Meeting Virginia's Electricity Demand with Clean Energy

Prepared For: Chesapeake Climate Action Network Action Fund

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Executive Summary

Dominion Energy, Virginia's largest utility, recently submitted an "Integrated Resource Plan" to state officials, projecting rising electricity demand in the state and proposing expanded energy generation to meet that demand over the next fifteen years. Unfortunately, Dominion's plan is not compliant with laws passed by the General Assembly in 2020 and 2021, including the Virginia Clean Economy Act and regulatory directives to account for economic externalities associated with air pollution. As an example, Dominion intends to build 1000 MW of new gas-fired generation capacity in Chesterfield County by 2027 even though doing so will generate more than 2 million tons of additional carbon emissions each year.[1] The Dominion plan also comes at a high cost to ratepayers and fails to take advantage of opportunities to minimize interconnection delays.

Gabel Associates was asked to develop a better approach. We drew from reputable, publicly available data and climate laws to show that Dominion can meet projected electricity load growth while improving compliance with Virginia's clean energy mandates, minimizing ratepayer costs, maintaining system reliability without facing greater interconnection delays, and putting Dominion on track to achieve carbon-free electricity by 2050.

This Report suggests an Alternative Plan, utilizing conservative and feasible adjustments to Dominion's preferred "Plan B," that,

1. Improves compliance with VCEA mandates;
2. Reduces energy generation and capacity costs;
3. Reduces transmission and distribution capacity costs;
4. Reduces PJM energy and capacity market clearing prices;
5. Reduces RPS deficiency penalty costs;
6. Reduces societal damages;
7. Increases local economic benefits;
8. Maintains system reliability;
9. Minimizes interconnection delays; and
10. Minimizes stranded costs.

[1] Virginia Department of Environmental Quality. Dominion Chesterfield Energy Reliability Center Project. Retrieved from https://www.dominionenergy.com/projects-and-facilities/natural-gas-facilities/chesterfield-energy-reliability-center

Currently, renewable energy comprises just 8% of Dominion's generation capacity, lagging the U.S. average of 18%. This resource mix leaves Dominion's system extremely reliant on non-renewable generation despite increasing electricity demand which must be satisfied using clean sources of power.

Dominion estimates that peak demand and energy consumption will grow by 2.32% and 3.25% annually. While this finding is challenged by some observers, our analysis shows that Dominion can meet its forecasted load growth while achieving substantial reductions in emissions, ratepayer costs, and societal damages without compromising system reliability or facing greater interconnection delays. Over the next 10 years, the Alternative plan saves ratepayers $28 billion in costs and avoids 52 million tons of greenhouse gas emissions. This can be achieved by:

1. Accelerating the retirement of coal and gas-fired power plants to reduce greenhouse gas emissions in line with Virginia's clean energy goals.
2. Utilizing PJM's Generator Replacement process to mitigate interconnection queue delays.
3. Adding battery storage deployments at existing facilities through PJM's Surplus Interconnection process to improve the reliability of co-located renewable energy generators.
4. Expanding behind-the-meter solar energy adoption through net metering and financial incentives to ensure more diverse and equitable distribution of clean energy generation resources.
5. Increasing energy efficiency investments and demand response programs to reduce overall energy consumption.

This Report demonstrates that Dominion can meet projected load growth over the next ten years while improving compliance with Virginia's clean energy mandates, minimizing ratepayer costs, maintaining system reliability without facing greater interconnection delays, and putting Dominion on track to achieve carbon-free electricity by 2050.

1 Background

1.1 Report Background

On September 7, 2023, Gabel Associates, Inc. (Gabel) executed a consulting services agreement with Chesapeake Climate Action Network Action Fund (CCAN Action Fund) to provide a high-level qualitative evaluation of Dominion's long-term resource plans and underlying load growth assumptions. The goal of this analysis is to identify a resource mix that is less costly, mitigates risk for consumers, and improves environmental quality in Virginia in accord with VCEA.

1.2 Gabel Associates Overview

Gabel is an energy, environmental and public utility consulting firm that has provided highly focused and specialized energy consulting services and strategic insight to its clients for over 30 years. Gabel Associates has applied its expertise to drive success for hundreds of clients involved in virtually every sector of the energy industry and has testified extensively throughout the United States. The firm has built its reputation on its extensive knowledge and rigorous analysis of wholesale and energy markets. We have successfully assisted public and private sector clients implement energy projects and programs that reduce costs and enhance environmental quality. The firm possesses strong economic, financial, project development, technical, and regulatory knowledge.

Gabel lives in both the world of energy market transactions (having undertaken project development for over 300 renewable and fossil-fuel generation projects and executed energy transactions for hundreds of thousands of accounts) and in the world of regulatory and policy analysis. We provide regulatory support on complex matters and expert testimony before Regional Transmission Organizations (RTOs), state commissions and courts, and the Federal Energy Regulatory Commission (FERC).

Gabel has provided extensive analysis in various jurisdictions related to the value of energy provided by renewable and non-renewable resources, including valuations of both direct energy values as well as environmental, societal, and induced economic impacts for a wide range of resources including solar, batteries, offshore wind, and fossil resources, among many others.

1.3 CCAN Action Fund Overview

CCAN Action Fund is the first grassroots, nonprofit organization dedicated exclusively to fighting global warming in Maryland, Virginia, and Washington, D.C. The mission of the CCAN

Action Fund is to effect change in public policy at local, state and national levels to directly address the threat of global warming. Through voter education, lobbying and participation in the electoral process, CCAN Action Fund seeks to move the U.S. into a leadership position on one of the most urgent global issues of our time — the climate crisis. With its sister organization, the Chesapeake Climate Action Network (CCAN), CCAN Action Fund focuses most of its efforts in the Chesapeake Bay states of Maryland, Virginia, and the District of Columbia. CCAN Action Fund believes positive solutions exist and must be embraced now to preserve our planet for future generations.

CCAN Action Fund has been at the center of the fight for clean energy and wise climate policy in Maryland, Virginia, and Washington, D.C. Working with a large and growing network of allies, the group has helped pass strong renewable electricity laws for 50% in Maryland and 100% in both Virginia and Washington, DC. It has also helped pass a landmark bill to ban fracking in Maryland, as well as one of the strongest statewide carbon caps in the country.

1.4 Dominion Overview

As Virginia's largest electric utility, Dominion Energy (Dominion) plays a vital role in supplying electricity across the Commonwealth. The company owns transmission and distribution infrastructure as well as several power stations including nuclear, coal, gas, and renewable energy generating facilities used to provide electricity to millions of customers throughout Virginia. In 2022, Dominion served more than 2 million customers and managed nearly 80% of the state's total residential electricity sales.[2] In contrast, the next largest utility manages just 14% of the state's residential electricity sales.

Compared to the overall U.S. electricity mix, Dominion relies more heavily on fossil fuel and nuclear generation.[3] More than 90% of Dominion's installed capacity comes from coal, natural gas, and nuclear plants, versus 76% nationally. Renewable energy is just 8% of Dominion's capacity, lagging the U.S. average of 18%. This resource mix leaves Dominion's system extremely reliant on non-renewable generation. Dominion's fossil fuel plants contributed to approximately 72% of Virginia's total electricity sector carbon emissions in 2022.[4]

[2] U.S. Energy Information Administration. (2023). Form EIA-861: Annual Electric Power Industry Report.

[3] U.S. Energy Information Administration. (2023). Form EIA-861: Annual Electric Power Industry Report.

[4] U.S. Environmental Protection Agency. (2023). eGRID2021 Summary Tables and eGRID PM2.5.

Over the past five years, Dominion's peak demand has grown at an average rate of 2.05% per year and its total energy consumption has grown at an average rate of 2.71% per year.[5] Over the next 15 years, Dominion estimates that peak demand and energy consumption will grow at slightly faster rates of 2.32% and 3.25%, respectively.[6]

Dominion's load growth forecast is influenced by several interrelated assumptions that could lead to higher or lower load growth, depending on how they are treated. For example, Dominion assumes that an expansion in data center energy usage will be partially offset by energy efficiency (EE) and demand side management (DSM) programs. However, it is unclear from the limited data and explanations provided by Dominion in its IRP if and to what extent the company's data center growth estimates are representative of current market trends or executed contractual arrangements. It is also unclear if and to what extent the EE and DSM programs can be expanded to further offset potential load increases over time. Overall, these uncertainties highlight the potential challenges for long-term resource planning in Viriginia as well the potential implications for the Commonwealth's ratepayers and environment.

For example, Dominion's forecasted data center load growth may be overstated if it fails to properly account for rising transmission costs, land use conflicts, increasing data center customer demand for clean energy, and improvements in data center energy efficiency and load management - each of which may limit the actual expansion of data centers or data center energy demand in Virginia over time, making Dominion's overall load growth assumptions higher than they may actually be.[7]

On the other hand, if Dominion's future load grows at a faster pace than historical load, Virginia could face several notable challenges and opportunities. The accelerated load growth could lead to increased greenhouse gas emissions and pollution if the higher demand is met primarily through fossil fuels. However, this could also present an opportunity to bolster investments in renewable energy sources such as wind and solar, particularly when paired with storage to increase the reliability and flexibility of renewable power. By investing in hybrid renewable resources instead of new or upgraded fossil fuel resources, the Commonwealth can avoid significant ratepayer costs and societal damages

[5] Accessed via S&P Global Capital IQ

[6] Virginia State Corporation Commission. (2023). Exhibit No. 2. Case No. PUR-2023-00066.

[7] Virginia State Corporation Commission. (2023). Exhibit No. 22. at PP 14-15. Case No. PUR-2023-00066.

from reduced RPS deficiency penalties and emissions without compromising system reliability.

The remaining sections of this Report explain how Dominion can meet expected load growth by developing a long-term resource plan that improves the company's ability to meet Virginia's clean energy mandates.

2 Resource Plan Objectives

Dominion can meet forecasted load growth while achieving substantial reductions in emissions, ratepayer costs, and societal damages without compromising system reliability or facing greater interconnection risk by prioritizing the following resource plan objectives:

1. Improve compliance with VCEA mandates;
2. Reduce energy generation and capacity costs;
3. Reduce transmission and distribution capacity costs;
4. Reduce PJM energy and capacity market clearing prices;
5. Reduce RPS deficiency penalty costs;
6. Reduce societal damages;
7. Increase local economic benefits;
8. Maintain system reliability;
9. Minimize interconnection delays; and
10. Minimize stranded costs.

2.1 Improve Compliance with VCEA Mandates

Under the VCEA, Dominion, as a "Phase II" utility, is required to follow the annual RPS targets, which establish the minimum share of the utility's total electrical energy sales that must come from renewable sources:

> In order to comply with the RPS Program, each Phase I and Phase II Utility may use and retire the environmental attributes associated with any existing owned or contracted **solar, wind, or falling water electric generating resources** in operation, or proposed for operation, in the Commonwealth or physically located within the PJM region, with such resource qualifying as a Commonwealth-located resource for purposes of this subsection, as of January 1, 2020, provided such renewable attributes are verified as RECs consistent with the PJM-EIS Generation Attribute Tracking System.

The **RPS Program requirements shall be a percentage of the total electric energy sold** in the previous calendar year and shall be implemented in accordance with the following schedule:

Figure 1 VCEA RPS Requirements

Year	*Phase I Utilities*	*Phase II Utilities*
2021	*6%*	*14%*
2022	*7%*	*17%*
2023	*8%*	*20%*
2024	*10%*	*23%*
2025	*14%*	*26%*
2026	*17%*	*29%*
2027	*20%*	*32%*
2028	*24%*	*35%*
2029	*27%*	*38%*
2030	*30%*	*41%*
2031	*33%*	*45%*
2032	*36%*	*49%*
2033	*39%*	*52%*
2034	*42%*	*55%*
2035	*45%*	*59%*
2036	*53%*	*63%*
2037	*53%*	*67%*
2038	*57%*	*71%*
2039	*61%*	*75%*
2040	*65%*	*79%*
2041	*68%*	*83%*
2042	*71%*	*87%*
2043	*74%*	*91%*
2044	*77%*	*95%*
2045	*80%*	*100%*
2046	*84%*	*100%*
2047	*88%*	*100%*
2048	*92%*	*100%*
2049	*96%*	*100%*
2050	*100%*	*100%*

Dominion is also required to account for the Environmental Protection Agency's (EPA) Social Cost of Carbon when determining the economic viability of any plans to construct a new generation resource:

> In any application to construct a new generating facility, the utility shall include, and the Commission shall consider, the social cost of carbon, as determined by the Commission, as a benefit or cost, whichever is appropriate.[8]

The EPA's Social Cost of Carbon is an economic measure of the long-term damages caused by each additional ton of carbon dioxide emissions. It was developed by a federal interagency working group in 2009 to help agencies and regulators monetize the impacts of greenhouse gas emissions when analyzing the costs and benefits of proposed regulations and projects. The Social Cost of Carbon provides a dollar value for the future economic damages associated with climate change impacts like rising seas, stronger storms, lost agricultural productivity, and risks to human health. For Dominion, an electric utility that relies heavily on fossil fuels, the Social Cost of Carbon highlights the real economic consequences of its carbon-intensive electricity generation. As Dominion considers future plans and investments in Virginia, the Social Cost of Carbon emphasizes the need to transition away from coal and gas plants and toward carbon-free renewable energy sources.

2.2 Reduce Energy Generation & Capacity Costs

Customers can realize consistent and material savings on their utility bills if the fuel needed to power generation resources or the type of generation resource needed to meet customer demand becomes less costly, as is the case when a utility transitions away from traditional fossil fuel-fired resources to cheaper and more sustainable renewable resources.

Energy generation costs refer to the cost of fuel needed to generate power. Whereas conventional fossil fuel-fired resources require a constant flow of expensive, polluting, and potential volatile commodities such as coal, oil, or gas to generate power, renewable resources can effectively generate power for free because there is no cost to harvesting sunlight or wind once a new power plant is built. Therefore, renewable resources can "avoid" the need to generate costly power from polluting resources, thereby resulting in lower ratepayer costs.

Generation capacity costs are the expenses that a utility or grid operator avoids by not having to invest in, operate, and maintain additional power generation infrastructure by procuring an equivalent amount of generation capacity from renewable resources. The term "capacity" here refers to the maximum output that a power plant or a power system can produce. Avoidable generation capacity refers to the value that is created by reducing the need for additional or upgraded traditional power plants like coal, gas, or nuclear, which are often

[8] Virginia Code, § 56-585.1(A)(6)

expensive to build, run, and maintain. For example, the supply of customer-sited power decreases the overall demand that the utility or grid operator needs to meet. As a result, the utility does not have to rely as much on traditional power plants or invest in building new ones to meet peak demands. When the need for traditional power plants decreases, the associated costs of these plants – capital costs, operation and maintenance costs, and even decommissioning costs at the end of their life – are also avoided. This is a saving for the utility, and depending on the regulatory context, these savings may also be passed on to consumers in the form of lower energy bills.

2.3 Reduce Transmission and Distribution Capacity Costs

The need to invest in costly transmission and distribution capacity can be reduced by increasing solar capacity additions – particularly for solar that is sited behind a customer's meter or that is close to load centers. For example, generating solar at a customer's site or at a nearby location will reduce the need for extensive investments in transmission lines, substations, transformers, and distribution lines, thereby lowering the associated capacity costs that would otherwise have been incurred and passed on to ratepayers. The cost savings are referred to as "avoided" because they represent expenses that utilities would otherwise have to incur to expand and maintain the grid infrastructure necessary to accommodate increasing demand or replace aging infrastructure.

2.4 Reduce PJM Energy and Capacity Market Prices

Dominion can reduce the costs it incurs when buying energy and capacity from PJM's wholesale power market by building or contracting supply from renewable energy generation resources, which can be cheaper to build and operate than conventional fossil fuel-fired resources.

In the context of wholesale power markets such as PJM, the ability to reduce energy or capacity market-clearing prices arises from the "merit order" ranking sequence in which sources of electrical power are dispatched based on their cost of production. The cheapest source of power is dispatched first, then the next cheapest, and so on. This ranking includes all possible power sources, such as coal, natural gas, nuclear, wind, solar, etc. Each power source's placement on the merit order is determined by their marginal cost, i.e., the cost to produce an additional unit of power. The merit order usually starts with renewable energy sources like wind and solar because their marginal cost is close to zero, as wind and solar power are effectively free sources of energy. After renewables, traditional power plants like nuclear and hydro are dispatched, followed by coal and then natural gas plants, which usually have the highest marginal cost. In power markets, the price for electricity is often set

by the last (or most expensive) source of power dispatched – this is sometimes referred to as the marginal or market-clearing price. During periods of high demand, if a higher-cost power plant is needed to meet the additional system demand because lower-cost resources are unavailable, the price for all electricity sold in that period would be set at the marginal cost of the more expensive resource.

For example, in 2022, Dominion and its affiliates purchased 29,850 GWh of power from wholesale markets.[9] Using the average price of electricity for the Dominion zone in PJM, $90.84/MWh,[10] as a simplifying proxy for the average cost of PJM energy market purchases during this period, this implies a total annual cost of more than $2.7 billion. Even assuming just a 1% reduction to the market-clearing price for energy would still translate into $27 million in annual ratepayer savings, all else being equal.

2.5 Reduce RPS Deficiency Penalties

Utilities that fail to comply with the VCEA's RPS requirements will incur an RPS deficiency penalty ranging from $45/MWh to $75/MWh beginning in 2021, with the cost of subsequent annual penalties escalating at a rate of 1% per year. This means that the more generation that comes from fossil fuels, the more Virginian ratepayers will have to pay for RPS penalties. Therefore, it is critical that Dominion's resource plan improve compliance with the VCEA to protect ratepayers in the Commonwealth from unnecessary and avoidable RPS penalties.

2.6 Reduce Societal Damages

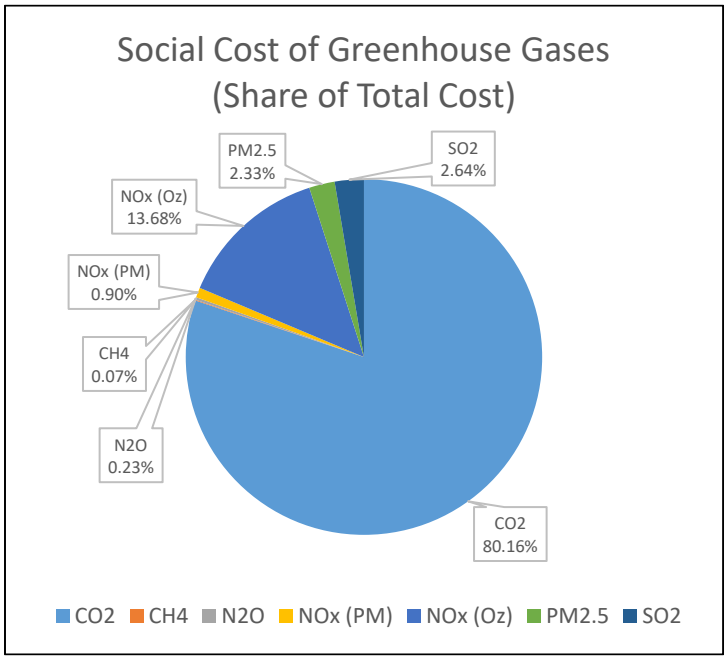
Societal damages refer to the known and measurable health and environmental costs caused by the emissions and air pollutants generated by fossil fuel-fired power plants. As noted previously, Dominion is required to account for the societal damages from CO2, which is one of the primary sources of harmful and costly greenhouse gas emissions.

Under the EPA's Social Cost of Greenhouse Gases framework, the Social Cost of Carbon equates to 80% of the total Social Cost of Greenhouse Gases.

[9] U.S. Energy Information Administration. (2023). Form EIA-861: Annual Electric Power Industry Report.

[10] Monitoring Analytics. (2022). Table 3-54: State of the Market Report for PJM.

Figure 2 Social Cost of Greenhouse Gases Breakdown



While this breakdown of the EPA's Social Cost of Greenhouse Gases highlights the relatively large cost share comprised by CO2, it also shows that the remaining emissions and pollutants still comprise a material share of the full scope of damages caused by fossil fuels. Therefore, it is critical that each of the emissions and pollutants be reflected in any assessment of Dominion's plans to build or retire new resources.

2.7 Increase Local Economic Benefits

Local economic benefits refer to the incremental job growth and investment in communities where new solar projects are built. The process of constructing and operating solar power plants can stimulate local economies by creating jobs, often in areas such as construction, electrical work, and project management, and circulate money within the community. When comparing different types of generators on a dollar-per-kilowatt of installed capacity, building small-scale behind-the-meter solar projects can generate more jobs and local economic growth than larger, traditional resources.[11] Additionally, these projects can lead to the development of local skills and capacities, further benefiting the local economy. Increasing the amount of renewable generation capacity that is located closer to the communities they would serve would not only decrease energy waste and offer

[11] Virginia State Corporation Commission. (2021). Exhibit No. 21, Section 4.3. Case No. PUR-2020-00134.

environmental advantages but also spur local economic growth, providing multi-faceted economic benefits for Virginia.

2.8 Maintain System Reliability

Improved system reliability can arise from the ability of standalone or hybrid solar systems to provide a redundant source of power and shift load from periods of high demand to periods of low demand, thereby reducing the risk of power outages. In PJM, one of the main metrics used to gauge the ability of a generation technology class (e.g., coal, wind, standalone solar, hybrid solar-plus-storage, etc.) to maintain system reliability is referred to as ELCC:

> To recognize the unique operating characteristics and contributions of renewable and storage resources, PJM and its stakeholders adopted an approach called the Effective Load Carrying Capability (ELCC). The ELCC method allows PJM to measure how much capacity may be provided by renewable and storage resources while ensuring resource adequacy. PJM's ELCC method was accepted by the Federal Energy Regulatory Commission in July 2021…In general, a resource that contributes a significant level of capacity during high-risk hours (i.e., hours with very high electricity demand and low wind or solar output) will have a higher capacity value under ELCC than a resource that delivers the same capacity during low-risk hours…PJM's ELCC methodology also considers the simultaneous reliability contribution of all resources and recognizes both complementary and opposing interactions among resources expected to provide capacity in a given delivery year.[12]

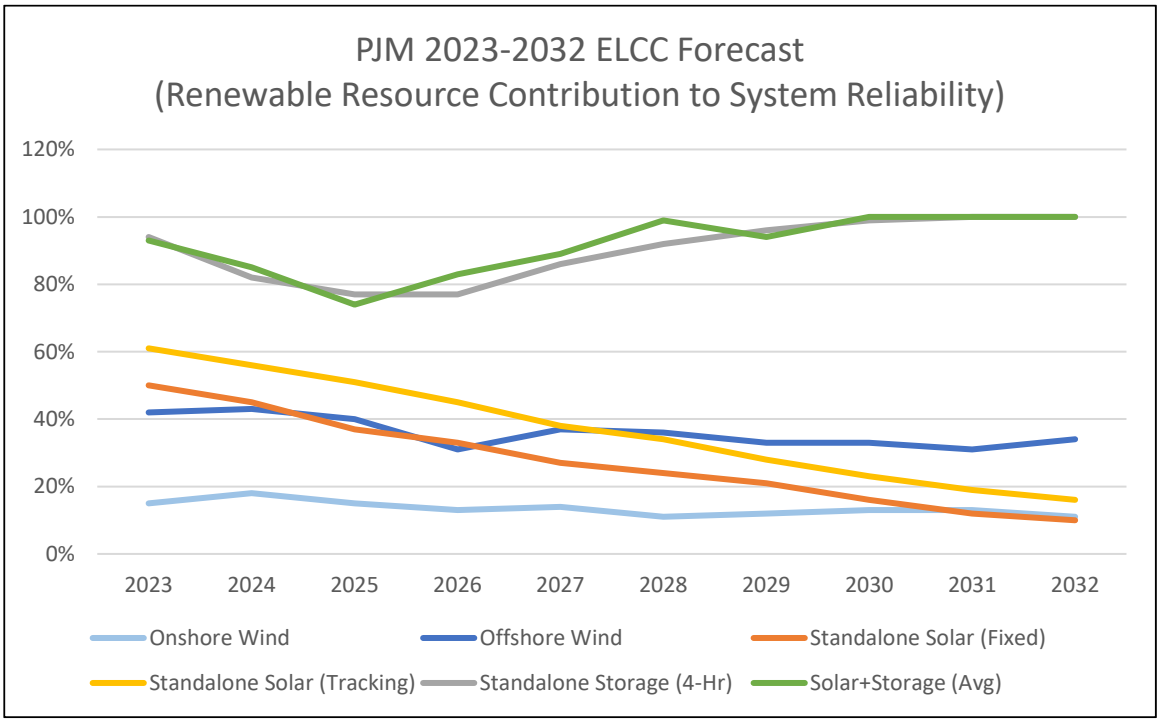
Under PJM's ELCC framework, paring solar with storage not only provides an effective means of ensuring system reliability today, as PJM credits these resources with 93% of their installed capacity, but also provides increasing resource adequacy and the associated system reliability benefits over time, as PJM expects that hybrid solar-plus-storage (S+S) resources will be able to "carry" 100% of the load it serves.[13]

[12] PJM Interconnection, LLC. (2022). Effective Load Carrying Capability Measures

Capacity Contribution of Renewables, Storage.

[13] PJM Interconnection, LLC. (2023). December 2022 Effective Load Carrying Capability (ELCC) Report.

Figure 3 2023-2032 ELCC Class Ratings for RPS Resources in PJM



This chart shows that S+S (green line) can contribute to grid reliability to a much greater degree than standalone generation resources. As the reliability of the power grid improves from the increased deployment of S+S systems, power outages will decrease in frequency and duration, all else being equal. These improvements are crucial as power disruptions can lead to significant economic costs, such as lost business revenue, damaged equipment, and productivity loss. Therefore, building more S+S can maintain or even increase system reliability and provide an additional layer of economic benefits for the Commonwealth.

2.9 Minimize Interconnection Delays

One of the main challenges in transitioning to a cleaner power grid is navigating the interconnection queue process, which has become increasingly challenging as power plant developers face mounting delays, costs, and uncertainties when trying to secure interconnection rights for their projects. Without these rights, developers are unlikely to build new projects.

To mitigate the risk of interconnection queue delays or related challenges, Dominion can use PJM's Generator Replacement or Surplus Interconnection Service processes. The Generator Replacement process allows existing resources to transfer their capacity interconnection rights to a new, planned resource once the existing resource retires from the market. The Surplus Interconnection Service provides another alternative interconnection strategy that

can be used to accelerate the deployment of renewable energy generators and storage resources by bypassing the conventional interconnection queue process. This FERC-approved process allows a new resource to co-locate at the existing facility's point of interconnection, with energy injection split between the resources up to the maximum output level for the existing facility. For example, the Companies could install a 100 MW battery or hybrid resource at the site of an existing 100 MW Natural Gas Combustion Turbine (NGCT). Either resource or both could inject energy onto the grid so long as the aggregate output does not exceed 100 MW. Surplus Interconnection Service interconnection studies occur outside the conventional queue process and take approximately 255 days to complete. Therefore, it provides a viable means of expediting the deployment of new technologies such as energy storage, which are necessary for reliability as reliance on renewable resources grows. Because the new resources rely on the existing generator's interconnection facilities, it lowers transmission costs.

2.10 Minimize Stranded Costs

Stranded costs refer to the potential losses to electric utilities when forced to retire a generation resource before it can fully recover its investment costs. To minimize the prospect of Dominion incurring stranded costs, we recommend retiring Dominion's fossil fuel-fired generators after they have operated for a full 20 years. 20 years is a reasonable retirement trigger because it reflects a conservative estimate for the length of time required by most conventional generation resources to fully recover their investment costs. For example, PJM uses a default assumed capital recovery period of 20 years for all new resources entering the market:

> The financial modeling assumptions for calculating Cost of New Entry for Generation Capacity Resources shall be: (i) nominal levelization of gross costs, (ii) **asset life of twenty years**, (iii) no residual value, (iv) all project costs included with no sunk costs excluded, (v) use first year revenues (which may include revenues from the sale of renewable energy credits for purposes other than state-mandated or state-sponsored programs), and (vi) weighted average cost of capital based on the actual cost of capital for the entity proposing to build the Capacity Resource.[14]

Similarly, the National Renewable Energy Laboratory (NREL) assumes a capital recovery period ranging from 20 to 30 years:

[14] PJM Interconnection, LLC. (2023). § 5.4.8.3. Manual 18. (emphasis added)

Cost Recovery Period: Both cases assume a constant cost recovery period—or period over which the initial capital investment is recovered—of 30 years for all technologies. The ATB also provides an option to look at cost recovery over a 20-year period, and a "tech life" period where the lifetime varies by technology.[15]

To put this in context, Dominion will have nearly 8.5 GW of fossil fuel capacity that can be retired without risking stranding any of its assets over the next ten years. By accelerating the retirement of these resources, Dominion can significantly improve its compliance with the VCEA if it replaces these resources with clean and reliable hybrid renewable energy and storage resources.

3 Resource Plan Recommendations

This section of the Report summarizes the core recommendations for developing a resource plan that accelerates the transition to renewable energy while maintaining system reliability and minimizing ratepayer impacts. The recommended plan outlines several key strategies, which include:

1. Accelerating the retirement of coal and gas-fired power plants to reduce greenhouse gas emissions in line with Virginia's clean energy goals.
2. Utilizing PJM's Generator Replacement process to mitigate interconnection queue delays.
3. Adding battery storage deployments at existing facilities through PJM's Surplus Interconnection process to improve the reliability of co-located renewable energy generators.
4. Expanding behind-the-meter solar energy adoption through net metering and financial incentives to ensure more diverse and equitable distribution of clean energy generation resources.
5. Increasing energy efficiency investments and demand response programs to reduce overall energy consumption.

3.1 Accelerate Retirements of Coal and Gas Resources

The need to retire Dominion Energy's existing coal and gas generators ahead of their proposed retirement dates is driven by several critical factors. First, these fossil fuel-based plants are significant contributors to greenhouse gas emissions, exacerbating climate

[15] National Renewable Energy Laboratory. (2023). Financial Cases and Methods. Annual Technology Baseline.

change and impacting public health through air pollution. Second, the regulatory landscape is shifting towards stricter environmental controls, making it more expensive to operate these aging assets in the long run. Third, the public and investors increasingly prefer companies with a strong commitment to environmental responsibility. Fourth, renewable generation and storage technologies can be more cost effective than fossil fuel resources as build costs continue to fall and the expansion of market incentives through the Inflation Reduction Act improve project returns for clean energy investors. Lastly, Dominion's aging fossil fuel resources can be retired without risking any stranded assets as these resources have operated over decades and have likely already fully recovered their sunk costs.

3.2 Replace Retiring Fossil Fuel-Fired Resources with Renewables

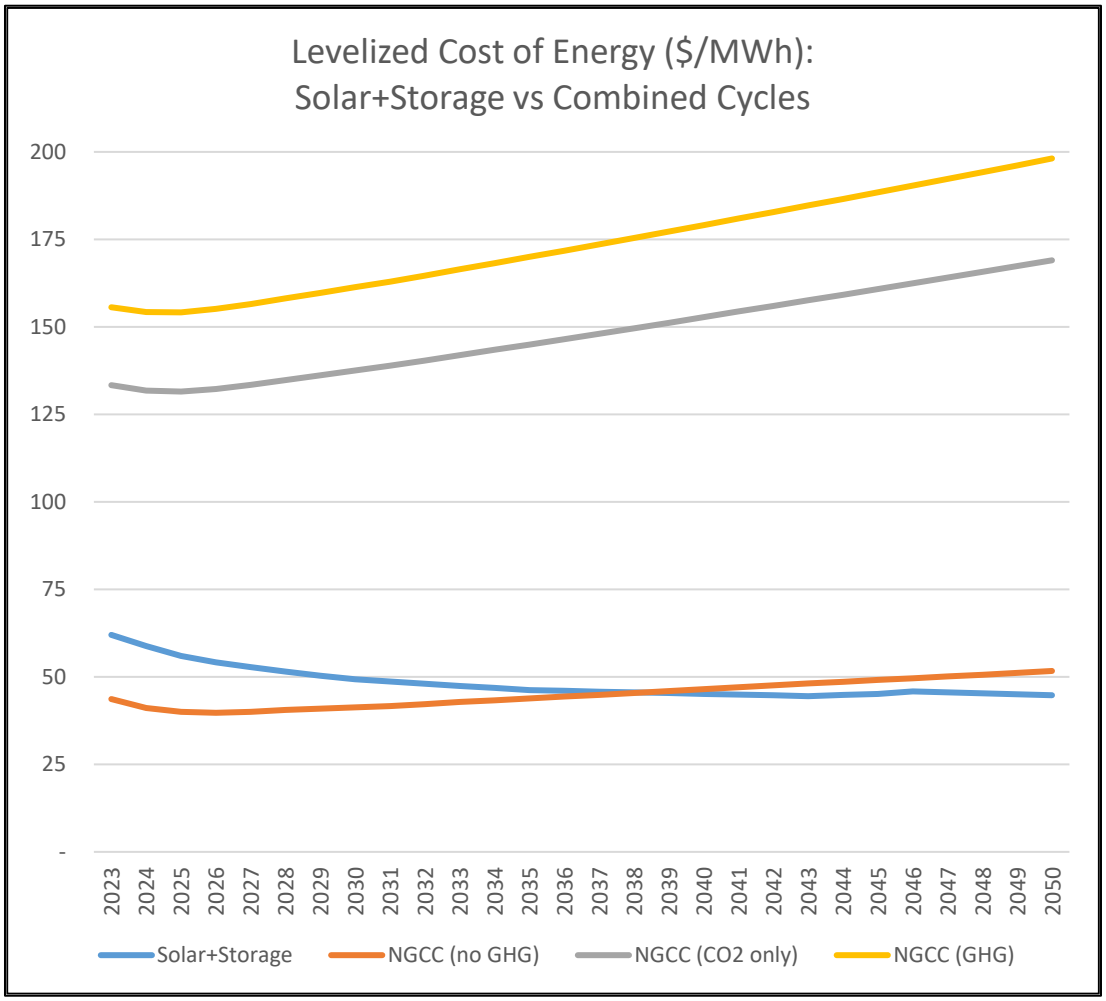
PJM's Generator Replacement process allows existing resources to transfer their capacity interconnection rights to a new, planned resource once the existing resource retires from the market. As Dominion retires its resources from the market, it can bypass PJM's volatile and lengthy interconnection queue process by transferring the existing interconnection rights from its retiring resource to new resources. Given the VCEA RPS mandates, Dominion should replace its retiring fossil fuel-fired resources with cheaper and cleaner alternatives without requiring any changes to PJM's interconnection process or facing any risk of interconnection queue uncertainty. This is one of the fastest and most cost-effective means of getting new renewable energy resources online.

3.3 Increase Storage Using Surplus Interconnection Queue Process

The Surplus Interconnection Service provides another alternative interconnection strategy that can be used to accelerate the deployment of renewable energy generators and storage resources by bypassing the conventional interconnection queue process. This FERC-approved process allows a new resource to co-locate at the existing facility's point of interconnection, with energy injection split between the resources up to the maximum output level for the existing facility. For example, the Companies could install a 100 MW battery or hybrid resource at the site of an existing 100 MW NGCT. Either resource or both could inject energy onto the grid so long as the aggregate output does not exceed 100 MW. Surplus Interconnection Service interconnection studies occur outside the conventional queue process and require approximately 250 days to complete. Therefore, it provides a viable means of expediting the deployment of new technologies like energy storage necessary for reliability as reliance on renewable resources grows. Because the new resources rely on the existing generator's interconnection facilities, it lowers transmission costs.

S+S resources generate emissions-free power at zero marginal cost and provide one of the most reliable and cost-effective forms of renewable power available today. As the cost to build and operate solar and storage resources continues to decline, S+S resources can be cheaper on a levelized cost of energy (LCOE) basis than natural gas combined cycles, which have historically been viewed as one of the most economical sources of power.

Figure 4 Levelized Cost of Energy Comparison



This chart compares the projected LCOE of S+S (blue line) and natural gas combined cycles (NGCC) resources from 2023 through 2050 using data from the EIA, NREL, and EPA. The S+S LCOE totals were developed using NREL's 2023 Annual Technology baseline and EIA's 2023 Annual Energy Outlook. The NGCC totals were developed using EIA's 2023 Annual Energy Outlook, as NREL does not provide comparable data for NGCC resources. We included three estimates for NGCC resources: LCOE totals that *exclude* all greenhouse gas costs (orange line), totals that *include* just the EPA's Social Cost of Carbon (gray line), and totals that include

the EPA's full Social Cost of Greenhouse Gases (yellow line). Although the Virginia Code requires Dominion to account for the EPA's Social Cost of Carbon when developing plans to build or retire generation assets, it is critical that Dominion also account for each of the additional sources of emissions to ensure that ratepayers are not subsidizing Dominion's fossil fuel-fired power plants.

The chart shows that NGCC resources are significantly more expensive than S+S resources except when excluding the cost of carbon or all greenhouse gas emissions. However, even when excluding the cost of carbon, S+S resources are still projected to be cheaper than NGCC resources by 2039. Nevertheless, excluding the Social Cost of Carbon from long-term resource planning is contrary to the Virginia Code and imprudent as the risks associated with investing in fossil fuels continue to rise. Therefore, S+S clearly provides one of the best options for Virginia to efficiently transition to a clean energy economy.

3.4 Expand Behind-the-Meter Solar

The need to increase behind-the-meter (BTM) solar generation in Dominion's IRP is underscored by several key considerations. BTM solar can improve grid resilience by distributing energy production, thus easing the burden on centralized facilities and networks. It also empowers consumers to take control of their energy needs, offering the dual benefits of cost savings and environmental responsibility. This aligns well with governmental goals for renewable energy and carbon reduction, making it not just an environmental imperative but also a policy-driven one.

From a feasibility standpoint, advances in solar panel and battery technologies have made BTM solar and storage more efficient and reliable. From a cost standpoint, policy-driven financial incentives ranging from net metering to tax credits help to reduce customer utility bills and improve investor returns, thereby expanding access to clean and cost-efficient BTM solar and storage generation.

3.5 Expand Energy Efficiency

The need to enhance energy efficiency and demand response in Dominion's IRP is reinforced by several factors. First, improving energy efficiency reduces overall energy consumption, which directly cuts greenhouse gas emissions and lowers costs for both the utility and consumers. Demand response can also optimize grid operations, reducing the need for peaking plants that often rely on fossil fuels. These strategies not only align with environmental goals but are often supported by policy incentives aimed at reducing energy use and emissions.

The feasibility of ramping up energy efficiency and demand response measures is high given today's technology and policy landscape. Energy-efficient appliances and smart meters are becoming increasingly affordable and accessible. Demand response programs, often facilitated by smart grid technologies, can be implemented without substantial infrastructure changes, allowing consumers to participate through existing home systems. Financial incentives and rebates further encourage the adoption of energy-efficient practices and appliances among consumers.

4 Resource Plan Summary

Consistent with the objectives outlined above, our recommended alternative to Dominion's resource plan relies on the following assumptions:

1. Load Growth: Use Dominion's "Adjusted PJM Load Forecast" from its 2023 IRP.
2. Starting Capacity: Hold constant Dominion's installed[16] and contracted[17] renewable generation capacity for the entire forecast period, under the conservative assumptions that the installed capacity would continue to operate and the contracted capacity would be renewed or replaced with an equivalent amount of capacity from comparable resources.
3. Resource Retirements: Accelerate the retirement of 8.5 GW of aging fossil fuel capacity, which has operated for at least 20 years.
4. Resource Additions:
    a. Include all solar, wind, and storage additions proposed by Dominion in Plan B of the 2023 IRP.
    b. Replace retiring fossil fuel resources with a diverse range of solar resources including utility-scale front-of-the-meter (FTM) resources, smaller-scale BTM resources, and contracted capacity with resources owned by third parties.
    c. Add battery storage to the sites of existing and planned renewable energy generators using PJM's Surplus Interconnection Queue process.
5. Plan Costs: include the cost of RPS penalties and the EPA's Social Cost of Greenhouse Gases to improve compliance with the VCEA.

[16] U.S. Energy Information Administration. (2023). Form EIA-860: Annual Electric Power Industry Report.

[17] Virginia State Corporation Commission. (2023). Exhibit No. 2, Appendix 5B. Case No. PUR-2023-00066.

We note that there are several additional feasible and cost-effective updates which can and should be made (e.g., increasing energy efficiency, increasing electricity imports, increasing offshore wind, etc.). We also note that the recommended resource plan does not provide individual estimates for the amount of incremental capacity that should be devoted to BTM or contracted solar, for example, as the focus of this Report is to provide a high-level alternative to Dominion's proposed resource plan rather than quantify the exact changes to all supply and demand drivers for each year of the long-term resource plan forecast. For simplicity, our recommended resource plan only reflects the five groups of assumptions listed above as these factors provide the most feasible and cost-effective solutions for Dominion to immediately and sustainably improve its ability to comply with the VCEA.

The following tables compare the recommended resource plan with Dominion's proposed resource plan (Plan B) from the 2023 IRP.

Figure 5 Recommended Plan Summary

Year	Load (GWh)	RPS Target (GWh)	Cumulative Fossil Fuel Retirements (MW)	Cumulative Solar Capacity (MW)	Cumulative Wind Capacity (MW)	Cumulative Storage Capacity (MW)	Total Emissions (MT)	RPS Penalty Cost ($M)	GHG Damages ($M)	Total RPS CapEx ($M)
2024	128,855	29,637	1,406	3,167	12	1,406	6.42	993	2,422	5,560
2025	136,328	35,445	3,859	5,621	12	3,859	6.25	976	2,381	5,318
2026	150,796	43,731	6,683	8,444	12	6,683	6.52	1,028	2,509	6,031
2027	163,997	52,479	6,683	9,059	12	6,683	8.64	1,377	3,358	813
2028	177,605	62,162	7,040	10,106	272	7,130	10.41	1,675	4,086	2,086
2029	189,774	72,114	7,219	10,990	272	7,429	12.67	2,059	5,022	1,355
2030	201,819	82,746	7,219	11,755	272	7,579	15.23	2,499	6,095	1,072
2031	214,320	96,444	7,778	13,325	332	8,318	17.99	2,982	7,274	2,572
2032	226,951	111,206	8,446	15,004	332	9,166	21.05	3,524	8,595	2,663
2033	237,408	123,452	8,446	16,015	2,932	9,406	20.92	3,538	8,629	13,475
Total	**1,827,853**	**709,416**	**8,446**	**16,015**	**2,932**	**9,406**	**126.12**	**20,650**	**50,370**	**40,945**
NPV								12,536	30,578	27,029

Figure 6 Dominion Plan Summary (2023 IRP Plan B)

Year	Load (GWh)	RPS Target (GWh)	Cumulative Fossil Fuel Retirements (MW)	Cumulative Solar Capacity (MW)	Cumulative Wind Capacity (MW)	Cumulative Storage Capacity (MW)	Total Emissions (MT)	RPS Penalty Cost ($M)	GHG Damages ($M)	Total RPS CapEx ($M)
2024	128,855	29,637	-	1,761	12	-	7.58	1,171	2,857	2,435
2025	136,328	35,445	-	1,761	12	-	9.31	1,454	3,547	-
2026	150,796	43,731	-	1,761	12	-	11.79	1,860	4,537	-
2027	163,997	52,479	-	2,376	12	-	13.95	2,223	5,421	813
2028	177,605	62,162	-	3,066	272	90	16.05	2,581	6,296	1,349
2029	189,774	72,114	-	3,771	272	210	18.49	3,004	7,328	993
2030	201,819	82,746	-	4,536	272	360	21.09	3,461	8,442	1,072
2031	214,320	96,444	-	5,547	332	540	24.36	4,037	9,846	1,471
2032	226,951	111,206	-	6,558	332	720	28.00	4,687	11,433	1,358
2033	237,408	123,452	-	7,569	2,932	960	27.93	4,723	11,520	13,475
Total	**1,827,853**	**709,416**	**-**	**7,569**	**2,932**	**960**	**178.56**	**29,200**	**71,227**	**22,967**
NPV								17,884	43,625	12,789

Figure 7 Recommended Plan Avoided Emissions Summary

Year	*Dominion Plan Total Emissions (MT)*	*Recommended Plan Total Emissions (MT)*	*Recommended Plan Avoided Emissions (MT)*
2024	7.58	6.42	1.15
2025	9.31	6.25	3.06
2026	11.79	6.52	5.27
2027	13.95	8.64	5.31
2028	16.05	10.41	5.63
2029	18.49	12.67	5.82
2030	21.09	15.23	5.86
2031	24.36	17.99	6.36
2032	28.00	21.05	6.95
2033	27.93	20.92	7.01
Total	**178.56**	**126.12**	**52.44**

Figure 8 Recommended Plan Net Savings Summary

Year	*Dominion Plan Total Costs ($M)*	*Recommended Plan Total Costs ($M)*	*Recommended Plan Total Savings ($M)*
2024	8,753	10,917	(2,164)
2025	7,844	10,584	(2,740)
2026	10,033	11,579	(1,546)
2027	12,802	8,239	4,564
2028	15,273	11,122	4,152
2029	17,200	12,462	4,738
2030	19,743	14,551	5,192
2031	23,246	18,658	4,588
2032	26,643	21,671	4,972
2033	38,952	32,559	6,393
Total	**180,490**	**152,342**	**28,148**
NPV	109,267	94,654	14,614

Over the next ten years, the recommended resource plan would drastically reduce emissions, ratepayer costs, and societal damages while maintaining system reliability and without increasing interconnection queue risk, avoiding 52 million tons of emissions and $28 billion in costs when compared with the Dominion Plan. On a present value basis, this translates to nearly $15 billion in cost savings.

It is also important to reiterate that the estimated benefits shown in these tables are conservative because they are based on load forecast that reflects lower growth assumptions than PJM's load forecast and just two of the value streams we've identified in this Report: avoided RPS deficiency penalties and societal damages from emissions, both of which are mandated by the VA code. In reality, a resource mix that includes more renewable and hybrid storage resources will generate significantly more benefits than the simplified and conservative estimates outlined above.

Conclusion

This Report demonstrates that Dominion can meet projected load growth over the next ten years while improving compliance with Virginia's clean energy mandates, minimizing ratepayer costs, and maintaining system reliability without facing greater interconnection risk.

Our analysis shows Dominion's load forecasts exceed historical trends, indicating the potential for increased greenhouse gas emissions and pollution if the higher demand is met primarily through fossil fuels. Dominion can avoid these harmful outcomes, however, by accelerating the retirement of 8.5 GW of aging fossil capacity and replacing it with renewable energy and storage. This approach provides an efficient path to clean, reliable, and affordable power generation.

As renewable costs decline, clean energy resources like solar, wind, and storage increasingly offer the lowest cost options for ratepayers. A renewable-focused plan that accounts for the full social cost of greenhouse gases will reduce harmful emissions and air pollutants, lower customer bills, and limit societal damages.

This Report demonstrates that with just a few relatively simple changes to Dominion's resource plan, the company can meet Virginia's clean policy goals in a timely and cost-effective manner, putting Dominion on track to achieve carbon-free electricity by 2050.

INDEX OF ACRONYMS AND ABBREVIATIONS

BTM	Behind-the-Meter
CAGR	Compound Annual Growth Rate
CCAN Action Fund	Chesapeake Climate Action Network Action Fund
DOM	Dominion Zone (located within PJM)
Dominion	Dominion Energy
EIA	U.S. Energy Information Administration
ELCC	Effective Load Carrying Capability
EPA	U.S. Environmental Protection Agency
EV	Electric Vehicle
FERC	Federal Energy Regulatory Commission
FTM	Front-of-the-Meter
Gabel	Gabel Associates, Inc.
GW	Gigawatt
GWh	Gigawatt Hours
lb/MWh	Pounds per Megawatt Hour
LSE	Load-Serving Entity
MW	Megawatt
MWh	Megawatt Hours
NGCC	Natural Gas Combined Cycle
NGCT	Natural Gas Combustion Turbine
NREL	National Renewable Energy Laboratory
PJM	PJM Interconnection
IRP	Integrated Resource Plan
RPS	Renewable Portfolio Standard
RTO	Regional Transmission Organization
S+S	Hybrid solar photovoltaic system paired with battery storage
SCC	State Corporation Commission
Solar PV	Solar Photovoltaic
VCEA	Virginia Clean Economy Act of 2020
VEPCO	Virginia Electric and Power Company