Unconstrained Demand

Virginia's Data Center Expansion and Its Impacts

SIERRA CLUB
VIRGINIA CHAPTER

Executive Summary

Virginia is at the epicenter of a growing crisis driven by the rapid expansion of data centers coupled with a lack of policy protections. The surging demand for computing power, fueled by artificial intelligence and cryptocurrency, is placing unprecedented strain on the state's energy grid, land, water resources, and health of local communities. This report provides a comprehensive analysis of the far-reaching scope and consequences of data center expansion, offers new data and outlines urgent state and local policy recommendations to safeguard Virginia's future from a host of immediate and long-term challenges.

Impacts at a Glance

The rapid growth of data centers in Virginia has come with consequences that are largely unaddressed by state policy. With the world's highest concentration of data centers, and facing a projected tripling of growth, Virginia cannot ignore the problem. The unchecked expansion of data centers has caused concern across many areas including: skyrocketing energy demand; rising consumer costs; severe water loss; environmental and health risks; land and community displacement; and, regulatory and policy failures.

IMPACTS TO LAND AND NEIGHBORHOODS

- Virginia could be **home to nearly 1,300 data centers** in the coming years.
- **Over 390,000,000 square feet of data centers** are proposed, built, or under construction.
- **Central Virginia is expecting 290+ data centers**, rivaling Northern Virginia's existing hubs.
- In Fairfax County, **data centers are increasingly encroaching on residential areas**:
  - 55% are within 200 feet of homes.
  - 70% are within 500 feet of homes.

IMPACTS ON WATER

- A single large data center can consume **5 million gallons of water per day**, enough to supply 50,000 people, impacting local water sources and often **operating without disclosing its consumption,** highlighting the industry's ongoing lack of transparency.
- Loudoun County's data centers alone used over **1 billion gallons of water in 2023**.
- Across Virginia, data centers consumed over **2.1 billion gallons of water in 2023**.

DEMAND FOR ENERGY

- More than **half of all U.S. data center energy consumption occurs in Virginia**.
- If unconstrained growth continues, energy demand will be well over **60 GW of power for data centers,** the equivalent to 68 massive coal plants.

IMPACTS ON CARBON EMISSIONS

- Loudoun County's **carbon emissions are up over 50% attributed to data centers.**
- Two massive data center projects in Pittsylvania County are **tapping into the Mountain Valley Pipeline (MVP) for fracked gas power**.
- The proposed **Balico Tech Campus plans to build a 3,500 MW fracked gas plant**, nearly **three times the size of any gas plant in Virginia today**.

IMPACTS ON ELECTRIC BILLS

- Dominion Energy projects that **residential electric bills will rise from an average of $142.77 today to $315.25 by 2039**—primarily due to the data center sector's growing energy needs.
- Virginians are **subsidizing the world's internet, cloud services and artificial intelligence applications** and paying for the infrastructure and energy that serve global corporations while reaping few local benefits.
- Across PJM territory, **62% of all planned transmission projects before 2031 service data centers**, costing **$2.4 billion**, a burden that will fall on **ratepayers' monthly electric bills**.

IMPACTS ON AIR QUALITY & HEALTH

- **8,910 generators have been approved for Virginia data centers**, with nearly all of them being **cheap, highly polluting Tier 2 models**.
- **DEQ has permitted these generators to run up to 500 hours per year**—equivalent to **1.4 hours of daily diesel pollution per generator**.

REGULATORY AND POLICY FAILURES

Despite the industry's rapid expansion, state and local policymakers have largely failed to enact adequate oversight. The lack of transparency, minimal environmental protections, and unchecked tax incentives have created a regulatory "race to the bottom" to attract data centers, while leaving Virginia's families and ratepayers to shoulder the long-term costs without clear protections.

RECOMMENDATIONS FOR IMMEDIATE POLICY INTERVENTIONS:

1. **Energy & Infrastructure Planning:** Ensure data centers contribute to grid stability as well as fund necessary, clean, renewable energy infrastructure rather than shifting costs to ratepayers.
2. **Fair Taxation:** End the Data Center Tax Exemption, or place conditions, to ensure Big Tech builds efficient, renewable powered facilities.
3. **Water Use Regulations:** Impose limits on data center water consumption to protect local resources.
4. **Stronger Environmental Protections:** Require sustainable energy such as on-site renewable generation requirements and stricter emissions controls on backup generators.
5. **Land Use Oversight:** Establish state-level planning standards to prevent reckless expansion adjacent to residential areas and on agricultural land.
6. **Transparency:** Mandate full disclosure of energy and water use, emissions data, and expansion plans to allow for informed public discourse and policy decisions.

CONCLUSION

Without decisive action, the unchecked expansion of data centers will exacerbate an emerging energy crisis, increase pollution and impose unbearable energy costs on residents. Policymakers should focus on tipping the scales towards environmental sustainability and public well-being instead of rubber-stamping data centers in the name of more revenue. This report serves as both a warning and a call to action—we must manage data center growth before it is too late.

ACKNOWLEDGEMENTS

Lead Author and Researcher: Ann Bennett
Contributors: Ivy Main, Dori Jaffe, Paige Wesselink, Connor Kish and Tim Cywinski
Data Collection: Bill Wright, the late John Lyver, Sarah Parmelee and local Sierra Club advocates
Photography: Hugh Kenny, Ann Bennett
Layout and Design: Robert Ullman

CloudHQ's 8.5 million sf, 14 data center complex in Loudoun County "where data lives."

Introduction

Virginia is at the center of a growing crisis—one that threatens its clean energy future, environment, and communities. The state isn't just home to the world's largest concentration of data centers on the planet, it's the backbone of nearly 70% of global data. As demand for computing power skyrockets—driven by artificial intelligence, cryptocurrency, and other energy-hungry technologies—our energy infrastructure is being pushed beyond its limits. But the challenge isn't just about meeting soaring energy needs. Virginia faces an urgent reckoning with skyrocketing energy costs, reckless land use, dwindling water resources, and mounting pollution. If policymakers and local decision-makers continue to leave the industry unchecked, these impacts—farmland loss, residential encroachment degraded air and water quality, excessive noise, and strained resources—will impose staggering long-term costs on Virginians, jeopardizing their health, quality of life, and economic future. This report lays out the full picture of what's at stake, and what should be done to protect Virginia from becoming collateral damage in the global technology race.

The data industry has grown at a stunning pace, on a scale not seen before. Yet, state and local leaders have been reluctant to holistically evaluate costs of the big, powerful data center industry as it promises economic development, often without the evidence to back it up. The financial, resource and pollution implications of data center growth are felt across the state, and yet decisions to grant permits have been left to localities, who are most easily wooed by the industry's financial promises. Focusing solely on the financial opportunities of data centers, without calculating societal costs has caught leaders flat footed as the exponential energy drain and its impacts pile up. Benefits have been published and celebrated annually. There is no doubt that the Data Center Tax Exemption,[1] by far the state's largest at 42% and growing over the last ten years, has

1 https://jlarc.virginia.gov/pdfs/reports/Rpt597.pdf.

successfully spurred a tidal wave of data center development. But has it benefited the people of Virginia who fund these tax benefits?

Sierra Club and other environmental groups have been sounding the alarm for several years, but with few exceptions, legislators and regulators at all levels of government have been unwilling to seriously engage and enact adequate policies or put the brakes on this runaway train. The decision to continue to expand our state-wide data center footprint, and under what regulatory structures, demands robust public discourse and immediate, decisive legislative and regulatory action.

Regulatory neglect has contributed to Virginia's predicament today, a *de facto* regulatory "race to the bottom," for fear the industry will go elsewhere. This report will show that it is clear:

1. Virginia is entering an energy crisis that requires a prompt and comprehensive solution.
2. The state must promptly and comprehensively manage the unique and unprecedented level of data center development.
3. Data centers must begin to pay their fair share to protect residential customers from paying for costs of new data center and energy generation infrastructure.
4. If left unchecked and substantially unregulated, the monumental number of diesel generators needed to serve as on-site back-up power will threaten local communities and the Commonwealth with major increases in air and noise pollution, resulting in significant detriment to health and quality-of-life.
5. The state and industry must enter into carbon mitigation planning to reduce the industry's negative impacts and state and localities must also reduce the energy, water and climate impacts of existing data centers. Among other things data centers should be required to satisfy a substantial amount of their own energy needs using sustainable means such as on-site solar and other renewable energy sources.
6. Data centers pose a threat to state water resources and limits must be imposed to protect drinking water supplies.
7. On the current trajectory, there will be more demand for new energy than is currently anticipated.
8. There is more data center development on the horizon than is commonly known and the problems will only escalate if not addressed immediately.

Last session, the Virginia General Assembly acknowledged that it needed to understand the costs of this transformational level of data center development and ordered a review by the state Joint Legislative Audit and Review Commission (JLARC).[2] The December 9, 2024 report touched on important land use and natural resource impacts and ratepayer issues. Notably, it also modeled the state's alarming energy predicament associated with "unconstrained demand" – that is, the status quo. As Sierra Club has articulated, the residents of Virginia face an energy crisis that puts us on a path to ballooning carbon emissions, greater water, air and noise pollution and higher electricity rates. Comprehensive action is needed now.

2 https://jlarc.virginia.gov/pdfs/reports/Rpt598-2.pdf.

Purpose

This report seeks to share what we know about the data center buildout in the Commonwealth of Virginia and provides a deep dive into the size and scope of current and future data center development and the impacts and externalities it brings with it. It also offers recommendations for long-overdue policy changes aimed to minimize both human health and environmental impacts and to protect ratepayers and taxpayers from subsidizing an industry whose benefits primarily flow to areas outside Virginia.

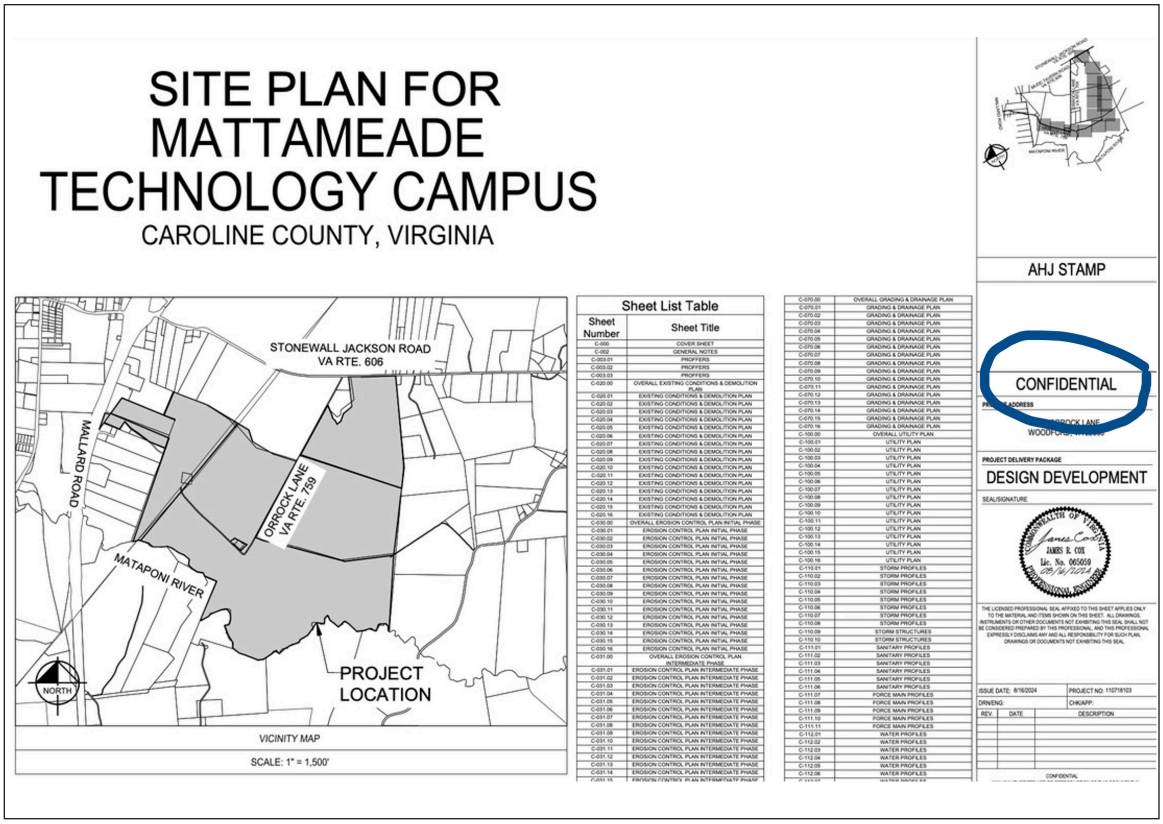
Methodology

This data was compiled from a variety of sources, including public records, land use documents, industry websites, satellite imagery, Security and Exchange Commission documents, Virginia Department of Environmental Quality (DEQ) records and newspaper and industry reports. Individual projects were identified by jurisdiction and by company. Data was collected on inputs including: square footage of buildings, number of buildings, megawatts, acreage and number of diesel generators. In the research, we cast the widest net, with the intention of determining what the "full build out" in Virginia could be. If a project is being built in phases – whether due to financing, energy availability or other factors -and the information is available for the entire project, all phases were included. This is a dynamic market, and like any real estate investment, properties change hands and innovation and resource issues can impact corporate decision-making. Unfortunately, given the absence of transparency in the planning process, not all data is publicly available or reported. If the information was unavailable, it was left blank. Since this is based on actual or reported data and not modeling, the publicly available data underreports the possible scale of the buildout.

Transparency Needs

This report might not be necessary if Virginia had been transparent about the data center build out. The shocking lack of transparency makes accurate data collection difficult, if not impossible. We applaud the Department of Environmental Quality (DEQ) for recently segregating data center air permit information on its website. However, the lack of information due to poor public reporting continues to be exacerbated by the industry's practice of using nondisclosure agreements and other means to keep their activities opaque to the public they affect.

While the new JLARC study "Data Centers in Virginia" has added to our understanding of the current situation, a complete accounting of all data center development is not publicly available or stored in a central location. This can be for a number of reasons. Often, data center companies require non-disclosure agreements with localities and public utilities. This shelters public utilities, such as Virginia Electric and Power, Co. (Dominion), from sharing or allowing applicants to share the energy requested for particular projects. Sometimes data is reported in filings, but the many projects approved under by-right development conditions can limit the information shared with the public. Lastly, counties and water authorities often agree to water commitments with data center companies before the public knows the deal is even being discussed, and generally information about water quantity is redacted.



Plans for Amazon's huge Mattameade/Orrock Tech Campus on the Caroline/Spotsylvania border.

"Cycle" of Regulatory Avoidance

The current financial incentive structure leads to regulatory avoidance. The state's exemption invites the industry in for economic development. Local governments seek additional revenue from real estate and business properties. This local competition has become a *de facto* "race to the bottom," offering the best package to compete for the business for fear of losing out to another jurisdiction. Supervisors, so desperate for local revenue, have overwhelmingly bought in with two major consequences: a reluctance to raise local real property and business tangible property rates *(and in many cases have lowered them)*, and an unwillingness to implement even the most basic land use and environmental regulations. This never-ending cycle is intentionally built into the structure of no coordination between local and state, enabling a unique "sweetheart" deal for some of the most profitable companies ever.

The data center industry lobby and Big Tech warn that any action on Virginia's part to put conditions or limits on its growth will cause the industry to go elsewhere. This is unlikely; Virginia's unique fiber network offers density, redundancy and cross-connect opportunities, relatively cheap energy and seabed cable links that make it enormously attractive to the data center industry. America's largest and most profitable companies continue to site projects in Virginia, throughout the United States and all over the world, including in countries where the regulatory environment requires more sustainable development. It is appropriate to ask why the companies that adhere to higher standards elsewhere have fought so hard to avoid them in Virginia.

Data Centers in Ashburn, Loudoun County, photo by Hugh Kenny, PEC.

How This Report Compliments the JLARC Study

In lieu of substantive policy answers to Virginia's growing data center challenges, the Virginia General Assembly opted to commission a study of the issue via Joint Legislative Audit Review Commission (JLARC) in 2024. While helpful in highlighting alarming challenges of "unconstrained" data center growth as it pertains to energy and water consumption, climate impacts, and ratepayer costs, the JLARC study was incomplete in understanding the cumulative impacts. More data is necessary to complete the full context of Virginia's unique relationship with the data center industry, especially as it pertains to air quality harms from diesel generators, the very real risk of an energy crisis, impacts on residential areas, and emerging trend of AI facilities becoming the new normal. This report does not seek to undermine existing data and conclusions from JLARC. It is intended to supplement the information.

The Data

In order to monitor and document trends, data was collected to better understand the scope of a full data center build out. This report represents our best understanding as of early 2025. In no way can we predict what a company might do with its land or how many servers it will pack into its buildings, and we have no way of knowing what applications it is running and the resulting natural resource implications. We do not know how much of its allowable square footage is used for servers versus office space. We can look at square footage, the number of buildings and diesel generators, and power associated with a project to paint a picture of how wide the data center tent might be. Whether the market holds in the long-run is impossible to predict, and to what extent consolidation will occur and there is no way to know how many data centers will ultimately be constructed in the coming years. Today, the scale of the build-out continues to expand as

evidenced by the almost weekly announcement of a new project in the state and existing entitlements. There are some gaps in the analysis due to unavailable data and possible errors in reporting. The tally for energy (MW) has large gaps, but the number of buildings has far fewer. Any inaccuracies are not for lack of trying, but because information is said to be proprietary and intentionally kept secret, is not subject to reporting requirements or is perhaps unverified when reported.

This data does not include the additional square footage still possible under by-right conditions,[3] sometimes part of industrial campuses or special overlay districts. Should this additional acreage enter the pipeline, it would significantly increase the numbers offered in this report. Virginians also are not privy to information on or planning for project developments that are quietly courted by local economic development authorities or much of the work of the state Virginia Economic Development Partnership.[4]

Jurisdictions that currently have or plan to have data centers are the counties of: Albemarle, Appomattox, Caroline, Charles City, Chesterfield, Culpeper, Fairfax, Fauquier, Franklin, Frederick, Halifax, Hanover, Henrico, King George, Loudoun, Louisa, Mecklenburg, Newport News, Orange, Pittsylvania, Powhatan, Prince Edward, Prince William, Roanoke, Rockbridge, Russell, Spotsylvania, Stafford, Surry, Tazewell, York, and Wise; Cities of Fredericksburg, Harrisonburg, Manassas, Manassas Park, Norfolk, Virginia Beach and the Town of Leesburg. There may be more jurisdictions competing for projects.

Types of Data Centers

Enterprise - Built, owned and operated by the same company (Meta)

Hyperscale - Significantly larger than most, often built for cloud service providers, and housing many more servers and requiring large power loads to process massive amounts of data (Amazon, Google, Meta)

Colocation - Companies/operators build to lease space to other companies (QTS, Compass)

Modular - Standardized buildings that are pre-engineered and prefabricated, complete with power and cooling infrastructure, and used to house computer servers and network equipment. (Microsoft)

Bitcoin Miner - Services cryptocurrency (TeraWulf)

Over the next few years, Virginia could be home to more than **1295 data centers**. Some of these are already built, but far more are approved, under construction, or shovel ready. A fourth category of data centers includes those that have been proposed or announced but are not yet entitled, have not submitted site plans (for by-right approvals) or do not have all permits and agreements in place. Loudoun County,[5] the market leader, has 199 data centers, with 196 more potentially in the pipeline (with 12 projects not reporting data on the number of buildings), illustrating how much construction awaits. If all of the proposed data centers come on-line in Loudoun County, it would house 380 data centers. By comparison, there are currently 382 McDonald's restaurants in the entire state.

3 Permitted under their current zoning and does require any legislative action or public hearings.
4 https://www.vedp.org/industry/data-centers.
5 This number includes the expanding market in the Town of Leesburg.

Loudoun County Data Center, photo by Hugh Kelly, PEC

Not all data centers are the same. Many of the previously constructed data centers are small (and pull less power) in comparison to the hyperscalers at over 200,000 square feet (sf) each, planned for multi-building campuses proposed today. These differ primarily from traditional data centers in sheer size. A hyperscale data center can house at least 5,000 servers. As such, hyperscale developments encompass millions of square feet of space. Google's facility in The Dalles, Oregon is considered the first hyperscale campus at 1.3 million sf, with the newest built to 290,000 sf.[6] As a result, hyperscalers are far more resource intensive and take far more land and energy to service and are the preferred facilities of developers in Virginia. While smart growth advocates seek taller buildings to reduce land use, increasingly data centers are going both "up and out" to sometimes well over 110 feet and with large building footprints on greenfield campuses with hundreds of acres to accommodate significant industrial equipment and energy infrastructure.

How Big is Big? Very Big!

It is now well known that it takes far more energy to run newer Artificial Intelligence (AI) applications than previously needed for older, less intensive uses and it is the major driver of the energy crisis confronting the state. The early applications for large language models were estimated to require about ten times the electricity—from 0.3 watt-hours for a traditional Google search to 2.9 watt-hours for a Chat-GPT query—to respond to user queries.[7] This shift accelerated after 2021 and is reflected in corporations' interest in larger, hyperscale data centers. One hyperscaler can use the same amount of power as 50,000 homes. Virginia has 3,717,677 housing units[8] and while energy use varies in

6 https://www.ibm.com/think/topics/hyperscale-data-center#:~:text=A%20hyperscale%20data%20center%20is,other%20big%20data%20computing%20pursuits.

7 https://www.epri.com/research/products/3002028905.

8 https://www.census.gov/quickfacts/fact/table/VA/INC110223.

the residential sector, using 50,000 as a variable, power would be somewhat equivalent to 74 large data centers. With a variable of 25,000 homes, or half the energy intensity, Virginia's residential sector compares to 148 data centers, just 12% of the data centers that could be built.

There are three ways to measure how big the data center build out could be: building square footage, the power demand (MW) or the number of diesel generators used for backup power. Square footage provides a basis on which to determine energy use based on watts per square foot (w/sf). That said, the total square footage a building is utilizing for servers (versus office space), how many servers are in use, power density and what applications are running can vary and may not be shared publicly.

As of early 2025, data centers totaling 390,831,608 square feet (sf) have been identified statewide, including those currently in operation, under construction, and proposed to be developed. This is the equivalent to 58 Pentagon buildings.[9] Nearly sixty percent of this market, or 227,279,780 sf are in four counties in Northern Virginia: Loudoun, Prince William, Fauquier and Fairfax Counties. Importantly, at least 36 projects are not included in this tally because the sf is unreported or unknown at this time.

FIGURE 1

County	Square Feet
Loudoun	110,378,527
Prince William	93,726,729
Fairfax	12,055,524
Fauquier	11,119,000
	227,279,780

This suburban market has offered considerable advantages to data center developers, including fiber latency, proximity to the government and airports and an educated workforce. Unfortunately, given the population density and the size and scope of the build out in these four counties, development is encroaching on residential neighborhoods more and more. The JLARC study makes clear that "the industrial scale of data centers makes them largely incompatible with residential uses. One-third of data centers are currently located near residential areas, and industry trends make future residential impacts more likely."[10]

The economic development deal Governor Youngkin and the General Assembly approved for Amazon Data Services (Amazon), the cloud computing subsidiary of Amazon, has opened the next frontier for large campuses south of Northern Virginia on the way to Richmond. These emerging markets are likely to predominantly serve Amazon, whether they self-build or are built by a third party and leased to Amazon. These new hyperscalers are expected to be designed to service AI and other energy intensive applications and to require far more energy than most of the existing data centers.

9 The Pentagon is the world's second largest building at 6,636,360 sf.
10 https://jlarc.virginia.gov/pdfs/reports/Rpt598-2.pdf.

Industrial Development and Data Centers in eastern Loudoun County.

DOWNSTATE DATA CENTER DEVELOPMENT

One of the impacts of burgeoning growth in AI is data centers are no longer just a Northern Virginia problem. Amazon is developing at least 4 major campuses in the region south of Northern Virginia and other companies could be developing for Amazon and other clients. Together, over 290 data centers (3 with incomplete data) will be housed in 8 counties in Greater Rappahannock/Upper mid-State Region with over 121,745,221 sf in total (with 3 campuses not reporting square footage, and the yet to be withdrawn AttaTech/XX campus). This region will rival the level of development in Loudoun County. It is also not clear how much square footage within the building will be dedicated to servers, but expect companies to efficiently pack them in. Together, these counties will see over 16,088 acres dedicated to data center development and have already announced the need for 20,653 megawatts of energy (with energy data only available for 22 of 45 projects). While older data centers in Virginia do not use this level of power, new hyperscalers will be more and more energy intensive. (see page__rural coops_). Fredericksburg may consider a 1.1 million sf proposal, not included here.

FIGURE 2 Greater Rappahannock/Upper mid-State Region Data Center Projects

County	Square Feet	#Buildings	Megawatts
Stafford	22,282,000	69	4,200*
Spotsylvania	18,878,000	45*	1,250*
Caroline	18,647,680*	36*	1,500*
King George	16,500,000	34	3,075
Culpeper	17,590,000	45	3,602*
Orange	5,000,000	*	1,500
Louisa	10,400,000	17	3,120
Hanover	12,447,541	44	2,406*
*incomplete data	**121,745,221**	**290**	**20,653**

The rest of the state, including Richmond, Southwest and Tidewater, could see 41,806,607 sf. These numbers are low since they do not include a portion of Microsoft's square footage which is unavailable for its Mecklenburg East Coast hub, and a 30 data center proposal at Surry (which could easily be 10,000,000 sf).

AMAZON

Measuring the breadth of Amazon's data center footprint in Virginia is challenging, but is worth exploring. It towers over the rest of the market and has an outsized impact on the industry's environmental metrics in Virginia. Amazon operates enterprise data centers and colocates in Digital Realty, COPT, Prologis, Stack, etc. operated buildings. But, it is impossible to quantify the size of Amazon's colocation use and the company would have to disclose that information in order for the public to know. Currently Amazon operates or will site campuses in at least 11 jurisdictions and is planning at least 11 new campuses in the Greater Rappahannock/Upper mid-State Region. It is also responsible for most of the new data centers in Fairfax County and holds nearly 40% of the air permits for diesel generators for all data centers (not including those at colocations not publicly known) and that is likely to rise as a percentage of all diesel generators for data centers.

FIGURE 3 Amazon's Impact*

	Known Data	Projects with No Data Reported
# of Buildings	286	9
Square Footage	81,503,603	18
Permitted Diesel Generators	3,383	42
Energy in Megawatts	11,384	86**

*best available information, not all-inclusive, especially for colocations
**single buildings and future campuses

Amazon data centers under construction next to Fairfax County recreational facilities in Chantilly.

Impacts on Land Use and Residential Areas

At least 39 jurisdictions have or will soon have data centers. Most data centers in operation are in Loudoun, Henrico and Mecklenburg Counties, however Prince William is projected to rival Loudoun in the size of its build-out. Fairfax, Fauquier, Stafford, Spotsylvania, Caroline, Chesterfield, Culpeper, King George and Pittsylvania Counties are also seeing accelerated growth.

Localities play an important role because they can set the stage for environmentally responsible development. Unfortunately, Virginia localities have been unable to deliver adequate policies or ordinances to address data center impacts. Loudoun and Prince William have done very little, although Loudoun is considering requiring special exception approvals and performance standards, but if codified, this action will come well after most data center projects are approved. Fairfax County passed a weak zoning ordinance amendment, notwithstanding the obvious serious impacts in neighboring counties and in two of its own highly-impacted, diverse communities (Bren Mar and The Meadows). Fairfax directed data center development to industrial zones that often abut suburban residential areas yet endorsed streamlined, by-right development for data centers in industrial zones that do not require public hearings or higher performance standards and rejected calls for special exception review of data center projects. It protected a one-mile radius around Metro, but deferred consideration of performance standards of data centers. According to JLARC, Fairfax has the worst record of siting data centers near residential neighborhoods, with 55% of them within 200 feet of homes and 70% within 500 feet. Even when residents have advocated for stronger protections and policies, and expressed concern about property values, the county has failed to pass or pursue substantive protections. In Northern Virginia, residential areas and data centers continue to collide. The JLARC study recognizes this:

> "The industrial scale of data centers makes them largely incompatible with residential uses. One-third of data centers are currently located near residential areas, and industry trends make future residential impacts more likely. Inadequate local planning and zoning have allowed some data centers to be located near residential areas, which sometimes causes impacts on those residents. In some cases, this occurred because local zoning ordinances did not consider data centers to be an industrial use. In addition, some localities have zoned industrial areas next to residential areas, even though land use principles state that industrial uses and residential uses should not be zoned next to each other. Local elected officials have also granted data centers exceptions that led to adverse residential impacts, such as approving rezonings that would allow data centers next to sensitive locations."[11]

A few counties have placed some limits on data center locations and minor ordinance standards, but few have adopted meaningful performance standards or rejected data center applications. Warren County voted down by-right approvals of data centers in early 2023. Some have developed industrial districts for by-right approvals, but special exceptions and rezonings outside of those zones have become commonplace.

11 https://jlarc.virginia.gov/pdfs/reports/Rpt598-2.pdf, p. vii.

The Town of Leesburg now requires special exception approval, but that came after the approval of many large projects, now totaling nearly a possible 17 million sf. Fauquier County has implemented a range of policies. Fauquier requires new projects to be near existing electrical infrastructure and in certain zones, eschews locations contiguous to residentially zoned land or park land, schools or medical care facilities, encourages on-site solar and geothermal energy as well as other renewable sources to meet a portion of the development's energy requirements. It also encourages data centers to meet a Power Usage Effectiveness (PUE) ratio of 1.5 or less (this is high, but good to recognize the need for energy efficiency), sustainable building materials and generators which incorporate advanced emission control technologies and meet the EPA's Tier 4 emission standards and maximum public disclosure of information relating to data centers.[12] Fredericksburg is now reviewing its policies for data centers.[13]

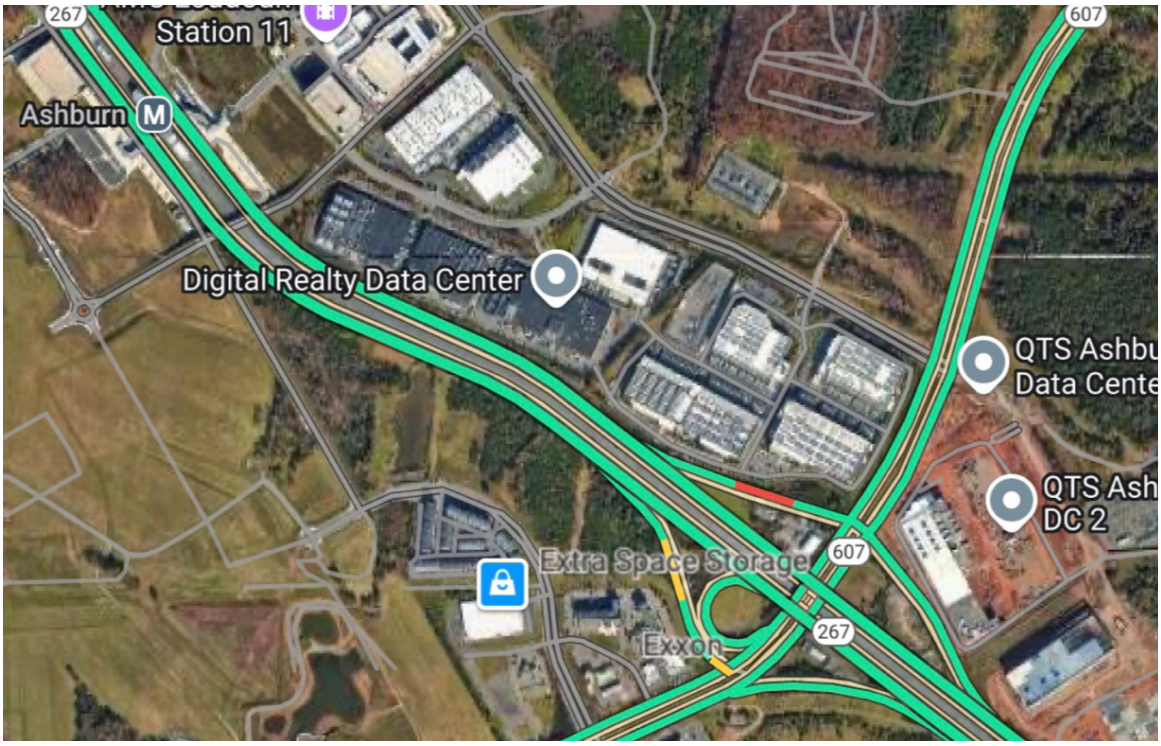
Data suggests that over **100,000 acres** will be lost to siting data center projects across Virginia by the end of the full build out. This includes acreage for the buildings, diesel fuel storage, other infrastructure and onsite substations and distribution lines. Acreage needed for offsite substations and transmission lines are not included in this number. Increasingly, and often in rural areas but not exclusively, people who live near transmission and natural gas pipelines should be aware they could be vulnerable to data center infrastructure and subject to eminent domain for transmission or distribution lines as a result. Add the number of distribution warehouses to this tally and the new impervious surface and cumulative tree loss is significant statewide. Further, data centers have no decommissioning requirements and will live on as a giant hulk of concrete long after its tech company occupants have decamped.

Playground dwarfed by new Amazon data centers and its infrastructure in Chantilly, Fairfax County.

12 https://www.fauquiercounty.gov/home/showpublisheddocument/39770/638387482643730000.
13 https://www.fredericksburgva.gov/2091/Data-Centers.

LOUDOUN TRANSIT - IMPACT OF POOR SITING

Northern Virginia residents have watched with dismay Loudoun's willingness to site data centers near planned silver line METRO stops for years. Perhaps it should come as no surprise that this mistake is now undermining METRO ridership and harming smart growth goals near this much-anticipated new commuter line. A recent article[14] highlights the low ridership numbers at the Loudoun Gateway stop, where QTS/Blackstone, Digital Realty and Amazon have data centers. It's not the only one. The Ashburn station, with the adjacent Loudoun Station mixed use development, has a similar issue with the same three companies. In that case, the hum from a Digital Realty facility, directly across from Metro Center Dr., is audible near the shopping area. In addition, the core areas of Waxpool Drive and Quantum Park are just about a mile away, considered walkable for mass transit. We know that data centers employ just a few workers who will not be the answer to METRO's woes at these stations. It's hard to imagine a more shortsighted series of local land use decisions that are ultimately costly to taxpayers.



QTS, Digital Realty and other data centers near Ashburn Metro (upper left) in Loudoun County.[15]

AMAZON PLAZA 500 IN FAIRFAX COUNTY, BY-RIGHT

On multiple occasions, residents of this diverse community along Edsall Road have advocated for the county to deny this ill-conceived project, where industrial zoning abuts existing residential areas, with inadequate buffers and noise protections. The proposed substation and 120 ft. transmission lines would run directly next to three existing, urban communities, two already degraded streams, a public park and near a community pool. That should be enough to deny these two noisy Amazon data centers

14 https://www.washingtonpost.com/dc-md-va/2024/12/27/least-used-metro-loudoun-gateway/.
15 https://www.google.com/maps/search/data+centers/@38.9962838,-77.4805183,1330m/data=!3m1!1e3?entry=ttu&g_ep=EgoyMDI1MDIxOS4xIKXMDSoJLDEwMjExNDUzSAFQAw%3D%3D.

and its associated energy infrastructure. A new substation would be 80 feet from existing townhomes. Dominion's November 15, 2024 State Corporation Commission (SCC)-directed Integrated Resources Plan Supplement (IRP),[16] identifies a proposed 230 kV transmission line needed solely for the interconnection of this new data center load.[17] This means that this project is simply to benefit one customer - Amazon's proposed data centers - while transferring the cost to all ratepayers who are then subsidizing the project to Amazon's financial benefit. This community pays twice: to live unprotected from the harmful and the negative impacts of adjacent industrial power infrastructure, and to subsume increased electricity bills to help pay for Amazon's data centers.[18]

HIDDENWOOD IN LOUDOUN COUNTY

Sadly, there are examples of communities seeking to vacate their neighborhoods due to jurisdictions allowing data centers to build next door. Loudoun has increasingly let data centers build in its Transition Policy Area (TPA), which was not intended to house data centers. Its Board has continued to approve development, which now impacts entire neighborhoods. For instance, the Board ignored its comprehensive plan and approved the True North development for Compass even though staff recommended denial. Similarly, residents who live on Hiddenwood Lane, have "cited a declining quality of life as zoning decisions made by county supervisors allowed data centers to be built around their neighborhood. Residents of Briarfield Estates, just north of Hiddenwood Lane, said permitting new data centers would surround them on all four sides by the massive buildings, pushing the declining quality of life into their backyards."[19] Their new neighbors include owners such as Yondr, JK Moving and Amazon.

DIGITAL GATEWAY IN PRINCE WILLIAM COUNTY - ADJACENT TO PUBLIC LANDS

Prince William Digital Gateway (PWDG) in Prince William County designates over 2,100 acres for 37 hyperscale data centers for QTS/Blackstone and Compass directly adjacent to Manassas National Battlefield Park and Conway Robinson State Forest, with shockingly inadequate buffers and park protections. How disturbing to have a national park be so vulnerable to intensive industrial development. The county de facto reversed its commitment to maintaining a protective down-zoned area in its "Rural Crescent" and defied public opinion to approve a behemoth project in proximity to federal and state public lands. This part of Prince William County houses the largest portion of the land within the Occoquan Watershed (40 percent) with over one-third of that forested land. This approved development risks damaging the region's drinking water supply and accelerating the rise of carbon emissions in Prince William County, undermining state and regional targets.

16 https://www.scc.virginia.gov/docketsearch/DOCS/82l101!.PDF.

17 For more information on specific transmission projects proposed throughout Virginia, see https://www.pecva.org/work/energy-work/initial-transmission-proposals-pec-web-map/.

18 https://www.sierraclub.org/virginia/scc-plaza-500-hearing.

19 https://www.loudounnow.com/news/arcola-neighborhoods-face-off-amid-data-center-encroachment/article_957e84e2-3fbd-11ef-bc6b-db225c527b1b.html.

The Manassas National Battlefield Park is threatened by adjacent data center development and expanded transmission.

THE MEADOWS CHANTILLY - ENVIRONMENTAL INJUSTICE

Fairfax County failed to stop a redevelopment of an Amazon data center in Chantilly next to The Meadows of Chantilly Mobile Home Community. The streamlined by-right approval process meant that the affordable housing staff and Manufactured Home Taskforce members, charged with protecting these communities, didn't know about the redevelopment. Emblematic of how little power residents have in land use decisions, they are not even required to be notified. Only landowners get that privilege. Further, the building will tower over the homes at 70 feet tall and the diesel generator yard will be directly adjacent to the mobile home residents. Low-income residents will now be subject to harmful diesel fumes in their backyards. These residents are particularly vulnerable when the diesel generators turn on during power outages due to excessive heat, and are more likely to have to keep their windows open if they do not have central air conditioning.

Substations

New mega data center campuses need multiple substations. For instance, the recent approved Tract 1200-acre campus in Hanover County will have 8 substations. In tax year 2023, the number of substations went from 16 to 76 in Prince William County.[20] If substations are 300 MW each, 76 would translate to 18,000 MW of capacity.

20 https://www.pwcva.gov/assets/2024-.10/TY2023_Data%20Center%20Industry%20Tax%20Revenue%20Report_09.24.2024.pdf.

Substations require considerable acreage and cost. While some may service non-data center clients along with data centers, many are specifically built to service the facilities only.

In more rural locations, Amazon and other developers may have fewer conflicts with residential and small commercial development. These large campuses can have six or more substations each, cover hundreds of acres, have 100 or more diesel generators, and can suck up to 20% of a county's water resources. But there are other issues, including transmission lines, eminent domain proceedings, deforestation, loss of farmland and pressure on sources of water consumption for data center cooling. In part, this is the legacy of the $35 Billion deal Amazon struck with the state.

Substation Adjacent to W&OD Loudoun County, Hugh Kenny, PEC

Deforestation

Tree loss from data center development is well underway and will be significant. It is rare to hear concerns expressed about the tree loss associated with large data center projects, even though most of the acreage being lost is forests or farmland (over 100,000 acres). Mitigation for disturbed forest land from data center development should be required.

Land cleared for an Amazon data center campus on Old Potomac Church Rd in Stafford Co.[21]

Other states may be requiring mitigation for tree loss. QTS/Blackstone has worked to minimize the impact of data center builds by replanting more trees than were cleared during the development of its data centers in Fayetteville, Georgia. QTS/Blackstone is partnering with Southern Conservation Trust to plant 7,000 native tree species on 600 acres of land. By replacing the trees initially removed as part of the data center development, this minimizes the impact on the community and helps to protect the natural environment and the entire ecosystem. This kind of program should be required in Virginia.[22]

Policy Recommendations

- End "by-right" approvals for data centers to ensure a public process and adherence to higher development and performance standards.
- Require conservation of similar lands offsite to mitigate adverse data center impacts to prime agricultural soils, contiguous forest lands, and land in forestry preservation. programs. Mitigation for disturbing forest lands should require conserving off-site forest lands at a ratio of 1:1 unless the forest land is located on C1 or C2 Ecological Core.[23] Increase buffers from residential areas to 1,000 feet to provide some protection from 24/7 noise, visual impacts and diesel fuel emissions.
- For similar reasons, require buffers of at least a quarter of a mile for parks, schools, hospitals and other public spaces.

21 https://www.fredericksburgfreepress.com/2024/10/16/data-center-construction-already-underway-in-region/.
22 https://qtsdatacenters.com/wp-content/uploads/2024/10/QTS-Sustainability-Report_2023_FINAL.pdf.
23 based on DEQ/House Bill 206 mitigations rulemaking.

- Require transparency at the local level: a baseline set of information that is publicly available on energy use, water consumption, diesel generator emissions and total emissions that localities must require of proposed data center developments so that reviews of projects across the state are more consistent and transparent.
- Require transparency at the state level: implement a reporting system around energy use, water consumption, and diesel generator emissions and total emissions of operating data centers and their diesel generators, to enhance future statewide planning and public transparency.
- Increase local air monitoring in areas where diesel generators are highly concentrated to provide additional information with regard to regulation.
- Strengthen noise ordinances to ensure that nearby residents and businesses are protected from the 24/7 noise levels and unique hum from nearby data centers - merely requiring sound modeling and studies does not protect those impacted.
- Substations should be located no less than a mile from residential neighborhoods, schools, hospitals and public spaces.
- Distribution and transmission lines should no longer be permitted in Resource Protection Areas
- Enact policies for decommissioning of data centers.
- Additional recommendations and policies for localities[24]

Impacts on Water

Another emerging externality of data centers is the water needed to cool them. AI-ready data centers produce a great deal of heat. Without adequate cooling, the servers can overheat, fail or even catch fire. Companies can either use traditional air conditioning to cool the servers, which is expensive, or use water for evaporative cooling. The latter is cheaper, but it also sucks up millions of gallons of water. A large data center can consume anywhere between 1 million and 5 million gallons of water a day — as much as a town of 10,000 to 50,000 people.

In order to meet the demands for more servers that run hotter, liquid cooling is positioning itself as the cooling solution for high-performance computing. And yet, its mainstream adoption depends on advances in technology and chip designs. So, companies are ramping up their water acquisition and usage while Virginians wait for technology or water protection measures to be required.

Issues of water quantity came to the fore in a legal battle in Dalles, Oregon, where Google admitted it was consuming 29% of the city's water. Water use climbed to 355.1 million gallons annually in 2021 from 104.3 million gallons in 2012, impacting private wells and the public water supply. The five data centers in the area were approved without any disclosure of how much water they would use, a norm in the industry that continues today despite calls for full transparency. Similarly, no one knew that Microsoft's OpenAI in Des Moines, Iowa, was guzzling millions of gallons of water from the watershed of the Raccoon and Des Moines rivers to cool a powerful prototype supercomputer working on ChatGPT.[25]

24 https://www.sierraclub.org/virginia/local-guidelines-data-centers.
25 https://www.datacenterdynamics.com/en/news/we-now-know-how-much-water-googles-oregon-data-centers-use-after-city-drops-lawsuit-against-journalists/.

While data centers have relied on air cooling technology in the past, water consumption to cool data center servers is increasing. The scramble to gain access to large quantities of water is on and the burden increasingly falls on public water utilities, and their ratepayers. Cooling is resource intensive:

> "There are different techniques to cool a data center, and while the most environmentally conscious choice will depend on its location, water or energy usage generally sit at opposite ends of a see-saw: if usage of one is decreased, the other must be increased to compensate. If operators use evaporative cooling—whereby warm air from the data center is passed over water and evaporated in a cooling tower—electricity usage will plummet, but inordinate amounts of water are required. If they use a closed-loop system—where water is cooled with air conditioning and piped to cool down servers, returning to be cooled again—operators will use far less water but an outsized amount of electricity. Most modern data centers combine one of these methods with some degree of free cooling which, as the name suggests, involves using fans to blow fresh outside air into servers. However, except in very rare circumstances, this method is not sufficient on its own. In short, there's no getting around the fact that the data centers consume water."[26]

Researchers have been trying to calculate the water footprint of generative AI, from chip manufacturing to training to deployment. Estimates are that ChatGPT 3 uses up to 500 milliliters of water (close to a 16-ounce water bottle) every time you ask it a series of between 5 to 50 prompts or questions, (depending on where its servers are located and the season.) The water cost of the next iteration, ChatGPT 4, is far higher. This includes indirect water usage that the companies don't measure, such as what's needed to cool power plants that supply the data centers with electricity.[27]

SUBURBAN LOCALITIES

Loudoun County paints a picture of the rising demand for water. Loudoun planned ahead and built a reclaimed water system for its data centers. In 2023, data center reclaimed water totaling 815,000,000 gallons. Over the same time period, however, potable water consumed by data centers reached 899,000,000 gallons, making it clear that the system in place was outpaced by the data center growth. In FY 2023, six of the seven top customers were data centers.

Loudoun Water's Potomac Water Supply Program plans to increase withdrawal from the Potomac River into Luckstone Quarry which stores 1 billion gallons (and up to 8 billion gallons eventually) in a banking system. By 2040, the utility's customers may nearly double to 90 MGD of drinking water, a 40 MGD increase from today's demand[28] Given this trend, it seems plausible that new water infrastructure is needed primarily to meet data center customers' projected increases in demand for water.[29]

26 https://www.techpolicy.press/why-we-dont-know-ais-true-water-footprint/.
27 https://www.ted.com/talks/shaolei_ren_ai_consumes_a_lot_of_water_but_why, 2024.
28 https://www.loudounwater.org/potomac-water-supply-program.
29 https://www.loudounwater.org/sites/default/files/ACFR%202023_AnnualReport-web_0.pdf, p. 91.

FIGURE 4 Water Consumption of Data Centers in Loudoun and Leesburg

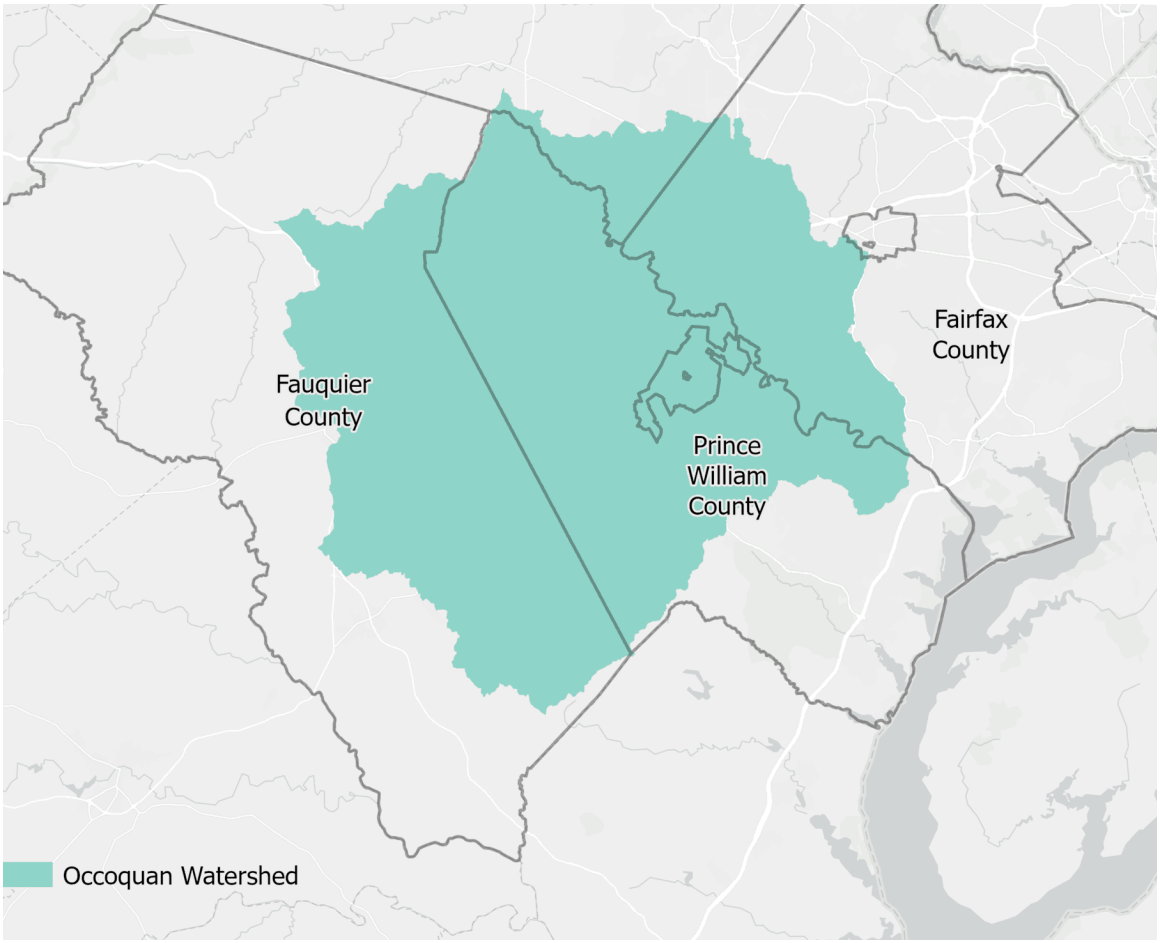
Gallons of Water for Data Center Cooling	2019	2023
Loudoun County	939,741,263 million	1,623,039,817 billion
Town of Leesburg	0	17,742,000 million

Fairfax Water provides about 167 million gallons per day (MGD) of drinking water to 2.1 million people in Northern Virginia, including most residents of Fairfax County. Fairfax Water also provides drinking water to the Prince William County Service Authority, Loudoun Water, the Towns of Herndon, Vienna, and the Cities of Alexandria, Dale City, Fairfax and Falls Church systems and Fort Belvoir, Dulles Airport. Fairfax County and neighboring jurisdictions store only a few days of local supplies of water and rely on continuous flows of the Potomac River from upstream sources and reservoirs. Using evaporative cooling, it is increasingly likely and that a 300 MW data center would need to evaporate about 3 MGD of water to the atmosphere. The recent report by the Environmental Quality Advisory Council (EQAC) is right to point out that increased data center water usage is not included in local planning efforts of the Interstate Commission on the Potomac River Basin. At the same time, to what extent new data centers will be designed for evaporative cooling is unknown, but "clearly, any use of evaporative cooling for new data centers must be considered carefully as a regional issue.' EQAC rightly recommends that if large data centers are approved with evaporative cooling, conditions must consider (1) Possible water cutoff during periods of drought; (2) Use of recycled wastewater where feasible; and (3) No return of any "blowdown" to the Occoquan Reservoir.[30]

Much of Northern Virginia relies on Prince William County's Occoquan Watershed (40 percent), with over one-third forested, to help maintain the region's drinking water supply. For residents in Eastern Prince William, the City of Alexandria, Fort Belvoir and parts of Fairfax County, the Occoquan Reservoir is the primary source of drinking water. A 2022 letter[31] from 32 environmental and historic preservation groups to state legislators in Northern Virginia addressed this specifically. During the early days of the debate over the massive 37 Compass/QTS/Blackstone Digital Gateway data center campus, Fairfax Water was quite concerned. It asked that "Prince William County request that the Occoquan Basin Policy Board convene and oversee a Comprehensive Study of the proposed Planning initiatives - the Comprehensive Plan Update, Digital Gateway Corridor, and the Data Center Opportunity Overlay District - to evaluate their impact on water quality in the Occoquan Reservoir." Fairfax Water asked the county "to embrace a holistic and comprehensive approach" using its Watershed Model "as an essential input to the land use decision process." The Board of County Supervisors agreed to a study, but it has still not been completed more than a year after the project's approval. Prince William County has distinguished itself by reversing its commitment to maintaining a protective down planned area in its Rural Crescent. Conversion of this critical watershed to data centers threatens the quantity and quality of drinking water of nearly two million Northern Virginians.

30 https://www.fairfaxcounty.gov/environment-energy-coordination/sites/environment-energy-coordination/files/Assets/FINAL%202024%20ARE%20%20ADA_A-1a.pdf, p. 60.

31 https://www.sierraclub.org/virginia/digital-gateway-data-center-concerns.



Occoquan Watershed Drainage Basin, NVRC.

JLARC's water data fails to tell the full story of the industry's potential impact on water resources. Because the industry has been transitioning from air to evaporative cooling, historical data only provides part of the story on water usage. JLARC reports that most data centers use as much water as the average large office building (6.7 million gallons per year). It found that a few require substantially more. In 2023, the industry used 2.1 billion gallons of water and 11 data center buildings each used over 50 million gallons, including one building that used 243 million gallons (10 percent of the industry's total use). These 11 data centers could reflect the switch from air to liquid cooling that is underway.

Cumulatively, data centers use a small share of state wide water withdrawals and a moderate share of some region's water withdrawals and this makes sense since the areas most sensitive to water overuse are just starting to build data centers. Water utilities said industry use made up from 2 to 21 percent of water use, after excluding reclaimed water use at the six water utilities evaluated. Data centers were typically one of these water utilities' larger customers. That a data center was the single largest customer for two utilities is significant and downplayed in the report. JLARC should make the raw data public[32] and local water authorities should publicly discuss and report on data center water infrastructure needs and costs with its customers before they are approved.

32 https://jlarc.virginia.gov/pdfs/reports/Rpt598-2.pdf, pp.62-63.

Rural Localities

Rural areas of Virginia are now seeing a water grab for data center campuses. So far, most of the publicly available information relates to new Amazon campuses. Neither the amount of water Microsoft, QTS or Meta uses for existing or expanding developments is known, nor whether they use efficient water technology, such as a closed loop system. The Greater Rappahannock/Upper mid-State Region straddles the banks of the Rappahannock, which has been experiencing low water levels and drought conditions in the past year and dozens of data center projects are vying for huge water volume.

- The Anchorstone data center campus in **Pittsylvania County** will need more than a staggering 3.0 MGD.[33]
- In **Louisa County**, Amazon signed a water Performance Agreement to use an astounding 620,000 GPD for its two new campuses. An average 4-person household in Virginia uses 300 GPD, so 620,000 would serve about 2066 households.[34]
- In **Caroline County**, the county water authority proposed to install a new water withdrawal intake structure located on the south bank of the Rappahannock River. Of the proposed average of 7.9 MGD (to a maximum of 13.9 MGD) to be withdrawn, 2.63 MGD would be allocated to **three data center campuses**, with only 2.3 MGD going to residential use. A public drinking water project was intended to supply data centers with water for cooling. DEQ's tentative decision was to issue the permit, but DEQ suspended and later abandoned the application due to public pressure and litigation for an eminent domain claim on 11 acres of farmland for the intake facility.[35]
- In **Spotsylvania County,** Amazon signed a Water Agreement with the county for its 3 campuses totaling 6.600,000 square feet in August 2024; however, the relevant numeric data was redacted, so the public has no idea how much water they will use.[36] (See Figure 5).
- **King George County** is fighting with Amazon over water usage for its 19 data center campus over a raw water system owned by Amazon and permitted by DEQ to withdraw from the Rappahannock River. King George presently uses 6.6 MGD and Amazon says it needs a stunning 2.7 MGD for the campus. Amazon is required to supply 600,000 GPD to the county and the new county board says it needs 2,000,000 GPD from Amazon to meet the needs of its residents.[37]
- The **Wise County** Data Center Ridge project will develop a data center project cooled by up to 10 billion gallons of water in the abandoned Bullitt coal mine.[38]

33 https://www.chathamstartribune.com/news/article_13809d08-495f-11ef-af02-a720a9f1ba9c.html.
34 https://www.neefusa.org/story/water/home-water-use-united-states#:~:text=Olympic%2Dsized%20pools!-,Virginia,in%20and%20around%20their%20home..
35 https://riverfriends.org/caroline-county-water-withdrawal-open-comment/.
36 https://spotsylvaniacova.portal.civicclerk.com/event/504/files/attachment/4128, p.2.
37 https://www.kinggeorgecountyva.gov/DocumentCenter/View/12699/GEV--MOU-Rev2-with-KGCSA-2-22-2024-2
38 https://www.datacenterdynamics.com/en/news/west-virginia-project-gets-3m-to-cool-data-centers-with-mine-water/.

FIGURE 5 Spotsylvania County Water and Wastewater Infrastructure Agreement with Amazon for Cosner Tech, Carter's Store and Summit Crossing data center campuses.

Table 1A: Service Specifications - Cosner Tech

Provider Service:	Potable Water	Additional Potable Water	Level 1 Reclaimed Water Production	Level 1 Reclaimed Water	Discharge
Infrastructure Description:	Massaponax Church Road Waterline Phase 1A and 1B	Massaponax Church Road Waterline Phase 2	Massaponax Wastewater Treatment Plant Reclaimed Production and Massaponax Booster Pump Station	Reclaimed Water System Distribution and Cosner Tech Booster Pump Station	Sanitary Sewer Improvements Receiving Flow
Design Specifications:	Exhibit 1	Exhibit 1	Exhibit 2	Exhibit 2	Exhibits 3 and 4
Delivery Rate (GPM)	**Interim Cooling** [redacted] gpm (2/7/2025-1/31/2028 (expected)); [redacted] gpm (in accordance with Section 3.3, expected 1/31/2027 - 1/31/2028) **Emergency Cooling** [redacted] gpm (1/31/2027 onward) **Domestic Potable** Maximum delivery rate: [redacted] gpm Average delivery rate: [redacted] gpm	**Emergency Cooling** Maximum delivery rate: [redacted] gpm	N/A	**Permanent Cooling Water** Maximum delivery rate: [redacted] gpm	**Permanent Spent Cooling Water Discharge** Maximum delivery rate: [redacted] gpm **Domestic Sewer Service** Maximum delivery rate: [redacted] gpm Average delivery rate: [redacted] gpm

As these examples show, Virginia's approach to building data centers without regard to the availability of critical natural resources reflects an unwillingness on the part of state and local leaders to require a dialogue regarding how much is too much. It also exhibits that local residents can be responsible for footing the bill for the water-related infrastructure.

Policy Recommendations

- During the local approval process (by-right or rezoning or special exception), make public the amount of water a data center or data center campus will need, the anticipated impact on water quality and who will pay for any associated infrastructure. Each data center or data center campus should report quarterly on its water usage and that information should be made public.

- Data centers should not be sited where there are water constraints and possible drought conditions.
- Data centers should be required to operate closed-loop water systems.
- Water should be recycled or reclaimed and should neither deplete nor imperil surface or groundwater sources needed for drinking water.
- Surface water withdrawals for data center use should be discouraged. Withdrawals reduce instream flow and can harm river instream flows for fish and invertebrates.
- Due to concerns about the cumulative impacts on regional sources of drinking water, drinking water should be designated as a priority use for residential and small commercial users during drought conditions.
- Provide additional state oversight by establishing proceedings to review and permit large data center proposals in addition to the local approval process.

Demand For Energy

REALITY CHECK ON FUTURE DEMAND

With the acceleration of computing and cooling demands from artificial intelligence (AI) and other rapidly-changing computing technologies, data centers now require far more energy, exacerbating pressure on the grid. As a result, energy demand has been rising for the last three years. Policymakers can no longer rely on projections based on past performances of older generation data centers, so the importance of projecting accurate energy demand is vital to delivering low cost, low emissions energy in the coming years.

How much new power is needed for Virginia's Data Center build-out? It is impossible to know exactly what future load growth will be without increased transparency from the industry and utilities, but energy markets have shifted significantly as a result of data center demand. For instance, White Oak Technology Park will require the same energy consumption as all of Manhattan Island in New York.[39]

Nationally, a 2024 Department of Energy report[40] finds that data centers consumed about 4.4% of total U.S. electricity in 2023 and are expected to consume approximately 6.7 to 12% of total U.S. electricity by 2028. The total data center electricity usage climbed from 58 TWh in 2014 to 176 TWh in 2023 and estimates an increase between 325 to 580 TWh by 2028.

Locally, signs of increased demand are that coal plant retirements for Mount Storm in West Virginia and Clover and Virginia City Hybrid Energy Center in Virginia have already been delayed. Dominion also announced that the Possum Point power plant in Prince William County would be increasing its capacity to burn natural gas (and it already burns diesel) to meet energy demand from data centers.[41]

39 https://www.12onyourside.com/2025/02/20/henrico-county-attracting-more-data-centers/.

40 https://eta-publications.lbl.gov/sites/default/files/2024-12/lbnl-2024-united-states-data-center-energy-usage-report.pdf, p.52.

41 https://www.princewilliamtimes.com/news/possum-point-powers-up-for-data-centers/article_3f1bc6c4-d373-11ef-a3a0-b7b7d9983293.html. Dominion Energy's Possum Point power plant burns natural gas and diesel fuel to create about 660 megawatts of electricity, enough to power about 170,00 homes. It's adding another 44 megawatts of generation capacity as part of a plan to help power data centers.

Possum Point power plant will be adding 44 MW of generation capacity to service data centers.

INCREASES IN ENERGY IMPORTS

Further, Governor Youngkin recently announced that Virginia energy imports have increased from 18% in 2020 to roughly 40% and the cost of that imported power is almost 10 times higher than it was just one year ago. Virginia now imports more electricity than any other state at about 50 million megawatt-hours per year according to the U.S. Energy Information Administration data. Virginia's growing commercial-sector demand, including data centers, has elevated it to the number one spot surpassing California due to its increased rooftop and net-metered solar installations and investment in energy efficiency programs which has reduced demand[42] Significantly, in its energy demand scenarios, JLARC estimates that energy imports would rise 55 percent to 146 percent (VCEA compliant scenarios).[43]

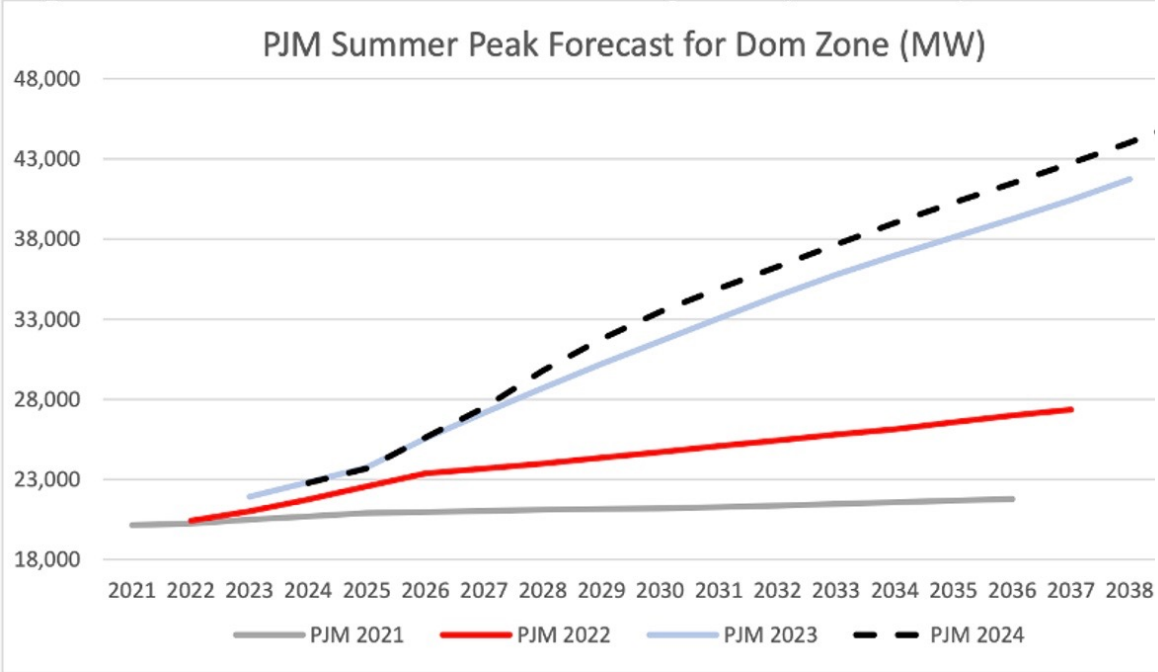
What's clear is Virginia's data center industry is driving staggering increases in energy demand. What is far less certain, and more likely, is that those projections do not fully capture the market potential.

DOMINION AND PJM

In 2024, Dominion expected to connect almost 1 gigawatt for 16 new data center campuses by the end of 2024, with an ultimate capacity of almost 1,000 MW in 2024. New data center load is expected to be 1,680 MW in 2025.[44] This represents 64% of PJM's total large loads.

42 https://cardinalnews.org/2025/01/21/virginia-now-imports-more-electricity-than-any-other-state/.
43 https://jlarc.virginia.gov/pdfs/reports/Rpt598-2.pdf, p. 31.
44 2025-load-adjustment-breakdown-for-capacity-obligations.

FIGURE 6 PJM Summer Peak Forecast Comparison (2021 to 2024) for the DOM Zone.[45]



In updated forecasts, Dominion expects its annual growth rate to be 6.3% for the next ten years, up from 5.5% in the 2024 IRP.[46] In January 2025, Dominion projected 23,556 NW of new data center load in its pipeline by 2039, up from 21,417 MW in July 2024, based on initial studies to electric service agreements (ESA). These contracted amounts do not capture the data center projects that have not yet reached a point in the service connection process and are not part of these load forecasts. The ESA contracts in hand already support the 2024 IRP load forecast through 2032, if not beyond, *but could fall far short of projects that are likely to seek grid connection in the near future*. This follows a pattern over several years that forecasts fall short of actual demand.

In February, just one month later, with the announcement of the company's 4th Quarter earnings, Dominion has once again blown its forecast out of the water with another massive revision to the data center contracts pipeline to 40,200 MW. This is a stunning 88% increase since July.[47] Dominion posted 6 GW of new contracts between July 2023 and July 2024 and now reports a 6 month increase of 18.8 GW. While this projected growth is staggering, its trajectory is more realistic based on the expansive data center pipeline and the data that undergirds this report. For perspective, Dominion currently services just under 5 GW of data center load and has contracts for over 40 GW.

45 https://cdn-dominionenergy-prd-001.azureedge.net/-/media/pdfs/global/company/irp/2024-irp-w_o-appendices.pdf?rev=c03a36c512024003ae9606a6b6a239f3. PJM's 2024 Load Forecast for the Dom Zone increased for the fourth year in a row relative to the prior year's forecast. Key drivers to the year-over-year change in the PJM DOM Zone Load Forecast include: 1) increases in data center load growth focused in the NOVEC and ODEC service territories, and 2) revisions to the PJM EV load projections.

46 https://www.pjm.com/-/media/DotCom/library/reports-notices/load-forecast/2025-load-report.pdf.

47 https://s2.q4cdn.com/510812146/files/doc_financials/2024/q4/2025-02-12-DE-IR-4Q-2024-earnings-call-slides-vTCII.pdf.

FIGURE 7 PJM and Dom Zone Summer Peak Data (MW)

	PJM Total Load**	PJM Data Center Total	Dom Zone Total Load***	Dom Zone Total Load for Data Centers	Dom Zone New Load for Data Centers	DZ Data Center Load Adjust
	2025	2025 (Supp) MW	2025 (Supp) MW	2025 (Supp) MW	2025 (Supp) MW	Firm Contracts
2024			23,128*			21,400
2025	152,256	7,729		4,970	1,680	40,200
2039	218,455	63,238	47,135	27,094	23,556	
2040	220,224	63,923	47,956	27,754	24,200	
2045	228,544	66,810	51,604	30,616	26,958	

*metered
**PJM annual growth rate 3.1%
***Dom Zone annual growth rate 6.3% (adjusted from 5.5%)
^Unconstrained (current model) with VCEA

Last fall, the SCC requested supplemental information to Dominion's 2024 Integrated Resources Plan[48] specifically to isolate data center associated growth and cost. In the November 15 Supplement, the utility demonstrates two findings: without data centers, peak demand will actually decrease slightly over the next few years, from 17,353 MW this year to 17,280 MW in 2027 and future data center growth will drive up utility spending by about 20%. Conclusion? Without data centers and with continued efficiency, electricity use in the Dominion territory would not increase.[49]

NORTHERN VIRGINIA ELECTRIC COOPERATIVE (NOVEC) LEADS THE WAY

NOVEC, the rural cooperative that supplies power to western Prince William County and parts of Fairfax and Loudoun, recently updated its data center forecast. NOVEC will surpass Dominion's load levels for data centers as soon as 2027. Over the next five years, NOVEC expects that data center summer peak loads will grow from roughly 1,050 MW in 2024 to nearly 5,900 MW in summer 2029. This load growth will be driven by the energy demand for more than 100 new data centers, and also some that are currently experiencing energy constraints in eastern Loudoun County. NOVEC's forecasts are also based on signed contracts, limited to projects now in development.

Because the vast majority of these projects are scheduled for delivery within the next decade, load growth slows markedly over the final years of NOVEC's updated forecast. However, NOVEC clearly states that *"this trend reflects the lack of projects with signed*

48 https://www.scc.virginia.gov/docketsearch/DOCS/82I101!.PDF.
49 https://powerforthepeopleva.com/2024/11/27/under-pressure-from-the-scc-dominion-reveals-the-true-cost-of-data-centers/.

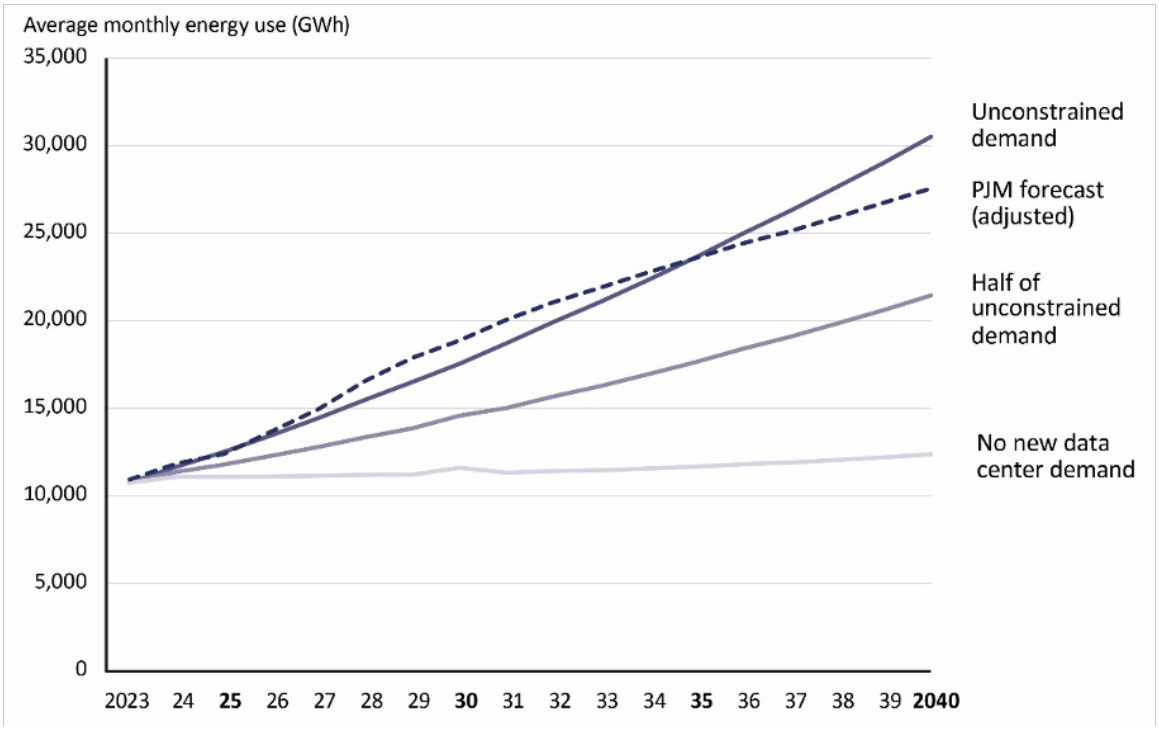
contracts for delivery during that time frame and should not be interpreted as a projection that growth will not or could not continue at a robust pace during that period." Data center loads are expected to grow to more than 12,500 MW by 2039 and as of January 2025, NOVEC already has additional new data center inquiries of about 3,000 MW that were not included in the 2024 forecast.[50]

UNCONSTRAINED DEMAND

At the same time that the data for energy imports was released, JLARC shared its independent, "Unconstrained Demand" model that sets the stage for the new reality that "the data center industry boom in Virginia has substantially driven up energy demand, and demand is forecast to continue growing for the foreseeable future. The state's energy demand was essentially flat from 2006 to 2020 because, even though the population increased, improvements in energy efficiency offset that increase. In a sharp reversal, by 2024 PJM forecast an unprecedented 5.5 percent year-over-year growth in the Dominion transmission zone, mainly because of increasing data center demand." This translates to a doubling of power within the next 10 years, attributed to data center growth.

JLARC's forecast[51] largely matched the most recent PJM forecast. JLARC's grid model found that a substantial amount of new generation and transmission infrastructure would need to be built in Virginia to meet unconstrained demand, or even half of unconstrained demand, and most of the new infrastructure needs would be attributable to the growing data center industry.[52] JLARC forecasts over 30,000 MW or 30 GW by 2040.

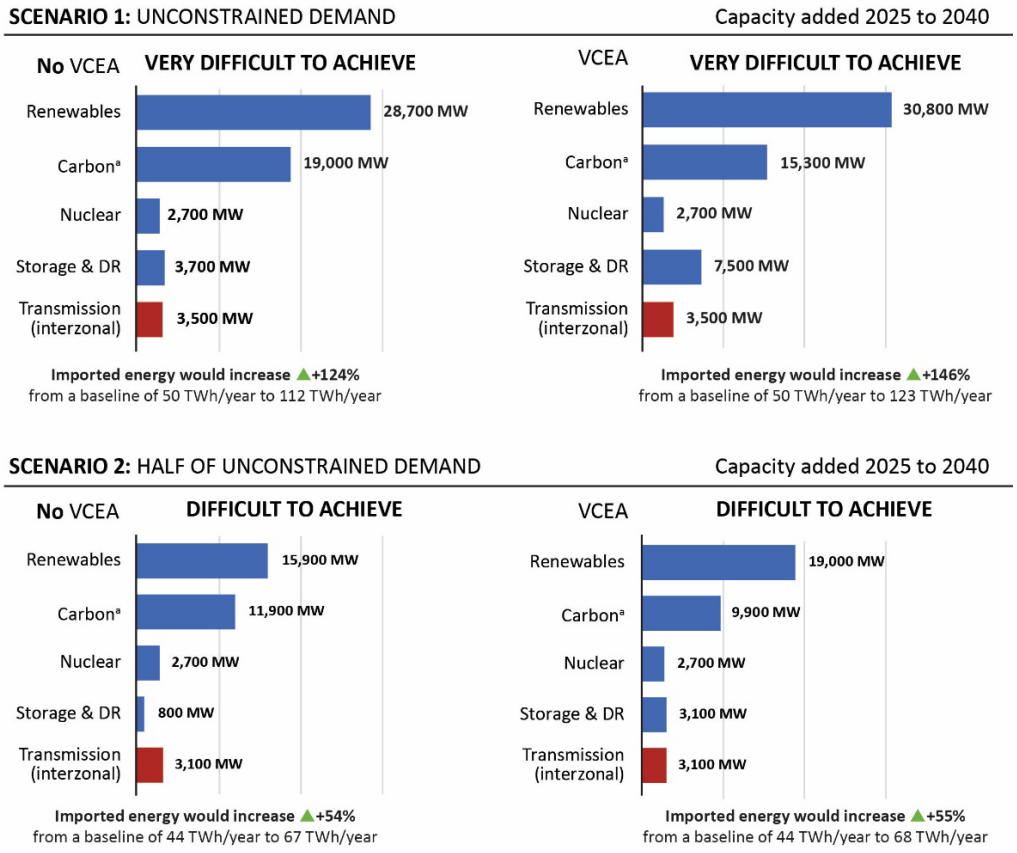
FIGURE 8 Data center demand would drive immense increase in energy demand in Virginia, based on JLARC's independent forecast and other forecasts.



50 https://www.pjm.com/-/media/DotCom/planning/res-adeq/load-forecast/novec-documentation.pdf.
51 https://jlarc.virginia.gov/pdfs/reports/Rpt598-2.pdf, p. 27.
52 Figure 3-3, https://jlarc.virginia.gov/pdfs/reports/Rpt598-2.pdf, p. 28.

These numbers are stunning and as a result, JLARC casts serious doubt on whether regional power generation can meet this level of demand, even by importing from elsewhere in the PJM market (See Figure 9 for generation mix through 2040).[53] Pressure to meet the needs of the expanding industry footprint in other states, such as in the Chicago and Ohio markets, could limit how much imported energy is available to Virginia.[54] By comparison, the SCC-directed Dominion IRP Supplement provides a "no data center growth" forecast of 18,608 MW, a savings of over 8 GW,[55] which would preclude the need for large increases in fossil fuel generation.

FIGURE 9: Estimated Generation Mix Needed to meet JLARC demand scenarios, with and without meeting VCEA requirements.



Data collected on specific data center projects for this report for which energy load is publicly available, already operating, in the pipeline or proposed, totals over 60,000 MW in demand. Of the 454 projects tracked, this energy tally excludes 273 or 60% of the data centers or campuses (219 with 3 or fewer buildings and 54 projects of 1 million sf or more) for which no energy load data is publicly available. Since this number significantly understates total data center demand now and over time, it raises the strong likelihood that forecasts will continue to rise significantly if the data center market holds. Of note, when totaling just the 28 Mega Projects (see Figure 10) for which we have data, 25 will require a total of nearly 38,000 MW at full build out.

53 https://jlarc.virginia.gov/pdfs/reports/Rpt598-2.pdf, pp. 124-126.
54 https://jlarc.virginia.gov/pdfs/reports/Rpt598-2.pdf, p. 35.
55 https://www.scc.virginia.gov/docketsearch/DOCS/82l101!.PDF.

Whether unconstrained development of data centers will require a third more or double the current energy demand, it is clear that current demand projections are too low. Even so, the numbers overwhelm the available power supply. For example, the coal-burning Clover Power Station in Halifax County provides 877 MW and powers 285,000 homes. Even 30,000 MW of new load would represent the equivalent of 34 new coal plants the size of Clover.

All of this demand puts strain on the system. Dominion Energy expects the time it takes to connect large data centers to the electric grid to increase by one to three years amid a surge in requests, bringing the total wait time to as long as seven years.[56] The longer wait time applies only to large data centers that need more than 100 MW of electricity and won't affect projects that have already been evaluated.

Clearly, a great deal of uncertainty about data center demand remains. To date, Dominion has relied on interconnection contracts to project increases in load growth. This helps determine near-term demand, but can the current system adequately project demand to forecast projects on the horizon when there are other factors in play such as:

- Are existing data centers changing how they service clients?
- What energy intensity will they utilize (watts/square foot)?
- Will existing data centers increase the number of servers/rack density in each data center?
- Will data center operators seek more power than originally requested at specific sites (requiring upgrades to substations/transmission, etc.)?
- Are companies keeping with their pledges to procure renewable energy on their own?
- How much by-right property remains available for development?

Concept Plan for GWV campus with 6 substations and 19 data centers in Stafford County.[57]

56 https://www.datacenterknowledge.com/energy-power-supply/data-centers-face-seven-year-wait-for-power-hookups-in-virginia?utm_content=bufferfeced&utm_medium=social&utm_source=linkedin.com&utm_campaign=buffer.

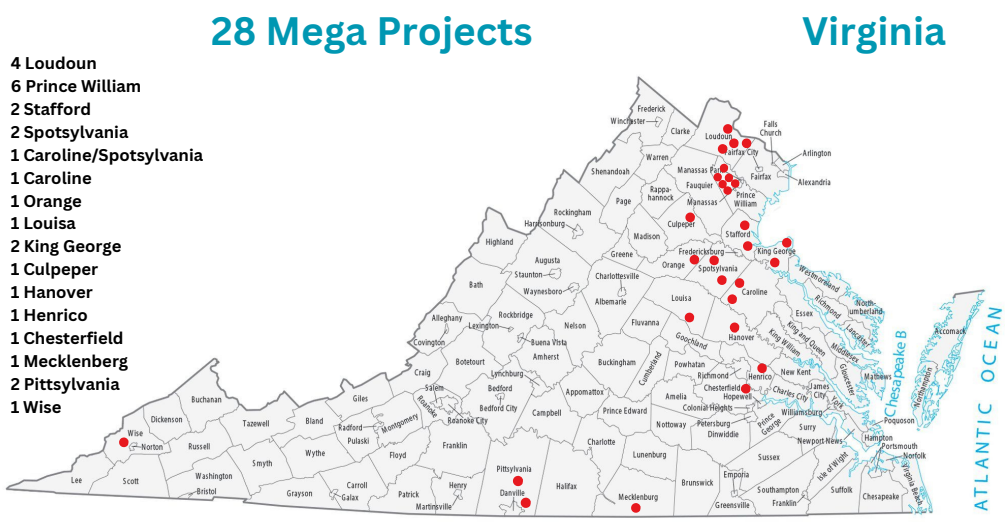
57 https://cdn.staffordcountyva.gov/Planning%20and%20Zoning/Development%20Review%20Meetings-Applications/December%202024/GWV%20Data%20Center%20Reclass/3-%20Impact%20Statement%20(10-15-24)%20-%20GWV%20Data%20Center.pdf.

FIGURE 10 1 Gigawatt Projects (Approved and/or Proposed)

Jurisdiction	Project	Acres	Square Feet	Bldgs	MW
Loudoun	CloudHQ LC1-14 21955 Loudoun Co Pkwy Ashburn	93	8,500,000	14	1700
Loudoun	Digital Realty "Western Lands/Digital Dulles" Sterling	424	11,700,000	11	1,000
Loudoun	Prologis 23799 Pebble Run/Carter's School Run Sterling	94	4,100,000	?	?
Loudoun	Active Infrastructure Spring Valley Tech Park Leesburg	362	4,700,000	14	1300
Prince William	QTS/Blackstone Digital Gateway North/ South (in litigation)	875.57	11,950,000	20	1,020
Prince William	Compass Digital Gateway West (in litigation)	884.16	11,550,000	17	1,700
Prince William	Microsoft University Bus Park University Blvd Gainesville	130.5	3,800,000	?	2,982
Prince William	Microsoft 13050 Hansen Farm Rd Gainesville	83	2,982,000	?	910
Prince William	JK Moving Hunter Property 8613 Linton Hall Rd Gainesville	196	3,650,157	11	?
Prince William	Stack/Youth for Tomorrow NVAO2 Hornbacher Rd Bristow	70	4,000,000	10	420**
Stafford	Garrett/GWV Data Center	1,042	7,900,000	19	2100
Stafford	Peterson Stafford Tech Campus	524	5,500,000	23	1800
Spotsylvania	Amazon Campuses (Cosner, Carter's Store, Summit)***	874	6,600,000	16	450**
Spotsylvania	AREP/PowerHouse 95	145	3,500,000	8	800
Caroline/Spots	Amazon Orrock Tech (Mattameade)	920	4,500,000	11	770
Caroline	Luck Stone Carmel Tech & Enterprise Center	1196.3	5,600,000	?	?
Orange	Amazon Wilderness Crossing (in litigation)	2600	5,000,000	?	1500
Louisa	Amazon North Creek Tech Campus	1440	8,700,000	10	2700
King George	Amazon (Birchwood)	869	7,500,000	19	2175
King George	Potomac Development Group (Dahlgren West)	500	9,000,000	15	900
Culpeper	AttaTech/XX Tech 15170 Hoffman Lane Brandy Station*	426	4,600,000	?	900
Hanover	Tract Hickory Hill Road Tech Campus	1,200	9,000,000	42	2400
Henrico	QTS/Blackstone White Oak Technology Park Sandston	622.1	3,600,000	13	1200
Chesterfield	Chirisa/AREP PowerHouse 1,600 Digital Drive	104	1,000,000	5	1,000
Mecklenburg	Microsoft Azure East BN1 101 Herbert Dr. Boynton	316	2,725,704	15	2,400
Pittsylvania	Anchorstone Advisors Data Center Campus Ringgold	950	8,000,000	5	200**
Pittsylvania	Balico Banister District	763	4,428,000	12	3,500
Wise	Energy Delta Lab Data Center Ridge	450	?	12	2,400
		18,153.63	**164,085,861**	**322**	**37,607**

*deferred indefinitely but not withdrawn
** will be far more MW than announced based on sf
***data from 3 proximate campuses: # of buildings missing for Carter's Store; Costner reports 450 MW (data not reported for other two)

FIGURE 11 Location of Data Center Mega Projects



*likely projects based on available public information

https://gisgeography.com/virginia-county-map/

MEGA PROJECTS

To further illustrate the level of anticipated energy demand, Figure 10 lists data center campuses, approved and proposed, that are each projected to need nearly 1 GW of power or more at full build out. These 28 "Mega Projects" add up to nearly 38 GW, even with 3 of them not having specific, published energy demand numbers and 3 likely underreporting based on square footage. If the MW per project is not publicly available, square footage or the number of planned substations can help determine how much energy could be required to power operations. For instance, the Prince William Digital Gateway could need up to 4 GW more than published reports. Most of these projects are approved but not built or operating yet.

One project is on hold, 2 are built and under expansion, 3 are subject to litigation. Adequate data about the size of Microsoft's investment in Mecklenburg, its eastern hub, has not been made available.

One cannot predict how much of the entitled land will ultimately be developed. That will be determined by market forces, energy availability, technological innovation and whether AI is truly poised to transform the economy. Even with some uncertainty, it is clear that demand published by PJM and JLARC is low based on this wide survey of the projects proposed state-wide. Much of this should be evaluated as additive to utility data, since many of these newer projects have not yet sought interconnection.

Big Shift in Energy Demand

POWER DENSITY

Power density is an important variable and impacts energy demand considerably and can vary widely. Operators are squeezing in more servers per rack to more efficiently use the same space. Higher power density can require more cooling, but the space efficiency can reduce costs for the end user. That end user has a financial incentive for increased density, but increased heat from the servicers is a negative byproduct if the

FIGURE 12 Power Density

Data Centers	Square Footage	Power Density w/sf	Total MW
Average Data Center	121,745,221	150	18,261
Hyperscaler	121,745,221	300	36,523
High Density Hyper-scaler	121,745,221	1000	121,745

goal is to minimize cooling needs.[58] Some companies advertise available power by watts per square foot (w/sf). A typical data center might use 150 w/sf, but those numbers are increasing. CyrusOne NVA5 in Loudoun offers up to 1000 watts/square foot at its massive data center.[59] At full buildout, the Corescale's Gainesville Crossing Campus will encompass 2.3 million square feet over five, two-story buildings and 326 MWs of available power and advertises 350 w/sf.[60]

In order to measure what this means at scale, new hyperscalers planned in the eight counties in the Greater Rappahannock/Upper mid-State Region illustrate how power density can vary considerably. With a current estimate of 121,745,221 sf, the range of load demand could vary tremendously:

To ensure that data centers have enough back up power to cover the increased power density, back-up power capacity may need to be incrementally increased. Since the number of diesel generators maps the energy power needed during an energy outage, and some data center operators appear to be incrementally adding diesel generators to existing facilities, there may be a connection. For instance, two data centers run by Amazon on Loudoun County Parkway in Ashburn (IAD114, IAD115) permitted in 2018 with 33 generators, added seven more in 2024 according to Department of Environmental Quality (DEQ) air permits.[61] Two were added at QTS/Blackstone in June at the Sandston Campus and also at its Lockridge campus in Loudoun. An air permit for 7 Amazon data centers added five generators in 2023 and 6 in 2024.[62]

NEED FOR ENERGY EFFICIENCY

All of these factors are leading to more unprecedented energy demand. Energy efficient facilities are more important than ever, since they use less energy, reducing energy costs and carbon emissions. Currently, there are no state provisions to ensure data centers are built and operated to meaningful levels of energy efficiency. Efficiency could serve as a partial solution to the current energy crisis since the amount of new power needed would be reduced. Given that Dominion and PJM have stated that new demand for energy in Virginia is being driven by growth in the data center industry, it makes sense to insist that operators who seek state tax incentives meet the highest standards for efficiency.

Sierra Club has sought to increase building energy efficiency throughout all building sectors and data centers should be no exception. By tying energy efficiency to state sub-

58 https://www.digitalrealty.com/resources/articles/how-can-i-determine-a-data-centers-power-density-and-what-factors-are-used-in-that-evaluation.
59 https://www.cyrusone.com/data-centers/north-america/virginia/nva5-sterling.
60 https://corscale.com.
61 https://www.deq.virginia.gov/home/showpublisheddocument/25628/638627830245070000.
62 https://www.deq.virginia.gov/home/showpublisheddocument/25624/638627824035800000.

sidies, Virginia is more likely to meet the state Virginia Clean Economy Act (VCEA) goal of 73% clean energy by 2035 and 100% clean energy by 2045. In the last two General Assembly sessions, legislation[63] has been introduced to incentivize more energy efficient data centers by conditioning the receipt of state tax credits on data center operators meeting high standards for energy efficiency and renewable energy procurement, and on not using highly-polluting diesel fuel for on-site power generation. Data centers would need to achieve power usage efficiency (PUE) scores of 1.2 or better, a rigorous but achievable score. The legislation also requires that data center operators who want Virginia tax incentives procure carbon-free renewable energy and associated renewable energy certificates to meet 90 percent of their electricity requirements on a 24/7 basis by January 1, 2027. This goal is consistent with the commitments of leading tech companies, and the 3-year lead time gives the market and grid operators time to prepare.

Amazon states that its new data centers are being designed to meet a PUE of 1.08, but will it commit to that for all new data centers in Virginia? Google's current operations in Virginia meet a 1.08 PUE and Microsoft advertises a PUE of 1.14 in the state. QTS/Blackstone reports a PUE of 1.43 for its fleet in 2023. While we have no way to validate any of these claims, it would appear that 3 of the 4 largest data center companies are already meeting efficiency targets outlined in the bills and should have no trouble supporting legislation requiring it. Instead, the industry has blocked energy efficiency bills and any meaningful legislation aimed to reduce demand for energy.

RURAL COOPERATIVES

While much attention focuses on Dominion's role, rural cooperatives are key to energy delivery for data centers. Northern Virginia Electric Cooperative (NOVEC), Mecklenburg Electric Cooperative (MEC) and Rappahannock Electric Cooperative (REC) increasingly service data centers. As the JLARC report noted, this presents a challenge to Virginia's efforts to achieve a clean energy transition since rural cooperatives are exempt from most provisions of the VCEA, the state's landmark legislation to reduce reliance on fossil fuels. Yet more than half of future energy demand growth is expected to occur in the co-ops' service territories, where many new data center campuses are expected to be built.

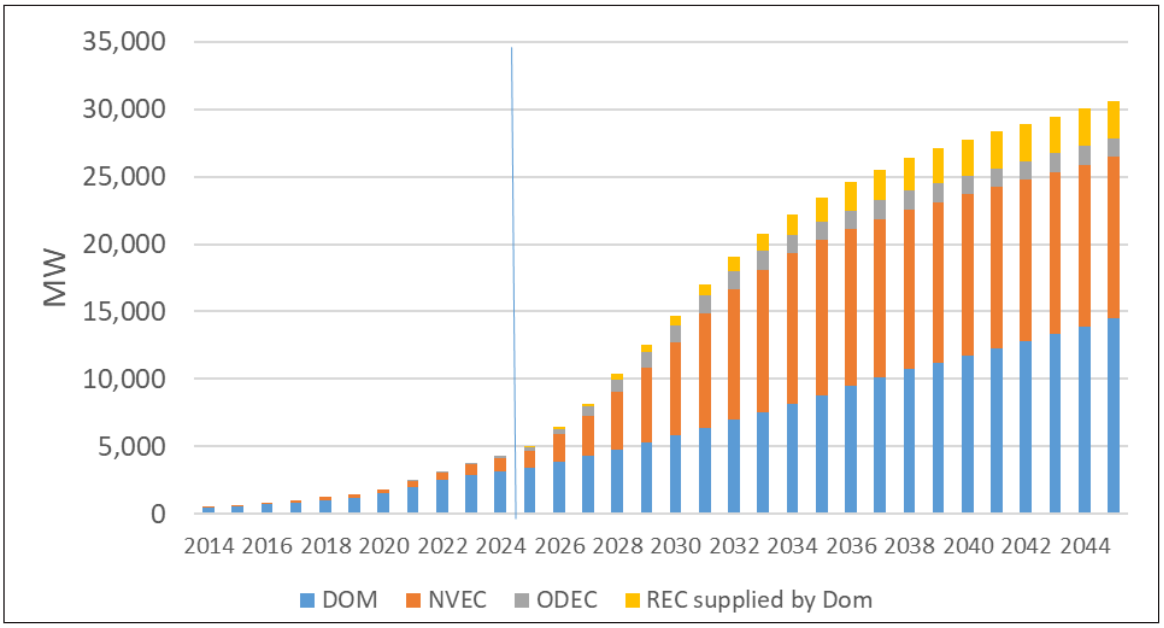
As previously noted, NOVEC poses a particular challenge. It currently serves 58 data center buildings on over 21 campuses in Fairfax, Fauquier, Loudoun, and Prince William counties and reports that over 70% of its sales are to data centers. This could rise to 95% by 2032. Data center customers account for 3,000 MW of contracted electric capacity through 2023, while another 10,500 MW is forecasted.[64] NOVEC maintains 10 substations that only service data centers and has seen an increase of over 60% in kilowatt hours sold between 2020 and 2023.[65]

63 HB 2578/SB 1196, introduced by Delegate Sullivan and Senator Deeds in the 2025 session, puts in place incentives to avoid increases in carbon emissions and reduces the taxpayer burden of paying for both future costs of carbon reductions and the state incentives.

64 NOVEC testimony at the December 9, 2024 SCC Data Center Technical Conference.

65 https://www.novec.com/About_NOVEC/upload/NOVEC_AR-2024-nobleed-compressed.pdf.

FIGURE 13 The chart below shows the total amount of large loads for summer in history and the forecast.[66]



Other electric cooperatives may soon follow NOVEC's path. REC reports that the largest data center it serves today needs 50 MW, but the utility projects new demand of over 16,700 MW by 2040, reflecting requests ranging from 150 MW to multi-thousand. REC is planning for the construction of several massive campuses for Amazon Data Services and other companies.[67] Between 2020 and 2023, MEC has more than doubled its kilowatt hours sold. This coincides with Microsoft's tremendous expansion plans, still underway.[68]

FIGURE 14 Rural Electric Cooperatives Growth

NOVEC	Kilowatt hours sold	MEC	Kilowatt hours sold
2020	6,210,000,000	2020	567,122,570
2021	7,370,000,000	2021	607,030,705
2022	8,520,000,000	2022	859,260,292
2023	10,100,000,000	2023	1,206,256,321

This increased energy demand mirrors what the Dominion service area is experiencing and 2024 numbers are expected to continue these trends. Most of the largest campuses in Greater Rappahannock/Upper mid-State Region (see Figure 15) will be serviced by rural cooperatives, with serious climate consequences if the cooperatives remain exempt from VCEA clean energy requirements.

66 https://www.pjm.com/-/media/DotCom/planning/res-adeq/load-forecast/2025-long-term-load-forecast-supplement.pdf.
67 REC testimony at December 2024 SCC Data Center Technical Conference.
68 https://www.meckelec.org/wp-content/uploads/2023-MEC-Annual-Report-Staying-Power.pdf.

FIGURE 15 Large Campuses in Greater Rappahannock/Upper mid-State Region

County	Project	Acres	Square Feet	Bldgs	MW
Stafford	Stack/Peterson Stafford Tech Campus	524	5,800,000	23	1800*
Stafford	Garrett/GWV Data Center	1,042	7,900,000	19	2100*
Spotsylvania	Amazon Carter's Store Tech Campus	314	2,600,000	?	?
Spotsylvania	AREP/PowerHouse 95	145	3,500,000	8	800
Caroline/Spotsylvania	Amazon Mattameade/Orrock Tech	920	4,500,000	14	770
Caroline	Luck Stone Carmel Tech & Enterprise Center	1,196	5,600,000	?	?
Orange	Amazon Wilderness Crossing (in litigation)	2,600	5,000,000	?	1500
Louisa	Amazon Campus 2 North Creek Tech	1,440	8,700,000	10	2700
Hanover	Tract Hickory Hill Road Tech Campus	1,200	9,000,000	42	2400
Culpeper	AttaTech/XX Tech Brandy Station (PC denied)	426	4,600,000	?	900
		9,807	**57,200,000**	**116**	**12,970**

*estimate based on #of substations

Policy Recommendations

- Enact state energy performance requirements for data centers to ensure energy efficiency. Tie Data Center Tax Exemptions to energy efficiency to incentivize even more energy efficient data centers by conditioning the receipt of state tax credits on data center operators meeting high standards for energy efficiency and renewable energy procurement, and on not using highly-polluting diesel fuel for on-site power generation. Data centers would need to achieve power usage efficiency (PUE) scores of 1.2 or better. Beginning in 2027, at least 90% of their energy would have to come from carbon-free renewable energy sources.
- Data Centers should be in their own class of customers within utilities.
- The law should allow large buyers to buy their own clean energy outside of Dominion.
- Large energy buyers with climate targets should reorient from annual (or volumetric) renewable energy purchases to hourly tracking to ensure that their energy requirements are being met by local, time-matched clean energy. Doing so can drive clean generation that is able to produce during the hardest hours, storage, and demand management, all of which serve to improve system reliability while reducing reliance on fossil fuel capacity.[69]
- Given the increasing load requests in areas served by rural electric cooperatives, those cooperatives should also be subject to renewable energy requirements under the law.

69 https://www.sierraclub.org/sites/default/files/2024-09/demandingbetterwebsept2024.pdf.

Impacts on Carbon Emissions

IS VIRGINIA BECOMING A CLIMATE POLLUTION "HOT SPOT?"

The Virginia Clean Economy Act (VCEA) establishes a target of 100% carbon-free energy by 2050. Clues that data centers are the catalyst to reversing Virginia's trajectory to reduce energy demand and carbon emissions came with Dominion's 2023 IRP projections of a doubling of greenhouse gas emissions to 36,000,000 metric tons by 2048. This is attributed to massive growth in data centers and the requisite need for new energy capacity.

While the JLARC study mentions carbon challenges due to the data center industry, it fails to provide much detail, analysis or focus. This leaves one with a sense that carbon concerns were not taken seriously in the study.

Across the Commonwealth, projects continue to get approved that contribute to demand for fossil fuels without any requirement for adequate energy efficiency and carbon reduction measures. Virginia's carbon footprint is increasingly tied to these buildings. While other sectors are reducing total emissions - data centers are blowing up our targets - on the backs of residents and small businesses.

Data reported by the Metropolitan Washington Council of Governments (MWCOG) suggests that increases in carbon emissions in Northern Virginia localities is already well under way. Shared data between 2005 and 2020 is calculated per capita during an era of high population growth. With population growth stagnant in the region and increasing emissions from the commercial sector (data centers), those numbers could skyrocket in the next reporting period. Loudoun, originally forward thinking when it committed to an Energy Strategy in 2010, reported emissions up 54% in 2020. A key goal was to have greenhouse gas emissions among the lowest in the country, but imagine how high emissions must be in 2024, given the massive growth in data centers.[70]

Prince William County has adopted greenhouse gas emissions goals that call for reducing emissions to half of 2005 levels by 2030, a target it has acknowledged it cannot meet. As a result, its Sustainability Commission has called for a pause in data center approvals "until the county can (a) adequately analyze and manage cumulative impacts of data center development, including effects of additional data centers on the climate mitigation goal, and (b) the County can devise a method to condition approval of any additional data centers on binding commitments by the applicants to use at least 90% zero-carbon electricity by 2030." The Community Energy and Sustainability Master Plan's (CESMP) forecast of the County's 2030 GHG emissions projected data centers would contribute only about 5% of the total forecast of 4.6 MMTCO2e. In [2024?], however, the Commission's independent determination indicated that data centers would contribute about 84% of a total forecast of 22 MMTCO2e. Accordingly, the Commission called for a pause in approving new data centers.[71]

---

70 https://www.loudoun.gov/DocumentCenter/View/49901/County-Energy-Strategy-V2-One-sheet?bidId=.

71 Sustainability Commission recommendations to manage greenhouse gas emissions from data centers in Prince William County, April 25, 2024. Commission recommends that the Board of County Supervisors (BOCS) examine ways to pause approvals on new data centers, including eliminating the opportunity zone and targeted industry status, BE IT FURTHER RESOLVED that the Commission recommends that the BOCS and Office of Sustainability immediately prioritize CESMP Action E.3: Encourage Renewable Energy Use in Energy-Intensive Commercial Buildings, including developing a program to encourage, and if possible, require all existing and fully permitted data centers to commit to use at least 90% zero- carbon electricity by 2030.

Some of the largest data center companies in Virginia have recently admitted that the impact of AI is undermining their emissions reductions goals, creating a "real risk" that tech company climate commitments will take a back seat to their AI aspirations. Even though many companies have committed to fast-approaching decarbonization targets, those goals are increasingly at odds with ambitions for massive computing power.[72] For example, MIcrosoft's total emissions are up 29.1% since 2020, with energy consumption up a whopping 30% between FY2022 and FY2023. This fall, Google also reported its energy consumption was up 17% in 2023 and its emissions were up 13%.[73]

Google Data Centers in Arcola, Loudoun County

Amazon claims to have met all its goals, be the industry leader in sustainability and have more renewable energy than its competitors. One area where it certainly does not lead, however, is in providing the data to support its claims. While Amazon has made significant and welcome investments in solar energy in Virginia, its data centers consume far more energy than is available from all the solar farms currently operating in the Commonwealth, and perhaps in all of PJM.

Given that Amazon will likely represent nearly half the data center market in Virginia, if it isn't that already, it should be expected to lead the way on transparency and share non-aggregated environmental metrics and carbon data for all of its buildings in Virginia.

We look forward to a time when Amazon's public pronouncements are backed up with verifiable facts. Earlier this year, Amazon announced plans to update its data center infrastructure to support innovation in AI, power, cooling and hardware design geared toward increasing energy efficiency and decreasing the carbon footprint of its data centers. This is a welcome announcement, but suggests that the company has a long way to go in upholding its public promises of operating sustainably.[74]

72 https://www.latitudemedia.com/news/microsoft-reveals-the-energy-impact-of-artificial-intelligence.
73 https://www.computerweekly.com/news/366592778/Microsoft-and-Googles-GHG-emissions-gains-call-viability-of-net-zero-targets-into-question.
74 https://www.reuters.com/business/environment/amazons-total-emissions-fell-2023-it-meets-renewable-power-goal-2024-07-10/.

NATURAL GAS

Dominion sees natural gas generation as a critical component to meet load forecasts and to ensure the ability to reliably meet generation demand.[75] The JLARC report confirmed trends toward on-site natural gas generation to help solve data center companies' power problems. Several data center companies indicated that they were pursuing on-site generation as a primary power source but planned to rely on the main grid for backup. Because electric utilities have an obligation to serve all customers in their service territory, they would still need to build the infrastructure necessary to provide power to these sites, even if they are only serving in a backup capacity.

"New natural gas plants would have to be added at a rate of one large 1,500 MW plant almost every year (without meeting VCEA requirements) or almost every 1.5 years (meeting VCEA requirements) for 15 consecutive years, which would be faster than the rate they were added during the busiest build period of the last decade in the state."[76] These are staggering numbers.

Natural Gas Plant, Austin, Texas, Al Braden, 2012.

Vantage, developing over 5.6 million sf in Loudoun has begun to directly plug natural gas into one of its facilities.[77] In its 2023 ESG report it is interesting to note that Vantage does not list Virginia data centers as those powered by renewable energy or those that have LEED certification. Its data centers in California and Washington State are LEED

75 https://cdn-dominionenergy-prd-001.azureedge.net/-/media/pdfs/global/company/irp/2024-irp-w_o-appendices.pdf?rev=c03a36c512024003ae9606a6b6a239f3, p. 41.

76 https://jlarc.virginia.gov/pdfs/reports/Rpt598-2.pdf, p. 31.

77 https://www.deq.virginia.gov/home/showpublisheddocument/25986/638633875365530000 for eight (8) -Solar SMT-130 simple cycle combustion natural gas fired turbines equipped with SoLoNOX burners.

certified.[78] Nearby, Blackstone (QTS) just announced that it will be purchasing the 774-megawatt Potomac Energy Center natural gas power plant in Leesburg in large part because of its proximity to data centers.[79] The Northern Virginia Regional Commission recently gave an audience to a firm that sees itself as an answer to the power needs. It sells natural gas-powered localized energy systems to provide autonomous or in conjunction with main grid reliable power generation in the name of reliability.[80]

Two recently-announced massive projects in Pittsylvania County are taking advantage of proximity to the Mountain Valley Pipeline (MVP) to service their proposed data centers with natural gas. Long opposed by the Sierra Club as a polluting fossil fuel behemoth, MVP gas would flow directly into these data centers. In comparing natural gas to coal, gas's methane releases puts its climate risk on par with coal.[81]

Anchorstone Data Center Campus in Ringgold is expected to build 8,000,000 sf of data centers (reportedly 70 buildings!) and a natural gas power plant. The recently re-proposed Balico Tech Campus includes plans for a massive 3,500 MW fracked gas plant, which would make it almost three times the size of any gas plant in operation in Virginia today, with a capacity well in excess of the 300 MW of data centers planned for the first phase. The developer said "MVP will provide us with all the gas we need, and it's right there on our site." AltaGas, an investor in the MVP, has said data centers would lead to the expansion of the MVP. Expansion plans for natural gas as the primary energy source to data centers or as backup energy when there's insufficient power from the grid are being considered.[82]

Needless to say, this direct line from fossil fuels to data centers has Virginia headed backwards when it comes to transitioning to a clean economy. The rather quick pivot to ramp up natural gas use is alarming. Given the bleak outlook of the JLARC modeling that says that both "unconstrained" and "constrained" demand scenarios "would be difficult to accomplish" and "especially challenging to meet demand while also fully meeting VCEA renewable requirements," the state should pause this extreme industrial expansion until a viable, zero-carbon energy solution is planned and in place and the ratepayers are fully protected from data center infrastructure costs.

The JLARC study is clear that while electrical utilities have an obligation to serve any customer within their service territory, they are not required to provide service immediately upon request. Their foremost responsibility is to ensure the reliability of the power grid before adding any new, large customers like data centers. Given infrastructure constraints, utilities can protect grid reliability by delaying the addition of new large load customers until there is adequate generation and transmission capacity. This has previously been done without legal objections.[83]

---

78 https://vantage-dc.com/wp-content/uploads/2024/07/2023-ESG-Report_Vantage-Data-Centers.pdf.

79 https://www.reuters.com/business/energy/blackstone-buy-1-billion-virginia-power-plant-near-data-centers-2025-01-23/.

80 https://enchantedrock.com/datacenters/.

81 https://rmi.org/reality-check-natural-gas-true-climate-risk/.

82 https://www.datacenterdynamics.com/en/news/data-centers-in-discussion-with-washington-gas-for-gas-as-primary-power-source-could-expand-mountain-valley-pipeline/.

83 https://jlarc.virginia.gov/pdfs/reports/Rpt598-2.pdf, p. 30-36. It is less clear if utilities are allowed to delay adding new load because of generation concerns. For example, representatives from one co-op utility indicated they did not believe they had the authority to provide less load than requested or delay new load additions for capacity, costs, or other reasons.

Policy Recommendations

- Uphold the Virginia Clean Economy Act
- Do not permit the expansion of natural gas use and rely on renewable sources of energy
- DEQ should track and make public scope 1, 2 and 3 emissions from data centers
- Create a Carbon Mitigation Fund to be financed by data center operators/owners
- The state should pause this extreme industrial expansion until a viable, zero-carbon energy solution is planned and in place and the ratepayers are fully protected from data center infrastructure costs
- The state could explicitly give utilities the authority to delay additions of new large loads if it is necessary to maintain grid reliability and avoid exceeding available generation or transmission capacity constraints.

Impacts on Energy Cost to Taxpayers and Ratepayers

THE COST OF THE TAX EXEMPTION

The December JLARC study says the state exempted 928.6 million in FY 23 with top 5 companies getting 759.3 million. The report does not list the 5 top recipients. If a typical modern 250,000-square-foot data center costs $250 million to $325 million to build and equip, taxpayers are subsidizing each data center to the tune of about $9 million to $15.5 million in savings (depending on the locality). This does not include the savings from equipment upgrades. Overall, the report evaluated the exemption to provide "moderate economic development" compared to other state economic incentives.[84][85]

A 2024 analysis notes that Virginia's 8.6 million residents lost about $87 each from the subsidy. At the same time, Loudoun County's 440,000 residents gained about $1,506 each. So, the local "concentrated benefits" disproportionately advantages certain jurisdictions, while all taxpayers help to fund the state subsidy.[86] If the market for data centers remains on its current course, the exemption will continue to rise significantly and will cost taxpayers more each year.

According to the 2024 JLARC Report on Economic Incentives, "Data centers were by far the largest beneficiary of incentive spending, which reflects the sizable capital investment by the industry. The sales and use tax exemption for data centers accounted for 42 percent of all incentive spending over the decade at $1.71 billion." Those last 10 years don't tell the whole story, however, since the growth in the exemption is expected to be explosive based on the number of projects planned to come online in the coming years.[87]

Initiated in 2010, Virginia was the first state to offer the tax exemption to spur busi-

84 https://jlarc.virginia.gov/landing-2024-data-centers-in-virginia.asp, p. 21.
85 https://jlarc.virginia.gov/pdfs/reports/Rpt597.pdf, p. 5. It looks like there might be discrepancies between the JLARC Study and the JLARC Economic Incentives Annual Review. The latter listed $685 m for FY 2023.
86 https://goodjobsfirst.org/virginia-data-center-subsidy-costs-balloon-by-1051/.
87 https://jlarc.virginia.gov/pdfs/reports/Rpt597.pdf.

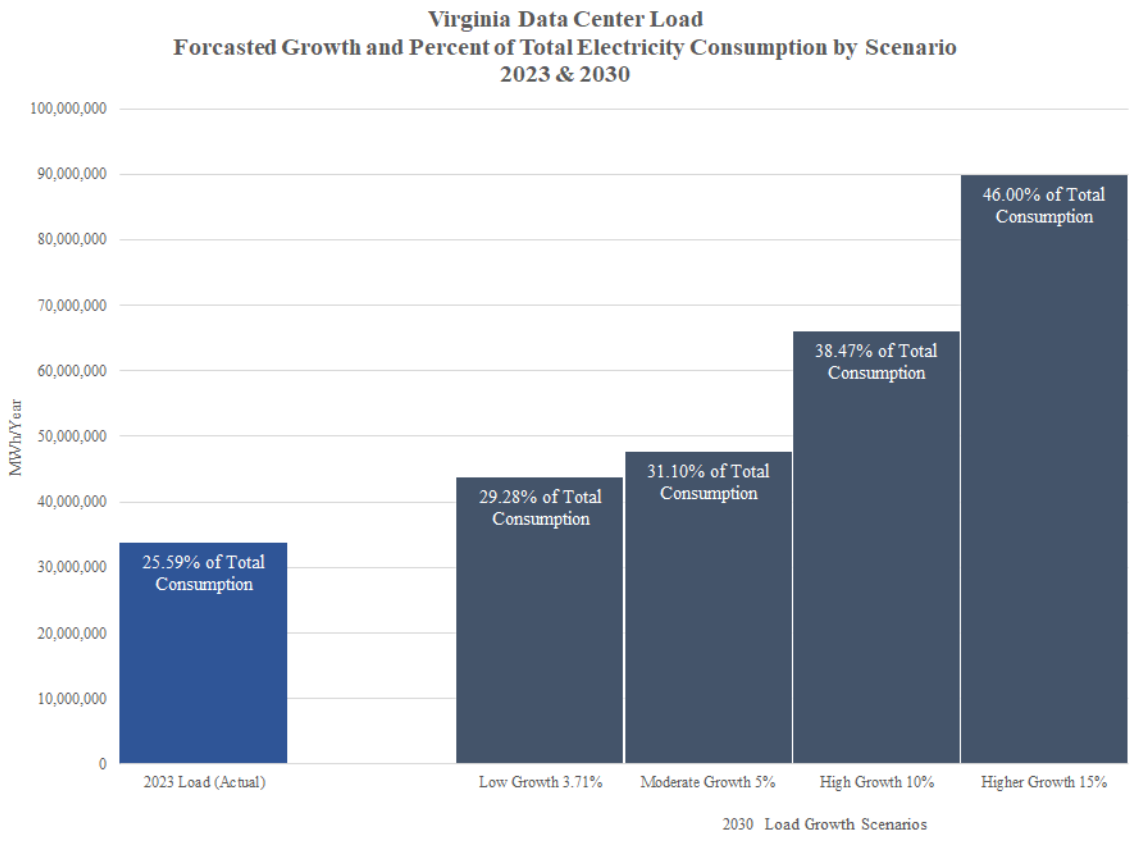
nesses to locate here. Companies were required to invest $150 million and at least 50 jobs. Amazon landed more incentives to expand in Virginia and qualifies for a 15-year extension on tax exemptions for equipment and software installed at the new locations and has to deliver just 1000 jobs altogether. It may be eligible for $140 million in performance grants, tied to infrastructure investments and workforce improvements.

What could once have been viewed as a reasonable effort to enhance economic development has become a boondoggle at the expense of taxpayers, who will increasingly subsidize an industry with record profits and whose major companies are reversing Virginia's plan and policies to transition its power grid to clean energy sources. Runaway reliance on fossil fuels is underway as is the resulting carbon pollution. The state's deep relationship with Amazon has been in full force since before it landed the second Amazon Headquarters in Arlington with a $750 million custom grant. The technology giveaway continues, arguably too successfully and at the expense of other industries.

RATEPAYER LIABILITY

Between Dominion's IRP, the recent JLARC study and the December SCC Data Center Technical Conference, the debate on who will bear the cost of this massive data center infrastructure expansion is raging. While the debate on how to protect residential and other commercial customers is just getting started, it is clear that historic data does not predict the future of who will bear the cost, given the pace and scope of infrastructure that is being planned. The need for accurate and thorough energy demand forecasting is imperative. Demand numbers are revised constantly, sometimes twice in one year, and still only reflect those projects that have entered into contracts with the utility companies.

FIGURE 16 Virginia Data Center Load



Dominion's 2024 IRP states that ratepayers can expect continuing increases in their electricity rates, and that is only based on projects currently in the pipeline. Analyzing its favored scenario using the methodology directed by the SCC, Dominion projects residential bills will rise over the next 15 years from an average of $142.77 today to $315.25 in 2039. This is not in the public interest of Virginia ratepayers. Further, in Dominion's November 15, 2024 SCC-directed IRP Supplement, Dominion confirmed that data centers are driving the demand for new power.

If these overall new energy requirements rise more than what is modeled by Dominion and JLARC, what will the ratepayer impact be? How will regulators hedge to protect non-data center ratepayers?

More than half of all the nation's energy consumption attributed to data centers occurs in Virginia, mostly in Northern Virginia. Today, that number is over 25.59% of Dominion's sales and is slated to rise to 46%.[88] The rural cooperatives are projecting far higher percentages.

A recent independent analysis sees PJM energy pricing in the following way:

> "The problem is particularly acute in the mid-Atlantic states that are members of the PJM Regional Transmission Organization, and especially in Virginia. The annual PJM capacity market auction provides a measure of spare capacity: If prices go up it is an indication that capacity is tight and the market, detecting a problem, signals a need for new investment via higher prices. In the most recent auction, capacity market prices increased from $29 to $270 per MW-day across the PJM region. In the parts of Virginia served by Dominion Energy, the capacity market price increased from $29 to $444 per megawatt-day [1]. This signals an urgent scarcity in generation and transmission capacity, which will require tens of billions of dollars in new investments to remedy, and this cost will ultimately fall to ratepayers. The sharp increase in capacity prices reflects not only tight market conditions but also adjustments to remedy transmission constraints and reliability issues of the sort revealed by Winter Storm Elliott. One way or another, the grid needs new investments to avoid future blackouts and brownouts. It is clear that energy prices will need to increase in the next five to ten years in Northern Virginia to pay for the increased investment in capacity and also to limit the quantity demanded. We estimate that prices will need to increase by 25 to 70 percent by the end of the decade…that translates to an increase in the average monthly electric from $183.57 in the reference case--the current price plus inflation--to $282 per month if residential customers pay the same pro rata share of the costs imposed by data center energy growth." [89]

RATEPAYER INEQUALITY

Residential ratepayers in Virginia already are subject to higher rates than commercial and industrial users. With an average monthly residential electricity bill of $144.24, Virginians pay 3.52% more than the national average of $139.34.[90]

88 Figure 2: Virginia Data Center Load Growth: 2023 & 2030 https://papers.ssrn.com/sol3/papers.cfm?abstract_id=5017484.
89 https://papers.ssrn.com/sol3/papers.cfm?abstract_id=5017484.
90 https://findenergy.com/providers/dominion-energy/

FIGURE 17 Dominion Energy Rates

Rate Class	Cents per kWh
Residential	14.09
Commercial	9.23
Industrial	7.63

One of the major risk components of the data center build out is the impact on residential ratepayers. While the JLARC study acknowledged this, it stated that it is difficult to assign values to the fixed costs of generation and transmission and it did not provide a rate design analysis for Virginia utilities serving data centers. It did share two findings that don't bode well for ratepayers: 1. Load growth will increase system costs directly attributable to new large loads and 2. The fixed costs associated with generation and transmission represent the largest sources of potential ratepayer inequity with data center growth vs. distribution costs that can be more easily assigned to specific customers. As mentioned above, the public now has an idea of how costly transmission will be. Of course, Virginians should be privy to the full range of infrastructure costs attributed to data center expansion.[91]

A recent analysis of utility proceedings put it this way:

> For many utilities, their expectations about growth are now dominated by new data centers. Rather than being dispersed across a utility's service territory like homes and businesses, these new data center consumers that are benefitting from utility expansion are identifiable and capable of paying for infrastructure that will directly serve their facilities. If PUCs allow utilities to follow the conventional approach of socializing system expansion, utilities will impose data centers' energy costs on the public. The easiest way for utilities to shift data centers' energy costs to the public is to simply follow long-standing practices in rate cases. In our view, however, utilities are often using more subtle ratemaking methods to push data centers' energy costs onto consumers' bills…Further
>
> And offer three ways that consumers cab be forced to pay for data center's energy costs: First, special contracts between utilities and data centers, approved through opaque regulatory processes, are transferring data center costs to other consumers. Second, disconnected processes for setting federally regulated transmission and wholesale power rates and state-set consumer prices are: A) causing consumers to pay for interstate infrastructure needed to accommodate new data centers; B) putting consumers on the hook for new infrastructure built for data-center load that never materializes; and C) allowing data centers to strategically reduce energy usage during a few hours to reduce their bills and shift costs to other consumers. Third, data centers that bypass traditional utility ratemaking by contracting directly with power generators may also be raising electricity prices for the public. These co-location agreements between a data center and adjacent non-utility generator may trigger an increase in power market prices and distort regulated electricity delivery rates.[92]

91 https://jlarc.virginia.gov/pdfs/presentations/JLARC%20Virginia%20Data%20Center%20Study_FINAL_12-09-2024.pdf, p. 19.

92 https://eelp.law.harvard.edu/wp-content/uploads/2025/03/Harvard-ELI-Extracting-Profits-from-the-Public.pdf, p. 10-11.

TRANSMISSION COSTS ALLOCATED TO RATEPAYERS

In the SCC requested Dominion's 2024 IRP Supplement[93] on data centers, Dominion was required to specifically "identify whether the need for the transmission project is primarily being driven by data center load growth." Data center driven projects "Y" specifically indicate that the interconnection is for new data center load. Projects identified by an "M" in the Data Center column are mixed load may be driven by increased loads within a region (including those from data centers) but are not directly attributed to a specific customer type.

Of the 203 projects listed, 89 or 44% are data center only "Y" and 37 are designated "M." Together, 62% of the transmission projects planned before 2031 involve data centers. The cost of the data center only "Y" projects comes to $2.4 billion. Under PJM's transmission cost allocation, the $2.4 billion tab will be paid for by utility ratepayers across the PJM footprint.[94]

In a recent SCC proceeding regarding the Amazon Plaza 500 application, the utility told the SCC that the $23 million project would be paid for via the FERC-approved transmission tariff. The utility's existing state-approved tariff allows half of all costs assigned through the FERC-regulated tariff to be billed to residential ratepayers, and the remaining half billed to other existing ratepayers. The result is that existing tariffs force the public to foot the bill for transmission investment just for data centers.[95]

CORPORATE PROCUREMENT OF RENEWABLE ENERGY

In its approach, Sierra Club advocates to minimize costs and unnecessary infrastructure and its impact on ratepayers. This requires that regulators ensure new large customers are transparent about their load projections and pay their fair share of transmission and system costs.[96]

Some companies are beginning to take steps in the right direction. Both Amazon and Meta have procured significant solar capacity in Virginia. A map on Amazon's website[97] shows the company has invested in 19 solar farms in Virginia, with a capacity that totals around 1,386 MW. But with its massive build out, this falls far short of actual demand in Virginia which is well over 11,000 MW (which excludes 86 buildings/projects for which energy data is unavailable).[98] Meta lists 700 MW of solar projects in the state.[99]

More recently, Google announced plans to purchase the full capacity of Rocky Forge Wind, a wind farm in Botetourt County that will be Virginia's first land-based wind farm. Rocky Forge, will consist of 13 turbines that will generate about 79 megawatts of power.

---

93 https://www.scc.virginia.gov/docketsearch/DOCS/82l101!.PDF, p. 53.

94 https://ieefa.org/sites/default/files/2025-01/UPDATED-REVIEWED-Southeast%20Gas%20Infrastructure%20and%20Data%20Cente.pdf, p. 19. PJM allocates costs for larger transmission projects based on a formula that is 50% allocated to all utilities based on their contribution to PJM's total load and 50% allocated to those zones of PJM expected to benefit most from the project. For smaller projects, the cost is allocated to the PJM zone where the benefits will be received, in this case the PJM Dominion Zone. (See 187 FERC ¶ 61,012).

95 https://eelp.law.harvard.edu/wp-content/uploads/2025/03/Harvard-ELI-Extracting-Profits-from-the-Public.pdf, p. 16.

96 https://www.sierraclub.org/sites/default/files/2024-09/demandingbetterwebsept2024.pdf.

97 https://sustainability.aboutamazon.com/climate-solutions/carbon-free-energy?energyType=true.

98 https://virginiamercury.com/2024/07/24/amazon-claims-to-power-all-its-operations-with-renewable-energy-if-only-that-were-true/.

99 https://datacenters.atmeta.com.

New powerlines in Arcola, Loudoun County

While a drop in the bucket given the size of Google's data center load, it brings welcome diversification to Virginia's renewable energy resources.[100]

Welcome as these investments are, they do not provide the kind of 24/7 energy that data centers demand, leaving utilities – and their ratepayers – with the substantial cost of meeting around-the-clock energy needs.

SMALL NUCLEAR REACTORS

One solution touted as a cure-all for the energy shortage is nuclear energy. Small Modular Nuclear Reactors (SMnRs) are nuclear power reactors that are typically under 300 MW. Though they are not in production yet, and are not expected to be technologically viable before the mid 2030s, the data center industry has embraced them as an economical alternative to large nuclear power plants. To date there is no evidence that because they are "modular" and smaller that they will save money compared to conventional sources of clean energy, such as solar, wind and battery storage.

Governor Youngkin and the 2024 General Assembly passed legislation allowing Appalachian Power and Dominion to recover some costs up front from ratepayers for the development of one SMnR each. Virginia ratepayers are already being asked to underwrite charges by charging ratepayers 80% through a special rate "rider" up front and the rest eligible for conventional recovery. Amazon signed an agreement with Dominion to contribute a $500 million downpayment on a 300 MW prototype for one SMnR. This would be enough to power one substation and only 2-4 data hyperscale data centers.[101]

100 https://virginiabusiness.com/big-tech-company-to-buy-power-from-va-s-first-onshore-wind-farm/.
101 https://www.power-technology.com/news/dominion-energy-amazon-mou-virginia/?cf-view.

Some legislators have suggested that SMnRs are the answer to the energy crisis. But even if the technology were ready today, it would take 100 SMnRs at 300 MW apiece to meet the 30 GW of data center load projected in the JLARC study. Appalachian Power Co (APCO) announced plans for an SMnR in Campbell County, and the Governor signed into law a provision that would allow APCO to recover up to $125 million from its ratepayers.[102]

In addition to traditional risks associated with nuclear power, SMnR's "mobile" units would be placed where the data centers are, or near residents, where 3.4 million Northern Virginians live, in Fairfax, Loudoun, Prince William counties. The Richmond area would also be likely to see them. This would require localities to revisit ordinances to consider how they would approve these power plants and what protections they would provide for residents. At the state level, ratepayers would likely bear the costs of this new and risky nuclear buildout. It goes without saying that it is not responsible to base the solution to an energy crisis that is happening today on a technology that is not viable now and may never be.

Policy Recommendations

- Data centers must pay the cost of additional infrastructure required so that residential customers are not left holding the bag
- Ensure Ratepayer Protection with an SCC-led analysis of the current structure and cost-allocation methods for new energy infrastructure. The SCC should develop a process to ensure that other ratepayers are not subsidizing the energy infrastructure needs of the data center industry, and should pause any infrastructure request primarily needed for data center development until that process is complete.
- The SCC should open a proceeding to consider whether a new large load rate schedule and structure is appropriate, as being considered in other states such as Ohio.

Impacts on Air Quality & Public Health

DIESEL GENERATORS

The thousands of diesel generators associated with backup power for data centers pose a serious threat to the health of Virginians. Exposure to diesel exhaust primarily affects the respiratory system and worsens asthma, allergies, bronchitis, and lung function. Diesel exhaust exposure may increase the risk of heart problems, premature death, and lung cancer. Burning diesel emits greenhouse gasses and other pollutants such as particulate matter (PM), Carbon monoxide (CO), Nitrogen oxides (NOx), Hydrocarbons (HC), and Volatile organic compounds (VOCs), which contribute to regional ground-level ozone, acid rain, and global climate change.

The harm is exacerbated by the sheer number of these commercial-sized, diesel-fueled generators and large fuel storage tanks that are routinely sited at data centers to ensure uninterrupted 24/7 service in the case of a power grid outage. Generators are available for emergency use, and are run for testing and maintenance on a regular schedule.

102 https://legacylis.virginia.gov/cgi-bin/legp604.exe?241+ful+CHAP0836.

Infrastructure includes diesel generators, chillers and water storage tanks, Hugh Kenny, PEC.

According to DEQ air permits,[103] **there are currently 8,951 generators approved in the state for data centers.** Almost all of these generators are Tier 2 generators, cheaper and dirtier than best available technology. Somewhat cleaner Tier 4 diesel generators are available, but Virginia does not require them, making it unlikely that companies will install them voluntarily given their higher cost.

To date, DEQ has permitted 7,176 of these diesel generators in four Northern Virginia counties, putting the air quality of millions who live there at risk. If averaging 2.5 MW each generator, these four jurisdictions house a staggering 17,940 MW of diesel generating capacity. The result is a diesel generator pollution corridor stretching from western Prince William County north to Frederick County Maryland. Hundreds more generators are in the permit process currently, and ultimately thousands more are expected over the next few years. As Northern Virginia is an ozone nonattainment area, this is particularly concerning.

This growing pollution corridor is a major health concern because of air pollutant dispersion that generally flows northeast into other high population areas. This can be measured by county.[104]

Alarm bells went off in February 2023 when DEQ proposed a temporary variance from clean air regulations that would have allowed data centers in Loudoun, Prince William and Fairfax counties to run their backup generators whenever the grid could not meet their demands from mid-March through the end of July. Due in part to public pressure, this ill-conceived work around for the lack of transmission capacity was pulled, but it illustrates what DEQ and the industry consider a viable alternative to power constraints: 7,176 and growing diesel generators running in Northern Virginia 24/7.

103 https://www.deq.virginia.gov/permits/air/issued-air-permits-for-data-centers.
104 https://www.epa.gov/cobra.

Microsoft Data Centers in Boydton, Mecklenburg County[105]

105 https://www.google.com/maps/place/960+Prison+Rd,+Boydton,+VA+23917/@36.6841263,-78.3499929,343m/data=!3m1!1e3!4m6!3m5!1s0x89ad8bc1e4bcb1db:0x837033a631e159c4!8m2!3d36.6620821!4d-78.3663758!16s%2Fg%2F11c89179m2!5m1!1e1?entry=ttu&g_ep=EgoyMDI0MTIxMS4wIKXMDSoASAFQAw%3D%3D.

Generator permits tell the story of who the biggest data center players are in Virginia, as the number of diesel generators is proportional to the size of the operation. Amazon takes the prize, with 3,383 generators under its name. However, its share is far bigger than the numbers indicate because it colocates at data centers built and run by other companies. This includes Digital Realty, which operates over 25 data centers, including the massive 1 gigawatt "Digital Dulles" campus in Sterling and more on the way. Air permits for Amazon's generators in Prince William County can currently power at least 1,804 MW (and that does not include data centers run for Amazon under a different name).

There is no way to know all of Amazon's specific locations, given its highly secretive nature. Spurred by the $35 Billion deal with the state, we know that most of the new campuses, at least 11, in central Virginia are being developed by or for Amazon. Amazon remains the most impactful company, the biggest diesel fuel polluter, and the least transparent of the tech companies.

The companies and counties that have the most permitted diesel generators are:

FIGURE 18 Permitted Diesel Generators

County	Amazon	Microsoft	QTS/ Blackstone	Meta	Google	Other	Total
Loudoun	1,929	148	164	0	359	2253	4853
Prince William	859	46	159	0	0	818	1882
Mecklenburg	0	713	0	0	0	35	748
Henrico	0	0	555	92	0	11	658
Fairfax	302	0	0	0	0	76	378
Fauquier	40	14	0	0	0	9	63
Other	253	0	12	0	0	104	369
Total	**3,383**	**921**	**890**	**92**	**359**	**3306**	**8951**

Averaging 2,500 kW each generator, Virginia has already permitted around 22,377 MW of diesel generating capacity, with hundreds more currently under review by DEQ.

Northern Virginia, the state's most populous region, likely houses the highest concentration of diesel generators in the world. There are several ways in which DEQ could act to better protect public health. It should require best available technology (BAT), either cleaner (Tier 4) diesel generators or low-carbon alternatives including battery storage. Since 2015, Tier 4 generators require a 90% reduction of particulate matter and nitrogen oxides.[106] DEQ should also evaluate the cumulative effects in Northern Virginia's diesel generator corridor and other jurisdictions, such as greater Richmond and Mecklenburg. Finally, the state should require companies to retrofit existing Tier 1 and Tier 2 generators with selective catalytic reduction technology to reduce the impacts of pollution on communities.

106 https://woodstockpower.com/blog/overview-of-generator-epa-tier-ratings/.

Cumulative Impacts of Diesel Generators

CASE STUDY: MICROSOFT'S GENERATORS

Microsoft currently runs 713 diesel generators in Mecklenburg County, with more on the way as the company expands its data center footprint. Together, permitted Mecklenburg generators add up to at least 1,896.5 MW. Microsoft also runs 148 diesel generators in Loudoun County with a capacity of 488.6 MW, has 126.6 MW in Prince William County and 39.5 MW in Fauquier County for a total of over 2,550 MW in Virginia so far. It should be noted that the Fauquier facility has installed selective catalytic reduction technology.[107] DEQ has permitted these generators to run for 500 hours per year[108] (an average of 1.4 hours per day each).

Sierra Club submitted comments in 2024 to the DEQ Piedmont Regional Office opposing the Microsoft Corporation East Coast Data Center Draft Title V Permit on the grounds that it "be considered in the larger context of Virginia's growing number of data centers." Looking at individual applications in a vacuum ignores the nature of air flow and the uniquely high number of generators that, if called upon to run 24/7, would produce monumental emissions of toxics into the air.

The issue of one Title V Draft Permit for a data center should not be considered in a vacuum. Rather, DEQ should take into consideration that Virginia is home to the world's largest concentration of data centers, and the number continues to grow. Thus, while the emissions limits in the Draft Permit may not seem high enough to affect the State's air quality, if every data center is allowed similar high emissions limits, the State's air quality, and the neighboring community would be in jeopardy. For example, if just 100 data centers in Virginia were allowed similar emissions limits per year for their facilities, their aggregate emissions could total 1,290 tons of PM10, 1,290 tons of PM2.5, 24,295 tons of NO2, 8,760 tons of carbon monoxide, 2,060 tons of VOCs, and 150 tons of SO2 each year. This would mean that 100 data centers would be allowed to emit almost five times more NO2 than all of Virginia's power plants emitted in 2023.[109]

> The Department should at least do a cumulative impact analysis of the permitted emissions from all backup generators at data centers in Virginia so that the public can be better informed of the effects of the emissions from such facilities if they ran their generators at the maximum permitted levels. Alternatively, DEQ should perform a cumulative impacts analysis on the local air impacts from diesel generators in Mecklenburg County if there was a power outage and all generators were turned on at the same time.[110]

DIESEL TRUCKS

Lastly, the transportation of diesel fuel to fuel storage tanks at data center facilities requires thousands of trips of diesel-powered tanker trucks to deliver the fuel regularly.

---

107 https://www.deq.virginia.gov/home/showpublisheddocument/25952/638633854222530000.
108 https://www.deq.virginia.gov/permits/air/issued-air-permits-for-data-centers.
109 33 According to EPA data, the total NOX emissions in 2023 from all power plants in Virginia was 5,810.7 tons. See Latest Emission Comparisons & Pollution Controls, supra note 11.
110 April 12, 2024 Sierra Club Comments in opposition to Microsoft Corporation East Coast Data Center Draft Title V Permit.

These tankers are increasingly delivering near residential areas, where both adults and children breathe the fumes emitted trip after trip. Transportation Impact Analyses for land use applications do not address the harmful pollution emitted from tanker trucks. How do we account for this aspect of the industry?

CHANGING STATE LAW TO BETTER ADDRESS AIR QUALITY

Virginia law (Virginia Code § 10.1-1321) establishes two primary rules that limit local authority to ensure clean air:

1. A locality must get the Air Pollution Control Board's approval before enacting any ordinance "relating to air pollution."
2. The Air Pollution Control Board cannot approve an ordinance that "regulates any emission source that is required to register with the Board or to obtain a permit" under the State Air Pollution Control Act.

In other words, state law places limitations on the authority of localities to manage air quality by requiring Best Available Technology (BAT) for diesel generators unless cleaner Tier 4 generators are proffered under a rezoning[111] or considered as conditions under a special exception approval. Localities do not have blanket authority under state law to require cleaner technology. Given the massive number of generators being installed, the General Assembly should revisit the limitations in state law so that localities can more easily require BAT to protect their residents.

Policy Recommendations

- The pollution emitted from diesel generators should be evaluated based on their cumulative impacts. The Department should at least do a cumulative impact analysis of the permitted emissions from all backup generators at data centers in Virginia (or at a minimum within the same county (such as Mecklenburg) or region (such as Northern Virginia) and inform the public of the effects of the emissions from such facilities if they were to run their generators at the maximum permitted levels.
- Alternatively, DEQ should perform a cumulative impact analysis on the local air impacts from diesel generators if there were a power outage and all generators were turned on at the same time.
- The General Assembly should pass legislation restricting the use of fossil fuels for back-up generation and condition receipt of tax incentives on data centers using non-polluting alternatives to diesel generators.
- Incentives should be provided to encourage solar-plus-storage microgrids to serve as backup power grids for data centers in lieu of diesel generators, especially in rural areas where campuses have large acreage.
- Where solar and storage are not adequate options for backup power, DEQ should only approve Tier 4 or best available technology for generators.
- Alternatively, the General Assembly should change Virginia code to address current limitations on local governments that seek to require BAT in order to ensure the least emitting generators are in use in local communities.

111 As an example, residents in Fairfax County convinced the Board to include Tier 4 generators at the Chantilly Premier data center rezoning.

- The Air Pollution Control Board should honor local ordinances that require BAT in its role to protect public health.

CONCLUSION

Virginia plays an outsized role in the history of developing and housing technology. The innovation for the growth in the internet, communications and cloud services is a point of pride for the state. In the past, the sector brought good jobs and expertise to Northern Virginia. Now, though, investment in data centers is bringing fewer permanent jobs, and is primarily a construction program. Virginia remains unique, but perhaps for the wrong reasons. Virginia has a data center problem. It also has an energy problem. Home to the largest number of data centers means the state also faces the largest headwinds in gaining control of the expanding energy crisis.

No level of government has adequately regulated the technology industry. AI has been subject to a Biden White House executive order, but no binding safety measures are in place, and the data center industry has not faced regulation to minimize its cumulative impacts. Consequently, Virginians now face a host of negative environmental and health impacts and tax and ratepayer obligations attributable to services that flow outside state boundaries. The December JLARC study certainly affirmed the trajectory of the data center energy crisis, and the supplemental data shared in this report suggests that the energy demand curve could continue to get steeper.

At this point in time, we have no idea what the AI revolution means long-term, who the winners of this technology race will be, other than that computers will be competing with human intellect at a new level for the first time in human history. But we already know that the scars of its underbelly - vast numbers of servers and hardware hidden in giant, nondescript concrete buildings - are both unsustainable and impacting us all in a host of harmful ways.[112]

Local decision makers who approve data center developments and state officials who fail to enact meaningful policies to curtail the negative externalities of this priorit y sector, are *de facto* greenlighting increased fossil fuel use and turning a blind eye to reducing carbon emissions. By prioritizing this industry at this scale, the state is forcing an unwanted set of conditions onto Virginia residents and asking them to pay for it. Robust dialogue of whether it is even favorable to build this amount of new power generation in Virginia is virtually absent from public policy discussions. At the same time, resistance is growing:

Residents do not want added fossil fuel pollution in their neighborhoods. Opposition will grow to projects such as Dominion's proposed Chesterfield gas plant, as they are seen as needed only to serve the growth of data centers.

- Nuclear power also ignites fear and skepticism among the public, especially when it is to be sited close to homes and businesses.
- Finally, new transmission infrastructure will see an even greater level of opposition due not just to the fact that it is primarily needed just for data centers, but also because

112 hhttps://www.bloomberg.com/graphics/2024-ai-power-home-appliances/?accessToken=--sanitized--&fbclid=IwZXh0bgNhZW0CMTEAAR0DIJ_R2PLmQESvSpeopNAynMt93g9tDBnBKJQ0Xx9YQTrROdJfo1GxZQk_aem_w_xXHzDF7IGUonZ38haMYQ.

utilities have the power of eminent domain to build them.

The current assessment of 390,831,608 square feet of data center development is far bigger than most analyses have suggested, and yet this data does not account for dozens of current projects and those on the horizon. Most of the data center build out has yet to occur and unfettered or unconstrained growth is no longer an option. Even with this massive expansion, almost no impactful regulation has been implemented at the state or local levels. The state faces an energy crisis and business-as-usual solutions are inadequate. The move to utilize natural gas as a bridge fuel to untested nuclear technology significantly undermines efforts to reduce carbon, as well as safety. The data center industry should be required to bear its own expense to procure new, clean energy to meet its growing energy needs. Given the level of data center growth, Virginia should mandate the highest performance standards and renewable energy requirements in the world.

Even if it weren't as heavily subsidized as it is, Virginia's data center industry should be made to take responsibility for its negative impacts on carbon emissions, land, water and energy. But the fact is, the industry enjoys enormous subsidies and isn't being required to give anything back in return. Policy makers and elected officials have the power to ensure this happens. Inaction is impacting and costing us all. Now is the time.

Transmission lines in eastern Loudoun County.