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The Virginia Challenge: Meeting Energy Demand Affordably

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THE CHALLENGE OF BALANCING CLIMATE AMBITION WITH REALITY

Virginia's energy policy is at a critical inflection point. The rigid, technology-specific mandates of the Virginia Clean Economy Act (VCEA), which legally commits the state to a 100% carbon-free electricity grid by 2045, are on a direct collision course with the skyrocketing energy demand from its world-leading data center industry. In 2020, this landmark legislation was enacted by a Democratic legislative majority on a mostly party-line vote and signed into law by then-Governor Ralph Northam. The world has since shifted dramatically, redefined by a surge in electricity demand from an industry that is both a pillar of the modern economy and a monumental consumer of power.

This conflict poses a risk to the Commonwealth's energy future. Unless Virginia adopts a more pragmatic approach that prioritizes reliable, clean firm power, i.e., sources that are both low-carbon and available on demand, it risks severe grid instability. Such a crisis would not only jeopardize the state's long-held advantage of affordable energy but could also paradoxically undermine its own climate goals by forcing reliance on less clean measures like prolonged coal generation and fuel oil peaker plants to maintain grid integrity.

To navigate this challenge, policymakers must first recognize the foundations of the state's prior success. Understanding Virginia's impressive pre-VCEA decarbonization achievements is crucial to charting a sustainable path forward that aligns its climate ambitions with the realities of its growing energy needs.

It is also important to note that while the VCEA primarily addresses carbon emissions from electricity generation, the largest source of emissions in Virginia is the transportation sector at 53%, followed by electricity generation at 23% *(Fig. 1).*

VIRGINIA'S ADVANTAGE: A HEAD START ON GAS AND NUCLEAR

Virginia's emissions profile demonstrates a history of effective decarbonization that predates the VCEA, positioning it as a national leader in carbon efficiency *(Fig. 2)*. This progress was driven

by a strategy centered on replacing high-carbon coal with a combination of lower-carbon natural gas and zero-carbon nuclear power.

Emissions Profile: In 2023, Virginia's per capita carbon emissions were 10.8 tons, 24% below the national average *(Fig. 3)*. Since 2005, the state has reduced its total emissions at an impressive rate of 1.7% annually, significantly outpacing the U.S. average of 1.2% (*see Appendix*).

Economic Efficiency: The state's economy is remarkably carbon efficient. Virginia emitted just 158 tons of CO_2 for every $1 million of economic output in 2023, ranking it the 12th lowest in the country, and 25% below the national average *(Fig. 4)*.

The primary driver of this success was a strategic shift away from coal and toward a clean-firm power baseload supply that includes nuclear and natural gas *(Fig. 3)*. In 2024, Virginia's electricity grid was powered 59% by natural gas and 28% by nuclear energy, while coal's contribution had been reduced to a mere 2%. This gas-plus-nuclear mix was directly responsible for halving the electricity sector's emissions over the last two decades by systematically replacing coal-fired generation.

This proven track record of decarbonization, achieved through a focus on reliable and dispatchable low-carbon resources, stands in contrast to the VCEA's more prescriptive approach, necessitating an evaluation of the Act's mandates in the context of 2025's new realities.

THE VIRGINIA CLEAN ECONOMY ACT: A REPORT CARD ON MANDATED GOALS

The Virginia Clean Economy Act (VCEA), enacted in 2020 on a party-line vote when Democrats had full control of state government, established a prescriptive statutory framework for a carbon-free grid. In the years leading up to 2020, the Green New Deal failed to gain sufficient traction at the federal level. Environmental activists refocused their efforts toward pushing state governments to implement strict mandates for steep emissions reductions and technology-specific renewable fuel goals.

The VCEA's core assumptions about future energy consumption did not account for the subsequent and unprecedented boom in demand, placing its rigid framework under immense strain. This prescriptive, renewables-only-focused approach marks a sharp departure from the state's proven decarbonization strategy, which relied on the dispatchable, 24/7 power supplied by its nuclear and natural gas assets.

The VCEA effectively created a statutory straitjacket by codifying specific, time-bound technology targets that utilities are legally required to meet.

- **Decarbonization Goal:** Mandates that Dominion Energy be 100% carbon-free by 2045 and Appalachian Power achieve the same by 2050.
- **Renewable Energy Targets:** Requires the development of 16,100 MW of solar and onshore wind capacity.
- **Offshore Wind:** Mandates the development of 5,200 MW of offshore wind capacity.
- **Energy Storage:** Sets a target for 3,100 MW of energy storage capacity by 2035.
- **Fossil Fuel Retirement:** Requires the phased retirement of nearly all coal-fired plants by the end of 2024 and mandates the closure of all other carbon-emitting plants by 2045 for Dominion Energy and 2050 for Appalachian Power.

In the current environment, the VCEA's performance reveals significant structural challenges. Despite an over twofold increase in generation since 2020, solar and wind still accounted for only about 7% of Virginia's total electricity mix in 2024. The law's foundational assumptions are proving outdated, as it failed to anticipate the 3.1% annual load growth driven primarily by data centers.

These rigid statutory mandates, conceived in an overheated political atmosphere of climate alarmism and a different economic era, are now being severely tested by an unprecedented demand shock *(Fig. 5)*.

THE LOOMING CRISIS: DATA CENTER ALLEY MEETS GRID CONSTRAINTS

Northern Virginia is now home to the world's largest and most critical cluster of data centers, key parts of the physical backbone powering the global digital economy. This concentration of digital infrastructure, while obviously a significant economic asset, is the primary driver of an unprecedented energy demand shock that is unique to the Commonwealth and is pushing the state's electrical grid to its limits.

The scale of this demand crisis is evident in key metrics that signal mounting pressure on the grid's reliability and cost structure.

- **Demand Shock:** Between 2019 and 2024, Virginia's electricity consumption grew at an annual rate of 3.1%. This is more than three times the national average growth rate of 0.9% over the same period.
- **Price Warning:** While residential electricity rates have remained affordable — 13% below the national average — wholesale market signals are flashing red. Wholesale electricity costs in the PJM Interconnection region, which serves Virginia, surged by over 40% in the first nine months of 2025.
- **Capacity Crunch:** The most alarming metric is the tripling of capacity charges in 2025. These are payments made to generators to ensure their availability during peak demand. Capacity charges rise when the market fears a shortage of reliable generators, a fear directly exacerbated by a policy that forces those same generators into retirement.

This collision is not theoretical. The VCEA legally mandates the retirement of the very firm, dispatchable power assets, specifically the natural gas fleet, that the state needs to backstop soaring demand and intermittent renewables. This creates a policy-induced reliability crisis and raises a critical strategic question: How can Virginia power its 21st-century digital economy while adhering to an unrealistic zero-carbon mandate?

A POLICY CROSSROADS: RE-EVALUATING THE PATH FORWARD

Virginia has arrived at a decision point. The Commonwealth can choose to adhere to inflexible legislative mandates that are increasingly disconnected from the physical realities of the grid, or it can pivot to a pragmatic strategy that embraces the state's proven strengths to ensure reliability, affordability, and continued decarbonization. This requires a shift from a technology-centric approach to an outcome-focused one.

Prioritize Clean-Firm Power

Virginia must evolve from a renewables-only mindset to a clean-firm power plus renewables strategy that explicitly values low-carbon sources available on demand. The state’s greatest climate asset is its nuclear generation, which provides the 24/7 carbon-free baseload power essential for data centers and overall grid stability. Rather than focusing exclusively on building intermittent resources like wind and solar, policy should also support and expand clean-firm assets. Furthermore, policymakers must acknowledge that high-efficiency, low-methane natural gas generation is a necessary partner to renewable expansion, providing the essential flexibility and reliability required to manage intermittency and meet peak demand. Investments in affordable battery storage will make solar more dispatchable, but it is not a singular solution for the scale of the demand crunch facing the Commonwealth.

Reform Inflexible Mandates

The VCEA's "reliability safety valve" must be reformed from a reactive backstop into a proactive planning tool. This provision, which allows the State Corporation Commission (SCC) to pause the retirement of fossil fuel plants if grid stability is threatened, must be strengthened to explicitly and proactively account for verified data center load growth and capacity warnings from PJM. Such a reform would shift the focus from rigid, calendar-based retirement dates to a more dynamic, reality-based approach to maintaining grid stability. This ensures that firm generation assets are not prematurely retired when they are critically needed to keep the lights on and power the economy.

Ensure Fair Cost Allocation

It is imperative to protect residential and small business ratepayers from bearing the infrastructure costs driven by the extraordinary growth of the tech sector, especially energy-intensive data centers. Virginia has already set a precedent for this. In November 2025, the SCC created a specific rate class for large data centers, requiring them to pay 60% of the

contracted generation demand and 85% of the transmission and distribution capacity built to serve their needs, a move intended “to help insulate ratepayers from the costs around the rapid build-out and construction of infrastructure.” This principle of fair cost allocation must be a cornerstone of future energy policy, ensuring that those who drive exceptional costs are responsible for them.

These recommendations provide a pragmatic framework for aligning Virginia's climate goals with its economic reality, securing a path that is both ambitious and achievable.

THE IMPERATIVE FOR A PRAGMATIC CLIMATE STRATEGY

Virginia's past success in reducing emissions was not an accident. It was the direct result of a pragmatic energy strategy. By replacing coal with a powerful combination of natural gas and nuclear power, the state built a clean firm baseload supply that delivered steady and substantial decarbonization while maintaining affordable and reliable electricity.

The current path dictated by the Virginia Clean Economy Act, with its rigid mandates and technology-specific targets, is fundamentally misaligned with the 2025 reality of surging demand. By forcing the retirement of reliable power sources precisely when demand is reaching unprecedented levels, the VCEA risks an energy crisis that could undermine both the state's economy and its climate progress.

To secure a future that is both green and reliable, the Commonwealth must reform the VCEA. A pragmatic climate strategy must prioritize achievable outcomes and firm capacity over inflexible mandates. By doing so, Virginia can avoid a self-inflicted energy crisis, secure its position as a global technology hub, and continue its legacy of pragmatic climate leadership.

APPENDIX: VIRGINIA STATE ENERGY CONSUMPTION AND EMISSIONS

Virginia has relatively low emissions per person and for the size of its economy, according to the most recent data from the U.S. Energy Information Administration (EIA). [1] Energy consumption is very close to the national average. The state relies heavily on cars with little transit ridership, boosting energy use. But electricity generation is dominated by gas and nuclear, with little coal, resulting in emissions well below average. Residential electricity prices have been consistently below average and have fallen in real terms since 2019. The state is home to the largest concentration of data centers in the world, which is pushing up electricity consumption. So far, rising power use has been accompanied by falling prices as fixed costs can be spread across more sales. But that will not necessarily be the case in the future.

Virginia's total emissions rank slightly lower (16th) than its population (12th) or the size of its economy (13th). The state has been more successful than most others in lowering them further in the last two decades. Emissions were cut to 95 million metric tons of carbon dioxide (CO_2) in 2023 from 129 million tons in 2005. The decline was significantly faster (1.7% per year) than across the country as a whole (1.2% per year), mostly because gas has almost completely replaced coal-fired generation in the state electricity system.

Emissions per person are well below average. Per capita emissions were cut by more than a third to 10.8 tons in 2023 from 17.1 tons in 2005. Emissions per person were the 15th lowest among the states, and 24% below the national average, approximately on a par with Luxembourg (10.3 tons) and South Korea (11.1 tons). [2]

Emissions are also relatively low given the size of the state economy. Virginia's major economic activities, such as professional and business services; finance, insurance and real estate; government; and education are not energy-intensive. The state emitted 158 tons of CO_2 for every $1 million of output in 2023, down from 293 tons in 2005, after adjusting for inflation. Emissions per unit of output were the 12th lowest in the country, behind Delaware (156 tons) and Vermont (154 tons), and around 25% below the national average.

The amount of energy consumed per person and for the size of the economy is almost exactly in line with the national average. Consumption per person amounted to 279 million British thermal units, nearly identical to the national average of 278 million BTUs, ranking 23rd among

[1] Unless stated otherwise, all the data and rankings in this profile are taken from the most recent online edition of the State Energy Data System (SEDS) published by the U.S. Energy Information Administration and cover energy consumption and emissions through 2023. Emissions are restricted to carbon dioxide (CO_2) from combustion of fossil fuels, excluding fugitive methane, other greenhouse gases, and emissions from land use, land-use change and forestry.

[2] International comparisons are taken from the Emissions Database for Global Atmospheric Research (EDGAR) published by the Joint Research Centre of the European Union.

the states. Consumption per $1 million of output was 4.08 billion BTUs compared with a national average of 4.13 billion BTUs, ranking 19th among the states.

But Virginia's energy system has slightly lower emissions than average, and they have fallen faster than in most other states. The state emitted 47 tons of CO_2 per billion BTUs of energy consumed in 2023, down from 59 tons in 2005. Emissions per unit of energy consumed have fallen faster (1.3% per year) than the country as a whole (1.0% per year). As a result, Virginia had the 13th lowest emissions per unit of energy consumed, about 8% below the national average (51 tons) in 2023.

Most energy-related emissions come from the state's transport sector (53%), with smaller shares from electricity generation (23%), industry (11%), commerce (6%), and homes (6%). Population density is fairly low, and public transport is underdeveloped. Like most of the United States, transport is dominated by private cars. Road traffic (10,000 vehicle-miles per person) was slightly higher than average (9,600 vehicle-miles per person) in 2023. Transit use is much lower than in more densely populated states such as New Jersey, New York, and Pennsylvania.

But emissions from electricity generation have halved in the last two decades, faster than the country as a whole, as coal-fired power has been phased out almost entirely and replaced by gas plus a small amount of solar. Emissions from power generation fell to 21 million tons of CO_2 in 2023 from 42 million in 2005. In 2023, most state generation came from gas (59%) or nuclear (28%), with a minor contribution from solar (7%) and a very low share from coal (2%). Shares from gas and nuclear are well above the national averages (43% and 19% respectively) while coal is much lower (16%). Virginia's gas-plus-nuclear mix is largely responsible for its lower-than-average emissions overall.

Virginia is something of a bellwether for energy spending. Total spending on petroleum fuels, gas, and electricity has tracked the nationwide average closely for the last two decades. Spending per person ($4,515) and as a share of output (5.5%) were almost exactly in line with national averages ($4,657 and 5.7%) in 2023. Gas prices have generally been slightly higher than average, while electricity prices have been slightly lower.

Electricity prices have been below the national average throughout the last 25 years. In 2024, the average retail price of electricity (including taxes) for residential customers was 14.4 cents per kilowatt hour, almost 13% below the nationwide average of 16.5 cents per kilowatt hour. Residential electricity prices are similar to Oregon (14.7 cents), South Carolina (14.2 cents), and New Mexico (14.2 cents), and well below high-priced states such as California (32.0 cents) and New York (24.4 cents).

Northern Virginia is home to the world's largest cluster of data centers, centered on Loudoun County, which is pushing up electricity consumption rapidly. Between 2019 and 2024, the state's electricity consumption increased more than three times faster (3.1% per year) than the country as a whole (0.9% per year). So far, increased demand has not boosted prices for other customers. After adjusting for inflation, retail power prices declined (-1.6% per year) compared

with increases across the country as a whole (0.3% per year). Faster growth allowed fixed costs in generation, transmission, and distribution to be spread across more sales. But this will not necessarily remain the case in the future.[3]

Nearly all of Virginia is served by the PJM wholesale electricity market, where prices have surged this year as a result of increased demand from data centers. Wholesale electricity costs across the region surged by more than 40% in the first nine months of 2025 compared with the same period in 2024, the fastest increase since Russia's invasion of Ukraine caused gas prices to spike in 2022. Rising wholesale costs will eventually filter through to higher residential rates.

In real terms, wholesale costs in PJM averaged more than $79 per megawatt-hour (MWh) in the first nine months of 2025, up from an average of $57 in the whole of 2024. Higher energy costs accounted for two-thirds of the total increase, mostly reflecting the rebound in fuel costs for gas-fired generators from record lows in 2024. But the fastest rise was in capacity charges, which tripled compared with a year earlier, as load additions outstripped extra generation capacity. [4]

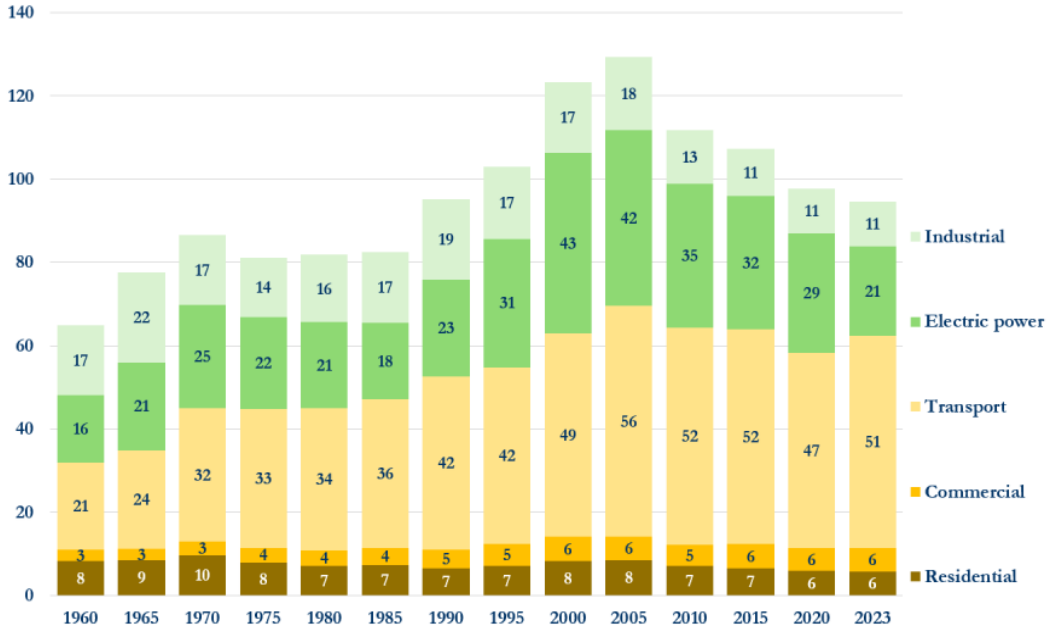
In November 2025, Virginia's State Corporation Commission scaled back requests for rate increases from Dominion Energy, the state's largest supplier. Regulators also created a new rate class for data centers and other very large loads demanding 25 megawatts or more. Data centers and other large customers will be required to pay for a minimum of 60% of contracted generation demand and 85% of transmission and distribution capacity "to help insulate ratepayers from the costs around the rapid build-out and construction of infrastructure."[5]

[3] *Factors Influencing Recent Trends in Retail Electricity Prices in the United States* (Lawrence Berkeley National Laboratory and Brattle Group, October 2025).

[4] *PJM State of the Market Report* (Monitoring Analytics LLC, 13 November 2025).

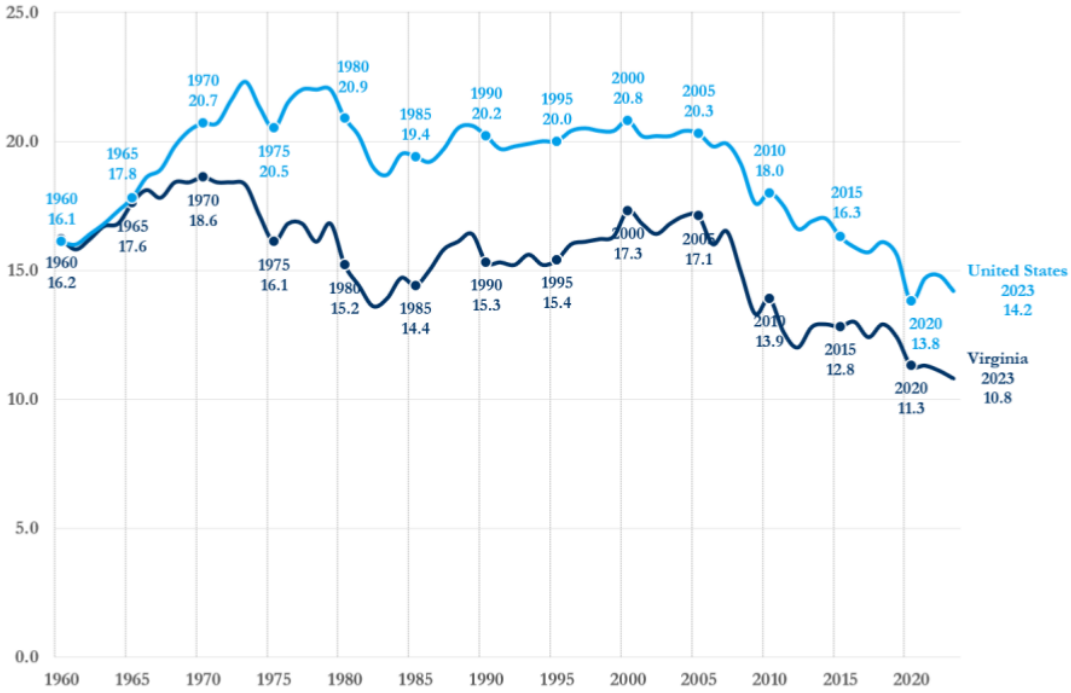
[5] *In Biennial Review Ruling, SCC Creates New Class for Large-Scale Energy Users* (State Corporation Commission of Virginia, 25 November 2025).

Figure 1: Virginia state energy-related carbon dioxide emissions, 1965-2023
million tonnes per year



Source: State Energy Data System (U.S. Energy Information Administration, 2024)

Figure 2: Virginia state energy-related CO_2 emissions per capita, 1960-2023
metric tons per capita



Source: State Energy Data System (U.S. Energy Information Administration, 2024)

Figure 3: State-level energy-related carbon dioxide emissions in 2023
metric tons per capita

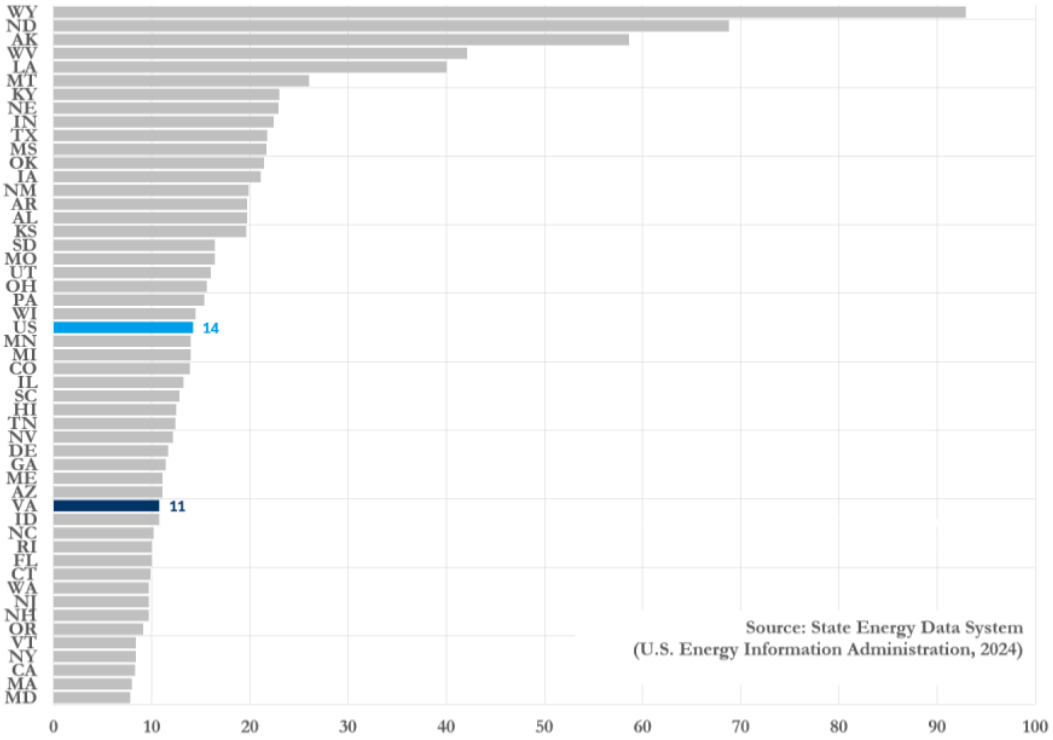
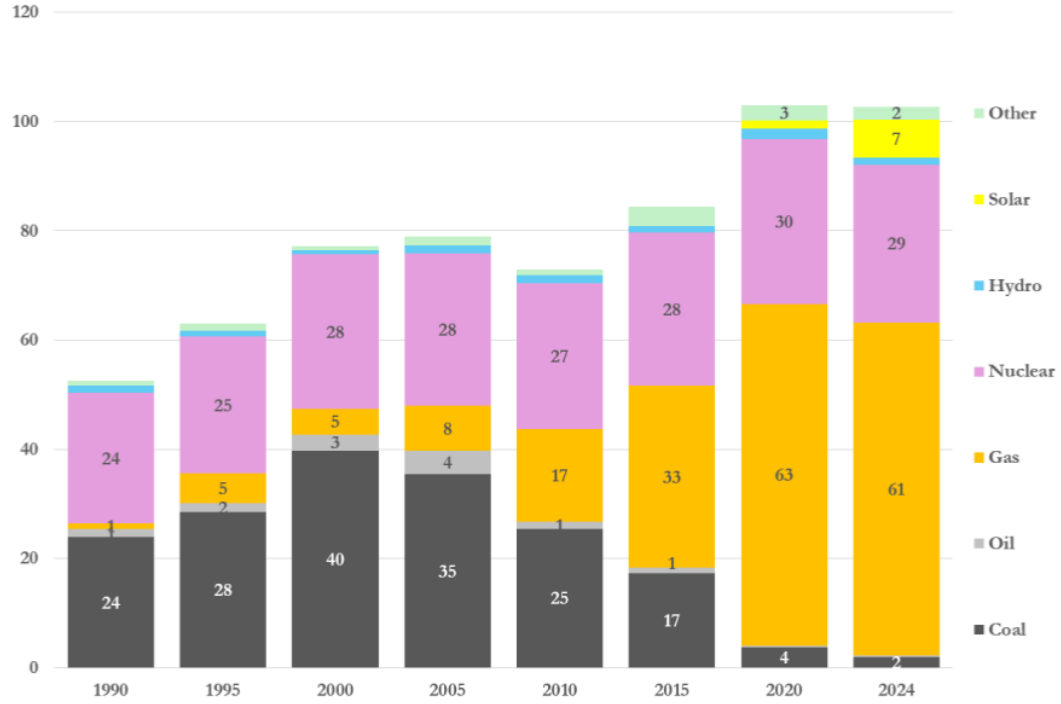


Figure 4: Virginia state electricity generation, 1990-2024
billion kilowatt-hours (TWh), annual

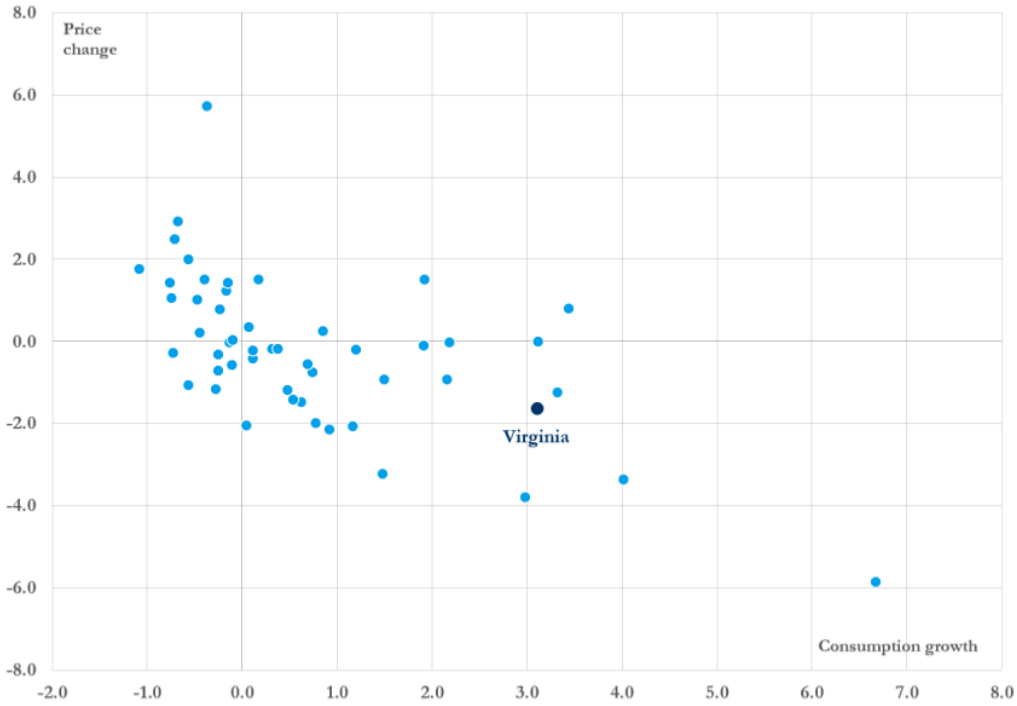


Source: Electric Power Annual (U.S. Energy Information Administration, 2025)

Figure 5: State electricity consumption growth versus retail price rises, 2019-2024

X-axis: electricity consumption (% CAGR 2019-2024)

Y-axis: retail electricity prices adjusted for inflation (% CAGR 2019-2024)



Source: U.S. Energy Information Administration

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