The 2018 Virginia Energy Plan

Comments by Virginia Advanced Energy Economy
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August 24, 2018

About Virginia Advanced Energy Economy

Virginia Advanced Energy Economy (Virginia AEE) is a coalition of businesses that seek to make the Commonwealth's energy more secure, clean, and affordable, bolstering Virginia's economy. Virginia AEE aims to drive the development of advanced energy by identifying growth opportunities, removing policy barriers, encouraging market-based policies, establishing partnerships, and serving as the voice of innovative companies in the advanced energy sector.

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Executive Summary

Advanced energy, which is comprised of renewable generation, energy efficiency, electric vehicles, battery storage, and other innovative technologies, is a vital part of the Commonwealth's economy. **Today this industry employs 97,700 people in Virginia**.[1] That is more people than are employed in grocery stores and supermarkets across the Commonwealth, and twice as many as are employed in hotels and motels.

Advanced energy employs a range of people with a wide variety of skill sets, from software designers and electrical engineers to construction workers and sales professionals. These jobs are spread throughout Virginia – from 1,990 in Roanoke to 4,600 in Virginia Beach, 3,580 in Chesterfield and 19,900 in Fairfax – and they are growing quickly. In 2018 alone we anticipate that the industry will grow 5%.

Advanced energy generates not only jobs, but also in-state investment. The development, construction, and operation of new wind and solar facilities, for instance, brings with it new wages, spending, and tax revenues for the state and localities. This portfolio of renewable projects also helps attract data centers and Fortune 500 companies. Investments in energy efficiency help residents, businesses, and state government save money, redeploying those resources to more productive ends. Meanwhile demand for new goods and services, such as electric vehicles, offshore wind, and battery storage, help to draw fast growing segments of the industry to our state.

Nationwide, the advanced energy industry is a significant part of the US economy. In 2016, the industry generated $200 billion in revenue, equal to pharmaceutical manufacturing and fast approaching wholesale consumer electronics.[2] Its growth outpaces the national GDP. In 2016, controlling for fluctuations in the ethanol market, the advanced energy industry grew at 5%, three times the rate of the US GDP. In short, not only is advanced energy already a vital part of the Commonwealth's economy, it is also a significant opportunity for economic growth and job creation.

With this opportunity in mind, we urge Governor Northam to craft a bold Virginia Energy Plan. Such a plan should advance the commitments in the Grid Transformation and Security Act, open our market and our grid to innovative, cost-effective resources, and make Virginia a leader in reliable, clean, and affordable advanced energy. These actions, taken together, will drive real job creation and economic growth in Virginia.

We are encouraged that the Northam Administration has conducted a robust stakeholder process to solicit input from a variety of stakeholder. Furthermore, we support the Administration's decision to focus this process upon five tracks – solar and wind resources, energy efficiency, electric vehicles and advanced transportation, storage, and offshore wind – all of which are important parts of the advanced energy economy. To that end, the comments that follow are structured around those tracks (although we've pulled offshore wind into a larger section on renewable energy).

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[1] Sources: Bureau of Labor Statics; AEE / BW Research Analysis of 2018 U.S. Energy & Employment dataset

. hj[2] Advanced Energy Now: 2017 Market Report. Navigant Research on behalf of AEE. 2017. https://info.aee.net/aen-2017-market-report

Section One – Renewable Energy – lays out a series of recommendations regarding how Virginia can grow its renewable resources, creating jobs, investment, and reliable, cost-effective, and sustainable generation. Today, advanced electricity generation employs 11,800 people in Virginia.[3] This is a good start, but falls short when compared with neighboring states. To spur growth in renewables, we recommend improvements to utility planning and procurement processes. We likewise present recommendations to open up the marketplace for distributed generation, like rooftop solar, allowing more Virginians access to these resources.

In Section One we also tackle the issue of corporate procurement. Virginia's utilities have made strides to expand access to renewables. But there is more than can be done, both through refinements to utility tariffs, and by improving market access for competitive suppliers, giving consumers better options and more competitive prices. To facilitate project siting, we recommend expanded financing for the Division of Natural Resources and reforms to the PBR process. Community solar in Virginia, an increasingly popular option for many consumers, falls short of national models. We recommend reforms to open this market to new suppliers and business models.

Offshore wind (OSW) shows promise for the Commonwealth, not only as a source of reliable, clean, and diversified generation, but also as a driver for new development in manufacturing and construction. Virginia has the potential to serve as a hub for the OSW industry on the Eastern seaboard. Our recommendations are geared towards supporting the Administration's ongoing actions to encourage this.

Section Two – Energy Efficiency (EE) and Demand Response (DR) – makes a set of recommendations aimed at improving the Commonwealth's energy conservation and productivity. Employing 76,600 people in Virginia today, EE and DR comprise the largest share of the advanced energy economy here. However the Commonwealth falls far short of its potential – and its own goals – when it comes to the deployment of these reliable, low cost resources. Our recommendations aim to change this by reforming how Virginia's utilities procure and utilize these resources. To facilitate that, we also make recommendations to improve regulatory processes that have, in the past, been obstacles to EE and DR deployment.

Access to energy usage data is critical to saving energy, developing new services, and improving productivity throughout Virginia. We have a set of recommendations in section two regarding how regulators, utilities, and other parties can facilitate data access and information sharing. Good data as vital to the public sector as it is to the private, which is why we recommend the completion and full-scale deployment of a dashboard to track energy usage in state facilities. With such a system in place, we recommend that the Administration pay particular attention to improving efficiency at Virginia's public colleges and universities, saving taxpayers money and improving facilities for students.

Section Three – Electric Vehicles (EV) – focuses upon the benefits of, and obstacles to, electrification of the transportation sector. Advanced vehicles already account for 4,700 jobs in the Commonwealth, with advanced fuels adding 1,900 on top of that. This sector is expected to grow rapidly as battery prices continue to fall and infrastructural hurdles are lowered. We put forward a set of recommendations to help tackle infrastructure

[3] Sources: Bureau of Labor Statics; AEE / BW Research Analysis of 2018 U.S. Energy & Employment dataset

issues – a key barrier to EV uptake – such as establishing good EV charging tariffs, building a widespread and accessible system of fast chargers, and facilitating the involvement of utilities in this space as appropriate.

Electrification of light-, medium- and heavy-duty transportation fleets, which includes a range of vehicles from municipal buses to drayage trucks at Virginia's ports, presents a number of opportunities, but some unique challenges as well. To overcome these we recommend that the Governor set a goal for conversion of the state fleet to EVs, establish a working group to focused on medium- and heavy-duty fleets, and use VW settlement dollars *solely* for electrification. Section three also includes recommendations to ensure that Virginia is fully equipped to embrace emerging technologies in the EV sector, which allow greater interaction between EVs and the grid.

Section Four – Battery Storage – puts forth a cluster of recommendations to guarantee that the Commonwealth takes full advantage of this transformational energy technology. The advanced grid and energy storage sector employs 2,700 people in Virginia today. This number should only grow, however, with a set of smart regulatory and legislative policies, such as better utility planning, "all-resource" procurement strategies, and time-variant rates to better reveal the value of storage on our grid. Not only can the growth of battery storage bolster the Commonwealth's economy, it can also facilitate the integration of more renewable resources, improve the reliability of the grid, and defray the need for costly capital investments.

A comprehensive, far-sighted, and ambitious Energy Plan, which fully embraces the economic, environmental, and health benefits of advanced energy, will make the Commonwealth a leader in this growing sector and create new, family sustaining jobs. We welcome Gov. Northam's leadership in this vital sector of our economy, and look forward to working with the Administration, lawmakers, and regulators as the 2018 Virginia Energy Plan is finalized and implemented in the months and years ahead.

Section 1 - Renewable Energy

Over the past two decades, renewable energy has grown dramatically in the United States. In 2001, renewables, including hydropower, comprised roughly 8% of US electricity generation, per the Energy Information Administration (EIA). By 2017, that had grown to over 17%, with wind and solar driving gains.

However, as the deployment of renewables has accelerated across much of the country, Virginia has lagged behind. Our Commonwealth has been lapped, not only by states like Arizona or Iowa, known for their abundant solar and wind resources, but also by our neighbors. North Carolina, for example, has over 4.4 gigawatts (GW) of solar generation deployed – almost seven times that of Virginia. Pennsylvania has over 1.3 GW of wind power while, to date, Virginia has none. These states have reaped the rewards of renewable projects such as new jobs; investment; tax revenue; and growing supply and support industries.

Renewable energy can be a significant source of jobs in the Commonwealth. To date, almost 12,000 Virginians are employed in advanced electricity generation. That's a good start, but it pales in comparison to the job numbers we see in other states, or the opportunities for job creation in the future.

According to recent analysis by the Solar Foundation if over the next seven years Virginia developed roughly 4,000 megawatts of solar capacity through a combination of distributed and large-scale systems, that activity would generate approximately 54,000 new jobs in state – five times the number we have today![4] Onshore and offshore wind show similar, if not greater, job creation potential. To encourage continued job gains and economic growth in Virginia, we recommend that Gov. Northam drive a bold renewable energy agenda.

Rec. 1-A: ***Ensure Virginia Utilities Establish a Clear Procurement Process for Renewable Generation***

The Grid Transformation and Security Act of 2018 (SB. 966) established an ambitious but achievable goal: the development of 5,500 megawatts of new wind and solar generation by 2023. Virginia's utilities must run a competitive procurement process to meet this target. But the details of that process are largely to be determined.

We urge the Northam Administration and regulators at the State Corporation Commission to establish clear expectations regarding the nature of that procurement process. Here are criteria it should meet to ensure that Virginia meets the 5,500 MW goal swiftly and cost-effectively:

- **Open:** A wide range of companies should be allowed to compete in each procurement round, ensuring robust competition that drives down costs and Virginia develops a diverse set of renewable energy resources.

- **Transparent:** The rules and parameters of the procurement process should be as clear and concise a possible - not arbitrary, burdensome, or overly

[4] Virginia Solar Jobs Census, The Solar Foundation.

proscriptive. As much as possible, the rationale for why projects are or are not selected should be made public to inform future participants.

- **Consistent:** The utilities should establish a predictable procurement schedule. Development of renewable resources can take years of planning. A consistent schedule allows companies to time their activities, knowing there will be a market for those resources at the end of their development process.

Only by adhering to these criteria will the targets established in SB. 966 lead to a robust renewable energy economy in Virginia.[5]

Rec. 1-B: ***Reform Virginia's Integrated Resource Planning Process***

Generation technology has evolved significantly in recent years, with scalable, cost-competitive renewable resources allowing for greater flexibility in terms of the type, size, and location of generation. One result of this is that consumers have more opportunities than ever to self-generate and manage their load through distributed energy resources (DERs).

Despite that, Virginia's utilities continue to rely heavily upon traditional generating units and transmission build-outs. For example, Dominion's 2018 IRP includes plans for 3.6 to 5.3 GW of new natural gas-fired generation over the next ten years.[6]

Virginia's Integrated Resource Planning (IRP) process is an important tool for utilities to develop and elucidate their long-term plans, and for a variety of interested parties to better comprehend and reshape those plans. However the current process suffers from a number of deficiencies. Here are a few:

- Interested parties are only able to formally engage in a utility's planning process *after* the utility has developed and filed their IRP with the SCC. This limits the scope of discussion around the IRP and may lead to a more contentious process than necessary.

- Resource price forecasts – key variables in the planning process –developed internally by a utility and their consultants have, in the past, had a a tendency to be higher than publicly available projections and market data. This can result in an unwarranted preference towards traditional generating resources.

- Traditionalism in utility planning, shaped in part by Virginia's regulatory climate, has led planners to prefer supply-side resources over those located on the customer's side of the meter, be that energy efficiency (EE), demand response (DR), DG, or storage. This can result in utilities overlooking cost-effective solutions to meet load-growth projections.

To address these shortcomings we recommend that *legislators, with the support of the Northam Administration, reform the IRP process as laid out in Virginia code*. This reform should include:

[5] For a specific example of what a clear, consistent procurement process can achieve, see Case Study 1 in the appendix.
[6] Dominion 2018 IRP, p.11-12.

- **Early & Ongoing Stakeholder Engagement** – Relevant stakeholders should be involved in the planning process *before* a utility IRP is finalized and filed with the SCC. This process should highlight major priorities, examine governing assumptions, and identify the range of technologies to be considered in the IRP.

- **Independent & Transparent Forecasting** – The resource price and load forecasts employed in the IRP should utilize up-to-date, publicly available, third party data. When possible, pricing data should be drawn from recent "all-source RFPs" (described below). This would provide an additional level of accuracy and salience.

- **Resource Neutrality** – To the maximum extent possible, planners should be required to employ a resource neutral approach in the IRP process. This would place supply- and demand-side resources, on a level playing field and help to ensure the IRP is as cost-effective as possible.[7]

To further ensure that utility IRPs are given the scrutiny they warrant, we also recommend that the Governor's budget for the Department of Mines, Minerals, and Energy (DMME) include *funding for at least one additional full time employee (FTE) to engage before the SCC regarding utility IRPs*.

Rec. 1-C: *Require "All-Source RFPs" to Address Identified Needs*

As noted above, Virginia utilities maintain a traditional approach to resource planning and procurement. As advanced energy resources, including both renewable generation and demand-side measures, have become all the more reliable, cost-effective, and nimble, these processes have not kept pace. This results in the continued procurement of conventional (often costly) generation resources and build-out of the bulk power system.

To ensure that the Commonwealth builds a diverse energy system with clean, cost-effective, and reliable resources, we recommend that *Virginia legislators, with the support of the Northam Administration, revise Virginia's statute governing Certificates of Public Convenience and Necessity.* Specifically, the revised statute should require that, prior to obtaining a CPCN, Virginia's IOU's must conduct "All-Source RFPs" to address the identified resource need. The All-Source RFP should be structured as follows:

1. The utility identifies a given resource need – for example the development of a large facility with a sizeable electricity load in a congested location.

2. The utility issues an RFP that describes the resource need in detail so that vendors can determine whether and how their services might provide a solution. Unlike a more conventional competitive solicitation, wherein the utility proscribes in advance the specific type of resource they are looking for (e.g. 100 MW of natural gas capacity), here the RFP should allow for respondents with a variety of different solutions.

[7] For a specific example of how Indiana has created a more open and collaborative IRP process, see Case Study 2 in the appendix.

3. Vendors submit bids that describe their technology, how it meets the resource need, the anticipated cost, and any additional information the utility may request.

4. The utility selects one or a combination of proposed solutions to address the resource need, subject to oversight and approval by state regulators. In the example above, the utility could get bids for distributed solar, utility-scale wind, storage, and demand response and choose demand response, targeted to that specific area, combined with additional wind resources that mirror the demand profile of the new facility.

We would likewise encourage legislators, in the reform recommended above, to require that the SCC open a docket to establish clear rules governing of such RFPs. The Commission to solicit input from a variety of advanced energy companies before finalizing this rule, to ensure that the "All-Source RFP" process is transparent and fully accessible to potential respondents.

"All-Source RFPs" have a variety of advantages. Responses provide the utility with up-to-date price information for a variety of resources, which can help to inform both short- and long-term decisions. Most importantly, by presenting the utility with a variety of solutions – both conventional and advanced – the "All-Source RFP" can help the utility transcend a tradition-bound decision-making culture, overly reliant upon known, but out-of-date and expensive, technologies.[8]

1.1. Distributed Generation & Net Metering

Over the past decade rooftop solar has proliferated across the United States, a result of dramatic decreases in the cost of photovoltaic (PV) generation, innovative financing and ownership structures, and consumer demand. Distributed generation (DG), of which "rooftop solar" is the most common variety, has gone from an academic concept to a practical, and increasingly cost-effective, option for many residents, business, and industries.

Neighboring states have witnessed significant DG growth in the past five years alone. Maryland, for instance, has seen the installation of over 650 MW of rooftop solar.[9] In New Jersey, over 1,000 MW has been installed at residential, commercial, and institutional locations.[10] By contrast, Virginia has seen less than 50 MW installed in the same timeframe. This is to our economic detriment, as the sale, installation, and maintenance of DG is a significant source of jobs. The primary obstacles to greater DG deployment in Virginia are our laws and regulations. Below are a series of recommendations to lower those obstacles:

Rec 1.1-A: *Improve the Regulations for Third Party PPAs*

Since 2013 Virginia has piloted the use of "Power Purchase Agreements" (PPAs) for third-party DG systems. Under such agreements, a consumer may enter into a contract with the third-party owner / operator of a DG system for generation and capacity. PPAs

[8] For a specific example of a limited all-source RFP conducted by Xcel in Colorado, see Case Study 3 in the appendix.
[9] Solar Spotlight – Maryland. SEIA, 2017.
[10] Solar Spotlight – New Jersey. SEIA, 2017.

are an excellent way to spur the growth DG and renewable generation in general. They provide access to this resource without requiring the upfront financing or technical expertise needed to build and operate a system. This pilot is a good first step, but reforms are needed to sustain and grow the market. Recommended reforms include:

- Increase the aggregate cap of 50 MW, currently in code, to 500 MW and study whether a cap is necessary at all. Since the start of 2018, capacity registered in the program has quadrupled, leading market participants to believe we will hit the cap by 2019.
- Raise the cap on individual, non-residential systems from 1 MW to 5 MW.
- Permit developers to enter into multiple, third-party PPA agreements for portions of load from a single facility, just as a building owner could lease different floors of the same building to different tenants.
- Expand the full pilot program to include the service territory of Appalachian Power Company (APCO), which currently has a pilot program restricted to non-profit institutions of higher education.

Rec. 1.1-B: ***Lift the System Cap for DG & Study Virginia's Generation System***

Currently, Virginia law only permits the deployment of DG connected to a utility's grid up to 1% of the system peak. This limitation is arbitrary and unnecessarily conservative. There is no evidence of which we are aware to suggest that moderate levels of DG penetration *exceeding* 1% create notable costs for the grid. Therefore we recommend that *legislators, with the support of the Administration, pass legislation lifting this cap*.

Policymakers need a holistic picture of Virginia's generation system before they can determine whether a cap on DG is appropriate and, if so, what that cap should be. Therefore we recommend that *the Northam Administration allocate funds to hire 2-3 additional FTEs in DMME*. These FTEs should have two primary responsibilities:

- Developing a clear and comprehensive picture of the Commonwealth's generation resources. This would entail gathering, and systematically updating, information regarding centralized and distributed generation resources, and housing that information at DMME. This process would likely take 18 months to two years at the outset to develop a holistic analysis.

- Drafting a report, to be updated periodically, regarding the benefits and impacts of DG on Virginia's grid. This report should study whether thresholds governing DG deployment should be established and, if so, at what level(s).

Rec. 1.1-C: ***Reform Compensation for DG Systems***

As the price of PV systems has fallen, the opportunity to reduce electricity costs through DG has become a significant driver of consumer demand. Most of these consumers remain connected to the grid, drawing off it at times and providing excess energy, from their DG systems, *to* it at others. The value of DG to the grid is calculated through a process referred to as "net metering." How "net metering" works varies from state to state, but it plays a critical role in determining the cost-effectiveness of DG systems.

Virginia scores a "C" when it comes to net metering, according to a recent report.[11] Generation from a DG system is credited to a customer's bill at the retail rate. At the end of 12 months, the customer may elect to rollover any excess, or get a payout at the avoided-cost rate. In addition, all non-residential DG users, and any residential user with a system over 10 kW in size, must pay a "standby" charge – i.e. a monthly fixed fee.

Upon completion of the DG report in Rec. 1.1-B above, we recommend that *Virginia launch a comprehensive and transparent process – led by DMME, with the input of the SCC, utilities, and relevant stakeholders – to reform "net metering" in Virginia.* The resulting compensation system should contain the following elements:

- **A "Value Stack" Approach** – DG can provide a wide variety of benefits, including - but not limited to - energy, capacity, ancillary services, and environmental attributes (i.e. RECs). It can likewise help defray the need for (and thus the cost of) new generation, transmission, and distribution. All of these benefits should be factored into (i.e. stacked together) the "net-metering" rate.

- **Adherence to Systems Analysis** – The benefits for which a DG system is credited should be based upon systems analysis to reflect the true value DG, located at a specific site, provides to the grid. A rooftop PV system in a congested urban center, for instance, probably helps to defray more costly T&D than one in a rural locale. The same analysis should be applied to any projected costs arising from the system. In other words, "standby costs" should be grounded in a site-specific systems analysis.

- **Grandfathering** – Although reform of Virginia's net-metering system should improve the economics for many consumers, those that already have a DG system should be allowed to remain in the current "net-metering" structure. Many DG owners make long-term (i.e. 20+ years) financial commitments when investing in a DG system, so an abrupt change could be highly disruptive.

- **Gradualism** – Changes to "net-metering" should be implemented over time and should be done in a stepwise manner, based upon thresholds established through technical processes. For example, if, after careful analysis, regulators and system planners determine that the benefits of DG to the grid begin to diminish after you reach 10% of peak load, and the costs escalate after 20%, then you should design a "net metering" system where compensation drops slightly for new DG systems installed after you reach 10%, then again after 15%, and further still after 20%.

For additional information about ways to reform "net metering," we recommend **Rate Design for a DER Future**[12] published by Advanced Energy Economy. The approach outlined therein (and described briefly above) played an important role in developing the compensation system for distributed energy resources with New York's REV process. It has been well received by a variety of utility and DG stakeholders.

[11] "*Freeing the Grid 2017" http://freeingthegrid.org/#state-grades/virginia*
[12] "Rate Design for a DER Future…" 21st Century Electricity System Issue Brief. Advanced Energy Economy. Jan 21, 2018 (updated).

1.2. Corporate Procurement

Recent years have seen staggering growth in advanced energy across the United States, to more than $200 billion in revenue, equal to pharmaceutical manufacturing, and approaching wholesale consumer electronics. A key driver of that growth has been demand from consumers large and small, drawn to the competitive economics, as well as environmental benefits. Whereas, in decades past, government policy, such as Renewable Portfolio Standards, *pushed* renewable energy onto the marketplace, today consumer demand is *pulling* those resources into the market. For instance, corporate purchasers have contracted for over 13 GW of new renewable energy since 2013 (as of August 2018), not counting onsite installations.[13]

Just as advanced energy is a win-win for these businesses, enabling them to access advanced energy is a win-win for Virginia. By expanding opportunities for large customers to access advanced energy, the Commonwealth can maintain its position as an attractive home for new or expanding businesses while also growing Virginia's strong but nascent advanced energy industry. There are a variety of ways to improve the market for large consumers. The recommendations below address some of these options, from improving utility renewable energy (RE) tariffs to expanding competitive supply options.

Rec 1.2-A: *Reform Utility RE Tariffs*

To date, utility RE tariffs in Virginia have seen limited uptake by large consumers. This stems in large measure from the structure and contents of specific tariffs. We will address those specific issues below. But, as Virginia utilities, regulators, and policymakers seek to improve these tariffs, they should have a goal in mind. While the energy needs to large consumers vary, there are a set of common elements that comprise an ideal RE tariff. We recommend future tariffs adhere to these elements:

- **Build a Portfolio** – In some states, including Virginia, RE tariffs have linked a specific load to a specific renewable resource, with the utility effectively serving as a pass through. While this works for some large consumers, we recommend that the utility build a portfolio of RE options. This allows the utility to shop for projects with the best economics, ensuring the tariff is as cost-competitive as possible. It also gives consumers an array of choices – they can choose to attribute their load to a specific resource, or spread it among several, as best serves their economic, environmental, and corporate goals.

- **Ensure Price Predictability, Competitiveness, and Transparency** – One of the most attractive features of renewable resources is their price predictability. To the maximum extent possible, a utility RE tariff should be reflective of this, with consistent, transparent pricing. Otherwise they expose consumers to the same price uncertainty and volatility as they currently face. Furthermore, programs should source projects competitively, allowing third-party participation, to ensure customers are paying a fair, market-based price.

[13] Business Renewables Center, *Corporate Renewable Deals* (Aug. 6, 2018), *available at* http://businessrenewables.org/corporate-transactions/.

- **Maximize Contract Flexibility** – In order to minimize the stranded asset risk that may arise from development of a renewable portfolio to serve the tariff, utilities prefer to lock large consumers into long-term contracts. Many consumers, by contrast, prefer medium terms (e.g., 10-15 years) to maximize flexibility while still benefitting from favorable economics. Other customers may be willing to pay a premium in exchange for even more flexibility (e.g., 2-3 year terms or even month-to-month). Tariff design should balance between these two competing needs. One option would be to allow large-consumers to shift load from meter-to-meter or even to another customer within the utility's service territory, ensuring the total load remains over the full life of the contract, but with greater flexibility.

- **Avoid Spillover** – Large consumers and utilities alike are committed to ensuring that voluntary purchases of RE, facilitated through a tariff, should not adversely impact other customers. There are a variety of strategies to address this potential risk. A 2017 paper by Advanced Energy Economy Institute outlines eight design principles to ensure that utility customers are protected from any impact due to voluntary customer purchases.[14]

For additional information about key design elements of utility RE tariffs, we recommend **Opportunities to Increase Corporate Access to Advanced Energy: A National Brief**, as commissioned by the Advanced Energy Economy Institute[15], **Essential Elements of Next-Generation Renewable Energy Tariffs,** by Advanced Energy Economy[16], and **Above and Beyond: Green Tariff Design for Traditional Utilities** by the World Resources Institute.[17]

As noted above, Virginia utilities have piloted a variety of RE tariffs to address demand from large customers. These tariffs have some positive elements, but design flaws and eligibility restrictions have limited uptake. For specific information on these tariffs, and how they can be reformed, we recommend **Customer Renewable Energy Options in Virginia**, a joint publication of Advanced Energy Economy and Virginia AEE.[18]

Dominion and Appalachian Power have also proposed a set of 100% RE tariffs. These proposals each have specific flaws that should be corrected. But even if those flaws are fixed, we do not recommend SCC approval. Were that to occur, it would preclude large customers from seeking 100% RE from competitive service providers (CSPs). This dynamic, discussed below, must be fixed before Virginia utilities are permitted to offer 100% RE tariffs. If not, the introduction of such tariffs could reduce customer choice and increase prices.

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[14] *See* Making Corporate Renewable Energy Purchasing Work for All Utility Customers, Advanced Energy Economy Institute (August 2017), available at https://info.aee.net/making-corporate-renewable-energy-purchasing-work-for-all-utility-customers.

[15] Opportunities to Increase Corporate Access to Advanced Energy: A National Brief. Meister Consultants Group on behalf of Advanced Energy Economy Institute. August 2016.

[16] Essential Elements of Next-Generation Renewable Energy Tariffs. Advanced Energy Economy. August 2017. Available at, https://info.aee.net/making-corporate-renewable-energy-purchasing-work-for-all-utility-customers.

[17] Above and Beyond: Green Tariff Design for Traditional Utilities. Letha Tawney, World Resources Institute. January 2014.

[18] Customer Renewable Energy Options in Virginia: A Guide For Policymakers, Regulators, and Commercial and Industrial Customers. Advanced Energy Economy and Virginia AEE. June 2018.

Rec. 1.2-B: *Increase Customer Access to CSPs*

Under Virginia's "hybrid" model, consumers have two pathways to access services from competitive service providers (CSPs). First, any customer, regardless of load size, may purchase 100% renewable generation from a CSP *provided* that their incumbent utility does *not* offer a 100% RE tariff. Second, a customer with at least 5 MW of load (either from a single site or aggregated) may enter into a contract with a CSP. To return to the service of their incumbent utility, however, this large customer must provide *five years* advance notice.

The result of these legal restrictions has been to limit CSP activity and customer uptake. The risk that a 100% RE tariff from a Virginia utility would block market access has limited the willingness of CSPs to offer 100% RE products in Virginia. Simultaneously, the substantial threshold and onerous notification requirements have discouraged large customers from entering into CSP contracts. To address these obstacles, we have three recommendations:

- **Eliminate the "Either-Or" Provision** – Legislators, with the support of the Northam Administration, should eliminate the provision in Virginia law that prevents CSPs from offering 100% RE options to customers if the utility has a 100% RE tariff in place.

- **Lower the Participation Threshold** - Legislators, with the support of the Northam Administration, should lower the threshold from 5 to 1 MW for customers to enter into CSP contracts for a variety of services.

- **Shrink the Advance Notification Requirement** – Virginia utilities shouldn't need five years to accommodate the re-entry of large-customers. We recommend that legislators, with the support of the Northam Administration, reduce this notification requirement from 5 years to 90 days, still the most stringent of states within the PJM regional transmission grid.

Ultimately, these reforms should lead more customers to consider CSP options, and for greater CSP engagement. This burgeoning competitive market should, in turn, create a virtuous cycle of greater customer participation, rising competition, falling prices, and more RE development.

1.3. Project Siting

Over the past decade, Virginia policymakers have made a concerted effort to facilitate the permitting of RE projects. The most notable result of this work has been "Permit by Rule" (PBR). PBR is a streamlined permitting process for wind, solar, and biomass based generation resources with a nameplate capacity less than 150 MW that are not rate-based. As of August 2018, 24 RE projects, totaling 750 MW of generation, had been permitted under PBR.[19] Nonetheless, developers report that the timeline for RE project approval under PBR has grown in recent years and become less predictable, increasing project costs. This is particularly problematic as the Commonwealth is slated to embark

[19] Permit by Rule (PBR) Process for Solar and Wind Projects in Virginia. Presentation by Beth E. Major for Williams Mullen. August 1, 2018.

on a period of accelerated RE development, a result of the Grid Transformation and modernization act.

The recommendations below are intended to help improve the speed of project review and approval, so that Virginia can meet its' renewable energy goals, creating new jobs and attracting additional investment in the process.

Rec. 1.3-A: ***Increase Funding for the Natural Resources Division***

During the 2017 campaign, Governor Northam pledged to increase funding for the Virginia's Natural Resources Division to 2% of the total state budget - more than tripling the resources currently devoted to the division. We urge the Governor to fulfill this campaign promise.

Staffs at DHR and DEQ are central to the review and approval of PBR applications. However they are overworked and under-resourced; their attention divided between a variety of energy projects. This has led to delays in the review of applications and, in some cases, repeated determinations that applications are incomplete, forcing project developers to revise and reapply.

Rec. 1.3-B: ***Review & Further Expedite the PBR Process***

The application delays referenced above are not only the result of under-staffing at permitting agencies. They also stem from ambiguities within the PBR process – some originating from the underlying statute, others from subsequent legal interpretations. To clear out this thicket of conflicting and ambiguous timelines, responsibilities, and standards, we recommend that DEQ convene a Stakeholder Working Group, comprised of developers, environmental officials, and other relevant stakeholders, to review the PBR process and suggest potential reforms. This working group should seek to ensure that, as it clarifies PBR, it hews to the original intent of the law, and does not create a longer or more onerous process.

Fundamentally wind and solar projects, if responsibly developed, should not have an adverse impact on the environment – indeed, they should to have a net positive impact on a regional and global basis. Recent research at the 550 MW Topaz Solar Farm Project in California indicates that, "after a short-term project construction disturbance period, vegetation within project fencing can return to native origins accompanied by the return of associated fauna."[20] This research, and observations at other RE facilities throughout the US, indicates that by following best practices, RE developers, owners, and operators can preserve, even enhance, the biodiversity of their project sites.

As much of the permitting that RE projects must receive revolves around environmental impacts, it seems reasonable that projects that go "above and beyond", creating a net positive environmental impact at the local level, should receive fast-track permitting. "Above and beyond" could take a variety of forms, from creating pollinator habitat, following "light-on-the-land" practices, or building on brownfield sites.

[20] Best Practices in Responsible Land Use for Improving Biodiversity at a Utility-Scale Solar Facility. Sinha et al. Case Studies in the Environment, 2018.

We therefore recommend that *the stakeholder working group proposed above should also determine (A) what practices create a net positive environmental impact at the local level and (B) what components of the PBR process could be further expedited to fast track projects that follow these practices*.

1.4. Community Solar

Community solar gives consumers the opportunity to invest in, and reap the rewards of, RE generation even if they don't have the capital, or physical wherewithal, to acquire DG. The national model for these projects is as follows: A for-profit or non-profit organization builds a solar facility. Members of the "community" (i.e. residents and business in the same service territory) buy "subscriptions", which represent a portion of the facility's output. Each month, these subscribers receive a credit on their utility bill equal to the kilowatt-hour production of their portion of the facility.

In 2017, the General Assembly passed legislation that allows Virginia's utilities to pilot "community solar". Under this law the utilities may contract for solar generation and sell it to subscribers.[21] In 2018, Central Virginia Electric Cooperative (CVEC) launched "Solar Share" connection with two new solar facilities – the first such program under the new law. In "Solar Share" CVEC customers can subscribe to 50 kWh blocks of power each month (up to 250 kWh) from these facilities. Each block replaces an equal amount of "brown" power CVEC would have purchased to meet that load. CVEC customers jumped on the program – over a quarter of the total available was signed-up in the first months.

CVECs efforts, and those of other Virginia utilities, demonstrate the appetite for shared solar. But these programs fall short of the national model for community solar by leaving the utility to decide how much can be developed, who can subscribe, and under what price and conditions. The recommendations below are intended to help move Virginia towards a more conventional model for community solar.

Rec. 1.4-A: *Make the pilot programs permanent*

Although the pilots fall short of model described above, they nonetheless represent progress in the right direction, helping to raise consumer awareness, catalyze a market, and provide access to RE for a range of small- and medium-size customers. We recommend *that policymakers, regulators, and the utilities move to make these pilots permanent, and expand them where possible*. This action will create greater certainty, a prerequisite for the benefits described above.

Rec 1.4-B: *Pass Legislation to Broaden the Range of "Community Solar" Options*

We recommend that *legislators, with the support of the Northam Administration, enact legislation to broaden the set of "community solar" options available to Virginia consumers*. Such legislation should have a number of important facets:

- It should require the SCC to open a docket to establish: (A) the value of generation to the utility from community solar; and (B) the value of customer bill credits from community solar facilities. These twin actions lay the economic

[21] Virginia "Community Solar" Plan leaves out the "Community" advocates say. Jim Pierbon, Energy News Network. March 16, 2018.

foundation for community solar, so it is vital a well-informed and unbiased authority administers them. (This work may be folded into a larger "net metering" reform process, as recommended earlier.)

- Legislation should require the SCC to establish the standards for participation by Virginia customers. To the fullest extent possible, the SCC should endeavor to ensure that a diverse set of customers, including those from historically disadvantaged and low-income communities, are able to participate.

- Finally, this legislation should explicitly permit third-party developers and providers to develop community solar projects and sell subscriptions to customers, for which said customers must receive credits on their monthly electricity bills.

For more information and model legislation regarding community solar, we recommend visiting **The Coalition for Community Solar Access**.[22] There you will find information on community solar and model legislation for both competitive energy markets and vertically integrated states.

1.5. Offshore Wind

Virginia is well-suited to be a hub for US offshore wind (OSW) development. Virginia's port facilities can swiftly serve costal locations from NJ to NC. Ready access to the Atlantic Ocean, little maritime congestion, exceptional infrastructure, and abundant space for dockside development makes these ports an attractive location for component assembly and construction. That's why the consulting firm BVG Associates concluded the appropriate upgrades could position Virginia's ports "to be the premier [OSW] manufacturing and construction staging hub for the US East Coast."[23]

In the past 6 months, Virginia has taken steps to catalyze this industry. The goal of building of 5,500 megawatts of new wind and solar generation, in Virginia, by 2023 – as laid down in the Grid Transformation and Security Act – sends a signal to the industry that Virginia's committed to such generation.

More immediate are two actions this summer. First, in July, DMME selected BVG Associates to help strengthen Virginia's position in attracting the offshore wind supply chain and service industry to the Commonwealth. Second, in early August, Dominion announced they would seek approval for an offshore wind demonstration project. These actions send clear signals to the industry that Virginia is committed to OSW development.

There is a distinct advantage to being an early-mover as the OSW industry develops in the US. Once those supply chains, which represent hundreds of millions in investment and thousands of well-paying manufacturing jobs, are in place, there's little a state can do to entice them to re-locate. The recommendations below are intended to help Virginia be an early-mover in OSW and reap these significant economic benefits.

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[22] www.communitysolaraccess.org

[23] BVG Associates, *Virginia Offshore Wind Port Readiness Evaluation, Report 3: High Impact Investment Opportunities* (June 2015).

Rec. 1.5-A: *Commit to Large-Scale OSW Development*

The demonstration project noted above is a good first step for Virginia, and Gov. Northam's vocal support for the project has been welcome. Unfortunately, this project alone will not spur the development of an OSW industry in the Commonwealth as states to our north are making large-scale investments. To do so, the industry needs to be confident that demand, both in Virginia and the region as a whole, is sufficient to warrant such an investment.

Therefore we urge Gov. Northam, members of the General Assembly, and Dominion, to publicly commit to move quickly from this pilot to competitively priced, full-scale development of the offshore lease area by the first half of the next decade.

There are a variety of ways in which policymakers can support utility-scale development. One course that the Governor could follow would be to prioritize renewable energy in general, and OSW in particular, in his Workforce Development Strategy. Virginia's labor force – especially within the military and civilian maritime community – already has many of the skills sought after by the OSW industry. That is particularly significant in light of the fact that 62% of employers say it is very difficult to find qualified candidates for advanced energy jobs.[24]

Rec. 1.5-B: *Swiftly Implement BVG Recommendations*

We applaud DMME's decision to hire BVG Associates to identify strategies to attract the OSW supply chain and service industry, especially given BVG's prior experience mapping out Virginia's port infrastructure to support OSW. We're glad that BVG will consult widely, as development of an OSW industry in the Commonwealth requires the coordinated engagement of many stakeholders.

The BVG analysis should be the beginning of a process to make Virginia a hub for OSW development. Completion of the analysis should be followed by prompt on the part of the Northam Administration and General Assembly to implement BVG's recommendations. In particular, they should carefully consider recommendations regarding (A) port infrastructure, to accommodate the OSW supply chain and staging activities, and (B) business incentives tailored to attracting components of the OSW supply chain, comparable to those used to attract other segments of the advanced energy industry.

Section 2 – Energy Efficiency & Demand Response

Energy efficiency (EE) and demand response (DR) offer some of the cleanest and most cost-effective ways to meet the energy needs of Virginians. These resources allow consumers, from families and small businesses to data centers and heavy industry, to save money and meet demand. Investment in EE and DR saves money, spurs in-state investment, and creates jobs. Today, 76,700 Virginians work in this sector.[25]

[24] Bureau of Labor Statics; AEE / BW Research Analysis of 2018 U.S. Energy & Employment dataset
[25] Ibid

Unfortunately, our Commonwealth is still wasting energy, costing consumers and taxpayers money. Repeated studies show significant potential for energy savings, but we are far from meeting that potential. In 2007, the Commonwealth set a goal of reducing energy consumption 10% levels by 2022. A decade later, the Commonwealth has achieved only 42% of those savings, according to recent DMME statistics.[26]

This inefficiency translates to higher bills for energy users across the Commonwealth, including working families. According to new data from the EIA, the typical Virginia household pays more on their monthly electricity bills than households in four out of five other states – even though we have relatively low retail rates.[27] This is money that consumers could use to pay for necessities, such as clothes, groceries, and education, or re-invest in Virginia's economy, creating new jobs and spurring economic growth.

Ultimately increasing energy productivity, through EE and DR, directly and indirectly creates jobs and stimulates the economy. Therefore we urge Gov. Northam to redouble Virginia's efforts and pursue an ambitious efficiency agenda, as outlined below.

Rec. 2-A: ***Reconstitute the GEC with a Clear Agenda***

The Grid Transformation and Security Act (SB. 966) contained several important provisions related to demand side management (DSM). These include reforms to cost / benefit analysis for DSM programs, authorization for the utilities to invest in technologies such smart meters that can enhance DSM, a commitment by the utilities to spend over $1 billion on DSM programs in the next ten years, and a stakeholder process to inform utility DSM portfolios. In short this new law has the potential to radically reshape EE and DR in Virginia, accelerating our energy productivity.

In order to ensure the Act meets its potential, we recommend that, *by Executive Order, Gov. Northam reconstitute the Governor's Executive Committee (GEC) on Energy Efficiency with the authority to track, and report back to the Governor, regarding the following items*:

- **Monitor Cost / Benefit Reform** – SB. 966 made needed reforms to the cost-benefit analysis undertaken by the SCC. Under the revised statute, EE measures can no longer be rejected for failing one test (often the Ratepayer Impact Measure). The intent was to ensure that the SCC approved a broader array of utility DSM measures. The GEC should monitor the cost-benefit analyses conducted by the SCC to ensure this intent is effectively followed.

- **Maximize Utility DSM Portfolios** – SB. 966 establishes a stakeholder process, administered by an independent facilitator the SCC hired, to provide input regarding the development of DSM programs by the utilities. The scope and duration of this stakeholder group is not defined by the legislation. Interactions with SCC staff indicate they may take a conservative view regarding this scope and duration. So the GEC should be empowered make recommendations regarding how the utilities may maximize their cost-effective EE portfolios.

[26] [Presentation] Virginia Energy Plan: Energy Efficiency Subcommittee,. July 18, 2018.
[27] The Highs and Lows of American Electricity. Bullard, N. & Regan, C. Bloomberg. April 28, 2018.

- **Identify Grid Mod / DSM Best Practices** – SB. 966 also permitted the utilities to make a set of "grid transformation" investments. These investments, such as smart meters, have the opportunity to create new EE and DR opportunities and amplify existing DSM programs. The GEC should be tasked with identifying best practices to ensure grid modernization investments enhance Virginia's energy productivity, increasing efficiency and lowering electric bills.

Rec. 2-B: ***Adopt Best Practices for Cost Benefit Testing***

When it comes to EE, a particular shortcoming of Virginia is its utility programs. Here, the Commonwealth scores zero out of 20 points per the American Council for an Energy Efficient Economy (ACEEE).[28] There are a variety of reasons for this, from the absence of a binding EERS to underinvestment in DSM programs by state utilities.

A consistent cause, though, has been the rejection of proposed DSM programs by the SCC. Repeated rejections are part of why Virginia utilities now pursue more limited DSM portfolios than their peers. The lengthy list of programs "Rejected and Not Currently Under Consideration" in Dominion's 2018 IRP (25 in total) provides ample evidence.[29]

A key reason for the rejection of these proposals has been the SCC's cost-benefit analysis. Regulators use four of the five standard tests: Total Resource Cost (TRC), Utility Cost (UCT), Participant Cost (PCT) and the Ratepayer Impact Measure (RIM).[30] Failure to pass even one of these tests– chiefly the RIM, which fails to fully capture many DSM benefits – has, in years past led, to the rejection of many DSM proposals.

SB. 966 sought to address this issue by mandating that regulators cannot reject a DSM proposal for failing just one cost-benefit test. It remains to be seen whether this reform will lead to the approval of more DSM proposals. However, even if regulators do fully implement this reform, *how* cost-benefit tests are structured and conducted by the SCC will still determine whether utility DSM programs grow.

Therefore we have three specific recommendations regarding how SCC conducts the cost-benefit testing of DSM proposals:

- **Adopt NSPM Guidance** – The National Standard Practice Manual (NSPM) is a consensus-based document designed to provide state regulators with guidance to capably administer cost-benefit testing.[31] It was developed with the input of utilities, regulators, the US DOE and EPA, EE implementers, and other groups. At its core is the "Resource Value Framework" – a methodology by which regulators can develop a holistic cost-effectiveness test (the Resource Value Test) that both ensures customers safe, reliable, and low-cost energy while meeting the state's other policy goals and objectives. It also provides regulators with guidance regarding how to ensure transparency, capture hard-to-quantify benefits and costs, and handle rate versus bill impacts. Following the guidance in

[28] The 2017 State Energy Efficiency Scorecard. Berg et al. ACEEE. September 2017.
[29] Dominion 2018 IRP, p. 45.
[30] ACEEE State Efficiency Database: Virginia. Updated July 2018. Database.aceee.org/state/virginia
[31] National Standard Practice Manual for Assessing Cost-Effectiveness of Energy Efficiency Resources. Woolf et al. for the National Efficiency Screening Project. May 18, 2017.

the NSPM should ensure that EE regulations in Virginia are, transparent, predictable and balanced.

- **Ensure Cost-Benefit Testing is Transparent** – Transparency is essential in cost-benefits testing. It ensures both that regulators are consistent in the evaluation of programs and that utilities know how a DSM proposal is evaluated – allowing them to better design programs. The NSPM has in-depth guidance regarding how to ensure transparency. In addition to that guidance, we recommend that *legislators, with the support of the Northam Administration, enact reforms to ensure that all inputs, calculations, and analyses done by SCC staff in the testing process be subject to freedom of information standards*.

- **Assess EE at the Portfolio Level** – Currently, regulators evaluate DSM proposals in Virginia at the program level. Each individual program must, on its own, be deemed cost-effective. By culling programs that don't score well, this approach can, perversely, lower the overall net economic benefit of the portfolio.[32] It can do so by cutting a program that entices customers to sign-up for a larger suite of EE investments, removing an avenue for the utility to build a relationship with the customer, or eliminating an investment necessary for other EE measures. Therefore we recommend that regulators evaluate the cost-effectiveness of utility DSM proposals on a portfolio level.

To further assist regulators with these recommendations, and monitor implementation, we also recommend that the Governor support funding for at least *one full time employee (FTE) at DMME to track and engage around utility DSM filings before the SCC*. This FTE may also be the same DMME employee engaged in the IRP process.

Rec. 2-C: *Improve Utility Incentives to Invest in DSM*

The poor performance of Virginia's utility EE programs also stems from the utility's business model. The profitability of Virginia electric utilities is coupled to their sales and capital investments – the more power they sell, and the more they must invest in Virginia's grid to serve their load, the more they profit. This discourages them from investing in DSM programs.

Policymakers have attempted to address this disincentive by establishing a lost-revenue adjustment mechanism (LRAM) in Virginia law.[33] Under the LRAM, utilities may apply for the recovery of revenues reductions related to EE programs. But, to date, Virginia utilities have not successfully employed the LRAM to recover lost revenues. Anecdotal evidence indicates that when they have attempted to do so, regulators informed them that it had not met the burden of proof necessary to demonstrate that the reduction in energy consumption was due to EE.

If Virginia utilities cannot count on the LRAM to recover lost revenues, they are less likely to invest in DSM programs that may reduce those revenues. That said the SCC shouldn't be obligated to simply trust the utilities claims of lost revenue, potentially to the

[32] National Standard Practice Manual for Assessing Cost-Effectiveness of Energy Efficiency Resources. Woolf et al. for the National Efficiency Screening Project. May 18, 2017. p. 86.

[33] ACEEE State Efficiency Database: Virginia. Updated July 2018. Database.aceee.org/state/Virginia

detriment of consumers. To address this dilemma, we recommend that *SCC regulators establish an independent evaluation, monitoring, and verification (EM&V) process for utility DSM programs.* Under this process, each IOU would be required to hire an independent EM&V contractor to oversee the process. These contractors would measure the energy savings of utility DSM programs, providing credible analysis to support LRAM requests. Arkansas has implemented an independent EM&V process closely resembling this.[34]

In the medium-term (i.e. 3-5 years) we may also recommend that the *SCC move the DSM filing process from an annual to a triennial schedule* so it can align rate adjustments proceedings. This will allow lost-revenue filings to be factored into larger deliberations around rates, facilitating a more holistic decision-making process.

In the long-term, however, we would advise moving away from LRAMs altogether. LRAMs are an ad hoc solution to a fundamental problem: regulated, vertically integrated utilities, like Virginia's IOU's, are incentivized to make certain investments (i.e. large capital projects) and not others (e.g. EE, DR, and DG). Today, utilities have a greater range of options to serve customers. The regulatory framework should be structured to encourage innovation and deployment of this full suite of options.

Thus, we recommend that the *SCC open a docket to consider alternative models to utility regulation, such as decoupling or "Performance Based Ratemaking"*. This reform would encourage Virginia's utilities to consider a wide range of potential resources without concern that such investments could erode their profitability.

2.1. Achieving Virginia's 10% Energy Conservation Goal

So far the Commonwealth has fallen short of the 10% energy conservation goal set in 2007. It is nonetheless a worthwhile goal. A recent study by the Electric Power Research Institute (EPRI) determined that over a 13-year period - in this case between 2017 and 2030 – implementation of all "economic" EE could reduce energy consumption across all sectors by 17.4%.[35] Even after considering that what is "achievable" may be more conservative – due to practical constraints – than what's "economic", this analysis tells us that a 10% reduction in energy consumption is entirely within reach.

In our view, the most viable path to greater energy conservation, in the short-term, runs through Virginia's utilities. They possess both the data and the customer relationships to effectively deploy EE and DR programs across a wide swath of consumers. The commitment by these utilities, in SB. 966, to spend over $1B in the next 10 years towards DSM, is a notable step in the right direction and represents a significant increase over years past.

Increased spending alone may not guarantee that Virginia achieves its' full conversation potential, however. Thus, the recommendations below, akin to those immediately above, are aimed at spurring the utility to fully and effectively deploy all of its resources, both data and dollars, to maximize conservation.

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[34] ACEEE State Efficiency Database: Arkansas. Updated July 2018. Database.aceee.org/state/Arkansas

[35] State Level Energy Efficiency Potential Estimates. Holmes, C. & Mullen-Trento, S. EPRI. May 2017. p. 41.

Rec. 2.1-A: *Ensure EE is Fully Incorporated into the IRP Process*

As was noted in recommendation 1-B above, the integrated resource plans (IRPs) produced by Virginia utilities tend to lean heavily upon traditional resources at the expense of cost-effective advanced energy solutions. This is as true for demand side resources, such as EE and DR, as it is for RE resources.

Dominion's 2018 IRP illustrates this point. By 2033, the company projects that its DSM programs will be capable of reducing annual customer energy usage by 805 GWh.[36] That sounds significant until you consider that the aforementioned potential study indicates that Virginia's residential sector *alone* could reduce annual energy consumption by 10,000 GWh.[37] Even when we consider that Dominion covers only a share of Virginia's residents, that's still a portion of potential EE savings.

To address this disparity we recommend that Virginia legislators, with the support of the Northam Administration, *reform the Commonwealth's IRP statute to require that the IOU's providing funding for an independent, consultant, whose responsibility it shall be to determine each utility's achievable EE potential.* This analysis should be conducted from the ground-up, using program-specific, distribution level modeling to maximize its accuracy. It should be completed prior to the filing of each utility's triennial IRP and shared with the utility, regulators, policymakers, and the public. Finally it should serve as a baseline against which the utility's proposed DSM program is evaluated.

Rec. 2.1-B: *Require "All-Source RFPs" to Address Identified Needs*

Demand-side resources can increasingly serve as substitutes for generation. EE, for instance, can help to broadly defray the need for new generation, such as base-load power supplied by coal or nuclear. DR, by contrast, can serve to address acute, time-specific needs, serving as an alternative, or compliment, to peakers and battery storage.

Because EE and DR are effective substitutes, they too should be considered to meet identified resource needs. Therefore, we again *recommend that Virginia legislators, with the support of the Northam Administration, revise Virginia's CPCN statue to require "All-Source RFPs".* This open RFP process can help Virginia to build a diverse, reliable, and cost-effective energy system by improving transparency, providing planners with up-to-date pricing, and helping to overcome an overly traditionalist decision-making culture within the utility.[38]

Rec. 2.1-C: *Ensure Effective Access to Useful Data*

Deploying EE and DR effectively requires access to data. Consumers must know how much energy they use, where, and when in order to benchmark their savings, make sound investments, and improve their behavior.

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[36] Dominion 2018 IRP. p. 4.
[37] State Level Energy Efficiency Potential Estimates. Holmes, C. & Mullen-Trento, S. EPRI. May 2017. p. 43.
[38] For a specific example of how demand-side resources can meet an identified resource need, consider the NYC BQDM program highlighted in Case Study 4 in the appendix.

Access to data can also be a source of significant value to third parties, such as innovators designing new EE hardware and software, energy service performance contractors (ESPCs), and DER providers. Using aggregated data and advanced analysis innovative companies can discover effective interventions and test groundbreaking products. With home and building data, ESPCs can market products and services that fit the unique needs to consumers. Employing anonymized, grid-level data, DER providers can identify the best locations for future deployments. All of these activities offer the potential for new economic growth and job creation in the Commonwealth.

Unfortunately Virginia does not have policies in place governing the release of energy usage data to consumers or third parties.[39] Some utilities have made data available to specific customers through online platforms and services like "Green Button." But many customers, especially those operating multi-unit buildings, face significant hurdles to access. For third parties the hurdles are often insurmountable.

Therefore we recommend that the *SCC open a docket to establish clear regulations governing data access*. Staff from DMME, the utilities, third-party service providers, consumer advocates, and other interested stakeholders should be engaged in these deliberations. The resulting regulations should contain the following elements:

- **Universal interface standards** to ensure that data can be readily shared with, and employed by, consumers and authorized third parties.
- **Streamlined authorization processes** allowing consumers to easily authorize the sharing of their data with third party service providers.
- **Strong security protocols** to ensure customer privacy and protect system data from unauthorized access and use.
- **Incentives for the utilities** to increase customer awareness of access to data and the ways in which data can be harnessed to save energy.
- **Pathways for access** to anonymized, grid-level data to help third party providers identify where their products and services are most valuable.

On August 9th, 2018, Dominion filed for approval of the first phase of their grid transformation plan.[40] The proposal contains $314 million for the installation of approximately 1.4 million smart meters over the next four years, out of a target 2.1 million over the next 10 years. It also has $7.2 million for a customer information platform – a figure that should grow to $185 million over 10 years.

These investments *should* increase the quantity and granularity of customer data, as well as the ability of individual customers to access their data. Evidence suggests that in order to generate new savings that data needs to be translated into understandable, actionable insights, either by the utility or outside service providers. Customers also

[39] ACEEE State Efficiency Database: Virginia. Updated July 2018. Database.aceee.org/state/Virginia
[40] Virginia Electric Power Company – For Approval Of A Plan for Electric Distribution Grid Transformation Projects Pursuant to § 56.585.1 A 6 Of The Code of Virginia. PUR-2018-00100. August 9, 2018.

need the ability to share that data with third parties, who can harness it to deliver tailored energy solutions. Thus, we also recommend that the **SCC** *make approval of grid transformation plans contingent upon two, data-related stipulations:*

1. That the utility agrees to key regulations, as described above, regarding customer access to data. In particular universal interface standards, streamlined authorization processes, and pathways for access to data are essential.

2. That, in testimony and materials presented in the grid transformation docket, the utility lays out a clear business plan to fully realize the customer benefits of advanced metering infrastructure.

For additional information regarding data access and information sharing, we recommend **Access to Data: Bringing the Electricity Grid into the Information Age** by AEE[41] and the **Energy Usage Data Access Toolkit** by ACEEE.

Rec. 2.1-D: Establish a CHP / WHP Working Group to Encourage Utilization

Combined heat and power (CHP) and waste heat to power (WHP) are important efficiency resources. By generating both heat and electricity from a single fuel source, CHP lowers emissions and increases overall fuel efficiency – allowing utilities and companies to effectively "get more with less." WHP, which uses waste heat as its energy source to generate electricity and requires no additional fuel and generates no incremental emissions, provides significant benefits as well. Using CHP and WHP, Virginia's large energy and thermal consumers, such as manufacturing facilities and universities, can significantly improve their efficiency and help the state achieve its 10% conservation target.

To ensure Virginia is utilizing these resources to the fullest extent possible, we recommend that *DMME convene a CHP / WHP Stakeholder Working Group*. This group should include, at a minimum, representatives of the U.S. Department of Energy Mid-Atlantic CHP Technical Assistance Partnership (CHP TAP), Virginia's electric and gas utilities, and end users. This working group, supported by DMME staff, should undertake the following three items:

- **Conduct a Potential Study** - While the Department of Energy published a CHP technical potential study for all 50 states, it does not capture the nuances of CHP potential in Virginia. Therefore the Working Group should develop a study regarding the potential for CHP at all current and planned state facilities, as well as other potential end users, such as industrial facilities, military installations, and critical infrastructure.

- **Recommend a Statewide CHP / WHP Goal** – Based upon the results of the above study, the working group should develop for Gov. Northam a 2030 CHP / WHP deployment goal. Setting such a goal will establish a benchmark for deployment of this resource, against which this Administration, and future ones, may measure progress.

[41] Access to Data: Bringing the Electricity Grid into the Information Age. 21st Century Electricity System Issue Brief. Advanced Energy Economy. April 9, 2018.

- **Evaluate Benefits & Barriers** – The working group should likewise assess the value proposition of CHP and WHP, including the resiliency value of CHP, and barriers to CHP and WHP deployment. In their assessment of barriers, the group should consider, in particular, interconnection rules and standby rates. The group should complete this assessment no later than November of 2019.

2.2. Lead-by-Example Strategies

If Virginia is going to meet the 10% conversation goal, then state government has an important role to play as both an exemplar of best practices and as a significant energy consumer itself. With over 100,000 employees spread across 50+ agencies and departments, our government is a sizeable energy consumer in and of itself.[42] Moreover, energy waste in government drains state coffers and, ultimately, impacts taxpayers.

To date, however, conservation efforts in state government have met with mixed results. Sizeable energy savings in one year have been met with backsliding the next.[43] Robust action among some state entities has been undercut by the inaction of others. The recommendations below, therefore, are aimed at ensuring that all parts of state government move aggressively to conserve energy and effectively track those savings.

Rec. 2.2-A: ***Set a New Goal to Reduce Energy Use at State Facilities***

Democratic and Republican Governors alike have sought to reduce energy consumption in state government. In 2007, the Gov. McDonnell signed Executive Order 19, which set a goal of reducing annual energy use by state government at least 5% by 2012.[44] Gov. McAuliffe upped the ante in 2014 with EO 31, which aimed to reduce energy use by 15%, below 2010 levels, by 2017.

We recommend that, following in the footsteps of his predecessors, *Governor Northam issue an Executive Order with the goal of reducing energy consumption at state facilities 20% by 2022*.To date, state government has fallen short of meeting Gov. McAuliffe's goal, so 20% by 2022 remains an ambitious target. Nonetheless, setting such a target will send a clear signal to leadership at agencies and institutions that conserving energy is an important priority of this administration.

McAuliffe's order leaned heavily upon energy service performance contracts (ESPCs) for the implementation of conservation measures. We strongly support the use of ESPCs whenever possible. They allow for the deployment of EE at no cost to the taxpayer. However, where ESPCs are not feasible, we would encourage the Governor to commit state budget resources upfront to EE measures.

Rec. 2.2-B: ***Fully Implement Energy Tracking System for State Buildings***

In Executive Order 31, former Gov. McAuliffe also directed DMME to develop a comprehensive system to measure, track and verify energy consumption at state facilities. In the years since, DMME has piloted an energy data system through which the consumption of state agencies can be tracked.

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[42] Virginia Energy Plan 2014. DMME. Commonwealth of Virginia. October 1, 2014.

[43] [Presentation] Virginia Energy Plan: Energy Efficiency Subcommittee. DMME. July 18, 2018.

[44] ACEEE State Efficiency Database: Virginia. Updated July 2018. Database.aceee.org/state/Virginia

We recommend that Governor Northam support this initiative and, in the aforementioned executive order, *require that, no later than January 1, 2020, the system is fully operational and all state facilities are consistently providing up-to-date and comprehensive information regarding their energy use.* The dashboard should be accessible to the public and easy to navigate. The information compiled therein should be easy to understand and, to the extent possible, updated in real time. To ensure "apples-to-apples" comparisons, we would encourage dashboard designers to group state facilities by category (e.g. office building, research laboratory, educational facility).

Gathering state government energy data and increasing transparency will provide a foundation for the implementation of EE measure and tracking of savings. Through "apples-to-apples" comparisons, state leaders can identify high-performers and areas of acute need. Fundamentally, it allows the Administration and General Assembly to save taxpayer dollars by identifying areas of energy waste.[45]

Rec. 2.2-C: ***Incent Public Higher Ed. Institutions to Invest in EE***

Virginia has 39 public institutions of higher education, from four-year colleagues and universities to two-year institutions such as the Virginia Community College System.[46] Taken together, Virginia's public colleges and universities are one of the largest consumers of energy in state government, and many individual facilities, such as the UVA Medical Center, are among the largest consumers in their community.

Unfortunately, Virginia's institutions of higher education have a problem with energy waste. According to a 2014 JLARC report, as of 2011, the Commonwealth's institutions of higher education had a backlog of deferred maintenance projects amounting to $1.4 billion.[47] Per the report, insufficient maintenance hinders the ability of these facilities to operate efficiently, "older facilities typically have outdated technology (such as HVAC and electrical systems), with lower energy efficiency and higher operating costs." Anecdotal evidence would suggest this backlog has only grown in the interim.

This backlog is a chronic cost to taxpayers and, especially, students. The latter have to bear the costs of deferred maintenance in the form of higher tuition to cover wasteful energy spending, physical discomfort, and disruptive, ad hoc repairs to critical problems. So solve this problem, we recommend Governor Northam take the following steps:

- **Prioritize Higher Ed. Data** – To ensure the state has good data on energy consumption at public colleges and universities, the Governor should make consistently and fully gathering data from these institutions a DMME priority as the Department rolls out the energy dashboard. DMME staff should work alongside administrators and sustainability officers at these institutions to establish systematic and, as much as possible, remote monitoring processes to routinely gather such data.

[45] For state specific examples of energy tracking systems and how they can be harnessed to encourage efficiency, see Case Studies 5 and 6 in the appendix.
[46] Higher Education System Overview. State Council of Higher Education for Virginia. http://www.schev.edu/index/agency-info/agency-overview/higher-education-overview
[47] Support Costs and Staffing at Virginia's Higher Education Institutions. Joint Legislative Review & Audit Commission (JLARC). October 2014. p. 51-52.

- **Establish a "Race to the Top"** – Using data gathered from these institutions the Northam Administration should incentivize Virginia's public colleges and universities to clear their maintenance backlogs through a "Race To The Top" style competition. Those that make the greatest reductions - percentage and overall - in consumption should receive both recognition and a financial reward.[48]

2.3. Financing

Rec. 2.3-A: Invest Carbon Permit Revenues in EE

EE and DR are cost-effective strategies to reduce emissions in the electric power sector. As they reduce electricity use, these tools avoid emissions of carbon dioxide (CO_2) and other harmful pollutants, often at the lowest cost.[49] As the Commonwealth plans to implement carbon regulations on the electric generation section, CO_2 reductions from EE and DR will help electric generating units meet emissions limits by reducing electricity production.

We recommend, therefore, *that DMME use the set-aside of allowances proposed in the draft carbon rule to invest in EE and DR projects that save energy and reduce utility costs for public and private sectors alike*. While EE and DR will greatly help to meet the Commonwealth's CO_2 emission targets, this does not mean that deployment will increase – even when it is the most cost-effective option. Market and regulatory barriers to investment in EE and DR can hinder its use as a compliance strategy.[50] The Commonwealth should consider using methods for allowance distribution to help address these barriers to energy efficiency deployment.[51] For example, an updating output-based allocation provides a transparent and predictable price signal, and rewards measures that deliver lasting CO_2 reductions.[52] [53]

Section 3 – Electric Vehicles

The United States is poised to witness a transportation revolution. Since 2011, the sale of light-duty electric vehicles in the US has grown by 50% year-over-year, with buses and heavy-duty EVs following closely. This is with good reason. When we take into account lifecycle costs, it is already less expensive to own an electric vehicle (EV) than a

[48] For a specific example of how Tennessee's public colleges and universities are using ESPC's to improve efficiency, see Case Study 7 in the appendix.
[49] ACEEE. 2016. How Much Does Energy Efficiency Cost? aceee.org/sites/default/files/cost-of-ee.pdf.
[50] ACEEE 2013. Overcoming Market Barriers and Using Market Forces to Advance Energy Efficiency. http://aceee.org/research-report/e136.
[51] See a description of allocation methodologies in ACEEE's Comments to Virginia Department of Environmental Quality on Allowance Distribution Under a Market-based CO2 Trading Program. https://aceee.org/regulatory-filing/ed-noira-0717.
[52] Several states participating in the NOx SIP Call use output-based allocation. In addition, see AJW's Direct Allocation approach (http://ajw-inc.com/mass-based-paper/) and AEE's Performance-based Allocation approach (http://info.aee.net/allocation-for-clean-power-plan-compliance).
[53] For additional information regarding investments in EE during carbon reduction revenues, please see Case Study 8 in the appendix.

fossil-fueled vehicle for many Americans. With battery prices continuing to fall, the upfront price of EVs is approaching parity.

Moving from fossil-fueled transportation to EVs will bring economic and health benefits to our Commonwealth. Transportation electrification brings EV charging installation jobs and other supply chain activity, which mean we can attract and keep investment dollars here, employing local power and reinvesting in Virginia. Advanced vehicles and fuels already employ over 6,600 people in Virginia.[54] Transitioning to EVs will also improve air quality and public health. EVs can provide a variety of benefits to the grid and consumers as a whole, with demonstrable economic gains.

The next three years will determine if the Commonwealth quickly realizes these benefits or, if regulation and policy is an obstacle to EV deployment. So far we are off to a good start. On August 9th the Commonwealth became the first state in the nation to take advantage of the Appendix D VW Settlement funds as Gov. Northam announced DEQ would award EVgo a $14 million contract to develop a statewide network of DC fast-chargers.[55] This network will enhance Virginia's existing public charging infrastructure, making it easier and faster to travel throughout the Commonwealth by EV.

Infrastructure development is essential in moving the Commonwealth towards transport electrification. However a focus on public infrastructure alone will not suffice. The Northam administration, regulators, and legislators have to collaborate with private providers, local leaders, and utilities to ensure Virginia is taking a holistic approach to infrastructure deployment. The same can be said of EV deployment as a whole – policymakers should work to ensure that the electrification of medium- and heavy-duty fleets keeps pace with light-duty EVs. Likewise, utilities and regulators have an important role to play in rate design – developing and approving tariffs that incentivize vehicle uptake and maximize the benefits EVs can provide to the grid.

Together, these policies can help accelerate transportation electrification in the Commonwealth – generating new jobs, in-state investment, energy, and health benefits to Virginians. For all these reasons we would urge Governor Northam to heed the recommendations below and lead on electrification.

Rec. 3-A: *Encourage the Development of Good EV Tariffs*

Charging electric vehicles can benefit consumers regardless of whether they own an EV or not. We all pay for the grid, no matter how much, or how little, each part of that system – each power plant or transmission line – is used. When EV charging is properly incentivized, it saves ratepayers money by improving the utilization of assets, spreading system costs over more sales volume and putting downward pressure on rates. The key to proper incentives is good rate design.

By contrast, bad rate design can raise system costs, by adding EV load to peak demand, rather than shifting it. That can impact EV-owners and non-owners alike. What is more,

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[54] Sources: Bureau of Labor Statics; AEE / BW Research Analysis of 2018 U.S. Energy & Employment dataset

[55] Gov. Northam Announces Selection of EVgo… Office of the Governor. August 9, 2018. https://www.governor.virginia.gov/newsroom/all-releases/2018/august/headline-828389-en.html

bad rate design and ill-conceived demand charges can undermine the economics of EV ownership – by raising the cost of "fuel" – and serve as a disincentive to uptake.

Virginia policymakers should ensure that the Commonwealth's rate structure, particularly EV specific tariffs, is designed to maximize the benefits, and minimize the impacts described above. To that end, we recommend that *Gov. Northam order DMME to produce a study regarding optimal EV tariffs for Virginia*. The study should be developed with the input of the SCC, Office of the Attorney General, EV stakeholders, and other interested parties. It should seek to identify best practices in rate design, make specific regulatory and / or legislative recommendations, and endeavor to ensure that EV tariffs in Virginia incentivize EV uptake, in both the light-, medium- and heavy-duty sectors, and benefit both EV owners and other ratepayers.[56]

3.1. EV Infrastructure Deployment

A consistent obstacle to EV uptake is "range anxiety." In a nutshell, this is the fear that your EV will run out of power before you can reach a charging station. As charging infrastructure has become increasingly widespread, and the range of light-duty EVs has grown – 56% on average between 2011 and 2017[57] – this fear has waned. Nonetheless, it persists and is commonly sited as one of the chief reasons consumers opt not to purchase EVs.

A comprehensive approach to EV infrastructure deployment can help quell "range anxiety" and increase uptake. A recent survey of over 350 metropolitan areas around the globe found a clear linkage between deployment and EV uptake.[58] A comprehensive approach to infrastructure deployment can do more than simply quell "anxiety"; it can address very real concerns about access to EV charging where consumers live, work, and shop. It can facilitate the deployment of charging infrastructure by private providers. And it can offer alternate solutions where the private market falls short. The recommendations below are intended to help steer Virginia towards a comprehensive approach.

Rec. 3.1-A: *Develop a Widespread & Accessible Public Charging Network*

Virginia has made important strides to develop a robust public charging network. Gov. Northam's announcement of $14 million in funding to build a public fast-charging network is the latest step. It builds upon the 25+ fast-changing stations that have already been deployed across the Commonwealth in places like Charlottesville, Richmond, Front Royal, and Hampton Roads[59] as well as a network of over 250 charging Level 1 charging stations that has grown from scratch over the past 10 years.

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[56] For a specific example of how good rate design can help shift EV load, please see Case Study 9 in the appendix.

[57] Fact of the Week #1008: Median All-Electric Vehicle Range… Department of Energy. Dec. 18, 2017. https://www.energy.gov/eere/vehicles/articles/fotw-1008-december-18-2017-median-all-electric-vehicle-range-grew-73-miles

[58] Emerging Best Practices for Electric Vehicle Charging Infrastructure. Hall, D & Lutsey. International Council on Clean Transportation. October 2017.

[59] Energy in the New Virginia Economy: Update to the 2014 Virginia Energy Plan. DMME. p. 31.

Virginia's charging network, especially its' DC fast-charger network, does contain notable gaps. Significant portions of the Northern Neck, Central and Southwestern Virginia – including the important I-81 corridor as it heads into Tennessee – are more than 30 miles from the nearest fast-charger, and in some cases any EV charger at all.[60] Hopefully, some of these gaps will be addressed via the awards mentioned above. To facilitate deployment, and expand coverage overall, we recommend that *DMME, DEQ, and VDOT, in coordination with EVgo, Virginia Clean Cities, and other parties, conduct deep-dive assessments of Virginia's primary and secondary transportation corridors* to identify optimal locations for additional public charging stations.

In the August 9th announcement, the Governor stated that the Commonwealth would seek to deliver an EV "changing network that is driver-focused, user-friendly, and promotes electric vehicle usage." Closing gaps in coverage is essential to achieving those aims. But, as new EV charging infrastructure is deployed, we would encourage state leaders to also ensure that it is developed in-line with open payment and technical standards. Such interoperability helps minimize "range anxiety" and maximize ease of use for consumers.

Rec. 3.1-B: *Lower Barriers to Private EV Charger Deployment*

In addition to the public network described above, Virginia should encourage the deployment of charging stations by private developers. These companies use private capital to build and operate EV chargers at locations like grocery stores and shopping malls. Such deployments are a valuable compliment to a public charging network, and ensure EV users have greater access to chargers. But private developers have run into practical barriers as they have sought to deploy charging stations. Here are three specific recommendations to address those barriers:

- **Require Utilities to Provide Timely, Useful Access to Data** – EV chargers, especially Level 2 or 3 chargers, can create significant new demand for energy at a specific point on the grid. While the grid is equipped to handle this demand, information regarding available capacity can help both private developers and grid operators best site new charging stations. Therefore, we recommend, as a component of the regulations governing data access (see recommendation 2.1-C) that *the SCC should lay out guidance regarding timely access to anonymous, grid-level data for private developers of EV charging.* If utilities would like to further ensure charging stations are well-sited on the grid, they should consider developing publicly available "heat maps" that identify points with significant capacity or congestion on the distribution grid.

- **Update Virginia's Building Code to Accommodate EV Growth –** Parking garages at multifamily residences and office buildings pose a challenge to EV growth. Retrofitting these garages to accommodate charging stations can require costly, and time-consuming construction. To avoid this dilemma going forward, we recommend that *policymakers revise Virginia's building code to require that 15% of all spaces in new parking structures accommodate EV chargers.* This is *not* a requirement that builders install such chargers, just the infrastructure (e.g. conduit) needed to facilitate development. New regulations in Atlanta, which

[60] Ibid.

require such infrastructure investments at new residential and commercial buildings, provide a model of this requirement.[61]

- **Permit Local Tax Breaks for EV Chargers** – To encourage the growth of certain businesses, such as renewable generation, the Commonwealth permits localities to reduce the property tax rate on the "machinery and tools" involved. As noted above, building more charging stations is key to encouraging greater EV adoption. So we recommend that *lawmakers, with the support of the Northam Administration, pass legislation allowing localities to reduce the property tax rate on EV charging stations.* This gives localities the option of creating additional financial incentives to attract more investment in EV charging.

Rec. 3.1-C: *Evaluate Regulations around Utility Ownership of EV Infrastructure*

Working in concert, the public and private sectors in Virginia have made demonstrable progress in developing an EV charging network. We hope that this activity will keep pace with EV growth. However there may be circumstances in which the private market, combined with public sector actions, falls short. In these instances, it may be necessary for state utilities to support the network through investments in charging infrastructure, particularly when it comes to medium- and heavy-duty fleet vehicles.

Utility investment in EV charging infrastructure can support industry development, creating a variety public energy, economic, and health benefits. But it also runs the risk of deterring private investment, especially in charging stations. So we would recommend that *the SCC identify specific parts of this emerging industry that are best served by utility investments, and promulgate appropriate regulations*. In particular, we would encourage regulators to consider permitting utilities to invest in "make readies" for chargers – i.e. all the infrastructure need to bring power up to the charging station.

3.2. Strategies to Expand EV Adoption

Expanding charging infrastructure, as described above, is a significant way to encourage light-duty EV adoption amongst consumers. However, the Northam Administration can take a more direct role in accelerating the adoption of EVs – especially medium- and heavy-duty EVs – by state government, municipalities, and other institutions.

Moving state, municipal, and other fleets away from conventional fuels and towards electrification has a number of benefits. First and foremost are cost savings. Municipal bus fleets provide a good example. Today – per internal industry data – an electric bus costs roughly $250,000 more upfront than a diesel bus. However, on an annual basis, the same electric bus costs $35,000 less in fuel, parts, and maintenance. As a result, over the course of a dozen years each electric bus can save a locality $170,000. That's money that can be returned to riders, in reduced fares, or reinvested to improve and expand transit service. The cost-differential for light-duty vehicles is, proportionally, is even better. As battery costs continue to decline, these savings will only continue to improve across all vehicle classes.

[61] Atlanta Passes Infrastructure Ordinance to Support EV charging. Katie Pyzyk. Smart Cities Dive. Nov. 22, 2017. https://www.smartcitiesdive.com/news/atlanta-passes-infrastructure-ordinance-to-support-ev-charging/511500/

The benefits extend beyond cost savings however. The medium- and heavy-duty EV industry is fast growing in the US, with leading manufacturers opening new facilities in the US in recent years. Virginia – with its favorable business climate – has the opportunity to attract this business through a clear commitment to EV technology. At the same time as it attracts new business and job growth, such a commitment will also help improve health and environmental outcomes for the Commonwealth.

Given the diverse benefits from moving Virginia's transportation fleets from conventional fuels to electricity, we urge the Northam Administration take a number of concrete steps to encourage and accelerate this transition.

Rec. 3.2-A: *Set an Electrification Target for the Commonwealth's Fleet*

Today, Virginia has approximately 4,000 light-duty vehicles in a centralized fleet, overseen by the Office of Fleet Management Services (OFMS), which state employees can use for government travel.[62] OFMS advertises electric vehicle charging infrastructure, including a Level 3 Fast Charger, as part of its' Alternative Fuels Program. OFMS provides little information, however, regarding the number of EVs in its fleet or how state employees can access them.

This should change. Given the numerous benefits discussed above, the Commonwealth should swiftly and cost-effectively transition the state fleet to EVs. Assuming roughly a 7% turnover rate[63], we recommend that *Gov. Northam set a target of converting 15% of the state fleet to EVs by the end of 2021***.** This would mean that roughly 7 in 10 new vehicles purchased, as part of the normal fleet turnover, would be EVs. At the same time, the Administration should work with OFMS to ensure that state employees have clear ways to select EVs for use and that the Office has sufficient charging infrastructure to accommodate this EV growth.

Rec. 3.2-B: *Establish a Medium / Heavy-Duty Fleet Electrification Working Group*

Fleets that operate with predictable routes and routines – such as municipal buses or drayage vehicles – are especially well suited to electrification, as they don't face issues of range anxiety or erratic charging schedules. But the electrification of such large fleets can present challenges too. Such fleets may require specific charging infrastructure with additional upfront costs, or they may generate substantial new load at specific times.

To address thee challenges and facilitate fleet electrification, we recommend that *DMME and DEQ establish a Stakeholder Working Group*. The group should be comprised of officials from the Administration and relevant municipalities, the utilities, fleet operators, EV manufacturers, and other interested parties. The group should be tasked with four broad goals:

- Identify the full range of medium- and heavy-duty vehicle fleets currently operating in Virginia, from school and municipal bus fleets to port and

[62] https://dgs.virginia.gov/fleet/fleet/about-fleet/
[63] America's Aging Vehicles Delay Rate of Vehicle Turnover. Hart Schwartz. The Fuse. Jan. 23 2018. (Data drawn from Transportation Energy Data Book, Oak Ridge National Lab) http://energyfuse.org/americas-aging-vehicles-delay-rate-fleet-turnover/

delivery vehicles, and, to the extent possible, rank those fleets in-terms of the cost-effectiveness of electrification.

- Survey best practices from around the country and develop a set of recommendations for state regulators regarding optimal interconnection standards for fleets. These standards should seek to ensure that the interconnection process is not an obstacle to fleet electrification while also accommodating the needs of grid planners.

- The working group should likewise develop a set of recommendations for state regulators regarding optimal tariff structures for various fleets operating in Virginia, building upon the work done by DMME under recommendation 3-A. They should take into account the different schedules and needs of these fleets and how those facets align with variations in load and generation.

- For those Virginia fleets ranked most cost-effective in terms of electrification, the group should work closely with the utilities to identify optimal locations for charging infrastructure, and any gird upgrades that might be necessary.[64]

Rec. 3.2-C: *Use remaining VW Settlement Funds Solely for Electrification*

In 2016, the US EPA and FTC reached a settlement with Volkswagen for their systematic and repeated violation of rules governing NO_x emissions from cars and trucks.[65] As part of this settlement, an "environmental mitigation" trust was established, endowed with $2.7 billion from the automaker, to reduce diesel emissions. Virginia's share of this settlement fund is roughly $96 million. Of that, the Commonwealth has allocated $14 million, per the Governor's announcement in early August, to the development of a public fast-charging infrastructure.

Virginia's remaining funds in the mitigation trust, approximately $82 million, must be used to repower diesel vehicles. Repowering entails switching from diesel to a variety of alternate fuels, such as natural gas, propane, biodiesel, and electricity. We recommend that *DEQ, as settlement administrator, use these funds solely to support electrification*. The fundamental purpose of the trust is to reduce NO_x emissions. When we consider the options, EVs go the furthest towards this goal and lead towards the most significant NO_x reductions. But there are also important economic rationales as well for a focus on EVs.

The first is cost savings. As discussed above, when we look at life cycle costs, a battery electric bus beats a diesel bus. Recent research by Carnegie Melon University expands that conclusion. There, researchers found that, when you consider the lifecycle costs of buses powered by a variety of different fuel sources battery electric buses are cost-competitive with compressed natural gas, liquefied natural gas, and hybrid-diesel buses.[66] What's more, they found, battery electric buses are cost competitive *even* when

[64] Fleet operators and EV entrepreneurs are exploring new medium- and heavy-duty fleets to electrify. See Case Study 10 in the appendix for two examples of pilot projects around rail, port and distribution facilities.
[65] Volkswagon Settlement: Beneficiary Plan Mitigation Toolkit. Malmgren, I. and Powers, C. NASEO. March 2017.
[66] Lifecycle ownership cost and environmental externality of alternative fuel options for transit buses. Tong et al. Transportation Research Part D. Jan. 5 2018.

buyers – e.g. a municipality – a must bear the full costs. When that upfront cost is reduced, through outside financing like VW dollars, the economics only improve.

The second is price volatility. As Virginia integrates more wind and solar into its generation fleet – as it is projected to do over the next decade – electricity prices should becomes less tied to those of fossil fuels (esp. natural gas) and more stable. Electrifying transportation fleets will, in turn, help to reduce their exposure to price volatility.

The third rationale is the risk of stranded assets. Any transition will require some degree of investment in new refueling infrastructure. As the costs of battery storage continue to decline the economic appeal of EVs will only improve. In turn, interoperable, well-designed charging infrastructure should be used more and more - minimizing the risk it becomes a stranded asset. That may not be true of infrastructure for other fuel sources.

Should DEQ choose to focus solely on transportation electrification, as we recommend, the challenge becomes stretching every dollar of the VW funds – through complimentary financing and innovative financial mechanisms – to maximize their effectiveness. To that end, we recommend that *policymakers at DEQ, and the Administration broadly, explore the following potential options*:

- **Aggregate Purchasing** – One of challenges that fleet operators can face is the absence of scale economies. As they often purchase vehicles on an incremental or pilot basis, they rarely reach the scale necessary to drive down per-unit costs. This problem may be overcome through aggregated purchasing, wherein multiple buyers combine their demand. DEQ should identify ways to encourage and facilitate such aggregated purchasing across Virginia when using VW funds.

- **Pair with Low-No Funds** – The 2015 "Fixing America's Surface Transportation (FAST)" Act created a financing stream – the "Low-No" Fund – to support the deployment of advanced transportation infrastructure and vehicles. In 2017 alone the Federal Transit Administration (FTA) dispensed $55 million in Low-No funds to municipalities throughout the US, including Hampton Roads.[67] DEQ should endeavor, whenever possible, to pair VW funding with Low-No dollars to multiply resources. This is just one example of potential federal financing.

- **Consider "Pay As You Save (PAYS)" Programs** – Transit operators face a dilemma: large EVs generate lifecycle savings, but have a substantial upfront cost. Left unresolved, this dilemma may constitute a market failure and warrant utility engagement through something like a PAYS Program.[68] Under such a program, the utility would use their capital to cover part of the cost of the battery(s) and charging infrastructure for a transit project. Project operators would then pay the utility back for that investment through a bill rider.

Through these options, and other potential solutions, DEQ and the Northam Administration as a whole should maximize the use of VW settlement funds to spur transportation electrification in the Commonwealth.

[67] Proterra Congratulates the Winners of FTA Low-No Grant Funding for Battery Electric Buses. Sept. 26, 2017. https://www.proterra.com/press-release/proterra-congratulates-the-winners-of-fta-low-no-grant-funding-for-battery-electric-buses/
[68] https://www.climatefinancelab.org/project/pay-save-clean-transport/

We would likewise encourage transit planners and fleet operators to consider leasing options for medium- and heavy-duty vehicles, such as the $200 million program created through a partnership between BYD and Generate Capital. [69] Though VW funding cannot be used for leasing programs, they provide fleet operators with another way to overcome upfront cost barriers.

3.3. Integration of Emerging Technology

New innovations, which allow for greater interaction between EVs and the grid, have the potential to unlock new value streams for consumers, grid operators, and EV companies alike. Two broad innovations are worth noting here: The first, "managed charging", also known as V1G, is a one-way communications infrastructure that allows grid operators (sometimes with the input of consumers) to manage EV load remotely.[70] In V1G, operators can dial up or down EV charging, treating it like a Distributed Energy Resource (DER) – dial-it up during off-peak hours to smooth load, or down to shave peak.

The second is V2G, a bi-directional communications and electric infrastructure between the grid and EVs.[71] In addition to the capabilities enabled under V1G, V2G essentially turns the vehicle's battery into a grid-connected storage device. This allows the vehicle to supply the grid with electricity on a time- and (potentially) location-specific basis. As such, the EV can provide many of the same benefits – and unlock many of the same value streams – as are discussed below regarding battery storage.

V1G and V2G technology have only begun to enter the marketplace, but they have the potential to enhance the economic value of EVs, as well as creating new grid-level benefits. Below are two recommendations for policymakers to ensure the Commonwealth is prepared to fully capitalize upon these innovations as they develop:

Rec. 3.3-A: *Ensure Grid Transformation Accommodates EV Innovations*

As has been noted previously, Dominion recently filed phase one of their "grid transformation" plan, a multibillion-dollar investment aimed at updating portions of Virginia's grid. The SCC has a vital role to play in overseeing this transformation, ensuring that ratepayer dollars are used effectively and efficiently.

EVs represent not only an emerging demand driver, but – though emerging technologies – also a potential DR and battery storage resource. As such, we recommend that the *SCC take into account trends in EV development and innovation prior to approving any grid modernization plan***.** Grid investments should not only accommodate new demand from EVs, but should be versatile enough to facilitate new EVs technologies that allow for greater remote control and vehicle-to-grid interaction. Otherwise grid operators may have to make additional investments, at further cost to ratepayers, to unlock such benefits.

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[69] https://www.greentechmedia.com/articles/read/byd-and-generate-capital-launch-a-200m-electric-bus-leasing-program#gs.QtUegSw

[70] Strategies for Integrating Electric Vehicles into the Grid. Kahn, S. and Viadyanathan, S. ACEEE. February 2018. p. 10.

[71] Ibid. p. 12.

Rec. 3.3-B: *Evaluate V2G Storage in the VSEDA Storage Study*

As is discussed in greater detail below, the Virginia Solar Energy Development and Energy Storage Authority (VSEDA) has been charged with developing a study regarding energy storage in Virginia. As part of this study, we recommend that the *consultant retained by VSEDA evaluate vehicle-to-grid storage as a deployment option in their analysis***.** V2G has the opportunity to facilitate the deployment of distributed battery storage with little upfront cost to ratepayers or utilities. If it can be effectively harnessed, this resource could be of significant value to grid operators as they seek to manage load and integrate more renewable resources.

Section 4 – Battery Storage

Electricity is an essential economic commodity without which much of modern life and commerce wouldn't be possible. But unlike most commodities – think oil or rice – it cannot be easily stored. Instead, electricity must be consumed or discarded virtually the moment it's produced. This fact has shaped the system we use to distribute it (i.e. the grid) and the economics around it (e.g. capacity markets, time-variant costs, etc.).

One form of energy storage, in the form of pumped hydro, has been around for decades. The Pumped Hydro facility in Bath County, Virginia, is one of the largest examples of this resource.[72] But such systems are limited by geography and *considerable* upfront costs.

Battery storage is markedly different. It's scalable, affordable, and can be deployed virtually anywhere. The latter attribute allows battery storage to serve as a substitute for T&D investments by alleviating congestion at the site. It can draw energy from the grid, and dispatch to it instantaneously, improving efficiency and providing ancillary services. Storage can increase the value of variable renewable generation – storing power from wind and solar when not needed, and dispatching it later – and reduce the need for new peaking and base-load generation. Together these attributes give battery storage the potential to revolutionize the electricity system.

It comes as little surprise, then, that as the cost of battery storage has fallen over the past decade – the result of technological improvements, economies of scale, and improved financing – the deployment of batteries has accelerated.[73] As of May 2017, approximately 1.4 GW of advanced energy storage (chiefly batteries) had been deployed across the US – a 450% growth over 2008.

Virginia has taken tentative steps towards battery storage. To date, approximately 2,700 people are employed in he advanced grid and energy storage industry in Virginia. SB. 966 authorized IOU's to conduct battery storage pilots. Virginia's recently enacted biannual budget likewise instructs VSEDA to conduct a two-year study regarding battery storage. If we is going to take full advantage of this technology, however, and the

[72] Bath County Pumped Storage Station. Dominion Energy. https://www.dominionenergy.com/about-us/making-energy/renewables/water/bath-county-pumped-storage-station

[73] Charging Ahead: An Energy Storage Guide for Policymakers. Stanfield, S., Petta, J. and Auck, S. IREC. April 2017.

economic opportunities it unlocks, the Commonwealth should move quickly and decisively. The recommendations below are designed to do just that.

Rec. 4-A: *Expedite Development of a Useable Battery Storage Study*

The biennial budget includes an appropriation of $50,000 in FY 2019 and $50,000 in FY 2020 for VSEDA to conduct a study aimed at accelerating energy storage development and deployment in Virginia. Specifically, the legislative language calls upon the Authority to determine "whether of not future legislation in the form of regulatory reforms and incentives" will spur more energy storage capacity in Virginia.[74]

The answer to that question is clear: Yes, legislative and regulatory reforms will spur the development of more battery storage in the Commonwealth. A set of recommended reforms are included below. That said it is worthwhile for the Authority to review storage policy across the US. To be as useful as possible, however, this study should go beyond such qualitative evaluations and conduct quantitative cost-benefit analysis.

Specifically, we recommend that *the study should analyze various levels of battery storage deployment in Virginia and identify the level at which the Commonwealth enjoys the greatest net benefit.* Battery storage can provide a range of services, such as customer energy management and ancillary services, and serve as a substitute to transmission, distribution, and generation.[75] Deployed effectively, storage can also help to increase system resiliency, and decrease emissions. Thus we would encourage analysts to consider the full scope of benefits and potential costs in this study.

As is noted in Case Study 11 (see appendix) substantive and rigorous battery storage studies conducted elsewhere in the US have cost significantly more than what has been allocated here. That is not to say this expenditure cannot produce a useful study. But if VSEDA wants to enhance the study, they should consider seeking matching funds from philanthropic donors and / or private institutions to supplement the $100,000 allocated.

Ultimately, the quantitative analysis that flows from this study should inform legislative and regulatory reforms. To ensure these reforms are implemented in a timely manner we strongly encourage the Authority to move expeditiously to complete the analysis and publish the report no later than Q3 2019. Doing so will allow lawmakers to develop and enact legislation during the 2020 legislative session.[76]

4.1. Legislative Reforms

Rec. 4.1-A: *Ensure Storage is Fully Assessed in Utility Resource Plans*

In its 2018 IRP, Dominion briefly considers battery storage in a discussion of dispatchable resources, noting the variety of services batteries can provide, including

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[74]

[75] The staff at the Oregon PUC has provided a useful template to help policy makers grasp the full range of these services. For more information, Oregon Public Utilities Commission Order No. 17 375 Approving Staff Report in docket number UM 1856 and UM 1857, available at: https://apps.puc.state.or.us/orders/2017ords/17-375.pdf.

[76] For a specific example of a useful battery storage study, conducted on a limited budget, consider the case of the NYC peaker study highlighted in Case Study 11 in the appendix.

"peak load shaving, frequency regulation services, or peak load shifting to off-peak periods."[77] Despite acknowledging these benefits, the utility opted not to consider this technology for further analysis – sidelining it from the resource planning process.

This is a disappointment. As noted above battery storage offers a wide range of benefits. Given the maturity of this technology, it should be thoroughly analyzed in all future IRPs. To ensure that occurs, we recommend that *legislators, with the support of the Northam Administration, reform Virginia's IRP statute to require that all future resource plans fully consider battery storage.* In order to ensure this occurs, we recommend that the statute include two key requirements:

- First, the IOU's must include a thorough assessment of battery storage systems as part of their IRP. That assessment should incorporate rigorous analysis of the potential transmission, distribution, and ancillary services benefits battery storage can provide to the grid. It should also include analysis of the ability of batter storage to meet identified generation and / or capacity needs.

- Second, prior to the approval of an IRP, SCC staff must determine that the utility has fulfilled the above requirement and employed appropriate methods to model and assess battery storage.

This process should ensure that the utilities thoroughly consider battery storage in their resource planning processes, facilitating deployment of this flexible and cost-effective resource across the Commonwealth.[78]

Rec. 4.1-B: *Require "All-Source RFPs" to Address Identified Needs*

Battery storage, as noted before, has the ability to cost-effectively address a wide variety of needs. As such, battery storage, like EE, DR, DG, and renewable generation in general, can serve as a substitute for a variety of conventional utility capital investments.

Therefore, for a third time, we *recommend that Virginia legislators, with the support of the Northam Administration, revise Virginia's CPCN statue to require "All-Source RFPs".* This recommendation compliments the IRP reform suggested above. It moves the consideration of battery storage by the utilities from a long-range planning process into the immediate realm of generation development and grid "transformation." It will also provide utility planners with up-to-date pricing information and a greater understanding of the scope of services battery storage can provide.[79]

4.2. Regulatory Reforms

Rec. 4.2-A: *Develop Storage through a Competitive Procurement Process*

SB. 966 compels Virginia's IOU's to establish battery storage pilot programs. Although the capacity targets are small – 10 MW for Appalachian, 30 for Dominion – the fact that

[77] Dominion 2018 IRP. p. 72.
[78] For a specific example of an IRP process driving storage deployment, consider the case of Indianapolis Power & Light, highlighted in Case Study 12 in the appendix.
[79] For a specific example of how all-source bidding can lead to more storage deployment, consider the example of SDG&E and SCE, as discussed in Case Study 13 in the appendix.

they are slated to explore the diverse benefits battery storage is encouraging. That said, *how* the pilots are administered remains to be determined.

Per SB. 966, the SCC must, by December 1st of 2018, establish rules or guidelines governing the administration of these pilots. We recommend that the Commission take advantage of this opportunity and *require the utilities conduct a competitive procurement process when developing battery storage projects.* Requiring such a process has two important advantages. First, it will provide the utilities with up-to-date pricing information regarding battery storage, which can be used to inform future IRPs and all-source RFPs. Second, it will ensure that the cost-effective battery projects are developed, protecting the interests of ratepayers while still building a 21st century grid.

To further improve cost-effectiveness, we would likewise encourage the SCC to require that the utilities explore different ownership models for storage, including third-party PPAs. Similar to generation projects, the utilities don't necessarily need to own and operate a battery storage asset to for the grid to benefit from its services. Ownership by an experienced third-party provider may even enhance operation of the asset. At a minimum, third-party ownership reduces the capital costs, and risks, of battery storage deployment for the utility.

Rec. 4.2-B: *Develop Time-Variant Rates to Facilitate DER Deployment*

The cost of producing electricity varies from day-to-day, even moment-to-moment. An additional kilowatt-hour is significantly more costly on a hot summer afternoon than on a mild spring morning. But most Virginia consumers don't see that in their energy bills. The price per kilowatt-hour is the same regardless of when we consume it.

This disparity is in large part the result of technological limitations. Most Virginia homes and businesses do not have smart meters, which would allow the utility to know *when* we consume power within a given day, week, or month. That's changing. This August Dominion rolled out the first phase of its grid transformation plan, which includes the deployment of over 2.1 million smart meters in the next ten years.[80]

This deployment offers the chance to move away from traditional – and inefficient – rates and towards Time-Variant Rates (TVRs), wherein the cost of a kilowatt-hour is higher during peak periods (e.g. 4 PM on a summer afternoon) and lower off-peak (e.g. 7 AM on a spring morning). Armed with the right information, as discussed in recommendation 2.1-C regarding data access, TVRs give consumers the opportunity to save energy, and reduce their electric bills, by changing behavior and improving the efficiency of homes and offices.

However TVRs have the added advantage of further improving the economics of DERs, including battery storage. Pairing customer-sited battery storage with TVRs, for instance, allows customers to optimize use of the battery system, charging during off-peak periods and using their battery, either to meet on-site demand or supply the grid, on peak.[81].

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[80] Virginia Electric Power Company – For Approval Of A Plan for Electric Distribution Grid Transformation Projects Pursuant to § 56.585.1 A 6 Of The Code of Virginia. PUR-2018-00100. August 9, 2018.

[81] Charging Ahead: An Energy Storage Guide for Policymakers. Stanfield, S., Petta, J. and Auck, S. IREC. April 2017. p. 21.

When distributed solar is added to this combination, the value of both the battery and solar system grows – as electricity produced at one point in the day can then be utilized or sold at another, when it is more in demand. These benefits flow not only to the customer, but the gird as a whole, as batteries – regardless of who owns them – can help defer the need for new investments in generation, transmission and distribution

To fully realize these diverse benefits, we recommend that the SCC *open a docket to explore the design and deployment of TVRs, and issue recommendations regarding TVR design.* This process should include input from the Administration, DER developers, and representatives of diverse consumer classes, and the utilities. It should consider the costs and benefits of TVRs and how best to institute such rates across all consumers without adverse impacts, especially upon low-income groups and small businesses.

We would also encourage the utility to explore, and for regulators to approve, opt-in rate structures regarding battery storage. In particular, such opt-in rates could incent consumers to charge customer-sited battery storage during off-peak hours and discharge during on-peak hours. Such a program would encourage the deployment of distributed battery storage throughout the Commonwealth, with the benefits discussed above, without requiring the utility to use ratepayer dollars for that.

For further information regarding the beneficial interaction of TVRs and battery storage, we recommend **Charging Ahead: An Energy Storage Gide for Policymakers** composed by the Interstate Renewable Energy Council.

Appendix – Advanced Energy Case Studies

Case Study 1 – NYSERDA Procurement Process: New York provides a good example of what a transparent, and consistent process can achieve. The NYSERDA conducts an annual auction for a set amount of renewable energy credits (RECs). While the revenue from these REC contracts comprises only a portion of the financing for a wind or solar project, the transparency and predictability with which these auctions are conducted yields significant and consistent year-over-year growth in New York's renewable energy industry. As of 2017, the Empire State had over 1,800 MW of installed wind capacity[82]– amounting to billions in in-state investment.

Case Study 2 – Indiana's IRP Process: In recent years, Indiana regulators have instituted an IRP process for utilities that contains many of the elements described above.[83] Each utility, in developing its IRP, holds a series of stakeholder meetings, in which assumptions, forecasts, and technologies are discussed and evaluated. Some of the utilities hire a third-party consultant to support the process and, in some cases the IRP process coincides with an all-resource RFP, the results of which are then used to inform future planning decisions.

Case Study 3 – Colorado's All-Supply RFP: In 2017, Public Service Company, Colorado's largest IOU, which is owned by Xcel energy, conducted a limited version of an "All-Source RFP" in compliance with new regulatory requirements. Having identified the need for 615 MW of new capacity by 2023, the utility issued an RFP for all sources of power generation, which included wind, battery storage, solar and fossil-fired generation (but not demand-side resources). In quarterly filings before Colorado regulators, the utility described the range of proposals they received, and the low bid price of some renewables, as "unprecedented."[84]

Case Study 4 – ConEd's BQDM Program: In 2013, ConEd, the utility serving New York City, identified the need to upgrade a set of distribution substations in the city to address load growth.[85] The anticipated cost to perform the necessary upgrades was over $1 billion. In response, the NY PSC ordered ConEd to conduct an all-source bidding process to identify alternative solutions to the dilemma. Out of that process came the Brooklyn Queens Demand Management program (BQDM), wherein the utility contracted for 52 MW of DR and EE, as well as storage and rooftop solar. This action has allowed the utility to defer the distribution upgrades until 2026 at a substantial savings to ratepayers, while still providing safe, reliable service.

Case Study 5 – Kentucky's Energy Dashboard: Virginia's neighbors are already tracking energy consumption in state governor through dashboards similar to the one described above. Kentucky, for example, has established the Commonwealth Energy Management and Control System.[86] CEMCS tracks energy savings in 164 different state

[82] Wind Energy In New York, AWEA, 2017.
[83] NIPSCO Integrated Resource Plan, 2018 Update. Public Advisory Meeting One. 3/23/2018.
[84] Public Service Company of Colorado, 2016. Electric Resource Plan 2017 All Source Solicitation 30-Day Report (Public Version), CO PUC Proceeding No. 16A-0396E.
[85] Petition of Consolidated Edison Company of New York, Inc. for Approval of the Brooklyn Queens Demand Management Program [BQDM]. Case 14-E-0302. Order Establishing the BQDM. December 12, 2014.
[86] The 2017 State Energy Efficiency Scorecard. Berg et al. ACEEE. September 2017. p. 117.

buildings, totaling over 10 million square feet, in real time and makes that data available to the public. Due to its success, CEMCS was one of the few programs to be granted a budget *increase* in Kentucky's recent biennial budget.

Case Study 6 – Rhode Island's "Lead by Example" Awards: In recent years, Rhode Island has also made energy conservation in state government a priority.[87] In 2015, Gov. Raimondo established a Lead by Example program within the state's Office of Energy Resources (OER) – the RI equivalent of DMME. OER is charged with establishing interim goals to meet an overall conservation target, publicizing state energy data, and recognizing EE leaders within state government. In 2017, the state held it's first Lead By Example awards, recognizing 11 agencies, quasi-public entities and municipalities for their achievements. Virginia provides such recognition through VAEEC awards, but may want to consider RI as a model to make this a more formal process.

Case Study 7 –Tennessee Colleges & Universities use ESPCs: Energy Service Performance Contracting has been an effective means of improving efficiency at public colleges and universities in neighboring states. In Tennessee the Board of Regents has implemented 17 ESPC projects over the course of the past decade.[88] These projects have amounted to $54 million in investment, but have an annual savings of $6.8 million – meaning they'll pay for themselves in less than a decade. The University of Tennessee has starting employing ESPCs as well. In May the Health Sciences center inked a $5.5 million contract, phase one of a $30 million overhaul of campus energy systems. Virginia's higher ed. institutions would do well to follow Tennessee's lead.

Case Study 8 – Carbon Revenues & Efficiency Investments: We recommend the Commonwealth look to states participating in the Regional Greenhouse Gas Initiative (RGGI) as examples of how to increase investment in energy efficiency. During the 2015 program compliance year, RGGI states invested 64% of proceeds in energy efficiency programs, representing $1.3 billion in lifetime energy bill savings to over 141,000 participating households and 5,700 businesses across the region.[89] Maryland allocates proceeds from the sale of allowances to the state energy office, the Maryland Energy Administration (MEA). The funds are directed through the State's Strategic Energy Investment Fund (SEIF), a non-lapsing fund administered by the MAE, that has supported cumulative energy efficiency upgrades for 16,991 low- to moderate-income households and provided over $2.5 million in grants to assist 42 commercial entities in enhancing efficiency through the Game Changer Competitive Grant Program.[90]

Case Study 9 – Indianapolis Power & Light EV Rate Design: In 2011 and 2012, Indianapolis Power & Light (IPL) conducted an EV pilot program.[91] As part of the program, IPL introduced a time-of-use (TOU) rate for EVs in its service territory, wherein it cost more to charge an EV on-peak than off. The purpose of the TOU rate was to shift EV charging, and it was a success. Per IPL, 76% of the electricity demand for resident

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[87] Ibid
[88] ACEEE State Efficiency Database: Tennessee. Updated July 2018. Database.aceee.org/state/Tennessee
[89] RGGI. 2017. The Investment of RGGI Proceeds in 2015. https://www.rggi.org/sites/default/files/Uploads/Proceeds/RGGI_Proceeds_Report_2015.pdf.
[90] Ibid.
[91] Strategies for Integrating Electric Vehicles into the Grid. Kahn, S. and Viadyanathan, S. ACEEE. February 2018. p. 26.

EV charging was pushed to off-peak hours. In their evaluation of optimal EV tariffs, we would encourage DMME to evaluate TOU rates.

Case Study 10 – California Medium- & Heavy-Duty EV Pilots: While there is a lot of attention paid to municipal bus fleets, planners, fleet operators, and entrepreneurs are exploring the electrification of a variety of medium- and heavy-duty fleets. Two recent pilot projects in California exemplify this innovation. In San Bernadino, Commerce, and Fontana, 23 battery electric Class 8 yard trucks and 4 Class 5 medium duty service trucks are being used in a pilot to move good around freight distribution centers and rail yards.[92] Across the Golden State, transportation officials have deployed 43 battery electric and plug-in hybrid drayage trucks to transport goods between ports, rail yards, and distribution centers. These pilot projects demonstrate the opportunity to use heavy-duty EVs in places like Virginia's ports and distribution centers.

Case Study 11 – NYC Peaker / Storage Study: A number of states have conducted cost-benefits studies akin to that described above. While some cost more than the $100K allocated here, a study regarding replacement of NYC's aging peakers may be a good model.[93] Prepared for NY-BEST, the study, which cost approximately $100K, the study focused on acute issue, evaluated potential solutions – including storage – and developed a set of proposals to drive the appropriate level of storage deployment.

Case Study 12 – Indianapolis Power & Light IRP and Battery Storage: The inclusion of storage in utility IRPs has become increasingly common in the US. In 2016, IPL modeled energy storage in their IRP as a means of addressing peak demand, supporting transmission, and providing frequency regulation. As a result of this, IPL's 20-year plan included 500 MW of standalone energy storage, 283 MW's of "hybrid" storage (co-located with generation) and 50 MW of distributed storage.[94]

Case Study 13 – SCE / SDG&E All-Source RFP: In 2013, Southern California Edison (SCE) and San Diego Gas & Electric (SDG&E) were facing a looming capacity shortfall due to gas plant retirements and the abrupt shutdown of the San Onofre nuclear facility.[95] In response, the utilities conducted an all-source solicitation, which led them to procure a diverse combination of conventional and advanced energy resources, including almost 400 MW of energy storage - the majority of which was battery storage.[96] This "all-source" process had the added benefit of giving the utilities as set of additional options. These they quickly called upon in 2016, when a leak at the Aliso Canyon Gas Storage facility imperiled fuel supplies for area gas plants and led the California PUC to order the utilities to procure more clean energy.

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[92] Transitioning to Zero-Emission Heavy Duty Freight Vehicles. Moultak, M., Lutsey, N. and Hall, D. International Council on Clean Transportation. Sept. 2017. p. 10.
[93] New York City's Aging Power Plants: Risks, Replacement Options, and the Role of Energy Storage. Strategen Consulting. September 20, 2017.
[94] Advanced Energy Storage in Integrated System Planning (2018 Update). Energy Storage Association. June 11, 2018.
[95] CPUC Ordering Decisions 13-02-015 (2013) and 14-03-004 (2014).
[96] SCE Testimony on Results of its 2013 Local Capacity Requirements. CEC Docket 15-AFC-01 http://docketpublic.energy.ca.gov/PublicDocuments/15-AFC-01/ TN215446-6_20170118T162944_Exh_7016.pdf.