ENERGY IN THE NEW VIRGINIA ECONOMY

UPDATE TO THE 2014 VIRGINIA ENERGY PLAN

ACKNOWLEDGEMENTS

Office of the Secretary of Commerce and Trade

Office of the Secretary of Natural Resources

Office of the Secretary of Technology

The Department of Mines, Minerals and Energy (DMME)

The Department of Environmental Quality (DEQ)

The Virginia Economic Development Partnership (VEDP)

The Virginia Department of Motor Vehicles (DMV)

Southside Community College

Virginia Clean Cities (VCC)

Members of the Virginia Energy Council (VEC)

Members of the Virginia Climate Change and Resiliency Commission (VCCRC)

Members of the Governor's Executive Committee on Energy Efficiency (GEC)

Members of the Virginia Nuclear Energy Consortium Authority (VNECA)

Members of the Virginia Nuclear Energy Consortium (VNEC)

Virginia State Corporation Commission (SCC)

Members of the Virginia Offshore Wind Development Authority (VOWDA)

Members of the Virginia Solar Energy Development Authority (VSEDA)

Advanced Energy Economy (AEE)

American Council for an Energy-Efficient Economy (ACEEE)

Southeast Energy Efficiency Alliance (SEEA)

Amazon

Dominion

Appalachian Power Company

Old Dominion Electric Cooperative (ODEC)

Columbia Gas of Virginia

Virginia Natural Gas

WGL Holdings, Inc.

Columbia Pipeline Group

Virginia, Maryland, Delaware Association of Electric Cooperatives (VMDAEC)

Bath Alleghany Rockbridge Electric Cooperative (BARC)

Maurice Jones, former Secretary of Commerce and Trade

Environmental Entrepreneurs (E2)

Apex Clean Energy

Clean Energy Solutions Inc

Virginia Energy Efficiency Council (VAEEC)

The United States Department of Energy

The United States Department of Navy

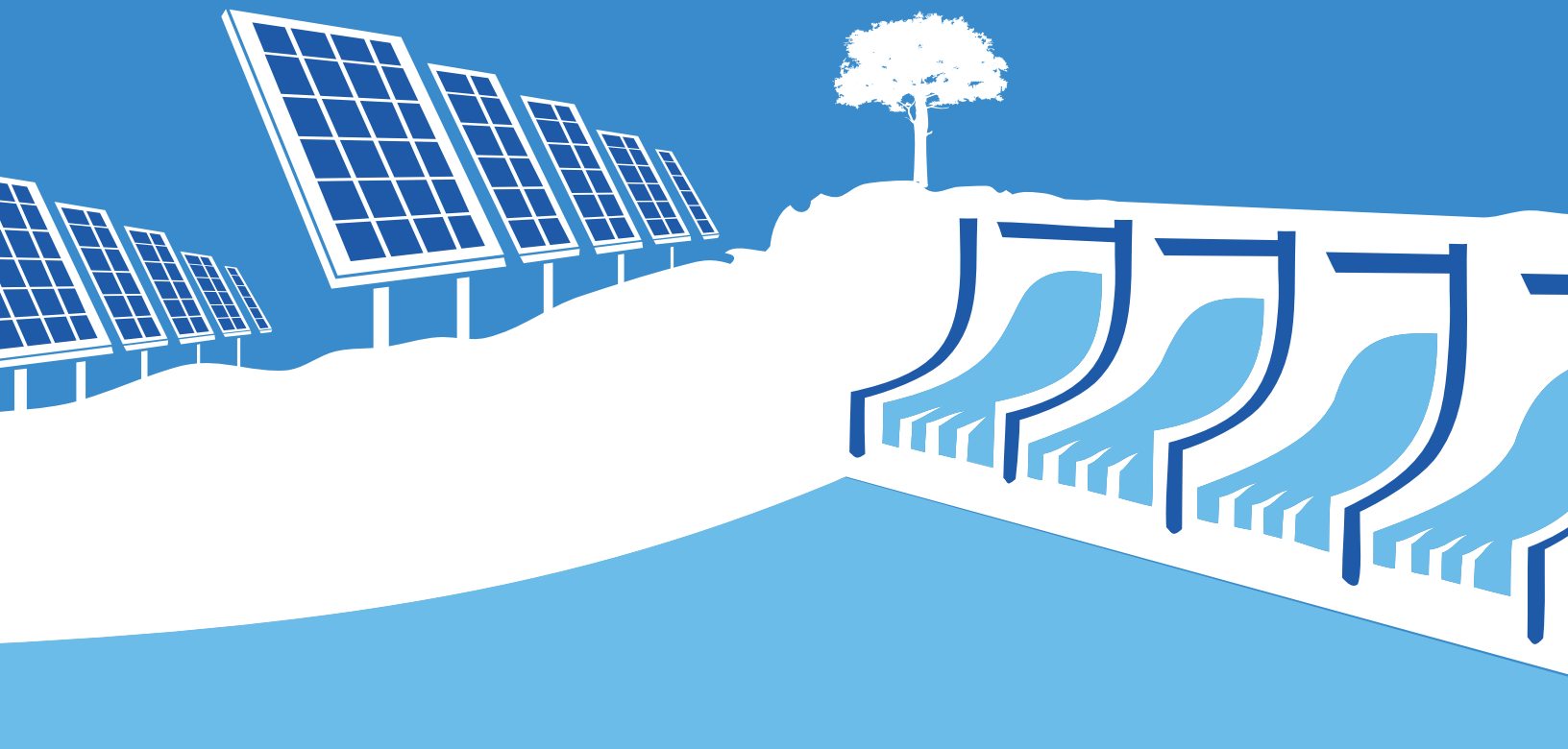
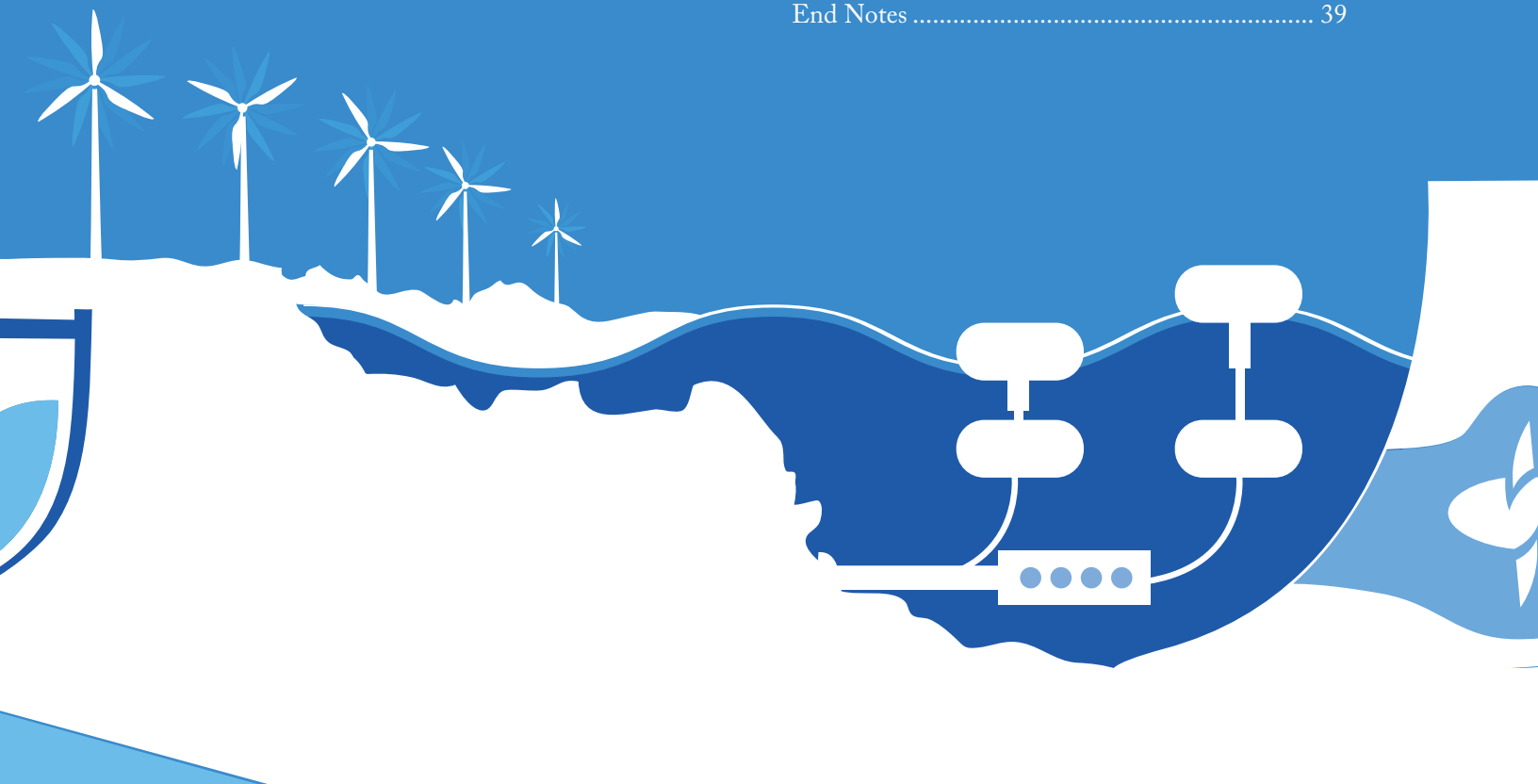


TABLE OF CONTENTS



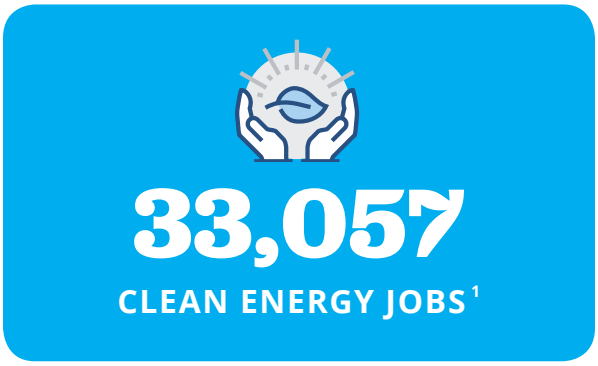
Governor McAuliffe signs a solar panel during an energy initiative agreement ceremony at Naval Air Station Oceana

PHOTO CREDIT: U.S. NAVY PHOTO BY MASS COMMUNICATION SPECIALIST 2ND CLASS JUSTIN YARBOROUGH

TRANSITION TO A NEW VIRGINIA ECONOMY

Governor McAuliffe released the Virginia Energy Plan in 2014. In it, he laid out his vision for the Virginia energy industry and the vital role it must play building the new Virginia economy. He pointed out that Virginia has had low-cost, reliable energy that businesses and residents have relied on to drive economic growth. However, he also noted that the energy landscape in Virginia and the country is undergoing unprecedented change, and Virginia must be decisive in driving innovation in energy generation and utilization to ensure that Virginia's economy benefits from the deployment of new technologies.

The changing energy economy presents both opportunities and challenges that the Governor has worked diligently to address. He has done this in the context of the four themes laid out in the 2014 Energy Plan: Strategic Growth in the Energy Sector, Best-in-Class Infrastructure, Alternative Fuels and Advanced Vehicle Technology, and Talent Development in the Energy Sector.



Since the release of the Plan, the Governor has remained committed to an "all of the above" approach to energy. The Commonwealth has seen significant activity in the areas of focus laid out in the 2014 Plan, and the Governor is driving results within the energy sector that create jobs and helps grow the Virginia economy. Since coming into office, he has attracted $500 million in capital investment in the clean energy industry.[2] He has also supported projects that could generate thousands of direct jobs and billions more in capital investment.

This report provides a summary of the momentum built and results achieved since 2014.

80 MW AC Amazon Solar Farm U.S. East solar array in Accomack county

PHOTO CREDIT: AMAZON

Strategic Growth of the Energy Sector

2014 VIRGINIA ENERGY PLAN RECOMMENDATIONS ACHIEVED:

- ✓ **Work to ensure diversity of Commonwealth's generation mix**
- ✓ **Establish Virginia Solar Energy Development Authority**
- ✓ **Facilitate partnerships to install 15MW of solar on state and local government facilities**
- ✓ **Facilitate installation of 15MW of solar on private facilities**
- ✓ **Increase the cap on non-residential solar generating systems from 500KW to 1MW**
- ✓ **Assess the offshore wind industry's supply chain needs and publicize Virginia assets as a strategic advantage to attract the industry**
- ✓ **Establish the Governor's Executive Committee on Energy Efficiency**
- ✓ **Create the position of Chief Energy Efficiency Officer**
- ✓ **Streamline and standardize the Energy Performance Contract (EPC) process by developing a comprehensive guide for all stakeholders**
- ✓ **Establish and implement the Go Global with Coal and Energy Technology Program**

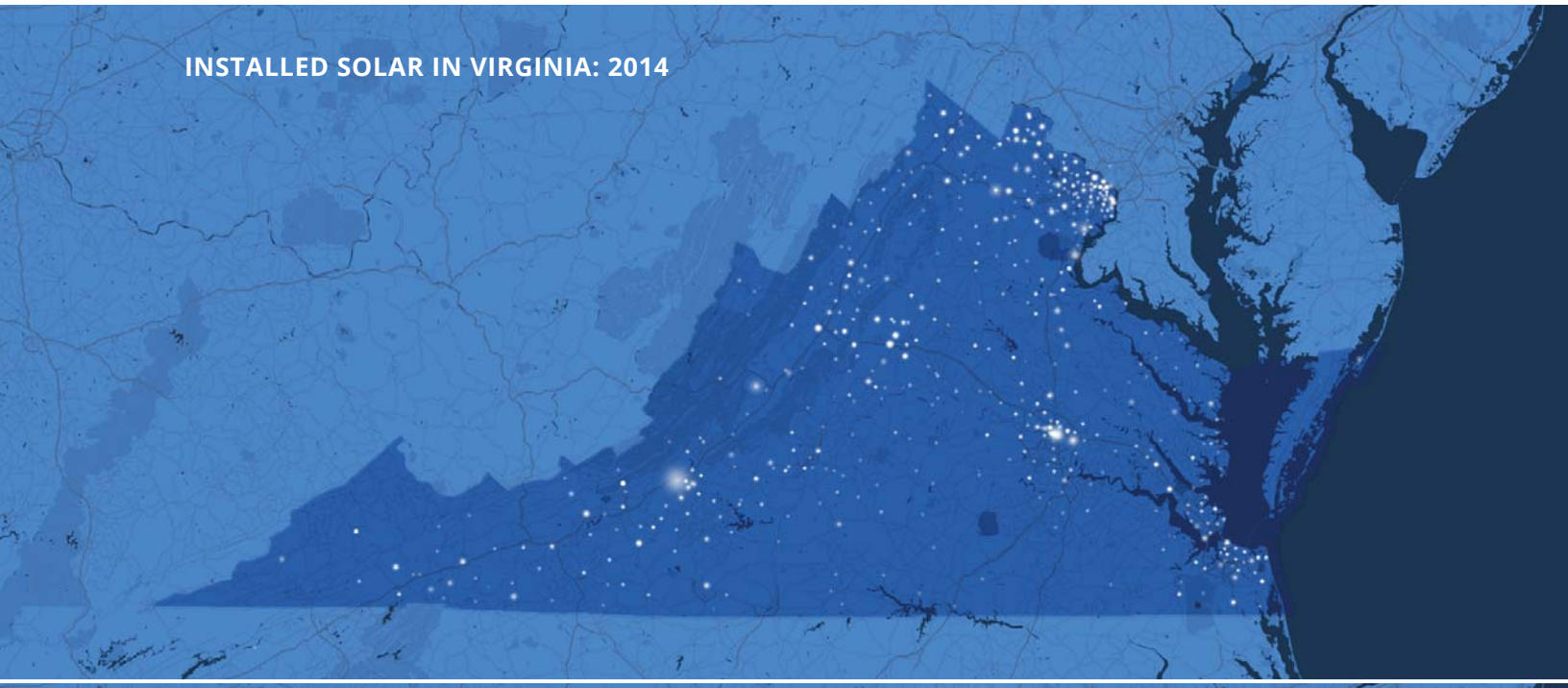
Governor McAuliffe has focused on an "all of the above" approach to energy development and utilization since coming into office. He recognizes that while Virginia must continue to utilize all available resources to power the economy, strategic growth in the energy sector will help shape the new Virginia economy.

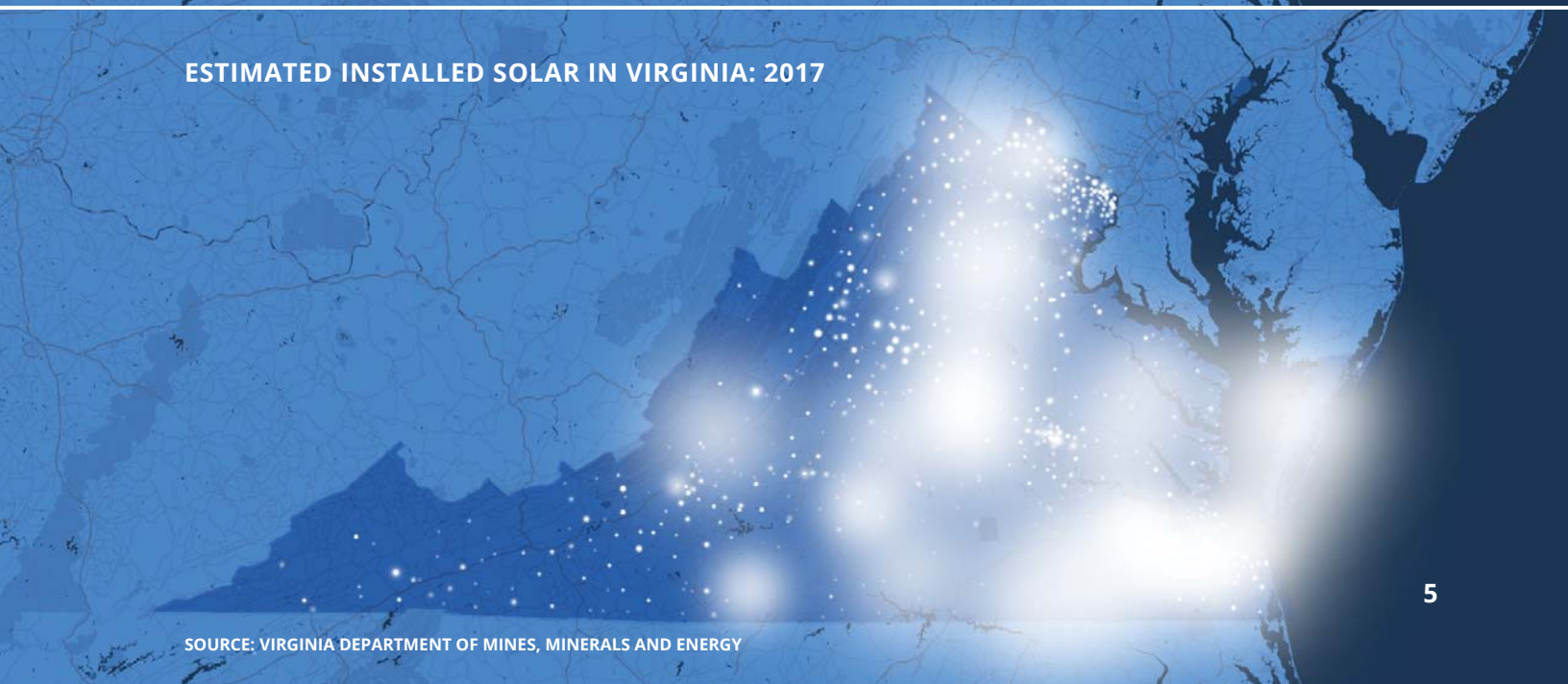
There are particular areas such as solar, wind, and energy efficiency that warrant significant attention, given the high growth potential within the Commonwealth. **The solar industry has accounted for 1 of every 83 new jobs created in the U.S. in 2015 and employs over 207,000 individuals nationwide.**[3]

Virginia is beginning to see this activity as companies within the solar industry develop potential utility-scale projects in many parts of the Commonwealth. **Energy Efficiency has the potential to employ 38,000 people in Virginia and contribute almost $300 million to state domestic product by 2030.**[4]

These industries provide opportunities to diversify the Virginia economy and ease the transition from an over-reliance on the federal government. There are also geographic areas, like southwest Virginia, that need economic diversification due to the decline in global and domestic coal consumption. Since 1990, Virginia's peak year for coal tonnage, employment in the coal industry has declined by 7,233 jobs, and the number of producing mines has decreased from 374 to 70.[5]

Many businesses in the coalfield region of Virginia have been almost entirely dependent on the coal industry in Virginia and need assistance in finding other markets for their expertise and products. These companies have products and services that are valuable to other industries in countries around the world.





SOURCE: VIRGINIA DEPARTMENT OF MINES, MINERALS AND ENERGY

The Governor also understands the value of fostering innovation from entrepreneurs who want to make Virginia their home. Providing resources to incubate ideas and accelerate the commercialization of high potential products and services can make Virginia attractive for those with the next breakthrough technology or business model.

In order for Virginia to embrace the role as leader in energy sector growth, investing in state energy expertise is vital. The Governor has made investments to drive the energy economy forward, to enhance strategic energy expertise to public officials, and to achieve the goals stated in Virginia's energy policy.

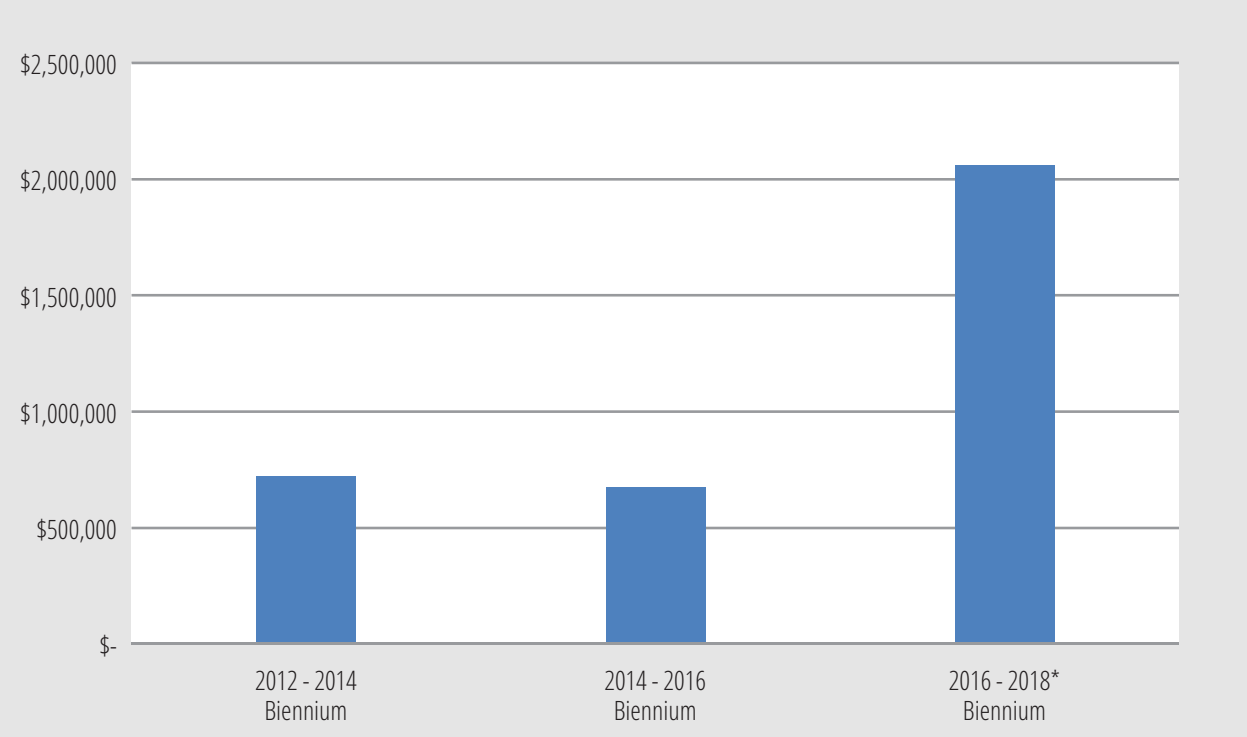
STRATEGIC GROWTH IN THE ENERGY SECTOR

INVESTMENTS IN STATE ENERGY EXPERTISE

When he came into office, the Governor recognized that there was a gap in state leadership when it came to driving clean energy policy. The Division of Energy, located in the Department of Mines, Minerals and Energy (DMME), has not traditionally been a comprehensive resource for all Virginians on Virginia's energy landscape.

The Governor believes that the Commonwealth should be able to provide objective policy and technical expertise on energy issues to citizens and businesses. This is why, in his 2016-2018 executive budget, he nearly tripled the amount of money the Division of Energy receives from the Commonwealth.[6] This includes three new full-time positions dedicated to providing Virginia with a strategic vision for driving clean energy industry growth. These resources will help the Commonwealth better understand, shape and adapt to Virginia's evolving energy landscape.

BIENNIAL APPROPRIATIONS 2012-2018 DIVISION OF ENERGY



*** Based on 2016-2018 Budget approved by** Governor **McAuliffe on May 20, 2016**
SOURCE: VIRGINIA DEPARTMENT OF MINES, MINERALS AND ENERGY

DMME DIVISION OF ENERGY COMPETITIVE GRANT AWARDS—2014-2016

Project	Grant Source	Federal Amount	Match
Measures (EM&V) - 2014 SEP Competitive Grant	DOE	$498,249	$101,235
10% EE Goal Roadmap - 2015 SEP Competitive Grant	DOE	$300,000	$60,046
Mid-Atlantic PACE Alliance - 2016 SEP Competitive grant (applied)	DOE	$500,000	$133,176
Virginia Energy Markets and Planning Project - NASEO	National Association of State Energy Officials	$20,000	0
Total		**$1,318,249**	**$294,457**

SOURCE: VIRGINIA DEPARTMENT OF MINES, MINERALS AND ENERGY

The additional resources will also be used as matching funds to aggressively seek out federal and non-profit dollars that can exponentially increase the impact of state resources. During the administration, the Division of Energy has leveraged **$294,457 in state resources to receive $1,318,249 in federal and non-profit awards.**[7] This represents more than **4 to 1 leverage ratio.**

As part of the Governor's significant investment in the Division of Energy, two new full-time positions were created to improve the Commonwealth's expertise in energy efficiency. One position will oversee Virginia's numerous energy efficiency financing programs, including Commercial PACE and VirginiaSAVES. This person will also assist in implementing the Commonwealth's 10% retail consumption reduction goal. The other position will provide advocacy and technical assistance for Energy Performance Contracting (EPC) throughout Virginia. This person will help grow the **$700 million performance contracting portfolio** that was built by both the state and localities. The Governor has also provided **$250,000 per year** to conduct an energy management pilot program to help the Commonwealth better understand its energy consumption and its options for energy conservation.[8]

In addition to providing much needed financial resources, the Governor saw the need for executive agencies to tap into the considerable energy and environmental expertise that exists in the Virginia private sector to craft better policy in the critical areas of clean energy, resiliency and climate change. In the 2015 General Assembly session, the Governor created, with bipartisan support, the Virginia Solar Energy Development Authority (VSEDA).[9] VSEDA is charged with helping to grow solar industry in Virginia. He also created the Governor's Executive Committee on Energy Efficiency to develop the path to achieve Virginia's goal of reducing energy consumption by 10%. He re-established the Climate Change and Resiliency Commission to address issues related to reducing carbon emissions in Virginia and increasing the resiliency of critical assets, infrastructure and communities vulnerable to the effects of climate change.

PHOTO CREDIT: DOMINION VIRGINIA POWER

SOLAR POWER

PRIVATE SECTOR

Governor McAuliffe has fought for meaningful policy changes through legislation to accelerate the deployment of solar energy in Virginia. He has been successful in pushing through changes resulting in the growth of utility-scale and small-scale solar industries.

Utility-scale solar

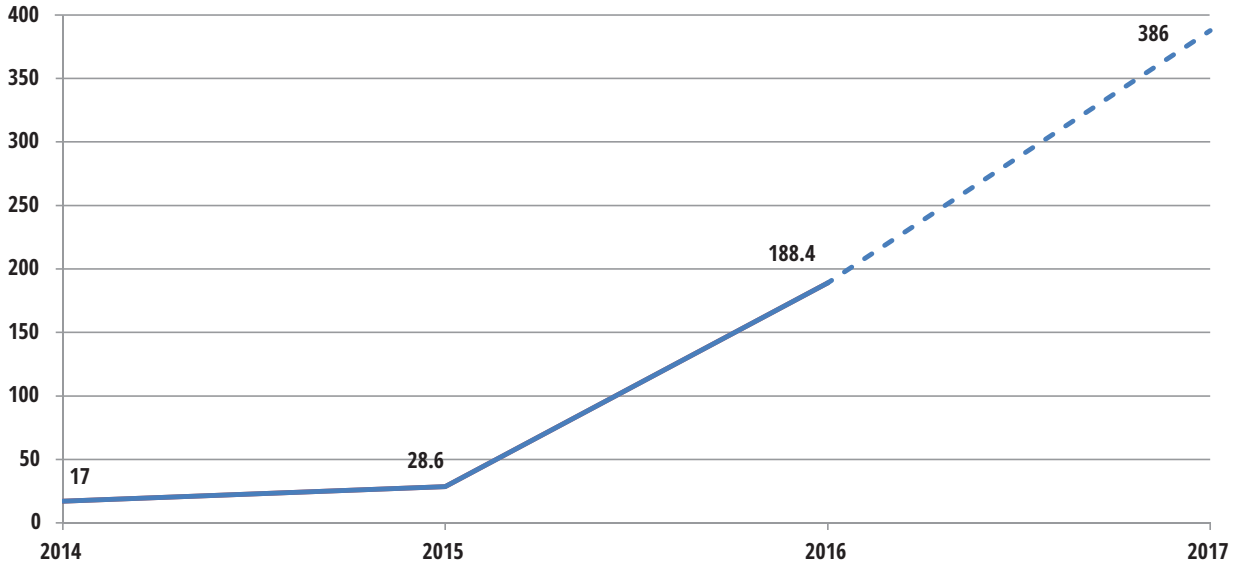
In 2015, Governor McAuliffe signed into law a bill that sets **500 megawatts of utility-scale solar** as in the public interest.[10] This legislation makes it easier for Virginia's utilities to build and supply solar energy to Virginia consumers on a large scale.

The Governor also signed a bill in 2016 that extends tax exemptions for large, utility-scale solar generation facilities. By 2018, this will provide an **80% exemption** on the local machine and tools tax for solar facilities greater than 5MW. The bill also preserves the existing **100% exemption** for any system under 5MW.[11]

Dominion Virginia Power conducted its first-ever request for proposal for utility-scale solar projects. This resulted in the approval by the State Corporation Commission of three solar projects totaling **56MW.**[12] It also resulted in Dominion signing its first ever Virginia solar power purchase agreement for a **20 MW**[13] project. An independent third-party developer will build, own, and operate the solar facility and sell the electricity generated to Dominion to power Virginia homes and businesses. *(Note: The Southampton County Board of Supervisors approved a 100MW solar energy facility on September 27, 2016. This will be built by a third-party developer and purchased by Dominion.)*

Utility-scale solar activity has not been restricted to investor-owned utilities. Old Dominion Electric Cooperative, which supplies electricity to cooperatives throughout Virginia, Maryland, and Delaware, is currently constructing two solar facilities totaling **30MW.**[14] A **10MW** facility will be built in Clarke County and a **20MW** facility will be constructed in Northampton County.

ACTUAL AND ESTIMATED SOLAR INSTALLED—2014 THROUGH 2017



SOURCE: VIRGINIA DEPARTMENT OF MINES, MINERALS AND ENERGY

Based on the projects announced and permitted, it is estimated that Virginia will have **188MW** of solar installed by the end of 2016 and an additional **198MW** installed by the end of 2017.[15] That will make close to **400MW** of solar generation installed in the Commonwealth during Governor McAuliffe's administration. These estimates do not include projects listed in the Virginia Department of Environmental Quality (DEQ) Permit By Rule (PBR). The PBR provides developers of renewable projects no larger than 100MW a streamlined regulatory process to receive all necessary state approvals to build renewable facilities within the Commonwealth. To date, DEQ has been made aware of projects under development in Virginia totaling **779MW.**[16]

Distributed Solar Generation

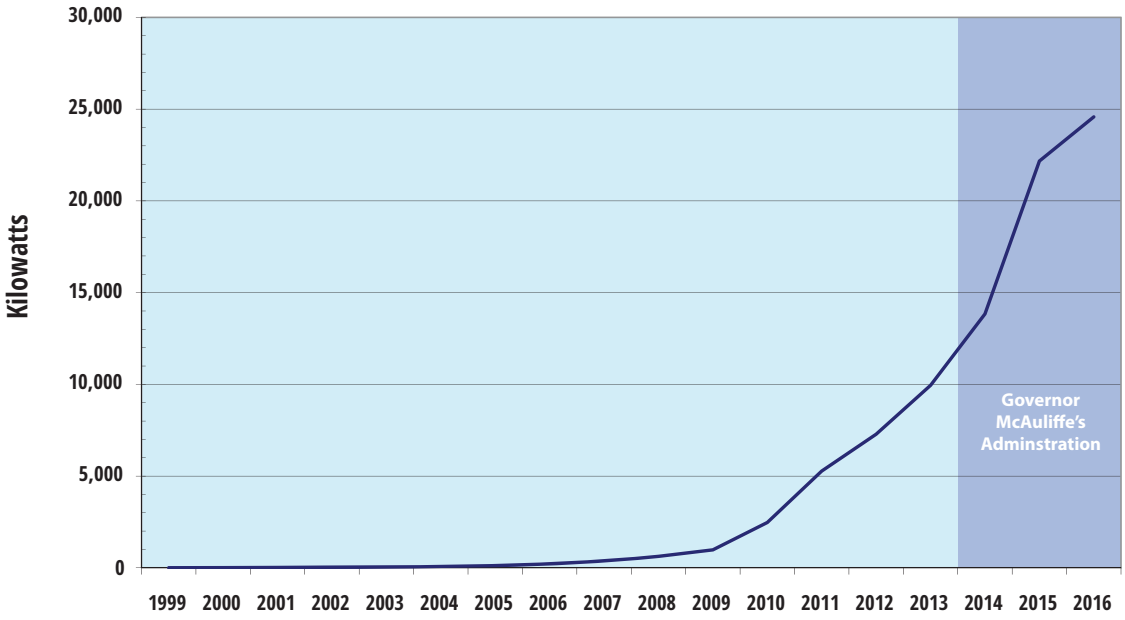
The majority of the realized and projected growth in installed solar in Virginia is coming from activity within the utility-scale solar market. However, there has also been significant activity in the deployment of distributed generated solar installations owned by individual consumers and businesses. Policy changes successfully achieved by the Governor have created an environment more conducive to the installation of solar generation systems smaller than 1MW.

The Governor has successfully doubled the system size allowed on commercial properties in Virginia from 500kw to 1MW.[17]

Additionally, the Governor has made it easier for solar generating systems to receive state-level pollution control equipment tax exemptions. Legislation signed in 2016 identifies the Department of Mines, Minerals and Energy as the agency that certifies a solar generation system as pollution control equipment.

In the last two years, Virginia has realized more growth in small-scale solar deployment than at any time in the Commonwealth's history. Installed net metering capacity in Virginia has grown from **12MW** in 2014 to **25MW** today.[18] That is **108%** more installed capacity in the last two years than in the previous 14 years combined.

INSTALLED NET-METERED SOLAR—1999 THROUGH 2016



SOURCE: VIRGINIA DEPARTMENT OF MINES, MINERALS AND ENERGY

INNOVATION

The administration's tireless work has also fostered an environment of innovation and creativity for solar energy deployment in the private sector. This innovation has led to renewable energy activity in Virginia from two of the world's most famous pioneering companies, Amazon and Microsoft. Amazon has partnered with Dominion Virginia Power to construct the largest solar facility in the Mid-Atlantic in Accomack County on Virginia's Eastern Shore. Amazon Solar Farm US East is an **80MW facility** developed by a solar energy company and purchased by Dominion. It's being built to help power data center operations in Northern Virginia owned by Amazon Web Services, a cloud computing subsidiary of Amazon.com. Amazon will be the sole purchaser of all of the electricity generated by the facility as part of Amazon's global mission of powering its operations from renewable energy.[19]

In March of 2016 the Governor announced a first-of-its-kind Public Private Partnership with Microsoft to build a **20MW solar facility**[20] in Fauquier County. Microsoft, a worldwide leader in software, services, devices, and solutions, operates one of it's largest data centers in Boydton, in Southern Virginia. The facility, projected to come online in 2017, will provide the Commonwealth with low-cost electricity that will save taxpayers money while allowing Microsoft to achieve its corporate sustainability goals through the retirement of the Renewable Energy Credits (RECs) generated by the facility. The solar facility will be built by an independent solar development company and owned by Dominion Virginia Power.

Virginia realized its first community solar program. In August 2016, the Governor commissioned the Bath Alleghany Rockbridge Cooperative (BARC). BARC's charge was to complete construction of a **550kw solar system** that allows customers to purchase "solar energy blocks" at a set rate equal to **25% of their energy bill.**[21] Due to high demand from customers, the system was fully subscribed before construction was complete. This project was partially funded through a **$500,000 grant** presented by the Governor from the Appalachian Regional Commission and the United States Department of Agriculture.

Virginia Spotlight

COMMUNITY SOLAR

Community Solar is a shared solar garden that is identical to rooftop solar, but without the barriers that accompany rooftop solar. With BARC Electric Cooperative building and maintaining the array, customers avoid the upfront cost of roof-mounted solar and all maintenance responsibilities.

Renters, low-income customers, and those with physical barriers such as inadequate roof space or shading, all can enjoy the benefits of solar through this project. And by BARC fixing the rate for 20 years, this project offers the additional benefit of acting as a hedge against future rate increases.

Customers can subscribe in blocks of solar energy produced from the project.

Private colleges and universities in Virginia are utilizing innovative tools to deploy solar energy on their campuses. The Council for Independent Colleges Virginia,[22] through a grant from the U.S. Department of Energy, has been developing comprehensive plans to deploy solar on member campus throughout Virginia. Fifteen colleges and universities are participating in the three-year program designed to help the colleges navigate complex legal, regulatory, and technical challenges, leverage group purchasing power to achieve price reductions for hardware and installation services, and create a learning network accessible by other organizations. Students, faculty, and staff will also pursue ways that solar projects can help enhance curricula, clinical learning experiences, and community service. At the end of 2015, each participating member received its own tailored solar master plan that provides information on code and regulatory considerations, sample power purchase agreements, and an estimated timeline for implementation.

The Governor will continue to work for more innovative partnerships in Virginia that add additional renewable power to the grid and create clean energy jobs within the Commonwealth.

8%

ELECTRICITY FROM RENEWABLE SOURCES

PUBLIC SECTOR

Governor McAuliffe has used his executive authority to make Virginia government a leader in solar development, actively working to grow the clean energy industry. The Commonwealth is a major consumer of electricity, but uses virtually no renewable energy as part of its energy portfolio. The Governor has made a commitment to power more of state government operations using more renewable energy.

In December of 2015, Governor McAuliffe announced that the Commonwealth will derive up to **8% of its total electricity consumption from renewable energy sources.**[23] This commitment equates to approximately **110MW of new renewable generation** to be installed within Virginia. The new generation will come from utility-scale facilities and distributed generation installations, and will be installed by investor-owned utilities as well as independent, third-party developers. The facilities will be deployed on both private and public property.

The Commonwealth will work with independent, third-party developers on the distributed generation projects. Developers will be selected through a competitive procurement process. The Department of Mines, Minerals and Energy, in conjunction with the James Madison Center for Wind Energy, is conducting a comprehensive state facility site evaluation to determine the best state assets for solar generation.[24] The Clean Energy Development and Services, or CEDs, initiative is an exhaustive evaluation of all state-owned buildings and land to determine their suitability for generating and using solar energy to power state operations. DMME will utilize **$6 million in grants** from the U.S. Government that will be provided directly to participating state agencies.

BREAKDOWN: 8% STATE RENEWABLE GOAL

	System Size	Connection		Structure
Utility-scale	>2MW	Grid	On or Off Site	PPA
Distributed Generation	<2MW	Behind Meter	On site, contiguous property	PPA

SOURCE: VIRGINIA DEPARTMENT OF MINES, MINERALS AND ENERGY

Virginia Spotlight

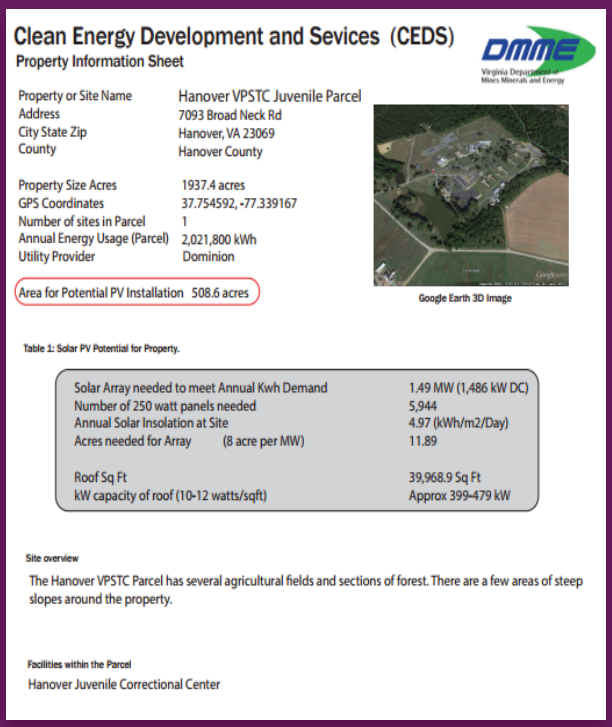
SOLAR DEVELOPMENT FOR STATE-OWNED PROPERTIES

James Madison University Center for Wind Energy has developed a site evaluation tool that identifies the suitability of state facilities to host Photovoltaic (PV) solar installations, both rooftop and ground mount.

The desktop analysis includes the maximum acreage potentially available and how much solar is necessary to meet annual electricity demand of the facility. Based on the evaluation, CEDs produces a Property Information Sheet for each location.

The Sheet includes maps of the facility and identifies areas of possible PV deployment.

Source: Virginia Department of Mines, Minerals and Energy



Clean Energy Development and Sevices (CEDS)

Property Information Sheet

DMME Virginia Department of Mines Minerals and Energy

Property or Site Name	Hanover VPSTC Juvenile Parcel
Address	7093 Broad Neck Rd
City State Zip	Hanover, VA 23069
County	Hanover County
Property Size Acres	1937.4 acres
GPS Coordinates	37.754592, -77.339167
Number of sites in Parcel	1
Annual Energy Usage (Parcel)	2,021,800 kWh
Utility Provider	Dominion
Area for Potential PV Installation	508.6 acres

Google Earth 3D Image

Table 1: Solar PV Potential for Property.

Solar Array needed to meet Annual Kwh Demand	1.49 MW (1,486 kW DC)
Number of 250 watt panels needed	5,944
Annual Solar Insolation at Site	4.97 (kWh/m2/Day)
Acres needed for Array (8 acre per MW)	11.89
Roof Sq Ft	39,968.9 Sq Ft
kW capacity of roof (10-12 watts/sqft)	Approx 399-479 kW

Site overview

The Hanover VPSTC Parcel has several agricultural fields and sections of forest. There are a few areas of steep slopes around the property.

Facilities within the Parcel

Hanover Juvenile Correctional Center

The first utility-scale project under this goal, announced in August of 2016, is a partnership with the U.S. Department of Navy and Dominion Virginia Power. Naval Air Station Oceana, located in Virginia Beach, will house an **18MW solar facility**[25] within its fence line. The Commonwealth will purchase all of the electricity generated from the facility to power state government operations. The state will also retire Renewable Energy Credits (RECs) to help satisfy the renewable procurement goal. This project represents **16% of the Governor's overall goal.**

The Governor also believes that Southwest Virginia can benefit from the growth of the clean energy industry. That is why he instructed DMME to convene a Southwest Virginia solar working group. The group's broad goal is to further the dialogue with regional stakeholders about the application of renewable energy in Southwest Virginia to deliver greater economic diversification. Participation includes Appalachian Voices, Southwest Virginia Technology Council, faculty at Mountain Empire Community College, and staff from Wise County. This group began meeting in the summer of 2016 and will continue to develop strategies to deploy more solar energy in Southwest Virginia, as well as attract the supply chain that supports the clean energy industry.

Regional organizations within Virginia have also worked to promote the deployment of solar energy in targeted jurisdictions. For example, the Solarize NoVA[26] program has supported deployment of over **85 new systems** in localities such as Alexandria, Dumfries, and Leesburg with a construction value of over **$2.29 million.**[27] Virginia SUN has sponsored fourteen solar cooperatives in localities including Arlington and Floyd Counties and with stakeholders including Interfaith Power and Light in Northern Virginia. Other solarize programs have been conducted in Blacksburg, Charlottesville, and the city of Richmond.

Another example of the public sector innovation is the Northern Virginia Regional Commission (NVRC), in partnership with the Metropolitan Washington Council of Governments (MWCOG). The NVRC is a regional council that provides information and technical services to its 14 member localities and provides a mechanism for regional cooperation. In August of 2016, the NVRC launched the Northern Virginia Solar Map.[28]

Search page for the NOVA Solar Map Program

SOURCE: HTTP://WWW.NOVASOLARMAP.COM/

The map is an online tool describing the solar energy potential of buildings and homes. The website displays a map with a search box that can be used to specify an individual address. A user can click on the particular building and view details about roof size, potential solar system size, and projected annual savings if a solar system is installed. This is the first mapping program of its kind in Virginia and can be used by potential customers interested in learning more about their buildings solar energy potential and by vendors that are working to ensure that customers receive the most value from their system.

While there has been tremendous progress made during the first three years of the administration, obstacles still remain. During the 2016 General Assembly session, the Governor proposed **$2 million in funding** for the Virginia Solar Energy Development Authority. The legislature removed this funding, leaving the Authority with no direct state financial support for their work, despite bipartisan support for its creation.

In 2015, the Governor put forth a series of bills that would have given Virginians more opportunity to install solar on their homes. The package included limiting standby charges to larger systems, increasing the cap on the amount of solar net metering that is permitted in Virginia, extending the current utility power purchase agreement pilot to all service territories and doubling the programs size, and increasing the size of permitted residential net metering systems. These efforts were rejected by the General Assembly.

806 KW AC roof-mounted solar array Western Branch High School, Chesapeake, VA

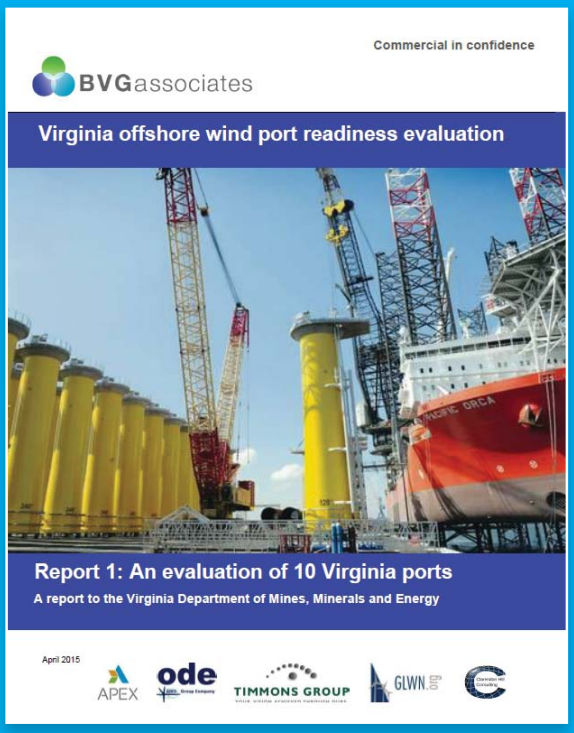
PHOTO CREDIT: DOMINION VIRGINIA POWER

WIND POWER

Wind energy in Virginia continues to have great potential, but slow progress. We have tremendous assets that could make Virginia a manufacturing and installation hub for the offshore wind industry. The Governor has worked to remove barriers to allow the installation of turbines off of Virginia's coast. Significant challenges remain in making offshore wind energy a reality in Virginia. The primary obstacle is cost. Unlike all forms of solar energy, the installed cost of offshore wind energy has not declined significantly in the past few years. Onshore wind energy has seen much recent progress and is close to becoming a reality within the Commonwealth. Local government, private sector, and individual landowner activity has increased substantially in portions of the state where the wind resource is significant. The administration has been and will continue to be an advocate for this industry given its economic development potential.

THE VIRGINIA OFFSHORE WIND PORT READINESS STUDY: RECOMMENDATIONS

The recommendations in the study fall into three broad categories; short-term, medium-term, long-term:



- **Short-term (2015 – 2017):** DMME should take the lead in promoting offshore wind manufacturing and construction through additional economic, marketing, and outreach analysis. DMME should coordinate with the Virginia Economic Development Partnership (VEDP) and the Virginia Port Authority (VPA) to establish a preferred port utilization scenario. DMME should ensure that all Virginia enabling bodies are presenting a clear, coordinated ports prospectus to offshore wind developers and manufacturers. DMME should monitor the progress at other regional ports, especially Paulsboro, NJ, and Sparrows Point (Baltimore), MD and adjust the Virginia port strategy as needed.

- **Medium-term (2018 – 2020):** Virginia should engage with developers and the supply chain to ensure the time line for port upgrades will enable and secure opportunities for domestic component supply. This timeline should also take account of superstructure development (including buildings, machinery and cranage) and the need to ramp-up production volumes over time. DMME and VPA should work to minimize regulatory barriers and conduct in-depth engineering analyses to characterize necessary port upgrades.

- **Long-term (2021 – 2023):** Virginia should secure investment from manufacturers and complete the port upgrades, so that manufacturing can commence by the end of this period.

Source: Virginia Department of Mines, Minerals and Energy

Virginia's skilled workforce and its location along the east coast make it an ideal location for manufacturing wind turbine components, such as this offshore wind turbine tower section.

OFFSHORE WIND

The progres in offshore wind energy in Virginia has seen both advancements and setbacks. The Governor has moved forward to assess the industry opportunity for Virginia and to remove regulatory hurdles that would slow progress.

In the spring of 2015, the administration released a comprehensive analysis[29] of Virginia's capabilities to attract and house the supply chain that supports 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 in the development of offshore wind generation facilities. The study concluded that five of Virginia's ports offer a high level of potential, and with strategic investments, is 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. This study is not meant to advocate for specific port improvements or for realignment for any particular use of Virginia ports. It is instead a high-level evaluation to inform of possible optional uses of port infrastructure should an offshore wind industry develop on the east coast.

On March 24, 2015, the Governor announced the signing of the nation's first federal offshore research lease with the U.S. Bureau of Ocean Energy Management (BOEM).[30] This lease allows Virginia access portions of the Outer Continental Shelf for wind development. Attorney General Mark Herring played a critical role in negotiating the lease in conjunction with the administration. The signing of the lease was a necessary component to allowing offshore wind research projects to be conducted in U.S. waters off of Virginia's coast. The lease area is 25 nautical miles off the coast of Virginia and borders the commercial Wind Energy Area (WEA) currently being leased by Dominion Virginia Power. This lease ensures that the Commonwealth is fulfilling its responsibilities for Dominion to build research turbines.

Despite the progress made by the Governor, the Commonwealth was handed a significant setback in its efforts towards offshore wind. In May of 2016, Dominion lost a $40 million grant to build two 6MW wind turbines off the coast of Virginia.[31] The project, called VOWTAP, was intended to demonstrate the use of innovative technology and identify opportunities to reduce the cost associated with turbine manufacturing and installation for future commercial installations.

Viewpoint simulation of preliminary design plan for Rocky Forge Wind Development

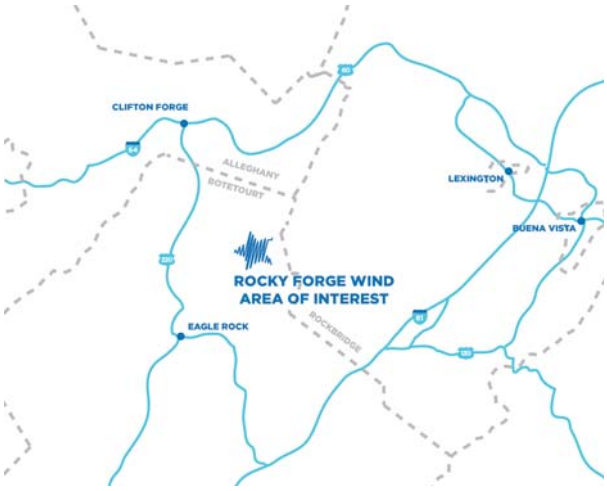
PHOTO CREDIT: APEX CLEAN ENERGY

ONSHORE WIND

While Virginia does not have as robust an onshore wind resource as offshore, there is still meaningful opportunity to build utility-scale systems within the Commonwealth. The map below shows the resources potential in Virginia. In the past developers have attempted to build systems, but none have been successful. Since the Governor came into office there has been a growing optimism that Virginia could see ground broken on its first wind farm before 2018. One project that has been in development for nearly a decade continues to present an opportunity.

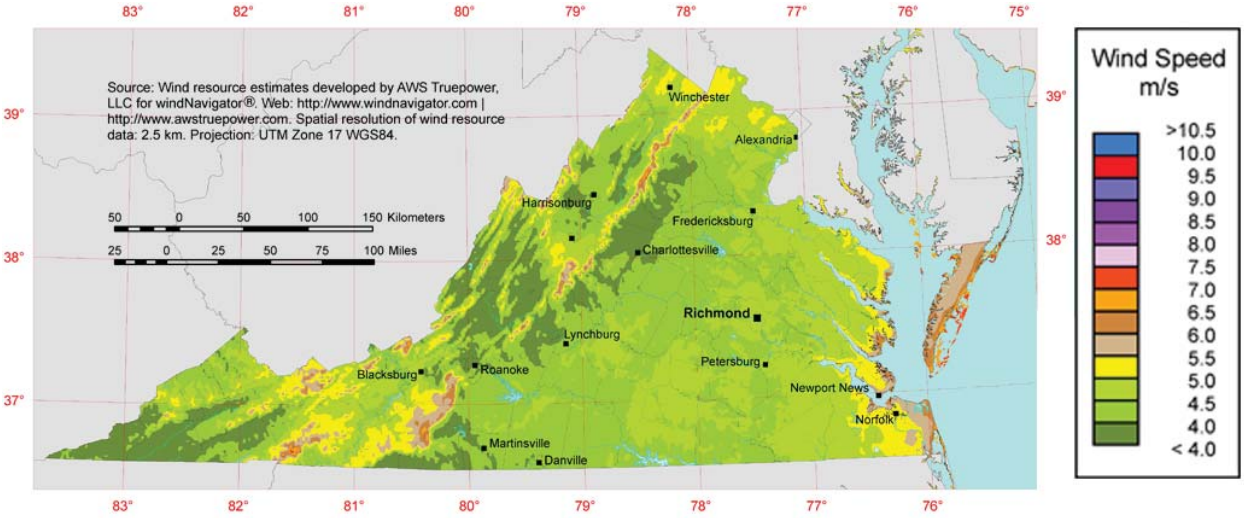
There is another more recent project that has been meticulously developed in collaboration with the locality and is currently moving through Virginia Permit by Rule process. Charlottesville-based utility scale wind and solar developer Apex Clean Energy has been developing the Rocky Forge Wind[32] project for the last three years.

This project would install up to **25 turbines** that could generate as much as **75MW of electricity,** enough energy to power up to **20,000 homes.** The turbines would be placed on private land located in Botetourt county. Apex is currently working through the Permit By Rule process and is seeking a customer to purchase the electricity that will be generated from the project.



Source: Apex Clean Energy

VIRGINIA ANNUAL AVERAGE WIND SPEED AT 80M



Source: Natural Renewable Energy Lab

ENERGY EFFICIENCY

PUBLIC SECTOR ENERGY

On October 16, 2014, Governor McAuliffe signed Executive Order 31 identifying energy efficiency in state government as a priority for his administration.[33] The signing occurred at an award presentation to the Department of Motor Vehicles for their work in reducing energy consumption through Energy Performance Contracting (EPC) at their main headquarters in Richmond.

In the executive order, the Governor established a goal of reducing state government electricity consumption by **15% by the end of 2017** (using 2010 as the baseline). In setting this goal, he identified EPC as a valuable tool for state agencies to take a comprehensive approach to reducing energy consumption in state buildings. This was an aggressive goal and one that will be challenging to achieve. Positive progress has been made in reaching this goal, but there is still work to be done. Currently, Virginia has achieved **38%** of the Governor's goal through EPC.[34] These efforts have resulted in the reduction of nearly **43 million kilowatt hours (KWh)** of electricity and the avoidance of **31,219 metric tons of carbon dioxide (CO2) emissions** being sent into the atmosphere annually.

Virginia Spotlight

VIRGINIA DEPARTMENT OF MOTOR VEHICLES ENERGY PERFORMANCE CONTRACT

The Virginia Department of Motor Vehicles (DMV) initiated an Energy Performance Contract (EPC) on the main DMV headquarters in Richmond, Virginia. As part of the contract, The Energy Service Company (ESCO) that performed the work guaranteed that the improvements would save $284,000 per year in energy costs throughout the life of the project. As in all EPCs, these savings would be utilized to finance the cost of making the improvements, allowing the DMV to lower its energy consumption without spending money upfront.

THE IMPROVEMENTS INCLUDED:

- Consolidate Electric Meters Water System Upgrades
- Interior and Exterior Lighting Upgrades
- HVAC | Chiller Plant, Controls, and Airside Upgrades
- Hot Water Plant Upgrades
- Replace all exterior glass panes

THE 2016 RECONCILIATION REPORT VERIFYING THE ENERGY SAVINGS SHOWED THAT THE IMPROVEMENTS MADE SAVED:

- $624, 680 in the first two years ($50,000 more than the projected savings)
- 8,665,127 kwh
- 14,864 kw of electrical demand
- 59,125 therms of gas and oil
- 9,468,480 gallons of water

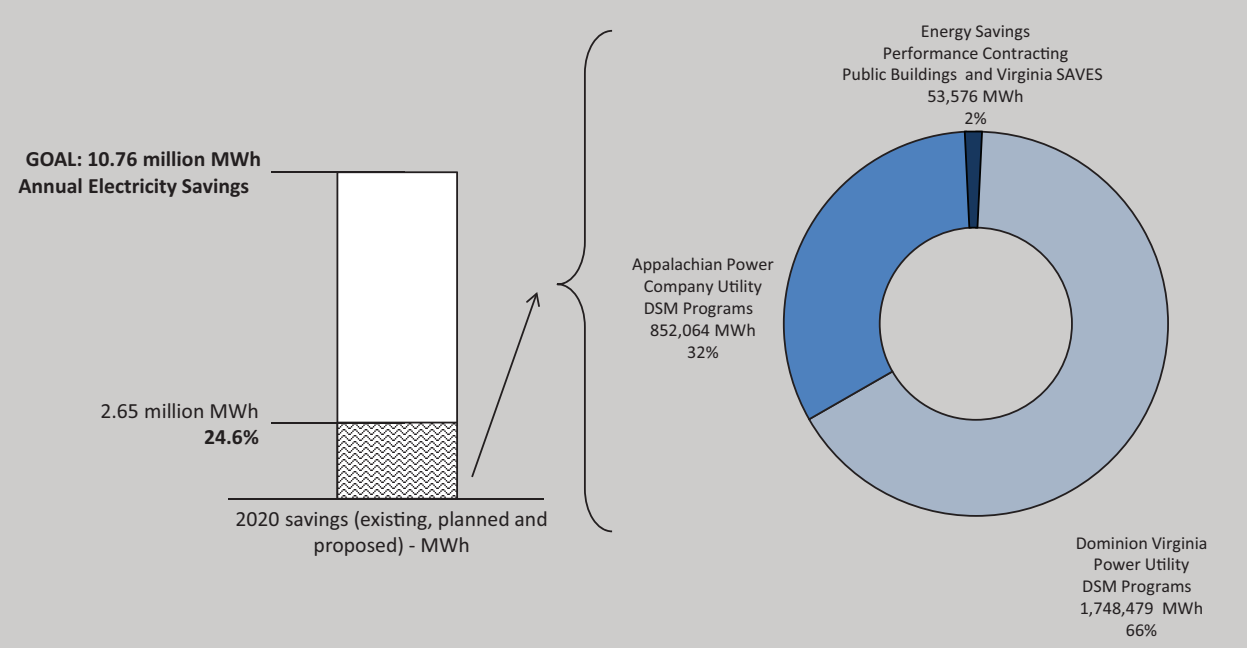
Source: Virginia Department of Motor Vehicles

The nation's first Chief Energy Efficiency Officer, located in the Secretary of Commerce and Trade's office, was established in Executive Order 31. This position oversees the efficiency initiatives established by the Governor and presides over the Governor's Executive Committee on Energy Efficiency (GEC).

Governor's Executive Committee on Energy Efficiency (GEC)
The GEC was established in May of 2015 to develop a strategic path toward reaching Virginia's voluntary goal of reducing retail electricity consumption by **10% by 2020.**[35] The Committee is comprised of experts and stakeholders from the utility, non-profit, low-income housing, finance, and consulting industries. It also includes local government representatives. The voluntary 10% reduction goal was established in Virginia's first Energy Plan in 2007. It was later added to Code and was determined by the State Corporation Commission to be achievable. However, as stated in the 2014 Energy Plan, there was only anecdotal evidence that work was underway to achieve the goal.

Given this lack of movement towards the goal, the first directive of the GEC was to identify where Virginia currently stands in achieving the goal and the appropriate metric to track progress over time. Based on the statutory language relating to the goal, the Committee determined the goal is to be measured by achieving identified savings in 2020 of 10% of the overall electricity consumption in the baseline year of 2006. This means that achievement of the goal represents identified consumption reductions of **10.76 million megawatt hours (MWh).**[36] The graph below shows where Virginia currently stands in reaching the goal, based on existing, planned, and proposed savings.

PROGRESS TOWARDS 10% GOAL



Source: Virginia Department of Mines, Minerals and Energy

This chart highlights three points; (1) Virginia is behind the pace needed to achieve the goal by 2020, (2) utility-sponsored efficiency programs make up the bulk of the identified savings, but still lag behind other states, and (3) there are substantial savings from non-utility programs that have not yet been identified and quantified. Due to the lack of consistent tracking since the inception of the goal in 2007, Virginia must accelerate the adoption of energy efficiency measures, both utility and non-utility, in order to achieve our goal.

The GEC has developed a set of recommendations to drive greater adoption of energy efficiency measures to reduce consumption. Additionally, The Virginia Department of Mines, Minerals and Energy (DMME) teamed with the Virginia Energy Efficiency Council, Clean Energy Solutions and the Southeast Energy Efficiency Alliance in a successful competitive grant proposal to develop and pursue a policy and strategy roadmap to support the GEC.

The project was awarded a **$300,000 grant** from the U.S. Department of Energy in January 2016 to achieve the 10% goal by:

- Providing technical expertise and administrative support to the GEC
- Developing a coalition of stakeholders to ensure that all relevant perspectives are fully considered and that all potential partners are engaged
- Analyzing strategies to address the regulatory environment as it relates to the quantity and quality of energy efficiency programs offered by the utility sector
- Analyzing strategies to address barriers and opportunities related to energy efficiency for each building sector
- Developing a roadmap document to achieving the goal that can serve as a valuable resource for Virginia as well as for other states

CREATIVE FINANCING TOOLS FOR ENERGY EFFICIENCY

Commercial Property Assessed Clean Energy (C-PACE)
In 2015, Governor McAuliffe signed legislation modifying Virginia's statute to offer localities the option to implement Commercial Property Assessed Clean Energy programs, otherwise known at C-PACE.[37] C-PACE programs allow commercial property owners to finance energy efficiency and clean energy improvements through a special assessment that may have the same lien status as property taxes. C-PACE provides commercial property owners with a new financing tool to make building improvements that would lower the energy consumption.

Through a robust stakeholder process, the Virginia Department of Mines, Minerals and Energy developed uniform statewide financial underwriting guidelines for use by localities. In developing these guidelines, DMME elicited input from real estate, energy efficiency, banking, local governments, and other relevant interests and industries. Specific criteria were used in developing these guidelines; such as savings-to-investment ratio, loan-to-value ratio, assessment-assessed value ratio, technical assessment requirements, and disclosure to future owners.

On August 22, 2016 Virginia was selected by the U.S. Department of Energy to receive a **$500,000 competitive grant** to advance energy efficiency financing for private sector clean energy investments.[38] The Mid-Atlantic PACE Alliance (MAPA) aims to transform and standardize Property Assessed Clean Energy (PACE) markets in Virginia, Washington, DC, and Maryland. The project will develop and promote region-wide coordinated and consistent practices to streamline every component of local PACE programs to create a significantly larger PACE market for building owners, contractors, and lenders.

Partners include Abacus Property Solutions, Anne Arundel County, MD, Arlington County, City of Charlottesville, Clean Energy Solutions, Inc., District of Columbia Department of Energy & Environment, Maryland Clean Energy Center, Metropolitan Washington Council of Governments, Northern Virginia Regional Commission, PACE Financial Servicing, The Solar Foundation, Urban Ingenuity, and the Virginia Energy Efficiency Council.

Currently, there are localities in the preliminary stages of exploring the development of C-PACE ordinances. These localities include Arlington county, Charlottesville, and the cities of Richmond and Roanoke.

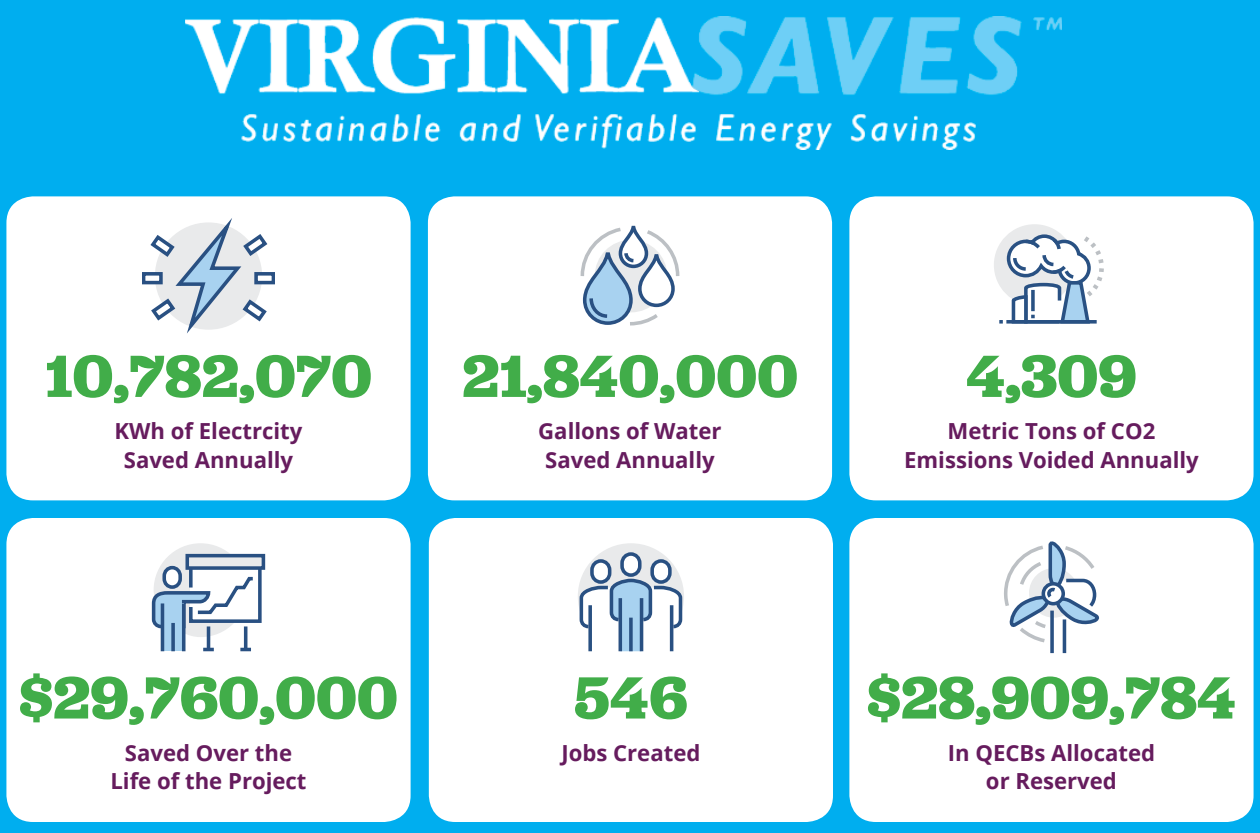
Green Community Program

In December 2014, Governor McAuliffe signed Executive Order 36 establishing the Commonwealth's **first statewide Green Community Program.**[39] The program is funded through the reauthorization of Qualified Energy Conservation Bonds (QECBs), which are federally-allocated interest rate subsidies intended to lower the costs of financing energy efficiency and clean energy projects in both the public and private sectors. QECBs were originally allocated to the state and qualifying localities in 2010, but only $3,715,194 of the total $80,600,000 was utilized prior to 2014. DMME hired a third party, CleanSource Capital and Abundant Power Group, to help develop and administer the Green Community Program, called VirginiaSAVES.[40] VirginiaSAVES, which stands for Sustainable and Verifiable Energy Savings, was officially launched on September 1, 2015.

In the thirteen months since the program's launch, approximately **$28.9 million** has been allocated or reserved. As of September 2016, there was at least **$65.9 million** in the project pipeline. It is likely that the state's entire QECB allocation will be exhausted by the end of 2017. In addition to the VirginiaSAVES program, an additional **$10.5 million** in QECBs was provided to the City of Norfolk's Green Community Program for use in the construction of Campostella Elementary School.[41]

HELPING VULNERABLE COMMUNITIES

In 2015, the Governor signed legislation that requires Virginia's investor-owned electric utilities to develop and implement innovative weatherization and assistance programs for Virginia's vulnerable communities. The purpose of the programs is to identify and fund new models for the provision of financial assistance to pay energy bills and install efficiency measures that reduce the electricity consumption of vulnerable communities. Both Appalachian Power and Dominion are implementing programs in their respective service territories.[42, 43]



Note: Estimated benefits

YEAR ONE BY THE NUMBERS

APPALACHAIN POWER AND DOMINION PILOT PROGRAMS

12,340

Customers Served

6,130

Multi-family Residences Served

840

Veterans Served

$57,000,000+

Committed Over 5 Years

Dominion developed a five-year pilot initiative that expands their existing EnergyShare program, which assists customers with energy bills and weatherizing homes. The new initiative expanded to include veterans, and added multi-family residences to its weatherization portfolio. Since September 1, 2015, this initiative has weatherized **7,000 residences, 6,100 of which were multi-family homes. Eight-hundred veterans and 1,000 people with disabilities** have been served.

"Each Phase I and II Utility shall conduct a pilot program for energy assistance and weatherization for low income, elderly, and disabled individuals in their respective service territories in the Commonwealth. Each pilot program shall be funded by the utility and shall commence September 1, 2015…"

— 2015 SENATE BILL 1349

Appalachian Power has developed a program to provide energy vouchers to veterans in its service territory, and conduct an energy efficiency pilot on a multi-family residence. The voucher program, called the **Veteran Energy Voucher Program,** provided **$500** vouchers to **40 veterans** to be used for new service connections. The program budget was **$100,000.** As of July 1, 2016, Appalachian Power provided grants of $19,500. The remaining money was rolled into the program for 2016-2017. The multi-family residential weatherization program focused on a five-building, thirty-unit complex. Appalachian Power replaced refrigerators, lighting, and heat pumps, among other improvements. The company has completed the improvements and will track energy usage to determine effectiveness.

Both utilities included an education and outreach component in their initiatives. This included mailers, organizing outreach events, and offers for free energy efficiency kits.

GOING GLOBAL WITH COAL AND ENERGY TECHNOLOGY (GGCET)

In his 2014 Energy Plan, Governor McAuliffe recommended developing a program focused on helping coal industry-dependent businesses diversify their client base by facilitating access to international markets. The Governor's commitment to building a new Virginia economy extends statewide and includes areas that have seen significant economic hardship, like the coalfields region of Virginia, known as Virginia's e-Region.

This commitment was displayed in August 2015 when the Governor announced an innovative partnership with the Virginia Coalfield Economic Development Authority (VCEDA) to sponsor e-Region coal and energy-related companies in the Virginia Leaders in Export Trade program (VALET).[44]

The Virginia Economic Development Partnership (VEDP) worked extensively with VCEDA to identify businesses that have traditionally been dependent on the Southwest Virginia coal industry, but needed assistance in accessing international markets to grow their business. As part of the partnership, VEDP provides the resources and infrastructure of the VALET program, while VCEDA provides individual grants of $15,000 to companies participating in the program. Thus far, VCEDA has provided grants to eight e-Region companies, all of which are currently enrolled in the VALET program.

This award-winning program assists companies throughout Virginia in expanding their international business. Each year, qualifying companies ramp up their global marketing efforts through this comprehensive, two-year business acceleration program. On average, companies experience a ***54% increase*** *in international sales during and immediately following the program.*

ENTREPRENEURSHIP AND INNOVATION IN THE ENERGY SECTOR

To further drive innovation in the clean energy sector in Virginia, the Governor established a business plan competition to encourage entrepreneurship and innovation in the energy and bioscience sectors.[45] The 2015 Virginia Velocity business plan competition awarded grants totaling **$850,000** to five companies.

Forty companies from around the country competed for these grants, going through an intense, multi-round judging process. The winning companies were required to sign performance contracts and agree to move their operations to Virginia. Two winners were named in the energy category, ConnectDER and Autonomous Marine Systems. The grants will be used to accelerate the commercialization of their products.

The 2016 Virginia Velocity competition is taking a different approach to encouraging entrepreneurs—the Virginia Velocity Tour. Throughout September of 2016, the Virginia Velocity Tour traveled the Commonwealth to spotlight the entrepreneurs building Virginia's 21st century economy.[46] It took place during one week and included tours, talks, and pitch competitions with over **$100,000** in prizes. At each stop, **5-8 finalists** participated in the day's events, based on the industry they work in. Over the course of each day, the finalists engaged with local businesses, networked with the region's civic and business leaders, and participated in a public pitch competition, where one finalist will won a **$25,000** equity-free grant prize. Each location had specific areas of focus.

- Roanoke/Blacksburg – STEM/Energy
  Winner: FluxTeq
- Richmond – Products/E-Commerce
  Winner: Hamilton Parking Collection
- Hampton Roads – Biotechnology/Health
  Winner: Adartis Animal Health
- Northern Virginia – Cybersecurity/GovTech
  Winner: Hilltop Security Inc.
- Charlottesville – Agriculture/Food
  Winner: Agrospheres, LLC

Virginia Spotlight

2015 VIRGINIA VELOCITY WINNER

ConnectDER LLC Energy Category, First Place $225,000. The ConnectDER is UL listed equipment that turns the electric power meter socket on a customer's home into a standardized inter-connection point for solar PV and other distributed energy resources (DERs).

ConnectDER provides a local asset manager at the home that cuts costs of using solar energy, thereby creating a win-win opportunity for the utility, PV installation contractors, and the solar customer.

Various military energy initiative awards on display during a solar signing ceremony at Naval Air Station Oceana

PHOTO CREDIT: U.S. NAVY PHOTO BY MASS COMMUNICATION SPECIALIST 2ND CLASS JUSTIN YARBOROUGH

Best In Class Infrastructure

As stated in the 2014 Energy Plan, a healthy economy needs reliable, resilient and cost-effective energy transmission and distribution infrastructure. This requires a combination of private sector investment and support, and responsible policies from the public sector. Governor McAuliffe has provided both support and policies and gives the private sector the certainty needed to make the necessary investments. The administration has supported the expansion and strengthening of Virginia's natural gas transmission infrastructure, and signed into law legislation that will help harden the Commonwealth's intrastate natural gas and electric assets. And, he has aggressively sought federal money to assist in increasing the resilience of communities most in danger from the effects of climate change. The foundation of these policies is grounded in the need to build the new Virginia economy. Increasing access to natural gas, especially in unserved areas, could lead to new economic development that diversifies the economy, while infrastructure hardening and resilience can provide existing businesses the opportunities they need to grow within their current community.

2014 VIRGINIA ENERGY PLAN RECOMMENDATIONS ACHIEVED:

- ✓ **Support policy to allow Virginia's natural gas utilities to more proactively approach expansion of intrastate infrastructure into unserved and under-served areas**
- ✓ **Support expansion of interstate natural gas pipeline infrastructure to increase capacity in currently restricted market areas, such as Central Virginia and Tidewater Virginia to improve the ability to attract new businesses and stimulate economic development in these regions**
- ✓ **Support nuclear energy generation, research, education and workforce development and recognize nuclear energy's important role in the Commonwealth's diverse electricity generation portfolio**
- ✓ **Create flexible financing mechanisms to help to put in place key additional energy assets and support priority energy programs**

INTERSTATE

Access to natural gas is critical to economic development in the Commonwealth. Governor McAuliffe supports the development of infrastructure that will increase access to affordable, reliable natural gas in all parts of Virginia. Not only does this supply provide a source of cleaner burning fuel for electricity generation, it also provides a vital source for industries such as manufacturing that provide good paying jobs. Economic developers often attract or lose important economic development prospects because of access, or lack thereof, to natural gas. Now, because of technological innovations in the gas and oil industry, the United States has become one of the world's largest producers of natural gas. However, the existing transmission infrastructure in Virginia does not provide adequate access to this abundant, affordable, domestic supply. One region that is directly impacted by this limited access is Hampton Roads. The current pipelines serving the region are not adequate to satisfy long-term incremental demand growth or potential new major industrial customers. The economic assets in the region make it well-positioned to see industrial growth, but must be able to provide the energy resources required to attract these industries.

There are a number of large-scale natural gas infrastructure projects underway in Virginia that have the potential to significantly increase the economic competitiveness of Virginia localities. Three projects are the Atlantic Coast pipeline,[47] the Mountain Valley pipeline,[48] and the WB Xpress.[49]

The Governor supports these projects because of the significant economic development and consumer savings potential. While the construction of these pipelines would provide over 14,000 jobs[50, 51] and $2.9 billion[52, 53] in capital investment, the increased access to cheap, domestic natural gas offers Virginia a potentially transformational tool for economic diversification and growth. It is estimated that the Atlantic Coast pipeline could provide consumers in Virginia with a net annual average energy cost savings of $243 million between 2019 and 2038. These energy cost reductions could support the creation of 1,300 permanent jobs in Virginia over this period.[54] The Mountain Valley pipeline has the potential to provide consumers with $3.6 million in annual savings from fuel switching in the six counties through which the pipeline would travel.[55] Both the Mountain Valley and Atlantic Coast pipelines would also provide significant state and local tax revenue during both construction and operation. Over $36 million in total tax revenue could be generated during construction, while annual tax revenue from both projects is estimated to be nearly $22 million during operation.[56, 57]

Each must receive approval from the Federal Energy Regulatory Commission (FERC) in order to be constructed. The Governor does not make the determination as to whether or not any of these pipelines are built. However, he is working to ensure that if they are built, the impact to Virginia's natural and historic resources is minimized and that they provide the most economic benefit to the state and localities possible. To do so, the Governor created a multi-agency mitigation team comprised of thirteen state agencies crossing four Cabinet Secretaries. This group meets monthly to update the administration on project activities such as impacts on state land, impacts to natural and historic resources, safety and security preparation, and permitting. The team works directly with the Secretaries of Natural Resources and Commerce and Trade to offer a comprehensive view of all of the activities involving these projects.

ATLANTIC COAST PIPELINE

The Atlantic Coast pipeline is a joint venture of Duke Energy, Dominion Resources, and Virginia Natural Gas. The proposed route will travel from Harrison County, West Virginia, through Virginia and end in Robeson County, North Carolina. The project also includes a smaller spur line that will start in Greensville County, Virginia, and end in the City of Chesapeake in Hampton Roads. The pipeline is projected to deliver **1.5 billion cubic feet (bcf) per day.**

MOUNTAIN VALLEY PIPELINE

The Mountain Valley pipeline is a joint venture between EQT Midstream Partners, NextEra US Gas Assets, Con Edison Gas Midstream LLC, WGL Midstream, Vega Midstream MVP, LLC, and RGC Midstream LLC. The proposed route will travel from Bradshaw, West Virginia, to Chatham, Virginia. The project is projected to deliver **2 bcf per day.** In October of 2015, the project announced a partnership with Roanoke Gas to expand access to natural gas in unserved communities in southwest Virginia.

WB XPRESS

The WB Xpress is a project proposed by Columbia Pipeline Group. The project will replace existing pipeline infrastructure, add additional compressor stations, and install two additional miles of pipeline. These activities will take place in both West Virginia and Northern Virginia. The enhancements will increase daily capacity for the existing system by **1.3 bcf.**

BEST IN CLASS INFRASTRUCTURE

INTRASTATE

NATURAL GAS LEGISLATION

In 2015, Governor McAuliffe signed into law a bill that makes it easier for natural gas companies to expand infrastructure to unserved communities. The bill, referred to as Making Access to gas Infrastructure Now or "MAIN",[58] increases the opportunity for consumers in unserved areas of Virginia to receive natural gas service by providing an alternative method for collecting the uneconomic portion of the costs associated with an expansion project, without affecting existing customers. Rather than requiring a burdensome upfront payment by the builder or developer, the uneconomic cost of the project may be recovered over time from the benefiting customers.

The MAIN legislation offers several advantages including: **(1)** it allows Virginia gas utilities to grow their systems to the benefit of all customers, and make natural gas service available to new customers who would not have such an option otherwise; **(2)** it allows builders and developers the opportunity to meet the demand for natural gas from home buyers and businesses, without incurring prohibitive costs; **(3)** it assists gas utilities in meeting Virginia's clean energy policy objectives by increasing the availability and delivery of reliable and adequate supplies of energy to customers at reasonable costs, and promoting the environmental benefits of increased use of clean burning natural gas; and **(4)** it ensures the continued growth and availability of affordable natural gas throughout Virginia.

Columbia Gas estimates that **the Program will add up to 3,000 new customers** over the first three years of implementation within its service territory.[59]

INFRASTRUCTURE RELIABILITY AND RESILIENCY LEGISLATION

Also in 2015, the Governor signed legislation that provided Investor-Owned Utilities the opportunity to make investments in distribution infrastructure reliability through a Rate Adjustment Clause.[60] The legislation allows a utility to seek recovery of costs that are not currently in rates to accelerate the vegetation management of the distribution rights-of-way. Appalachian Power conducted a three year pilot program that showed these types of measures will expedite significant distribution reliability improvements, particularly in mountainous areas of the state where there is a high density of forest.

During the 2016 General Assembly session the signed budget provided nearly **$2 million**[61] for the Commonwealth **Center for Recurrent Flooding Resiliency.**

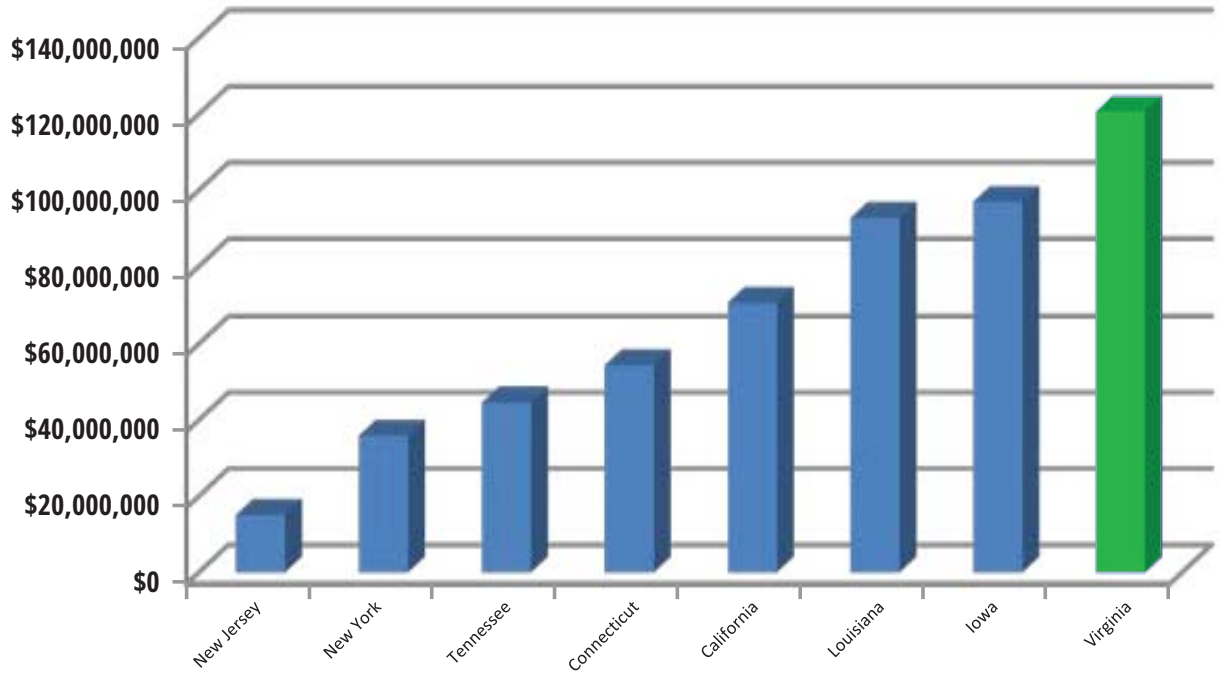
The Center is a joint effort of Old Dominion University, the Virginia Institute of Marine Science, and the College of William and Mary. The Center will conduct modeling, research and data analysis, and develop communications strategies that will aid Virginia's planners, emergency managers, businesses, and citizens.

The Governor also created the **Virginia Shoreline Resiliency Fund,**[62] which provides low interest loans to residences and small businesses for resilience-related improvements. While no funding was provided initially, the administration is seeking federal resources for seed funding until state appropriations are possible. Both the Center for Recurrent Flooding Resiliency and the Shoreline Resiliency fund were recommendations made by the Governor's Climate Change and Resiliency Commission.

HUD NATIONAL DISASTER RESILIENCY COMPETITION

In 2014, U.S. Housing and Urban Development announced the availability of nearly **$1 billion** in federal funds through the National Disaster Resiliency Competition (NDRC). The NDRC was established to assist states and localities with increasing the resiliency of critical assets, infrastructure and communities vulnerable to the impacts of climate change. Given that the Hampton Roads region is the second most vulnerable area in the country to the effects of sea-level rise, the Governor directed his administration to aggressively pursue these dollars. These efforts were rewarded as the Commonwealth, in partnership with the cities of Norfolk, Chesapeake, and Newport News, was awarded **$120.5 million to address climate change impacts in Hampton Roads.**[63] This was the most money received by any state applicant. These dollars will be used to: **(1)** support specific projects in area watersheds that are in need of comprehensive water management systems and **(2)** establish a coastal resiliency laboratory and accelerator to foster regional economic development and innovation in the fields of resiliency and coastal adaptation.

NDRC STATE AWARDS



Source: https://www.hudexchange.info/news/hud-awards-1-billion-through-national-disaster-resilience-competition/

NUCLEAR

Under the leadership of Governor McAuliffe and the Virginia Nuclear Energy Consortium Authority (VNECA or the Authority), an independent, non-profit organization was created to provide a single voice to the critically important nuclear industry in Virginia. This organization, the Virginia Nuclear Energy Consortium (VNEC or the Consortium) is privately funded by a variety of stakeholders with a significant presence and investment in the nuclear industry in the Commonwealth.[54] Currently, VNEC is comprised of eight founding members representing nuclear interests from the public sector, academia, and private industry. The Consortium is working closely with the Authority, the administration, and other state entities to raise the public profile of Virginia's nuclear industry and accomplish the goals laid out in the 2014 Energy Plan.

Since its launch, the Consortium has prioritized workforce development needs and has established relationships with the Workforce Commission and the Virginia Center for Energy Workforce Development. The Consortium also partnered with the Nuclear Energy Institute (NEI) to host the first Virginia Nuclear Energy Summit in Richmond in June 2016.[65]

FOUNDING MEMBERS OF THE VIRGINIA NUCLEAR ENERGY CONSORTIUM

Alternative Fuels and Advanced Vehicle Technology

Progress has been made both in expanding the use of alternative fuel vehicles in Virginia and in the installation of alternative fueling infrastructure across the Commonwealth. In the 2014 Energy Plan, the Governor established robust goals in both of these areas to diversify Virginia's transportation fuel mix, reduce greenhouse gas emissions, and save consumers and the public sector money. The transportation sector in Virginia accounts for more than 50% of Virginia's greenhouse gas emissions. Increasing the use of cleaner burning fuels and electric vehicles is an important way to improve the Commonwealth's air quality and combat climate change.

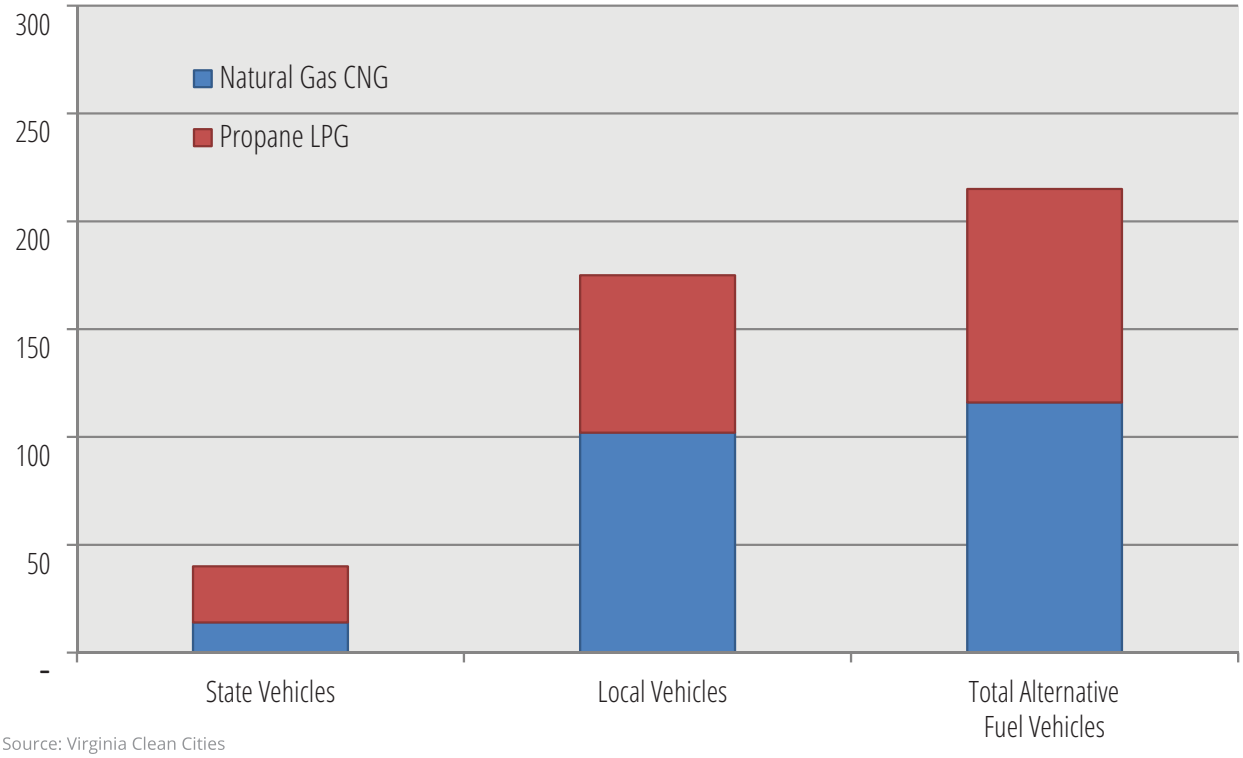
2014 VIRGINIA ENERGY PLAN RECOMMENDATIONS ACHIEVED:

- ✓ **Deploy at least 300 vehicles by the end of the Administration (on pace)**
- ✓ **Double of number of alternative fueling stations to 800 by 2018 (on pace)**
- ✓ **Create the Governor's Green Fleet Awards**
- ✓ **Support the continued use of Gas Gallon Equivalent for compressed natural gas**

VEHICLES

As recommended in the 2014 Plan, state funding support for vehicle purchase and conversion has largely come from federal Congestion Mitigation and Air Quality Improvement (CMAQ) funds. In 2015, the Governor expanded the scope of these funds to include use by localities located in air quality non-attainment areas of Virginia. Through 2020, **$9 million dollars in CMAQ funding** will be made available for state and local use to cover the incremental costs of purchasing or converting a vehicle to alternative fuels over a gasoline-powered vehicle. **$737,000** in CMAQ funds have been used to purchase or convert **97 school buses, sedans, refuse haulers, and utility vehicles.** An additional **68 alternative fuel vehicles** have been deployed in CMAQ areas but have not yet received CMAQ funding. Fleet conversion is also taking place in areas outside of the CMAQ localities. To date, there have been **50 public sector alternative fuel vehicles** purchased or converted in other parts of Virginia. This total of **215 public sector alternative fuel vehicles** purchased or converted since 2014 represents **72% of the Governor's overall goal** of 300 alternative fuel vehicles deployed by the end of the administration. The chart below shows the total number of public sector natural gas and propane vehicles in Virginia.[66]

GROWTH OF ALTERNATIVE FUEL VEHICLES IN THE PUBLIC SECTOR—2014 THROUGH 2016



Source: Virginia Clean Cities

The air quality impacts of CMAQ funded vehicle conversions and purchases are a key benefit. These conversions and purchases represent a **reduction in CO2 emissions of 227,464 pounds per year.**[67]

In the private sector there has been significant growth in the utilization of hybrid and fully electric vehicles in Virginia. These vehicles are more cost competitive with gasoline powered vehicles and additional fueling infrastructure continues to ease the range anxiety of interested consumers. Since 2014, electric vehicle usage in the Commonwealth has increased **36% to 32,215 hybrids and 303% to 3813 battery electric and plug-ins.**[68]

FUELING STATIONS

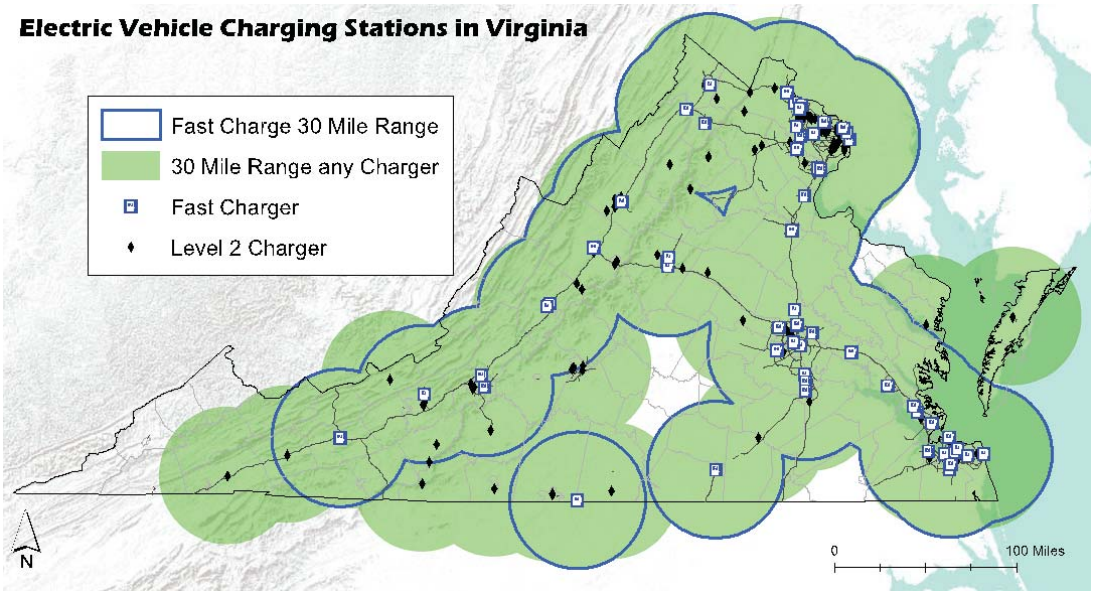
The Governor has also achieved success in the deployment of alternative fueling infrastructure. Across Virginia, as shown in Chart 8, there have been **271 alternative fueling stations installed**[69] since the beginning of 2014. The total additional stations represent **68% of the Governor's overall goal** of installing 400 new stations during his administration. Lead by Virginia Clean Cities in conjunction with DMME, Virginia has secured funding for **12 biofuel stations** from the U.S. Department of Agriculture and commitments for an additional **20 electric vehicle charging stations** from an automotive manufacturer.

Additionally, when the Virginia Energy Plan was released, there were no publicly available Direct Current (DC) fast charging stations outside of Northern Virginia. Since that time, **25 DC fast charging stations** have been installed in areas like Richmond, Charlottesville, Hampton Roads, Blacksburg, and Front Royal.

In 2015 Virginia Clean Cities partnered with Nissan North America, private businesses and local governments to install 25 DC Fast Chargers throughout Virginia.

These fast-charging stations allow electric vehicle (EV) drivers to recharge their vehicles in less than an hour. This public-private partnership created Virginia's largest fast-charging network for electric vehicles. This network connects Front Royal to Blacksburg along Interstate 81 and Staunton to Virginia Beach along Interstate 64. These fast-charging site hosts include shopping centers, entertainment districts, historic downtowns, local government parking lots, hotels and gas stations. VCC continues to play an active role in monitoring the usage of these stations and providing customer service to drivers.

In August of 2016, a publicly available charging station was unveiled at the Harry F. Byrd Visitor Center on Skyline Drive in Shenandoah National Park. The electric charging station is the first of its kind in a National Park in Virginia and provides electric cars owners a 240 volt, 30 amp charger that can be used while visiting the park.



Source: Virginia Clean Cities

GOVERNOR'S GREEN FLEET AWARDS

For the last two years, the Governor has partnered with Virginia Clean Cities on the Governor's Green Fleet Awards,[70] highlighting the important work being done throughout the Commonwealth to improve air quality, lower emissions, and lessen Virginia's dependence on foreign sources of oil.

THE 2016 CATEGORIES AND AWARD WINNERS ARE:

- **Governor's Petroleum Champion Award:** Dominion Resources. Dominion has over 1,500 on-road alternative fuel vehicles in their Virginia fleet. Most of these vehicles run on biofuel, but Dominion also utilizes electric, hybrid, and E85 vehicles. Dominion received this award because it has reduced its usage by nearly 450,000 gallons of petroleum in 2015.
- **Governor's Petroleum Reduction Leader Award:** TFC Recycling. TFC Recycling operates 32 CNG Refuse Trucks in its fleet. These refuse trucks reduced fuel usage by nearly 300,000 gallons of petroleum in 2015.
- **Governor's Greenhouse Gas Reduction Champion Award:** SuperValu. SuperValu operates 110 heavy duty biodiesel vehicles. In addition, it operates 63 CNG tractor trailers that avoid use of more than 1 million gallons of petroleum a year. Supervalu received this award because it reduced its emissions by over 1.5 million tons of greenhouse gases last year.
- **Governor's ZEV Leader of the Year Award:** City of Norfolk. The City of Norfolk has taken the lead on deploying public electric vehicle charging infrastructure with the City, serving as host to three stations in the 2015 DC Fast Charger Deployment Project.
- **Governor's Green Fleet of the Year Award:** City of Richmond. Utilizing the Commonwealth's CMAQ Program, Richmond has retired 22 diesel vehicles and replaced them with CNG vehicles. As part of the EPA-funded Virginia Emissions Reduction, Deployment, and Education (VERDE) Program, the City will re-power 12 heavy duty diesel trucks with CNG.

TFC Recycling Natural Gas Vehicle, and Propane-Powered Trucks and School Buses, at the 2016 Governor's Green Fleet Awards Rally at the Raceway

PHOTO CREDIT: VIRGINIA CLEAN CITIES

Workforce Development

A cornerstone of the Governor's economic development strategy is aligning the training and development of Virginia's current and future workforce with the skills needed by the private sector to be successful. When he came into office, the Governor wasted no time devising a plan that would ensure all workforce development resources that the state had are used to accomplish this goal. Often working in a bi-partisan manner, the administration has implemented policies that identify needs and create an effective structure to getting the workforce prepared to fill the positions and be ready to succeed on day one.

2014 ENERGY PLAN RECOMMENDATIONS ACHIEVED:

- ✓ **Collaborate with Higher education to train STEM workers in the energy sector**
- ✓ **Establish annual goals and identify opportunities to increase attainment rates of credentials**
- ✓ **Align workforce supply to employer demands by constructing career pathways and training solutions**

EXECUTIVE ORDER 23

In 2015, across all industry sectors, **more than 175,000 middle skills job openings** occurred in Virginia.[71] These technician and trades jobs generally require more education or training than a high school diploma but less than a bachelor's degree. Each of these types of jobs, on average, took 26 days for companies to fill. That nearly month-long gap stripped businesses of more than 36 million hours of productivity; families of more than $1 billion in wages; and Virginia's General Fund of an estimated $54 million in state income taxes.

To help close the skills gap for middle skills jobs, Governor McAuliffe issued Executive Order 23, which instructs Virginia's education and workforce development programs to increase STEM-H workforce credential attainment to more than 50,000 credentials a year by the end of his administration.[72] These STEM-H workforce credentials include industry recognized certifications, occupational licenses, apprenticeship credentials, and college career certificates and associate of applied science degrees that are aligned with high demand occupations and serve as an entrée to skilled jobs offering access to middle class wages.

In July 2015, STEM-H workforce credential attainment by Virginians had **increased by 9,400** over 2014 rates of attainment when EO23 was released. The Commonwealth is on track to achieve the Governor's goal as the recently ended year showed Virginia was less than 3,500 credentials from reaching the 50,000 threshold.

To better align education and training to the needs of business and the new Virginia economy, Governor McAuliffe has championed new initiatives and law, and increased budgets to drive skills development in Virginia's emerging and incumbent workforce and close the skills gap, particularly for middle skills jobs.

NEW ECONOMY WORKFORCE CREDENTIALS

In the 2016 General Assembly session, the Governor and General Assembly took decisive action to drive workforce credential attainment rates. Signed into law in March 2016, the New Economy Workforce Credentials Act is supported by nearly **$20 million** in the state biennial budget.[73] The new law and funding will help close the skills gap by making workforce credentials much more affordable. For example, where it once cost almost **$2,500** to earn a welding credential through non-credit training at a community college, it will now cost **less than $700.** This is the first statewide pay for performance workforce training program in the country. The new program will also improve student success, as colleges will only receive full payment of tuition from the state when and if a student completes a training program and obtains a certification. Companies can use the new program to encourage their employees to obtain incumbent workforce training. Companies can pay the 1/3 tuition that a student would normally pay, and the state will cover the remaining 2/3 of tuition due. For more information, go to http://www.vccs.edu/workforce/workforce-credential-grant.

FINANCIAL AID FOR NON-CREDIT TRAINING

To help those Virginians most in need of workforce training and least able to pay for it, the adminstration and Virginia's Community Colleges launched the state's first financial aid program in 2015 to support short-term, non-credit workforce training that leads to a high-demand credential. **$2 million a year** is now available to support this new form of financial aid available at all community colleges.

INCUMBENT WORKFORCE CREDENTIALING PROGRAM

Incumbent workers also need to develop their skills and earn high demand credentials to ensure that businesses thrive and grow. That is why, in April 2016, the Governor, the Virginia Board of Workforce Development, and Virginia's Community Colleges announced a new **$1 million** initiative to provide small businesses of up to 250 employees with training and credentials to upskill their employees.[74]

Early in the administration, and inspired by a National Governors Association grant to better align education and training to labor market and business needs, Virginia's workforce development system began a cross-program, cross-agency drive to ensure that all workforce development training and instruction aligns to high demand occupations and jobs providing access or pathways to middle class wages. Examples of activities that have been conducted to support this goal include supply and demand dashboards that show regional and state progress in meeting skills gaps in select industry sectors (in development) and in the Commonwealth's first official list of high demand occupations. This list is now a required reference for use of New Economy Credentials Act funds and other workforce resources.

GOVERNOR'S COMPETITION FOR TALENT SOLUTIONS

In 2015, the **Governor's Competition for Talent Solutions** offered up to **$200,000** in state funds for businesses to come together to collectively develop or expand business-designed workforce training programs for future or current employees.[75] To spur more public and private partnerships and increase funds available for talent development and training, the private sector provided a cash amount equal to the amount of state funds for which they applied. One of the winners was the Virginia, Maryland and Delaware Association of Electric Cooperatives. They received **$200,000** to create a new Power Line Technicians Academy at Southside Virginia Community College.

EXPANDING REGISTERED APPRENTICESHIPS

In October 2015, the Governor signed Executive Order 49 as a first step in doubling the number of registered apprenticeships in Virginia.[76] It is also intended to spur business interest in apprenticeships in industry sectors that have not traditionally employed apprentices.

The Executive Order initiated a new statewide program to provide fiscal support to companies sponsoring new apprenticeships in IT and cybersecurity, business or professional services and more. Companies of any size sponsoring new apprentices in these occupations can receive up to **$1,000 per year,** for each year that the registered apprentice is enrolled in related instruction, to apply towards education and training cost of the apprenticeship.

TALENT PIPELINE MANAGEMENT

In the last six months of 2015, Virginia participated in the US Chamber of Commerce Foundation's Talent Pipeline Initiative.[77] The Talent Pipeline Management "movement" calls for employers to take an expanded leadership role in closing the skills gap by leveraging lessons learned from supply chain management and applying those lessons to education and workforce partnerships.

Virginia's pilot initiative in Talent Pipeline Management focused on the IT and cybersecurity sector in Northern Virginia, but the training and practice that the Governor's workforce team gained in applying the Talent Pipeline Management model of Demand Planning, Talent Flow Analysis, and Implementation of Strategies could be put to good effect in any industry sector interested in launching business driven solutions to workforce challenges.

Virginia Spotlight

Southside Community College's Power Line Worker Training School is the first linemen training program in Virginia. The inaugural class of 11 trainees received certification in May 12, 2016. Nine of the eleven trainees have been placed into full employment.

- Number of Total Trainees: 60
- Estimated Job Placement Rate: 83%
- Talent Solution Grant Award: $200,000
- Private Sector equipment and supply donations: $1,000,000
- Private Sector Cash Match: $316,000

Targeted Certifications: OSHA Certifications, NCCER, Cardio-Pulmonary Resuscitation, Commercial Drivers' License

2000 KW AC ground mounted solar array installed at Philip Morris' Park 500 facility on Bermuda Hundred Road
PHOTO CREDIT: DOMINION VIRGINIA POWER

Clean Power Plan

In June of 2014, the U.S. Environmental Protection Agency ("EPA") proposed carbon dioxide emission standards for existing fossil fuel (coal and natural gas) fired power plants under §111d of the Clean Air Act ("Clean Power Plan" or "CPP").[78] EPA's original proposal looked at a state's entire electric generating system to determine the best system of carbon emissions reduction and calculated a separately tailored carbon reduction goal for each state. Under this approach, Virginia's goal was a reduction to 810 pounds of carbon emitted per megawatt hour by 2030. This represented a 38% reduction over Virginia's 2012 baseline.[79]

The Governor believed that the proposed rule disproportionately affected Virginia by, among other things, failing to recognize the work Virginia had done to reduce carbon emissions by 21% since 2005.[80] He worked with stakeholders across the Commonwealth to advocate for changes to the draft rule that would make it both more equitable for Virginia and more defensible to legal challenges. Because of these efforts, EPA's final rule is stronger and fairer for Virginia.[81] The final rule ensures equity amongst the states by imposing nationally consistent standards that are less vulnerable to legal challenge. The final rule also provides greater flexibility in implementation and pushes back the interim compliance date from 2020 to 2022. This would allow Virginia to continue to build up clean energy industries and deploy renewable generation in time to comply with the rule. Based on these changes, the Administration views the final rule as a way to further stimulate the clean energy economy and create opportunities for states like Virginia to generate economic growth.

500 KW AC on 70,000 square feet of roof area of the Canon facility in Gloucester, Virginia

PHOTO CREDIT: DOMINION VIRGINIA POWER

After the final rule was issued, the Governor tasked the Virginia Department of Environmental Quality ("DEQ") with engaging stakeholders to determine how compliance strategies should be formulated and how the Commonwealth would implement the rule. DEQ held an informal 60 day comment period beginning in August of 2015 and ending in October of 2015. DEQ also held a series of six listening sessions to obtain public input from citizens around the state. Finally, DEQ convened a technical stakeholder group, which met from November of 2015 through March of 2016. This group included representatives from the electric utilities, electric co-ops, manufacturing industry, independent power generators, local governments, clean energy businesses, coal industry, and environmental organizations.[82]

The CPP faced legal challenges, and on February 9, 2016, the United States Supreme Court voted to stay implementation of the rule.[83] The stay will remain in place until final disposition of the rule on its merits, either from a Supreme Court decision or a Court of Appeals decision if the Supreme Court decides not to hear the case.

However, even prior to the release of the CPP, the Governor was committed to finding ways to reduce Virginia's carbon emissions. That is why, despite the temporary stay on federal action, the Commonwealth is moving forward with exploring ways to reduce carbon emissions. In July 2016, the Governor issued Executive Order 57,[84] which directed the Secretary of Natural Resources to convene a workgroup to recommend concrete steps to reduce carbon pollution from Virginia's power plants under existing state authority. The working group will provide the Governor with recommendations for action by May 31, 2017. Regardless of the outcome of litigation involving the CPP, the Governor will work to identify a path toward further reducing Virginia's carbon emissions and shifting to greater utilization of clean energy to power the Commonwealth economy.

END NOTES

1. Preliminary data provided by Environmental Entrepreneurs from upcoming clean energy jobs report, http://www.e2.org/. Data provided September 26, 2016.
2. Virginia Economic Development Partnership.
3. The Solar Foundation, "National Solar Jobs Census", 2016. http://www.thesolarfoundation.org/national/ . Accessed August, 29 2016
4. Brown, Marilyn, et al, "State Profiles of Energy Efficiency Opportunities in the South. Energy Efficiency in the South." Appendix G, pg. 8. April 2010.
5. Virginia Department of Mines, Minerals, and Energy.
6. Virginia Department of Mines, Minerals, and Energy.
7. Virginia Department of Mines, minerals, and Energy, Division of Energy.
8. Virginia Department of Mines, minerals, and Energy, Division of Energy.
9. Chapter 398 of the 2015 Acts of Assembly in Virginia, http://lis.virginia.gov/cgi-bin/legp604.exe?151+sum+HB2267. March 29, 2015.
10. Chapter 599 of the 2015 Acts of Assembly in Virginia, http://lis.virginia.gov/cgi-bin/legp604.exe?151+sum+HB2237. Signed into law March 26, 2015.
11. Chapter 346 of the 2016 Acts of Assembly in Virginia, http://lis.virginia.gov/cgi-bin/legp604.exe?161+sum+HB1305. Signed into law March 11, 2016.
12. State Corporation Commission Final Order, case number PUE-2015-00104. June 30, 2016.
13. Dominion Press Release, https://www.dom.com/corporate/news/news-releases/137105. February 8, 2016.
14. Old Dominion Electric Cooperative Press Release, "ODEC Awards Solar Power Contracts totaling 30MW." http://www.odec.com/news/odec-awards-solar-power-contracts-totaling-30mw/. November 11, 2015.
15. Virginia Department of Mines, minerals, and Energy, Division of Energy.
16. Virginia Department of Environmental Quality, "Renewable Energy Projects Map." https://www.google.com/maps/d/viewer?mid=1XZyl-JGFb-2B9uAbuXCXfxUrb31k. Accessed September 10, 2016.
17. Chapter 431 of the 2015 Acts of Assembly in Virginia, http://lis.virginia.gov/cgi-bin/legp604.exe?151+sum+SB1395. Signed into law March 23, 2015.
18. Virginia Department of Mines, Minerals, and Energy, Division of Energy.
19. Community Energy Press Release, "Community Energy Announcement Dominion Energy, Inc. Acquires 80-Megawatt Amazon Solar Farm U.S. East." https://www.communityenergyinc.com/blog/community-energy-announces-dominion-energy-inc-acquires-80-megawatt-amazon-solar-farm-u-s-east/. November 15, 2015.
20. Governor McAuliffe Press Release, "Governor Announces Public-Private Partnership Among Commonwealth of Virginia, Microsoft, and Dominion for Affordable Solar Energy." https://governor.virginia.gov/newsroom/newsarticle?articleId=14609. March 16, 2016.
21. Governor McAuliffe Press Release, "Governor Announces Virginia's First Community Solar Project." https://governor.virginia.gov/newsroom/newsarticle?articleId=16574. August 29, 2016.
22. Council of Independent Colleges Virginia, http://my.solarroadmap.com/ahj/smp-icv/view. Accessed September 25, 2016.
23. Governor McAuliffe Press Release, "Governor Announces Actions to Stimulate Growth of Renewable Energy in the Commonwealth." https://governor.virginia.gov/newsroom/newsarticle?articleId=13729. December 21, 2015.
24. Clean Energy Development and Services (CEDS), https://maps.cise.jmu.edu/public/wind/CEDS-map/. Accessed September 10, 2016.
25. Governor McAuliffe press release, "Governor McAuliffe Announces Solar Project to Power Government Operations with Renewable Energy." https://governor.virginia.gov/newsroom/newsarticle?articleId=16120. August 2, 2016.
26. Solarize NoVA, http://solarizenova.org. Accessed September 25, 2016.
27. Virginia SUN, www.vasun.org. Accessed September 25, 2016.
28. Northern Virginia Regional Commission, "Solarize Map," www.novasolarmap.com. Accessed September 25, 2016.
29. Offshore Wind Port Readiness Evaluation, https://www.dmme.virginia.gov/DE/Offshore-WindPortEvaluation.shtml. Accessed September 10, 2016.

30. Governor McAuliffe press release, "Governor McAuliffe Announces Virginia Awarded First Wind Energy Research Lease." https://governor.virginia.gov/newsroom/newsarticle?articleId=8019. March 24, 2015.

31. Mayfield, Dave. Virginian Pilot, "Dominion loses $40 million federal grant for offshore wind project." http://pilotonline.com/news/local/environment/dominion-loses-million-federal-grant-for-virginia-offshore-wind-project/article_5e69e24a-bb41-57b3-b582-a411d12c352b.html. May 27, 2016.

32. Rocky Forge Wind Project, www.rockyforgewind.com. Accessed September 25, 2016.

33. Governor McAuliffe press release, "Governor McAuliffe Signs Executive Order on Reducing Energy Consumption in Virginia Government." https://governor.virginia.gov/newsroom/newsarticle?articleId=6872. October 16, 2016.

34. Virginia Department of Mines, minerals, and Energy, Division of Energy.

35. Virginia Department of Mines, minerals, and Energy, Division of Energy.

36. Virginia Department of Mines, minerals, and Energy, Division of Energy.

37. Chapter389 of the 2015 Acts of Assembly in Virginia, http://lis.virginia.gov/cgi-bin/legp604.exe?151+sum+HB1446. Signed into law March 29, 2015.

38. Virginia Department of Mines, Minerals, and Energy, Division of Energy.

39. Governor McAuliffe Press Release, "Governor McAuliffe Signs Executive Order 36, Creating Virginia's First Green Community Program." https://governor.virginia.gov/newsroom/newsarticle?articleId=7447. December 10, 2014.

40. VirginiaSAVES, http://www.vasavesgcp.com/. Accessed September 25, 2016.

41. Virginia Department of Mines, Minerals, and Energy, Division of Energy.

42. Dominion Virginia Power, "EnergyShare Annual Report." https://www.dom.com/energyshare-va. September 1, 2016.

43. Appalachian Power, "Report of Pilot Program." July 1, 2016.

44. Governor McAuliffe press release, "Governor McAuliffe Announces Partnership with Virginia Coalfield Economic Development Authority." https://governor.virginia.gov/newsroom/newsarticle?articleId=12333. August 7, 2015.

45. Governor McAuliffe Press Release, "Governor McAuliffe Announces the Commonwealth's First Business Plan Competition." https://governor.virginia.gov/newsroom/newsarticle?articleId=7392. December 5, 2014.

46. Virginia Velocity, http://www.virginiavelocity.org/. Accessed September 25, 2016.

47. Atlantic Coast Pipeline, https://www.dom.com/corporate/what-we-do/natural-gas/atlantic-coast-pipeline. Accessed September 25, 2016.

48. Mountain Valley Pipeline Project, https://www.mountainvalleypipeline.info/. Accessed September 25, 2016.

49. WBXPress Project, https://www.cpg.com/current-projects/wb-xpress-project. Accessed September 30, 2016.

50. Chmura Economics &Analytics, "The Economic Impact of the Atlantic Coast Pipeline in West Virginia, Virginia, and North Carolina," https://www.dom.com/library/domcom/pdfs/gas-transmission/atlantic-coast-pipeline/acp-chmura-report-091014.pdf?la=en. Page 18. September, 2014.

51. FTI Consulting, "Economic Benefits of the Mountain Valley Pipeline Project in Virginia," https://www.mountainvalleypipeline.info/~/media/sites/mvp/files/MVP-Virginia-Report-Oct-2-2015.pdf. Page 3. October 2, 2015.

52. Chmura Economics &Analytics, "The Economic Impact of the Atlantic Coast Pipeline in West Virginia, Virginia, and North Carolina," https://www.dom.com/library/domcom/pdfs/gas-transmission/atlantic-coast-pipeline/acp-chmura-report-091014.pdf?la=en. Page 4. September, 2014.

53. FTI Consulting, "Economic Benefits of the Mountain Valley Pipeline Project in Virginia," https://www.mountainvalleypipeline.info/~/media/sites/mvp/files/MVP-Virginia-Report-Oct-2-2015.pdf. Page 2. October 2, 2015.

54. ICF International, "The Economic Impacts of the Atlantic Coast Pipeline," https://www.dom.com/library/domcom/pdfs/gas-transmission/atlantic-coast-pipeline/acp-icf-study.pdf?la=en. Page 12. February 9, 2015.

55. FTI Consulting, "Economic Benefits of the Mountain Valley Pipeline Project in Virginia," https://www.mountainvalleypipeline.info/~/media/sites/mvp/files/MVP-Virginia-Report-Oct-2-2015.pdf. Page 4. October 2, 2015.

56. ICF International, "The Economic Impacts of the Atlantic Coast Pipeline," https://www.dom.com/library/domcom/pdfs/gas-transmission/atlantic-coast-pipeline/acp-icf-study.pdf?la=en. Page 12. February 9, 2015.

57. FTI Consulting, "Economic Benefits of the Mountain Valley Pipeline Project in Virginia," https://www.mountainvalleypipeline.info/~/media/sites/mvp/files/MVP-Virginia-Report-Oct-2-2015.pdf. Page 13. October 2, 2015.

58. Chapter 231 of the 2015 Acts of Assembly in Virginia, http://lis.virginia.gov/cgi-bin/legp604.exe?151+sum+HB1475. Signed into law March 29, 2015.

59. Columbia Gas of Virginia.

60. Chapter 37 of the 2015 Acts of Assembly in Virginia, http://lis.virginia.gov/cgi-bin/legp604.exe?151+sum+SB1334. Signed into law February 27, 2015.

61. Chapter 780 2016 Acts of Assembly in Virginia. http://lis.virginia.gov/cgi-bin/legp604.exe?161+sum+HB30. Signed into law July 1, 2016.

62. Chapter 762 of the 2016 Acts of Assembly in Virginia, http://lis.virginia.gov/cgi-bin/legp604.exe?161+sum+SB0282. Signed into law April 10, 2016.

63. Virginia's Resiliency Plan, http://www.dhcd.virginia.gov/index.php/virginias-resiliency-plan.html. Accessed September 25, 2016.

64. Virginia Nuclear Energy Consortium, http://www.virginianuclear.org/. Accessed September 25, 2016.

65. Nuclear Energy Institute, http://nei.org/News-Media/News/News-Archives/Summit-to-Spotlight-Virginia-s-Nuclear-Industry. Accessed September 25, 2016.

66. Virginia Clean Cities at James Madison University.

67. Virginia Clean Cities at James Madison University.

68. Virginia Clean Cities at James Madison University.

69. Virginia Clean Cities at James Madison University.

70. Third Annual Rally at the Raceway, http://www.vacleancities.org/news/third-annual-rally-at-the-raceway-update/. Accessed September 25, 2016.

71. Virginia Employment Commission.

72. Governor McAuliffe Press Release, "Governor Announces Significant Gains in STEM-H Workforce Credentials," https://governor.virginia.gov/newsroom/newsarticle?articleId=5787. August 13, 2016.

73. Governor McAuliffe Press Release, "Governor McAuliffe Signs First-in-the-Nation Pay-for-Performance Workforce Law," https://governor.virginia.gov/newsroom/newsarticle?articleId=14554. March 10, 2016.

74. Governor McAuliffe Press Release, "Governor McAuliffe Invests $1 Million to Assist Small Businesses in Training and Credentialing Incumbent Workers," https://governor.virginia.gov/newsroom/newsarticle?articleId=14899. April 12, 2016.

75. Virginia Employment Commission.

76. Governor McAuliffe Press Release, "Governor McAuliffe Signs Executive Order on Advancing Apprenticeships in Virginia," https://governor.virginia.gov/newsroom/newsarticle?articleId=12963. October 6, 2015.

77. Governor McAuliffe Press Release, "Virginia Selected by U.S. Chamber of Commerce Foundation and the USA Funds to Join National Network to Close the Workforce Skills Gap," https://governor.virginia.gov/newsroom/newsarticle?articleId=8379. May 8, 2015.

78. United States Environmental Protection Agency, 40 CFR Part 60, https://www.gpo.gov/fdsys/pkg/FR-2014-06-18/pdf/2014-13726.pdf. June 18, 2014.

79. Virginia Department of Environmental Quality, "Report: Implementation of Carbon Emission Guidelines for Existing Electric Power Generation Facilities," http://www.deq.virginia.gov/Portals/0/DEQ/LawsAndRegulations/GeneralAssemblyReports/GAReportCarbonEmissionGuidelines.pdf. December, 2015.

80. Governor McAuliffe Press Release, "Virginia Submits Comments on EPA's Clean Power Plan," https://governor.virginia.gov/newsroom/newsarticle?articleId=7263. November 14, 2014.

81. United States Environmental Protection Agency, 40 CFR Part 60, http://www.gpo.gov/fdsys/pkg/FR-2015-10-23/pdf/2015-22842.pdf. June 18, 2014.

82. Virginia Department of Environmental Quality, "Report: Final Activity Report – Stakeholder Group Concerning the Clean Power Plan for Greenhouse Gases," http://www.deq.virginia.gov/Portals/0/DEQ/Air/GHG/final%20report.pdf. April 18, 2016.

83. Lyle Denniston, "Carbon pollution controls put on hold," SCOTUS Blog. http://www.scotusblog.com/2016/02/carbon-pollution-controls-put-on-hold/. February 9, 2016.

84. Governor McAuliffe Press Release, "Governor Signs Executive Order to Reduce Carbon Emissions in Virginia," https://governor.virginia.gov/newsroom/newsarticle?articleId=15762. June 28, 2016.

Report numbers accurate as of printing.
Unless otherwise noted, all photos were taken by Michaele White and Pierre Courtois.