy growth (over 50 percent), the remaining account aggregated electric energy consumption declined by over 10 percent compared to 2010. While filtering the data to possibly normalize for growth has revealed potential progress in energy efficiency, more analysis is needed to evaluate the data to determine progress on

the goal. Additionally, enhancements to the data could provide a vehicle to increase the ambition of Virginia's lead-by-example target.

A number of stakeholders provided recommendations that the Commonwealth should continue to establish a lead-by example energy efficiency target for state facilities and that such target should continue the trajectory of the previous 15 percent goal.

RECOMMENDATION

- ***Governor Northam should establish a goal of reducing energy consumption in state buildings by 20 percent by 2022.*** The new goal should attach minimum conditions to all funds for construction, support local government programs as part of achievement of the state goal, and include development of a state clearinghouse for data management. DMME should expand its existing energy data warehouse to include energy usage at all state-owned or leased buildings and local governments already benchmarking their public buildings.

VIII. ENERGY PERFORMANCE CONTRACTING

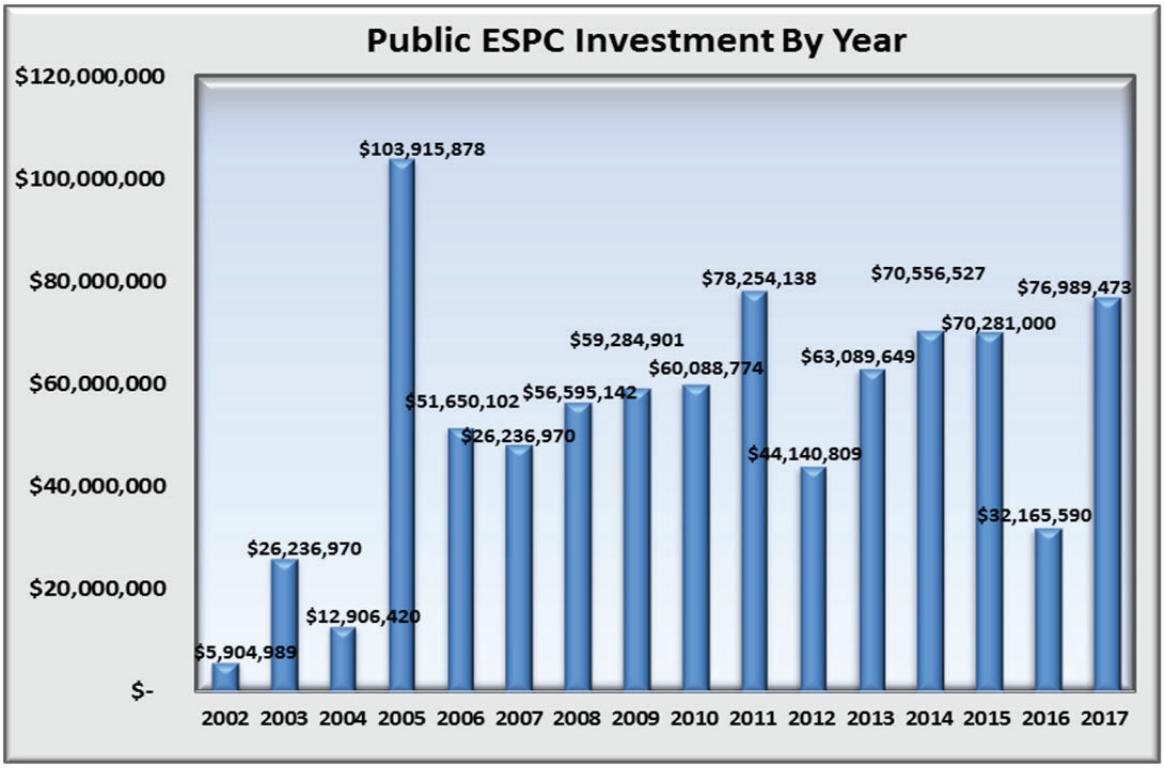
Energy Performance Contracting, or EPC (also referred to as Energy Savings Performance Contracting, or ESPC) is a budget neutral, cost-effective tool that allows state agencies and publicly-owned facilities to reduce their deferred maintenance backlogs without adding any financial burden to the taxpayer. In addition, EPC is an effective mechanism to finance capital improvements using leveraged energy savings to reduce both energy costs and consumption.

The customer uses future avoided utility costs to pay off the original investment, plus financing and maintenance costs over the term of a contract. Energy services companies (ESCOs) provide a corporate guarantee that savings will be greater than the costs of financing. If actual savings are lower than guaranteed in any given year, the ESCO reimburses the owner for the shortfall and is accountable to take corrective actions to ensure savings will be met in the following years.

The EPC projects target electricity, water, natural gas, and other energy savings that responsibly preserve Virginia's natural resources. The program has established strong partnerships with numerous ESCOs that employ thousands of individuals in the Commonwealth. The economic growth includes participation of Small, Women-owned, and Minority-owned (SWaM) businesses in Virginia's procurement opportunities.

DMME has managed the program since 2002, providing robust technical assistance to localities and state agencies considering EPCs. A statewide, competitively procured EPC contract with prequalified ESCOs streamlines the procurement process that saves time and resources. To date, more than 240 ESPC projects have been completed by state and local agencies in Virginia, valuing nearly $900 million in savings for the Commonwealth.

Figure 5: Commonwealth of Virginia ESPC Investments



Virginia's EPC program has demonstrated that significant energy savings, typically 15-25 percent annual savings, are achievable for the targeted state facilities. Calculated energy savings for EPC projects performed in 2017 totaled 6.5 million kWh, accounting for 4.2 percent of the 15% lead-by-example goal. Using the accumulation method, counting the annual savings effect of 2010 through 2017 ESPC projects, 2017 saw calculated savings totaling 63.6 million kWh, or 40.8 percent of the existing 15 percent energy conservation goal.

The Commonwealth's EPC program has been and will continue to be a valuable tool to realize energy savings. Many projects are in the ongoing process of being evaluated, and many more will be targeted in the future.

RECOMMENDATION

- ***Governor Northam should include in any energy efficiency target for state buildings the need for agencies to continue to proactively pursue EPC***. The Commonwealth should commit to a performance contracting target for state-owned buildings and should evaluate setting a goal for higher education facilities as well. To facilitate additional deployment of EPC, DMME should produce a ranking of top performers for best practices and a list of facilities that most need improvements. Further, DMME should expand EPC options to include the consideration of rooftop solar and preparation for electric vehicle charging infrastructure.

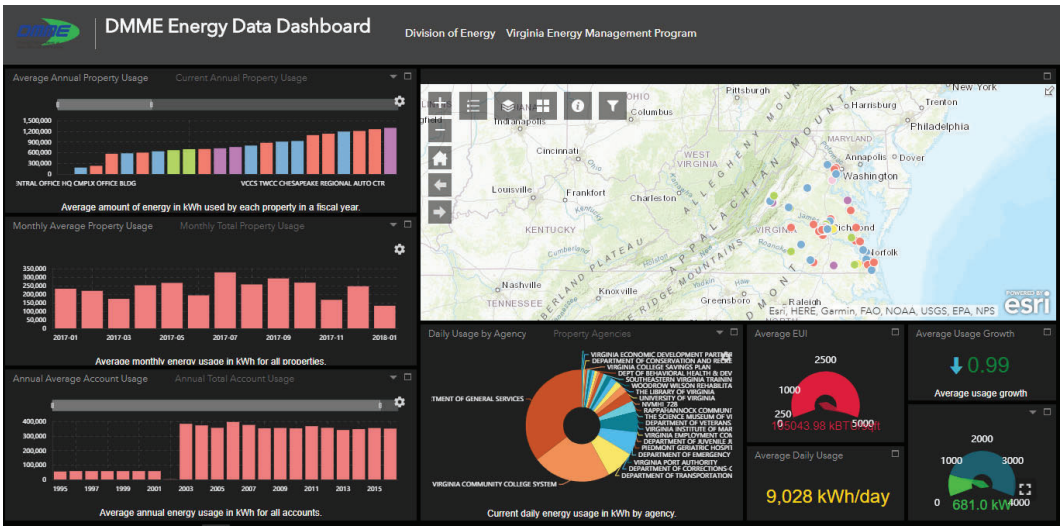
IX. DATA MANAGEMENT

One key to continued and accelerated success in energy efficiency is data-driven decision making. An energy data warehouse solution that enables the storage, integration of disparate information, and analytics of data will be critical to effectively evaluating the impact of energy efficiency and the achievement of statewide and lead-by-example goals. Currently, energy use and facility information are not linked for state facilities.

DMME is currently exploring various software to integrate the 200 highest-user state agency accounts with the Department of General Services (DGS) facility management software, CovaTrax. Next steps in this process include data clean-up, data correlation, and data integration.

The energy data warehouse will serve to integrate energy consumption data (electric, gas, and water), facilities data (building attributes, square footage, and use type), and energy efficiency measures (cost, year, projected dollar savings, energy savings, and carbon reduction). Energy consumption can then be assessed in comparison to similar users.

Figure 6: Sample Dashboard of Key Performance Indices



The database will consolidate record-keeping, maintain institutional knowledge, and support business intelligence, including predictive analytics. Among the many benefits will be the ability to perform analytics, project trends of state energy use at the aggregate level, raise awareness, highlight success stories of energy efficiency program deployment, identify potential candidates for energy performance contracting, provide replicable solutions in connection with benchmarking, and document savings that could be used to enable pay-for-performance or other utility programs.

While the database will not initially be capable of real-time energy management, it can serve as a strategic energy management tool to provide high-level information on state performance as well as detailed individual facility tracking.

RECOMMENDATION:

- ***The Commonwealth should better track and manage energy consumption and the results of energy efficiency measures in order to measure and assess the effectiveness of any energy efficiency program.*** As DMME develops an energy database to project trends and analyze the electric consumption of the top 200 largest state agency accounts, the agency should evaluate whether the database could also be made available to local governments that want to track and manage their own energy usage.

X. COMMERCIAL PROPERTY ASSESSED CLEAN ENERGY FINANCING

Commercial Property Assessed Clean Energy (C-PACE) programs are authorized by § 15.2-958.3 of the Code of Virginia. The program allows property owners to finance energy and water efficiency improvement and renewable energy systems using private capital. C-PACE assessments are recorded as a tax lien on the property, and may be paid back via the property tax bill or by direct pay agreement with the capital provider. Financing terms for C-PACE are longer than typical bank loans, which allows for the financing of more comprehensive retrofits.

Virginia's first C-PACE program launched in January 2018. The Arlington C-PACE program pairs the program sponsor, Arlington's Initiative to Rethink Energy (AIRE), with the program administrator, Sustainable Real Estate Solutions (SRS).[20] In addition to Arlington County, a number of local governments are considering C-PACE, and both Fairfax and Loudoun Counties have taken formal action to start the process of program development.

DMME is a participant in the Mid-Atlantic PACE Alliance (MAPA) project, which is funded through a $500,000 State Energy Program (SEP) competitive grant from the U.S. Department of Energy.[21] DMME's partners on the grant include the Maryland Clean Energy Center, District of Columbia Department of Energy and Environment, the Virginia Energy Efficiency Council, Clean Energy Solutions, Inc., and the Solar Foundation.

The objective of MAPA is to promote regional coordination of existing C-PACE programs to scale the market to an aggregate volume of $80 million in closed deals, and to provide tools and resources to local governments that will help them expedite the process of implementing C-PACE programs. These tools include the Regional C-PACE Toolkit released in June 2018.[22] The MAPA grant provides funding through December 31, 2019.

RECOMMENDATION

- ***To enhance state-level support for C-PACE, the Commonwealth should provide increased outreach, implementation assistance, and other resources to local governments as they work to implement C-PACE programs.*** The overall goal of this outreach should be to expand C-PACE programs to at least a dozen local government programs over the next three years.

XI. VIRGINIASAVES

The VirginiaSAVES program is the Commonwealth's first statewide green community program that was established via Executive Order 36 in 2014. VirginiaSAVES was successful in utilizing $57.58 million of Virginia's remaining $66 million Qualified Energy Conservation Bonds (QECBs) allocation. DMME contracted with CleanSource Capital to administer the program. The program funded 13 projects, including 11 energy performance contracts covering 156 buildings and 2 photo-voltaic (PV) arrays that will collectively save $72 million in energy costs over the lifespan of the projects and create over 900 jobs.

As a result of the Tax Cuts and Jobs Act (HR 1), which was signed into law on December 22, 2017, the unused authority for QECBs was eliminated effective January 1, 2018. This removed the source of funding for the VirginiaSAVES program in its current form. All bond issuers and holders for tax credit bonds issued by December 31, 2017 through the program will receive associated tax credits and payments for the life of the bonds.

DMME has worked to determine if other funding sources could be used to continue the program. A possible source may be the proceeds from regulations proposed to limit carbon dioxide emissions. If implemented, DEQ's carbon regulation will allocate 5 percent of annual carbon dioxide emissions allowances to DMME, starting in the first control year of 2020. These allowances could then be monetized through the Regional Greenhouse Gas Initiative (RGGI) by agreement with a third-party entity authorized to exercise the transaction. The third party could then deploy these funds to finance energy efficiency projects that serve the purpose of carbon pollution abatement.

RECOMMENDATION

- ***The Commonwealth should reconstitute the VirginiaSAVES program with new sources of revenue to replace QECBs, potentially from the RGGI auction or other sources of funding, to deploy an energy efficiency financing program.*** One potential option is for DMME and the Virginia Resources Authority to coordinate on the development of an interest-free revolving loan fund for public bodies with revenues to be generated based on a percentage of excess revenues in the state's recordation tax fund. This concept was reflected in HB 560 in 2018.

XII. COMBINED HEAT AND POWER

Combined heat and power (CHP) and waste heat to power (WHP) systems generate both heat and electricity from a single fuel source, which can significantly lower emissions and increase overall fuel efficiency. The U.S. Department of Energy has identified 4,308 MW of technical on-site combined heat and power (CHP) potential, including 65 MW of waste heat to power (WHP) potential, at existing facilities in Virginia.[23] However, the number of CHP installations in Virginia lags behind several of the mid-Atlantic and Northeast states.[24]

CHP installations for mission-critical facilities such as hospitals, military installations, and emergency management centers could help these entities reduce energy costs, improve power reliability, and be better prepared for power outages and disruptions associated with severe storms and weather events. Increasing the use of CHP systems also facilitates the transition to a more distributed grid, and CHP can be installed in combination with distributed solar resources and microgrids.

As a preliminary step, Senate Bill 966 directs Dominion Energy to consider in its next Integrated Resource Plan the deployment of 200 MW of CHP or WHP by 2024. A number of stakeholders recommended that increasing Virginia's focus on CHP to even a fraction of Virginia's 4,308 MW potential could position the Commonwealth to effectively achieve other public-policy strategies such as energy efficiency and resiliency.

RECOMMENDATION

- ***As Dominion Energy analyzes the deployment of 200 MW of CHP or WHP, the Commonwealth should establish a cumulative target for CHP of at least 750 megawatts by 2030***. In furtherance of this target, DMME should develop a roadmap for deployment of this level of investment through utility-sponsored programs, public buildings, and the private market.

ENERGY STORAGE

The demand for renewable energy is stronger than ever, but an inherent limitation is the intermittency of the resource. Energy storage technologies could provide a stable source of electricity and stabilize, if not revolutionize, the grid. A variety of energy storage technologies are playing a role in the dynamic energy storage sector.

One such technology is pumped storage hydropower (PSH), which is a mature technology with a strong Virginia connection. The Bath County Pumped Storage Station has been described as "the largest battery in the world" and has a capacity of 3,003 MW, which is enough to power 750,000 homes. Pumped storage resources employ two connected reservoirs at different elevations. During the night-time hours, when electricity costs are low, water is pumped from the lower reservoir (charger) to the upper reservoir to be stored (charged battery). During the day, when demand or costs of electricity are high, the water is released from the upper reservoir (battery) and flows through a turbine to generate electricity. Other sites in the Southwest Virginia are being evaluated for PSH stations.

Although not currently deployed in Virginia, compressed air energy storage is another promising form of storage. Like pumped storage hydropower, it uses less-expensive offpeak power by pumping and compressing air in underground containment areas. The air is held until power is needed and then is released through a combustion turbine with the natural gas fuel, increasing the efficiency of the generator to provide more economical electricity at times of high demand.

Flywheel energy storage systems are also used to regulate sudden changes in supply and demand. These systems quickly and efficiently convert kinetic energy to electricity by spinning a rotor in a low friction environment. Typically, flywheel systems are used in aerospace and telecommunications applications.

Thermal storage systems represent an additional emerging technology. Frequently paired with concentrated solar power systems, these systems store excess energy produced as heat in the form of molten salt or other materials. During offpeak times, the steam generated by the molten salt can be used to drive turbines.

While the technologies described above will play an extremely important role in the deployment and availability of energy storage, much of the recent attention has been on lithium-ion batteries. These batteries are similar to those that power laptops and cellphones, but are significantly larger in size and capacity. According to an early 2017 GTM Research report, lithium-ion batteries accounted for about 95 percent of deployed systems in the utility-scale battery market in 2015.[25] In a recent 2018 report by GTM Research, global lithium-ion battery deployment is projected to grow by 55 percent annually over the next five years as costs continue to decline.[26]

While lithium-ion battery uses a liquid electrolytic solution to regulate the flow of current, solid-state batteries use a solid electrolyte. Using a solid rather than a liquid conductive chemical mixture not only increases the maximum storage capacity, it also improves charging times and the lifespan of the battery while also reducing its physical size.[27]

Redox-flow batteries are also showing promise. Redox-flow batteries consist of two tanks of chemical liquids that are separated by a membrane. The two chemicals are pumped past the membrane, which facilitates the ion exchange to generate electricity. These batteries have a lower energy density and typically have a higher initial cost than other batteries. However, the major benefit of redox-flow batteries is that they are characterized by their extremely long life, tens of thousands of cycles if not more, which is significantly more than other batteries and as a result, reduces lifetime costs, especially in high-cycle applications.[28]

Finally, it is important to note the impact of electric vehicles on the grid. The batteries in electric and plug-in hybrid electric vehicles could potentially be used as battery storage technology to stabilize the grid. In theory, off-peak or low cost electricity from the grid could charge the vehicles, shifting load to the nighttime hours or otherwise helping to match supply and demand. The vehicles' batteries could also be used as storage to provide electrons to the grid during peak hours. The University of Delaware and PJM are currently evaluating this concept under the "vehicle-to-grid" (V2G) technology test.[29]

The demand for more renewables and battery storage prompted the General Assembly to enact legislation that studies the impact of these technologies. Senate Bill 966 requires each investor-owned utility to develop a pilot program to deploy battery storage. Dominion Energy may deploy a battery storage pilot program with up to 30 megawatts of capacity, and APCo may install a battery storage pilot program with up to 10 megawatts of capacity.

In addition, the 2018 budget included $100,000 for the Solar Energy Development and Energy Storage Authority to conduct a study to determine if regulatory reforms and incentives will prove fruitful in encouraging emerging energy storage capacity in the Commonwealth. More information on this study and its recommendations will be provided once the study commences.

RECOMMENDATION

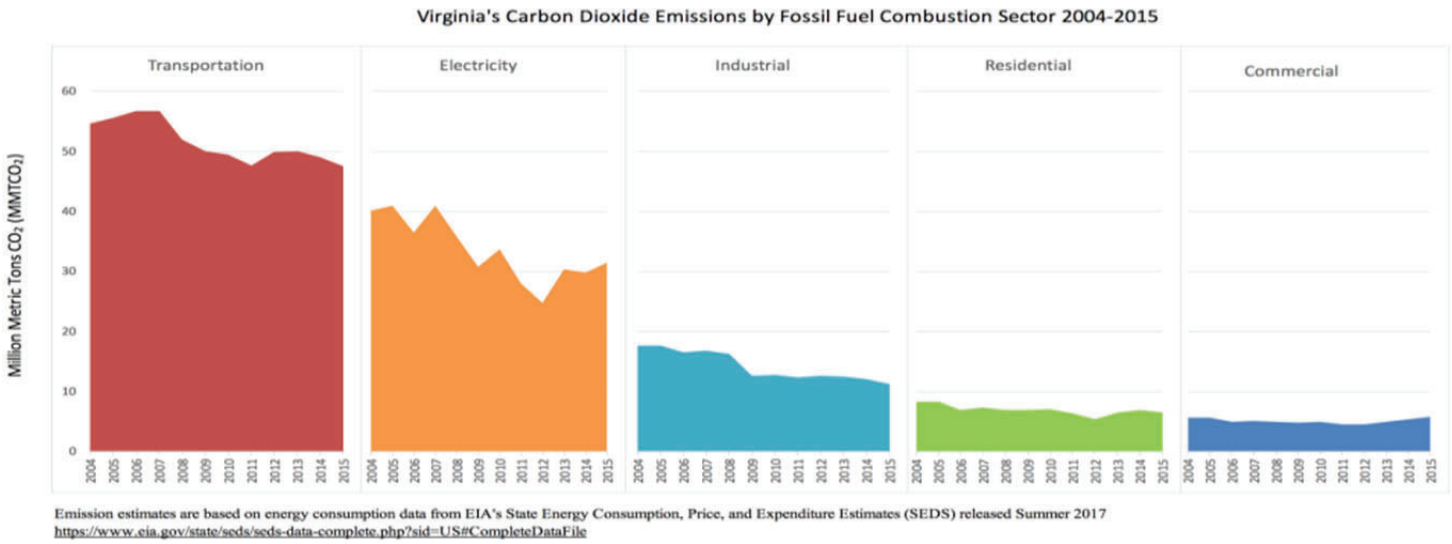
- ***DMME and the Solar Energy Development and Energy Storage Authority should work collaboratively to ensure that their solar energy study aligns the Commonwealth's competitive advantages and potential incentives with energy storage industry needs.*** Effective collaboration will ensure that statewide energy storage adoption and supply chain growth move forward as quickly as possible.

ELECTRIC VEHICLES AND ADVANCED TRANSPORTATION

XIII. ELECTRIC VEHICLES

Transportation forms an integral part of Virginia's economy and environment. The transportation sector is the largest end-use energy-consuming sector in the state.[30] In 2017, Virginia's drivers spent $33,500,000 on 13,000,000 gallons of imported gasoline and diesel per day to fuel their vehicles.[31] Each gallon of petroleum fuel produces 19 pounds of carbon dioxide (CO2), and results in a total daily vehicle output of 123,500 tons of CO2 in Virginia. This makes transportation the largest source of CO2.

Figure 7: Carbon Dioxide Emissions by Sector

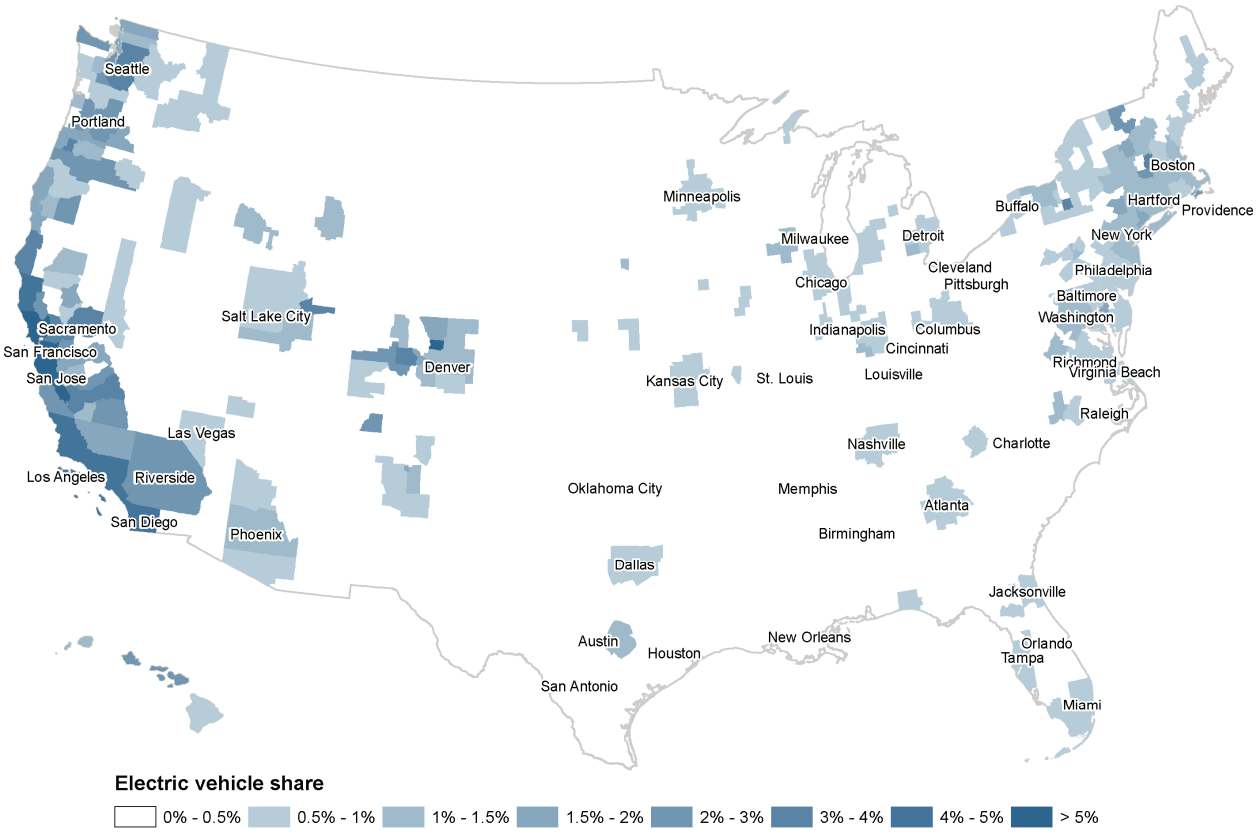


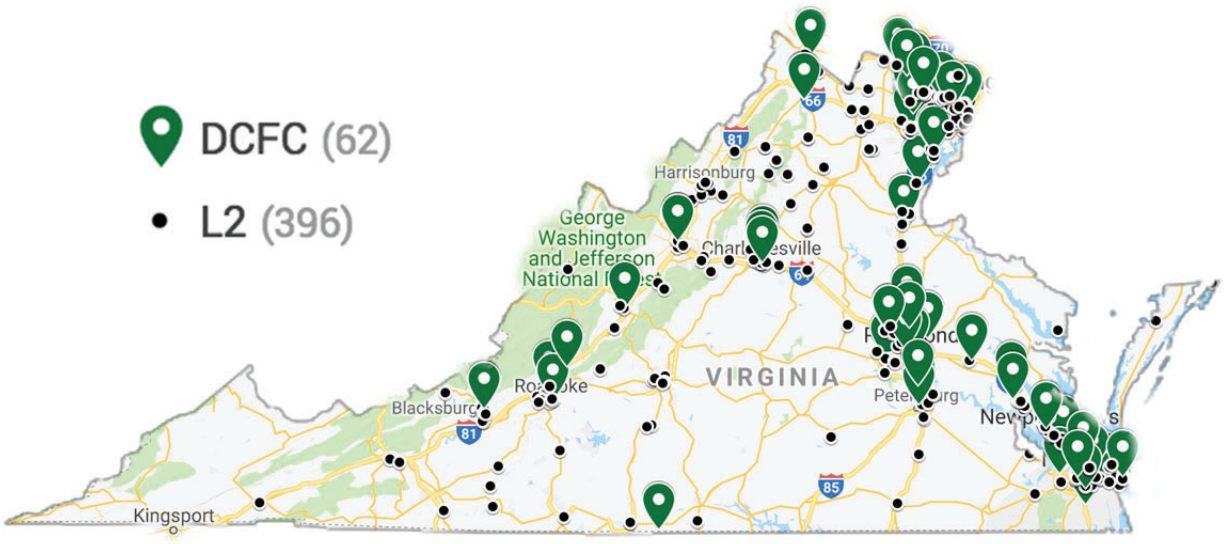
In recent years, Virginia has made considerable progress in reducing the carbon intensity of its electric generation through the use of natural gas and renewable energy resources. With a cleaner electric grid in Virginia, electric vehicles (EVs) provide a "well-to-wheel" emissions and energy consumption advantage over conventional vehicles running on gasoline or diesel.[32]

Significant progress has also been made in electric vehicle technology in recent years, including performance improvements and cost reductions. Certain passenger battery-electric vehicles (BEV) currently on the market have ranges of over 200 miles on a single charge. In 2017, the two-millionth EV was sold, and EVs make up more than 10 percent of new vehicle sales in several local U.S. markets. In 2018, Volkswagen, General Motors, BMW, Ford, Fiat, and Volvo all announced $100 billion investments in new EVs and plan to release numerous new EV models by 2025.

There are approximately 11,000 BEVs and Plug-in Battery Electric vehicles in Virginia, which account for 0.14 percent of all passenger vehicles registered in the state.[33] The lack of direct current (DC) fast-charging infrastructure represents a major barrier to growth in the EV market. There are currently 62 public DC fast-charging locations concentrated in certain areas of the state. The lack of accessible statewide DC fast-charging infrastructure across Virginia restricts drivers' ability to take longer trips and limits the utility and attractiveness of EVs, especially for any household without the ability to charge at home.

Figure 8: Electric Vehicle Share of New 2017 Vehicle Registrations by Metro Area





In 2017, Virginia was designated a beneficiary in the Volkswagen Diesel Emission Mitigation Settlement. In August 2018, the Commonwealth awarded a contract to EVgo to develop a statewide public charging network to accelerate EV adoption. The network will complement existing and other large-scale deployments of charging infrastructure underway maximizing the state's investment. The network will prioritize high-powered DC fast charger (DCFC) deployment along heavily traveled corridors and metropolitan areas, while ensuring charging accessibility across the entire state. Lower output Level 2 (L2) chargers will also be disbersed statewide.

The program will offer sites with multiple chargers to ensure redundancy and will be designed to accommodate additional chargers or power for future upgrades. EV charging site and corridor signage will integrate with Virginia's existing systems to allow the public to safely and efficiently find desired charging stations. The network will be developed over three (3) one (1)-year investment cycles, and when complete, approximately 95% of Virginians will be within 30 miles of a DC fast charger.

Growing the fleet of EVs increases the need for emissions-free electric generation and requires an electric distribution system able to accommodate the demand of EVs and their charging systems.

RECOMMENDATIONS

- ***The Commonwealth should adopt the Advanced Clean Cars (ACC) program.*** The ACC program includes both low-emission vehicle (LEV) standards as well as the Zero Emission Vehicles (ZEV) program. Adopting the LEV standards is especially important in light of recent federal action to roll back fuel efficiency standards, and a ZEV program would increase access to a wide range of EV models. Consumer access is linked to higher adoption rates and, as of 2015, 65% of nationwide EV sales occur in the nine states with a ZEV program.

- ***The Commonwealth should develop a comprehensive Virginia Transportation Electrification Action Plan and should include a goal for new electric vehicle-charging infrastructure by the end of 2021.*** A Transportation Electrification Action Plan could provide a more in-depth exploration of legislative, administrative, and public-private partnership opportunities to accelerate vehicle electrification. Through the stakeholder outreach process, the Commonwealth should also create an EV awareness marketing campaign to include an informational website and other marketing materials to promote the benefits of electric transportation.

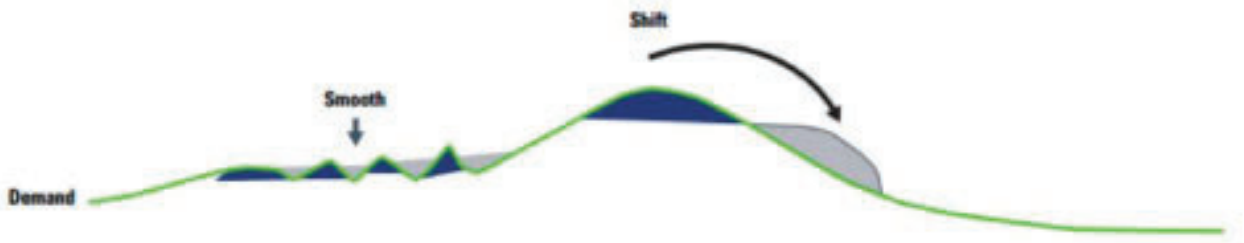
- ***The Commonwealth should establish a Green Fleet Program and clean vehicle purchasing standards for state agencies.*** With an emphasis on its own fleet of vehicles, the Commonwealth should expand efforts for alternative fuel vehicles and work toward the electrification of public fleets across Virginia. To lower costs, the Commonwealth should also evaluate opportunities to provide joint procurement options for local governments.

XIV. INTEGRATION OF EMERGING TECHNOLOGIES

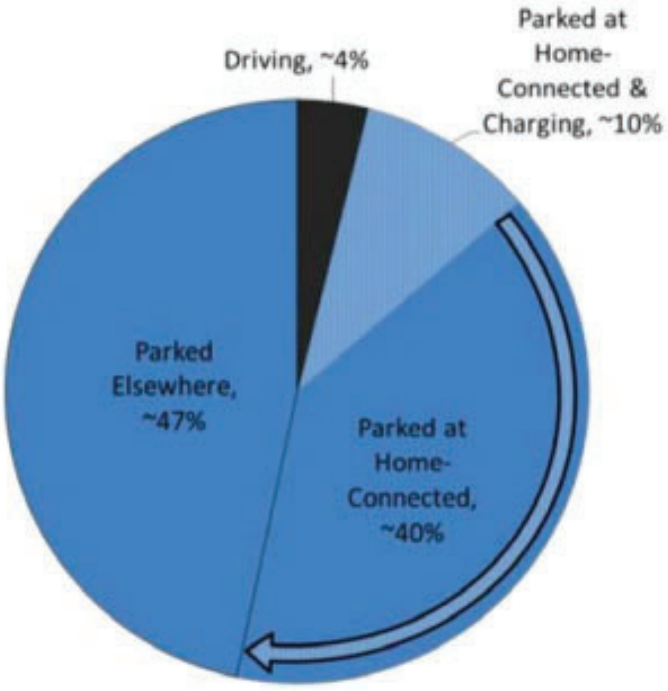
As the number of EVs and their charging needs increase, so too will the load that utility companies have to manage. Uncontrolled, EV load growth has the potential to exacerbate already expensive system peaks. Although it is difficult to estimate with certainty the effects of added load that EVs will place on Virginia's electricity grid and the grids serving Virginia, the potential is significant.[34]

Given its flexibility, EV charging can be used by utilities to make the grid itself more flexible. EV load can be moved to times of day when it is less expensive to serve. As illustrated in Figure 9, the demand to which EVs might contribute (blue) could be shifted off-peak (gray), avoiding the need for new generation. EV load could also be moved to times when otherwise unused renewable energy might be available.[35]

Figure 9: Depiction of Load Shift Potential



An EV's ability to provide both load and generation, while also serving as a source of mobility, suggests the potential for coordination between regulators, customers, equipment providers, and grid operators to take advantage of EVs as grid resources.[36] EV charging services are capable of providing significant benefits to the overall utility transmission and distribution network if they are properly deployed, but without a price signal, drivers will generally plug in and charge immediately upon arriving home after work, exacerbating evening peak demand.[37]



A properly-designed rate can help mitigate these problems by sending price signals to customers that encourage them to charge their vehicles when there is less stress on the system during off-peak periods.

While rate design can play a key role in managing EV charging, utilities have developed smart charging programs to further enable vehicle integration. Examples of smart charging include demand response, one-way controlled charging, or vehicle-to-grid. Demand response (DR) principles can be applied in the EV charging context. Utilities can simply pause charging at peak times or when supply is otherwise disrupted. A DR approach could help stabilize grid frequency and avoid the dispatch of often more-expensive and dirty peaking generation resources.

Another version of smart charging, referred to as "one-way, controlled charging," adds scheduling and modulating charging to the basic DR approach. This allows utilities greater flexibility to move the charging activity to times when the grid is most capable of providing the service, saving the EV owner and power company expense by avoiding the need for additional investment in infrastructure or generation capacity.

Vehicle-to-Grid (V2G) or two-way charging can be thought of as an advanced form of smart charging. It essentially allows for an EV's battery to serve as a storage device that can discharge power back onto the grid when called upon.[38]

XV. ADVANCED TRANSPORTATION PROGRAMS

Virginia has a number of ongoing transportation initiatives to advance clean and domestic fuel options for transportation. Virginia has worked to support local decision makers in moving towards clean domestic fuels, educating and encouraging fleet managers to retire vehicles earlier and purchase safer and cleaner fuel vehicles. Strategies include a focus on the deployment of cleaner vehicles in state and local government fleets, dray equipment at the Port of Virginia, other diesel vehicle replacements, and public education and outreach.

Virginia currently provides a number of funding opportunities for replacement of heavy-duty vehicles and procurement of vehicles, including those using compressed natural gas, propane, electricity, hydrogen, biodiesel, and ethanol. The emerging fuels of renewable propane and renewable natural gas can bring further benefit

RECOMMENDATIONS

- ***Virginia should continue fleet and consumer clean fuel adoption programs for all Virginia fuels.*** Virginia's cleaner fuels as a replacement to gasoline and diesel can include ethanol, biodiesel, propane, and natural gas. As part of these programs, Virginia should offer one-on-one technical support for fleet managers and organizations seeking to transition to alternative and clean fuels. Virginia has worked to support local decision makers in moving towards clean domestic fuels, educating and encouraging fleet managers to retire vehicles earlier and purchase safer and cleaner fuel vehicles.

- ***Virginia should support bulk collaborative procurement options for use by school and local government fleets in order to reduce the costs of clean vehicle acquisition.*** Virginia is a partner in the 'Fleets for the Future' procurement effort run through the Metropolitan Washington Council of Governments. This approach can reduce the initial costs of vehicles and infrastructure as government and private sector managers purchase in bulk. The Commonwealth should evaluate engaging in similar aggregated procurement that may enable fleets to reduce their costs of clean vehicle acquisition.

CARBON REDUCTION

Setting a limit on carbon pollution serves as a concrete commitment to addressing climate change and sends a clear signal that Virginia will embrace the economic opportunity of transitioning to greater deployment of clean energy technologies. Climate pollution limits will unleash investment in clean energy and encourage innovation to implement existing solutions and develop new ones.

With climate change, those responsible for emitting pollution do not generally have to pay for the costs of that pollution. Internalizing this cost by putting a price on carbon would avoid many of the impacts and damages, as energy markets more efficiently allocate capital toward solutions. Markets will function more effectively and climate solutions will accelerate.

On May 16, 2017, Governor McAuliffe issued Executive Directive 11 (ED 11), directing DEQ to develop a proposed regulation under existing state law to abate, control, or limit carbon dioxide emissions from electric power facilities. Based on recommendations from the work group established by the previously-issued Executive Order 57 and from an official advisory opinion from Attorney General Mark Herring, ED 11 directed that the proposed regulation:

- Include provisions to ensure that Virginia's regulation is "trading-ready" to allow for the use of market-based mechanisms and the trading of carbon dioxide allowances throughout a multi-state trading program; and

- Establish a corresponding level of stringency to limits on carbon dioxide emissions imposed in other states with such limits.

Following an extensive public process and discussions with states involved in the Regional Greenhouse Gas Initiative (RGGI), DEQ submitted a draft proposed RGGI-linkable carbon trading rule for new and existing fossil fuel electric generating facilities to the State Air Pollution Control Board in November 2017.

RGGI is an example of a regional market-based program to reduce climate pollution from the electric power sector across Northeast and Mid-Atlantic states. Launched in 2009, RGGI is a cap and invest system that has seen extraordinary success in reducing pollution, creating jobs and economic value, and saving consumers money.

The RGGI states establish a regional limit on the amount of carbon pollution that power plants are allowed to emit. States then auction allowances via the RGGI market on a quarterly basis, and the auction establishes the allowance price. Under Virginia's proposed regulation, the Commonwealth will not directly auction the allowances, so any revenue generated from the auction will go directly to the regulated entity.

Since 2009, RGGI has achieved over 50 percent reduction in carbon pollution and the cap will continue to decline by 2.5 percent annually through 2020 and 3 percent per year from 2021 to 2030. The health benefits of reduced carbon and other pollutants were valued at $5.7 billion for the period of 2009 to 2014.

RGGI has also led to increased economic health. The program created 45,000 job years of work across the region and added $4.3 billion in economic value. Further, between 2008 and 2016, economic growth in the RGGI states outpaced that of non-RGGI states by 4.3 percent, and electricity prices in the region fell by 6.4 percent even while prices rose by an average of 6.2 percent in non-RGGI states.

Virginia's proposed regulation establishes a carbon program starting in 2020 using the RGGI August 2017 model rule and covers fossil fuel-fired electric generating units that are 25 MW and greater. The Virginia regulation will generate at least a 30 percent reduction in electric power sector carbon emissions by 2030 and will create significant opportunity for investment of carbon revenue to further accelerate emissions reduction. Virginia's draft regulation proposed an initial starting cap of either 33 or 34 MMT for this sector. As of October 1, 2018, the regulation is still under development.

ANALYSIS OF VIRGINIA'S ENERGY SYSTEM

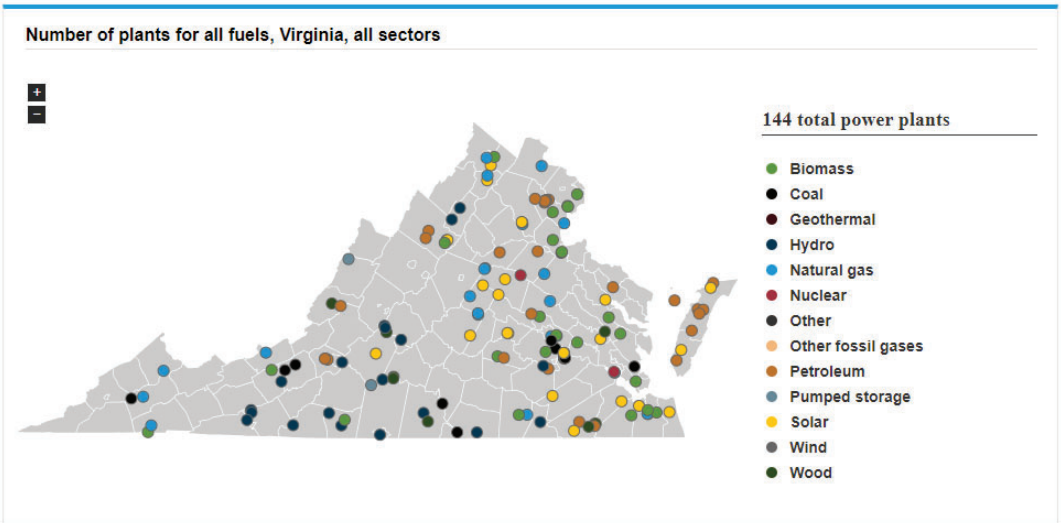
In addition to development of a set of recommendations, § 67-201 of the Code of Virginia also requires the Energy Plan to include an analysis of the Commonwealth's energy infrastructure, energy consumption, energy efficiency, air emissions, and disproportionate adverse impacts on economically disadvantaged or minority communities. The sections that follow provide an analysis of these topics.

ENERGY INFRASTRUCTURE

I. ELECTRIC GENERATION

Virginia is served primarily by two investor-owned utilities (IOU) for electric service: Dominion Energy and Appalachian Power Company (APCo). Both are members of the PJM Regional Transmission Organization (RTO), which operates a competitive wholesale electricity market and manages the high-voltage electricity grid to ensure reliability for more than 65 million customers in thirteen states and the District of Columbia. Virginia is also home to 144 utility-scale power facilities.

Figure 10: Virginia Utility-Scale Generation Facilities[39]



As PJM members, Dominion Energy and APCo are signatories to PJM's Reliability Assurance Agreement, which obligates the IOUs to own or procure sufficient generating and distribution capacity to maintain overall system reliability. PJM determines these obligations for each zone through its annual load forecast and reserve margin guidelines. PJM then conducts a capacity auction through its Short-Term Capacity Planning Process to meet these requirements three years into the future.

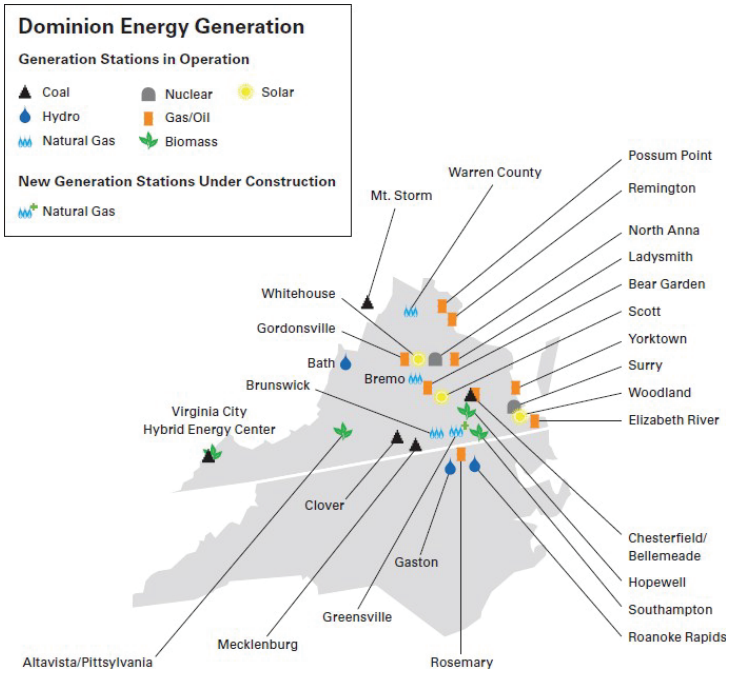
As generation providers, Dominion Energy and APCo bid their capacity resources, including owned and contracted generation and demand-side management (DSM) programs, into the Reliability Pricing Model (RPM) auction. As Load Serving Entities

(LSE), both companies are obligated to obtain enough capacity to cover PJM-determined capacity requirements either from the RPM auction or through any bilateral trades.

DOMINION ENERGY

Dominion Energy's existing generating resources are distributed throughout the state. The fleet of 100 generation units includes 4 nuclear, 12 coal, 4 natural gas-steam, 10 combined-cycle (CC), 41 combustion turbine (CT), 4 biomass, 2 heavy oil, 6 pumped storage, 14 hydro, and 3 solar with a total summer capacity of approximately 18,265 MW.[41]

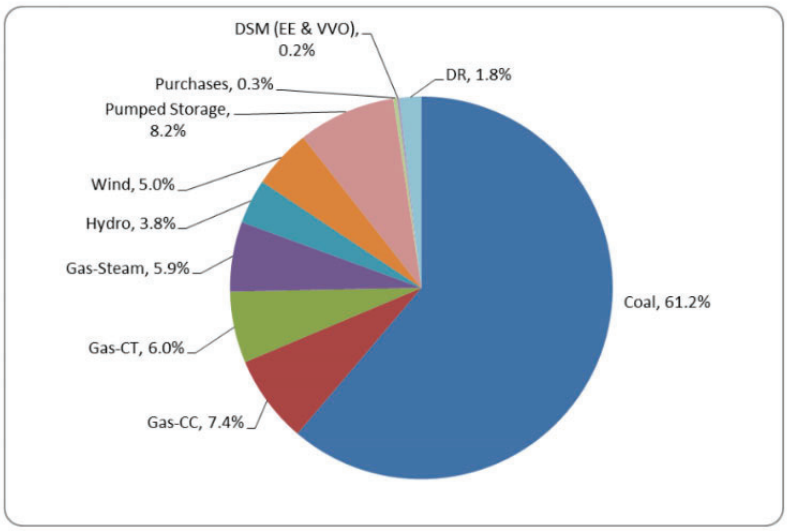
Figure 11: Dominion Energy Generation - 2018[40]



APPALACHIAN POWER COMPANY

Appalachian Power's generation fleet provides 6,958 MW of capacity from generating units that include 5 coal, 9 gas, 8 hydro, 5 pumped storage, and 7 power purchase agreements for hydro (2) and wind (5).[43]

Figure 12: 2017 APCo Nameplate Capacity Mix[42]



II. ELECTRIC TRANSMISSION AND DISTRIBUTION

Virginia's electric transmission system is made up of high-voltage, high-capacity components. Dominion Energy, Appalachian Power, Delmarva Power, and Old Dominion Electric Cooperative own and maintain transmission and distribution facilities in Virginia.[44]

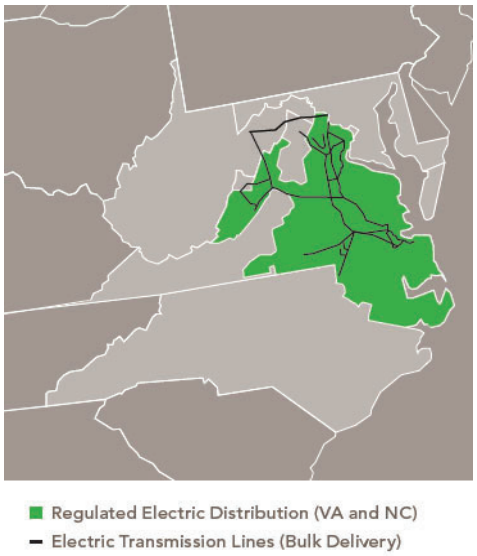


Figure 13: Virginia Electric Transmission Lines[45]

Dominion Energy has about 6,500 miles of 69 kilovolts (kV) and above of transmission lines located in Virginia, West Virginia, and North Carolina that serve 2.6 million customers.[46] Between 2013 through 2017, Dominion has spent close to $4.5 billion to upgrade or add new transmission and distribution lines, substations, and other facilities to meet growing electricity demand within its service territory and maintain reliability.[47] Dominion also owns one of the largest 500 kV systems in PJM.[48]

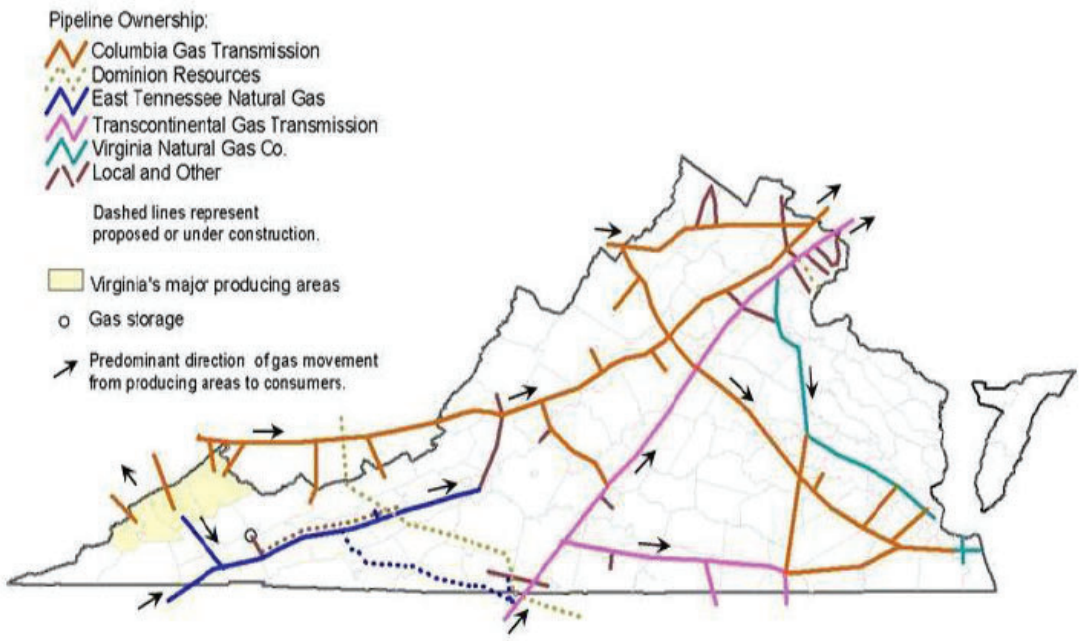
Appalachian Power Company's East Zone is comprised of nearly 15,000 miles of transmission circuitry operating at or above 138 kV, including 3,800 miles of 345 kV transmission lines and over 2,100 miles of 765 kV transmission lines within the states of Indiana, Kentucky, Michigan, Ohio, Tennessee, Virginia, and West Virginia.[49] In Virginia, APCo's transmission infrastructure consists of 2,634 miles, ranging from 69 kV to 765 kV lines, which provided 15,503,756 megawatt hours (MWh) in 2016.[50]

Delmarva Power owns and operates both 138 kV and 69 kV transmission lines near the border of Maryland and Virginia. Old Dominion Electric Cooperative (ODEC) owns approximately 110 miles of 69 kV lines on the Eastern Shore of Virginia in Accomack and Northampton counties. In addition, ODEC also co-owns 1,000 feet of 500 kV transmission lines in Maryland.[51]

III. NATURAL GAS TRANSMISSION AND DISTRIBUTION

Interstate and intrastate natural gas pipelines in Virginia consist of 3,000 miles of high-pressure pipelines and over 40,000 miles of lower-pressure distribution pipes connecting 1.2 million customers. In addition, there are about 36 miles of gathering and collector lines that connect gas-production wells to the distribution pipeline network. The Virginia State Corporation Commission (SCC) oversees safety for the intrastate distribution lines, while the Federal Energy Regulatory Commission (FERC) and other federal entities regulate interstate pipelines that cross state lines.

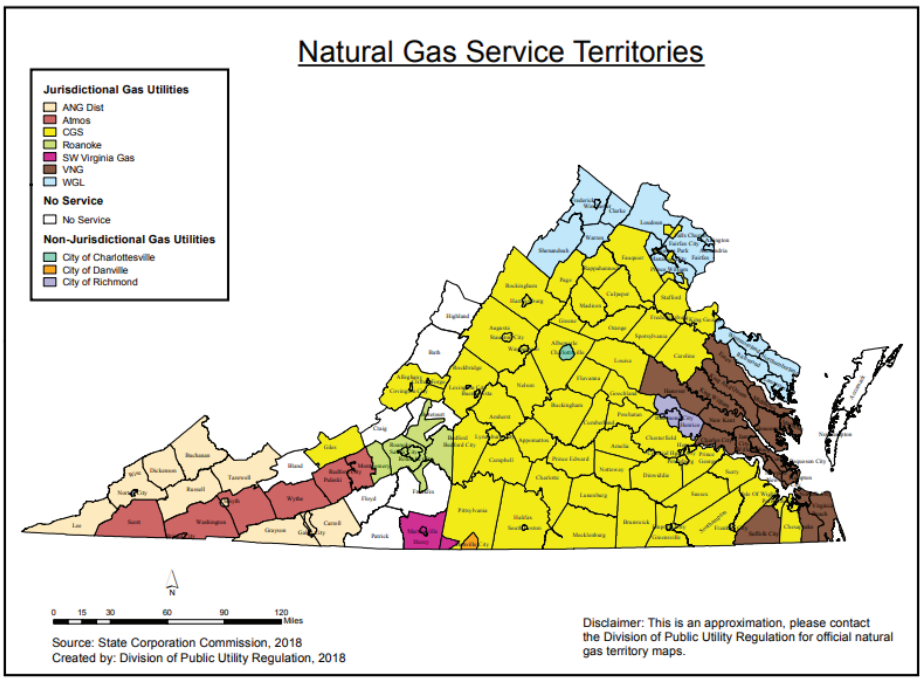
Figure 14: Natural Gas Pipeline Network



Two proposed new interstate natural gas pipelines are the Atlantic Coast Pipeline (ACP) and the Mountain Valley Pipeline (MVP). The ACP is proposed to add approximately 600 miles of new high-pressure pipeline in West Virginia, Virginia, and North Carolina and is expected to provide up to 1.5 billion cubic feet equivalent (BCF) per day of firm transmission capacity. The MVP is proposed to add approximately 600 miles of new high-pressure pipeline in West Virginia and Virginia and is expected to provide up to 2.0 BCF per day of firm transmission capacity.

Virginia's Local Distribution Companies (LDCs) provide end-use customers with natural gas service in ten respective service territories, as set forth in Figure 15.

Figure 15: Natural Gas Service Territories[52]



ENERGY CONSUMPTION

I. SECTOR-LEVEL

Energy consumption statewide increased steadily across the residential, commercial, and transportation sectors between the 1970s and 2000s, but has experienced some declines since approximately 2008-2010. Consumption in the industrial sector began to decline in 2005 and has remained relatively flat over the last decade.

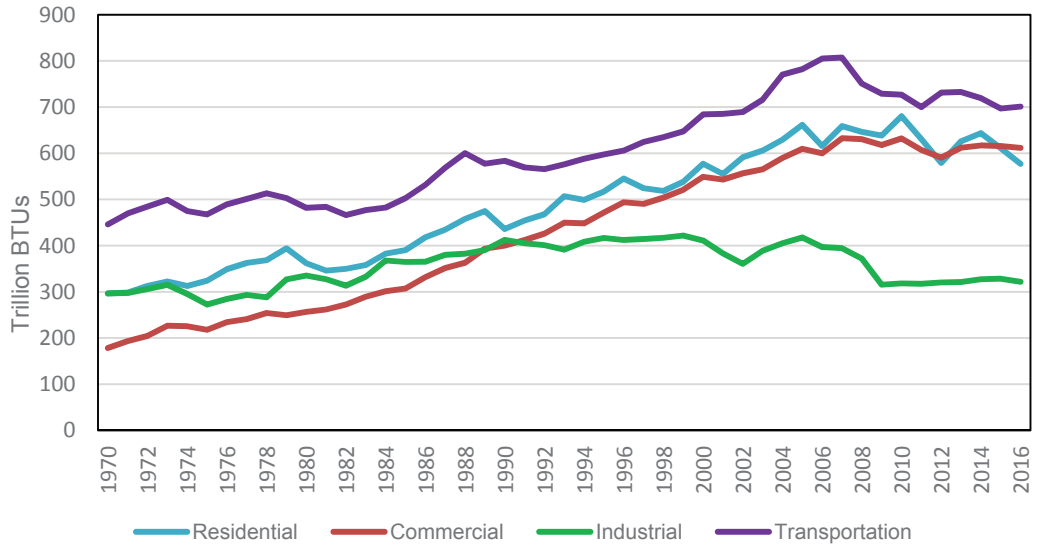


Figure 16: Total End-Use Energy Consumption by Sector[53]

Residential – Electricity delivers 58 percent of energy to the residential sector for space conditioning, hot water, lighting, and electronic devices. Approximately one in three households in Virginia use natural gas for home heating.

Commercial – Electricity delivers 61 percent of all energy to the commercial sector, with most of the remainder served by natural gas. Commercial building energy use overall peaked in 2010 and has declined slightly in subsequent years.

Industrial – The industrial sector is the second-largest natural gas-consuming sector in Virginia, consuming 19 percent of electricity used statewide. Natural gas is an ingredient of a number of products and serves as fuel for heating and hot water or steam.

Transportation – The largest sector for total energy use, the transportation sector uses 701 trillion British thermal units (Btu) in Virginia. Petroleum motor fuels (primarily gasoline, diesel, and jet fuel) deliver 99 percent of energy. About 1 percent of energy used for the transportation sector is electricity.

II. SOURCE-LEVEL

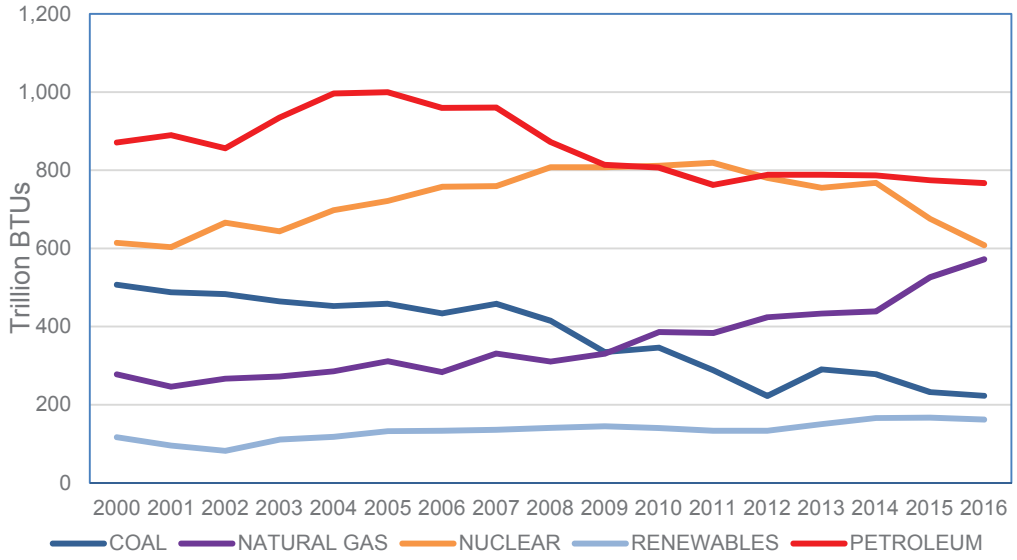
Electricity generated in Virginia in 2016, the most recent year in which data is available, came from a variety of sources including:

- 28% from nuclear
- 52% from natural gas
- 11% from coal
- 6% from renewables
- 2% from hydroelectric
- 1 % petroleum[54]

Energy consumption can be cyclical and driven by the economy and other factors, such as changes in production costs. Year-to-year fluctuations may also be weather-dependent. According to the Energy Information Administration (EIA), 2016 retail electricity consumption in Virginia was approximately 112,280 gigawatt hours (GWh), ranking 10th highest in the nation in 2016.[55]

Changes in dispatch from coal to natural gas have impacted the overall electricity profile. The use of natural gas in Virginia has increased significantly over the last five years, from 410,106 million cubic feet in 2012 to 541,620 million cubic feet in 2016.[56] Coal use in Virginia has declined steadily since 1991, and 2016 consumption of approximately 9.5 million short tons was primarily through the electric power sector (approximately 82%) and industrial sectors (18%).[57]

Figure 17: Historical Consumption by Source, 2000-2016[58]

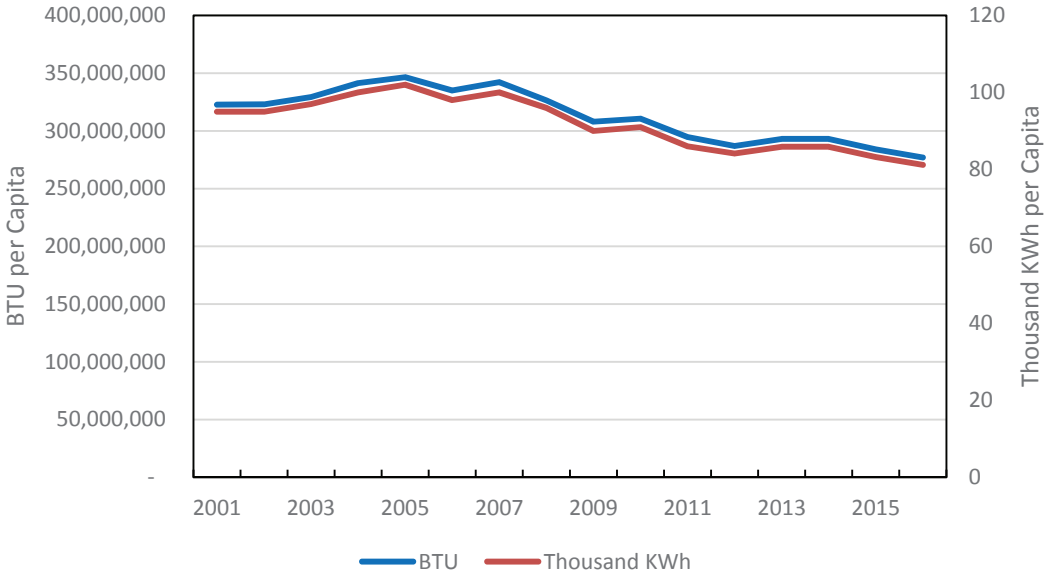


ENERGY EFFICIENCY

The United States has made significant progress on energy conservation efforts, including both energy efficiency (doing the same function with less energy, such as replacing an old air-conditioning unit with a new highly-efficient unit) and behavior changes (such as turning the lights off when leaving a room). Driven by economics, advances in technology, consumer awareness, and public policy initiatives, the United States economy has continued to grow steadily while *per capita* energy use is down 7% below 2010 levels.[59]

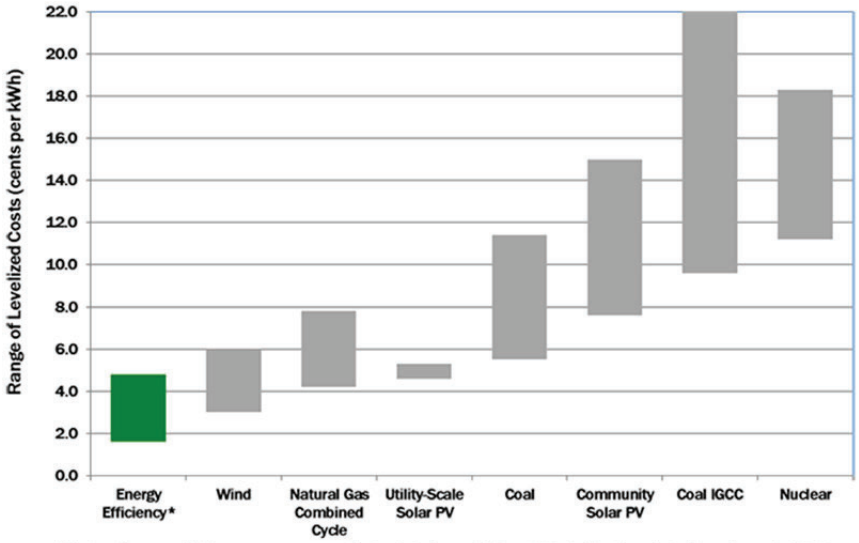
Despite efficiencies in Virginia's energy system, energy load is expected to grow in Virginia. PJM predicts net energy load growth of 0.4% annually over the next 10 years and 0.5% over the next 15 years in the PJM Regional Transmission Organization (RTO).[60] However, Virginia uses energy more efficiently than the nation, consuming 277 million Btu per capita, while the nation consumes an average of 345 million Btu per capita.

Figure 18: Virginia's Per Capita Energy Use, 2001-2016[61]



The energy efficiency industry is a $1.5 billion industry that supports over 75,000 jobs in Virginia.[62] Energy efficiency is traditionally considered the lowest-cost resource in comparison to traditional supply-side generation.

Figure 19: Levelized Cost of Energy Efficiency vs. New Generation Options



*Notes: Energy efficiency program portfolio data from Molina 2014; All other data from Lazard 2017. High-end range of coal includes 90% carbon capture and compression.

ENERGY SECTOR EMISSIONS

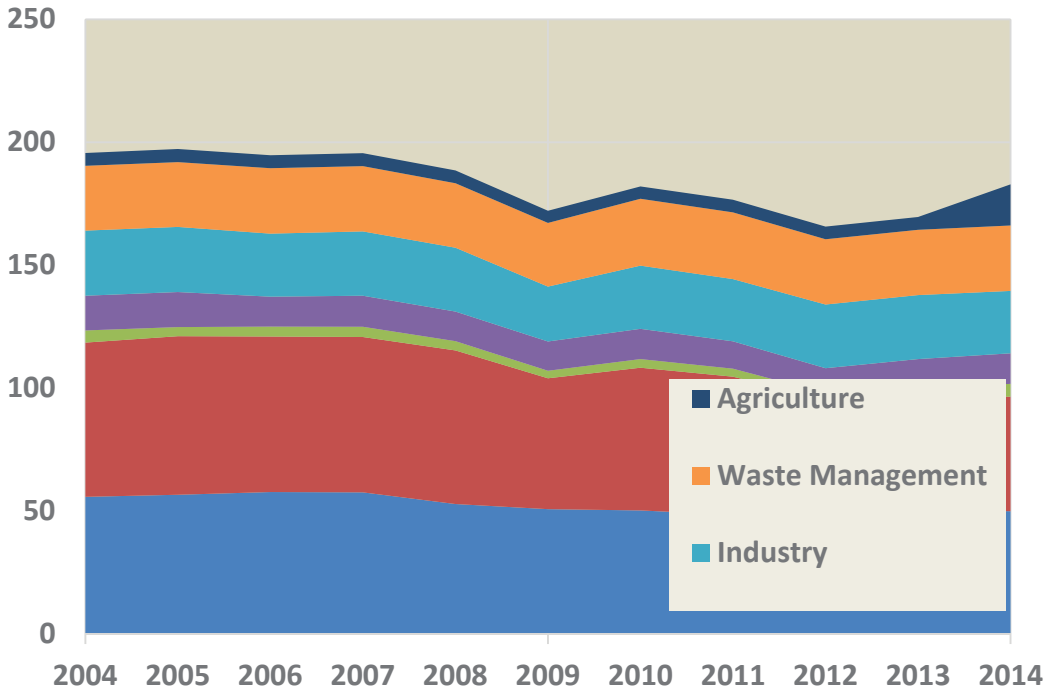
While the energy sector is responsible for a variety of emissions that the Virginia Department of Environmental Quality (DEQ) regulates, most stakeholders in the Energy Plan focus on the regulation of greenhouse gas (GHG) emissions. Climate change poses potentially devastating risks to Virginia due to coastal and inland flooding, increased frequency and severity of storms, sea-level rise, water shortages, heat waves, ocean acidification, and negative public health outcomes. This climate disruption is caused primarily by human emissions of GHG and has accelerated over the last several decades. One element of mitigating the harms from climate change is the deployment of clean energy and the transition to a low-carbon economy.

DEQ periodically compiles an inventory of criteria pollutant air emissions (including GHG) from point, area, mobile, and biogenic sources in the Commonwealth. Point source emissions are inventoried annually. Area, mobile, and biogenic source inventories are developed every three years. The most current inventory data and previous years' data is provided on the DEQ website in Excel spreadsheet form.[63]

DEQ is not currently required to collect GHG data or develop inventories. The DEQ inventories developed to-date use the Environmental Protection Agency State Inventory Tool, which is then supplemented with state-specific data to the extent that such data is available. This process began as part of the Commonwealth's first Commission on Climate Change in 2007.

A regular and transparent accounting of Virginia's current and projected GHG emissions compared to an established baseline and a future goal would help accurately assess emissions, track progress, and ensure policies remain suitable compared to climate goals. In 2017, Virginia joined the Under2 Coalition, a group of subnational governments committed to reducing climate pollution and keeping global temperature rise to under 2°C. As part of this effort, Virginia committed to reporting GHG emissions annually to the Carbon Disclosure Project.

Figure 20: Greenhouse Gas Emissions Trends[64]



The most recent GHG inventory covers the period 1990-2014 and provides projections through 2030 using a business-as-usual model that does not account for recent policy or technology changes. In 2014, Virginia's GHG emissions total was 160.363 MMT CO_2e. According to the latest inventory, Virginia GHG emissions peaked in 2007 at 188.375 MMT CO_2e and, in 2012, Virginia GHG emissions were at the lowest since 1990 at 150.218 MMT CO_2e.

DISPROPORTIONATE ADVERSE IMPACTS

Virginia is dedicated to ensuring that there are not disproportionate impacts on economically-disadvantaged or minority communities during the siting of energy resources. Ensuring that certain populations are not disproportionately impacted during energy development is critical to environmental justice efforts.

Environmental justice is defined as the fair treatment and meaningful involvement of all people regardless of race, color, faith, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.[65] The siting of projects is one aspect of environmental justice, but there are broader environmental justice initiatives percolating and developing within the Commonwealth.

Governor Northam has taken steps to help Virginia gain a better understanding of the Commonwealth's environmental justice needs by continuing the Advisory Council on Environmental Justice (the Council). The Council is tasked with providing independent advice and recommendations to the Governor and his cabinet.

The Governor also signed Executive Order 6 (EO6) on April 4, 2018 to support the critical role of DEQ to protect Virginia's air, water, and public health.[66] EO6 requires DEQ to improve communication with the public and the regulated community and provide more opportunities for proactive education, especially among underserved and low-income populations. As part of the EO6 stakeholder process, DEQ has gathered input on ways in which communications may be enhanced to reach more communities during decision-making processes.

In addition, Virginia has deployed mechanisms to assist low-income communities by increasing access to energy efficiency and renewable energy resources. The recommendations that follow in the sections below provide additional options to expand these clean energy resources in a way that benefits underserved and low-income populations. Finally, DEQ's existing obligations to ensure that all regulated entities comply with health-based standards will continue in all permitting activities to reduce public health burdens on all populations.

ENDNOTES

[1] NARUC, "Evolution of the Distribution System & the Potential for Distribution-level Markets: A Primer for State Utility Regulators, January 2018, available at https://www.naruc.org/default/assets/File/201801%20Evolution%20of%20the%20Distribution%20System.pdf

[2] NC Clean Energy Technology Center, "50 States of Grid Modernization", Q2 2018 Quarterly Report Executive Summary, available at https://nccleantech.ncsu.edu/wp-content/uploads/Q2-18-GridMod-Exec-Final-1.pdf

("In Hawaii, a proceeding investigating integrated grid planning is currently underway, while draft rules under consideration in Missouri would incorporate DERs into utility resource planning, as well as transmission and distribution system analyses. In Washington, draft distribution system planning rules establish a "cross-functional" planning approach that would plan for system needs through investments in generation, DERs, and infrastructure investments.").

[3] Comments of Virginia Natural Gas.

[4] Data provided by the Virginia State Corporation Commission.

[5] Data provided by the Virginia State Corporation Commission.

[6] Code of Virginia § 10.1-1197.5 et seq.

[7] See DEQ, "Renewable Energy Projects," available at https://www.deq.virginia.gov/Programs/RenewableEnergy/RenewableEnergyProjectsNoticesofIntent.aspx

[8] The Solar Foundation, "National Solar Jobs Census," available at https://www.solarstates.org/#state/virginia/counties/solar-jobs/2017

[9] Solar Energy Industries Association, "Virginia Solar Factsheet," available at https://www.seia.org/state-solar-policy/virginia-solar

[10] Solar Energy Industries Association, "Virginia Solar Factsheet," available at https://www.seia.org/state-solar-policy/virginia-solar

[11] National Renewable Energy Laboratory, U.S. Department of Energy Regional Resource Centers Report: State of the Wind Industry in the Regions," available at https://www.nrel.gov/docs/fy16osti/62942.pdf

[12] U.S. Department of Energy, Virginia 80-Meter Wind Resource Map, available at https://windexchange.energy.gov/maps-data/127

[13] University of Virginia, "Renewable Energy Tracker," available at https://renewableenergy.fm.virginia.edu/

[14] Code of Virginia § 67-600 et seq.

[15] Code of Virginia § 67-1201 et seq.

[16] Virginia Offshore Wind Port Readiness Evaluation, available at

https://www.dmme.virginia.gov/de/OffshoreWindPortEvaluation.shtml

[17] Collaborative Fisheries Planning for Virginia's Offshore Wind Energy Area, available at

https://www.deq.virginia.gov/Programs/CoastalZoneManagement/CZMIssuesInitiatives/OceanPlanning/FishingandVirginiaOffshoreWind.aspx

[18] American Jobs Project, "Virginia Jobs Project: A Guide to Creating Advanced Energy Jobs," available at http://americanjobsproject.us/wp-content/uploads/2016/05/VA-Full-Report-5.14.pdf

[19] Virginia Department of Mines, Minerals and Energy, "The Virginia Energy Plan 2007," available at http://dls.virginia.gov/groups/energy/VEP.pdf

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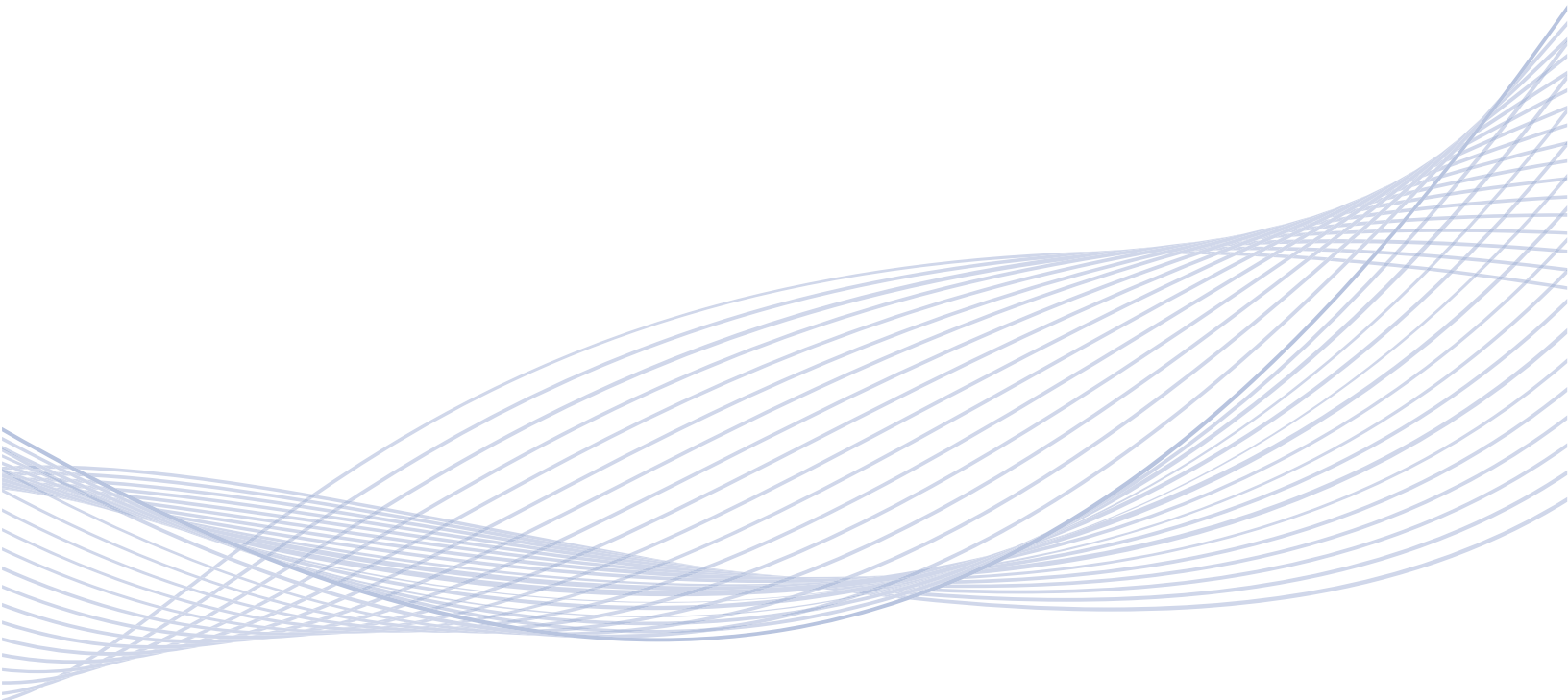
APPENDIX A



Acknowledgment of Public and Stakeholder Comments and Recommendations for the 2018 Virginia Energy Plan

The Commonwealth would like to thank the many individuals, businesses, non-profits, local governments, state agencies and others who submitted comments, offered recommendations and provided other input to inform the content of the 2018 Virginia Energy Plan. Civic engagement and public participation are critical in ensuring government is working on behalf of all residents of the Commonwealth. The Commonwealth is grateful for this enthusiastic public involvement.

The Department of Mines, Minerals and Energy received a large volume of comments and recommendations from 988 separate sources. These included Virginia citizens and various business and non-profit organizations, associations, state agencies, and other stakeholders interested in contributing their concerns and ideas to be considered for inclusion in the 2018 Virginia Energy Plan. These comments were collected from more than a dozen public listening sessions and through written comments submitted by stakeholder groups and citizens. The comments were summarized and entered into an indexed spreadsheet to make them easier for DMME and the Office of the Secretary of Commerce and Trade to develop specific sections and recommendations in the 2018 Virginia Energy Plan. DMME and the Office of the Secretary of Commerce and Trade also participated in 14 separate stakeholder meetings that Dominion Energy contracted with the Meridian Institute to facilitate as part of the work under the Grid Transformation and Security Act (Senate Bill 966).

Virginia Regulatory Town Hall

Here is a breakdown of the top 20-most mentioned issues/topics and the number of comments received regarding those topics on the Town Hall website.

Issue/Topic	Number of Comments
Grid modernization	263
Energy Efficiency	166
Solar	93
General Comments	91
Advanced Transportation	81
Other*	79
Wind	43
Net Metering	41
Utilities	32
Gas	29
Corporate Procurement	27
Energy Storage	25
Siting	24
Electric Vehicles	20
Transportation	19
Coal	19
Community Solar	18
Climate Change	12

* Other topics include building codes, achieving the 10% energy reduction goal, new energy efficiency financing programs, energy performance contracting, effects on children's health, power purchase agreements, benchmarking, jobs/education, biomass, the all-of-the-above approach, Commercial Property Assessed Clean Energy, and improving data access.

Public and Stakeholder Listening Sessions

The Office of the Secretary of Commerce and Trade and DMME held a total of 12 listening sessions between late June and early August. A kick-off meeting was held in Richmond on June 25 that drew about 150 attendees. Other general-topic sessions were held around the state:

- July 30, 2018 Roanoke 47 attendees, including 21 speakers
- July 31, 2018 Abingdon 43 attendees, including 14 speakers
- August 16, 2018 Fairfax 69 attendees, including 36 speakers

Sessions covered energy policy broadly and specifically. Five distinct stakeholder tracks were identified on which to focus facilitated meeting discussions: Energy Efficiency, Solar and Wind, Offshore Wind, Energy Storage, and Electric Vehicles (EV)/Advanced Transportation. The Regulatory Assistance Project (RAP) facilited five meetings on energy efficiency and advanced transportation, which were held in Richmond:

- June 25, 2018 Energy Efficiency 150 attendees
- July 18, 2018 EV/Adv. Transportation 50 attendees
- July 18, 2018 Energy Efficiency 75 attendees
- August 1, 2018 Energy Efficiency 75 attendees
- August 1, 2018 EV/Adv. Transportation 50 attendees

Three stakeholder sessions concentrated on solar/wind, offshore wind, and energy storage topics and issues:

- July 10, 2018 Solar/Wind 89 attendees at Richmond meeting
- July 23, 2018 Energy Storage 35 attendees at Richmond meeting
- July 25, 2018 Offshore Wind 20 attendees at Newport News meeting

More than 700 persons attended the twelve listening sessions, and many of these participants also submitted written comments to the Regulatory Town Hall web portal.

Meridian-facilitated Stakeholder Sessions

The Meridian-facilitated stakeholder engagement process consisted of a Public Kickoff Meeting on July 10, a series of thirteen stakeholder group meetings over the course of August, an online survey to collect written comments, and a public forum on August 28. Meridian identified the following nine stakeholder categories as the basis for structuring the process:

- Solar energy industry and advocacy organizations
- Wind energy industry and advocacy organizations
- Organizations representing other energy sources
- Environmental and environmental justice organizations
- Business associations and large customers
- Historic preservation and land use organizations
- Advocacy Groups for energy affordability for residential customers
- Local governments
- Virginia electricity providers

Each group met once or twice to discuss four specific topics set forth in Senate Bill 966, which was signed into law by Governor Northam on March 9, 2018. These topics included:

- Potential improvements to net metering programs as provided under § 56-594 of the Code of Virginia;
- Potential improvement to the pilot programs for community solar development as provided under § 56-585.1:3 of the Code of Virginia;
- Expansion of options for customers with corporate clean energy procurement targets; and
- Impediments to the siting of new renewable energy projects

More than 350 stakeholders participated in the Meridian-sponsored sessions, and some of those participants also submitted written comments through the Virginia Regulatory Town Hall Portal. More detail regarding the Meridian-facilitated stakeholder meetings and the outcomes of those meetings may be found in Appendix B.

Comments from State Agencies, Local Governments, Businesses, Associations, and Institutions

The Commonwealth of Virginia received comments from the following state agencies, local governments, organizations, businesses, and institutions that were submitted directly to DMME via formal letters, through the Virginia Regulatory Town Hall system, and during listening sessions.

Advanced Energy Buyers Group
Alliance for Industrial Efficiency (AIE)
American Academy of Pediatrics
American Council for an Energy-Efficient Economy (ACEEE)
American Electric Power and Appalachian Power
Arlington County, VA
Appalachian Voices
Business Council for Sustainable Energy
Ceres

Christopher Newport University (CNU)
City of Alexandria
Town of Blacksburg
City of Charlottesville
Dominion Energy
Electric Vehicle and Advanced Transportation Subcommittee
Energy Efficiency Subcommittee
Energy Storage Subcommittee
General Motors
George Mason University (GMU)
Grid Alternatives
GridWise Alliance
Governor's Executive Council on Energy Efficiency (GEC)
Home Performance Coalition
Hunton Andrews Kurth LLP
James Madison University Center for Wind Energy
Library of Virginia
Meridian Institute
Mid-Atlantic Renewable Energy Coalition (MAREC)
Municipal Electric Power Association of Virginia (MEPAV)
Natural Resources Defense Council (NRDC)
Nature Conservancy
Offshore Wind Subcommittee
Orsted
PJM Interconnection (PJM)
Polyisocyanurate Insulation Manufacturers Association (PIMA)
Prince William Conservation Alliance
Regulatory Assistance Project (RAP)
Roanoke Higher Education Center
Secure Futures LLC
Sierra Club (Virginia Chapter)
Sigora Solar
Solar and Wind Subcommittee
Southern Environmental Law Center
Southern Virginia Higher Education Center & the Innovation Center (SVHEC)
Southwest Virginia Higher Education Center
SunTribe
Transition Policy Council on Commerce and Trade
U.S. Department of Energy (DOE)
U.S. Green Building Council (USGBC)
Virginia Agribusiness Council
Virginia Advanced Energy Economy (VAEE)
Virginia Advanced Energy Industries Association (VAEIA)
Virginia Center for Wind Energy at James Madison University (CWE)
Virginia Chamber of Commerce
Virginia Clean Cities (VCC)
Virginia Coal and Energy Alliance
Virginia Commonwealth University (VCU)

Virginia Department of Environmental Quality (DEQ)
Virginia Department of Mines, Minerals and Energy (DMME)
Virginia Department of Transportation (VDOT)
Virginia Energy Efficiency Council (VAEEC)
Virginia Nuclear Energy Consortium Authority (VNECA)
Virginia Nuclear Energy Consortium (VNEC)
Virginia Offshore Wind Development Authority (VOWDA)
Virginia Oil and Gas Association
Virginia Petroleum, Convenience and Grocery Association (VPCGA)
Virginia Petroleum Council
Virginia Solar Energy Development and Energy Storage Authority (VSEDA)
Virginia Transportation Construction Alliance (VTCA)
Viridiant
WGL Energy

The following groups of businesses and associations sent joint comments to DMME:

- Adobe, Bon Secours, Emory & Henry College, JLL, Mars Incorporated, Nestle, Salesforce, Sweet Briar College, Unilever, Virginia Wesleyan University, Washington and Lee University, Worthen

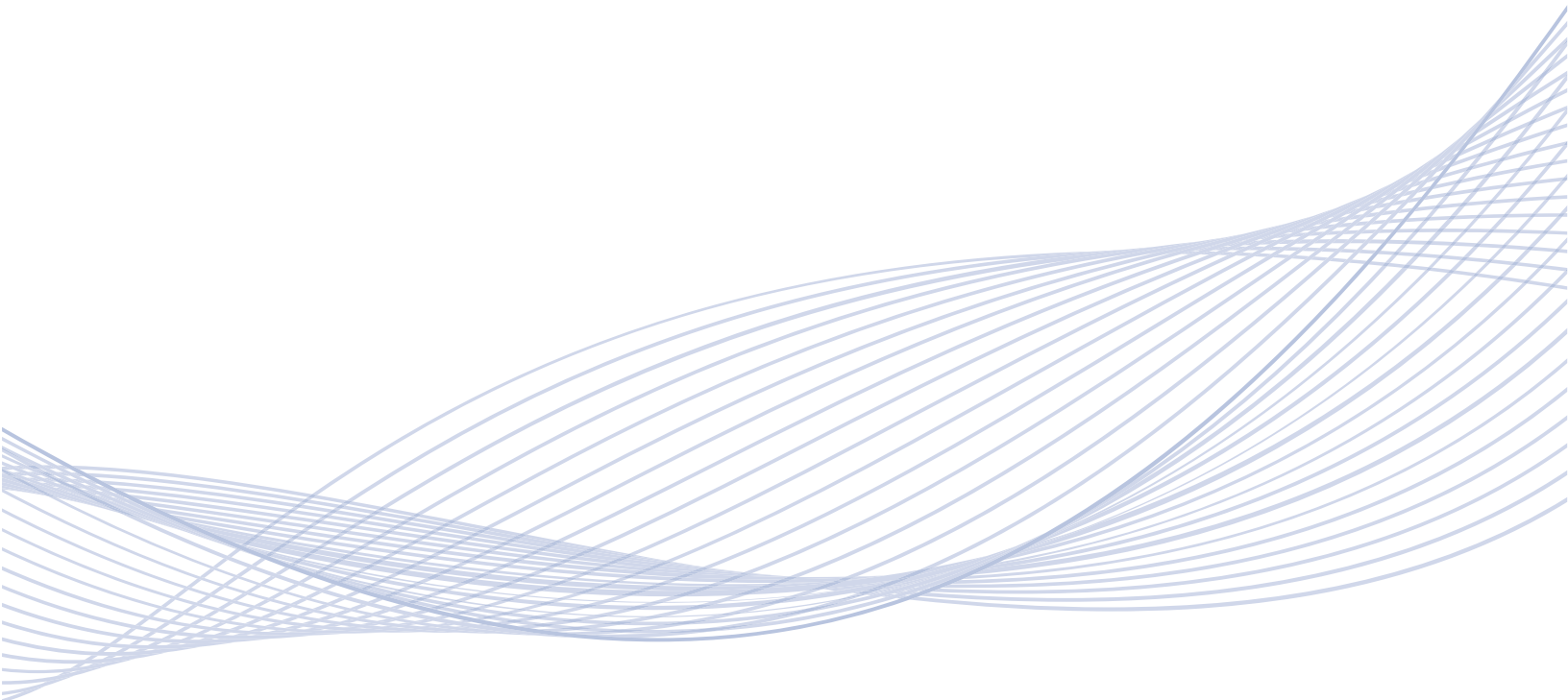
- Alliance for Industrial Efficiency, Columbia Gas of Virginia, Washington Gas

- EPS Industry Alliance, Insulation Contractors Association of America, National Insulation Association, North American Insulation Manufacturers Association, Polyisocyanurate Insulation Manufacturers Association

- National Association of Energy Service Companies (NAESCO), Schneider Electric, CREE, AMERESCO, National Electrical Manufacturers Association (NEMA)

Because of the large volume of comments received through various means and media, DMME may have inadvertently missed acknowledging a contribution. For this omission, we sincerely apologize.

APPENDIX B



Final Report

Virginia Solar and Wind Energy Stakeholder Feedback Summary

September 20, 2018

Meridian Institute
Connecting People to Solve Problems

Table of Contents

Overview of the Stakeholder Engagement Process

Dominion Energy contracted with Meridian Institute to design and facilitate a stakeholder engagement process that focused on four specific topics set forth in the Grid Transformation and Security Act (SB 966) which was signed into law by Governor Northam on March 9, 2018. As set forth in the Grid Transformation and Security Act SB966, these topics included:

- Potential improvements to net metering programs as provided under § 56-594 of the Code of Virginia;
- Potential improvement to the pilot programs for community solar development as provided under § 56-585.1:3 of the Code of Virginia;
- Expansion of options for customers with corporate clean energy procurement targets; and
- Impediments to the siting of new renewable energy projects.

The process was executed in close collaboration with the Virginia Governor's Office, and the findings in this report will serve as input into development of the 2018 Virginia Energy Plan. In addition, the topics addressed in the stakeholder engagement process are a subset of the topics that Dominion Energy is required to report on under SB966. This report will be incorporated into the public report that Dominion Energy will issue by November 1, 2018, the deadline for reporting under the Grid Transformation and Security Act.

The stakeholder engagement process had four primary components: 1) a Public Kickoff Meeting on July 10, 2018; 2) a series of stakeholder group meetings over the course of August 2018; 3) an online survey to collect written comment; and 4) a Public Forum on August 28.

Public Kickoff Meeting

On July 10, 2018 Meridian convened a Public Kickoff Meeting for the Solar and Wind Energy Stakeholder Engagement Process that approximately 90 people attended. At this meeting, Meridian presented and gathered feedback on the planned approach to the process and the questions that would serve as the focus for collecting stakeholder perspectives on the four topics articulated in the Grid Transforming and Security Act. The draft list of questions presented during the Stakeholder Group Meetings is located in Appendix A, and the participants list from the July 10 meeting is located in Appendix B. At this meeting, Meridian also gathered feedback on the types of stakeholder groupings that could serve as a means of organizing the process. Based on input received at the July 10 meeting, as well as through other sources, Meridian identified the following nine stakeholder categories which served as the basis for structuring the process:

- Solar energy industry and advocacy organizations
- Wind energy industry and advocacy organizations
- Organizations representing other energy sources
- Environmental and environmental justice organizations
- Business associations and large customers
- Historic preservation and land use organizations
- Advocacy Groups for energy affordability for residential customers

- Local governments
- Virginia electricity providers

Stakeholder Group Meetings

Throughout August 2018, Meridian held Stakeholder Group Meetings with approximately 160 participants excluding Meridian, Dominion Energy and APCO Government staff who self-identified with the categories listed above. The purpose of these meetings was to provide an opportunity for input from all participants. Participants were afforded an opportunity to participate in-person or virtually through an online webinar-type platform.

Meridian conferred with representatives from Dominion Energy and the Governor's office to identify and recruit a co-convener organization for each stakeholder meeting and, through a joint effort, all of the stakeholder groupings listed above had one or more organizations agree to serve as the co-convener. For most of the groupings, there was one co-convener. The solar energy industry and advocacy organizations had two co-conveners and two separate meetings, and the business associations and large customers had three co-conveners and three separate meetings. In the case of the local governments and organizations representing other energy sources groups, there were two co-conveners for each of those groupings but only one meeting. In the case of the environmental and environmental justice organizations group, there was one co-convener and two meetings. In total Meridian conducted 13 stakeholder meetings between August 3 and 23.

A summary from each of these 13 meetings is included in this report. As stated at the start of each meeting and as stated in the introduction to the meeting summaries, no effort was made to ascertain whether points of view expressed at the meeting were agreed to by all participants. Rather, the intent was to provide all participants with an opportunity to express their views in response to the questions (Appendix A). Meridian produced a draft summary of each meeting and shared the draft with everyone who participated in-person or virtually in that meeting. Meridian provided all participants with an opportunity to suggest comments and revisions to the draft to improve the accuracy and completeness of the draft summary. Meridian shared the final version of the summary with participants and included the final summary in this report as explained below.

Survey to collect written feedback

For a variety of reasons, not all interested stakeholders were able to attend a stakeholder group meeting. To provide an additional avenue for input, Meridian developed an online survey to collect written comments. The survey asked respondents to indicate which of the stakeholder groups they were affiliated with. The questions posed in the survey were the same questions that were posed in the stakeholder group meetings (Appendix A).

Five stakeholders provided written comment. The vast majority of comments provided through the written form were reflected in the summaries for relevant stakeholder group meetings. There were a couple of comments from solar energy industry and advocacy organization stakeholders that were not reflected in the existing solar energy and advocacy organization meeting summaries. As such, at the end of the summary of August 7 Solar Energy Industry and Advocacy Organizations

Stakeholder Group Meeting, Meridian created a section titled "Additional Input from Online Survey" where this feedback was summarized.

Concluding Public Forum

On August 28, 2018, Meridian convened a Public Forum to provide a final opportunity for input from those participants who did not attend a stakeholder group meeting, review all the stakeholder input collected to date, and provide an opportunity for feedback on a verbal summary of stakeholder input collected to date. Appendix C contains a list of the 45 participants who attended the Public Forum.

Overview of this Final Report

Following the public forum, Meridian synthesized all feedback collected from the initial Public Kickoff Meeting, the 13 Stakeholder Group Meetings, the online survey, and the concluding Public Forum as the basis for this report. The High-Level Summary of Stakeholder Feedback contained in the section that follows identifies the overarching themes that emerged from the stakeholder group meetings. It builds upon the verbal presentation Meridian presented at the concluding Public Forum, and incorporates feedback received from stakeholders who participated in that final public forum. The final versions of the summaries of each of the 13 stakeholder group meetings will be posted on the project website which is located here.

High-Level Summary of Stakeholder Feedback

Overarching themes

Expansion of renewable energy in Virginia – Most stakeholders who expressed a general opinion about the expansion of renewable energy in Virginia indicated that they support such expansion. Others indicated that their support for renewable energy was dependent upon a variety of factors. Some stakeholders did not express a general opinion about the expansion of renewable energy in Virginia. Some solar energy industry and advocacy organization and environmental and environmental justice organization participants emphasized that expansion of renewable energy in Virginia means expanding the choices that Virginia have for their energy procurement. Participants from the other energy sources stakeholder group and some business association and large customer participants indicated they support renewable energy development in Virginia in the context of an all-of-the-above energy policy for Virginia that recognizes the important contribution to energy security, reliability, and resilience that results from a diverse supply of energy. Additionally, at the Public Forum, a number of participants emphasized that expansion of renewable energy should be accomplished in a manner that is cost effective, equitable, context sensitive, competitive, transparent, and ensures grid reliability and resilience.

Piecemeal and Outdated Policy – Many participants expressed the view that some of Virginia's laws and regulations regarding renewable energy are outdated and that there currently is a patchwork policy landscape. This can create challenges for accessing renewable energy because a) engaging in renewable energy in Virginia can require a steep learning curve; and b) this patchwork

landscape at times creates legal uncertainties that can create barriers to the expansion of renewable energy in Virginia.

It's not just solar – It was repeatedly highlighted that renewable energy policy should not be equated with solar energy policy. Several participants highlighted that wind and other energy sources, including natural gas, hydropower, and biogas, should receive more attention in both formal and informal policy settings.

Education – Many participants echoed that they see a need for education regarding challenges and opportunities for expanding renewable energy in Virginia.

Federal Tax Incentives – Numerous stakeholders urged that Virginia policy consider how to best take advantage of federal tax incentives related to renewable energy before they are reduced and/or eliminated. Some business associations participants also emphasized that uncertainty on the longevity of the federal tax credit creates uncertainty that may make it difficult for businesses to plan out long-term energy development and/or procurement strategies.

Smart grids, meters, and storage – Throughout the process, stakeholders commented that grid modernization, including smart meters, along with advances in renewable energy storage will provide important opportunities for improving renewable energy policies in Virginia based on factual evidence rather basing policy on anecdotal evidence and assertions.

Economic development and workforce development – It was frequently emphasized that expansion of renewable energy in Virginia provides significant economic development opportunities. These opportunities can come in the form of jobs and activities surrounding construction and maintenance of new renewable energy projects (whether they be small-scale distributed generation (DG) systems, medium-scale community systems, or large, utility-scale systems), as well as in the form of jobs and activities associated with the arrival of very large corporate entities with renewable energy procurement targets. Participants urged that as Virginia sees more economic develop opportunities, it should prioritize training and hiring Virginians to fill the jobs that these opportunities generate.

Key themes regarding net metering

Restrictions on Net Metering in Virginia – Participants had diverse and, in some cases, polar opposite perspectives on current restrictions on net metering in Virginia, including the 1% cap of a utilities' previous year peak load, system size limitations for residential customers based on energy use during the previous year, the 1 MW system size limitations for non-residential customers, standby charges for residential systems between 10-20 KW, and restrictions on whether and how net metering customers can engage in purchase power agreements (PPAs) with third parties. For each of the limitations listed above, some participants supported current limitations while participants offered a variety of suggested alternatives.

The 1% cap of a utilities' previous year peak load – Some electricity provider and business associations and large customer participants supported the 1% cap on net metering because it helps ensure that DG penetration levels do not create grid reliability issues or cost shifting issues. Some solar energy

and advocacy organizations, wind energy and advocacy organization, local governments, and environmental and environmental justice participants did not support the 1% cap because they found the 1% number to be arbitrary and not based on data, and because they do not believe that there are any negative impacts on the grid or any cost-shifting occurring as a result increased DG penetration until a much higher percentage of DG penetration is achieved. Some suggested that such impacts would not occur until there is 30% or more DG penetration in the Virginia market. Some of those participants who did not support the 1% cap recommended that the cap be adjusted to 2%, 2.5%, 3%, or 10%. Other participants recommended that rather than relying on a market cap, Virginia could consider using a percentage penetration to trigger the completion of well-designed study of the impacts of expanding DG in Virginia. This study could examine both the level of DG penetration that results in cost shifting, the level that creates grid reliability issues, as well as other issues that could inform policymaker's decisions relating to whether to keep or modify the 1% cap.

System size limitations for residential customers based on energy use during the previous year – Several electricity providers participants supported systems size limitations for residential customers because, in their view, these restrictions prevent customers from oversizing their system which can lead to engineering challenges with the grid. Some solar energy and advocacy organizations and environmental and environmental justice organizations participants noted that this residential system size restriction prevents customers from sizing their DG systems with future energy needs in mind, such as a new electric vehicle or the addition of a family member. Still other environmental and environmental justice participants opposed this limitation on principle, articulating their belief that citizens have a right to choose their preferred source of energy, and that system size limitation infringe on that right. Specific suggestions for appropriate limits to system size included suggestions to leave them as they are, increase the size limitation to 150% of the previous year's peak load, generally increase the size limit, and remove the limit entirely.

The 1 MW system size limitations for non-residential customers – Some solar energy industry and advocacy organizations and local governments participants raised concerns with the current 1 MW system size limitation for non-residential customers because they are aware of non-residential customers who cannot meet their full energy load with DG energy due to this limitation. Specific suggestions for appropriate modifications to the size limit included adjusting the system-size cap for individual, non-residential net metering systems from 1 MW to between 2 to 5 MW.

Standby charges for residential systems between 10-20 KW – Several electricity providers and business associations and large customers participants supported standby charges for residential customers with systems between 10-20 KW because the revenue from these charges help utilities recover the cost of service to DG customers. Many participants from the solar energy industry and advocacy organizations, wind energy industry and advocacy organizations, historic preservation and land use organizations, local governments, and environmental and environmental justice organizations did not support standby charges for residential customers. A few of these participants expressed that they opposed standby charges because they do not think that a) it has been proven scientifically that DG customers have disproportionate negative impacts on the grid and b) the costs of those hypothetical impacts do not equate to the costs of current standby charges.

Restrictions on whether and how net metering customers can engage in PPAs with third parties – Some solar energy industry and advocacy organizations and environmental and environmental justice

organizations participants did not support current restrictions on whether and how net metering customers can engage in PPAs with third parties. Many of these participants reflected that generally, third-party PPA financing options for net metering customers should be expanded so that all customers can access DG from third parties if they wish. Specific recommendations included generally expanding the Dominion pilot, expanding the Dominion pilot from 50 MW to 500 MW, and expanding the Appalachian Power Company (APCO) pilot to all customer classes.

Fair Compensation – Many participants across stakeholder groups articulated the need to compensate DG customers and the utility fairly. They disagreed on whether the current system provides fair compensation.

Cost recovery – Participants generally agreed utilities should be able to recover the costs of infrastructure upgrades associated with expanding DG. However, they disagreed over what are the costs and benefits of DG, as well as what constitutes appropriate and adequate cost recovery. Several solar energy industry and advocacy organization and environmental and environmental justice organization participants emphasized the necessity for utilities to generate demonstrable and clear evidence of cost impositions associated with DG. Many participants across stakeholder groups noted that wide-spread availability of smart meters could help create a data set to help all stakeholder evaluate the costs and benefits of DG.

Who bears the costs? – Participants disagreed over equity issues regarding the ways in which the transmission, distribution, and system administration costs are borne by different utility customers. There is no agreement on whether there is "cost shifting" or "cross subsidization," nor which customers are subsidizing other customers. Most electricity providers and many but not all business associations and large customers participants expressed a belief that DG customers are or will soon be shifting the costs of service to non-DG customers. Most, if not all, environmental and environmental justice organizations, local governments, and solar energy industry and advocacy organizations participants articulated that they are not aware of any evidence that the cost of service to DG customers is being subsidized by other customers. Several participants noted that there is a myriad of costs to establishing and maintaining the grid, and there are numerous, complex and diverse ways in which different customers both contribute to and pay for those costs. From this perspective, all customers are subsidizing each other to one degree or another because it is not possible to directly calculate the impact one customer has on the costs of the system level distribution, transmission, and administrative costs.

Meter Aggregation – Most stakeholders expressed the view that more flexible approaches to aggregating meters is needed in Virginia to increase the deployment of DG. Electricity provider stakeholders emphasized the fact that utilities will need to cover the costs of expanding meter aggregation which may include additional administrative costs and technology investments. Several advocacy groups for energy affordability for residential customers, environmental and environmental justice organizations, local governments, and solar energy industry and advocacy organizations participants noted that limits on meter aggregations are a strong barrier for further DG penetration in Virginia, especially for low- and moderate-income (LMI) customers.

Additionally, some business associations and large customers and local governments participants indicated that a wider variety of options for aggregating loads across facilities is essential for helping government entities and private companies meet corporate clean energy procurement targets.

Access & Equity – Many participants urged Virginia to explore how net metering and complementary policies and programs can be designed to work better for low and moderate income (LMI) customers who typically are renters living in multi-family housing.

Grid Resilience and Reliability – Many participants across stakeholder groups noted that as the number of net metering customers expands, Virginia policy should ensure grid resilience and reliability is maintained and enhanced.

Explore Alternatives – Across stakeholder groups there was interest in exploring alternative methods to compensate DG customers other than through net metering. Several participants observed that alternative frameworks could fairly compensate DG customers while also ensuring that utilities can recuperate necessary costs. Specifically, some participants suggested a buy-all-sell-all model, a value-stack approach, net billing in which excess generation is compensated at a non-retail rate that is closer to wholesale rates at the time the energy is generated, and the development of a unique rate class for DG customers.

Key themes for community solar pilot programs

Support for Senate Bill 1393 – Several participants from the environmental and environmental justice organizations, business associations and large customers, and solar energy industry and advocacy organizations groups expressed support for SB 1393, the 2017 bill that created the current framework for community solar pilot programs. Many participants explicitly supported the program because it allows a wider range of Virginians to access solar energy. Several business association stakeholders appreciated that subscriptions to the pilot program will be voluntary and the costs of the pilot program can only be borne by the subscribers. They noted that this approach ensures there is not cost-shifting between participants and non-participants.

Geographic independence – Some historic preservation and land use participants noted that the feature of the current program that allows the solar facilities to be developed in locations that are geographically separate from the community solar customers could be helpful in siting projects in a way that is sensitive to the preservation of historic, cultural, and natural resources. Other historic preservation and land use participants and a few business association participants noted that if siting of community solar projects occurs in a piecemeal fashion, it could lead to land fragmentation. Some participants expressed the view that it would be better if community solar projects were sited close to the communities they serve to avoid environmental justice issues pertaining to wealthy communities siting community solar facilities in poor rural communities.

Concerns Over Pricing – Some environmental and environmental justice organizations and advocacy groups for energy affordability for residential customers participants noted that the proposal from Dominion Energy submitted in the summer of 2018 for implementing SB 1393 will not be affordable for all customers. Additionally, they noted that due to current limits on meter aggregation, community pilot programs could be a very effective way to make solar available to

those who live in multi-family residential buildings. However, if price concerns are not addressed, many LMI customers will likely not be able to afford to subscribe to a community solar offering.

Concerns over System Size Restrictions – Individual projects within the 10-40 MW Dominion Energy program may not exceed 2 MW. Several participants from different stakeholder groups commented that both size caps should be increased or removed entirely. Other stakeholders expressed support for these restrictions or did not comment on the restrictions.

Definition of Community Solar in Virginia – Many participants across stakeholder groups highlighted that the current definition of community solar under the Code of Virginia is not the only definition of community solar and urged Virginia to allow for programs that provide more flexibility for third party developers and administrators of "bottom-up" approaches to community solar. These participants noted that labeling a utility-administered program as a "community solar pilot program," as is the case under § 56-585.1:3 of the Code of Virginia, is confusing because these programs differ from community solar projects in which community members collaborate to develop and administer their own renewable energy generation capacity. Some of these participants suggested that the pilot programs for community solar are similar to green tariff programs.

Development of Community Wind – Many wind energy industry and advocacy participants urged Virginia policy makers to consider how to enable development of community wind.

Linkages between community solar pilot programs and siting new utility-scale renewable energy projects – Several participants noted that much of the discussion relating to siting new utility-scale renewable energy projects should also be considered in siting community solar projects.

Key themes for expanding options for corporate clean energy procurement targets

Definition of clean energy – While there is a statutory definition of renewable energy, there is no statutory definition of clean energy in Virginia. Participants had significantly different definitions of clean energy, with some noting that clean energy is synonymous with renewable energy. Other stakeholders expressed the view that clean energy is anything that generates lower carbon emissions than coal fired power plants. Still others identified specific energy sources they believe should be included as clean energy. For example, some business associations and large customer participants commented that clean energy should include energy from biomass, energy from manufacturing waste products such as black liquor from forest products, and the use of methane gas recovered from landfill emissions.

Unclear Legal Definition of 100% Renewable Energy Program – Some participants from environmental and environmental justice organizations and large companies with renewable energy targets noted that there is significant uncertainty over the legal definition of what constitutes a 100% renewable program. Specifically, if a utility administered 100% renewable program is approved, it is unclear whether Virginia-based businesses can continue to pursue 100% renewable energy offerings from third-party providers. Some participants expressed the view that this uncertainty creates unacceptably high risks for both the third-party provider and the customer.

Options for large customers that do not have heavy energy loads – Many participants commented that Dominion Energy's offerings seem to be well-suited to large customers with high and consistent energy loads but there are not adequate renewable energy offerings to large companies that do not have heavy energy loads. These participants offered suggestions for expanding options to better meet the needs of large customers with variable energy demands, and medium and small businesses with clean energy procurement targets including:

- *Expanding ways that customers can interact with third party PPAs* – There are various limitations on third-party involvement in providing renewable energy to help companies meet procurement targets. Participants from solar energy industry and advocacy organizations, wind energy industry and advocacy organizations, environmental and environmental justice organizations, and businesses with renewable energy targets shared their experience that these limitations prevent corporate customers from engaging in a wide array of procurement options. Additionally, these limitations may hamper competition in procurement processes for renewable energy.
- *Modifying policies surrounding aggregation* – Some business association and large customers participants expressed the view that limits on meter and load aggregation reduce companies' ability to procure renewable energy. They noted that the ability to aggregate energy load can be critical to reaching the 5 MW minimum for engaging with a third-party energy provider. Moreover, it would be a key first step in enabling customers to aggregate loads across the PJM market enabling the procurement of a larger amount of competitively priced renewable energy.
- *Advanced notification requirement* – A few participants from the environmental and environmental justice organizations and solar energy industry and advocacy organizations suggested that Virginia alter the requirement that customers with loads above 5 MW who contract with a third-party energy provider for any type of power must provide 5 years advance notice prior to returning to their incumbent utility. These participants recommended that this time frame can and should be reduced.

Wholesale energy contracts – Some electricity provider stakeholders noted that it can be difficult for municipal utilities and electric cooperatives to meet corporate clean energy procurement targets because they often procure energy through long-term wholesale energy procurement contracts with larger investor-owned utilities. As such, it may be difficult for them to modify their energy supply to meet corporate clean energy procurement targets.

Linkages between corporate clean energy goals and siting new utility-scale renewable energy projects – Some participants across stakeholder groups highlighted a link between efforts to assist companies with clean energy procurement targets and the siting and development of new utility-scale renewable energy projects and the environmental justice issues regarding utility-scale renewable energy projects described above.

Key themes for siting of new renewable energy projects

Permit by Rule (PBR) – Many participants across stakeholder groups commented on the PBR process, noting both effective and challenging components of the process. Several solar energy industry and advocacy organizations and wind energy industry and advocacy organizations

participants expressed support for the process. However, several historic preservation and land use organizations, solar energy industry and advocacy organizes, and wind energy industry and advocacy organizations elevated the need to increase staff resources and financial resources at the Department of Environment Quality (DEQ) and the Department of Historic Resources (DHR).

Need for guidelines – Numerous participants across stakeholder groups highlighted that many localities may not have the expertise required to make informed siting decisions. Several of these participants, particularly from historic preservation and land use organizations, suggested the creation of best practice guidelines for siting renewable energy projects in Virginia. While guidelines such as this do exist, and are identified in later sections of this report, there is no one central resource for siting of renewable energy projects in Virginia.

Need to identify most appropriate land for siting – Many participants noted the current siting process does not effectively enable developers to identify the best places to site renewable energy projects. Several participants noted that renewable energy developers often do not identify the most ideal location for siting due to the lack of relevant and sufficiently detailed information regarding several competing considerations including: proximity to and impact on existing grid infrastructure; potential impacts on existing historic, cultural, or natural resources; how the project fits in the context existing local land use plans; and other potential environmental impacts such potential storm water impacts from large solar facilities. Several participants expressed the view that potential storm water impacts from utility-scale solar need to be thoroughly assessed during siting stage of project develop, not just during the PBR process.

Varying perspectives about on-site and off-site solar – Some local governments and business associations participants suggested that Virginia policy should incentivize development of on-site solar rather than off-site solar because on-site solar can reduce impacts on communities that are not utilizing the energy and helps to ensure that the community using the energy bears the potential negative impacts of such facilities. Other participants from diverse stakeholder groups noted that off-site solar is an important option for expansion of renewable energy in Virginia because it is often cheaper to develop larger solar installations than smaller installations and installation size can be greater at off-site locations. As such, on-site solar may be less economically competitive for certain customers than offsite solar.

Utilize existing impervious surfaces – Some participants from the environmental and environmental justice organizations and local governments groups recommended that Virginia develop incentives to site solar installations on existing impervious surfaces such as large rooftops, reclaimed mine lands, etc., to help reduce pressure to site projects in prime agricultural or forested land.

Utilize reclaimed mine lands – Some participants from the environmental and environmental justice organizations, business associations and large customers, solar energy industry and advocacy organization, other energy sources, and local governments groups suggested that Virginia consider developing incentives for renewable energy developers to build renewable energy facilities on post-industrial "brownfields" and/or reclaimed mine land.

Need to consider transmission lines in siting renewable energy facilities – Several participants from the business associations and large customers, historic preservation and land use organizations, advocacy groups for energy affordability for residential customers, local governments, and electricity providers groups noted that Virginia should consider the potential need to expand transmission lines to connect new utility-scale renewable energy facilities to the grid.

Concerns surrounding local taxes – Participants across diverse stakeholder groups highlighted that it is difficult to assess the local tax implications of siting new renewable energy projects. Between variations in the tax codes between localities, the complex patchwork of policies relating to renewable energy in Virginia, and lack of clarity regarding recent changes to the Machinery and Tools (M&T) tax, it can be difficult to develop a comprehensive and accurate assessment of the local tax implications to siting of a new renewable project.

Recommendations to expedite permitting – Some solar energy industry and advocacy organization, wind energy industry and advocacy organization, and business association and large customer stakeholders noted that it could be helpful for Virginia to develop additional methods for expediting permitting for development of new renewable energy projects for specific types of projects. For example, it was suggested that industrial sites, including industrial parks developed with public funding, could be pre-permitted to include renewable energy such that the developer of the site would have an incentive to include renewable energy facilities in conjunction with the development of the industrial site.

Concerns about the Stakeholder Engagement Process

Over the course of the stakeholder engagement process, many participants expressed gratitude for Meridian's efforts to complete an intensive and inclusive process in a short time frame. However, a few participants expressed frustrations over the timeliness of email communications they received from Meridian regarding the planning and preparation of the stakeholder meetings. In addition, one participant expressed frustration that stakeholders who were not able to participate in daytime meetings were excluded from the process, thereby making the process less inclusive and less representative of the full breadth and scope of stakeholder interests from the millions of Virginians who are ordinary rate payers.

Glossary of Terms

- **Cross-subsidization** – A situation in which customers of one class or category do not pay for the full cost of the energy services they receive from their utility and those costs are born by others who are in a different class or category of customers or based on some other distinguishing characteristic within the same class or category.
- **Distributed generation (DG) –** Small power generators installed on the distribution network at lower voltages, often owned and operated by a utility customer at the customer's premises.
- **Electrical cooperative** – Any utility consumer services cooperative.
- **Investor owned utility (IOU)** – As defined by the Code of Virginia, an investor owned utility is an electric utility that is a Phase I Utility or a Phase II Utility.
- **Meter Aggregation –** A process by which a utility combines multiple meters to one account for the purposes of billing. Each utility may have different applicability requirements for meter aggregation.
- **Municipal Utility** – Waterworks, sewerage, gas works (natural or manufactured), electric power plants and distribution systems, public mass transportation systems, storm water management systems and other public utilities acquired, established, or otherwise controlled by a locality.
- **Net-metering** – Measuring the difference, over the net metering period, between electricity supplied to an eligible customer-generator or eligible agricultural customer-generator from the electric grid and the electricity generated and fed back to the electric grid by the eligible customer-generator or eligible agricultural customer-generator.
- **Pilot Program for Community Solar** – As defined in § 56-585.1:3 of the Code of Virginia, pilot program for community solar means a program conducted by a participating utility pursuant to this section following approval by the Commission, under which the participating utility sells electric power to subscribing customers under a voluntary companion rate schedule and the participating utility generates or purchases electric power from participating generation facilities selected by the participating utility.
- **PJM Market –** Refers to PJM Interconnection LLC, a regional transmission organization that serves all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and the District of Columbia.
- **Standby charges** – Charges applicable to certain customer-generators who participate in net metering utilizing an electric generation facility with an alternating current capacity that exceeds 10 kilowatts.
- **Utility Scale Solar** – A term of art that refers to large solar projects as opposed to small solar projects or solar distributed generation projects. Depending on the source, utility scale solar is defined differently in terms of size.

Appendices

Appendix A: Questions to Guide Discussion During at Stakeholder Group Meetings

The following questions were revised based on feedback provided at the July 10, 2018 Public Kick-off Meeting for the Solar and Wind Energy Stakeholder Engagement process being conducted by Meridian Institute for Dominion Energy Services, Inc. and the Commonwealth of Virginia. The definition of key terms used in this document are the same definitions as those set forth in SB 966[1] and, for net metering, § 56-594 of the Code of Virginia[2]. For the questions pertaining to pilot programs for community solar, the definitions are those used in Section § 56-585.1:3 of the Code of Virginia[3].

Net Metering

SB 966 requires Phase I and II utilities to "investigate potential improvements to the net energy metering programs as provided under § 56-594 of the Code of Virginia."

1. How are you/your organization affected by net metering in Virginia? (participant, provider of distributed generation, ratepayer, etc.)
2. What aspects of net metering work well in Virginia, why do they work well, and how can they be improved and/or expanded?
3. What aspects of net metering do not work well in Virginia, why do they not work well, and what suggestions do you have for improving net metering?

Community Solar

SB 966 requires Phase I and II utilities to "investigate potential improvements to pilot programs for community solar development as provided under § 56-585.1:3 of the Code of Virginia."

1. How are you/your organization impacted by the pilot programs for community solar development authorized under § 56-585?
2. What aspects of the community solar pilot programs under § 56-585 do you anticipate will work well and why, and how can they be improved and/or expanded?
3. What aspects of the community solar pilot programs under § 56-585 do you anticipate will not work well and why, and how can they be improved?

[1] To view the relevant definitions, please view the SB 966 text.
[2] To view the relevant definitions, please view § 56-594 of the Code of Virginia.
[3] To view the relevant definitions, please view § 56-585.1:3 of the Code of Virginia.

Expanding options for customers with corporate clean energy procurement targets

SB 966 requires Phase I and II utilities to "investigate expansion of options for customers with corporate clean energy procurement targets."

1. How are you/your organization affected by corporate clean energy procurement targets?
2. What aspects of the approach Virginia takes to providing corporate customers ways to meet their clean energy procurement targets are working well, why are they working well, and how can these positive aspects be improved and/or expanded?
3. What aspects of the approach Virginia is taking to providing corporate customers ways to meet their clean energy procurement targets are not working well, why are they not working well, and what suggestions do you have for how negative aspects can be improved?

Siting of new renewable energy projects

SB 966 requires Phase I and II utilities to "investigate impediments to the siting of renewable energy projects."

1. How are you/your organization affected by the siting of renewable energy projects in Virginia?
2. What aspects of Virginia laws and programs are working well regarding the siting of renewable energy projects, why are they working well, and how can they be improved and/or expanded?
3. What aspects of Virginia laws and programs are not working well regarding the siting of renewable energy projects, why are they not working well, and how can they be improved?

Appendix B: July 10 Public Kickoff Meeting Participant List

Peter Anderson, Appalachian Voices

James Bacon, Bacon's Rebellion

Jonathan Baker, EDF Renewables

Richard Ball, Sierra Club Virginia Chapter

Corrina Beall, Sierra Club Virginia Chapter

Glen Besa, Sierra Club

Carmen Bingham, VPLC

Katharine Bond, Dominion Energy

Jessica Bull, Mothers Out Front

Bruce Burcat, Mid-Atlantic Renewable Energy Coalition

Becky Campbell, First Solar

Keith Cannady, HRPDC

Tom Carlson, EDF Renewables

Steven Carter-Lovejoy, Sierra Club

Ethan Case, Cypress Creek Renewables

Caroline Cirrincione, Solar Energy Industries Association

Hannah Coman, Southern Environmental Law Center

Mark Coombs, American Battlefield Trust

Sarah Cosby, Dominion Energy

Kendyl Crawford, Virginia Interfaith Power & Light

Bishop Dansby, Climate Change Advocate

Mary Doswell, Doswell Strategic Consulting Services, LLC

Nicole Duimstra, Secure Futures

Judy Dunscomb, The Nature Conservancy

Todd Edgerton, The Oak Hill Fund

Bill Eger, City of Alexandria

David Eichenlamb, VA SCC

Christopher Ercoli, Brookfield Renewable

Brianna Esteves, Ceres

Matt Faulconer, Rappahannock Electric Cooperative

Adam Forrer, Southeastern Wind Coalition

Hayes Framme, Orsted

Ryan Gilchrist, Coronal Energy

Adam Gillenwater, American Battlefield Trust

Harrison Godfrey, Virginia AEE

Lydia Graves, Appalachian Voices

Andrew Grigsby, Virginia Renewable Energy Alliance

Morgan Guthridge, Guthridge Associates

Rhea Hale, WestRock

Terry Hill, PHIUS

Francis Hodsoll, SolUnesco, MDV-SEIA Board

Dan Holmes, Piedmont Environmental Council

Ben Hoyne, Virginia Clinicians for Climate Action

Eric Hurlocker, Greene Hurlocker

Ronald Jefferson, Appalachian Power

Robert Jorz, Suntribe Solar

Joshua Kaplan, World Wildlife Fund

Karla Loeb. Sigora Solar

Joy Loving, Climate Action Alliance of the Valley

Tucker Martin, McGuireWoods Consulting

Chris McDonald, Virginia Association of Counties

Matthew Meares, Virginia Solar

Jonathan Miles, James Madison University

Susan Miller. VCCA

Lisa Moerner, Dominion Energy

John Morrill, Arlington County

David Murray, MDV-SEIA

Angela Navarro, Governer Northham

Eleanor Nowak, Appalachian Power Company

Tommy Oliver, SCC

Jennifer Palestrant, Tidewater Community College

Albert Pollard, Independent Consultant

Drew Price, Hexagon Energy

Beth Roach, Mothers Out Front

Dawone Robinson, Natural Resources Defense Council

Kaitlin Savage, Sol Vis

Walton Shepherd, NRDC

Brian Smith, WGL Energy

Kristie Smith, Virginia Conservation Network

Brianna Smith, Sierra Club intern

Tony Smith, Secure Futures Solar

Matt Smith, Hampton Roads Planning District Commission

Rachel Smucker, Secure Futures Solar

Howard Spinner, NOVEC

Tim Stevens, Falls Church City Planning Commission

Susan Stillman, Vienna's Community Enhancement Commission

Aaron Sutch, Solar United Neighbors of Virginia

Sarah Taylor, City of Alexandria

Malesia Taylor, Dominion Energy

Maron Taylor, US Green Building Council

Adam Thompson, Urban Grid Solar

David Toscano, House of Delegates

Tyson Utt, Apex Clean Energy

Adam Ventre Hexagon Energy

John Warren, VA Dept Mines, Minerals & Energy

Devin Welch, Sun Tribe Solar

Matthew Wells, WestRock

Connor Woodrich, Columbia Gas of Virginia

Andie Wyatt, Grid Alternatives

Appendix C: August 28 Public Forum Participant List

Jessica Ackerman, Virginia Municipal League

Kate Baker, Virginia Retail Federation

Corrina Beall, Sierra Club Virginia Chapter

Al Christopher, VA Dept. of Mines Minerals and Energy

David Clarke, Eckert Seamans Cherin & Mellott

Mark Coombs, American Battlefield Trust

Sarah Crosby, Dominion Energy

Walid Daniel, VA Dept. of Mines Minerals and Energy

Thomas Dick, MEPAV

Daryl Downing, Sierra Club

Bill Eger, City of Alexandria

Brianna Esteves, Ceres

Sheri Givens, Givens Energy

Harrison Godfrey, Virginia AEE

Rhea Hale, WestRock

Karen Harrison, Office of Delegate Jennifer Boysko

Mark Hickman, CSG

Terry Hill, PHIUS

Ronald Jefferson, Appalachian Power

Ron Jenkins, Virginia Loggers Association

Nannette Jenkins, Virginia Loggers Association

Petrina Jones Wrobleski, Virginia Retail Merchants Association

Ken Jurman, VA Dept. of Mines Minerals and Energy

Joshua Kaplan, World Wildlife Fund

Frank Krawczel, Commonwealth Power

Joe Lerch, Virginia Association of Counties

Karla Loeb, Sigora Solar

Christina Luman Bailey, GoGreen VML

Jonathan Miles, James Madison University

David Murray, MDV-SEIA

Eleanor Nowak, Appalachian Power Company

Guy Rohling, Powered by Facts

Ben Rowe, Virginia Farm Bureau Federation

Aimee Seibert, CSG

Brian Smith, WGL Energy

Howard Spinner, NOVEC

Adam Thompson, Urban Grid Solar Projects, LLC

Tyson Utt, Apex Clean Energy

Brett Vassey, Virgina Manufacturers Association

Andrew Vehorn, VMDAEC

Michael Whatley, Consumer Energy Alliance (CEA)

Alison Williams, Edison Electric Institute

Alice Wolfe, Blue Ridge Power Agency

Connor Woodrich, Columbia Gas

Michael Woods, Troutman Sanders

About Meridian

Meridian Institute is a not-for-profit organization that helps people solve complex and controversial problems, make informed decisions, and implement solutions that improve lives, the economy, and the environment. We design and manage collaboration, providing services such as facilitation, mediation, convening power, and strategic planning. Drawing from over two decades of experience, we help people develop and implement solutions across a wide range of issue areas, including climate change and energy, agriculture and food systems, oceans and freshwater, forests, and health. As a neutral third-party, we bring people together to listen to one another, build trusted working relationships, and forge consensus.

Contact us

Washington DC Office
1800 M Street NW, Suite 400N
Washington, DC 20036
202.354.6440

Colorado Office
PO Box 1829
105 Village Place
Dillon, CO 80435
970.513.8340

Website: www.merid.org
Twitter: @MeridOrg

Meridian Institute
Connecting People to Solve Problems