PLANNING COMMISSION REGULAR MEETING

Tuesday, May 20, 2025 at 7:00 PM

AGENDA

CALL TO ORDER AND ESTABLISHMENT OF A QUORUM.

ADOPTION OF MINUTES.

1. Draft January 21, 2025 Planning Commission Regular Meeting Minutes
2. Draft April 22, 2025 Planning Commission Work Session Meeting Minutes

HEARING OF PUBLIC HEARING ITEMS.

3. **Zoning Ordinance Text Amendment - ZOTA-25-1 – A Text Amendment to Remove Data Centers as a Permissible Use within the Industrial District.** On March 22, 2025, Town Council adopted a Resolution to initiate a text amendment to Articles 3, 9, and 12 of the Town of Warrenton Zoning Ordinance. This text amendment is for the purpose of removing Data Centers as a Permissible Use within the Industrial District, and therefore make Data Centers an impermissible Use within the Town of Warrenton.

NEW BUSINESS.

4. Planning Commission Bylaws Update

WORKSESSION ITEMS.

COMMENTS FROM THE COMMISSION.

COMMENTS FROM THE STAFF.

ADJOURN.

PLANNING COMMISSION REGULAR MEETING

21 Main Street

Tuesday, January 21, 2025, at 7:00 PM

MINUTES

A REGULAR MEETING OF THE PLANNING COMMISSION OF THE TOWN OF WARRENTON, VIRGINIA, WAS HELD ON JANUARY 21, 2025, at 7:00 PM

Regular Meeting

PRESENT	Mr. Ryan Stewart, Chair; Mr. Terry Lasher, Vice Chair; Ms. Darine Barbour, Secretary; Mr. James Lawrence; Mr. Steve Ainsworth; Ms. Denise Harris, Planning Manager; Patrick Corish, Associate Town Attorney
ABSENT	N/A

The minutes laid out will be a brief recap of the agenda items. Please see recorded video for more in-depth information.

CALL TO ORDER AND ESTABLISHMENT OF A QUORUM.

The meeting opened at 7:00 PM by Mr. Stewart and declared a quorum present.

ELECTION OF OFFICERS

Commissioner Ainsworth motioned to nominate Commissioner Stewart as Chair; Commissioner Lawrence seconded the motion. The motion passed in a 4-0-1 vote (Stewart Abstain).

Commissioner Lawrence motioned to nominate Commissioner Lasher as Vice Chair; Commissioner Ainsworth seconded the motion. The motion passed in a 5-0 vote.

Commissioner Lawrence motioned to nominate Commissioner Barbour as Secretary; Commissioner Ainsworth seconded the motion. The motion passed in a 5-0 vote.

ADOPTION OF MINUTES.

November 19, 2024, Draft Planning Commission Regular Meeting Minutes . Commissioner Lawrence moved to approve the minutes. Vice Chair Lasher seconded the motion. Motion passed 5-0 to approve the minutes.

NEW BUSINESS

Planning Commission Bylaws Update Discussion

Ms. Harris walked the Planning Commission through the redline draft bylaws that has been developed over the course of several months of Planning Commission discussions.

DRAFT

The Planning Commission offered additional thoughts related to the Purpose Statement and clarifying language in various Articles. Staff was directed to modify the draft Bylaws and redistribute to the Planning Commission. The updated Bylaws are anticipated to be adopted at the next Planning Commission meeting.

The Planning Commission proposed 2025 meeting schedule and annual goals.

The Planning Commission reviewed the meeting schedule for the 2025 calendar year. Commissioner Ainsworth moved to keep the meetings at 7:00 PM on the third and fourth Tuesdays of the month; Commissioner Lawrence seconded the motion. The Planning Commission voted 5-0 to adopt the 2025 meeting schedule.

The Planning Commission reviewed the draft 2025 goals for the year. One grammatical error was found and there was discussion on updating the fifth bullet point related to the Capital Improvement Program. Commissioner Lawrence motioned to adopt the 2025 Planning Commission goals per the updated language; Commissioner Ainsworth seconded the motion. The Planning Commission voted 5-0 to adopt the 2025 Planning Commission goals.

Draft 2024 Planning Commission Annual Report for review

The Planning Commission reviewed the draft 2024 Annual Report. Commissioner Ainsworth motioned to approve the 2024 Planning Commission Annual Report; Commissioner Lawrence seconded the motion. The Planning Commission voted 5-0 to approve the 2024 Planning Commission Annual Report.

COMMENTS FROM THE COMMISSION.

Each of the Planning Commissioners wished the room a Happy New Year, welcomed the new Associate Town Attorney, and thanked staff for their work. The Commission expressed they were looking forward to working together in the coming year.

COMMENTS FROM THE STAFF.

Ms. Harris spoke to the Public Forum and meetings scheduled for January 28th and 29th on the Zoning Ordinance Update, the bills in the General Assembly, and potential future land use applications.

ADJOURN.

Commissioner Lawrence moved to adjourn the meeting; Commissioner Ainsworth seconded the motion. With no further business, the Chair Stewart adjourned at 8: 40 PM.

I hereby certify that this is a true and exact record of actions taken by the Planning Commission of the Town of Warrenton on January 21, 2025.

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Darine Barbour, Secretary
Planning Commission

DRAFT

DRAFT

PLANNING COMMISSION REGULAR MEETING

21 Main Street

Tuesday, April 22, 2025, at 7:00 PM

MINUTES

A WOEK SESSION OF THE PLANNING COMMISSION OF THE TOWN OF WARRENTON, VIRGINIA, WAS HELD ON APRIL 22, 2025, at 7:00 PM

Regular Meeting

PRESENT	Mr. Ryan Stewart, Chair; Mr. Terry Lasher, Vice Chair; Ms. Darine Barbour, Secretary; Mr. James Lawrence; Ms. Denise Harris, Planning Manager; Heather Jenkins, Zoning Administrator; Patrick Corish, Associate Town Attorney
ABSENT	Steve Ainsworth

The minutes laid out will be a brief recap of the agenda items. Please see recorded video for more in-depth information.

CALL TO ORDER AND ESTABLISHMENT OF A QUORUM.

The meeting opened at 7:00 PM by Chair Stewart and declared a quorum present.

WORK SESSION ITEMS.

1. Zoning Ordinance Text Amendment - ZOTA-25-1 – A Text Amendment to Remove Data Centers as a Permissible Use within the Industrial District. On March 22, 2025, Town Council adopted a Resolution to initiate a text amendment to Articles 3, 9, and 12 of the Town of Warrenton Zoning Ordinance. This text amendment is for the purpose of removing Data Centers as a Permissible Use within the Industrial District, and therefore make Data Centers an impermissible Use within the Town of Warrenton.

Ms. Heather Jenkins, Zoning Administrator, gave an overview of the Town Council initiated text amendment and then asked the Planning Commission for their thoughts on a draft to be developed.

Chair Stewart opened the floor up to questions.

Commissioner Lawrence inquired about the language in the initiation resolution passed by the Town Council and if this is as simple as undoing the previous 2021 ordinance that added the data center use.

Ms. Jenkins reviewed the pre 2021 Zoning Ordinance language contained in the staff report attachment. Article 3 would remove data center as a use from the Industrial district, Article 12 definition for data center would be removed, and Article 9-26 data center special use regulations would be removed.

Mr. Patrick Corish stated that it would be a simple strike through.

Vice Chair Lasher inquired if there has been a financial analysis of what this could potentially mean.

Mr. Corish stated he doesn't think there would be an impact on already authorized vested use. Council has the ability to add and/or subtract uses from the Zoning Ordinance.

Chair Stewart brought up that a potential use has been granted to property owners and now talking about having it rescinded. Would it be considered a taking? He wants to ensure Council is well informed and look at all alternatives before simply rescinding as it may not be the best choice without looking at options.

Mr. Corish stated the property owners only have the right to the use after vesting. He does not think it is a taking if not yet vested. Only when the permit is approved.

Vice Chair Lasher raised the concern of the Town modifidying the Zoning Ordinance on a regular basis and the uncertainty this creates. He asked if once an use has been addressed for it not to come up again under a certain timeframe?

Mr. Corish stated the Town Council has the right to pass ordinances as the political winds go.

Secretary Barbour agreed with Vice Chair Lasher's concerns regarding changing the Zoning Ordinance every two-four years. She indicated the use was previously vetted and asked what is the reasoning now to change it again? She asked if there had been specific guidance provided by Town Council as to why the Planning Commission is reviewing this. Secretary Barbour reviewed the current ordinance has restrictions are in place and the Town has the ability to say yes or no to a land use application. She stated that Town needs to stand by its Zoning Ordinance to provide predicable guidance to the property owners

Chair Stewart agreed with Secretary Barbour. He stated the Town conducted public hearings, vetted it, found the use in the best interests of Town, and met public health, safety, and welfare. He asked what has changed. What is in the underlying data to find the use is no longer in the public health, safety, and welfare? Is there a form that is more appropriate? Maybe a data center needs a different process or criteria for the proposed use. The Amazon site has no construction and no use in place to give us data. It has been a paper exercise to this point.

Vice Chair Lasher's raised a concern about creating a precedence of special rules for special uses.

Chair Stewart stated that perhaps it is not a separate process but distinct criteria like setbacks from residential properties, maximum square footage, etc.

Commissioner Lawrence believes the public comments express very clearly about how the community feels about the use and if the Planning Commission is a recommending body of the Town Council, who has directed us to amend the Zoning Ordinance, it is the job of the Planning Commission to review language and provide it to Town Council. He does not believe it is the Planning Commission's mandate to redebate the use.

Secretary Barbour stated there needs to be some data, some reason for this amendment. She wants to understand what is the benefit. She believes the Planning Commission needs to do our due process. There needs to be a basis to make this change. What are the concerns and issues? She stated assumptions being made.

Chair Stweart acknowledged Commissioner Ainsworth's email as he was not present. The email raised concerns over this action, stating it feels arbitrary and recommended the Town Council rescind the direction to remove data centers until new information is provided regarding the impact on the public health, safety, and welfare. He likened data centers to the old telephone exchange buildings and discussed how data centers are essential to town businesses and citizens.

Ms. Jenkins indicated that the old telephone buildings are considered utilities. At this time, data centers are not.

Commissioner Lawrence stated he would be interested in seeing the clean language for public hearing next month.

Chair Stewart stated that to his knowledge there is no other jurisdiction in Virginia that has made data centers a non-allowable use. He asked the Associate Town Attorney if there are any concerns in setting a precedent for the Commonwealth.

Mr. Corish indicated he will research and provide a more robust answer.

After being asked, Ms. Jenkins stated the 100 day clock for the Planning Commission starts in this meeting.

Vice Chair raised the question of financial impact again, He stated he would like to understand associated costs. He asked if it is possible to consider long term, maybe 20 years, financial considerations with this type of flip flopping. He asked if there is an opportunity cost that impacts the bottom line for the Town. What is the potential tax revenue vs tax loss.

Commissioner Lawrence pointed out that the Planning Commission asked those same questions during the Amazon SUP discussion and never received an answer. It is a hard number to get from the user and puts staff in a difficult position.

Chair Stewart asked if there is any data on the use since 2021 on the negative impacts of data centers on public health, safety, and welfare?

Chair Stewart stated the next steps would be a draft text to review. He asked if the Planning Commission would like another work session or public hearing?

Consensus was to move to a public hearing to allow time for public input.

Ms. Jenkins confirmed the Planning Commission needed to act by July 31st

Commissioner Lawrence stated the Planning Commission may consider holding the public hearing next month and holding it open as well.

Chair Stewart agreed to this approach.

ADMINISTRATIVE ITEMS.

Next Regular Meeting of the Planning Commission will enable them to take action on the update of their bylaws.

COMMENTS FROM THE COMMISSION.

Chair Stewart stated he and Secretary Barbour attended the special meeting of Town Council the previous evening.

COMMENTS FROM THE STAFF.

Ms. Denise Harris stated that on April 22, 2025 the Commission on Local Government's three panel judge is meeting to determine the Voluntary Settlement Agreement for the Arrington property.

ADJOURN.

Vice Chair Lasher moved to adjourn the meeting; Commissioner Lawrence seconded the motion. With no further business, the Chair Stewart adjourned at 7: 47 PM.

I hereby certify that this is a true and exact record of actions taken by the Planning Commission of the Town of Warrenton on April 22, 2025.

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Darine Barbour, Secretary
Planning Commission

DRAFT

DRAFT

Office of the Town Manager
Frank Cassidy

STAFF REPORT

Planning Commission Meeting Date:	May 20, 2025
Agenda Title:	ZOTA-25-1 – A Text Amendment to Remove Data Centers as a Permissible Use within the Industrial District
Requested Action:	Hold a Public Hearing
Department / Agency Lead:	Community Development
Staff Lead:	Heather Jenkins, Zoning Administrator

EXECUTIVE SUMMARY

On March 22, 2025, Town Council adopted a Resolution to initiate a text amendment to Articles 3, 9, and 12 of the Town of Warrenton Zoning Ordinance. This text amendment is for the purpose of removing Data Centers as a Permissible Use within the Industrial District, and therefore make Data Centers an impermissible Use within the Town of Warrenton.

On April 22, 2025, the Planning Commission held a work session to discuss this text amendment, where staff was directed to bring this item back the following month for a public hearing. Additionally, the Planning Commission indicated their intent to leave the May 20, 2025, public hearing open for an additional month, so as to allow for sufficient time for public input and comment. Per Zoning Ordinance Section 11-3.9.8, the Planning Commission is required to make a final recommendation to Town Council within 100 days of the April 22, 2025 work session. The 100-day deadline falls on Thursday, July 31, 2025.

BACKGROUND

On August 10, 2021, Town Council adopted an Ordinance to add Data Centers as a Permissible Use within the Industrial District with the approval of a Special Use Permit by Town Council. This text amendment added Data Centers as an allowable use under Section 3-4.12.3 *Permissible Uses*, as defined in Article 12 *Definitions*, and subject to the standards listed in Section 9-26 *Data Centers*. A copy of the adopted text amendment is included with this staff report as Attachment A – *Ordinance to Adopt ZNG 2021-0321*. A brief timeline of the text amendment process for the previous Data Center text amendment is as follows:

Data Center Text Amendment (ZNG 2021-0321) Timeline:

- July 11, 2017 – Town Council initiates a Zoning Ordinance Text Amendment to research industrial areas and the possibility of adding data centers.
- The originally initiated Text Amendment was not pursued with the Planning Commission or Town Council.
- April 13, 2021 – Town Council initiates a Zoning Ordinance Text Amendment to allow data centers within the Industrial District with the approval of a Special Use Permit.
- May 25, 2021- Planning Commission holds a work session on the Text Amendment.
- June 15, 2021 – Planning Commission holds a public hearing on the Text Amendment.

- July 20, 2021 – Planning Commission holds a public hearing on the Text Amendment, and recommends approval 5-1.
- August 10, 2021 – Town Council holds a public hearing on the Text Amendment, and approves the Text Amendment 7-0.

Following approval of this text amendment on August 10, 2021, one Special Use Permit application for a Data Center was submitted for consideration by the Planning Commission and Town Council, application number SUP-22-3, located at 719 Blackwell Road (PIN 6984-69-2419-000). On February 14, 2023, Town Council approved this Special Use Permit application subject to the associated Conditions of Approval. The Special Use Permit SUP-22-3 and the associated Site Development Plan, case number SDP-23-6 approved on April 18, 2024, remains the sole approved Data Center Use within the Town. A copy of the resolution to approve SUP-22-3 is included with this staff report as Attachment B – *Resolution to Approve SUP-22-3*.

On March 22, 2025, Town Council adopted a Resolution to initiate a text amendment to Articles 3, 9, and 12 of the Town of Warrenton Zoning Ordinance. This Resolution includes the statement that a Data Center is a Use that does not further the health, safety and welfare of the public, nor does a Data Center Use promote public necessity or public convenience within the Town of Warrenton. A copy of this Resolution is included with this staff report as Attachment C – *Resolution to Initiate ZOTA-25-1*.

During the April 22, 2025, work session, Planning Commission members requested information on the possible impacts of data centers on communities. Staff has provided a copy of the *Data Centers in Virginia* report provided to the Governor and General Assembly of Virginia by the Joint Legislative Audit and Review Commission (JLARC), dated December 9, 2024, which provides an in-depth report of the impact data centers can have on local communities, to include economic, fiscal, energy, natural and historic resource impacts, as well as potential impacts on residential areas adjacent to data centers. This report is included with this staff report as Attachment D – *JLARC Data Center Report*. A briefing of this report, as presented to the General Assembly and other bodies, is included with this staff report as Attachment E – *JLARC Data Center Presentation*, where this briefing summarizes the findings of the JLARC report.

STAFF RECOMMENDATION

Staff requests that the Planning Commission hold a public hearing to discuss this matter, and then provide guidance to staff. As per the discussion held by the Planning Commission during the April 22, 2025 work session, it is understood by staff that the Planning Commission intends to hold the public hearing open, and hold a second public hearing on this matter during the regularly-scheduled June meeting, so as to provide sufficient notice to the public and gather as much public input as possible. A draft copy of the proposed text amendment is included with this staff report as Attachment F – *Draft Text Amendment*.

Service Level/Collaborative Impact

There are no known service level or collaborative impacts.

Policy Direction/Warrenton Plan 2040

The Zoning Ordinance currently allows for Data Centers as a Permissible Use within the Industrial District. Industrial Zoned parcels within the Town are located along the eastern boundary of the Town jurisdictional limits, adjacent to the Eastern Bypass and Route 17 Spur. The Comprehensive Plan, Future Land Use Map shows that Industrial Zoned properties are located within the New Town Mixed Use/New Town Character District, Old Town Mixed Use/Old Town Character District, and Greenway and Wellness Mixed Use/Greenway and Makers District. The desired development for these character districts is described in the Comprehensive Plan, Town Warrenton 2040, in Goals L2, L3, and L5, predominantly as mixed-use and walkable.

While the New Town Character District, Goal L3, calls for the establishment of a major employer, a Data Center was not specifically listed in any of the Future Land Use or Character Districts. This issue was raised during the initial Zoning Ordinance Text Amendment public hearing process for *ZNG 2021-0321.* As such, Town Council has asked staff to prepare a Text Amendment to remove Data Centers as a Permissible Use within the Industrial District.

Fiscal Impact

The potential fiscal impacts associated with data center development are highly individualized as to the circumstances of the locality and the proposed site-specific data center development conditions, so that a generalized quantitative analysis is not feasible, other than what has been provided as a part of the JLARC Data Center Report (Attachment D). Generalized fiscal impacts are summarized in the JLARC Data Center Report, and this report finds that the greatest amount of revenue generation from data centers to a locality comes during the initial construction phase, due both to the large number of construction-related jobs that are generated and the purchase of building materials, as well as secondary revenue generators such as hotel stays, food purchases, and other service-sector related transactions.

As the Planning Commission members requested an example of a cost/benefit analysis for a locality that currently contains data center development, included with this staff report is a copy of the *Prince William County, Virginia Data Center Fiscal Impact Analysis*, prepared by PFM Group Consulting, dated July 7, 2022. This fiscal impact analysis looks at both existing and proposed data center developments within the County, and provides a fiscal cost/benefit analysis. However, staff cautions that this analysis is specific to Prince William County, and may not translate well to Warrenton-specific conditions. A copy of this report is included as Attachment G – *Prince William County Fiscal Impact Analysis*.

Per Zoning Ordinance Section 11-3.9.1 – *Authority for Change* – zoning ordinance text amendments are meant to *further the pubic necessity, convenience, general welfare, or good zoning practice*; additionally, Ordinance Section 11-3.9.13 – *Criteria for Consideration of Text Amendments* includes the two considerations of *whether the proposed text amendment is consistent with the Comprehensive Plan* and *whether the text amendment is consistent with the intent of Zoning Ordinance*. Therefore, staff recommends that the Planning Commission base any final recommendation to Town Council on **land-use considerations**, and not on potential tax revenues.

Legal Impact

Should a text amendment be approved to remove Data Centers as a Permissible Use within the Industrial District, the Data Center approved as a part of case number SUP-22-3 ***may*** become a non-conforming use, subject to the standards found in Zoning Ordinance Section 11-4 *Non-Conforming Uses and Structures*. A determination of non-conformity requires the concurrence of the Zoning Administrator and the Town

Attorney; however, staff defers to the Town Attorney for any questions as to how this text amendment may or may not affect any existing Data Center approvals.

There are multiple court cases currently filed within the Circuit Court that may or may not be impacted by this proposed text amendment to remove Data Centers as a Permissible Use. Staff defers to the Town Attorney for all questions related to on-going litigation.

ATTACHMENTS

- Attachment A – *Ordinance to Adopt ZNG 2021-0321*
- Attachment B – *Resolution to Approve SUP-22-3*
- Attachment C – *Resolution to Initiate ZOTA-25-1*
- Attachment D – *JLARC Data Center Report*
- Attachment E – *JLARC Data Center Presentation*
- Attachment F – *Draft Text Amendment*
- Attachment G – *Prince William County Fiscal Impact Analysis*.

ORDINANCE

AN ORDINANCE TO APPROVE A ZONING ORDINANCE TEXT AMENDMENT TO ARTICLES 3, 9 AND 12 TO ALLOW A DATA CENTER USE WITH THE APPROVAL OF A SPECIAL USE PERMIT

WHEREAS, the Town of Warrenton seeks to update Articles 3, 9 and 12 of the Zoning Ordinance to allow a Data Center with the approval of a special use permit; and

WHEREAS, in addition to allowing the Data Center use, supplemental standards and a definition are being added to Articles 9 and 12 respectively; and

WHEREAS, the text amendment seeks to require legislative action for a data center proposal in the Industrial District; and

WHEREAS, the Town Council of the Town of Warrenton feels a data center use is appropriate for the Town's Industrial District with the appropriate safeguards as proposed as part of the Supplemental Use Regulations; and

WHEREAS, the Town Council has determined that the health, safety, general welfare of the public and good zoning practice warrant this amendment; and

WHEREAS, the Town Council initiated this text amendment on April 13, 2021; and

WHEREAS, the Town of Warrenton Planning Commission held a work session on the proposed amendment on May 25, 2021; and

WHEREAS, the Town of Warrenton Planning Commission held a public hearing on the proposed amendment on June 22, 2021 where the applicant's representative spoke and the Commission deferred recommendation until the next scheduled Regular Meeting; and

WHEREAS, the Town of Warrenton Planning Commission discussed this text amendment as part of their Unfinished Business portion of the agenda on July 20, 2021 and recommended approval by a 5-1 vote; and

WHEREAS, on August 10, 2021, the Town of Warrenton Town Council held a public hearing and considered written and oral testimony on the proposed text amendment; now, therefore, be it

ORDAINED by the Town Council of the Town of Warrenton this 10th day of August 2021, That the Town Council hereby approves the following text amendment to Articles 3, 9 and 12 of the Zoning Ordinance:

____

Town Clerk

Article 3 Zoning Districts and Map

Amended by Town Council: March 11, 2008
February 12, 2013
April 12, 2016
June 14, 2016
August 9, 2016
December 11, 2018
August 11, 2020
August 10, 2021

3-4.12 I Industrial District

3-4.12.1 Legislative Intent

It is the intent of this district to implement the Town's Comprehensive Plan by providing for a variety of light manufacturing, fabricating, processing, wholesale distributing, and warehousing uses appropriately located for access by highways and providing a controlled environment within which signing is limited, uses are to be conducted generally within completely enclosed buildings, and a moderate amount of landscaping is required. In order to preserve the land for industry, to reduce extraneous traffic, and avoid future conflicts between industry and other uses, business and service uses are limited primarily to those which will be useful to employees in the district and future residential uses are restricted.

3-4.12.2 Permitted Uses (by-right)

- Accessory buildings
- Active and Passive Recreation and Recreational Facilities
- Banks and savings and loan offices
- Broadcasting studios and offices
- Business and office supply establishments
- Cabinet, upholstery, and furniture shops
- Cafeteria or snack bar for employees
- Clinics, medical or dental
- Commercial uses constituting up to 15% of permitted site or building area
- Conference Centers
- Contractor's office and warehouse without outdoor storage
- Crematory
- Dwellings for resident watchmen and caretakers employed on the premises
- Employment service or agency

- Flex Office and Industrial uses
- Health and Fitness Facilities
- Institutional buildings
- Janitorial service establishment
- Laboratories, research, experimental or testing, but not testing explosives, rockets, or jet engines
- Light manufacturing uses which do not create danger to health and safety in surrounding areas and which do not create offensive noise, vibration, smoke, dust, lint, odor, heat, glare, or electrical impulse than that which is generally associated with light industries
- Mobile Food Vendors subject to Article 9-24
- Monument sales establishments with incidental processing to order but not including shaping of headstones
- Motion picture studio
- Nurseries and greenhouses
- Offices- business, professional, or administrative
- Off-street parking and loading subject to Article 7
- Open space subject to Article 9
- Printing, publishing, and engraving establishment; photographic processing; blueprinting; photocopying; and similar uses
- Private club, lodge, meeting hall, labor union, or fraternal organization or sorority
- Rental service establishment
- Retail or wholesale sales and service incidental to a permitted manufacturing, processing, storing, or distributing use
- Rug and carpet cleaning and storage with incidental sales of rugs and carpets
- Security service office or station
- Sign fabricating and painting
- Signs, subject to Article 6
- Studios
- Transmission and receiving towers of height not exceeding one hundred twenty-five (125) feet
- Utilities related to and necessary for service within the Town, including poles, wires, transformers, telephone booths, and the like for electrical power distribution or communication service, and underground pipelines or conduits for local electrical, gas, sewer, or water service, but not those facilities listed as requiring a special use permit
- Wholesale establishment, storage warehouse, or distribution center. furniture moving

3-4.12.3 Permissible Uses (by special use permit upon approval of the Town Council)

- Automobile body shop

- Automobile and truck repair and service
- Commercial Kennels
- Contractor's storage yard
- Data Center
- Farm equipment, motorcycle, boat and sport trailer sales and service
- Fuel, coal, oil distribution storage yards
- Lumber and building supply with undercover storage.
- Maintenance and equipment shops with screened outside storage
- Outdoor storage of any kind
- Plumbing and electrical supply with undercover storage
- Restaurant or cafeteria, drive-thru or otherwise
- Self-service mini-warehouse
- Temporary fair and show grounds
- Tire and battery sales and service, tire recapping and retreading
- Transmission and receiving towers of height greater than one hundred twenty-five (125) feet.
- Treatment plants, water storage tanks, major transmission lines or pipelines, pumping or regulator stations, communications towers, storage yards and substations, and cable television facilities and accessory buildings

3-4.12.4 Lot and Yard Regulations

Use	**Minimum** Lot Size (sq. ft.)	**Minimum** Lot Frontage (at front setback)	**Maximum** Lot Coverage (impervious surfaces and accessory buildings)
All principal manufacturing and processing uses in industrial parks	One (1) acre	100 ft.	75%
Other uses, including permitted retail and service establishments	10,000 square feet	100 ft.	75%

Minimum Setbacks

Use	Front	Side	Rear
All principal manufacturing and processing uses in industrial parks	Fifty (50) feet from the right-of-way of a local street having a right-of-way of fifty (50) feet or less. Sixty-five (65) feet from the right-of-way of a major thoroughfare or collector street having a right-of-way greater than fifty (50) feet. Forty (40) feet from the right-of-way of a service drive. Accessory buildings shall not be permitted forward of the setback line.	Twenty-five (25) feet on an interior lot or adjacent to any C or I district including accessory buildings or parking structures, ten (10) feet for parking lots. Fifty (50) feet adjacent to any R district including accessory buildings or parking structures, thirty (30) feet for parking lots.	Forty (40) feet on an interior lot or adjacent to any C or I district including accessory buildings or parking structures, ten (10) feet for parking lots. Sixty-five (65) feet adjacent to any R district including accessory buildings or parking structures, fifty (50) feet for parking lots.
Other uses, including permitted retail and service establishments	same	same	same

3-4.12.5 Building Regulations

Use	Maximum Height
All buildings	35 feet
Accessory buildings	Within 20 feet of any lot line shall not exceed 15 feet in height. All accessory buildings shall be less than the main building in height.

3-4.12.6 Special Regulations for Manufacturing and Commercial Buildings

3-4.12.6.1 Enclosed Buildings. All uses shall be conducted within a completely enclosed building of permanent and durable construction, with no open storage of raw, in process, or finished material and supplies or waste material. Finished or semi-finished products manufactured on the premises may be stored in the open if screened from the street or from a residence district by landscaping, fences, or walls.

3-4.12.6.2 Landscaping. In general, where approval of a site plan is required, the landscape plan shall be designed to promote harmonious relationships with adjacent and nearby residential properties, developed or undeveloped, and to this end may provide effective screening along side and rear property lines by means of fences, walls, hedges, planting screen, or natural vegetation as outlined in Article 8, General Provisions for Landscaping.

3-4.12.6.3 Fencing. All fencing shall have a uniform and durable character and shall be properly maintained.

Article 9 Supplemental Use Regulations

Amended by Town Council: February 12, 2013
July 8, 2014
August 9, 2016
December 11, 2018
April 9, 2019
August 10, 2021

Contents (Sections)

Article 9 Supplemental Use Regulations

9-26 Data Centers

Data Centers, as defined in Article 12, are permissible in the Industrial (I) District, subject to the following requirements.

9-26.1 Additional Standards

A. Minimum Lot Size: 25 acres. Town Council may approve a data center on parcels less than 25 acres as part of the special use permit application.

B. The data center shall utilize recycled water or air chillers, in conjunction with using recycled water, for cooling purposes. Potable water shall not be used for cooling.

C. All electric service lines from the substation to the data center shall be placed underground.

D. Setbacks: Per Section 3-4.12.4 (“All principal manufacturing and processing uses in industrial parks”).

   1. Town Council may approve building heights greater than 35 feet during the review of the Special Use Permit. Buildings must be setback one (1) additional foot (horizontally) from the required setback line for each additional one (1) foot (vertically) greater than 35 feet. Building heights shall be in conformance with the Comprehensive Plan.

   2. The data center building shall be setback a minimum of one-hundred (100) feet from property lines.

E. Parking: In accordance with “Assembly or Manufacturing Uses” per Section 7-7 of the Zoning Ordinance.

F. Building Facades:

   1. Building facades shall include at least two of the following design elements:

      a. Change in building height;
      b. Building step-backs or recesses;
      c. Fenestration (25% minimum);
      d. Change in building material, pattern, texture, or color;
      e. Use of accent materials.

G. Mechanical Equipment:

1. Mechanical equipment shall be completely screened through the use of walls, fences or evergreen vegetation so that no part of the mechanical equipment can be seen from adjoining properties or right-of-ways.

2. All generators shall be equipped with mufflers to reduce emissions and noise.

H. Security:

1. The facility shall provide access to Town and County emergency services staff at all times.

I. Landscaping:

1. In addition to the landscape planting requirements of Article 8 of the Zoning Ordinance, any portion of the data center (including equipment) visible from a park or adjoining/across the street from a residential district shall be screened by vegetation consisting of a double staggered row of evergreen trees planted 15 feet on center. A minimum 3 foot berm planted with a double staggered row of evergreen shrubs planted 10 feet on center may be used in place of the double staggered row of evergreen trees required above.

J. Substations:

1. Substations associated with the data center shall be screened from adjacent properties and right-of-ways through the use of opaque fencing in addition to evergreen trees and shrubs.

Article 12 Definitions

Amended by Town Council: February 12, 2013
June 14, 2016
August 9, 2016
December 11, 2018
April 9, 2019
September 10, 2019
October 13, 2020
August 10, 2021

Data Center: A facility containing one or more large-scale computer systems used for data storage and processing for off-site users. Typical supporting equipment includes back-up batteries and power generators, electric substations, cooling units, fire suppression systems, and enhanced security feature

February 14th, 2023
Town Council
Regular Meeting

RESOLUTION PURSUANT TO SECTION 11-3.10 OF THE ZONING ORDINANCE OF THE TOWN OF WARRENTON FOR APPROVAL OF APPLICATION FOR A SPECIAL USE PERMIT 22-03

WHEREAS, Warrenton, VA (Hereinafter "the Town") is a municipal corporation located within the County of Fauquier; and

WHEREAS, Amazon Data Services, Inc., ("the Applicant"), is the requesting a Special Use Permit approval on a parcel of land containing approximately 41.793 acres, identified as GPIN 6984-69-2419-000, located off Blackwell Road and Lee Highway in the Town of Warrenton and hereinafter referred to as the "Property"; and

WHEREAS, the Applicant has applied for a Special Use Permit pursuant to §3-4.12.3 of the Zoning Ordinance, to allow for approximately 220,200 square-foot data center to be located on the Property, hereinafter the "Special Use Permit"; and

WHEREAS, the Applicant requested waivers and modifications to increase the building height from 35 feet to 37 feet, increase the fence height from six feet to eight feet, and decrease the parking loading space requirement from 22 spaces to one space; and

WHEREAS, pursuant to §11-3 of the Zoning Ordinance upon petition of the Applicant for approval of the Special Use Permit, the Planning Commission upon advertisement and notice properly given pursuant to §15.2-2204 of the Virginia Code held a Public Hearing on November 15, 2022, November 22, 2022, and December 20, 2022; and

WHEREAS, the Town Council received and considered the recommendation of the Planning Commission for denial of the Special Use Permit; and

WHEREAS, the Town Council of the Town of Warrenton held a Public Hearing on January 10, 2023, upon notice properly and duly given; and

WHEREAS, the Town Council of the Town of Warrenton held open the Public Hearing on January 10, 2023 to February 14th, 2023, upon notice properly and duly given; and

WHEREAS, the Town Council has considered the issues and the Applicant addressed the applicable factors listed in §11-3.10.3 of the Zoning Ordinance for the Town of Warrenton; and

WHEREAS, the Town Council finds that the Application meets the criteria for approval in the Town of Warrenton Zoning Ordinance and that the Application is consistent with the Town of Warrenton's Comprehensive Plan based on the analysis in the staff report; and

WHEREAS, the Town Council, in consideration of all of the foregoing, is of the opinion that the application for the Special Use Permit be approved subject to certain conditions;

NOW, THEREFORE, BE IT RESOLVED that the Warrenton Town Council approves

SUP 22-03, subject to the attached Special Use Permit with Conditions of Approval dated February 14th, 2023, and all documents referenced in the Conditions of Approval, with requested waivers and modifications listed above.

ATTACHMENT:
Conditions of Approval

Votes:
Ayes: Ms. Heather Sutphin, Mr. Brett Hamby, Mr. James Hartman, Mr. John "Jay" Heroux
Nays: Mr. William Semple, Mr. David McGuire, Mr. Paul Mooney.
Absent from Vote:
Absent from Meeting:

For Information:
Community Development Director,
Town Attorney

ATTEST: Christopher E Martino
Town Recorder

Resolution

March 11, 2025
Town Council
Regular Meeting

A RESOLUTION TO INITIATE ZOTA-25-1, A ZONING ORDINANCE TEXT AMENDMENT TO ARTICLES 3, 9 AND 12 TO REMOVE DATA CENTERS AS A PERMISSIBLE USE WITHIN THE INDUSTRIAL ZONING DISTRICT

WHEREAS, Warrenton, VA (Hereinafter "the Town") is a municipal corporation located within the County of Fauquier; and

WHEREAS, the Warrenton Town Council (Hereinafter “Council”) may, by ordinance, amend, supplement, or change the regulations of the Zoning Ordinance of the Town whenever the public necessity, convenience, general welfare or good zoning practice may require such an amendment; and

WHEREAS, such an amendment may be initiated by resolution of Council in accord with the procedures and requirements of Section 11-3.9 of the Zoning Ordinance; and

WHEREAS, on August 10, 2021, Council approved a Zoning Ordinance Text Amendment to Articles 3, 9 and 12, case number ZNG 2021-0321, to add Data Centers as a Permissible Use within the Industrial District with the approval of a Special Use Permit by Council; and

WHEREAS, Council now finds that a Data Center is a Use that does not further the health, safety and welfare of the public, nor does a Data Center Use promote public necessity or public convenience within the Town of Warrenton; and

WHEREAS, Council hereby directs staff to prepare a text amendment for consideration by the Planning Commission to remove Data Centers as a Permissible Use within the Industrial District, and therefore render Data Centers as an impermissible Use within the municipal boundaries of the Town of Warrenton; now, therefore, be it

RESOLVED, by the Warrenton Town Council this 11th day of March, 2025, that Council hereby initiates a text amendment to Articles 3, 9 and 12 to remove Data Centers as an allowable Use.

<u>Votes:</u>
Ayes:
Nays:
Absent from Vote:
Absent from Meeting:

For Information:
Community Development Director,
Town Attorney

ATTEST: ____
Town Recorder

Item 3.

Commonwealth of Virg
December 9, 2024

Report to the Governor and the General Assembly of Virginia

Data Centers in Virginia

2024

COMMISSION DRAFT

JLARC
JOINT LEGISLATIVE AUDIT
AND REVIEW COMMISSION

Joint Legislative Audit and Review Commission

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JLARC Report 598
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Contents

Summary: Data Centers in Virginia

WHAT WE FOUND

Data centers provide positive economic benefits to Virginia's economy, mostly during their initial construction

Data centers provide positive benefits to Virginia's economy mostly because of the industry's substantial capital investment. The primary benefit comes from the initial construction of data centers. Most construction spending likely remains in the state economy because much of it goes to Virginia-based businesses providing construction materials and services.

WHY WE DID THIS STUDY

In 2023, the Joint Legislative Audit and Review Commission directed staff to review the impacts of the data center industry in Virginia.

ABOUT DATA CENTERS

Data centers are specialized facilities that manage, process, and share large amounts of data. They enable the digital services that people rely on daily, including websites, electronic applications, and cloud-based platforms, such as email and media steaming. Northern Virginia is the largest data center market in the world, constituting 13 percent of all reported data center operational capacity globally and 25 percent of capacity in the Americas. Multiple factors have contributed to Northern Virginia's market prominence, including a strong fiber network, supply of reliable cheap energy, available land, proximity to major national customers, and the creation of a state data center tax incentive. The data center industry is growing rapidly in Virginia, both in established markets and newer ones. Significant new market growth is expected in counties outside of Northern Virginia and along the I-95 corridor to Central Virginia.

Data centers employ fewer employees than some other industries, but data center jobs tend to be high paying. Several data center representatives indicated that a typical 250,000-square-foot data center may have approximately 50 full-time workers, about half of which are contract workers. Data center construction supports a substantially larger number of workers. Construction of an individual data center building usually takes about 12 to 18 months, and data center representatives indicated that, at the height of construction, approximately 1,500 workers are on site from various construction-related industries.

Overall, the data center industry is estimated to contribute 74,000 jobs, \$5.5 billion in labor income, and \$9.1 billion in GDP to Virginia's economy annually. Most of these economic benefits derive from the construction phase rather than data centers' ongoing operations. The economic benefits from the industry are concentrated in Northern Virginia, where most data centers are located, but other regions of the state also benefit because data centers are also located there, or they are home to businesses that provide materials for data center construction.

Data centers can generate substantial local tax revenues for localities that have them

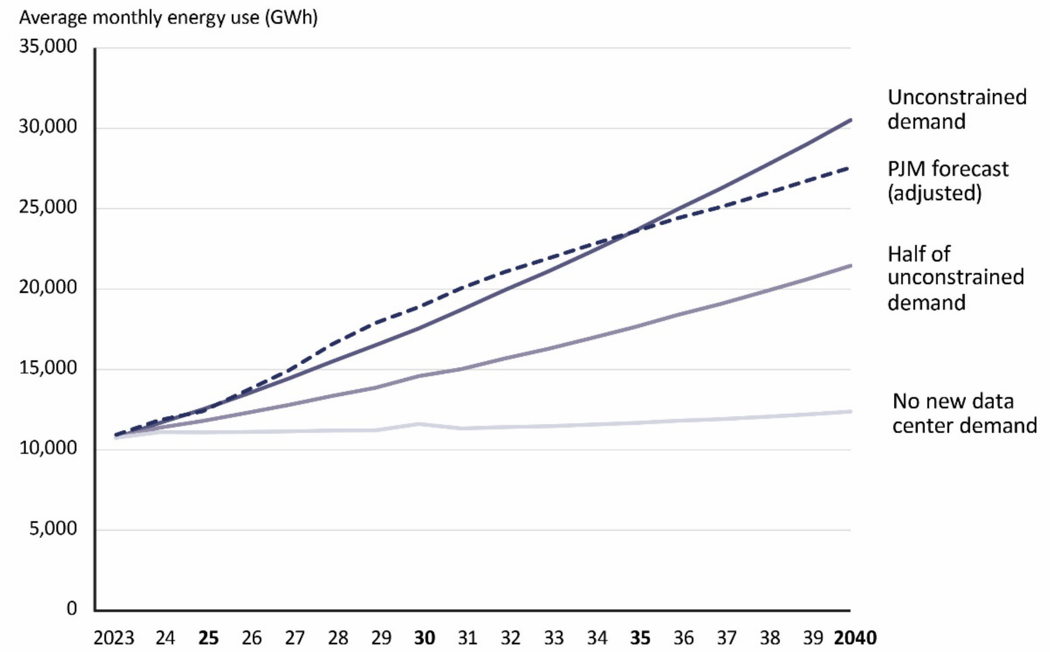
Localities with data centers can collect substantial tax revenues from the industry, primarily from business personal property and real property (real estate) taxes. The amount of local data center revenue depends on several factors, such as the size of their data center market and local tax rates. Some localities have greatly reduced their business personal property tax rates for computer equipment to try to attract data centers, but this also reduces the revenue they can collect from the industry. For the five localities with relatively mature data center markets, data center revenue ranged from less than 1 percent to 31 percent of total local revenue.

Localities in economically distressed areas of the state could benefit from data centers through increased local tax revenue, but these localities could have difficulty attracting the industry. Access to power and large, flat areas of land are key requirements for data centers, but are not available in some distressed areas, particularly in Southwest Virginia. Many distressed localities are also in rural areas that are away from data center customers and population centers, which makes it harder for them to attract the industry. However, these localities may be able to compete for data centers running certain artificial intelligence (AI) workloads, such as training. These localities could potentially become more attractive to the industry if they are able to proactively develop industrial sites suitable to data centers.

Data center industry is forecast to drive immense increase in energy demand

Modern data centers consume substantially more energy than other types of commercial or industrial operations. Consequently, the data center industry boom in Virginia has substantially driven up energy demand in the state, 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 population increased, it was offset by energy efficiency improvements. However, an independent forecast commissioned by JLARC shows that unconstrained demand for power in Virginia would double within the next 10 years, with the data center industry being the main driver. JLARC's independent forecast largely matches the most recent forecast by PJM, which is the regional organization that coordinates generation and transmission operations for Virginia and several other eastern and midwestern states.

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

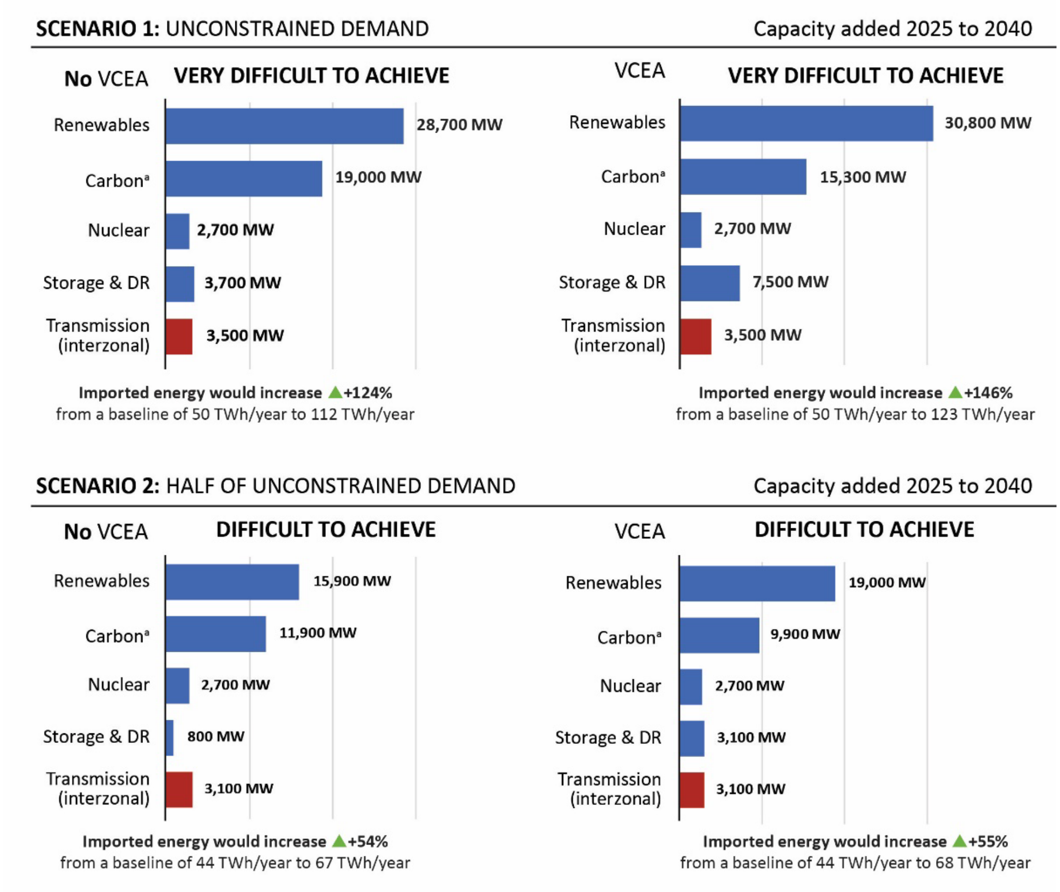


SOURCE: JLARC staff consultant analysis.
NOTE: A detailed note is provided for this figure in Chapter 3.

Building enough infrastructure for unconstrained data center demand will be very difficult and meeting half that demand is still difficult

An independent model of the energy grid commissioned by JLARC staff found that a substantial amount of new power generation and transmission infrastructure will be needed in Virginia to meet unconstrained energy demand or even half of unconstrained demand. Building enough infrastructure to meet unconstrained energy demand will be very difficult to achieve, with or without meeting the Virginia Clean Economy Act (VCEA) requirements (Scenario 1, figure). New solar facilities, wind generation, natural gas plants, and increased transmission capacity would all be required to meet unconstrained demand, and the number of projects needed would be very difficult to achieve. For example, new solar facilities would have to be added at twice the annual rate they were added in 2024, and the amount of new wind generation needed would exceed the potential capabilities of all offshore wind sites that have so far been secured for future development. Large natural gas plants would also need to be added at an equal or faster rate than the busiest build period for these facilities (2012 to 2018), depending on VCEA compliance.

Estimated generation mix needed to meet demand scenarios, with and without meeting VCEA requirements



SOURCE: E3 grid modeling analysis.
NOTE: A detailed note is provided for this figure in Chapter 3.
[a] Carbon includes natural gas, coal, and oil. Biomass facilities are counted as renewable resources, per the VCEA. However, starting in 2045, E3's grid model assumes natural gas plants would be converted to hydrogen fuel in each scenario when VCEA requirements are met.

Building enough infrastructure to meet half of unconstrained energy demand would also be difficult (Scenario 2 above). If VCEA requirements were not considered, the biggest challenge would be building new natural gas plants. New gas would need to be added at the rate of about one large 1,500 MW plant every two years for 15 consecutive years, equal to the busiest period of the last decade (2012 to 2018). If it is assumed that VCEA requirements would be met, the biggest challenges would be building enough wind, battery storage, and natural gas peaker plants. Wind generation needs would be the same as the unconstrained demand scenario. The amount of new battery storage would be several times the small amount currently in place in Virginia and a significant number of new natural gas peaker plants would have to be constructed. Both Scenarios 1 and 2 would rely on energy from as yet unproven nuclear technologies.

The state could encourage or require data centers to take actions to help address their energy impacts by promoting development of renewable energy generation, participating in demand response programs, and managing energy efficiency. However, these actions would have only a marginal impact on decreasing data center energy demand.

Existing electric utility requirements and processes help limit risks associated with system capacity and reliability

Data centers' projected energy demand increases have raised concerns about whether enough infrastructure can be built to keep pace. Currently, PJM attempts to protect regional grid reliability by requiring utilities to secure sufficient generation capacity plus a reserve margin, and the state requires utilities to develop plans that describe how generation capacity needs will be met. However, individual electric utility planning does not guarantee that the generation resources needed for the whole PJM region will be built because regional generation is not centrally planned. This is less of a concern with transmission because PJM and utility transmission owners centrally identify the impact large loads are expected to have, and how those loads can be brought on safely without causing transmission reliability problems.

If utilities are unable to build enough new infrastructure to keep pace with demand, one of the main ways they can protect grid reliability is by delaying the addition of new large load customers until there is adequate generation and transmission capacity. Utilities appear to be able to delay large load additions for transmission-related concerns, but it is less clear if they are allowed to delay adding new load because of generation concerns.

Data centers are currently paying their full cost of service, but growing energy demand is likely to increase other customers' costs

JLARC staff commissioned an independent study of electric utility cost recoveries under current rate structures to see if the data center industry is paying its share of current costs. The study found that current rates appropriately allocate costs to the customers responsible for incurring them, including data center customers.

However, data centers' increased energy demand will likely increase system costs for all customers, including non-data center customers, for several reasons. A large amount of new generation and transmission will need to be built that would not otherwise be built, creating fixed costs that utilities will need to recover. It will be difficult to supply enough energy to keep pace with growing data center demand, so energy prices are likely to increase for all customers. Finally, if utilities are more reliant on importing power, they may not always be able to secure lower-cost power and will be more susceptible to spikes in energy market prices. A typical residential customer of Dominion Energy could experience generation- and transmission-related costs increasing by an estimated $14 to $37 monthly in constant (or real) dollars by 2040 (independent of inflation). Establishing a separate data center customer class, changing cost allocations, and adjusting utility rates more frequently could help insulate non-data center customers from statewide cost increases.

Data centers create additional financial risks to electric utilities and their customers

The data center industry presents additional financial risks to electric utilities and their customers because of the sheer size of the industry's energy demand. One risk is that utilities will build more generation and transmission infrastructure than is needed if forecast demand does not materialize, or several large data centers close. This could strand utilities with infrastructure costs that would have to be recouped from their existing customer base. Another risk is particular to electric co-ops, which are not-for-profit companies that are owned by their member customers. If a data center customer delayed, disputed, or failed to pay an energy generation bill and the co-op was unable to recoup these costs from the customer, they would ultimately have to be paid by all other co-op members. A large enough bill could potentially result in a co-op defaulting and going bankrupt.

Another risk relates to data center participation in the state's retail choice program, which allows data centers and other large load customers to purchase generation through third parties rather than through their incumbent electric utility. This also has the potential to shift generation costs to other customers if enough data centers "leave" their incumbent utility for retail choice.

Data center backup generators emit pollutants, but their use is minimal, and existing regulations largely curb adverse impacts

To ensure constant operations in the event of a power outage, nearly all data centers maintain diesel generators on-site for backup power. Diesel generators emit several harmful air pollutants, such as nitrogen oxides, carbon monoxide, and particulate matter. To limit potential emissions from backup generators, the Virginia Department of Environmental Quality (DEQ) permits limit when they can be run, how long they can be run, and the maximum annual emissions each permitted site is allowed. Nearly all current data centers use "Tier 2" diesel generators, which DEQ allows to run only in emergencies or as part of routine maintenance testing.

Data center generators are run mostly only for maintenance, and most data center operators interviewed by JLARC staff reported experiencing zero to two minor outages per site in the last two years, with nearly all outages being only a few hours long. Consequently, data centers' diesel generators are a relatively small contributor to regional air pollution—in Northern Virginia, they make up less than 4 percent of regional emissions of nitrogen oxides and 0.1 percent or less of carbon monoxide and particulate matter emissions. While they make up only a small part of regional emissions, DEQ is conducting further study to ensure no harmful impacts occur locally. If the study detects any local air quality impacts, DEQ has the authority to increase protections as needed.

Data center water use is currently sustainable, but use is growing and could be better managed

Data centers require industrial-scale cooling, which is sometimes dependent on water, to manage the heat generated by their computing equipment. Most data centers use about the same amount of water or less as an average large office building, although a few require substantially more, and some require less than a typical household. The amount of water a data center uses depends on its size, computing density, and type of cooling system.

Most data centers receive their water from local water utilities, which make withdrawals from Virginia's water sources (rivers, groundwater). DEQ regulates water withdrawals, including requiring permits for large-scale withdrawals, to protect future water availability and environmental sustainability. However, while DEQ is responsible for ensuring water sustainability, there is less oversight over how available water should be shared across various uses in a locality. Virginia as a whole is relatively water rich, but water is more limited for some localities that do not have access to large amounts of surface water and are in groundwater management areas.

Localities have allowed data centers to be built near neighborhoods, but some localities are taking steps to minimize residential impacts

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.

In response to increased residential opposition, some localities have taken steps to minimize the residential impacts of data centers. The three Virginia localities with the largest data center markets have taken or are considering changes to zoning ordinances to better manage future data center development, and several localities considering their first data center projects are proactively implementing planning and zoning changes to promote appropriate industry development. The effectiveness of local efforts to minimize residential impacts ultimately depends on the decisions of local elected officials when considering more restrictive zoning ordinances or individual special permit or rezoning requests.

Data center noise near residential areas presents unique challenges, and some localities are unsure about their authority to address it

The constant nature of data center noise has sometimes been a problem when data centers are located near residential areas. Data centers emit low-frequency noise that is not loud enough to damage nearby residents' hearing and rarely loud enough to violate noise ordinances. However, some nearby residents report that the constant noise generated by some data centers affects their well-being. Although noise has been a problem for some data centers, a large majority of data centers do not generate noise complaints because of their location or design.

Localities traditionally use noise ordinances to address noise concerns, but those typically target excessively loud noise from short-term sources, such as parties and barking dogs, and carry a low maximum civil penalty of $500. Noise restrictions for data centers could be more effective if included in zoning ordinances instead, but some localities were uncertain whether they have the authority to establish these restrictions in such ordinances. Zoning ordinances that establish maximum allowable sound levels for both new and existing data centers would allow localities to better account for the low-frequency noise data centers emit, prescribe a better process for measuring potential noise violations, and impose more effective penalties for addressing any violations.

Some data center companies are conducting sound modeling studies *before* building data centers, but not all Virginia localities currently require this, and some were unsure whether they had the authority to do so.

Changes to the state's data center sales tax exemption could address some policy concerns related to the industry

Since 2010, Virginia has offered an exemption to the state's retail sales and use tax to attract large-scale data centers. The exemption allows data centers and their tenants to purchase computers and other equipment, such as servers, network infrastructure, cooling equipment, and generators, without paying sales tax. Because data centers are capital intensive, the exemption is valuable to the industry (providing $928 million in tax savings in FY23), and about 90 percent of the industry uses the exemption. Data center companies report the exemption is an important factor when deciding where to locate and expand, and most of the other states that Virginia competes with for new data center developments have similar exemptions.

Because the data center exemption is a valuable incentive and used by most of the industry, it could be used to incentivize data centers to take actions to address many of the issues discussed throughout this report. There are a range of changes that could be made to the exemption, depending on the General Assembly's policy objectives.

Extend the exemption to maintain industry growth — If the General Assembly wishes to maintain data center industry growth in Virginia and the associated economic and local tax revenue benefits, it could extend the exemption. The exemption is scheduled to expire in 2035, and data center representatives unanimously reported that expiration of the exemption would negatively affect the state's ability to attract new data centers and keep existing ones. Data center companies typically consider the cost of ownership over a 15- to 20-year period when making location decisions, so to influence future site selection decisions, an extension would need to be in place well before 2035.

Allow the exemption to expire to reduce industry growth and associated energy impacts — If the General Assembly wishes to slow the data center industry's growth in Virginia because it determines that energy impacts, including increasing costs to residential and other customers, outweigh the industry's economic benefits, it could allow the exemption to expire in 2035. While the General Assembly could allow the exemption to expire only in certain regions, like Northern Virginia, that approach would be less effective in reducing overall growth in energy demand because significant growth is occurring in several counties outside of Northern Virginia and is expected to continue.

Change the exemption to balance industry growth and energy impacts — Rather than choosing between economic benefits or reduced energy impacts, the exemption could be changed to try to balance these competing impacts. The General Assembly could allow the full exemption to expire in 2035 (or end it before then) and apply a partial sales tax exemption until 2050. A partial exemption would also better align the economic benefits the state receives with the value of the exemption. Most economic benefits occur during construction, and switching to a partial exemption in 2035 would reduce the value of the exemption in later years when the economic impacts of current and planned data centers could be expected to slow. A partial exemption could also generate more tax revenue for the state.

Use the exemption to address other policy concerns related to the data center industry — If the General Assembly extends the exemption, even as a partial exemption, there are several additional options the General Assembly could implement to address concerns in specific policy areas. The exemption could be modified to address energy, natural resource, historic resource, and residential impacts.

WHAT WE RECOMMEND

This report includes multiple policy options for the General Assembly to consider depending on its policy goals for the data center industry in Virginia. The report also includes several recommendations. The following recommendations include only those highlighted in the report summary. The complete list of recommendations and options is available on page xi.

Legislative action

- Clarify that electric utilities have the authority to delay, but not deny, service to customers when the addition of customer load cannot be supported;

- Direct Dominion Energy to develop a plan for addressing the risk of infrastructure costs being stranded with existing customers, and file that plan with the State Corporation Commission;
- Expressly authorize local governments to require and consider water use estimates for proposed data center developments;
- Expressly authorize local governments to require sound modeling studies for proposed data center developments; and
- Expressly authorize local governments to establish and enforce maximum allowable sound levels for operational data center facilities using alternative low frequency metrics and zoning ordinances.

Executive action

- The Virginia Economic Development Partnership should clarify that grants under the Virginia Business Ready Sites Program can be used for potential data center sites.

Recommendations and Policy Options: Data Centers in Virginia

JLARC staff typically make recommendations to address findings during reviews. Staff also sometimes propose policy options rather than recommendations. The three most common reasons staff propose policy options rather than recommendations are: (1) the action proposed is a policy judgment best made by the General Assembly or other elected officials, (2) the evidence indicates that addressing a report finding is not necessarily required, but doing so could be beneficial, or (3) there are multiple ways in which a report finding could be addressed and there is insufficient evidence of a single best way to address the finding.

Recommendations

RECOMMENDATION 1

The Virginia Economic Development Partnership should clarify in site characterization and development guidelines that potential data center sites are eligible for grants under the Virginia Business Ready Sites Program. (Chapter 2)

RECOMMENDATION 2

The General Assembly may wish to consider amending the Code of Virginia to clarify that electric utilities have the authority to delay, but not deny, service to customers when the addition of customer load cannot be supported by the transmission system or available generation capacity. (Chapter 3)

RECOMMENDATION 3

The General Assembly may wish to consider amending the Code of Virginia to expand the Accelerated Renewable Buyers program, which allows large customers of energy utilities to claim credit for purchases of solar and wind *energy* to offset certain utility charges, to also allow customers to claim partial credit for purchases of *capacity* from battery energy storage systems based on the current PJM electric load carrying capacity rating. (Chapter 3)

RECOMMENDATION 4

The General Assembly may wish to consider amending the Code of Virginia to require that utilities establish a demand response program for large data center customers and to require that these customers participate in the program. (Chapter 3)

RECOMMENDATION 5
The General Assembly may wish to consider amending the Code of Virginia to direct Dominion Energy to develop a plan for addressing the risk of generation and transmission infrastructure costs being stranded with existing customers and file that plan with the State Corporation Commission as part of its biennial rate review filing or as a separate filing. (Chapter 4)

RECOMMENDATION 6
The General Assembly may wish to consider amending the Code of Virginia to expressly authorize local governments to (i) require proposed data center developments to submit water use estimates and (ii) consider water use when making rezoning and special use permit decisions related to data center development. (Chapter 5)

RECOMMENDATION 7
The General Assembly may wish to consider amending the Code of Virginia to expressly authorize local governments to require sound modeling studies for data center development projects prior to project approval. (Chapter 6)

RECOMMENDATION 8
The General Assembly may wish to consider amending the Code of Virginia to expressly authorize local governments to establish and enforce maximum allowable sound levels for data center facilities, including (i) using alternative low frequency noise metrics and (ii) setting noise rules and enforcement mechanisms in their zoning ordinances, separate from existing noise ordinances. (Chapter 6)

Policy Options to Consider

POLICY OPTION 1
The General Assembly could consider amending the Code of Virginia to require that, as a condition of receiving the sales tax exemption, data center companies meet and certify to an energy management standard, such as the International Organization for Standardization's 50001 standard for energy management. (Chapter 3)

POLICY OPTION 2
The General Assembly could consider amending the Code of Virginia to allow electric cooperatives to create for-profit subsidiary companies that could fulfill their legal obligation to provide energy services (retail sales) to customers with load capacity of over 90 MW. (Chapter 4)

POLICY OPTION 3
The General Assembly could consider amending the Code of Virginia to require that electric utilities establish caps on participation in retail choice that protect ratepayers from undue costs, and that such caps be approved by the State Corporation Commission through a formal case process. (Chapter 4)

POLICY OPTION 4

The General Assembly could amend the Code of Virginia to require that, as a condition of receiving the data center sales and use tax exemption, all new data center developments in the Northern Virginia Ozone Nonattainment Area use only Tier 4 generators, Tier 2 generators with selective catalytic reduction systems, or generators with equivalent or lower emission rates. (Chapter 5)

POLICY OPTION 5

The General Assembly could amend the Code of Virginia to require that, as a condition of receiving the sales and use tax exemption, data center companies meet and certify to an environmental management standard, such as the International Organization for Standardization's 14001 standard for Environmental Management Systems. (Chapter 5)

POLICY OPTION 6

The General Assembly could amend the Code of Virginia to require that, as a condition for receiving the sales and use tax exemption, data center companies conduct a Phase I historic resource study of a proposed development site, as well as a viewshed analysis when a proposed site is located within a certain distance of a registered historic site, and report the study findings to the appropriate locality prior to development. (Chapter 5)

POLICY OPTION 7

The General Assembly could amend the Code of Virginia to require that, as a condition for receiving the sales and use tax exemption, data center companies conduct a sound modeling study prior to the development of a proposed data center that is to be located within a certain distance of a residential development or area zoned for residential development and provide the study findings to the appropriate locality. (Chapter 6)

POLICY OPTION 8

The General Assembly could amend the Code of Virginia to extend the expiration date for the state's sales and use tax exemption for data centers from 2035 to 2050. (Chapter 7)

POLICY OPTION 9

The General Assembly could allow the sales and use tax exemption for data centers to expire in 2035. (Chapter 7)

POLICY OPTION 10

The General Assembly could amend the Code of Virginia to extend a partial sales and use tax exemption for data centers from 2035 to 2050. (Chapter 7)

1 Overview of the Data Center Industry

In 2023, the Joint Legislative Audit and Review Commission (JLARC) directed its staff to review the impacts of the data center industry in Virginia. Specifically, staff were directed to assess the impact of the industry on state and local revenue; Virginia's energy demand and supply; natural, historic, and cultural resources; and local residents. Staff were also directed to forecast future growth of the industry in Virginia and determine (i) how any economic benefits could be more widely distributed and (ii) if Virginia's data center tax exemption could be improved. (See Appendix A for the study resolution.)

To complete this study, JLARC staff conducted over 250 interviews with more than 150 different stakeholders, including local residents and stakeholder groups; data center companies and developers; state and local officials; electric and water utility companies; and subject-matter experts. Staff analyzed water usage and air quality and emissions data, as well as capital expenditure, employment, and tax benefit data from users of the data center tax exemption. Staff also reviewed state and local land use regulations and conducted case reviews of local data center-related zoning and permitting requests. (See Appendix B for more information on methods used for this study.)

JLARC staff contracted with two consultants as part of this study. Faculty from the Weldon Cooper Center for Public Service at the University of Virginia (Weldon Cooper Center) developed an economic impact analysis of Virginia's data center industry and an independent energy demand forecast for Virginia and its utilities. Consulting firm Energy + Environmental Economics (E3) modeled how data center growth was likely to affect future generation and transmission needs, carbon emissions, and utility costs, including how costs could be passed on to ratepayers. E3 also made additional refinements to the Weldon Cooper Center energy demand forecast.

Data centers are key hubs of the world's digital infrastructure

Data centers are specialized facilities that manage, process, and share large amounts of data. They enable the digital services that people rely on daily, including websites, electronic applications, and cloud-based platforms such as email and media streaming. These services are also critical to businesses and organizations, for example, allowing businesses to make secure transactions electronically or conduct complex computing tasks using artificial intelligence (AI). Given their essential role in daily life, business, and the economy, data centers have become a critical part of the world's digital infrastructure (sidebar).

Digital infrastructure encompasses the systems and technologies needed for the internet, online services, and other digital activities to function. This includes networks (e.g., fiber, switches), hardware (e.g., computers, servers), software (e.g., operating systems, applications), data centers, and the personnel who manage and maintain these components.

Megawatts are units used to measure power, equivalent to one million watts. Megawatts measure the amount of energy produced or consumed at any instant, rather than total over time. A different unit of measure is used to measure the amount of energy produced or consumed over a given time period. For example, megawatt-hours describe the number of megawatts produced or consumed during an hour.

For context, **a Virginia town of 10,000 people uses approximately 10 megawatts**.

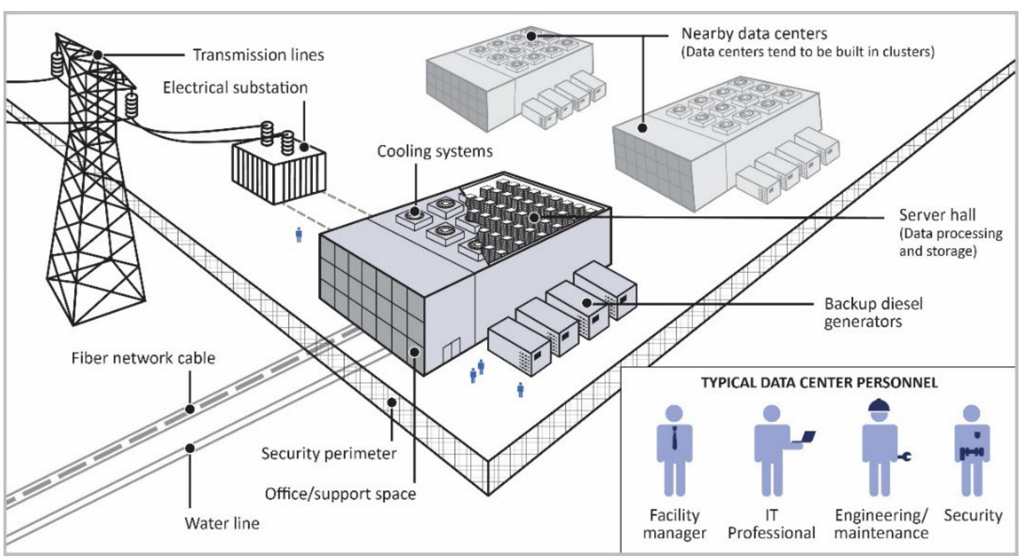
A typical, modern data center is a large industrial building filled with computing equipment, including servers, storage drives, and network hardware. Externally, these buildings often resemble warehouses or distribution centers. Data centers can vary greatly in size, ranging from smaller facilities with a few thousand square feet to large, multi-story buildings exceeding one million square feet. Data centers are often located on campuses alongside other facilities or other data centers operated by the same company. In addition, many data centers have physical security measures, such as floodlights, fencing, and access controls, to protect the facility and its data.

Data centers require large amounts of electricity to operate. This energy powers the computing equipment inside, as well as cooling equipment that prevents the computing equipment and building from overheating. The amount of electricity needed for a data center varies based on its size, the density and type of computing equipment, and the cooling system used. A small data center can require five to 20 megawatts of power, while a larger data center can require 100 or more megawatts (sidebar). Given the amount of electricity needed for operations, data centers often have power lines and substations connecting them directly to nearby high-voltage transmission lines. All data centers also have backup generators on-site to ensure continuity of operations if their primary power supply fails.

Data centers are operated and maintained by a skilled workforce, including technicians, electricians, and network engineers. Data centers also generally have security personnel.

Figure 1-1 illustrates the infrastructure, equipment, and personnel found in and around a typical, modern data center.

FIGURE 1-1
Common infrastructure, equipment, and personnel at a typical data center



SOURCE: JLARC staff.
NOTE: Illustrative example. Data centers may have different equipment, e.g., based on their cooling system.

There are various types of data centers, ranging from traditional enterprise and colocation facilities to newer hyperscale operations.

- Enterprise data centers are private facilities owned and operated by a single company, designed specifically to meet that company's IT and data storage needs. These are generally non-technology companies, such as banks, insurance firms, and credit card companies, that rely heavily on secure, in-house data processing and storage. Enterprise data centers are generally located on-site, such as within a corporate campus or integrated into a larger office building. Enterprise data centers are a shrinking segment of the data center market as companies increasingly rely on the cloud for their computing needs.
- Colocation data centers are facilities owned and operated by a company that leases physical space within their data center to other companies and organizations. These tenants, which include smaller technology companies, online retailers, and government agencies, house their computer equipment within their leased space and have their own staff who maintain and upgrade this equipment. Tenants rely on the data center owner to provide all other services such as power, cooling, and physical security. Colocation data centers generally serve multiple tenants—often upwards of 20 or more—which allows these companies to benefit from economies of scale.
- Hyperscale data centers are purpose-built facilities designed to serve the world's major technology companies (e.g., Amazon Web Services [AWS], Google, Meta, Microsoft), often known as "hyperscalers." These are the largest data centers with the largest operational capacity and power requirements (sidebar). Hyperscale data centers can either be owned and operated by the hyperscaler company or by a third-party that leases the facility to the hyperscaler. In some cases, the third party that owns the data center also provides services such as power, cooling, and security, while in others the hyperscaler manages all building operations. Hyperscale data centers are a growing segment of the data center market.

Operational capacity—also called "capacity"—refers to the amount of power a data center needs to operate. This includes all the power needed to run the computing equipment, cooling systems, and other building operations. Capacity is often used to describe the size of a data center. For the purposes of this chapter, capacity is measured in megawatts.

Data center industry is growing rapidly, driven by a combination of established and emerging trends

The data center industry spans markets around the world, clustering in locations that provide access to land, energy, and fiber, and are business friendly, politically stable, and at low risk from natural disasters. Many data center markets are located near key population, business, and government centers because they are close to their customers and end users. Being in proximity to customers reduces the time it takes for data to travel between the data center and the customer, ensuring fast processing, which can be critical for certain business operations, such as financial transactions (sidebar).

The time it takes for data to travel from one point to another, such as from a data center to the end user, is called "**latency**." Low latency indicates data is traveling more quickly; high latency indicates there is a longer delay. Many factors affect latency, most notably the geographic distance between the data center and user. Some tasks—such as financial transactions—are more "latency sensitive" than others, meaning they require as low latency as possible.

It also reduces time for end users to access data, which, for example, reduces buffering times and increases picture quality when streaming media.

The data center industry is dominated by a few large participants. In the U.S., four hyperscaler companies—AWS, Google, Meta, and Microsoft—are responsible for much of the data center industry. These companies operate their own hyperscale data centers, lease other hyperscale data centers, and can also be customers within traditional colocation data centers.

Data center industry is growing rapidly worldwide

The data center industry is growing worldwide, with many data centers under construction or in development. Market reports and trade literature indicate the industry has grown significantly over the past decade, with an especially rapid growth rate in recent years, particularly in the Americas. For example, a 2024 report from the real estate firm Cushman & Wakefield estimates 44,600 megawatts of data center capacity is in development worldwide. More than half (55 percent) of this capacity is in the Americas region, 30 percent is in the Asia–Pacific region, and the remaining 15 percent is in the Europe, Middle East, and Africa (EMEA) region. When completed, this growth would double existing capacity across the EMEA markets and more than double existing capacity in the Americas and Asia–Pacific markets.

The industry is growing both in terms of the number of data centers under construction as well as the size and scale of those data centers. More data centers are being built, and many of the new data centers under construction are larger and have more operational capacity. For example, the capacity of a typical data center has increased from requiring only a few megawatts of power to more than 100 megawatts.

There has also been a recent shift toward companies building data center *campuses,* rather than individual data centers, to serve the needs of hyperscalers. Such campuses can be made up of multiple parcels of land and house several data centers owned by the same entity. Collectively, the operational capacity of these campuses can reach hundreds of megawatts, and in some cases, exceed one gigawatt (i.e., 1,000 megawatts). Companies are increasingly developing data center campuses, rather than individual facilities, to consolidate operations, improve efficiency, and more easily expand capacity in response to growing demand.

Industry expected to grow for foreseeable future, though factors could shift where growth occurs

The data center industry is expected to keep growing, driven by demand for digital services, such as e-commerce, media streaming, and cloud-based applications. This trend accelerated during the COVID-19 pandemic as more people and businesses relied on these services and is expected to continue. As the economy becomes increasingly digitized, more consumers use digital services, and the number of internet-connected devices rises, the need for data storage, processing, and network capacity will continue to grow.

The recent emergence of AI is another significant driver of data center growth. AI applications, such as machine learning and data analytics, require immense computing power and storage to process large amounts of data. As businesses increasingly adopt AI tools and AI is integrated into commercial applications, the demand for data centers to support these technologies has surged and is expected to continue to grow.

AI workloads typically require more power than traditional data center tasks because they use more energy-intensive hardware. The servers conducting AI tasks often include graphics processing units (GPUs) alongside central processing units (CPUs), because GPUs are better suited to running large, simultaneous data processes required for AI applications. Since GPUs consume more power than CPUs, AI tasks are generally more energy demanding.

AI also has the potential to reshape how and where the data center industry grows. For example, some AI workloads, such as large language model training, are not latency sensitive, allowing data centers housing these tasks to be located farther from established data center markets. Additionally, AI workloads are often much larger than typical data center demands, requiring larger facilities with more computing capacity and more power needs (sidebar).

Market constraints could also shift where the industry grows. Key factors, such as power availability, land price and availability, local opposition, and regulatory environments, are constraining the industry, especially in established markets. As these constraints grow, some markets may become less attractive for development, driving data center growth toward other locations.

Northern Virginia has the largest data center market in the world, and the state's industry is growing

There are approximately 150 data center sites in Virginia, which collectively house around 340 data center buildings. These sites vary in size, ranging from a single 2,400-square-foot data center building to a campus of seven buildings that total more than 3 million square feet. In total, Virginia has over 63 million square feet of data center space on 7,200 acres of land (sidebar).

For context, **Pocahontas State Park—the largest in Virginia—covers 7,600 acres.** The entire state park system spans a total of 75,900 acres.

Virginia data center sites also vary in size in terms of operational capacity. The smallest sites require only about one megawatt of power, while some larger campuses are estimated to need 200 or more megawatts and are still growing. In total, Virginia data center sites use approximately 5,050 megawatts of power (sidebar). (This is based on the 2024 peak load forecast by Dominion Energy and Mecklenburg, Northern Virginia, and Rappahannock electric cooperatives in August 2023.)

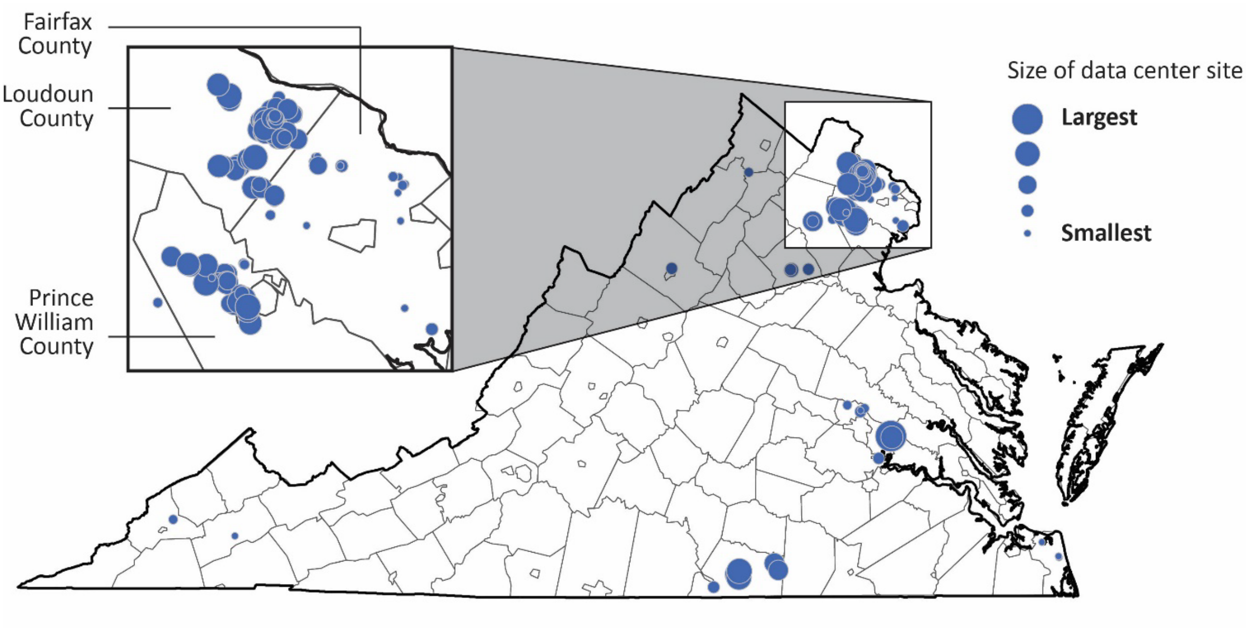
Data centers' power usage in Virginia—about 5,050 megawatts— is roughly **equivalent to the electricity needs of 2 million Virginia households** (about 60 percent of households in the state).

Virginia's data center industry is mostly concentrated in Northern Virginia, with other small clusters near Richmond and Mecklenburg

Data centers are located across the state, but 80 percent of Virginia's data center industry is concentrated in three Northern Virginia localities: Loudoun, Prince William, and Fairfax (Figure 1-2). Loudoun County alone accounts for approximately half of the state's data center industry in terms of number of sites, building square footage, and estimated energy usage. The eastern part of the county north of Dulles

International Airport has become known as "Data Center Alley" because of its high concentration of data centers. The remaining 20 percent of Virginia's data center sites are in 11 other localities, with the most notable clusters in the Richmond region and Mecklenburg County.

FIGURE 1-2
Most of Virginia's data center industry is concentrated in Northern Virginia

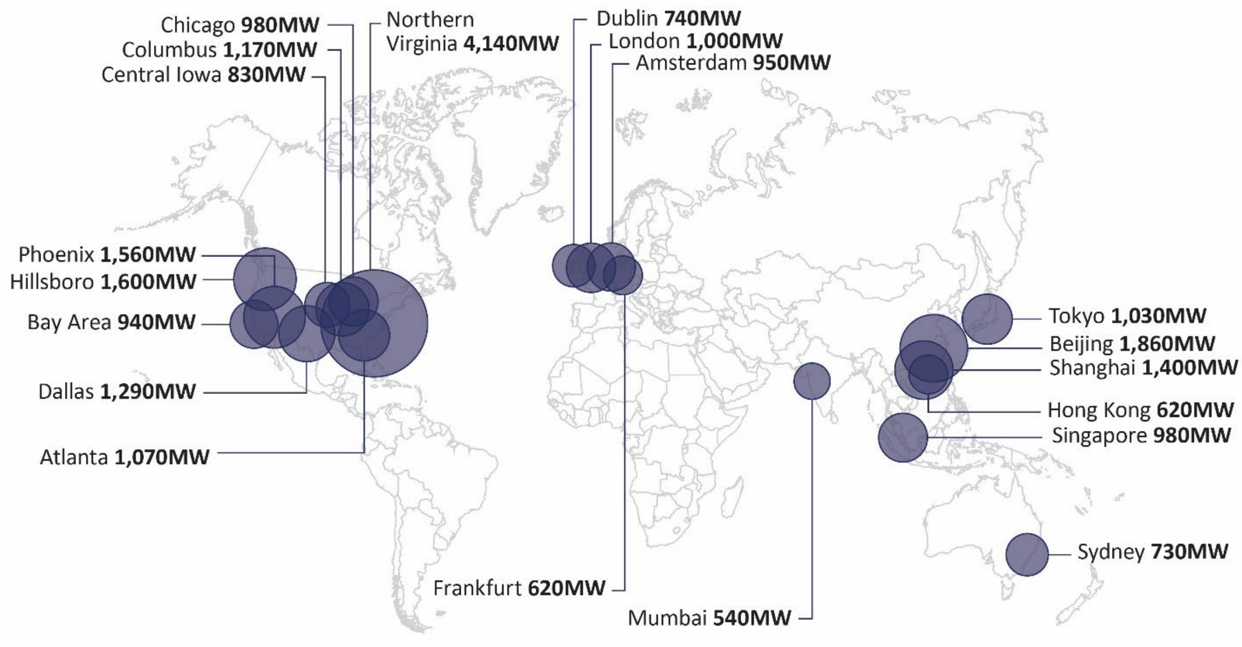


SOURCE: JLARC analysis of Virginia Department of Environmental Quality data and county property real estate records.
NOTE: Map shows one dot per data center site, which may include multiple data center buildings. Size of each site represented by size of dot, as measured by the maximum capacity (in terms of megawatts) the site is permitted to backup via diesel generators. This capacity is larger than the current operational capacity because it (i) accounts for the site's full build-out potential, which many sites have not yet reached, and (ii) includes allowances for redundancy. Data center operators report 0 to 25 percent of backup capacity is typically for redundancy.

Northern Virginia is the largest data center market in the world because of multiple factors

Northern Virginia has the highest concentration of data centers in the world and is recognized as the world's premier data center market. The exact size of the Northern Virginia data center market (in terms of the number of sites and energy demand) varies based on the sources used; however, every source indicates Northern Virginia is the global leader. According to data reported by Cushman & Wakefield, in terms of megawatts, the Northern Virginia market is more than twice the size of the next largest market in the world, Beijing, and nearly three times the size of the next largest market in the U.S., located in and around Hillsboro, Oregon (Figure 1-3). The Northern Virginia market constitutes 13 percent of all reported data center operational capacity globally and 25 percent of capacity in the Americas region.

FIGURE 1-3
Virginia has the most operational capacity of all global markets



SOURCE: JLARC analysis of Cushman & Wakefield 2024 Global Data Center Market Comparison.
NOTE: Reflects market size in terms of operational capacity as measured by megawatts. Shows 20 largest markets. "Northern Virginia" refers to an estimate of data center capacity in the traditional Northern Virginia market consisting of Fairfax, Loudoun, and Prince William counties and Manassas. The Cushman & Wakefield report also includes an estimated 560 megawatts of capacity in Culpeper and Fauquier counties and the Richmond metropolitan region.

Multiple factors have contributed to Northern Virginia's market prominence. The region's role in the early stages of the internet's development gave it a head start as a key data center hub. In the mid-20th century, early data processing companies contracting with government agencies and high-technology government labs were drawn to the region given its proximity to their federal government customers. The establishment of an internet exchange point in the 1990s further attracted major telecommunications and early internet companies to the region.

As the internet grew, a strong fiber network, supply of reliable cheap energy, and available land encouraged more data centers to locate in the region. Data centers were also drawn to the region given its proximity to major national customers, including most notably the federal government, government contractors, and technology firms that held an enormous amount of government and other data. With the rapid growth of the internet in the 2000s, it became advantageous for data centers to cluster near each other so they could share information more quickly. The high concentration of data centers also led to a burgeoning ecosystem of industry professionals, real estate developers, construction companies, and tradespeople with expertise in data centers, which continues to make the region attractive today.

The creation of a state data center tax incentive has also been a key factor in the industry's development in Northern Virginia, as well as the state more broadly. In 2010, Virginia adopted a sales and use tax exemption that exempted data centers from paying retail sales tax on computer and related equipment purchases, and the General Assembly has since expanded the exemption. (See Chapter 2 for more information about the sales and use tax exemption and its impact.)

Data center industry is growing rapidly in Virginia, both in established markets and newer ones

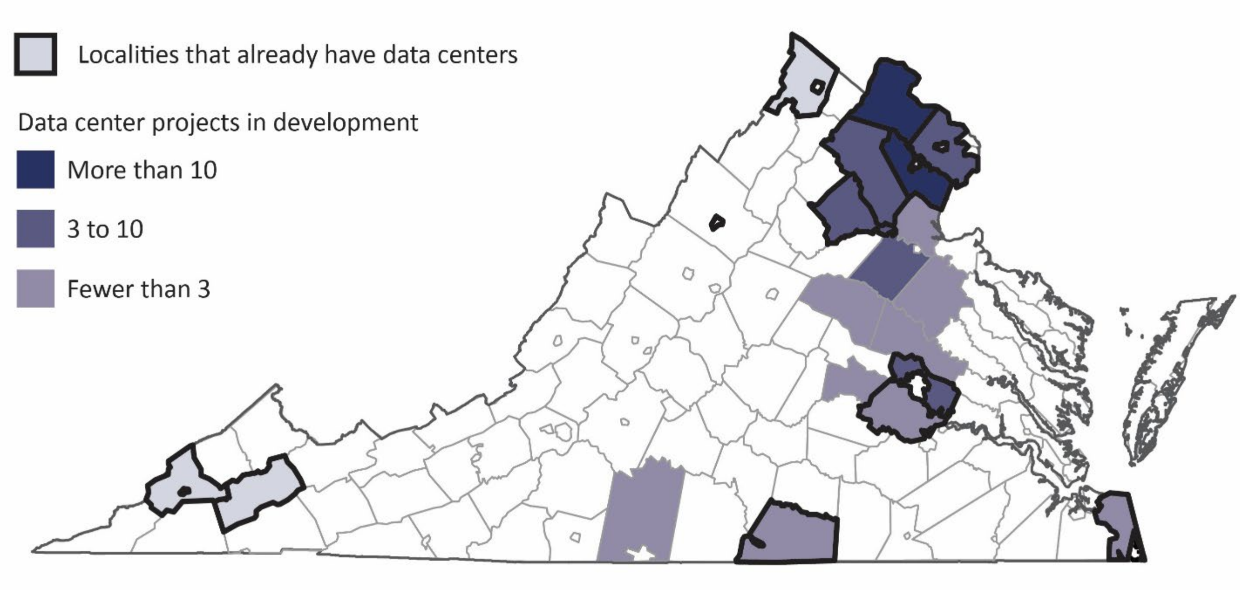
The data center industry is growing rapidly in Virginia. Since 2020, data center *space* in Virginia has more than doubled, with over a quarter of the state's existing data center square footage built in 2022 and 2023. Additional square footage has been built in 2024. A 2024 Cushman & Wakefield report underscores this trend, noting there is a record amount of data center *capacity* in development in the state. This includes 1,500 megawatts under construction and 2,900 megawatts in earlier stages of development. When this development is complete, it will nearly double the size of data center capacity in Virginia.

As of September 2024, there are at least 70 new known data center sites under active development across the state. These projects are at various stages of the development process, with more than half having received full local government approval and/or under construction. The remaining projects are at earlier stages, such as awaiting local rezoning or approval.

Much of the data center development is occurring in the established markets of Northern Virginia, the Richmond region, and Mecklenburg County. Within these existing markets, the majority of growth continues to be in Loudoun and Prince William counties, with Prince William County being the fastest-growing locality (Figure 1-4). The growth in these markets is driven by data center developers and companies building at new sites as well as expanding existing campuses.

The data center industry is also growing in new Virginia markets, most notably in counties outside of the established Northern Virginia market and along the I-95 corridor (Figure 1-4). For example, seven localities without any data centers have recently approved new campuses or have applications pending. According to stakeholders, data center development is moving into these new markets as land availability and local regulatory environments become more challenging in Northern Virginia. Additionally, AWS is leading development into localities along I-95 as part of its agreement with the state to invest $35 billion in data centers in new Virginia locations by 2040.

FIGURE 1-4
Data center industry still growing in established markets, but development starting to spread into new areas, such as along I-95



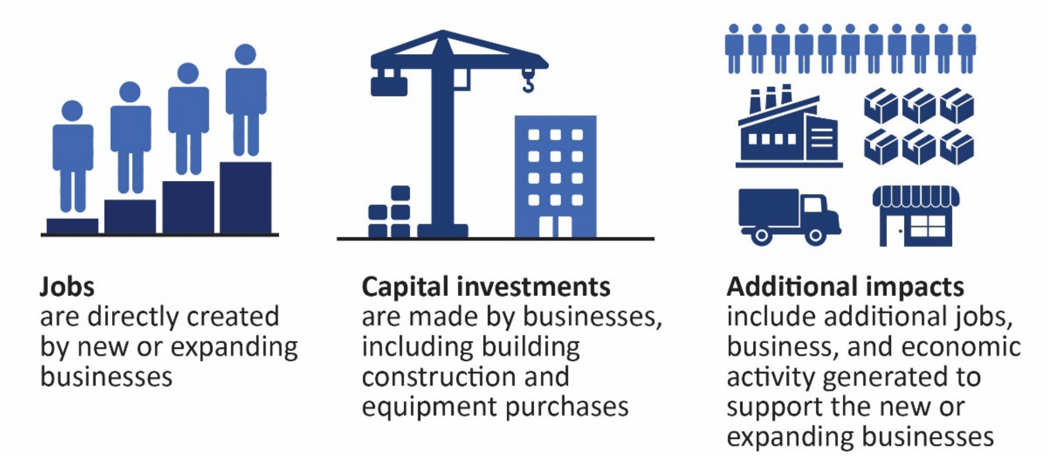
SOURCE: JLARC summary analysis as of September 2024.
NOTE: "In development" includes projects that are under construction, permitted, and/or have been approved through local rezoning or other approval processes (if applicable).

2 Economic and Fiscal Impacts

States strive to build and maintain a strong and diverse economy. A strong economy benefits the state by increasing the wealth of its citizens, helping its businesses succeed, and generating tax revenues to support state and local government operations. Tax revenues help pay for essential services like roads, schools, and public safety.

Virginia looks to improve its economy by attracting new businesses and having existing businesses expand their operations. Businesses benefit the economy directly by creating new jobs and making capital investments, such as constructing new buildings and purchasing vehicles and equipment. Business activities have many additional impacts that further economic growth, such as creating additional jobs at in-state suppliers and in the service industries that support the original business and its employees (Figure 2-1).

FIGURE 2-1
Businesses create jobs and capital investment and have additional impacts that benefit the state economy



SOURCE: JLARC staff analysis.

Data center industry provides positive economic benefits to state

State and local economic development agencies view data centers as an attractive industry. Data center companies are some of the largest and most well-resourced technology companies in the world. Though data centers directly employ relatively fewer employees than some industries, data center jobs tend to be higher paying, so jobs

Tradeable sector includes businesses that compete or export goods and services outside of where they are located. They have larger economic impacts because they bring in new revenue from outside the state instead of simply reallocating existing economic activity.

An **employment multiplier** is an estimate of the number of additional jobs created in the economy to support each job created directly by an industry.

have a higher economic impact. Data centers also meet other characteristics of a high impact industry: they are in a tradable industry sector and have a high employment multiplier (sidebar). Data centers—like manufacturers, steel producers, and transportation industries—are also capital intensive. Their facilities are enormous and require multibillion-dollar outlays for construction and equipment, which can provide substantial tax revenue for local governments and a comparatively smaller amount of tax revenue for the state (for the portion that is not tax-exempt).

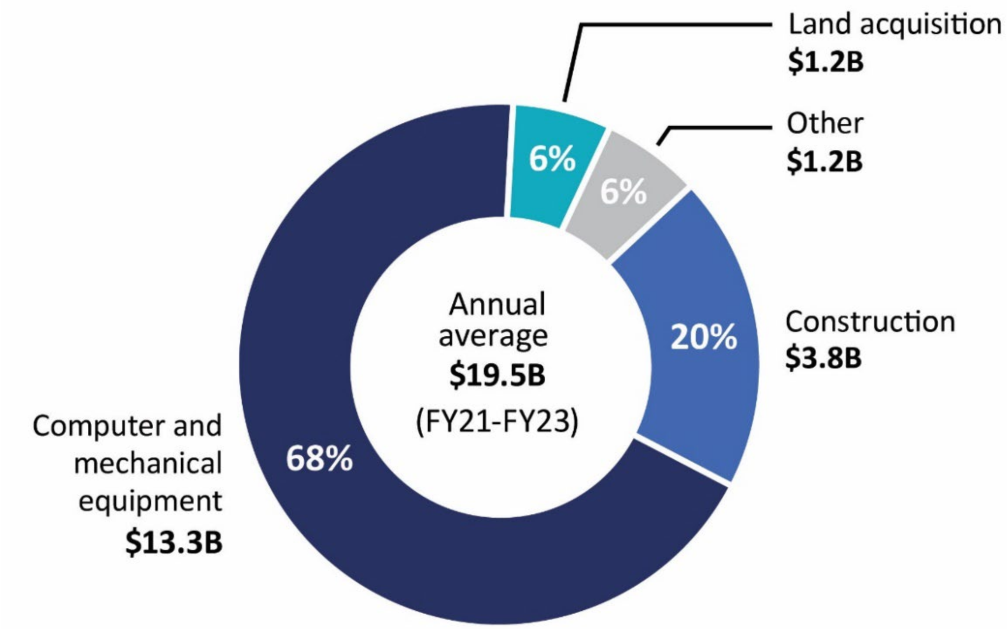
The data center industry provides secondary economic benefits to the state as well. The clustering of data centers in a region, like Northern Virginia, can have "knock on" economic effects by indirectly attracting other related technology businesses, which help create a well-trained, regional IT workforce. This clustering of data centers, related businesses, and skilled workers can further improve the region's attractiveness to additional businesses in the technology sector and other sectors.

Data center capital investment is substantial, although only a portion of it benefits Virginia's economy

Capital investment in Virginia data centers is substantial, exceeding $24 billion in FY23, and primarily consists of equipment purchases from Virginia-based and out-of-state companies. Data center investment represented 84 percent of the total capital investment across all economic development projects announced by the Virginia Economic Development Partnership (VEDP) between FY22 and FY24. However, like capital investments made by other industries, only a portion of data center capital investment benefits the Virginia economy. The primary benefit to Virginia's economy is related to data center construction, which comprises about 20 percent of total data center capital investment (Figure 2-2). Most construction spending likely remains in the state economy because much of it goes to Virginia-based businesses performing key construction services such as clearing and grading sites, erecting steel frames, installing high-voltage electrical equipment, installing industrial-scale cooling systems, and running miles of cable, conduit, and piping. Materials used in data center construction are often also sourced from Virginia businesses throughout the state.

The largest portion of data center capital investment is for IT and mechanical equipment (68 percent), and most of this spending occurs with out-of-state companies. Computer servers are the biggest equipment expense and, because there are no major computer server manufacturers in Virginia, are sourced from outside the state or the country. Some other equipment used in data centers is sourced in Virginia. For example, Virginia has suppliers of electrical and cooling equipment, raised-access floors and hot/cold aisle containment systems, and fiber infrastructure. These suppliers have recently located or expanded operations in Virginia because of the state's large data center market. Even so, a substantial amount of non-computer equipment still likely comes from out-of-state, such as the diesel generators data centers use for backup power.

FIGURE 2-2
Primary benefit of data center capital investment to Virginia's economy is from construction, which comprises 20 percent of data centers' capital investment



SOURCE: JLARC staff and Weldon Cooper Center analysis of data center capital investment between FY21 and FY23 reported to VEDP.

Data center industry supports relatively small operations workforce and sizable construction workforce, both with average or above average wages

Data centers typically employ a small number of workers for data center operations, relative to their facility size. For example, several data center representatives indicated that a typical 250,000-square-foot data center may have approximately 50 full-time workers (one employee per 5,000 square feet versus one employee per 650 square feet for some distribution centers). About half of these workers are likely direct employees of the data center company (or for colocation data centers, direct employees of the tenant). These workers include facility managers, engineers, data technicians, and facility maintenance staff. The other half are contract workers, including electricians, pipefitters, and security personnel who work full-time at the facility (sidebar).

Data centers require constant ongoing maintenance of electrical and cooling systems. Data centers have hundreds of electrical and mechanical components that must be replaced as they break down over time. Additionally, these systems can also be upgraded or configurations changed as computer equipment is upgraded and replaced.

Data center direct employees and contract workers accounted for, by JLARC staff estimates, over 8,000 full-time jobs in FY23. A data center may add new jobs each year as new facilities begin and expand operations. In FY23, data centers added more than 800 new full-time jobs.

Data center construction, however, supports a substantially larger number of workers than data center operations. Construction of an individual data center building usually takes about 12 to 18 months, and it can take five or more years to fully build out a campus. Data center representatives indicated that, at the height of construction, approximately 1,500 workers are on site building a facility and installing electrical and cooling systems and include occupations such as

- site developers and surveyors,
- equipment operators for land clearing and leveling,
- workers to erect steel building frames and concrete walls,
- electricians installing cabling, equipment, and generators, and
- pipefitters and HVAC technicians installing piping and cooling equipment.

Both data center operations and construction workers earn average or above average wages, contributing to the economic benefit of the industry. On average, data center employees and contractors earn about $100,000 per year, varying based on job role and area of the state. Many construction-related jobs do not require a college degree but are also relatively high-paying. For example, the starting salary for electricians is approximately $24 per hour, and a "journeyman" (fully trained) electrician can make approximately $56 per hour. These wages translate to $50,000 and $116,000 in annual wages, respectively, but the actual annual wages are likely higher because these workers often work over 40 hours per week and can earn overtime pay.

The growth of Virginia's data center industry has contributed to the expansion of the state's trades and construction industry. A representative from a construction supplier and contractor indicated that the data center industry is the largest construction sector right now, and data center projects are about one-third to one-half of their current projects and nearly two-thirds of their backlog. A representative of an electrical workers union in Northern Virginia indicated that, because of demand from the growing data center industry, their apprenticeship program has grown from 300 apprentices per training course to 500 in the last several years and could grow larger. A benefit of this growth is that many workers are able to stay in-state and move to another data center construction job after a project is complete, rather than moving to another state to find work.

JLARC's independent economic impact analysis was performed by staff from the Weldon Cooper Center. The analysis was conducted using economic modeling software developed by IMPLAN. The model uses an industry standard methodology but does not account for the cost of some potential externalities, such as health and environmental costs associated with increased carbon emissions, that may be associated with the industry's large energy demands. See Appendix D for additional details.

Data center industry has added thousands of jobs and several billion dollars to state's economy, mostly from construction

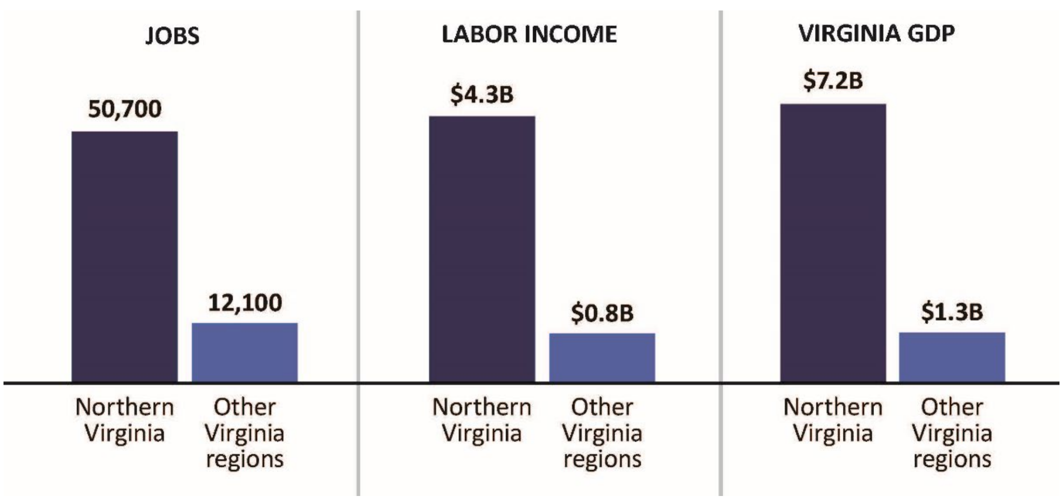
The data center industry benefits the Virginia economy because of the additional jobs and personal income created and the value it adds to the Virginia economy (i.e., Virginia gross domestic product or GDP). JLARC staff commissioned an independent economic impact analysis of the data center industry in Virginia (sidebar). The analysis estimated that the data center industry provides approximately 74,000 jobs, $5.5 billion in labor income, and $9.1 billion in Virginia GDP overall to the state economy annually, based on average spending by the industry between FY21 and FY23 (Table 2-1). These estimates are just over 1 percent of total statewide employment, income, and Virginia GDP during the last three years. Most of the economic benefits have been in the Northern Virginia region, but other regions where data centers are located or under construction, or that have businesses that otherwise support the industry, also benefited (Figure 2-3).

TABLE 2-1
Data center industry has positive economic benefits on Virginia

	Annual average based on data center capital investment and related operation spending		
Economic impact	**Construction phase**	**Operations phase**	**Total impact**
Jobs	59,000 jobs *(35,000 direct)*	15,000 jobs *(4,400 direct)*	74,000 jobs *(39,400 direct)*
Labor income	$4.3 B *($2.6 B direct)*	$1.2 B *($0.4 B direct)*	$5.5 B *($3.1 B direct)*
Virginia GDP	$6.4 B *($3.3 B direct)*	$2.7 B *($1.1 B direct)*	$9.1 B *($4.4 B direct)*

SOURCE: Weldon Cooper Center economic impact analysis of the data center industry impacts, based on data center spending between FY21 and FY23 reported to VEDP, adjusted to account for non-exempt data centers. Numbers may not sum because of rounding.
NOTE: Direct operations jobs include only data center employees and exclude contractors that work full time at data centers. Total impact includes direct impacts plus indirect and induced impacts. Average data center economic impacts presented here likely underestimate the impacts in more recent years given the growth of the industry.

FIGURE 2-3
Economic impact from data centers is concentrated in Northern Virginia



SOURCE: Weldon Cooper Center economic analysis of the annual data center industry impacts, based on data center spending between FY21 and FY23 reported to VEDP, adjusted to account for non-exempt data centers.
NOTE: Totals for Northern Virginia and other Virginia regions do not sum to statewide totals shown in Table 2-1 because the analysis does not account for impacts from activity in Northern Virginia occurring in other Virginia regions and vice versa.

Much of the data center industry's economic benefits in Virginia derive from capital spending during the construction phase rather than spending during ongoing operations (Table 2-1). Annual average spending during the construction phase is estimated to be more than three times annual operation spending, according to prior research. Data centers were estimated to contribute 59,000 jobs annually during the construction phase, accounting for 80 percent of total annual jobs resulting from data centers. This estimate includes 35,000 direct jobs, most of which were construction workers (28,000), although some were IT-related workers manufacturing and installing equipment (7,000). Another 24,000 jobs were estimated to be in supporting sectors, such as materials suppliers, and "induced jobs" in businesses that benefit from worker spending, such as restaurants and retail. The data center construction phase also accounted for most of the annual increase in total labor income (80 percent) and total Virginia GDP (70 percent) from data centers. Appendix D provides additional technical details on these and other analysis outcomes.

Because most of data centers' economic benefits are from construction, continued growth of the data center industry would be needed in Virginia to maintain the same level of economic impact. Current trends suggest continued growth is likely to happen, at least for the near future. Virginia's data center market is expected to double in the next few years based on the data center capacity currently under construction and in the early development stages.

Data centers generate substantial local tax revenues for localities that have them

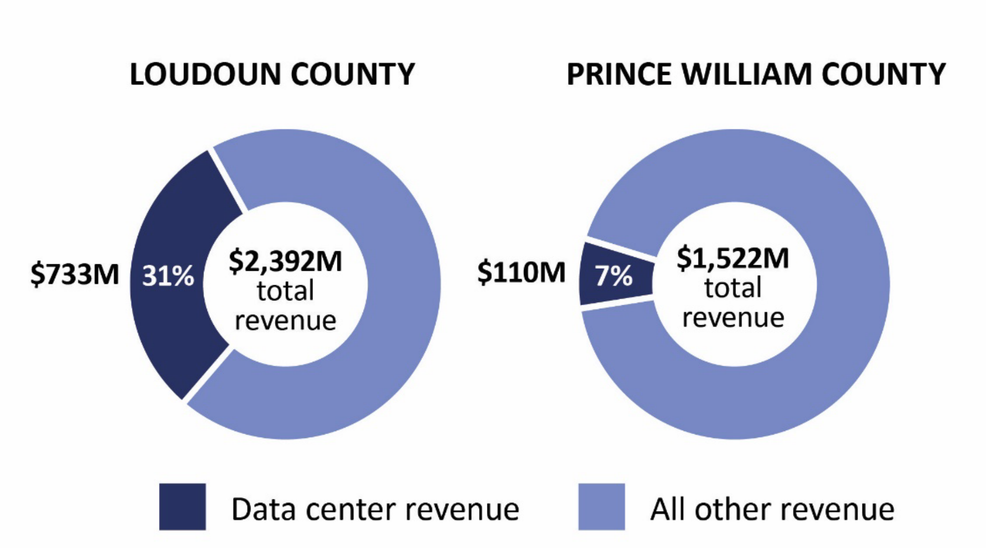
Business personal property taxes are levied by local governments on the value of property, such as furniture, fixtures, computer equipment, machinery, tools, and heavy equipment within their locality. State law allows a locality to tax certain classes of personal property at lower rates, including computer equipment for data processing.

Real property (or real estate) taxes are levied by a local government on land and improvements in their locality.

Local governments with data centers in their jurisdictions can collect substantial tax revenues from the industry. Data centers pay different types of local taxes, but the primary ones are business personal property and real property (real estate) taxes (sidebar). The business property tax, in particular, can generate substantial revenue. A single data center typically has business personal property valued in the millions, a large portion of which is computer equipment that is typically replaced every five years.

Although data center tax revenues can be substantial, the industry's share of local revenue varies. For the five localities with relatively mature data center markets (Loudoun, Prince William, Mecklenburg, Henrico, and Fairfax), data center revenue ranged from less than 1 percent to 31 percent of total local revenue. The amounts collected and percentage of local revenues vary substantially because of differences in the size and maturity of the data center markets, locality sizes and tax bases, and local tax rates and depreciation schedules. Loudoun and Prince William have the largest and most mature markets, and data center revenue accounted for 31 percent and 7 percent, respectively, of total local tax revenue (Figure 2-4). Loudoun collects substantially more revenue from data centers primarily because its data center market size is three times larger than Prince William's. Revenue estimates are not provided for all of these localities to protect taxpayer confidentiality.

FIGURE 2-4
Data center tax revenue can be substantial for local governments (FY23)



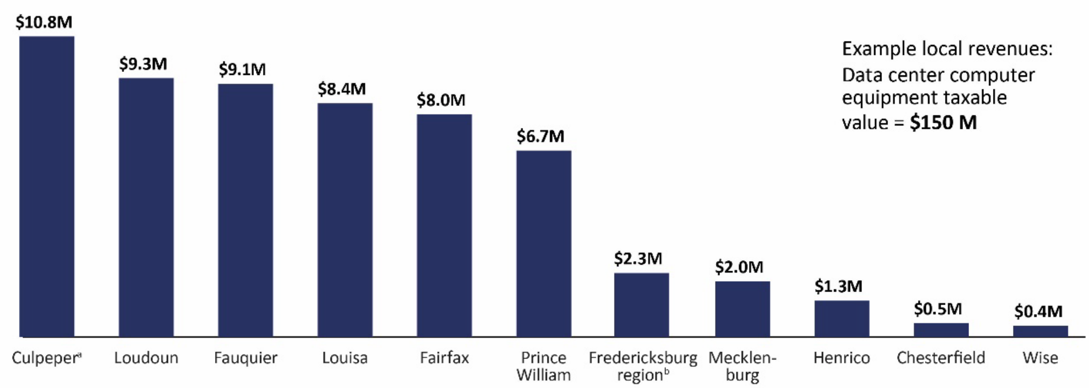
SOURCE: JLARC staff analysis of revenue collections from localities and the APA Local Government Comparative Report, FY23.

Tax rates also significantly affect the amount of revenue a locality can generate from data center developments. Some localities have greatly reduced their business personal property tax rates for computer equipment to try to attract the industry and, therefore, collect far less revenue than other localities with a higher tax rate would collect for a comparable project. For example, assuming a data center with $150 million in taxable computer equipment, counties could collect from $10.8 million to $0.4 million over a five-year period (after accounting for different tax rates and depreciation schedules) (Figure 2-5).

Even with the variation in tax revenue collections, local government staff from the five counties with the greatest data center presence indicated that data center revenue has benefited their locality. Local government staff indicated data center revenue has allowed their locality to

- lower real estate tax rates (Loudoun and Prince William),
- develop an affordable housing trust fund (Henrico County),
- establish revenue stabilization or reserve funds (Loudoun and Prince William), and
- construct new schools (Mecklenburg).

FIGURE 2-5
Some localities would collect far less revenue over a five-year period than others for the same data center development



	Culpeper[a]	Loudoun	Fauquier	Louisa	Fairfax	Prince William	Fredericksburg region[b]	Mecklenburg	Henrico	Chesterfield	Wise
Tax rate / $100	$3.50	$4.15	$3.45	1.90	$4.57	$3.70	$1.25	$0.66	$0.40	$0.24	$0.24
Depreciation rate	Slow	Moderate	Slow	Slow	Fast	Fast	Fast	Moderate	Moderate	Fast	Fast

SOURCE: JLARC staff analysis of locality property tax rates and depreciation schedules for computer equipment.
NOTE: Tax rate is the business personal property tax rate in 2024 for computer equipment. Amounts exclude real property taxes. Amounts are based on a data center with $150 million in equipment. Data center equipment is typically replaced every five years, which resets the depreciation schedule used to calculate the decline in value of equipment each year after its purchase.
[a] Culpeper provides a local tax rebate for data centers that invest at least $10 million and hire at least 10 new employees in the Culpeper Technology Zone, and therefore may reduce this amount for qualifying data centers. [b] Fredericksburg Region includes the City of Fredericksburg, Caroline County, King George County, Spotsylvania County, and Stafford County.

In addition to the revenue the industry generates, local government staff reported that data centers are an attractive industry because they impose minimal direct costs on the provision of government services compared with other industries. Data centers employ relatively few employees in comparison with other industries like manufacturing and logistics. Industries with more employees place greater demand on local roads, school systems, and other services.

Localities in distressed areas have difficulty attracting data centers

Data center developments could benefit localities in economically distressed areas of the state through increased local revenue. However, localities in these areas face several challenges in attracting data centers. To be considered, a locality likely needs to have 230kV transmission lines (the preferred voltage for modern data center campuses) and large and flat properties close to those transmission lines. These requirements could prevent many counties in distressed areas, particularly in Southwest Virginia, from being considered.

Localities in economically distressed areas that are away from population centers can also only compete for certain types of data centers. They cannot compete for data centers that need to be close to customers or require low latency, such as cloud computing and colocation facilities. However, they may be able to compete for data centers running artificial intelligence (AI) workloads, such as training models, which do not need to be near populated areas and may not require low latency. AI is expected to drive a lot of future industry growth and presents an opportunity for more remote localities.

The state could improve the competitiveness of localities in distressed areas by helping them identify, prepare, and market industrial sites that are attractive to the data center industry. Data center companies prefer to move fast once a site has been identified, so available land should have access to roads and other utilities (water, sewer) that allow construction to begin soon after selection. Company representatives said industrial sites that are shovel-ready could be particularly attractive. The primary reason Mecklenburg was successful in attracting Microsoft was because the county had already identified a site suitable for data center development when Microsoft was looking for potential Virginia locations.

The Virginia Business Ready Sites Program, which is administered by VEDP, can be used for this purpose. The program identifies and assesses the readiness of potential industrial sites and provides site characterization and development grants to local governments and regional authorities. The program is intended to develop sites to attract large employers, such as manufacturers, but it can be used to identify and develop sites for which data centers would be a "best use" and would generate a positive return on investment for the state. For example, a 150-acre site that has limited road and rail infrastructure but is located close to 230kV transmission lines might be best used as a data center instead of a manufacturing plant. To help localities in distressed areas compete for data centers, VEDP should clarify that potential data center sites can be included in VEDP's site listings and are eligible for Virginia Business Ready Sites Program grants.

RECOMMENDATION 1

The Virginia Economic Development Partnership should clarify in site characterization and development guidelines that potential data center sites are eligible for grants under the Virginia Business Ready Sites Program.

The 2020 General Assembly **lowered the eligibility requirements** for the data center exemption in distressed areas of the state to 10 jobs and capital investment of $75 million to encourage growth in these areas.

The state made changes to its data center sales tax exemption, discussed in the next section, several years ago to try to attract data centers to distressed areas of the state (sidebar). However, very few data centers have qualified for the exemption under the changes, so the changes alone may not be sufficient to overcome other challenges to attract data centers to these areas.

State's data center exemption encourages industry growth and has moderate economic benefits

Virginia, like other states, uses incentives and other strategies to try to attract specific industries that can create new economic activity. The goal of targeting specific industries is to establish industry clusters or ecosystems.

Since 2010, Virginia has offered a retail sales and use tax exemption to attract large-scale data centers. The exemption allows qualifying data centers and their tenants to purchase computers and other equipment without paying the state sales tax on the following items, namely

- computer equipment such as servers, mainframes, network infrastructure, and data storage hardware; and
- other equipment such as cabling, switches, cooling equipment, generators, monitoring systems, and similar items used to operate exempt equipment.

This report includes higher **estimates of the tax revenue impact of the data center exemption** than was reported in prior years. Data centers using the exemption are now required to report to the Virginia Economic Development Partnership their annual eligible exemption expenditures and tax benefits.

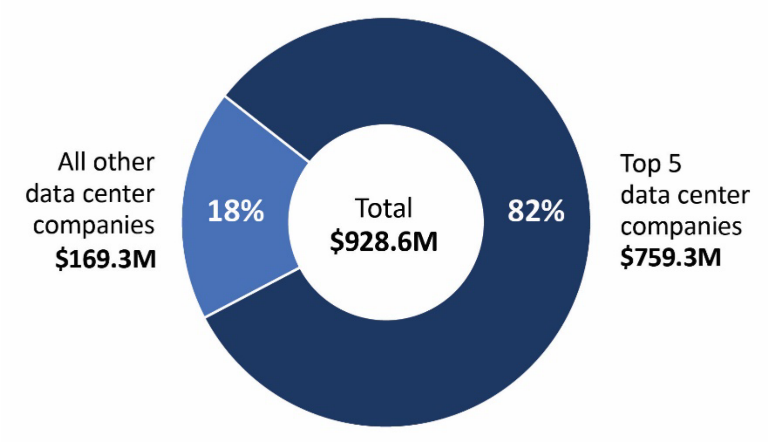
The statewide retail sales and use tax includes a 4.3 percent state share, a 1 percent local option share, and additional 0.7 percent to 1.7 percent regional share, depending on the region. In addition to collecting revenue from the local option, localities tax data center property in other ways, as described in this chapter.

Exemption provides qualifying data center companies with substantial tax reductions

Data center owners and their tenants, which can include a wide range of businesses in sectors like technology, health care, financial institutions, and retail, can claim the data center sales and use tax exemption if they meet eligibility requirements. To qualify, data centers must create a minimum of 50 jobs paying at least 150 percent of the prevailing annual average wage in the locality where the data center is located and make a $150 million capital investment. As noted above, the minimum thresholds are lower for distressed areas. Data centers and tenants reported saving $928.6 million in sales taxes in FY23 because of the exemption, including state, local, and regional portions of the tax (sidebar). The state portion of the exempted amount was an estimated $683 million, making it by far the state's largest economic development incentive, with the next closest incentive valued at $74 million.

Although approximately 30 data center companies (and their tenants, for colocation data centers) claim the exemption, most of the tax savings accrue to a small number of companies (Figure 2-6). Even so, the median savings for a data center company using the exemption was $5.4 million in FY23, and all but six companies saved $1 million or more.

FIGURE 2-6
Most of the tax savings from data center exemption go to only a few data center companies (FY23)



SOURCE: JLARC staff analysis of data center exemption information reported to VEDP.
NOTE: For colocation data centers, the tax savings is attributed to the data center owner rather than the individual tenant, because the data center owner is the "holder" of the MOU and the reporting entity.

Exemption likely affects data center location and expansion decisions

Data center companies consider several factors when determining where to locate, and state sales tax exemptions are regularly ranked among their top factors. The other top site selection factors are access to power, available land, workforce quality, customer needs, business-friendly regulatory climate, and utility and other costs. While it is impossible to precisely determine the exemption's importance in data centers' location decisions, representatives from data center companies indicated the exemption was a key consideration because it greatly reduces their costs.

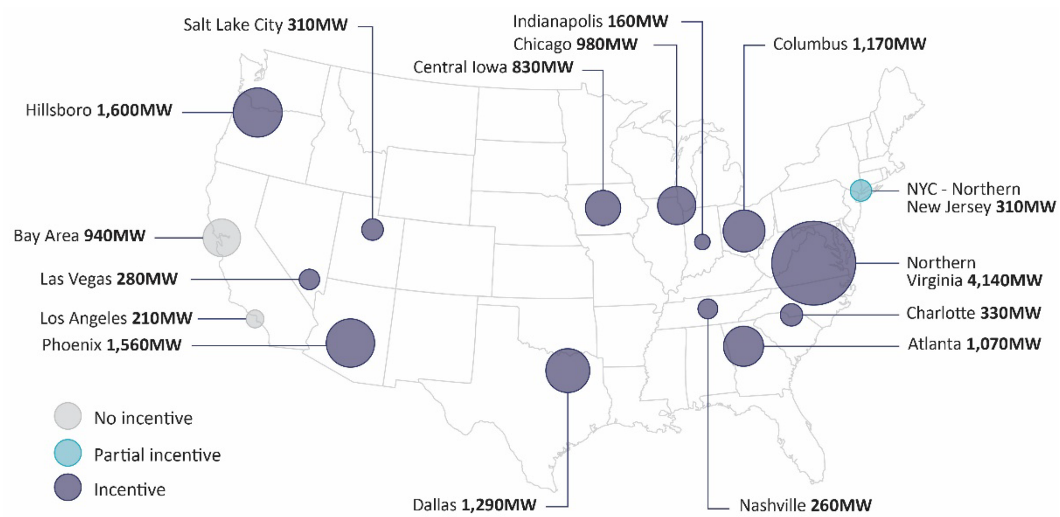
Data center companies view the exemption as important because their industry is capital intensive, and the exemption provides substantial savings on those investments. If a typical modern 250,000-square-foot data center costs $250 million to $325 million to build and equip, the exemption would provide an initial benefit of about $9 million to $15.5 million in savings (depending on the locality). Companies also save on subsequent equipment purchases, usually made every five years when data centers replace and upgrade their computer equipment. For colocation data centers, the exemption is also important for meeting customer needs, because it provides savings to tenants who purchase their own equipment.

Virginia is competing for data centers with other states that have similar exemptions

Since the late 2000s, states have increased their efforts to attract data centers, primarily by adopting sales tax exemptions. In 2008, Virginia became the seventh state to adopt a sales tax exemption. (The initial exemption applied to very few localities and is no longer in effect, but a statewide exemption was adopted in 2010.) Today, the majority of states either have a sales tax exemption for data centers (34) or do not have a sales tax (4). All states bordering Virginia provide a sales tax exemption to data centers. (See Appendix E for a map of states with a data center sales tax exemption.)

Virginia competes with other states for new data center developments, especially states that also have primary markets. Most other primary markets are located in states with exemptions, with the exceptions being markets in California and the New Jersey portion of the New York-northern New Jersey market (Figure 2-7). These two markets have a relatively small data center presence considering their proximity to major population centers, the California market's proximity to high tech firms in Silicon Valley, and the New Jersey market's proximity to the U.S. financial center in New York City.

FIGURE 2-7
All primary data center markets in the U.S. have exemptions, except for California and northern New Jersey markets, which are relatively small



SOURCE: JLARC staff analysis of Cushman & Wakefield 2024 Global Data Center Market Comparison.
NOTE: Oregon (Hillsboro market) does not have a sales tax (which has similar effect of the exemption). "Northern Virginia" refers to an estimate of data center capacity in the traditional Northern Virginia market consisting of Fairfax, Loudoun, and Prince William counties and Manassas. The Cushman & Wakefield report also includes an estimated 560 megawatts of capacity in Culpeper and Fauquier counties and the Richmond metropolitan region.

Data center exemption has moderate economic benefits and return in revenue to the state compared with other incentives

The data center exemption has moderate economic benefits and moderate return in revenue to the state compared with Virginia's other economic development incentives. (See *Data Center and Manufacturing Incentives,* JLARC, 2019.) It is rated as moderate because it is similar to the economic benefits and return in revenue for the average incentive (Table 2-2). Like most economic development incentives, the data center exemption does not pay for itself when considering just the state portion of the exemption cost and the state return in revenue.

TABLE 2-2
Data center exemption has moderate benefits compared with other incentives

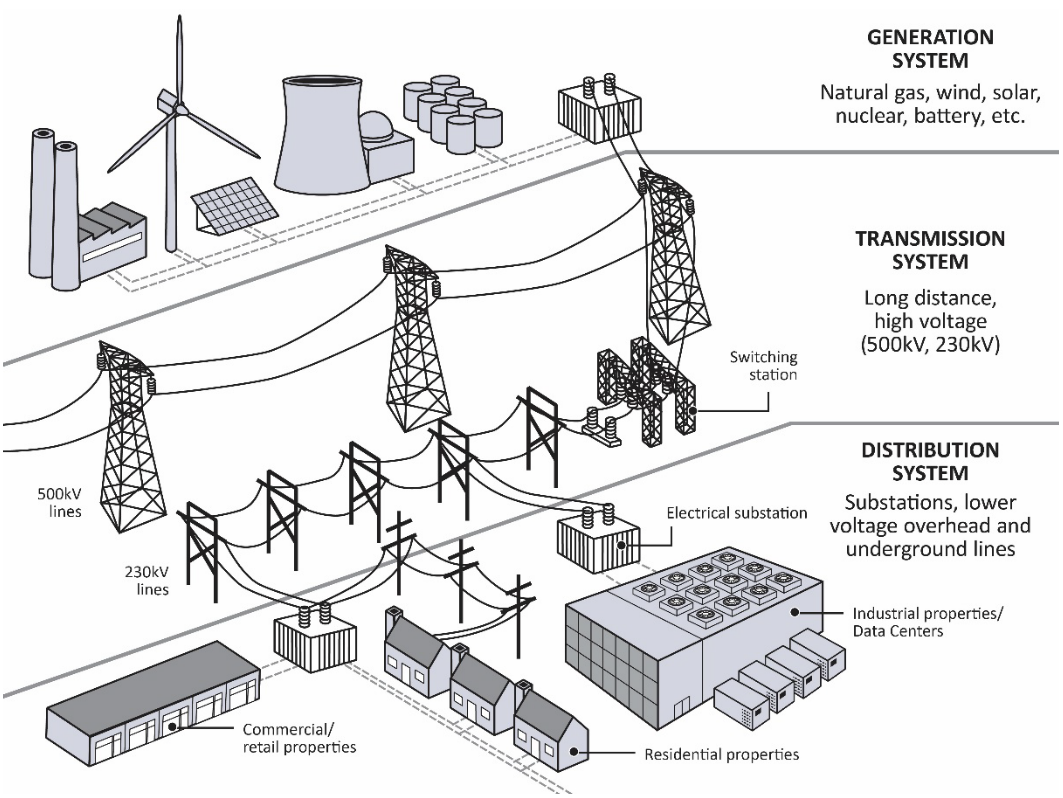
	Annual average	
	Data center exemption	**Average Virginia incentive**
Economic impact per $1 million spent on the exemption		
Jobs added	84 jobs	58 jobs
Income added	$6 M	$5 M
Virginia GDP increase	$10 M	$9 M
Impact on state revenue per $1 spent on the exemption		
Return in revenue per $1 spent	48¢	41¢

SOURCE: *Economic Development Incentives 2024*, JLARC 2024.

3 Energy Impacts

Virginia's power grid is part of the North American Eastern Interconnection, a massive energy infrastructure network that provides electricity to most states and several Canadian provinces east of the Rocky Mountains. The grid comprises three key interconnected systems: generation, transmission, and distribution (Figure 3-1). Power generation in Virginia has historically come from a few large carbon fuel and nuclear plants, but is increasingly coming from renewable sources like solar and wind. The transmission system moves power in bulk over long distances from where it is generated to the area where it is consumed. Power is then reduced to lower voltages and provided to homes, businesses, and other consumers through the distribution system.

FIGURE 3-1
Power grid is a complex network of generation, transmission, and distribution systems

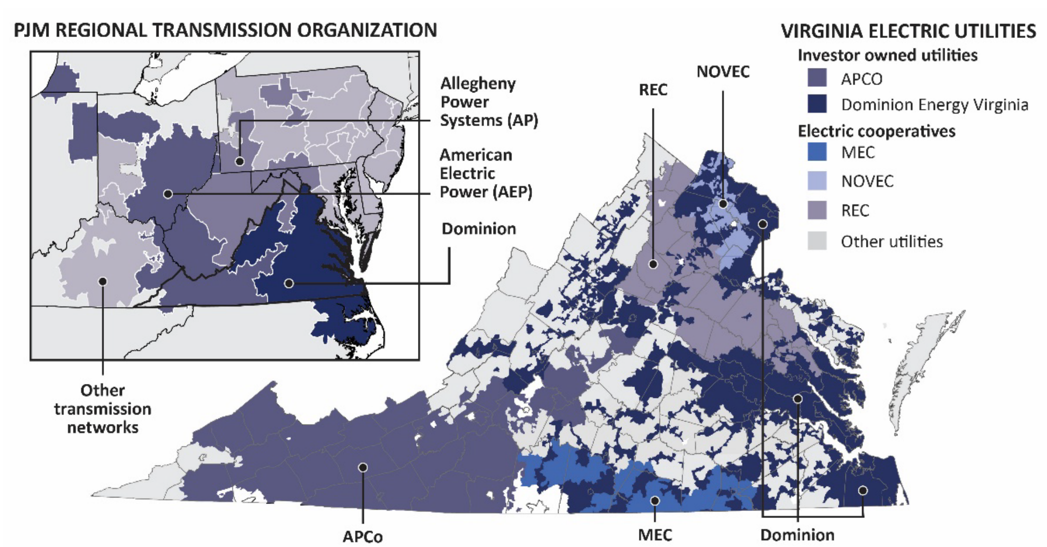


SOURCE: JLARC staff.

Within the eastern power grid, Virginia is part of the PJM regional transmission organization (Figure 3-2). PJM is a not-for-profit organization that coordinates generation and transmission operations and operates as a wholesale power market for its members, including utilities, independent power generators, and other energy companies. Within Virginia's section of PJM, the two main power utilities are Dominion and American Electric Power (AEP), which operate much of the generation and most of the transmission that serve the state. Dominion and AEP (under its subsidiary Appalachian Power Company, or APCO) are also the distribution utilities for much of the state. However, a significant portion of the state is served by 13 distribution cooperatives (the "co-ops"). Most co-ops purchase their power through another generation and transmission utility, the Old Dominion Electric Cooperative (ODEC), which operates or partially owns a few power plants, and contracts for additional power, in and outside of Virginia. The largest distribution co-op, the Northern Virginia Electric Cooperative (NOVEC), purchases its own generation and operates one power plant.

Virginia's power utilities are subject to state and federal laws and are regulated by the State Corporation Commission (SCC) and the Federal Energy Regulatory Commission (FERC). One of the SCC's key functions is to approve new generation and transmission projects. See Appendix F for more discussion of generation and transmission projects' potential impacts and how regulators and utilities try to minimize those impacts.

FIGURE 3-2
Virginia is part of PJM and relies on transmission and distribution utilities



SOURCE: PJM and SCC maps.
NOTE: MEC = Mecklenburg Electric Cooperative. REC = Rappahannock Electric Cooperative. Additional cooperatives that are not named above include A&N, BARC, Craig-Botetourt, Community, Central Virginia, Northern Neck, Powell Valley, Prince George, Southside, and Shenandoah Valley. There are also several small municipal power utilities, and the investor-owned Eastern Kentucky Power Company serves a small portion of Southwest Virginia.

Data center industry is driving immense increase in energy demand and will require enormous new infrastructure investments

Modern data centers consume substantially more energy than other types of commercial or industrial operations. For example, one of the smaller data centers recently constructed in Virginia can draw up to 18 MW of power (sidebar). This is roughly equivalent to a mid-sized automobile assembly plant, 60 large commercial office buildings, or 4,500 homes. The largest new data centers can draw from 100 to over 200 MW each, which is more than most industrial consumers. Some planned data center campuses are expected to consume well over 1,000 MW, once fully built out, which is more than the 950 MW generation capacity of the state's largest nuclear reactor.

Data center power demand is typically measured in megawatts (MW). A watt measures the amount of energy produced or consumed at any instant, and a megawatt is equal to 1 million watts. For example, a 100 MW data center can consume up to 100 MW of energy at a given point in time. Energy consumption over time is typically measured in kilowatt-hours (KWh) or megawatt-hours (MWh).

To evaluate the potential energy impacts of the data center industry, JLARC staff commissioned an independent forecast of *unconstrained* power demand growth in Virginia, based on historical data trends. The unconstrained forecast shows what demand would be before accounting for constraints like the ability to build enough energy infrastructure to meet demand. JLARC staff also commissioned an independent grid model to project what future generation and transmission infrastructure would be needed to meet (1) unconstrained demand and (2) half of unconstrained demand. The grid model also estimated infrastructure needs if there was no new data center demand, so that the effects of data center growth could be separated from other effects on the grid. The demand forecast was developed by staff from the Weldon Cooper Center for Public Service at the University of Virginia, and the grid model was developed by energy consultant Energy + Environmental Economics (E3). See Appendix B for additional details.

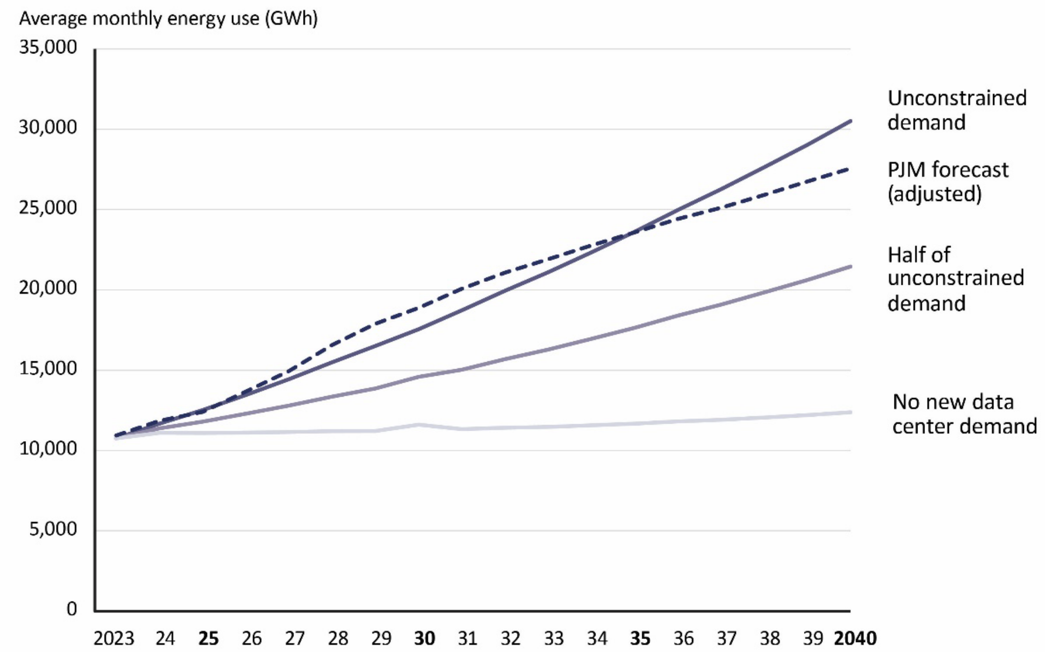
Data center industry is forecast to drive immense increase in energy demand

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. However, 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.

JLARC's independent forecast shows that unconstrained demand for power in Virginia is expected to double within the next 10 years, driven primarily by the data center industry's growth (Figure 3-3). Almost all of the demand growth is expected to occur in the Dominion transmission zone, which covers the Northern and Central Virginia regions, where most new data centers are being built. JLARC's forecast largely matched the most recent PJM forecast.

Item 3.

FIGURE 3-3
Data center demand would drive immense increase in energy demand in Virginia, based on JLARC's independent forecast and other forecasts



SOURCE: JLARC staff consultant analysis.
NOTE: Forecast is for Virginia. PJM forecast is the 2024 forecast for the Dominion transmission zone adjusted upward to account for APCO; this adjustment had no effect on the trendline shown and was done so that the forecasts could be more easily compared. JLARC's independent forecast was developed using actual, historical energy use and employed advanced statistical methods to project use going forward. While JLARC's forecast was checked against the data reported by utilities on future data center load requests, that data was not used to formulate the forecast.

The first five years of JLARC's unconstrained demand forecast are in line with the new data center load additions that are expected, based on existing utility service and data center construction agreements, data center projects that have been announced, and national energy research conducted by Lawrence Berkeley National Laboratory and the Electric Power Research Institute.

New generation and transmission infrastructure will need to be built to help address data center demand

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 (Table 3-1). For each of the demand scenarios, the model considered the most feasible and economical approaches to meeting infrastructure needs with and without the requirements of the Virginia Clean Economy Act (VCEA). The modeling was done using industry standard approaches and tools for electric utility and state energy planning purposes. It is based on current state and federal laws and regulations. Some costs, such as the social cost of carbon, were not explicitly included in the model.

VCEA was enacted in 2020 to drive investment in renewable resources and requires the phaseout of carbon-emitting generation in the state by 2050. (See Appendix G.) VCEA requires that an increasingly larger share of the energy sold by the investor-owned utilities, Dominion and APCO, to their retail customers come from renewable and in-state generation sources. While this results in slightly more generation being built in-state than would otherwise occur, it has little effect on new transmission infrastructure needs and could increase the amount of energy that is imported from out of state. VCEA's effects on renewable and in-state generation are not as pronounced as might be expected because the requirements for utilities to sell energy from these sources do not apply to the co-ops, and a majority of projected data center growth (~60 percent) is expected to occur in co-op service territories. See Appendix H for additional details on generation capacity and energy sources expected under each scenario.

TABLE 3-1
Addressing demand from data centers would require substantial investment in new in-state generation resources and transmission by 2040

			Change from 2025 to 2040			
			Scenario 1: Unconstrained demand		Scenario 2: Half unconstrained demand	
	Current system		No VCEA	VCEA	No VCEA	VCEA
Generation resources (in-state)	36,000 MW capacity	Net increase	+54,100 MW	+56,300 MW	+31,200 MW	+34,700 MW
		Data center share	*+35,600*	*+34,300*	*+12,800*	*+12,700*
Transmission (interzonal)	8,700 MW capacity	Net increase	+3,500 MW	+3,500 MW	+3,100 MW	+3,100 MW
		Data center share	*+3,500*	*+3,500*	*+3,100*	*+3,100*
Imported energy (net)	38 TWh annual energy [a]	Net increase	+62 TWh	+73 TWh	+24 TWh	+24 TWh
		Data center share	*+79*[b]	*+92*[b]	*+41*[b]	*+43*[b]

SOURCE: E3 grid modeling analysis. Current system capacity and energy are derived from Energy Exemplar PLEXOS database.
NOTE: Generation is in-state nameplate capacity that would need to be built, which can be significantly higher than the amount of energy produced by a resource over a year (e.g., Virginia solar facilities produce at around 25 percent of nameplate capacity). The model predicts new generation capacity would still be built even without data center growth, because the grid is expected to shift to cheaper renewable energy sources and building more in-state generation to reduce reliance on imports. Transmission shows only current and additional interzonal capacity needed for power exchange between the Dominion transmission zone and neighboring zones. It does not show transmission capacity or additions *within* the Dominion transmission zone.
[a] TWh=terawatt hours. TWh are used to measure large amounts of energy consumed over time. One TWh = 1,000,000 MWh.
[b] Data center share of imported energy is larger than the net increase because, without data center demand, imported energy would decline. For example, under Scenario 1 (no VCEA), energy imports would decrease −17 TWh from 2025 to 2040 without data center demand. +79 TWh data center share −17 TWh = net increase of +62 TWh.

Building enough infrastructure to meet growing data center demand will be difficult under both forecast scenarios

Historically, utilities and other PJM members have kept up with demand by building enough new generation resources and transmission to meet demand. Utilities have been able to do this because demand has increased slowly or been relatively flat over the past several decades, but the expected increase in demand from data centers will far outpace previous energy demand growth. If utilities are unable to build enough new generation and transmission to keep pace with forecast data center demand, there are two likely outcomes: (1) they will delay the retirement of older fossil fuel plants, and less economical plants, to the extent allowed by state and federal law, and (2) they will delay the addition of new large load customers, mainly data centers, until there is adequate transmission and generation capacity to serve them. On the demand side, data centers will seek out markets where demand can be met and pursue ways of contracting for and generating their own power. While it is possible that enough infrastructure could be built to meet growing data center demand in Virginia, it would be difficult to accomplish.

VCEA financially penalizes utilities that do not comply with renewables requirements by levying deficiency payments, but in practice, utilities may choose to pay those deficiency payments if it is more economical or feasible than securing new renewable generation. Statute directs any deficiency payments collected to be used in support of job training, energy efficiency, and renewable energy programs. The costs of deficiency payments are recovered from utility customers.

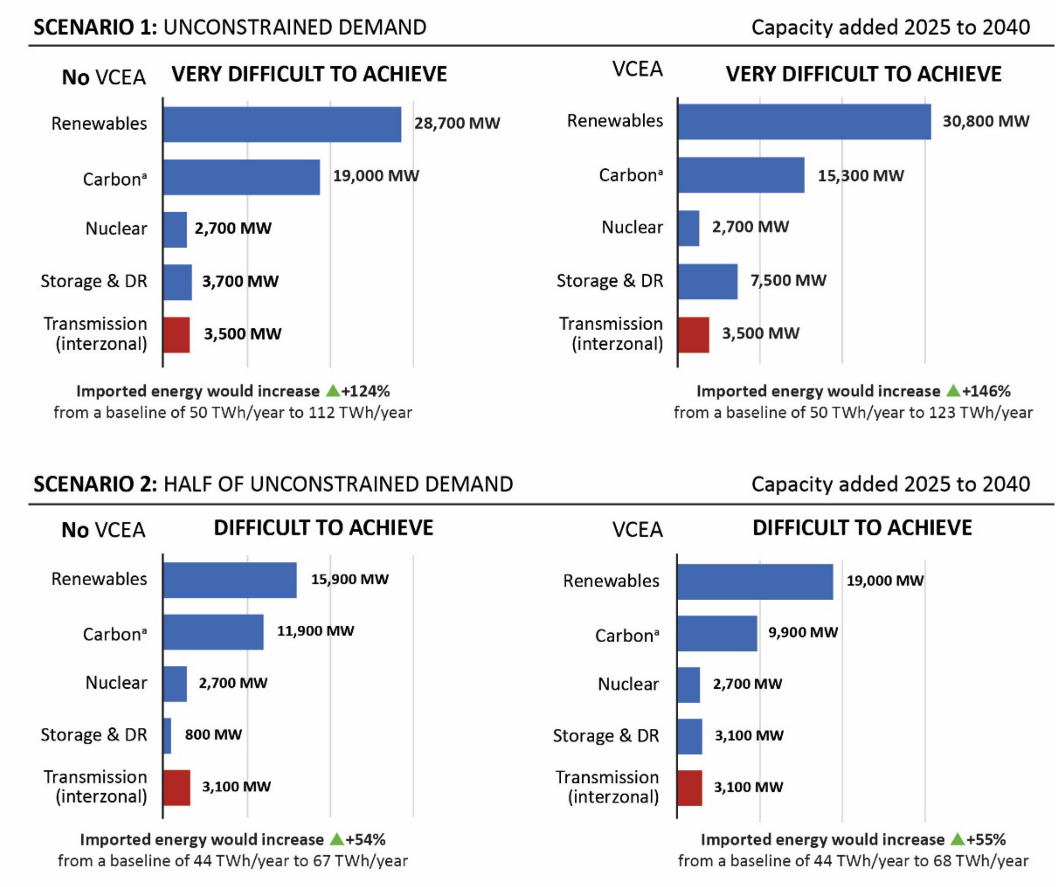
It could be especially challenging to meet demand while also fully meeting VCEA renewable requirements. Dominion's 2024 integrated resource plan indicates that it expects to meet VCEA renewable requirements for most, but not all, years between now and 2040 and expects to pay deficiency payments in some years (sidebar). In addition, in its previous 2023 plan, Dominion indicated it did not expect to meet VCEA requirements to retire carbon emitting assets that take effect in 2045. The previous plan stated: "Due to an increasing load forecast, and the need for dispatchable [i.e., easily scalable] generation, the [modeled planning scenarios] show additional natural gas-fired resources and preservation of existing carbon-emitting units beyond [the 2045] statutory retirement deadlines established in the VCEA." The revised 2024 plan does not comment on this and does not project out past 2040.

Building enough infrastructure to meet *unconstrained* energy demand will be very difficult, with or without meeting VCEA requirements (Scenario 1)

It will be very difficult to build new generation and transmission in Virginia fast enough to match unconstrained demand by 2040 (Scenario 1) and would require a massive and sustained build-out of new renewable, carbon, nuclear, and storage facilities (Figure 3-5). Build rates would have to greatly outpace what has been accomplished historically. Solar facilities would have to be added at about twice the annual rate they were added in 2024, and the amount of new wind generation needed (8,800 MW) would exceed the potential capabilities of all offshore wind sites that have so far been secured for future development (7,400 MW). 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. Additional pipeline capacity may also need to be added to serve such a substantial increase in natural gas generation, which would create additional challenges. The unconstrained demand scenario would also require building more nuclear generation, presumably using new technologies.

FIGURE 3-4
Estimated generation mix needed to meet demand scenarios, with and without meeting VCEA requirements



SOURCE: E3 grid modeling analysis.
NOTE: The generation and transmission solutions generated by the model are tested to ensure they would produce a reliable system. Generation capacity is given in *nameplate* capacity, which can be significantly higher than the amount of power that can actually be expected after accounting for resource intermittency and downtime (firm capacity). The model predicts only interzonal transmission needed between PJM zones, but additional transmission would need to be built within the Dominion transmission zone. DR is demand response resources, which refer to customers who can reduce energy use during peak load events or add energy back on to the grid. The figure does not show what would need to be built if there were no new data center demand (Scenario 3). Under this scenario, the grid would be able to transition to a more renewable-based system with relatively less difficulty.
[a] Carbon includes natural gas, coal, and oil. Biomass facilities are counted as renewable resources, per the VCEA. However, starting in 2045, E3's grid model assumes natural gas plants would be converted to hydrogen fuel in each scenario when VCEA requirements are met.

To meet transmission needs, the state would have to increase interzonal capacity to the Dominion transmission zone by approximately 40 percent and construct additional transmission within the zone. Many of the new transmission lines would need to be built in densely populated regions of the state with limited options for siting new infrastructure. (Figure 3-4 shows only new interzonal transmission.)

In addition to building new in-state generation and transmission, the state would need to more than double the amount of energy imported from out of state. Consequently, Virginia would be reliant on additional generation being built at a rapid pace in other states in the PJM region and would need these other states to build sufficient generation capacity to serve Virginia's needs as well as their own.

Building enough infrastructure to meet only *half of unconstrained* energy demand will be difficult (Scenario 2)

It would likely still be difficult to build enough new generation and transmission to meet half of unconstrained demand by 2040 (Scenario 2). Meeting demand would also require a sustained build-out of new renewable, carbon, nuclear, and storage facilities. Solar facilities would have to be added at a rate of 650 to 700 MW per year, which is substantial but lower than the 1,000 MW expected to be added in 2024. New nuclear generation would also be needed.

If VCEA requirements are not considered, the biggest challenge would be building new natural gas plants. New gas would need to be added at the rate of about one large 1,500 MW plant every two years for 15 consecutive years, which would be about the same rate Dominion added these types of plants during its busiest period of the last decade (2012 to 2018).

If it is assumed VCEA requirements are met, the biggest challenges would be building enough wind, battery storage, and natural gas "peaker" plants (sidebar). Wind generation needs would exceed the potential capabilities of all secured offshore wind sites in Virginia. The amount of new battery storage needed would be several times the small amount of existing battery storage in Virginia, but would be equivalent to what has already been installed in Texas and about half of California's installed capacity. A significant number of new natural gas "peaker" plants would also be needed to help balance intermittent generation from renewables.

Transmission needs would remain substantial under the half of unconstrained demand scenarios, especially in and around the Northern Virginia region, and building enough transmission capacity within a 15-year timeframe could be even more difficult than building enough generation. The amount of energy the state would need to import would increase by over 50 percent.

"Peaker" plants are 50 MW to 150 MW facilities used intermittently to supplement other types of generation when there is not sufficient energy to meet demand. Historically, they have mostly operated at times when cooling and heating needs are the highest among households. However, as more solar and wind generation is incorporated into the grid, they can be used to provide energy when these renewables are not producing (alongside battery storage).

New infrastructure projects face several challenges that make a rapid increase in construction difficult to achieve

Under the most favorable circumstances, it takes five or more years to develop and build new generation facilities, limiting how fast they can be added to the grid. New generation projects face several challenges that could keep them from being built, including community opposition (especially to solar and natural gas projects), long lead times to procure equipment, workforce constraints, and state and federal laws that limit what new carbon-emitting generation facilities can be built. PJM data shows that only a small percentage of projects that submit applications are ever actually built (sidebar).

PJM must study and approve the addition of most new utility-scale generation to the grid. PJM's approval process became overwhelmed by small-scale renewable projects in 2022, which led to a two-year pause in approvals while PJM reformed its process. This pause may have affected the number of projects that have been built in recent years, but project success rates were already low before the pause (29 percent in 2018).

A significant portion of new generation would need to come from solar projects, which could face challenges acquiring enough land. Generally, a solar facility in Virginia needs five to 10 acres to produce one MW of power. Assuming an average need of 7.5 acres per MW, and the scenarios modeled above, JLARC staff estimated that Virginia will have about 57,000 acres of land devoted to utility-scale solar by 2025, and new projects could require from 73,000 to 165,000 additional acres by 2040, depending on the demand scenario. Utilities and independent generators could face significant challenges in acquiring and gaining local approval for this much additional land, given the resistance solar projects have already encountered in some Virginia communities.

Small modular nuclear reactors have been identified as a potential future generation source. However, none have been successfully built in the United States, only a few exist worldwide, and this technology has not yet been proven to be a viable utility generation source. They also have high up-front costs that pose a barrier to their commercial viability, and some communities may oppose them being built nearby. Other promising, emerging technologies that have not yet proven to be commercially viable at a utility scale are hydrogen generation, long duration battery storage, and floating offshore wind.

Utilities also face challenges completing the many major transmission projects that will be needed to connect generation to data center markets, including the numerous new and dispersed renewable generation facilities that are expected to be built. For example, PJM's goal is to have $3.5 billion in Virginia transmission projects that were proposed in December 2023 for Virginia, mostly to serve data center demand, to be in service by June 2027. This 3.5-year timeline is possibly unrealistic considering that major new transmission projects often take five to seven years to complete.

Demand growth raises concerns about system capacity and reliability, but existing utility requirements and processes limit risks

Federal Energy Regulatory Commission (FERC) oversees the nation's electrical grid.

North American Electrical Reliability Corporation (NERC) sets reliability standards for the grid.

Electrical utilities in Virginia have an obligation to serve any customer within their service territory, but 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. Federal and international bodies oversee transmission organizations and utilities and set reliability standards that PJM and Virginia utilities must follow (sidebar). The state also sets its own requirements for utilities, which the SCC is responsible for enforcing. These requirements and processes are intended to identify future reliability problems and ensure they are resolved before the grid is affected.

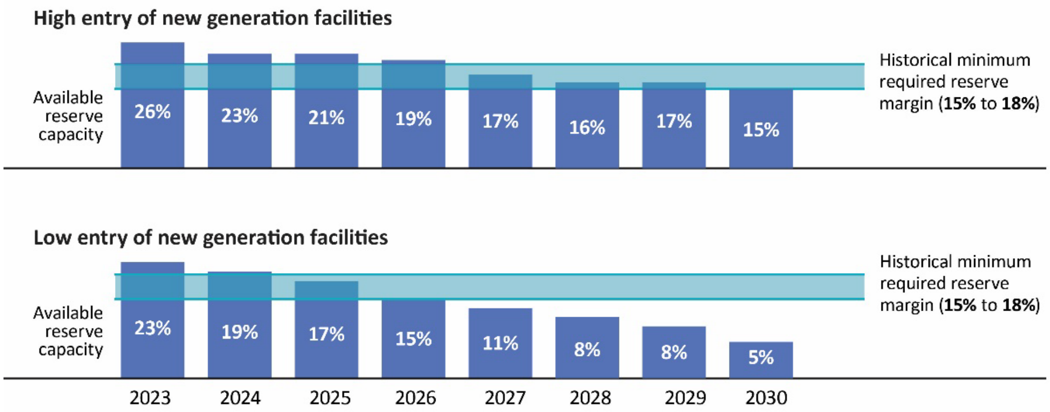
Generation capacity concerns are partially addressed through PJM requirements and utility planning processes, but risks remain

PJM protects grid reliability by requiring utilities to secure enough generation capacity to meet the next three years of projected customer demand, plus a reserve margin to account for peak load (i.e., high energy use) events like hot summer days. The regional PJM grid appears to have sufficient generation capacity to meet current demand without causing any system reliability concerns. However, PJM estimates the grid could run out of needed reserve capacity by 2030, even under optimistic assumptions for adding new generation (Figure 3-5). If utilities are not able to secure enough capacity to meet projected demand, they would have to delay adding new load or shed existing load to meet capacity requirements and maintain system reliability.

Although PJM sets minimum capacity requirements for utilities, there is some uncertainty in whether regional generation will be sufficient because it is not centrally planned. PJM does not plan for and identify specific generation projects that are needed (like it does for transmission), cannot direct new generation to be built, does not own or operate any generation sources (like a utility), and cannot stop a utility or independent operator from retiring an existing generation facility (although it can offer "reliability must run" payments to keep a facility open in the short term). Virginia cannot address these structural issues because PJM is federally regulated, not state regulated. PJM is aware of generation capacity concerns and is working to try and address them.

Item 3.

FIGURE 3-5
PJM projects available generating capacity could decline below reserve levels within a few years



SOURCE: JLARC staff analysis of PJM data and reports.
NOTE: PJM's reserve capacity projections were prepared in February 2023, using its 2023 demand forecast. PJM has since revised its demand forecast upward and in August projected a potential 1,663 MW shortfall in total capacity by 2029/2030.

At the state level, utilities protect grid reliability by planning to meet their own generation needs and PJM capacity requirements. Dominion and APCO—Virginia's two investor-owned utilities—are required to develop integrated resource plans that describe how they will meet capacity needs and submit them to SCC as part of a litigated proceeding. SCC holds public hearings to review the plans and gain perspectives from the utility, SCC staff, and other stakeholders, such as environmental groups and business interests. Despite disagreements over utility plans (sidebar), this process ensures the state's largest utilities plan to meet future generation needs and that these plans are scrutinized by regulators and stakeholders. Virginia co-ops also plan for their future generation needs, although the process is not as formal or subject to the same scrutiny. Most co-ops plan to purchase energy for data center customers from the PJM market rather than building generation to serve data center energy needs.

Stakeholders sometimes contest whether the integrated resource plans developed by utilities provide the best generation solutions for meeting future demand, or whether proposals conform to state law. For example, SCC staff recommended that Dominion's most recent 2023 plan be denied over VCEA compliance concerns, and the plan was not approved by the Commission..

Individual utility planning does not guarantee that the generation resources needed for the whole PJM region will be built, which contributes to uncertainty about the sufficiency of future capacity. Both investor-owned utilities and co-ops plan to fulfill some future share of their energy demand with energy imported from elsewhere in the PJM market and, as discussed above, there is some uncertainty in whether regional generation will be sufficient to meet that demand. Growing demand from the data center industry in other states, such as the growing Chicago and Ohio markets, could limit how much energy is available to be imported by Virginia utilities.

Transmission reliability concerns appear to be effectively addressed through existing PJM and utility planning processes

PJM and utility transmission owners centrally identify the impacts large loads are expected to have, and how those loads can be brought on safely without causing transmission reliability problems. At the project level, transmission owners like Dominion are required to study how the addition of a proposed data center (or any other large load) would affect the transmission system. These interconnection studies determine if the existing transmission system is sufficient to handle the load or if upgrades are needed to avoid violations of national reliability standards, such as excessive voltage incidents or outages. At the system level, both PJM and transmission owners must review the expected cumulative impact of demand growth on the transmission system, from proposed data centers and all other sources, and identify needed improvements (sidebar). Utilities cannot add new large loads to the grid, including from data centers, until identified transmission improvements are made. For example, if a new transmission line is needed for proposed data centers in Northern Virginia, utilities cannot add new data center loads until that line is operational.

PJM evaluates the overall transmission system through its annual Regional Transmission Expansion Plan (RTEP). Under the RTEP process, both PJM and transmission owners assess the potential impacts of expected changes in demand and generation to see if and where standards violations or other reliability concerns could occur. They then solicit or propose system improvements, such as new transmission substations and lines, to address identified problems.

Transmission planning processes appear to be working properly to protect reliability. In 2022, Dominion paused adding new data center loads in Loudoun County for three months as it worked to resolve regional transmission constraints. Since then, Dominion has incrementally added new data center loads in Loudoun to ensure new additions do not compromise the reliability of the transmission system. The utility expects the constraints that limit new load additions will not be fully resolved until 2025. Similarly, in July 2024, Dominion sent a letter to customers informing them that future large load additions to any part of the Dominion transmission zone are expected to take 12 to 36 months longer than they have previously taken so that the utility can appropriately plan for and connect the "record pace" of new load requests to the transmission system.

State could clarify that utilities can delay the addition of new, large loads if necessary to protect grid reliability

If utilities are unable to build enough new infrastructure to keep pace with energy demand, one of the main ways they can protect grid reliability is by delaying the addition of new large load customers until there is adequate generation and transmission capacity. Utilities appear to have the authority to delay large load additions for transmission-related concerns because this has already been done without legal objections. 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. 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.

RECOMMENDATION 2
The General Assembly may wish to consider amending the Code of Virginia to clarify that electric utilities have the authority to delay, but not deny, service to customers when the addition of customer load cannot be supported by the transmission system or available generation capacity.

Some stakeholders have asserted that the state should have a process for determining *whether* demand from large load data center customers should be met, not just *how* it should be met. In theory, the state could require evaluation of large load requests and allow requests to be denied through the existing SCC case process. However, this would be a shift in the historical U.S. electric utility paradigm and could be subject to legal challenges.

State could encourage or require data centers to take actions to help address their energy impacts, but actions would have marginal impact on demand

Virginia's growing data center industry is projected to greatly increase energy demand and will require construction of new generation and transmission infrastructure beyond what would have otherwise been built. Although regulators and utilities have requirements and processes in place to manage risks to grid reliability, new infrastructure projects can put VCEA renewable energy goals at risk, affect local communities and natural and historic resources (Appendix F), and affect customers' utility rates (Chapter 4). Data center companies could help address their energy impacts by

- promoting development of renewable energy generation,
- participating in demand response programs, and
- managing energy efficiency.

Many data center companies are already taking some of these steps, and the state could encourage or require further action. Data center companies are also exploring options for generating their own power, but it is unclear if this would address their impacts on the main power grid (Appendix I).

While these actions could have a marginal effect on data centers' energy impacts, they will not substantially reduce their energy demand or the challenges posed by growing demand.

Data centers could adopt more effective strategies for promoting renewable energy, but these would not lower their energy demand

Data center companies—including the four hyperscaler companies that account for a vast majority of the industry in Virginia—have carbon neutral policy goals that encourage investment in new, renewable generation. Some companies also directly invest in renewable energy projects in the PJM region and the development of new technologies, like small modular nuclear reactors. The scale of industry efforts is not easily quantifiable, so it is uncertain how much these efforts could help offset the industry's growing demand in Virginia.

Virginia's data center industry could be encouraged to further support investment in renewable energy and a reliable, decarbonized grid within the PJM region. The state already partially encourages this through VCEA's Accelerated Renewable Buyers program. Under the program, large customers with loads over 25 MW, which includes most data centers, can get credit for their purchases of renewable wind and solar energy made in the PJM region. Those credits go to offset what a utility charges customers for the utility's renewable generation projects, providing a financial incentive to participate. The program could be expanded to include utility-scale battery energy storage systems. Battery storage is needed because it can store and provide energy during periods when intermittent solar and wind generation is not producing power. Although battery storage systems do not count as net new generation, providing a financial incentive to invest in these resources is beneficial because of their importance in balancing loads from renewables. Any credit for using battery storage should be a partial credit per MW, based on capacity provided rather than energy consumed, and account for electric load carrying capacity (ELCC). ELCC is essentially a measure of the system energy contributions a given type of resource provides, and PJM assigns and regularly revises ELCC ratings. Currently four-hour battery storage has an ELCC rating of 59 percent for 2025/20026, meaning that a partial credit of 59 percent could be allowed for each MW of capacity purchased from battery storage resources.

RECOMMENDATION 3

The General Assembly may wish to consider amending the Code of Virginia to expand the Accelerated Renewable Buyers program, which allows large customers of energy utilities to claim credit for purchases of solar and wind *energy* to offset certain utility charges, to also allow customers to claim partial credit for purchases of *capacity* from battery energy storage systems based on the current PJM electric load carrying capacity rating.

The program could be further expanded in the future to include other renewable or non-carbon energy sources, such as hydrogen generation and small modular reactors. This could help bring more generation resources online to serve growing data center demand but would not reduce energy demand.

Demand response programs could have a more meaningful impact on energy consumption

Under demand response programs, utility customers agree to reduce their power use or send power back to the grid during peak load events. This reduces the need for additional generation and transmission to meet peak loads, and customers benefit by not getting billed higher peak load energy prices. Demand response programs are an effective way to reduce the need for new generation and transmission. As data centers become an increasingly large share of Virginia's base energy load, their participation in demand response programs could reduce the need for new infrastructure.

Data center companies in Virginia do not currently participate in demand response programs. Company representatives indicated that they have little flexibility to decrease energy use during peak load events because energy use is driven by computing activity, and computing activity is driven by customer and end user demand. From a business perspective, data center companies have strong incentives to keep facilities fully operational to meet their customer and end-user computing needs, and these typically outweigh financial incentives offered by voluntary utility demand response programs.

Despite limitations, there appear to be several viable ways that data center companies could participate in demand response programs. These include options for reducing demand during peak load events and adding energy to the grid during such events to offset a portion of their demand. Companies could

- shift some computing activity to other facilities outside of the region during peak load events,
- make operational adjustments that temporarily reduce energy use within the facility, such as small temperature adjustments for short periods, or
- install more environmentally friendly backup generators that are permitted to operate in non-emergency situations (sidebar), which could range from all generators at a facility to a subset of the generators used, or
- host battery storage systems that could serve as both a general utility and a demand response resource.

Most data centers backup generation' comes from Tier 2 diesel generators, which cannot and should not be used as a demand response resource because of their emissions (nitrogen oxides, carbon monoxide, and particulate matter). Natural gas and Tier 4 diesel generators have lower emissions and can be used for demand response under state and federal law. Backup generation is discussed more in Chapter 5.

JLARC's consultant modeled the energy impact if data centers participated in demand response programs by using battery storage or backup generators to reduce or offset the equivalent of 10 percent of their load in a peak load emergency. The model found data centers could provide 2,000 to 2,400 MW of capacity value to the grid, which would slightly reduce the need for new in-state generation and transmission. A key consideration is that these demand response capabilities would have to be in place before new generation is added to have maximum effect.

Without state direction, most data center companies appear unlikely to participate in demand response programs. The state should not require a specific demand response method because different approaches may be more or less feasible for different companies. Instead, the state could direct utilities to implement a demand response program for large data center customers, such as any customer over 25 MW, and require these customers to participate in the program. This requirement could be phased in gradually to give companies time to work with utilities on demand response solutions and participation levels (e.g., MW or percent of load a customer will commit) that are feasible for all parties. The requirement could be initially limited to investor-owned utilities and later expanded to include co-ops.

RECOMMENDATION 4
The General Assembly may wish to consider amending the Code of Virginia to require that utilities establish a demand response program for large data center customers and to require that these customers participate in the program.

Improving data center efficiency makes better use of energy but is likely to have only a marginal impact on demand

Data centers can improve energy efficiency in two primary ways. First, they can use newer and more efficient computer chips; computing activity ultimately drives almost all energy use in a data center. Second, they can improve the efficiency of their building systems, especially the cooling systems that account for most of the remaining energy use.

To promote energy efficiency, the state could encourage data center companies to meet an energy management standard, such as the International Organization for Standardization's (ISO) 50001. ISO 50001 requires organizations to set improvement goals, continually measure and evaluate outcomes, and revise policies to better achieve energy goals. An energy management standard can be fairly applied to all companies regardless of their business model. It is also preferable to requiring green building standards, such as Leadership in Energy and Environmental Design (LEED) building standards. Building standards could be required for new construction but may be unreasonable to retroactively apply to existing facilities.

The state could encourage data centers to adopt an energy management standard by making the state's sales and use tax exemption contingent on adoption. Many data center companies already set energy efficiency goals and policies, and a well-designed state incentive would complement these efforts and encourage other companies to adopt similar goals and policies.

POLICY OPTION 1
The General Assembly could consider amending the Code of Virginia to require that, as a condition of receiving the sales tax exemption, data center companies meet and certify to an energy management standard, such as the International Organization for Standardization's 50001 standard for energy management.

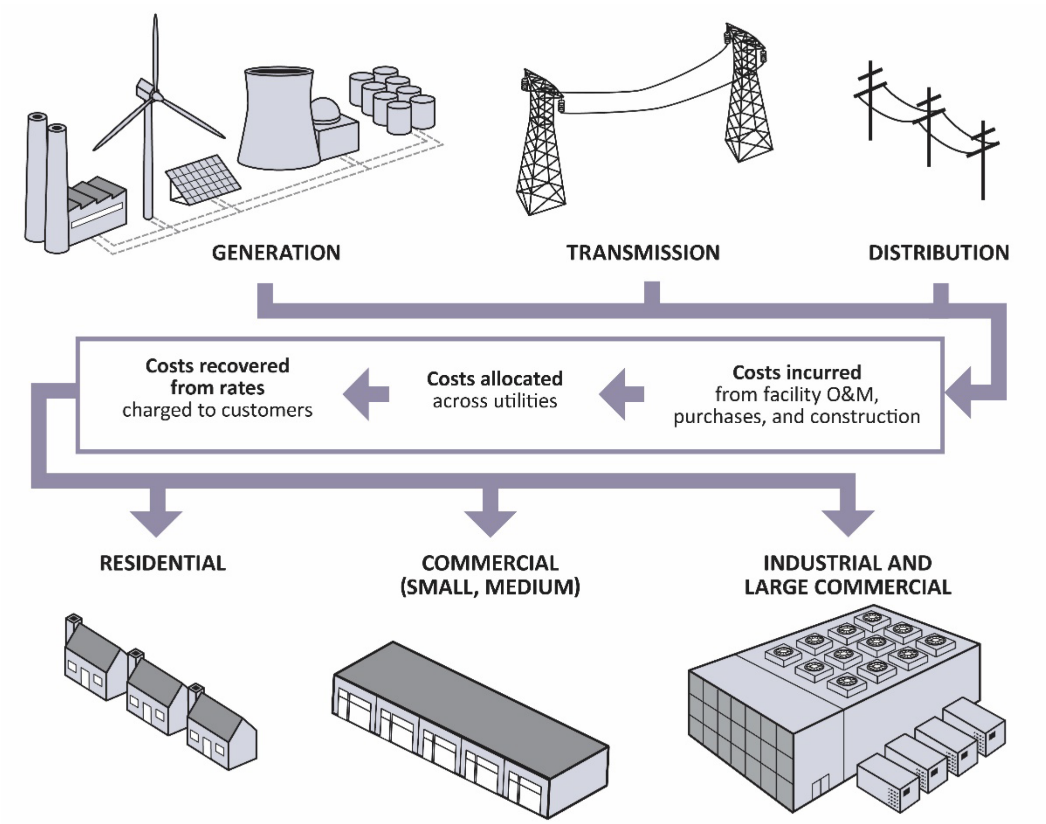
Recent legislation proposed requiring data centers to meet a specific Power Usage Effectiveness (PUE) ratio. The efficiency of cooling and other building systems in data centers is commonly measured using a PUE ratio. However, PUE does not indicate a data center's overall energy efficiency; it measures only the efficiency of cooling and other building systems that support facility operations. The data center industry has a strong market incentive to be energy efficient because energy is one of their largest operating costs. Requiring a specific and narrow requirement, like meeting a specific PUE ratio, could have unintended consequences, and could not be as widely applied as the ISO 5001. (See Appendix J for additional information on PUE.)

Energy efficiency in general is an important goal for the data center industry, but efficiency improvements are unlikely to reduce the industry's overall energy demand. Currently, the data center industry is growing fast, demand for energy exceeds the available supply, and companies want to maximize the value of their multimillion-dollar assets. Consequently, any energy saved from efficiency gains is likely to be used to perform more computing activity. One company representative noted "at the end of the day, a 200 MW data center is going to be a 200 MW data center."

4 Energy Costs

Utilities incur costs to build, operate, and maintain the energy grid and provide power to customers. These costs are ultimately recouped through rates charged to customers (Figure 4-1). The main principle underlying utility rates is that the rates charged to different types of customers should recover costs that are approximately equal to the costs of serving those customers.

FIGURE 4-1
Utilities recover costs through rates charged to customers



SOURCE: JLARC staff analysis.

Utilities group their customers into classes of similar users, based on their cost of service. While the exact customer classes vary slightly among utilities, they generally fall into three groupings:

- residential customers,
- small to medium commercial customers, and

- industrial and other large commercial customers.

Within each customer class, customers are charged three categories of rates: generation, transmission, and distribution rates. Each rate is intended to recover costs related to that part of the system. For example, generation rates recover costs associated with operating power plants, constructing new plants, purchasing energy, and securing generation capacity from third parties. Transmission rates recover the cost of building and maintaining transmission lines. Distribution rates recover costs of building and maintaining substations, street-level powerlines, and other infrastructure needed to serve end-use customers. Utility rates sometimes include "riders" or "rate adjustment clauses" specifically intended to capture the cost of new infrastructure (e.g., a generation plant) or a specific initiative (e.g., grid modernization). Some costs can also be directly assigned to customers.

The State Corporation Commission (SCC) regularly reviews and approves utility rates to ensure they are reasonable. For example, the SCC reviews Dominion's rates every one to two years, depending on the rate type. SCC reviews consider if a utility is over- or under-collecting costs by customer class and whether any changes are needed to address any allocation issues. In making its determinations, the SCC examines cost of service studies and other information presented by the utility and sometimes performs its own independent analysis. SCC's responsibilities are established in state law.

Data centers are currently paying full cost of service

JLARC's cost recovery study was performed by energy consultant E3. See Appendix B for additional details.

JLARC staff commissioned an independent study of utility cost recoveries under current rate structures to see if the data center industry is paying for its current costs (sidebar). The study focused on rates charged by Dominion, the Northern Virginia Electric Cooperative, and the Mecklenburg Electric Cooperative (the co-ops) because most existing data centers are located in their service territories. The study found that current rates appropriately allocate costs to the classes and customers responsible for incurring them, including data center customers. For example, the consultant's independently derived cost allocations for Dominion closely match the ones that the utility uses to set its rates, with only a few small differences for residential and large customer rates (Table 4-1). This finding is corroborated by SCC reviews of utility cost recoveries, especially its biennial reviews of Dominion's rates.

Utilities try to ensure data center customers pay the costs they incur in several ways. Dominion groups data centers into the same class with similar industrial and large commercial customers, charges rates based on energy and system use, and ensures recovery of costs associated with any new distribution infrastructure for data centers through contractually required minimum payments. Co-ops essentially treat data centers as their own customer class, charge rates based on energy and system use, and directly assign distribution costs for data centers to each specific customer. Co-ops take additional steps to separate the energy sources they use for data centers from the sources they use to serve the rest of co-op customers.

TABLE 4-1
Consultant's independent cost allocations closely match allocations Dominion uses to set customer rates

	Generation-related costs		Transmission-related costs	
Customer class	Independent consultant allocation	Dominion allocation	Independent consultant allocation	Dominion allocation
Residential	40%	41%	53%	55%
GS-1 (small non-residential)	5%	5%	5%	5%
GS-2 (intermediate)	14%	14%	12%	12%
GS-3 (large, secondary voltage)	15%	15%	12%	11%
GS-4 (large, primary voltage, includes most data centers)	26%	26%	18%	16%
Total	100%	100%	100%	100%

SOURCE: E3 analysis and Dominion rate schedules. Numbers may not sum because of rounding.
NOTE: GS = General Service. Table does not show churches or outdoor lighting customer classes because <1%.

Growing energy demand from data centers is likely to increase other customers' costs

Utility rates recover the cost of operating and maintaining the current system and any new infrastructure that must be built. Even though current rate structures appropriately allocate costs across customers, data centers' increased demand will likely increase system costs for all customers, including non-data center customers. This is because current utility rate structures are not designed to account for sudden, large cost increases from the construction of new infrastructure to serve a relatively small number of very large customers.

JLARC's consultant modeled the potential cost impacts of data center demand resulting from increased infrastructure needs. The model estimated costs under the two demand growth scenarios from Chapter 3: (1) unconstrained demand and (2) half of unconstrained demand, both with and without VCEA compliance. For this exercise, the model focused on cost and rate impacts in the Dominion transmission zone where most data centers are expected to be located (sidebar).

Dominion transmission zone includes the Northern, Central, and Tidewater regions of Virginia. These regions include Dominion's *distribution* service territory and the *distribution* territories of most of the state's electric cooperatives. See Chapter 3 for a map of the zone.

Generation and transmission costs are expected to increase from growing data center demand and will likely affect non-data center customers

Utility costs are likely to increase from the fixed costs of new infrastructure that will need to be built to address data center demand and the increase in prices as energy supply becomes constrained. Costs for the Dominion transmission zone could increase by an estimated \$16 to \$18 billion by 2040 under the unconstrained demand scenario, depending on if VCEA requirements are met. Costs could increase by \$8.5 to \$10 billion under the half of unconstrained demand scenario. In both scenarios, most of the projected cost increases are attributable to growing data center demand. Costs do not reflect the full up-front capital costs of building new generation and transmission infrastructure, because these costs are amortized and collected from customers over a period of 20 to 40 years. Instead, they reflect the share of capital costs that would need to be recovered from customers each year, plus operating costs and energy purchases.

Building enough generation and transmission infrastructure to meet data center energy demand would be difficult because it requires constructing enormous amounts of new infrastructure. In addition, unconstrained demand scenarios would require building infrastructure faster than has been historically possible. See Chapter 3 for additional details.

Because generation and transmission costs are passed on to customers based on their actual usage, a substantial share of these costs would be recovered from the growing data center industry. However, a share of cost increases would be borne by other customers in three ways. First, a large amount of new generation and transmission would need to be built that would not otherwise be built, creating fixed costs that utilities would recover over the next several decades. A portion of these costs would be paid by non-data center customers. Second, because it would be difficult to provide enough energy supply to keep pace with growing data center demand, energy prices would increase for all customers (sidebar). Third, if utilities are more reliant on importing power to meet demand, they may not always be able to secure lower-cost power and would be more susceptible to spikes in energy market prices. These higher overall costs are likely to affect all customers, proportional to their energy use.

Distribution cost increases are likely to be assigned mostly to data centers and not other customers

Data center loads are typically so large that they are not served from the regular distribution system and are instead connected directly to transmission lines from a substation that serves one or a few data center customers. Consequently, the main distribution costs that data centers incur are for building and maintaining these substations.

Utility rate structures appear to effectively insulate other customers from paying for distribution costs associated with data centers. Dominion recovers data center distribution costs by charging them its standard industrial and large commercial customer class rates, but it also contractually requires data centers to make minimum payments that fully recover the cost of the distribution substations built to serve them. In addition, Dominion charges data center customers directly for any "surplus" equipment (e.g., redundant connections requested by the customer). Co-ops require data centers to directly pay all costs associated with new substations as they are constructed.

There is one way that growing demand from data centers could indirectly increase distribution costs for other customers. As data center demand grows, some transmission lines could be upgraded to higher voltages to meet demand. For example, an existing 115kV transmission line could be upgraded to a 230kV line. This can require distribution-side upgrades to *all* existing substations connecting to the high voltage line, including those that serve and are paid for by non-data center customers. The cost impacts of potential substation upgrades are uncertain because they cannot easily be modeled across the system.

Residential customers could experience cost increases that current utility and regulatory rate reviews cannot fully address

Utilities recover costs, including any future cost increases, through rates charged to customers. Rates are regularly reviewed by utilities, the SCC, and the Federal Energy Regulatory Commission (FERC) to ensure costs are being properly assigned to customers (sidebar). Rate reviews ensure that system costs are being allocated in a way that best reflects which customers are responsible for incurring costs. For example, in 2019, Dominion received FERC approval to revise how transmission costs are allocated to utilities within its transmission zone, which effectively assigned a greater share of costs to large customers and reduced residential transmission costs by about 10 percent. While current rate structures will assign a larger portion of costs to data centers over time, rates are not designed to isolate other customers from cost increases driven by the expected system-transforming increase in data center demand.

Utilities regularly review their rates as required by state and federal laws.

SCC reviews and approves changes to generation, transmission, and distribution rates charged by utilities serving Virginia customers, such as Dominion and the co-ops.

FERC reviews and approves changes to how transmission costs are allocated to PJM and how transmission operators allocate cost to utilities.

Residential rates are likely to increase because of costs associated with growing data center demand

JLARC's consultant modeled how residential rates for Dominion customers might be affected by growing demand, assuming utilities and regulators use current practices to regularly reallocate costs. Dominion was chosen because of its large size and concentration of data centers. Residential rate changes were a key focus because they show how Virginia households could be affected and are indicative of how other customers, such as businesses, might be impacted.

Using the consultant's analysis, JLARC staff estimated that a typical residential customer with monthly consumption of 1,000 kWh could experience generation- and transmission-related costs increasing by an estimated combined total of $33 per month by 2040 under the unconstrained demand scenario. Factoring in VCEA requirements would increase monthly costs by four more dollars. However, building enough infrastructure to meet unconstrained demand would be very difficult. Under the half of unconstrained demand scenario, which is still difficult to achieve, the total cost is estimated to increase by around $14 per month (Table 4-2), whether or not VCEA compliance is assumed.

The rate changes shown here represent the share of generation and transmission rate increases that could be attributed to growing data center demand. Dominion's total residential bill projections, from its integrated resource plan, show much larger overall increases than the numbers reported here. Dominion's projections apply to the whole residential customer bill and include several costs that are not captured in JLARC's analysis, such as distribution costs and the cost of some additional transmission and generation projects that may not be solely attributable to data centers.

Dominion's residential bill projections are also in nominal dollars that have been adjusted upward using an inflation assumption, whereas JLARC's are held in constant (or real) 2024 dollars to show the real growth of costs that consumers will experience, independent of inflation. Dominion used a demand forecast that is similar to JLARC's unconstrained demand forecast and substantially higher than the half of unconstrained demand forecast.

TABLE 4-2
Generation- and transmission-related costs for residential customers would increase by 2040 because of data center demand (Dominion example)

	Projected increase in generation & transmission charges (not including distribution charges & some transmission costs; 2024 constant dollars)	
	2030	**2040**
Typical monthly residential generation and transmission charges (2023)	**$90**	**$90**
Scenario 1: Unconstrained demand		
- VCEA (very difficult to achieve)	+$23	+$37
- No VCEA (very difficult to achieve)	+$22	+$33
Scenario 2: Half unconstrained demand		
VCEA (difficult to achieve)	+$7	+$14
No VCEA (difficult to achieve)	+$6	+$14

SOURCE: JLARC staff analysis of E3 model results and Dominion 2024 integrated resource plan.
NOTE: Typical monthly residential charges are the sum of the amount billed to Dominion residential customers assuming typical use of 1,000 kWh. Does not include potential increases in distribution and several other charges that customers typically pay for. Does not capture the cost of the many intrazonal transmission projects that would be needed or generation projects that are not attributable to data center demand.

Utilities could help insulate customers from systemwide cost increases with new data center customer class and rate-setting approaches

Historically, adding new customers to the energy grid, even large load customers like manufacturers, has not increased costs for other customers because additions have been gradual, and the existing system has had enough capacity to serve them. However, addressing the needs of the fast-growing data center industry, even if only half of unconstrained demand is met, would require increasing generation capacity by 80-to-90 percent and transmission capacity 36 percent by 2040. Current utility rate structures are not designed to account for sudden, large cost increases from new infrastructure construction to serve a relatively small number of very large customers. New approaches would be needed to isolate residential and other customers from cost increases.

Establishing a separate data center customer class is a first step utilities could take to help insulate residential and other customers from the energy cost impacts of the industry. Utilities already have the authority to create separate rate classes with SCC approval. Creating a separate data center customer class would allow costs to be more closely allocated to data centers and provide utilities with more flexibility over how to charge rates. Co-ops essentially treat data centers as their own customer class already, so this change would only affect Dominion, which groups data centers with other industrial and large commercial customers. The General Assembly could require Dominion to establish a separate data center customer class, although historically the legislature has not set such detailed requirements in statute.

Establishing a separate data center customer class alone would not fully insulate other customers from cost impacts. Utilities, with SCC approval, would also need to establish new cost allocation methodologies that assign a greater share of generation and transmission fixed costs to the new data center customer class. For example, they could design rate structures that *directly* assign some fixed generation or transmission costs to a new data center customer class, or an increased share of those costs to the new class.

Rates may also need to be adjusted more frequently to insulate other customers from data center-driven costs. Currently, rate adjustments occur only every one to two years and can over or underestimate actual cost growth. For example, under Dominion's current biennial rate review, generation costs are reallocated and rates are adjusted every two years, based on forecast energy demand. While forecasts expect data center demand to increase, accurately forecasting the industry's rapid growth is challenging because of the many factors that can affect demand in a given year. Consequently, new rates may not fully account for shifts in how costs are being incurred across customer classes in the years in between biennial reviews. For example, if the company allocates 55 percent of costs to residential customers, but rapidly growing data center demand results in residential customers only being responsible for 52 percent of costs during the biennium, the costs recovered from residential customers could be higher than the costs they incur. This could also potentially work in the other direction, with residential customers being undercharged if costs are under-allocated based on forecasts.

Utility cost allocation and rate design are complex and highly technical, and the practicality and legality of any changes require detailed analysis to be fully understood. For this reason, utilities and SCC are in the best position to address future cost concerns through cost allocation and rate design changes. SCC is proactively looking into cost concerns from the data center industry and has scheduled a technical conference for December 2024 to explore the effects of the increasing number of data centers and other large-load customers on Virginia's utilities, ratepayers, and power grid. The conference will provide participants an opportunity to identify ways to address the cost concerns noted here and throughout this chapter.

Even if new customer classes and rate-setting methodologies are established, it may not be possible to isolate any customers from the cost impacts of higher energy prices (discussed above). In addition, energy prices in Virginia could still be affected by data center demand even if data center growth is slowed in the state, because industry growth could shift to other states in the PJM region, increasing energy prices throughout the region.

Data center growth creates additional financial risks to utilities and their customers

The growth of the data center industry presents several additional, but so far unrealized, financial risks to utilities and their customers. These risks largely result from the sheer size of the data center industry's energy demand relative to all other customers. These risks exist with the current size of the data center industry and will increase as the industry grows. Utilities have several mechanisms they use to manage financial risks from large data center customers, from planning processes to contracts, but these may not always be sufficient to mitigate the risks posed by the industry.

Data center demand could drive generation and transmission infrastructure to be overbuilt, stranding costs with existing customers

One of the main risks posed by the data center industry's rapid growth is that utilities will build more energy infrastructure than is needed if forecast demand does not materialize as expected, or one or more large data centers close. Overbuilding could strand utilities with infrastructure costs that would have to be recouped from their broader customer base. This would drive up costs for all customers, including residential and other non-data center customers. The overbuilding risk is mostly associated with generation and transmission, not distribution (sidebar). It is also more of a concern for Dominion than the co-ops, because Dominion builds generation to meet all customer needs and is responsible for transmission, whereas co-ops *purchase* most energy for their data center customers and are not directly responsible for transmission.

Distribution could be overbuilt but is less of a risk because most of these costs are fully recovered from data centers directly or through contractual minimum payment requirements.

Generation could be overbuilt if a substantial portion of the expected data center demand does not materialize, or if there is a decrease in that demand overtime. As a result, non-data center customers would pay a larger share of the fixed costs for this new generation. While it does not currently appear likely that supply will exceed demand, there is some risk because much of the data center industry is concentrated in a small number of companies. Therefore, business decisions at one company could have a substantial effect on overall demand. For example, if one of the major hyperscaler companies decided not to pursue development of new artificial intelligence (AI) products or has a line of AI products that fail to be commercially viable, then energy demand from that company could decrease substantially.

On the transmission side, there are three types of transmission lines to consider: (1) "backbone" lines that bring power into a region, (2) regional lines that move power to distribution points within the region, and (3) short extension lines that move power from main lines to serve a single distribution point, including extension lines that might be built to serve one or a few data center customers. Because transmission lines serve specific regions and distribution points, they are more at risk of being overbuilt if regional or individual customer demand does not materialize or decreases over time.

Utilities attempt to avoid overbuilding transmission and otherwise ensure costs are recovered. Dominion indicated it tries to avoid overbuilding by making transmission upgrades only as needed to meet the metered load expected from customers. For example, even if data center customers in an area have requested 2,000 MW of capacity, Dominion will only build new transmission to serve 1,000 MW if that is the forecasted metered load. One co-op utility indicated that it contractually requires data center customers to reimburse the utility for any penalties from transmission providers that may be incurred if a data center project is canceled. However, while utility actions reduce the risk of transmission costs being stranded with other customers, they do not eliminate this risk. For example, transmission costs can take up to several decades to recoup, and if a data center ceases operation before then, or it never uses the amount of energy it expected to, costs will be recovered from other customers.

Utilities could take additional steps to reduce the risk of generation and transmission costs being stranded with customers.

- Utilities could obtain contractual agreements from data centers customers to provide minimum payments that ensure the costs of major generation and transmission buildouts are not stranded with other customers. For example, AEP Ohio has proposed requiring any data center with over 25 MW of capacity to pay for at least 85 percent of the energy they expect to need, even if they use less, for at least 12 years.
- Utilities could directly assign some or all costs of smaller projects, such as transmission line extensions, to the customers or customer class for whom the line is primarily being built to serve. For example, if a two-mile transmission extension is primarily being built to serve a data center development, some or all of the project's costs could be assigned to that customer.

The state should direct Dominion to develop a plan for addressing the risk of generation and transmission infrastructure costs being stranded with existing customers. (Dominion is currently the only transmission-owning utility in the state expected to experience rapid demand growth.) The plan could adopt one or more of the approaches described above, or other approaches the utility identifies as more practical and effective. The plan could be included as part of Dominion's biennial rate review filing with SCC, or as a separate filing.

RECOMMENDATION 5

The General Assembly may wish to consider amending the Code of Virginia to direct Dominion Energy to develop a plan for addressing the risk of generation and transmission infrastructure costs being stranded with existing customers and file that plan with the State Corporation Commission as part of its biennial rate review filing or as a separate filing.

Data centers pose particular cost and financial solvency risks to electric co-ops and their customers

Virginia's electric co-ops are not-for-profit companies that are essentially owned by their member customers. Their main purpose is to provide members with reliable power at low costs. Co-ops are much smaller than the state's investor-owned, for-profit utilities—Dominion and APCO—and do not have the same financial resources or reserves as these companies.

An increasing share of data center growth is expected to occur in co-op service territories, and co-ops are statutorily obligated to serve these customers. Based on the half of unconstrained demand forecast, the industry could account for 80 percent or more of annual energy sales in three Virginia co-ops by 2030. This growth creates unique challenges for the co-ops, which must find ways to insulate themselves and other customers from the cost and financial solvency risks associated with taking on a small number of extremely large data center customers.

The main risk co-ops identified is that a data center could potentially delay, dispute, or fail to pay its energy generation bill. Co-ops purchase energy from PJM energy markets and then sell that energy to their data center customers. A weekly data center energy bill can be extremely large under normal circumstances and can be magnified by price spikes from peak load events. For example, one co-op estimated the weekly energy bill for 4,000 MW of power at data center sites expected to soon be built in its service territory could be $20 to $40 million and could range upward of $100 million under the energy price spikes that were seen in a major winter storm in 2022. PJM bills weekly, and if one or more data center customers dispute or otherwise do not pay on time, a co-op would have to cover its energy costs until they can be recouped. If the co-op was unable to recoup costs from one or more of its data center customers, the costs would ultimately have to be paid by all other co-op members, and a large enough bill could result in the co-op defaulting and going bankrupt.

Some co-ops said they were sufficiently addressing risks through their contracts with data centers, as allowed under current state law. Namely, these co-ops said the contracts allowed them to:

- perform credit checks when establishing service,
- require more frequent weekly payments for energy use, which aligns with PJM's weekly billing cycle, so they do not have to float co-op funds to pay data center bills,
- require upfront payment of deposits and pledges of collateral based on what the co-op expects it would need to cover unpaid data center bills until further action, such as terminating service, can be taken, and
- terminate service for failure to pay.

Other co-ops said they did not believe that the existing contractual and legal tools available were sufficient to fully cover all potential financial risks, especially considering data centers could soon account for the vast majority of their energy costs. They noted that current termination of service notification and dispute time periods could allow unpaid bills to continue increasing for several weeks (sidebar). They also said it can be challenging to get data center companies to agree to some contractual terms, such as committing to large collateral obligations designed to cover a large peak load event. These contractual and legal issues could be addressed at the SCC technical conference in December.

State law allows utilities to **terminate service after 10 days** of advance notice. However, customers can dispute billing issues that might lead to service termination, and co-ops indicated that **dispute resolution can take as long as 30 to 60 days**.

One co-op indicated that, even with additional contractual protections, they were still at risk if a data center company failed to meet its contractual obligations, such as if the company itself were unable to provide agreed upon payments. To address this, the co-op attempted to get SCC approval to create for-profit subsidiary companies to serve data center customers. Under this arrangement, if a data center did not pay its bills, only the subsidiary company would be affected, and the business continuity of the co-op would be assured. The SCC acknowledged the risks the co-op had identified, but did not grant the request because it did not believe it had the legal authority to allow a co-op to serve customers through a separate for-profit legal entity, among other factors. The General Assembly could amend the Code of Virginia to expressly allow co-ops to create for-profit subsidiaries to serve data centers and other large load customers. The customer size could be set at 90 MW to match the statutory threshold that already exists for the retail choice program (discussed in the next section).

POLICY OPTION 2

The General Assembly could consider amending the Code of Virginia to allow electric cooperatives to create for-profit subsidiary companies that could fulfill their legal obligation to provide energy services (retail sales) to customers with load capacity of over 90 MW.

Data center company participation in retail choice program could shift generation costs to other customers

In Virginia, most customers are obligated to purchase generation through their incumbent utility. For example, a customer in Dominion's service territory must purchase power from Dominion. The one major exception is that large load customers, including most data centers, are allowed to participate in retail choice, which allows them to purchase energy through a provider of their choice (sidebar). The goal of the program is to encourage competition and lower energy prices for industrial and other large commercial customers.

The current retail choice program was established in 2007 when Virginia's energy sector became reregulated. Under the program, a qualifying customer can enter into an agreement to receive power from a third-party competitive service provider, which can purchase energy from the PJM market or enter into power purchase agreements with independent generators in or outside of Virginia to provide power to the customer.

Customers qualify for retail choice if they (a) exceed 5 MW and account for less than 1 percent of the utility's peak load, or (b) exceed 90 MW. The restriction that a customer cannot account more than 1 percent of the utility's load was intended to prevent customers from leaving the utility for retail choice if it could have negative cost impacts on the utility's remaining customers. The 90 MW exception was reportedly added to allow one particular industrial customer to participate in the program. At that time, very few customers exceeded the 90 MW threshold. Today, many existing data centers, and virtually all planned future ones, exceed 90 MW and are eligible to participate in retail choice.

Now that data centers make up a substantial and growing share of energy use in the state, retail choice creates two financial risks to utilities and their customers.

- Utilities are required to build or secure enough generation to meet all customer demands. If a customer leaves the utility for retail choice, the fixed cost of any recently built generation is divided among the remaining customers. For example, the costs of constructing Dominion's recent Brunswick and Greensville power stations are paid for by all of its customers. If a substantial portion of data centers leave for retail choice, a greater share of those fixed costs will be allocated to remaining customers. The risk for this potential dynamic will be compounded in upcoming years because a lot of new generation is planned to be built to serve growing data center demand.
- Utilities also indicated that, because they are legally obligated to serve any customer in their territory as a provider of last resort, they must plan for the capacity needs of current and future customers. If utilities plan and build infrastructure to serve future data center customers, and some of those customers at some point leave for retail choice, the utility will incur costs for customers who are no longer actively paying generation bills.

It is difficult to model the cost impacts of data center customers shifting to retail choice, because it is unclear how many might pursue this option. However, utilities report that only a small number of data center customers are currently participating in retail choice, so there is the potential for many more to enter the program, especially as the industry grows. Dominion estimated that if all currently eligible customers chose to participate in retail choice, including non-data center customers, the cost-shift to other customers could exceed $600 million annually (a $150 per year cost impact for a typical residential customer). That figure is likely to grow substantially as data centers make up an increasing share of the customer base.

Before returning to their incumbent utility, **a retail choice customer must provide advance written notice of five years.** However, statute allows the customer to return earlier by seeking an exemption from the SCC if its energy supplier "has failed to perform, or has anticipatorily breached its duty to perform, or otherwise is about to fail to perform," and the customer is unable to obtain service at reasonable rates from an alternative supplier.

JLARC staff identified several ways the state could manage the financial risks of retail choice to residential and other customers. The General Assembly could direct utilities to determine an overall cap on retail choice participation for their customers, such as a total amount of the utility's customer load that could be obtained through retail choice, and require the SCC to review and approve the caps. This would provide an avenue for utilities and customers to present their cases and give SCC authority to decide what is appropriate. Other alternatives to this approach include requiring exit fees for customers leaving for retail choice or directing utilities to continue directly charging them for fixed generation costs (i.e., making these "non-bypassable" charges). In addition, the General Assembly should leave in place the existing legal requirement that any customer participating in retail choice must notify the utility five years before returning (sidebar). Requiring advance notice of at least several years is important so that utilities can appropriately plan for system needs, secure needed capacity, and protect other customers from rate fluctuations.

POLICY OPTION 3

The General Assembly could consider amending the Code of Virginia to require that electric utilities establish caps on participation in retail choice that protect ratepayers from undue costs, and that such caps be approved by the State Corporation Commission through a formal case process.

Data center companies could soon have access to utility market-based pricing options that largely achieve the same goal as retail choice without shifting costs to other customers. Currently, co-ops already provide all their data center customers with market-based energy prices. Dominion has also established a small market-based rates pilot program and recently filed an application with the SCC to make the program permanent and widely available to customers. Market-based rates provide customers with potentially lower energy pricing that is similar to what they could expect to obtain through retail choice, but they remain a utility generation customer and therefore continue to help pay for fixed generation costs (instead of having these costs passed on to other customers).

5 Natural and Historic Resource Impacts

Virginia has abundant natural and historic resources, which provide economic, environmental, cultural, and educational benefits to the state. The value of these resources has long been recognized by the federal, state, and local governments. Governments have established regulatory systems intended to protect these resources and reduce the impacts that land development and other human activity have on them. The extent of natural and historic resource protections varies by resource type, with some regulatory systems providing stronger protection than others (Table 5-1). Natural and historic resource protections apply to data center operations and developments just as they apply to other commercial and industrial operations and developments (sidebar).

Data center energy demand, and its related impacts on Virginia's natural and historic resources, is discussed in Chapter 3 and related appendixes.

TABLE 5-1
Federal, state, and local regulations protect natural and historic resources from commercial and industrial operations and developments, such as data centers

	Regulatory protections			
	Federal	**State**	**Local**	**Brief overview**
Air resources				
Pollutant emissions*	●	●	○	Federal and state governments regulate harmful emissions and concentrations
Water resources				
Water withdrawals*	○	●	○	State sets and enforces water withdrawal limits and conditions
Wastewater discharges*	●	●	○	Federal and state governments regulate harmful discharge contents
Stormwater runoff*	●	●	◑	Federal, state, and some local governments regulate runoff rate and quality
Wetland and stream disturbances*	●	●	◑	Federal, state, and some local governments require impact mitigation
Land resources				
Conservation	◑	◑	◑	All government levels set aside lands for conservation, but few regulations, outside voluntary programs, protect private lands
Electronic waste				
Disposal	◑	◑	◑	No regulations require reuse or recycling, but some disposal limitations exist
Historic resources				
Preservation	◑	◑	◑	Federal, state, and some local governments regulate impacts in specific circumstances

SOURCE: JLARC staff summary of federal, state, and local regulations, staff interviews, reports, and websites.
NOTE: ● = stronger mandatory protections, ◑ = partial mandatory protections, ○ = no mandatory protections. * indicates that permits are required for potentially sizeable impacts. The responsibility or authority for a given government level to regulate impacts varies by resource.

Data center backup generators emit pollutants, but their use is minimal, and existing regulations largely curb adverse impacts

To ensure constant operations in the event of a power outage, data centers maintain on-site backup power. Data centers report that providing uninterrupted operations is extremely important to their customers, which can include banks and hospitals, who expect no outages or downtime. In Virginia, nearly all data centers use diesel generators for backup power (Figure 5-1). On average, each data center site has 54 permitted generators, but the number and electrical capacity of these generators vary widely depending on the number of data center buildings at a site, overall power and redundancy needs, and the sizes of generators used (typically one to three megawatts per unit). In total, the industry has approximately 8,000 permitted generators throughout the state.

FIGURE 5-1
Data centers rely on diesel generators for power in the event of an outage

SOURCE: JLARC photo of diesel generators at a data center in Virginia.

The federal Clean Air Act requires the U.S. Environmental Protection Agency to set **National Ambient Air Quality Standards**. These standards identify safe concentration thresholds for six pollutants—including ozone (which nitrogen oxides may form), carbon monoxide, and particulate matter—based on scientific evidence.

Diesel generators emit several harmful pollutants, so their commercial use is regulated by state and federal agencies. The main emissions are nitrogen oxides, carbon monoxide, and particulate matter. When highly concentrated in the air, these emissions can have adverse effects on public health and the environment. Exposure to high concentrations of diesel generator emissions can affect human cardiovascular, respiratory, and central nervous systems. Nitrogen oxides, which diesel generators emit in much larger quantities than other pollutants, can contribute to ground-level ozone pollution (including smog) and acid rain.

To prevent harmful concentrations, Virginia's Department of Environmental Quality (DEQ) is required by federal and state law to regulate sizeable emissions of these pollutants and enforce National Ambient Air Quality Standards (sidebar). DEQ requires diesel generators used by data centers to be permitted, primarily because of their nitrogen oxides emissions (sidebar). Moreover, DEQ monitors air quality and creates plans to maintain or attain National Ambient Air Quality Standards across the state. For instance, Northern Virginia has historically struggled to meet the standard for ozone, to which nitrogen oxides can contribute, so DEQ has stricter policies for nitrogen oxides emissions in that region.

DEQ permits are required for any new development that may annually emit over 40 tons of nitrogen oxides, 100 tons of carbon monoxide, or 10–25 tons of particulate matter, depending on the particulate matter size. Data centers using diesel generators usually meet the criterion for nitrogen oxides, but not for the other pollutants.

Data center backup generators are rarely run for prolonged periods, and emissions are unlikely to adversely affect regional air quality

Data center operators aim to have backup generator capacity for days-long outages, but in practice, the generators are rarely run for prolonged periods. Most operators reported experiencing zero to two minor outages per site in the last two years, with nearly all outages being between one and five hours long. Otherwise, generators are typically run only for limited amounts of time as part of routine maintenance (sidebar). For example, in 2023, the industry's actual emissions were only 7 percent of what permits allowed, with most emissions coming from maintenance testing.

Data center operators indicated that **maintenance testing** typically involves a short (10–30 minute) monthly test and one long (one- to four-hour) annual test. Testing of generators is staggered across a site on an individual or group basis.

On a regional level, data center emissions from diesel generators have grown substantially in recent years, but they remain a relatively small contributor to regional air pollution. Since 2015, nitrogen oxides emissions from data center diesel generators have more than doubled, carbon monoxide emissions have tripled, and particulate matter emissions are five times larger. However, these emissions make up a small part of overall emissions in the region. Based on National Emissions Inventory data, in Northern Virginia, where most data centers are concentrated, data center emissions make up less than 4 percent of regional nitrogen oxides emissions and 0.1 percent or less of regional carbon monoxide and particulate matter emissions. Overall, air quality in Northern Virginia has improved during the same time that the industry has grown, as reductions in car and other emissions have been greater than data center emission growth.

While emissions from data centers' diesel generators make up a small part of *regional* emissions, understanding whether they have adverse *local* impacts is more difficult. Because the data center industry's large clusters of diesel generators are unique, local air quality impacts are harder to assess. Diesel generators' intermittent use makes their impacts difficult to model, and no other type of development uses nearly as many generators on one site as a data center development. Additionally, air quality monitoring occurs regionally and does not effectively capture localized effects. While DEQ staff believe that data centers' intermittent use and low emissions levels are unlikely to cause adverse impacts, the agency has recently launched a three-year study that will directly monitor data center generator emissions in Northern Virginia to more fully understand their air quality impacts. If the study detects any local air quality impacts, DEQ has the authority to increase protections as needed.

Federal and state regulations limit potential emissions from backup generators, even under worst-case scenarios

The U.S. Environmental Protection Agency has established **generator tiers** based on emission rates, or the amount of a pollutant emitted by a source over a given amount of time. Data centers could use generators that are considered Tier 2 or Tier 4.

DEQ permits limit when data center generators can be run, how long they can be run, and the maximum annual emissions each permitted site is allowed. Nearly all current data centers use "Tier 2" diesel generators, which are only permitted to run in emergencies or as part of routine maintenance testing (sidebar). This restriction prevents data centers from running their generators for any other reason. Permits are issued per data center site, rather than per building or generator, and cap the total emissions allowed per site. For example, a data center campus would not be allowed to run its generators indefinitely, even in an emergency, because it would likely reach its emissions limits within a few days. Because outages are rare, data centers do not often approach their emission limits. (For information on data center generator fuel choice, see Appendix K.)

In the event of a prolonged outage that affects one or more Northern Virginia counties, any affected data centers could reach their emission maximum within a few days and potentially affect regional air quality. For example, under a worst-case scenario where all data centers in Northern Virginia reach their maximum allowed emissions, data centers would emit over 9,000 tons of nitrogen oxides in the region. That is equal to about half of what has typically been emitted annually in Northern Virginia by all sources. Such a large-scale outage could potentially result in violation of air quality standards and contribute to regional air quality issues. However, the extent of any impact would depend on weather patterns and contributions from other emissions. Such large-scale outages are rare, and air quality levels would return to normal after the event is over.

General Assembly could incentivize use of generators with lower emission rates to reduce risk of local and regional impacts during prolonged power outages

To reduce the risk of air quality impacts from data centers during a prolonged outage, the state could incentivize the industry to adopt technologies that reduce potentially harmful emissions. "Tier 4" diesel generators are designed to emit significantly less nitrogen oxides and particulate matter than the "Tier 2" generators most data centers use. Alternatively, Tier 2 generators can be equipped with selective catalytic reduction systems (SCRs). Both technologies can significantly reduce emissions of nitrogen oxides and particulate matter—reportedly by up to 90 percent—over long run times. Some newer data centers in Virginia use SCRs on their generators, and only one uses Tier 4 generators.

Without state incentives, data center companies are unlikely to change their backup power choices. Tier 4 generators and SCRs are more costly, and data center companies have expressed concerns about the extra complexity and the current availability of Tier 4 generators to meet campuswide and statewide backup power needs. The state could encourage adoption of these technologies by requiring new data centers in the Northern Virginia Ozone Nonattainment Area to use Tier 4 or SCR-equipped Tier 2 generators to be eligible for the state's sales and use tax exemption (sidebar). This requirement could be phased in over time to account for data centers that have already ordered generators or otherwise made investments that would not comply with this requirement.

The Northern Virginia Ozone Nonattainment Area includes Arlington, Fairfax, Loudoun, and Prince William counties and the cities of Alexandria, Fairfax, Falls Church, Manassas, and Manassas Park.

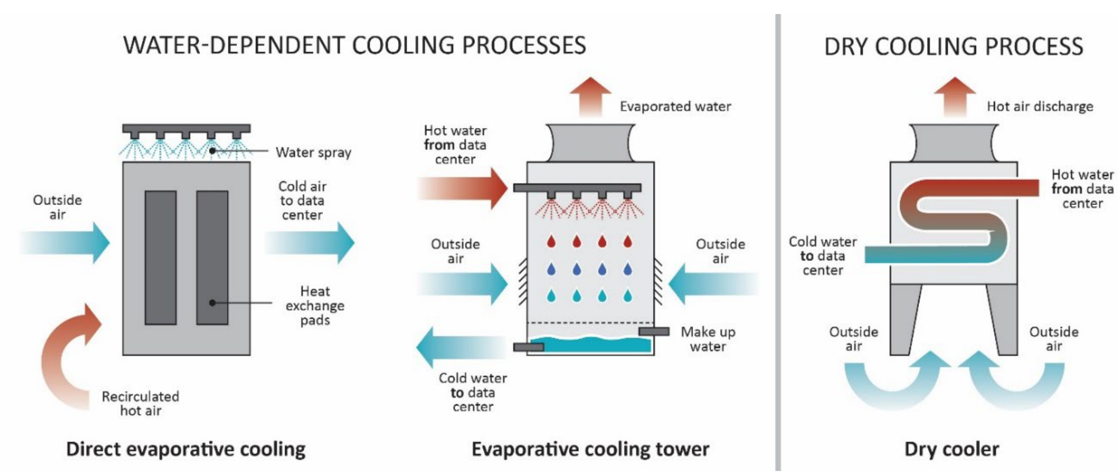
POLICY OPTION 4

The General Assembly could amend the Code of Virginia to require that, as a condition of receiving the data center sales and use tax exemption, all new data center developments in the Northern Virginia Ozone Nonattainment Area use only Tier 4 generators, Tier 2 generators with selective catalytic reduction systems, or generators with equivalent or lower emission rates.

Data center water use is currently sustainable, but use is growing and could be better managed

Data center water use varies depending on the data center's size, computing density, and type of cooling system. Data centers require industrial-scale cooling to manage the heat generated by their computing equipment. Some cooling systems use water evaporation, and these systems typically require regular water refills to operate (Figure 5-2). Other cooling systems recirculate all or most of their water, similar to a radiator, and use relatively little water. Some data centers use a combination of cooling processes, including processes that do not require any water.

FIGURE 5-2
Evaporative cooling processes require more water than dry cooling processes



SOURCE: JLARC synthesis of interviews, government reports, and research literature.
NOTE: Depicted examples are generalizations and do not include all data center cooling processes and equipment.

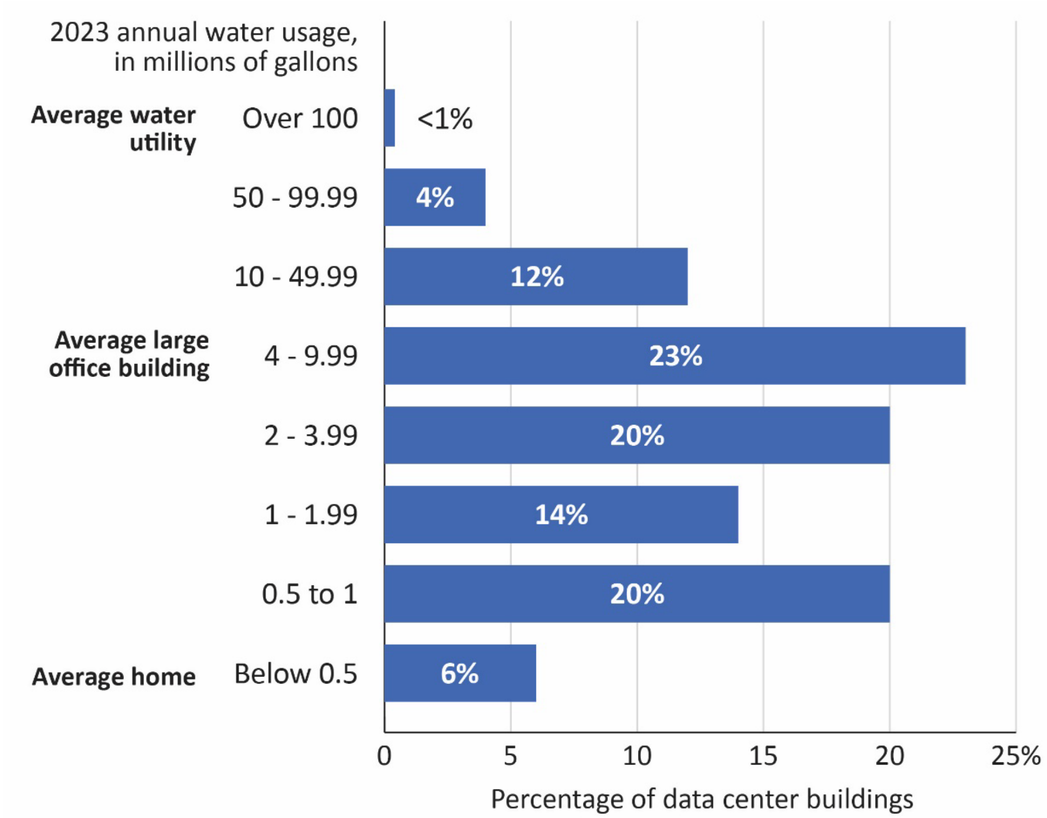
Item 3.

While some data centers use substantial amounts of water, most use similar or less than other large commercial and industrial water users

For comparison, **the state's largest industrial water user in 2023** used about 36.5 billion gallons of water annually.

Based on available data, most data centers use about the same amount of water (or less) as an average large office building (6.7 million gallons per year), although a few require substantially more, and some require less than a typical household (Figure 5-3). In 2023, 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) (sidebar).

FIGURE 5-3
Annual data center building water use varied widely, but most used the same amount of water as an average large office building or less (2023)



SOURCE: JLARC staff analysis of data provided by water utilities serving Fairfax, Henrico, Loudoun, Mecklenburg, and Prince William counties and the Town of Wise. Average uses are based on federal and state water use statistics.
NOTE: Data was not available for all data centers in Virginia but was for the large majority. Water use is on a per building, not per campus, basis. Annual usage for some data center buildings is approximate because of data constraints.

Reclaimed water is wastewater that is treated, often to a non-potable standard, and re-used, such as for irrigation and industrial purposes. It reduces the need for additional water withdrawals, diverts wastewater from entering water sources, and reduces demand on potable water systems.

Cumulatively, data centers use a small share of statewide water withdrawals and a moderate share of some region's water withdrawals. In 2023, the data center industry used an estimated 2.1 billion gallons of water, with just over a third coming from reclaimed water instead of new withdrawals (sidebar). Data center water use accounted for less than 0.5 percent of total state withdrawals.

The industry's impact was also limited regionally. Most data centers are served by water utilities, and industry use made up from 2 to 21 percent of water use, after excluding reclaimed water use, at the six water utilities JLARC staff reviewed. Data centers were typically one of these water utilities' larger customers, but a data center was the single largest customer for only two utilities.

State regulates water withdrawals to ensure future water availability and to protect water ecology

To protect future water availability and environmental sustainability, DEQ regulates withdrawals from Virginia's water sources, including requiring permits for large-scale withdrawals (sidebar). Withdrawals can reduce the amount of water that is available for future use if it is withdrawn faster than it is naturally replaced. Additionally, they may affect aquatic flora and fauna, such as by reducing available habitat. Most data centers receive their water from local water utilities, which make the withdrawals. In these cases, DEQ ensures that data centers' water use is sustainable through permitting the utility's withdrawals. Only two data centers have their own DEQ withdrawal permits, and any data centers that do make their own withdrawals are subject to the same regulations as water utilities.

Withdrawal permits are required for withdrawals above 10,000 gallons per day from non-tidal surface waters, two million gallons per day from tidal surface waters, and 300,000 gallons per month from groundwaters in a groundwater management area. There are some exceptions for users that pre-date these regulations. Withdrawals that do not require permits may still require annual reporting.

To determine appropriate water withdrawal allowances, DEQ performs scientific modeling that evaluates water withdrawal impacts on future water availability and aquatic flora and fauna in that water source. Permits specify withdrawal limits and set other conditions, such as requiring the permit holder to limit withdrawals during droughts. If a requested withdrawal amount would exceed sustainable levels, DEQ would issue a permit only for a sustainable amount or add conditions to the permit that ensure sustainability. Permits must be renewed at least every 15 years, at which time DEQ reruns the water model with updated water source condition data. If growing data center demand prompted a water utility to seek a larger withdrawal than their permit currently allows, the requested permit withdrawal allowance increase would also have to be modeled by DEQ.

Data center water needs are likely to increase as the industry grows, and state and local governments could help ensure limited water resources are used effectively

While DEQ is responsible for ensuring that permitted water withdrawals are sustainable for the water source, there is less oversight over how available water should be shared across various uses. While the state as a whole is relatively water rich, water is a limited resource for some Virginia localities, such as those that do not have access to major rivers or other surface waters and are in groundwater management areas. Additionally, when local water use demand exceeds current permit or infrastructure thresholds, utilities may need to expend significant resources to meet the additional demand (sidebar). Therefore, localities should fully consider their allocation of available water. For instance, when reviewing a potential new development that may use a

Some **water utilities that serve or will soon serve data centers** have recently expanded their permits and/or infrastructure. For instance, five have requested new or larger withdrawal permits, though these expansions are not fully attributable to data centers. Water utility staff shared that data centers pay their fair share for any additional infrastructure they require.

large amount of water, a locality should consider whether the project could affect the locality's ability to meet future residential demand or pursue other types of economic development.

State could clarify localities' authority to request potential water use information from proposed developments

While any large water user has the potential to affect local water availability, water use information may be particularly helpful for zoning decisions for data center developments. Data centers can use a relatively large range of water amounts compared with other land uses. Some companies will continue to build data centers that use water for cooling, and potentially larger amounts of water as cooling needs increase. While others are moving away from water, the industry's net water use is expected to increase. In addition, because the industry is growing rapidly and typically grows in clusters, data center water use in a given locality can grow suddenly.

Localities have general statutory authority to consider water resources in their land use planning, but state law is not clear on localities' ability to require a proposed data center development to provide a water use estimate or to consider water use in their rezoning and special use permit decisions. (Rezonings and special use permits are discussed more in Chapter 6.) In interviews, local planning staff, government attorneys, and a local elected official conveyed different understandings of the law or reported being uncertain whether a locality could consider water use estimates when evaluating data center development projects. This information could be helpful for assessing a development's potential impacts, but data center developers can be reluctant to share this information because of proprietary concerns. State law should clarify localities' authority to require this information from data center developers and consider water usage in their rezoning and special use permit decisions. This clarification could potentially be extended to other development types, such as other developments with the potential to use large amounts of water.

RECOMMENDATION 6

The General Assembly may wish to consider amending the Code of Virginia to expressly authorize local governments to (i) require proposed data center developments to submit water use estimates and (ii) consider water use when making rezoning and special use permit decisions related to data center development.

Additionally, if local planning officials have this information, they should consult with their local water utility—prior to approving data center developments—on the impact these developments could have on the utility or future water availability. In some data center approvals, this information was not shared between parties. Doing so could help to ensure water use impacts are fully understood prior to approving the development.

Increasing use of reclaimed water may help reduce impacts on water resources

Some utilities offer reclaimed water systems for their customers, and using reclaimed water instead of potable water for cooling, including evaporative cooling, is generally a best practice for data centers. Reclaimed water can reduce a development's impact on water resources because it does not require additional water withdrawals and can decrease wastewater discharges. DEQ currently permits only two water utilities, including Loudoun Water, to provide reclaimed water for evaporative cooling uses.

Reclaimed systems may not be viable or available in all localities, but utilities that serve data centers should consider the option. Smaller utilities may not create enough wastewater for a reclaimed system that could sustain data center operations. Moreover, financial considerations may also limit reclaimed water use, as reclaimed systems have high capital costs. However, because of the potential benefits for water availability, utilities that serve data centers—and other large water customers—should consider the viability of using reclaimed water systems, as well as potential opportunities for data center companies to help with upfront costs.

Some stakeholders, including a data center company and several water utilities, indicated that Virginia's reclaimed water system regulations for evaporative cooling use are difficult to meet or confusing. DEQ indicated that regulatory changes, such as explicitly listing minimum standards for reclaim water use in data center evaporative cooling processes or reducing some treatment and monitoring conditions, could potentially address concerns while maintaining necessary safeguards but would require further review. DEQ is already scheduled to conclude an internal review of these regulations by September 2026 as part of its quadrennial review process, but DEQ could start this review now so that any eventual changes could be implemented a year earlier. Any potential changes DEQ identifies would need to be implemented through the standard regulatory process—including a Notice of Intended Regulatory Action and public comment period.

Data center construction has similar land and water impacts to other large developments, and state and local regulation mitigate most effects

The development of land for industrial, commercial, or residential uses, particularly "greenfield" developments, can affect Virginia's land and water resources (sidebar). Depending on the characteristics of the site being developed, the construction process may change land characteristics and uses, modify stormwater runoff patterns, and/or disturb wetlands and other waterways (Table 5-2). Such impacts can degrade air and water quality, destroy wildlife habitat, and increase flooding and erosion risks.

A development's ability to mitigate its potential impacts depends on the site, development type, and the resource. A development can mitigate overall potential impacts on these resources in three ways:

"Greenfield" development occurs on land that has not previously been developed. In contrast, redevelopment occurs on the site of a former development. A redevelopment is less likely to impact land and water resources, as any potential impacts likely already occurred during the previous development.

State-managed databases, such as the Department of Conservation and Recreation's **Natural Heritage database**, identify on-site resources that may be impacted by development.

- **avoiding** direct impacts to the maximum extent practicable, such as not constructing a building on forested land,
- **minimizing** impacts to the maximum extent practicable, such as using a retaining wall to minimize impacts to an adjacent waterway, or
- **compensating** for any impacts that do occur, such as offsetting impacts to a wetland by restoring or constructing that same type of resource elsewhere.

TABLE 5-2
Constructing new developments can result in loss of undeveloped and agricultural lands, create stormwater runoff risks, and potentially disturb wetlands

	Land resource loss	Stormwater changes	Wetland disturbances
Development action	Undeveloped and agricultural lands may be developed for industrial, commercial, residential, or other uses.	Impervious surfaces may be created to support buildings and ancillary developments.	Wetlands (including streams and other waterways) may be drained, filled, or encroached upon to maximize developable area.
Potential impact	Forests, agricultural lands, and other green spaces are lost.	Less rainwater is absorbed into the ground, increasing stormwater runoff.	Wetland areas are destroyed, diverted, or otherwise disturbed.
Effect without mitigation	Air, water, and soil quality degradation, loss of habitat, and lower agricultural production occur.	Increased flooding and erosion, water pollution, and slower groundwater recharge, occur.	Water source degradation, loss of habitat, and increased flooding and erosion occur.
Effect with mitigation	Losses are avoided, minimized, or offset by preserving, creating, or restoring lands elsewhere. [a]	Predevelopment runoff rate and quality are maintained, minimizing adverse impacts.	Disturbances are avoided, minimized, or offset by funding or implementing wetland creation or restoration. [a]

SOURCE: JLARC synthesis of interviews, government reports, and other information.
NOTE: [a] Offsetting impacts can be difficult and require significant time and space, particularly for replacing lost undeveloped and agricultural lands.

Some regions have seen substantial data center growth, but their construction impacts are similar to other large developments

Data center development has construction impacts that are similar to other large-scale developments' impacts. While comprehensive information on data centers' impacts to natural resources is not tracked, the vast majority of their development is greenfield development—although some redevelopment is also occurring.

The development pressures from data centers on undeveloped and agricultural lands statewide are not more than other fast-growing developments in Virginia. For example, the total land area of currently operating data centers is equal to about 1.4 percent of the farmland lost in Virginia between 2017 and 2022. According to land conservation experts, the current primary threat to undeveloped and agricultural lands is solar energy developments.

On a regional level, however, the share of undeveloped and agricultural land development in Northern Virginia attributable to data centers has been substantial. JLARC staff estimated that the data center industry accounted for between 20 and 30 percent of land development in Loudoun and Prince William counties from 2013 to 2021, and the amount of data center development has already increased 50 percent since then. However, these are some of Virginia's fastest-growing counties, which means that some portion of land developed for data centers likely would have been developed for other uses, such as housing, mixed-use commercial space, or distribution centers.

Data center developments have similar impacts on stormwater and wetlands as other large-scale developments, such as warehouses or shopping centers. The magnitude and significance of impacts depend on site characteristics as much as the development itself (sidebar). Therefore, impacts may be the same whether a site is developed for a data center or another land use.

Magnitude of impact depends on the change to the environment, not the development itself. For example, a small greenfield development may create more impervious surface than a large redevelopment.

Impact significance depends on the resource that is affected. For example, a given amount of water pollution may have a larger effect in a small river than a big river.

State and federal regulations require mitigation of stormwater and wetlands impacts, but land conservation is at local discretion

Federal and state regulations require stormwater management and wetland permits for sizeable impacts, regardless of development type. Stormwater permits for individual developments are usually administered by DEQ or the locality, and wetland permits are typically jointly issued by the U.S. Army Corps of Engineers and DEQ. Most data center developments require a stormwater permit because of their size, but only those that affect a wetland or other waterway require a wetland permit (which is the same for all types of development).

Stormwater management permits require developments to manage their stormwater runoff to meet water quality and quantity requirements to minimize impacts. For instance, a development would be required to install a stormwater management system, such as an on-site stormwater pond, to slow and filter its runoff. Data centers create a relatively large amount of impervious surface, and stormwater permits require management that is proportional to the addition of impervious surface and land cover changes. Some impacts may still occur even if all permit requirements are met, such as less water being absorbed into the ground or water source temperature increases, but these same impacts can occur from any developments that create large impervious surfaces or change land cover, such as a warehouse or shopping center.

Wetland permits require developments to avoid and minimize impacts to wetlands and other waterways to the maximum extent practicable and to compensate for any remaining significant impacts. Because data centers require large building footprints, they may be relatively less able to avoid or minimize impacts. However, any significant impacts that do occur require proportionate compensation, which ensures losses are replaced to the extent possible through the preservation, restoration, or creation of that resource elsewhere.

In Virginia, federal and state regulations do not require mitigation of impacts to undeveloped and agricultural lands. Localities have full discretion through their zoning laws to determine how lands that are not protected from development can be used. While localities can require, negotiate, or accept offers to conserve a portion of the existing natural landscape as part of a development, data center developments generally use most of land that is practicable and allowed to be developed. Because undeveloped and agricultural lands are difficult to replace, the primary mitigation method to protect them is to avoid or minimize development on these lands. The state could consider imposing land use restrictions to prevent or minimize the land impacts from data center development, but this would be a profound change in the state's involvement in local land use decisions, and, currently, there does not appear to be a basis for distinguishing data centers from other large developments in considering such restrictions.

State could require data centers to meet environmental management standard to receive tax exemption

Even though federal and state regulations already limit most negative natural resource impacts of data centers, the state could encourage them to meet an environmental management standard because of their large and growing presence. Environmental management standards, such as the International Organization for Standardization's (ISO) 14001 standard, require companies to proactively review and reduce their impacts to natural resources (sidebar).

The ISO 14001 standard for Environmental Management Systems is one of the most used environmental management frameworks in the world. The U.S. Environmental Protection Agency believes it helps organizations to systematically identify and reduce their environmental impacts.

Environmental management standards do not set required minimum standards but involve continuous improvement in operational sustainability. Required minimum standards may not be viable for all data center companies and may not be wholistically sustainable (sidebar). Environmental management standards call for companies to evaluate all of their environmental impacts and set and pursue sustainability goals. This process is repeated every few years and encourages a wholistic approach to sustainability. For instance, ISO 14001 seeks to promote organizational improvement in air emissions, water use, water discharge, waste generation, and energy consumption—all of which have been raised as concerns about data centers. (For more information on data center water discharges and waste generation, see Appendix K. For more information on data center energy impacts, see Chapter 3.)

Required minimum standards for specific resources could have unintended consequences, including: 1) not being viable for all data center companies, who have different operational systems and preferences, 2) not ultimately improving sustainability, such as water restrictions leading to more energy-intensive cooling, or 3) not being adaptable as the data center industry evolves, such as if new technologies shift the industry's environmental impacts.

The state could encourage adoption of an environmental management standard by making the state's sales and use tax exemption for both new and existing data centers contingent on adoption. Many data center companies already set sustainability goals and policies, and a well-designed state requirement would encourage other companies to adopt similar goals and policies. At least four other states—Arizona, Illinois, Iowa, and Washington—require data centers to meet a sustainability standard as a condition of their state data center tax incentive program.

POLICY OPTION 5

The General Assembly could amend the Code of Virginia to require that, as a condition of receiving the sales and use tax exemption, data center companies meet and certify to an environmental management standard, such as the International Organization for Standardization's 14001 standard for Environmental Management Systems.

Data center impacts on historic resources are similar to other developments, but current protections could be strengthened

Developments have the potential to negatively affect historic resources, both during and after construction. Historic resources can include sites (e.g., battlefields and cemeteries), structures (e.g., buildings), and objects (e.g., artifacts) (Figure 5-4). Impacts can vary substantially depending on the type of development being proposed, the significance of the historic resources affected, and how those resources will be affected. In many cases, a development will not adversely affect historic resources because there is nothing historically significant on the development site or located nearby.

FIGURE 5-4
Virginia has a wide range of historic resources

SOURCE: Image courtesy of the Virginia Department of Historic Resources (cropped by JLARC).

Data center developments can affect historic resources in the same ways as other large developments

Some data center developments have affected state historic resources. For instance, two data center developments have relocated or damaged cemeteries, and several have been located on historic sites, including a turn of the 19th-century residential site, a historic African American horse showground, and part of a Civil War battlefield. Additionally, several approved but not yet built data center developments have raised concerns of viewshed impacts on historic battlefields around the Northern Virginia region. Like with other development types, the total number and extent of data centers' impacts on historic resources are unknown as not all of these resources—or impacts to them—have been identified and catalogued.

Preservation experts consider data centers' impacts and risk of impact to be similar to those of other large-scale developments. Data centers have less flexibility than some other developments, like housing, to avoid building on parts of the property where resources might be located. Data center developments also require extensive grading, which can destroy buried structures and objects, and tall data center buildings are more likely to have viewshed impacts on nearby resources. However, other large-scale developments, like warehouses and shopping centers, can have the same impact. The rapid growth of data center development increases the likelihood that historic resources will be disturbed by these developments, but the same is true of other commercial and residential construction growth.

Pre-development studies help promote mitigation of impacts to historic resources

Before site development begins, sites can be studied to identify any potentially significant historic resources and determine mitigation strategies if impacts were to occur. Developers can hire experts or third parties to perform "Phase I" historic resource studies, which could include background research, physical inspection, and remote sensing, to identify historic resources that may be affected by a new development. If a Phase I study finds historic resources, Phase II historic resource studies can determine their significance and, if needed, develop mitigation approaches (sidebar). When needed, Phase III historic resource studies involve carrying out mitigation approaches, such as excavating and relocating a resource or documenting a resource. Once historic resources have been identified, developers can additionally perform viewshed analyses to determine whether a new development would be visible to these resources, potentially affecting their significance.

Various methods may be used to **mitigate impacts to historic resources**. For instance, developments may avoid or minimize impacts by moving building locations or lowering building heights. If historic resources cannot be avoided, they may be excavated and relocated, studied and documented before their destruction, and/or commemorated with signage. The appropriate strategy can depend on the resource, development type, and the site.

Phase I historic resource studies and viewshed analyses are relatively inexpensive predevelopment tools. Some data center companies reported that they conduct Phase I studies for some or all of their data center developments, and several have conducted and shared viewshed analyses as part of the local zoning approval process. Studies can ultimately save developers time and money by preventing delays or the need for design changes from unexpected discoveries after developments have been approved.

Few legal or regulatory protections exist to protect historic resources, but pre-development studies could be more strongly encouraged

While there are many layers of federal, state, and local protections for natural resources, fewer protections exist for historic resources. For private developments, federal regulations require that historic resource impacts need to be considered—studied and potentially mitigated—only if a wetland or other federal permit is required. State law only requires additional Virginia Department of Historic Resources (DHR) oversight of private developments when human remains need to be removed.

Local regulation of historic resources varies by jurisdiction, depending on local capabilities and priorities. All localities have the authority to restrict development around historic resources through their zoning ordinances, but some are better able to identify these resources than others. For instance, Loudoun requires Phase I historic resource studies for all non-residential developments and has a county archeologist who evaluates study results and makes recommendations to planning staff if additional action is needed. Most localities do not require pre-development studies and do not have an archeologist on staff. Moreover, when development and historic resource preservation goals conflict, it is up to local elected officials to make zoning decisions.

To ensure that potential impacts to historic resources are identified, the state could encourage Phase I historic resource studies for all new data center developments, as well as viewshed analyses for new developments within a certain distance of a registered historic site. To do this, the state could make eligibility for the sales and use tax exemption contingent on this work being performed for any new data center developments. For example, the state could require that, for any data center that begins construction in 2026 or later, the data center company perform a Phase I study (along with a viewshed analysis, if applicable) before the facility is constructed in order to be eligible for the exemption. Data center developers would pay for the study and report findings to localities, which would determine if any further action is required.

POLICY OPTION 6

The General Assembly could amend the Code of Virginia to require that, as a condition for receiving the sales and use tax exemption, data center companies conduct a Phase I historic resource study of a proposed development site, as well as a viewshed analysis when a proposed site is located within a certain distance of a registered historic site, and report the study findings to the appropriate locality prior to development.

Some localities may not currently have the time, expertise, or resources to review the Phase I historic resource study submissions. DHR could offer grants for localities to hire consultants or have staff available for consultation, but this would require additional funding or staff to implement. Alternatively, localities would have the option to require data centers to pay for a consultant hired by the locality to perform the review.

Some historic resource preservation experts stated that, while they would appreciate greater protections around historic resources, establishing mitigation requirements at the state level may not allow for site-specific characteristics or local preferences. For instance, prohibiting data center development near historic resources statewide, as was proposed during the 2024 legislative session, may be broader than needed—as impacts do not occur every time a development is on or near a historic resource—or could prove too restrictive given the abundance of historic resources in Virginia.

6 Local Residential Impacts

Local governments are responsible for managing land development in their jurisdictions for different residential, commercial, agricultural, and industrial uses. Localities manage development through planning and zoning to ensure developments conform with state and local laws and are grouped with appropriate types of development.

On the planning side, state law requires localities to create and update long-term comprehensive plans to support "coordinated" and "harmonious" development. These plans provide a strategic vision for development in the county but, while important for guiding local decisions, do not set any legal boundaries.

On the zoning side, localities pass zoning ordinances that set legal restrictions on development. Zoning ordinances establish conceptual *zones* (e.g., rural residential, light industrial), which have their own sets of rules and requirements for new development. For each zone, the ordinance lists *uses* that are allowed. Uses can allow different types of business operations (e.g., data center, brewery), different types of residential construction (e.g., townhouse, single-family house), and other distinct uses. Additionally, zoning ordinances can impose minimum requirements on specific uses or zones, such as maximum heights or mandatory setbacks from property lines.

Within a zone, a use can be allowed by right, allowed by special permit, or prohibited. If a use is prohibited in a zone, then a developer can seek to have the parcel rezoned to allow the use.

- **By right** uses are allowed within a zone without any special approval by the locality. For example, if data center development is a by-right use, a developer can build a data center in the zone without seeking special approval from the locality. Localities cannot require data center developers to do anything not already established in the zoning ordinance. For example, a locality could not require a by-right data center to be set back farther from nearby property lines than the ordinance already dictates.
- **Special permit** uses are allowed if approved by the locality's elected officials, e.g., a county's board of supervisors (unless they delegate this authority to the local board of zoning appeals), often following a public hearing. As part of the special permit process, the locality can make approval conditional on additional restrictions to mitigate negative impacts, such as bigger property line setbacks or lower building heights.

- **Rezoning** changes the conceptual zone a parcel falls under and therefore its allowed uses. Rezoning requests require a public hearing and approval from elected officials. Like with special permits, the locality can consider the developer's willingness to conform to additional restrictions or actions as a condition of rezoning approval.

Growing number of data centers are being built close to residential areas, causing residential impacts

This chapter focuses on data centers' impacts on residential areas. While minimizing impacts on **other sensitive uses** such as schools and parks is important, concerns of negative impacts in Virginia have primarily come from residential areas.

Land use planning principles state that neighboring property uses should be compatible with one another. These principles generally dictate that industrial uses should be far from residential and other sensitive uses because they are often incompatible (sidebar). Residential neighborhoods are generally expected to be safe, quiet, and pleasant places to live, whereas industrial facilities are often large, unsightly, and potentially noisy. For example, Loudoun County ordinances state that "industrial uses […] are incompatible with residential uses due to the prevalence of outdoor storage and emissions of noise, odor, and vibrations."

Data centers are industrial facilities that are largely incompatible with residential uses

The industrial scale of data centers makes them largely incompatible with residential uses. A modern data center site includes one or more large, industrial buildings, similar in size and appearance to a new distribution center or a manufacturing facility, which is an abrupt contrast to a residential home.

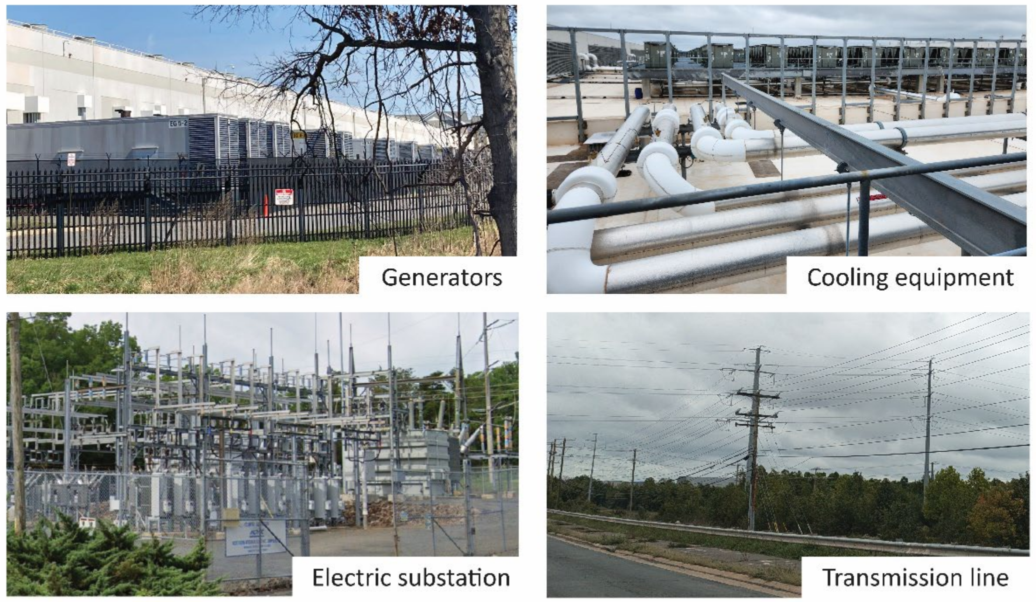
Resident descriptions of nearby data centers include:

— "a giant monolith in the wrong place"

— "a prison"

Other components of data center sites are also industrial in character and unsightly to residents who live close by (sidebar) (Figure 6-1). Trailer-sized generators (a median of 35 per site) are often lined up beside the data center building or housed in large generator sheds. Industrial-scale cooling equipment, such as chillers or water towers, often sit on the roof or outside the main building. Many data center sites are encompassed by security fences and deploy bright security lighting. Data centers also require industrial-scale electrical infrastructure. Sites will often include one or more electrical substations on or adjacent to the site, and some require above ground transmission lines extending from nearby main lines.

FIGURE 6-1
Data center buildings and sites have industrial characteristics and infrastructure



SOURCE: JLARC staff photos and Google Earth.

Homeowners in residential areas close to data centers frequently express concern that having industrial sites nearby will decrease their property values. While it is certainly possible that nearby data centers have affected the resale value of homes, there is not yet evidence of this relationship. In interviews with representatives of neighborhoods opposed to nearby data centers and other informed individuals (sidebar), almost none observed a decline in property value or speed of home sales. One commonly cited explanation was that the tight housing market in Northern Virginia decreases buyers' selectiveness and so proximity to data centers has not yet had a noticeable effect on property values.

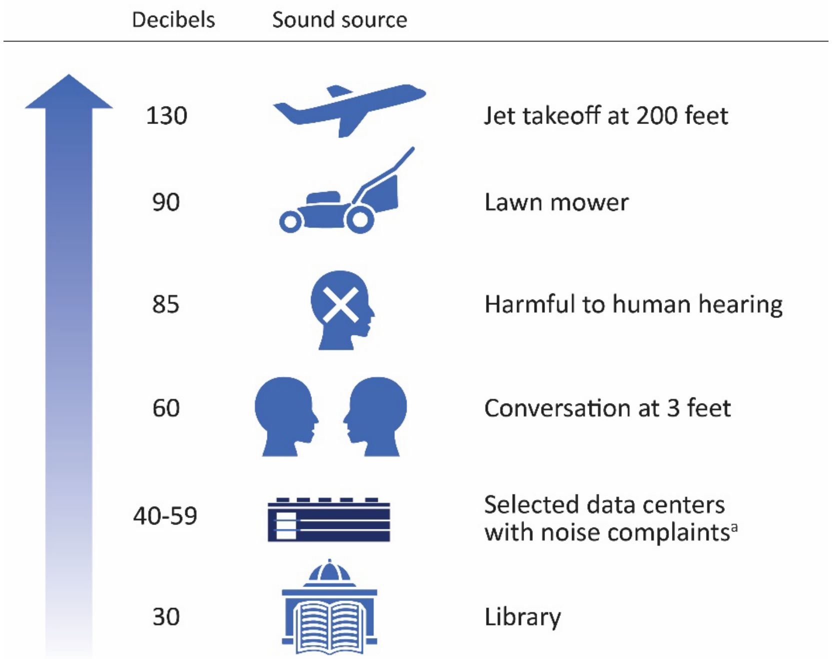
To assess data centers' impacts on property value, JLARC interviewed representatives of neighborhoods opposed to data centers proposed or recently constructed nearby, local stakeholder groups, county assessor's offices, and a local real estate agent association.

Some nearby residents report that constant noise from data centers impacts their well-being

The constant nature of data center noise has been a reported problem when data centers are located near residential areas. Whether data center noise can be heard past the facility's property line depends on its design and its type of cooling system, which can cause noise. In addition, local geography and surrounding buildings can affect how sound travels.

While some data centers have been noisy enough to cause complaints, the noise is not loud enough to damage nearby residents' hearing and rarely loud enough to violate noise ordinances (Figure 6-2). Data center noise that has prompted resident complaints ranges from an estimated 40 to 59 decibels (per JLARC's review of noise measurements of selected data centers that have prompted complaints by residents). This sound level is typically below the 55 or 60 decibel limit that Loudoun, Prince William, and Fairfax allow in their ordinances for residential areas. Rather than the volume of the noise, it's data centers' constant noise that some residents consider problematic. Data center noise is described as a constant "drone" or "hum," similar to house air conditioning systems but magnified to an industrial scale. The noise can sometimes be heard both in and outside of nearby residences.

FIGURE 6-2
Data center sound is noticeable but quieter than many common sounds



SOURCE: JLARC review of Occupational Safety and Health Administration, U.S. Centers for Disease Control and Prevention, and Federal Aviation Administration websites, and analysis of complaint data from Fairfax and Loudoun.
NOTE: The units are A-weighted decibels. [a] Encompasses measurements at locations where local staff recently measured data center noise using A-weighted decibels. Measurements are a response to complaints, so they are not representative of all data centers. Measurements indicate total sound, not the isolated amount from data centers.

Residents who have reported that data center noise is a problem have indicated that it has adversely affected their well-being. JLARC staff spoke with residents who live near data centers that have been the subject of noise complaints to learn how the noise affects them. Some residents described physical symptoms such as migraines from the facilities' constant noise. Others said that they experience health problems caused by disrupted sleep, and some residents described an inability to concentrate on tasks. A common theme was poorer quality of life, with some residents avoiding their decks and yards because the sound is louder outdoors.

Data centers are not required to reduce their noise if they are not violating local ordinances, which has made it difficult to address noise concerns. Some neighborhoods have attempted to address concerns through the county and engagement with data center companies. Residents of the Great Oak neighborhood in Prince William reported noise to county police from a nearby data center in May 2022, and as of October 2024, the issue had not been fully addressed by the data center owner to all residents' satisfaction. Residents of the Brook Haven neighborhood in Loudoun contacted the county in 2021 about noise concerns, and the data center completed an attempted solution in November 2023. In both cases, residents observed reductions in noise from the nearby facilities but emphasized it took time and repeated communications from residents to prompt action.

Data center construction sites can be especially disruptive to nearby residential areas

Because of data centers' size and scale, their construction takes a long time and is disruptive to residential areas. Construction activities typically include clearing trees, grading land, laying foundations, erecting buildings, and installing equipment. While these activities are not unique to data centers, the impacts on residents are especially large because of the projects' scope. Each building takes about 12 to 18 months to construct, and with the industry moving toward developing data center campuses, work on additional buildings often begins as soon as one is completed. Therefore, a large site could take as long as seven years to fully complete. This work requires thousands of workers on site and substantial truck deliveries of materials.

Some residents report they have been negatively affected by data centers' construction. Their concerns include loud construction noises and vehicle traffic. For example, one neighborhood's main access road was damaged by frequent use of heavy vehicles, which reportedly sometimes blocked school buses and emergency vehicles.

One-third of data centers are near residential areas, and industry trends make future residential impacts more likely

The majority of data centers are appropriately located in industrial or commercial areas and are not close to residential uses. Over 60 percent are more than 500 feet from residential-zoned properties (as measured from property line to property line, meaning the actual facility and residences are even farther apart) (sidebar). The farther away a data center is from residential areas, the less likely it is to affect nearby residents.

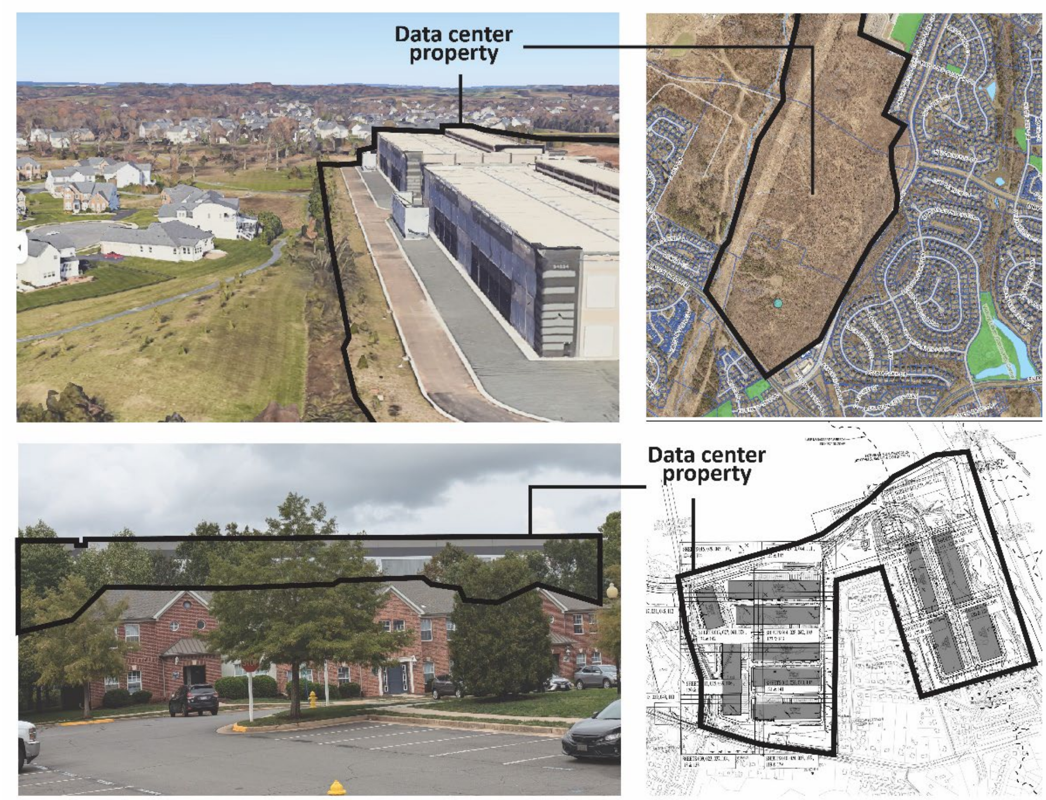
Analysis of the proximity of data center properties to residential zoning used data from eight localities that account for nearly all (93 percent) data centers in Virginia. (See Appendix B.)

A minority of data centers have generated noise complaints. At least 15 data centers (10 percent of operational data center sites) appear to have generated noise that nearby residents regard as problematic, according to resident groups and government records.

However, the number of data centers being built near residential areas is increasing. Almost one-third (29 percent) of operational data center properties in Virginia are within 200 feet of residentially zoned properties. Currently, there are several data centers being constructed adjacent to single-family homes, townhouses, and apartment complexes. Several recently approved data centers in Loudoun and Prince William will be built on land adjacent to neighborhoods, including at least two proposed developments where the property also abuts an elementary school (Figure 6-3). Other counties—such as Fairfax, Stafford, and Henrico—have also received proposals for data centers close to residential areas.

Trends in real estate availability and facility design increase the likelihood of future residential impacts. As the industry's footprint in Northern Virginia grows, the amount of land ideal for data center development is decreasing, and developers are more likely to consider locations closer to residential and other sensitive areas. Additionally, the typical data center building is becoming taller, larger, and more power-intensive, which has the potential to make their industrial characteristics more pronounced and, depending on the design, could generate more noise.

FIGURE 6-3
Some recently built or approved data centers are close to residential areas



SOURCE: JLARC site visits, Google Earth, and locality websites.
NOTE: In order, the pictures depict: (1) existing data center from the Loudoun Meadows neighborhood of Loudoun, (2) land approved for Devlin Technology Park in Prince William, (3) an existing data center next to the Regency neighborhood in Prince William, and (4) a proposed site plan for property that was rezoned to allow data centers around the Amberleigh Station neighborhood in Prince William.

Localities have allowed data centers near neighborhoods, sometimes without sufficient mitigation of impacts

Appropriate local planning and zoning decisions can reduce the risk of data center developments affecting residents. Localities need to proactively update their planning and zoning to manage data center development, because the industry is rapidly changing. As recently as 10 years ago, data centers were much smaller facilities that were similar in size and appearance to commercial office buildings. Local ordinances that continue to treat data centers as non-industrial commercial uses, which are often allowed next to residential areas, are outdated and can affect residents.

Localities need to consider which areas are appropriate for data center development, classify data centers as industrial uses in zoning ordinances, ensure data centers are not too close to residential zones, and include requirements to mitigate any potential negative impacts from data centers, such as building setbacks and height restrictions. In addition, local elected officials should adequately consider potential residential impacts when considering special permit and rezoning requests.

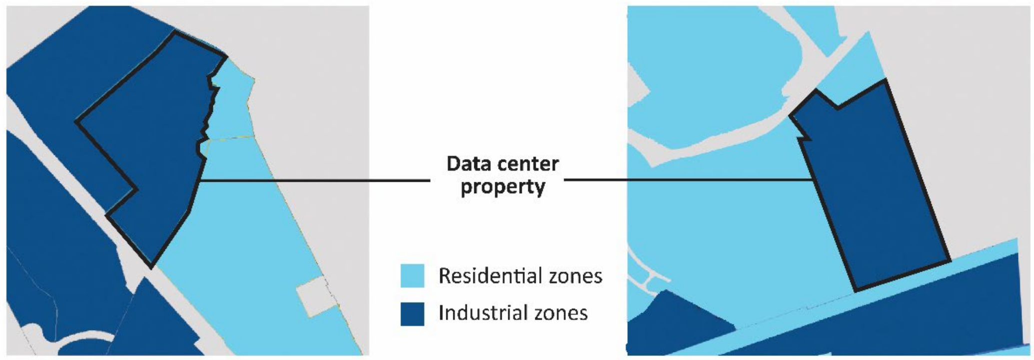
Inadequate planning and zoning have allowed data centers near residential areas

Data centers have sometimes been built too close to residential and other sensitive areas because local zoning ordinances did not consider them to be an industrial use. For example, until 2021, Fairfax considered a data center to be a telecommunications facility, which allowed data centers to be built in areas zoned for residential and office uses. Loudoun originally treated data centers as an office use and continues to allow by-right data center development in areas zoned for office uses in some parts of the county.

In addition, some localities have zoned industrial areas next to residential areas on their zoning maps, even though land use principles state that industrial uses are ideally separated from residential uses by buffers, such as commercial zones. For example, the Great Oak neighborhood in Prince William and the Bren Mar neighborhood in Fairfax are directly adjacent to industrial zones (Figure 6-4). This has allowed data center development by right despite being close to residences. The likelihood of residences being close to data centers has also increased because of some local decisions to rezone land to residential despite being in primarily industrial areas. If zoning maps are not reviewed and updated, more data centers are likely to be built closer to residential areas.

Item 3.

FIGURE 6-4
Some industrial zones border residential zones, allowing by right data centers too close to residential zones



SOURCE: JLARC review of Prince William and Fairfax geographical informational systems and planning staff reports.
NOTE: The first picture depicts an existing data center near the Great Oak neighborhood of Prince William. The second picture identifies a planned data center near the Bren Mar neighborhood of Fairfax County. Grey coloring indicates a zone that is (1) neither residential nor industrial or (2) within another locality. "Zones" refers to the official zoning classification in local ordinances.

Zoning ordinances often include requirements intended to mitigate negative impacts from businesses, but these requirements are not always sufficient. Required building height limits and property line setbacks are fundamental ways to reduce a development's impacts. For example, the property on the right side of Figure 6-4 was zoned industrial and is only subject to a setback of at least 40 feet (although the developer is voluntarily planning a larger setback). This zoning would have allowed a new data center to be built close to the property lines of two adjacent townhouse complexes. Landscaping and architectural requirements are other ways to mitigate data center impacts, but their value is limited. Newly planted trees take decades to grow, and the size and proximity of a nearby data center matters more to residents than its architecture.

Some localities' elected officials have granted data centers exceptions to requirements designed to reduce residential impacts

Local officials in Virginia have sometimes approved data center requests to build in locations that prompt resident opposition or are likely to cause impacts. These elected officials are responsible for reviewing applications for special permits and rezonings and ensuring they are compatible with the locality's long-term comprehensive plan (or amending the long-term plan). While there is no objective way to assess if officials made the "right" decision in approving a given project, there are cases where elected officials' decisions have led to impacts on residents or contradicted development strategies laid out in long-term plans. For example,

- Elected officials have approved property rezonings that allow data centers next to sensitive locations. Prince William approved rezoning from mixed residential to industrial for the Devlin Technology Park (second in Figure 6-3), which is adjacent to a school and about 80 feet from residential zoning.

- Elected officials have approved data center requests in areas that are not suitable, according to the locality's long-term comprehensive plan. In Loudoun, the board of supervisors approved the True North development even though staff recommended denial because the county's "transitional" long-term plan classification for the site does not support data centers (sidebar).
- Elected officials have exempted individual data centers from local requirements intended to mitigate negative impacts on residents. For example, Loudoun's board of supervisors allowed Aligned Energy's Relocation Drive project to exceed the zone's maximum height and square footage, despite staff recommending against the exemption because of nearby residential areas.

Local planning staff can recommend denial for several reasons. Sometimes staff may recommend denial because they believe more information from the developer is needed before a decision should be made. Other times staff may recommend denial because the proposed use is not compatible with the proposed site or there are not sufficient mitigations planned to adequately protect nearby residents.

Some localities have taken steps to minimize residential impacts, though success of these efforts rests with elected officials

Residents' opposition to data centers has grown in recent years, especially in Loudoun and Prince William. While data center projects rarely generated citizen opposition in the past, it is now more common for individuals and organized groups to speak against data center proposals at local planning commission and board of supervisors meetings. Some grassroots groups have been created to fight specific proposals for new data centers, joined by existing organizations such as regional environmental groups. These local groups often also advocate for more government restrictions on allowable locations for data centers.

Opposition to data center proposals has also emerged outside of the main Northern Virginia markets. For example, local groups contested recent proposals in Henrico County and the Town of Warrenton. However, some locations such as Mecklenburg have not encountered significant resident opposition.

Several Virginia localities are making or considering zoning ordinance changes to reduce the risk of residential impacts

Most of the Virginia localities with sizable data center markets have taken or are considering steps to better manage future data center development. Since 2019, elected officials in the three localities with the most data centers (Loudoun, Prince William, and Fairfax) have taken some steps to address residential concerns (Appendix L). For example,

- All three localities have increased the requirements for data centers to improve their appearance or reduce their visibility, for example, increasing setback requirements, requiring specific design standards for the building façade, or screening external mechanical equipment.

- Loudoun and Fairfax have reduced the number of zones allowing data centers by right.
- All three localities have taken steps to address noise, such as requiring sound studies for new projects, requiring proactive sound measuring for existing data centers, and eliminating a partial exemption in the local noise ordinance for nighttime noise from businesses (including data centers).
- All three localities recently initiated studies of their data center policies to better manage development. Fairfax's study concluded with elected officials amending their ordinances in fall 2024. Loudoun and Prince William are reviewing potential changes to their long-term comprehensive plans as part of their studies and tentatively plan to vote on study proposals in 2025.

In several of the Virginia localities that are considering or expecting their first data center projects, elected officials have proactively implemented planning and zoning changes to promote appropriate industry development. The goals of these changes are to avoid the types of residential impacts that have occurred in established data center markets. For example, in 2023, Stafford County added data center principles to its comprehensive plan, prohibited data centers in several commercial and light industrial zones, and established industry-specific standards. Culpeper County also coordinated amending its comprehensive plan and zoning ordinance relevant to data centers. Culpeper allows data centers in multiple industrial zones but provides tax incentives to encourage development in a newly designated Technology Zone with more stringent design requirements.

Localities generally have adequate expertise to make data center decisions

For the most part, local government staff possess sufficient expertise to support review and approval of data center projects. Data centers are one of many types of development that local planning, permitting, and other staff evaluate. Evaluating whether a data center project is in an allowable location, has appropriate setbacks and building height, or is proposing effective landscape screening is similar to evaluating other large commercial or industrial developments. The one exception is noise, a topic where staff from several localities would like more expertise. For example, planning staff from a locality with data center experience are uncertain whether their recently revised ordinances are the right way to prevent data center noise impacts.

Data center applications can be challenging, however, for smaller counties with less experience with the industry, given the complexity, size, and scale of data center projects. These localities have addressed challenges by reaching out to staff in other localities with more industry experience and by contracting for tasks where their expertise may be lacking, such as assessing economic impacts. For some functions, such as reviews of stormwater management plans, the Department of Environmental Quality may perform the review instead of the locality. Larger counties have sometimes used consultants as well, such as Prince William for a noise study.

Effectiveness of local efforts to minimize residential impacts ultimately depends on elected officials

The effectiveness of local efforts to minimize the residential impacts from data center development ultimately depends on elected officials. Local staff can propose well-designed zoning ordinance changes and provide sound advice on whether a special permit or rezoning request should be approved based on local development standards and the locality's comprehensive plan, but elected officials make the final decisions. As described above, elected officials in Fairfax, Loudoun, and Prince William have recently taken actions to minimize residential impacts of data centers, and several localities considering data center projects are taking actions proactively. While these actions do not guarantee elected officials will always make the "right" decisions to address impacts, they do indicate that elected officials are actively responding to residents' concerns.

State intervention does not appear warranted, but localities should consider using key practices in data center ordinances and decisions

Land use decisions are traditionally a local responsibility in Virginia, because they directly affect local residents. Land use decisions are also very site specific, and local governments are better positioned than the state to evaluate what is appropriate for a given site.

Nature of data center impacts does not appear to merit state intervention, and localities appear to be taking needed actions

Although some stakeholders have advocated for greater state involvement in land use decisions, there is not currently a compelling reason for a state role in setting local requirements for data centers or intervening in local approval decisions. State intervention should only be considered if local policies are causing significant threats to residents' health and safety or other significant harm, but that is not the case with data centers.

Furthermore, only a minority of data centers in Virginia have been reported to impose negative impacts on residents. While some localities have allowed data centers to be built in areas incompatible with residential uses, those localities now appear to be taking actions to avoid future impacts by reviewing and changing local zoning ordinances. Other localities that have not experienced negative impacts on residents yet appear to be taking proactive action to minimize impacts.

Localities should implement several practices to minimize residential impacts

Localities should implement several practices to protect residents and ensure data center development proceeds appropriately and with minimal impacts. Namely, localities should:

- classify data centers as an industrial use in their zoning ordinances;
- review the locations of zones allowing data centers by right, and adjust the zoning map if needed, considering proximity to residential areas;
- ensure that minimum requirements in the zoning ordinance adequately mitigate negative impacts on residential or other sensitive areas (e.g., setbacks, building heights), and add requirements specific to data centers as needed;
- identify optimal areas for data center development in the locality, including locations that are suitable from the county's perspective (e.g., far from residential areas) as well as the industry's perspective (e.g., large parcels, access to transmission);
- reduce the likelihood of noisy data centers (including through limiting allowable locations and requiring sound modeling) and prohibit the constant low-frequency noise of data centers from reaching residential areas; and
- require commitments from data centers making zoning requests to sufficiently mitigate negative impacts on any nearby residential areas.

Localities can take steps to mitigate data center noise, but some are unsure of authority to do so

Although only a few data centers have caused impacts to residential areas, noise is reported to be one of the most disruptive problems for residents, and data center noise concerns can be difficult to resolve. Noise impacts can be reduced by siting data centers away from residential areas and by modeling data centers' potential noise impact before they are built. Localities also need to be able to address noise that occurs after data centers are operational.

Noise concerns can be reduced by modeling data center sound impacts before a data center is built

In addition to having zoning ordinances that prevent data centers from being located close to residential areas, localities should require sound modeling for data centers proposed close to residential areas. Sound modeling predicts the sound a facility will generate once operational and provides an opportunity for building designers to assess the need for, and effectiveness of, sound reduction strategies. Localities could review study results to determine if any further action, such as sound barrier construction, should be required before approving a development project.

Sound modeling studies can also be used to establish the baseline level of noise already occurring around the proposed data center site, which can later be used to determine whether a data center has contributed to noise in the area. Many data center companies are now doing sound modeling studies for all or some of their projects, and companies explained that sound modeling prior to construction is worthwhile because reducing noise after a building is operational can be difficult and expensive.

Some localities were unsure whether Virginia law allows them to require sound modeling studies. Given this uncertainty, the Code of Virginia should be amended to clarify that local governments have the authority to require sound modeling studies by data center developers and to review and consider the results in their land use decisions.

RECOMMENDATION 7

The General Assembly may wish to consider amending the Code of Virginia to expressly authorize local governments to require sound modeling studies for data center development projects prior to project approval.

The state could incentivize sound modeling by making eligibility for the sales and use tax exemption contingent on this work being performed for any new data center developments proposed near residential areas. For example, the General Assembly could amend the law to require any data center company with a data center that is proposed to be constructed in 2026 or later near a residential area or area zoned for residential development perform a sound modeling study and provide the results to the appropriate locality in order to qualify for the exemption.

POLICY OPTION 7

The General Assembly could amend the Code of Virginia to require that, as a condition for receiving the sales and use tax exemption, data center companies conduct a sound modeling study prior to the development of a proposed data center that is to be located within a certain distance of a residential development or area zoned for residential development and provide the study findings to the appropriate locality.

Localities also need the ability to address noise issues that occur once a data center is operational

Localities also need to be able to address data centers' noise once they are operational, but local ordinances have been largely ineffective at addressing data center noise concerns. Most local noise limits are defined using "A-weighted" decibels (sidebar). This metric is designed to target excessively loud noise from sources such as parties and barking dogs. The lower frequency noise data centers emit is not fully captured in "A-weighted" decibels. Therefore, data center noise rarely exceeds the allowable limits set in ordinances, despite the constancy of the sound being problematic for residents. To effectively address data center sounds that cause resident complaints, localities could

"**Decibels**" are a pure unit of measurement of sound's volume. When measuring sound, different modifications can be used to account for various frequencies. For example, "A-weighted" decibels prioritize frequencies perceived loudest by humans and therefore reduce particularly low frequencies. "C-weighted" decibel measurements account more for low frequencies.

develop a supplemental noise limit defined using a metric that better accounts for low frequency sounds, such as “C-weighted” decibels.

Another challenge is that most localities address excessive noise in *noise ordinances*, and state law limits civil penalties for noise ordinance violations to $500 after the first offense. Stakeholders have expressed concern that this small penalty is not sufficient to affect the behavior of the large companies that own data centers. Addressing noise limits through localities’ *zoning ordinances* would allow localities to better address data center noise. For example, the zoning ordinance could prescribe a process for measuring potential noise violations and penalties for not addressing them.

Some localities were unsure whether state law allows them to (i) establish maximum sound levels in alternative low frequency sound metrics and (ii) set noise rules and enforcement mechanisms in their zoning ordinances. The state should clarify that local governments have the authority to use these approaches to address data center noise.

RECOMMENDATION 8

The General Assembly may wish to consider amending the Code of Virginia to expressly authorize local governments to establish and enforce maximum allowable sound levels for data center facilities, including (i) using alternative low frequency noise metrics and (ii) setting noise rules and enforcement mechanisms in their zoning ordinances, separate from existing noise ordinances.

7 Potential Changes to Data Center Sales Tax Exemption to Address Policy Concerns

Virginia's data center retail sales and use tax exemption is a valuable incentive to data centers (providing $928 million in savings in FY23), and about 90 percent of the industry (as measured by megawatts of power) uses the exemption. The General Assembly could therefore use the exemption to incentivize the industry to take actions that help address many of the concerns discussed throughout this report.

If consideration is given to amending the exemption, two factors should be considered. The exemption was adopted primarily to attract data centers to Virginia for economic development purposes, so any changes to advance other policy goals could make it a less effective economic development tool. The exemption is also consistent with tax policy principles that generally exempt businesses' production-related inputs (in this case computer and related equipment) and therefore provides equitable tax treatment with other capital-intensive industries that have business input exemptions.

Exemption changes could encourage continued data center growth, reduced energy demand, or a balance of these priorities

The data center industry provides positive economic benefits to Virginia (Chapter 2). However, a primary concern about the growing industry is the immense increase in energy demand it will require (Chapter 3), which could increase costs to other customers (Chapter 4). The state could consider changes to the exemption to maintain data center industry growth, reduce energy demand by reducing industry growth, or attempt to balance these two competing priorities.

Extending the exemption could help Virginia maintain industry growth and associated economic and local tax revenue benefits

The data center industry provides moderate economic benefits to Virginia and can provide localities that have them with substantial tax revenues. While economic benefits are concentrated in Northern Virginia, other regions of the state also benefit. For example, data center construction benefits equipment manufacturers and material suppliers in Tidewater, Southwest, and Southside Virginia. While historically only a few localities have benefited from data center tax revenues, the industry is rapidly growing. Data center projects are under development in at least 15 localities, most of which did not previously have data centers. Therefore, from an economic development perspective, the state may want to continue attracting the industry and maintain Virginia's position as a top global data center market.

The state's data center sales tax exemption is scheduled to expire in 2035, and data center representatives unanimously reported that expiration of the exemption would have a negative impact on the state's ability to attract new data centers and keep existing ones. Some companies indicated the expiration date could start to affect site selection and expansion decisions made in the next few years, because companies typically consider the costs of data center ownership over a 15- to 20-year period when making location decisions. Companies indicated that, without the exemption, the total cost of data center ownership and operation would significantly increase. Virginia is currently competing for new data center development with several other primary U.S. markets, almost all of which have data center exemptions. Without an exemption, data center representatives indicated any new development in Virginia would be limited to only what is "absolutely necessary," and development would likely shift to other markets.

To help Virginia remain competitive, the state could extend the exemption's expiration date. To influence future site selection decisions, an extension would need to be in place well before 2035. A reasonable new expiration year would be 2050, which would match the special extension that has already been created for companies that meet certain additional criteria (sidebar). The exemption should continue to have an expiration date, because this is considered an effective practice to ensure periodic scrutiny of its need and effectiveness.

The 2023 General Assembly passed **a special data center sales tax exemption extension to 2040 or 2050** for companies that create 1,000 or 2,500 jobs (100 of which must meet above average wage requirements) and make a capital investment of at least $35 billion or $100 billion, respectively. So far, this extension applies to only one data center company, but several others may be interested in qualifying for this extension.

POLICY OPTION 8

The General Assembly could amend the Code of Virginia to extend the expiration date for the state's sales and use tax exemption for data centers from 2035 to 2050.

Extending the expiration date for the exemption, without making any other changes to it, would not address one structural issue with the exemption. Most of the economic benefits of the exemption occur during data center construction, but the exemption provides companies with substantial tax benefits in subsequent years after economic benefits have declined.

Allowing the exemption to expire could help reduce industry growth and associated energy demand

Virginia's utilities have historically been able to keep up with energy demand, but even if data center energy use grows at only half the forecasted rate, the state will need to make enormous investments in energy infrastructure. While data centers will incur much of the cost of new infrastructure investments, energy rates for all users are likely to increase. Growing energy demand could also make it more difficult for the state to meet goals set forth in the Virginia Clean Economy Act.

If the General Assembly wishes to slow down the data center industry's growth in Virginia because it determines that energy concerns outweigh the industry's economic benefits, it could allow the sales tax exemption to expire in 2035. While it is difficult to gauge the exact effect this would have, it is likely industry growth would slow and could eventually stop or even contract. If the industry contracts, it would reduce the need for future generation and transmission infrastructure but would actually increase energy costs paid by other ratepayers, who would have to share a larger portion of current systemwide costs. While the state could allow the exemption to expire only in certain localities or regions, like Northern Virginia, that approach would be less effective in reducing overall growth in energy demand. Industry growth is occurring in several counties outside of the Northern Virginia region and is expected to continue, so allowing the exemption to expire in Northern Virgina while extending it elsewhere would not address the energy impacts where much of the future industry growth is likely to occur (sidebar).

Outside of the Northern Virginia planning district, data center projects are currently under development in the counties of Caroline, Chesterfield, Culpeper, Fauquier, Hanover, Henrico, Louisa, Mecklenburg, Pittsylvania, Powhatan, Spotsylvania, and Stafford. Dominion Energy expects the Stafford area to "become another super large market" like Loudoun and Prince William counties.

If the General Assembly allowed the exemption to expire in 2035, it would need to determine how to treat the large subset of data centers that will likely qualify for the special 2040 or 2050 extension. This extension currently pertains only to Amazon Web Services, but other companies may be interested in developing agreements to use the extension. Disallowing Amazon Web Services from using the extension would likely affect its custom performance grant agreement with the state to develop multiple data center facilities throughout Virginia, which was negotiated under the assumption the company would receive the extension, and could be subject to legal challenges.

POLICY OPTION 9

The General Assembly could allow the sales and use tax exemption for data centers to expire in 2035.

Exemption could be changed to balance industry growth with energy impacts

By either extending the exemption or allowing it to expire, the state would be choosing either economic benefits or reduced energy impacts. An alternative approach is to try and balance these competing objectives. The state could do this by allowing the *full* exemption to expire in 2035 (or ending it before then) and applying a *partial* tax exemption to 2050.

The size of a partial exemption could depend on whether the state wants to emphasize economic benefits or reduced energy impacts. For example, under the current exemption, qualifying companies are exempt from paying the full 4.3 percent state share of the retail sales and use tax and local and regional portions (sidebar). Focusing on the state share, a partial exemption could require qualifying companies to pay a 1 percent sales tax, which would keep much of the exemption's value intact and would likely remain somewhat effective at promoting industry growth (but would do less to reduce energy use). Alternatively, qualifying companies could be required to pay a higher 3 percent sales tax, which would likely be less effective at promoting industry growth and so would reduce future energy use more. By choosing a higher partial tax rate, the state could risk losing some of its existing data centers, particularly in Northern

The statewide retail sales and use tax includes a 4.3 percent state share, a 1 percent local option share, and an additional 0.7 percent to 1.7 percent regional share, depending on the region.

Virginia, although this risk may be diminished by the region's many attributes that make it so attractive to the industry.

The state would need to determine if the partial exemption would apply to data centers that qualify for the existing special 2040 or 2050 extension. This extension currently pertains only to Amazon Web Services, but other companies may be interested in developing agreements to use the extension. To be most effective at addressing energy impacts, and to maintain a level playing field for competitors, the same or a similar partial exemption could also be applied to these data centers.

POLICY OPTION 10

The General Assembly could amend the Code of Virginia to extend a partial sales and use tax exemption for data centers from 2035 to 2050.

A partial exemption would also better align the economic benefits the state receives with the exemption's value. Most economic benefits occur during construction, and switching to a partial exemption in 2035 would reduce the value of the exemption in later years when the economic impacts of current and planned data centers could be expected to slow. A partial exemption would also generate more revenue for the state. For example, a 1 percent partial sales tax would have generated approximately $160 million in state tax revenue in FY23.

Exemption changes could address other policy concerns related to the data center industry

If the decision is made to extend the exemption, this report provides several options the General Assembly could enact to modify it and address concerns in specific policy areas (Table 7-1). These policy options would add new requirements, in addition to the existing requirements, for data centers to be eligible to receive the exemption (sidebar). These options could be phased in gradually to give data center companies enough time to implement them, and the General Assembly could decide to enact some but not others.

Virginia's sales tax exemption currently requires…

50 new jobs located at the data center, associated with operations or maintenance.

Jobs pay at least 150% of the prevailing annual average wage of the locality where the data center is located.

$150 million in capital investment.

Requirements are lower for data centers in economically distressed localities (10 jobs and $75 million capital investment).

The General Assembly will need to determine its primary policy goals for the industry to determine whether to add new requirements to the exemption. If some or all of these policy options were adopted, it would likely make the exemption harder to use and more complex to administer. Alternatively, the General Assembly could pass legislation *requiring* the industry to take these actions, regardless of whether they qualify for the exemption, but this approach could lead to some data centers choosing to either shut down or operate in violation of the law.

The policy options in Table 7-1 would require changes to the Memoranda of Understanding (MOUs) all data center companies are required to enter into with the Virginia Economic Development Partnership (VEDP) to receive the exemption. Current law allows all of a company's data centers in a specific locality to collectively qualify for the exemption. Therefore, the company reports data to VEDP for all of its data centers in each locality where it operates rather than by each individual data center. Policy options that apply only to new data centers might require changing MOUs to apply to each individual data center or to have addenda to the MOUs that identify the individual eligible data centers. VEDP would need to determine exactly how MOUs would need to be restructured.

VEDP would also need to determine the evidence data center companies would need to provide to qualify for the exemption, which would likely add to the complexity of administering the exemption. For example, companies could be required to provide appropriate documentation before a new data center becomes operational to qualify for the exemption. Alternatively, companies could be allowed to self-certify under the condition that documentation must be provided if requested by VEDP or Virginia Tax. VEDP would need to develop guidelines for how to implement any new compliance requirements and set forth new terms in the MOUs.

TABLE 7-1
General Assembly could modify the sales tax exemption to address energy, natural resource, historic resource, and residential impacts

Change	Issue Addressed	Policy option
Options that could apply to *all* Virginia data center operations		
Implement ISO-50001 Energy Management standard or equivalent	Energy impacts and costs	1
Implement ISO-14001 Environmental Management Systems standard or equivalent	Natural resource impacts	5
Options that could apply to *new* data centers built after a certain date		
No Tier 2 diesel generators in Northern Virginia Ozone Non-Attainment area without SCR systems	Natural resource impacts	4
Phase 1 historic resources study required, viewshed study required if near registered historic site	Historic resource impacts	6
Sound modeling (noise) study required	Residential impacts	8

SOURCE: JLARC staff analysis.
NOTE: ISO = International Organization for Standardization. SCR = Selective Catalytic Reduction systems that reduce emissions of nitrogen oxides, a major contributor to smog-forming ozone, and other harmful emissions.

Appendix A: Study resolution

Resolution of the Joint Legislative Audit and Review Commission directing staff to review data centers

Authorized by the Commission on December 11, 2023

WHEREAS, there has been substantial growth in the data center industry in Virginia, particularly Northern Virginia which has the largest concentration of data centers in the world, Southern Virginia, the Greater Fredericksburg region, and the Greater Richmond region; and

WHEREAS, growth in the data center industry is expected to continue with increasing demand from deployment of advanced and innovative technologies used by individuals, business of all sizes across all industries, government agencies, and other organizations that require the digital infrastructure that data centers provide; and

WHEREAS, data centers can bring economic benefits to localities because they can create significant economic activity during construction, they can increase property tax revenue for local governments without placing high demands on government services like schools, and the clustering of data centers can make a region more attractive to other high tech businesses and help support ecosystems of vendors, service providers, and suppliers; and

WHEREAS, concerns exist over data centers because they require large amounts of energy, which can affect the broader energy market; they may have impacts on natural, historical, and cultural resources; and some citizens have expressed opposition to having data centers located near residential areas due to concerns over issues such as noise and the adverse visual impact: and

WHEREAS, the data center sales tax exemption is Virginia's largest economic development incentive, and JLARC conducted an in-depth review of the exemption in 2019; now, therefore, be it

RESOLVED by the Joint Legislative Audit and Review Commission that staff be directed to review the overall impacts of the data center industry in Virginia and state and local policies regarding the industry. In conducting its study staff shall (i) research recent and expected trends in factors impacting data center industry growth and forecast future growth of Virginia's data center industry, taking into account how various factors may affect these projections; (ii) assess impacts of the data center industry on Virginia's natural resources, as well as historic and cultural resources, and identify potential technologies that could reduce their impacts on these resources; (iii) assess the impacts of the data center industry on current and forecasted energy demand and supply in Virginia, including how data centers will likely affect future energy infrastructure needs, energy rates paid by customer classes and whether cost allocation methods ensure no single customer class is unreasonably subsidized by other customer classes, and the state's ability to transition from fossil fuels to renewable energy sources; (iv) estimate the impact of the data center industry on local revenue and assess how local tax policies may affect data centers; (v) identify how data centers may impact local residents, including concerns such as noise pollution, decreasing property values, and the adverse visual impact; (vi) identify considerations around the construction and siting of data centers, and review how zoning and regulatory restrictions and requirements can affect data center deployment; (vii) identify guidance and assistance state agencies could provide to local governments for use in making decisions about the location and expansion of data centers; (viii) assess whether more geographically diverse data center industry growth would provide greater economic benefits to the Commonwealth, and if so, identify obstacles to attracting data centers to other areas, particularly economically distressed or rural regions of the state, and policy changes that could increase geographic diversity, such as changes in electricity policy, tax policy, and broadband infrastructure policy; (ix) compare Virginia's competitiveness in attracting data centers with other states; and (x) determine if Virginia's data center tax exemption could be improved, including whether the exemption could be better targeted, the level of benefit is appropriate given the cost, or other changes should be considered.

JLARC may make recommendations as necessary and may review other issues as warranted.

All agencies of the Commonwealth, including the Virginia Department of Energy, the Virginia Department of Environmental Quality, the State Corporation Commission, the Virginia Economic Development Partnership Authority, the Virginia Department of Taxation, and Virginia local governments shall provide assistance, information, and data to JLARC for this study, upon request. JLARC may use consultants as necessary to complete the study. JLARC staff shall have access to all information in the possession of agencies pursuant to § 30-59 and § 30-69 of the Code of Virginia. No provision of the Code of Virginia shall be interpreted as limiting or restricting the access of JLARC staff to information pursuant to its statutory authority.

Appendix B: Research activities and methods

Key research activities performed by JLARC staff for this study included:

- structured interviews with local residents and stakeholder groups, data center companies and developers, state and local officials, electric and water utility companies, and subject-matter experts;
- contracts with consultants to produce an independent energy demand forecast for Virginia and its utilities, and model how future data center growth in Virginia is likely to impact energy supply, demand, emissions, and cost;
- site visits to data centers and nearby communities;
- development of inventories of (i) operational and (ii) planned data centers;
- economic impact analysis of the data center industry (see Appendix D);
- data collection and analysis, including on data center water usage, emissions, capital expenditures, employment and tax benefits amongst users of the data center tax exemption, and data center proximity to residential areas;
- review of state and local laws, ordinances, reports, and policies relevant to energy, natural and historic resources, land use, and noise;
- review of research literature relevant to data centers, energy, natural and historic resources, and noise; and
- review of other documents, literature, and media sources.

Structured interviews

Structured interviews were a key research method for this report. JLARC staff conducted over 250 interviews with 165 different stakeholders.

Residents and stakeholder groups

JLARC staff conducted interviews with nearly 20 local residents and resident stakeholder groups, such as neighborhood associations, including those in Fairfax, Fauquier, Henrico, Loudoun, and Prince William counties. These interviews focused on the impact of data centers on local residents and communities, such as viewshed and noise issues.

JLARC staff also conducted roughly 20 interviews with state and regional stakeholders groups, including those that represent data center companies, electric cooperatives, construction tradespeople, land conversation and preservation, battlefield preservation, sustainability and the environment, and local and tribal interests. Staff interviewed the American Battlefield Trust, Clean Virginia, Cultural Heritage Partners, Data Center Coalition, Friends of the Rappahannock, Northern Virginia Technology Council, Preservation Virginia, Sierra Club, Southern Environmental Law Center, Virginia Association of Counties, Virginia Association of Soil and Water Conservation Districts, Virginia Chapter of the American Planning Association, Virginia Clinicians for Climate Action, Council of Virginia Archaeologists, Virginia Data Center Reform Coalition, Virginia Farm Bureau Federation, and Virginia, and Maryland & Delaware Association of Electric Cooperatives. Staff also interviewed representatives of the Pamunkey tribe. These interviews covered a range of topics related to the impact of data centers.

Data center companies and developers

JLARC staff conducted nearly 40 interviews with 12 data center companies and developers. These companies operate colocation and hyperscale data centers in Virginia and include industry leaders. These interviews covered a range of topics, including their data center operations in Virginia, the economic impact of data centers, data center site selection, energy issues and sustainability, and the impact of data centers on natural and historic resources, local planning, and community impacts.

State agency staff

JLARC staff conducted more than 30 interviews with state agency staff, including staff from the Virginia Department of Environmental Quality (DEQ), State Corporation Commission, Virginia Economic Development Partnership, Virginia Department of Taxation, Virginia Department of Conservation and Recreation, Virginia Department of Historic Resources, Virginia Department of Forestry, Virginia Department of Agriculture and Consumer Services, Virginia Department of Energy, Virginia Department of Housing and Community Development, and Virginia Department of General Services. These interviews covered a range of topics related to the impact of data centers, including energy issues, issues related to natural and historic resources, and economic development.

Local government staff

JLARC staff conducted more than 50 interviews with local government staff and elected officials in Caroline, Chesterfield, Culpeper, Fairfax, Fauquier, Frederick, Henrico, Loudoun, Mecklenburg, Prince William, Stafford, and Wise counties, and the town of Warrenton. These interviews covered a range of topics, including planning and zoning, economic development, environmental services, public works, historic resources, and local tax and revenue impacts.

Federal government staff

JLARC staff conducted interviews with staff at the U.S. Army Corps of Engineers, U.S. Department of Agriculture, and U.S. Environmental Protection Agency. These interviews generally focused on the impact of data centers on natural resources.

Electric companies and cooperatives in Virginia and Virginia's regional transmission organization

JLARC staff conducted more than 20 interviews with electric companies and cooperatives in Virginia, including Dominion Energy, Appalachian Power Company, and the Central Virginia, Mecklenburg, Old Dominion, Northern Virginia, and Rappahannock electric cooperatives. These interviews focused on the impact of data centers on energy demand, supply, and rates. Interviews with Dominion Energy also focused on energy transmission and generation issues.

JLARC staff also interviewed the PJM regional transmission organization, which serves Virginia. These interviews focused on energy transmission and generation in the region, as well as the impact of data centers on energy demand and supply.

Water utilities

JLARC staff conducted 15 interviews with local water utilities, including those in Caroline, Fairfax, Fauquier, Henrico, Loudoun, Mecklenburg, Prince William, Stafford, and Wise counties. These interviews focused on the impact of data centers on water utilities, planning, and availability.

Subject-matter experts

JLARC staff conducted more than 25 interviews with subject-matter experts across a range of topics related to data centers. These experts included researchers at the Cooling Technologies Research Center at Purdue University, Lawrence Berkeley National Laboratory, National Renewable Energy Laboratory, Occoquan Watershed Monitoring Laboratory, and Rutgers Noise Technical Assistance Center; experts at engineering, law, and real estate firms with experience working with data centers; and leading data center construction materials and equipment manufacturers, such as a steel fabricator and generator manufacturer.

Contracts with consultants

JLARC contracted with faculty from the Weldon Cooper Center for Public Service at the University of Virginia (Weldon Cooper Center) to develop an independent energy demand forecast for Virginia and its utilities. JLARC also contracted with consulting firm Energy + Environmental Economics (E3) to model how data center growth in Virginia is likely to affect future generation and transmission needs and whether the associated costs of system changes could be passed on to residential ratepayers. E3's work was divided into two projects: (1) grid modeling and (2) cost of service and rate impacts.

Additionally, JLARC contracted with Terance Rephann and Joao Ferreira, regional economists at the Weldon Cooper Center, to assist in the economic impact analysis. The methods used for the economic impact analysis are described in Appendix D.

Weldon Cooper Center energy demand forecast

WCC was contracted to develop an independent energy demand forecast for Virginia that accounts for the expected growth of the data center industry. WCC collected data on historical retail energy sales for Dominion Energy, Appalachian Power Company (APCO), and utilities serving the rest of Virginia. WCC collected additional data on retail energy sales to *data center* customers for the utilities that currently serve most of the Virginia data center industry: Dominion, Northern Virginia Electric Cooperative (NOVEC), and Mecklenburg Electric Cooperative (MEC). WCC also collected data on metered load forecasts for data center customers in the Rappahannock Electric Cooperative (REC). REC does not currently have any operational data center customers, but a substantial number of new, large data center campuses are planned to be built in REC's distribution service territory.

Using historical energy sales data, WCC applied advanced statistical methods to develop an *unconstrained energy demand* forecast for Virgina. The unconstrained demand forecast shows what demand would be before accounting for constraints like the ability to build enough energy infrastructure to meet demand. WCC also developed a forecast for *half of unconstrained demand* to provide a lower-growth scenario for analysis purposes. Finally, WCC developed a *no new data center demand* forecast so that the effects of the industry on energy demand could be isolated for analysis purposes. WCC's forecast made several projections, including baseload demand growth from all non-data center customers, demand growth from data center customers, and demand growth from electric vehicles. Additional details on the data and statistical methods used to develop the forecast are detailed in WCC's final report to JLARC staff.

WCC's forecasts cover the period from 2025 to 2050 because VCEA requires carbon emitting generation owned by Dominion and APCO to be retired by 2045 and for the utilities to have all energy from non-carbon emitting sources by 2045 (Dominion) or 2050 (APCO). However, because forecasts become more speculative the farther out they go, this report shows energy demand forecasts up to 2040. The energy demand forecasts for later years are detailed in WCC's final report to JLARC staff.

One of the limitations of the WCC forecasts is that historical data does not fully capture some of the trends that are likely to drive future data center growth, such as how artificial intelligence (AI) will be developed and deployed. However, the unconstrained demand forecast is within the bounds of what can be expected in the next five-plus years based on the electric service and construction agreements that utilities report having in place with data center customers. It is important to note that because forecasts were developed using actual, historical energy sales, they are not subject to distortion by speculative capacity requests from developers or data center companies.

Energy + Environmental Economics grid modeling (project 1)

E3 developed a model of the regional PJM generation and transmission grid. E3 then converted the WCC *energy* demand forecasts into *peak load* demand forecasts that estimate the highest overall power demand that would be placed on the grid each year, under different scenarios. The peak load forecast considered daily and seasonal energy use trends and weather patterns. E3 then modeled three main demand scenarios. For each of the demand scenarios, the model considered the most feasible and economical approaches to meeting infrastructure needs with and without the requirements of the Virginia Clean Economy Act (VCEA).

- Scenario 1: unconstrained demand, with and without VCEA. E3 also modeled variations where unconstrained demand and VCEA requirements could be met by using high levels of nuclear and renewable generation or by better regional coordination across PJM.
- Scenario 2: half of unconstrained demand, with and without VCEA.
- Scenario 3: no new data center demand, with and without VCEA.

E3's modeling used industry standard approaches and tools used for electric utility and state energy planning purposes. The model applied constraints on the amounts of infrastructure that could be built by 2030 using historical build rates, relaxed those constraints for 2035, and removed most constraints for 2040 and following years. Modeling was based on state and federal laws and regulations in place in 2024. For VCEA scenarios, the model followed the "letter of the law" and assumed that certain requirements—such as the Renewable Portfolio Standards and associated Renewable Energy Certificate requirements for investor-owned utilities—would not apply to electric cooperatives. This assumption has a significant impact because a majority of future data center growth is expected to occur in the electric cooperatives' distribution service territories. Societal costs, such as the social cost of carbon, were not explicitly included in the model. Additional details on the exact methods and assumptions used to develop the model are detailed in E3's final report to JLARC staff.

For each scenario, the model predicted the mix of generation and transmission capacity that would be needed to meet demand, the resulting mix of generation energy sources (including energy imports), and their associated emissions. Outcomes were developed for the Dominion transmission zone, Virginia, and the PJM region. The model also predicted system costs for the Dominion transmission zone, where most data center growth is expected to occur. Each scenario outcome was tested to ensure that the system being built would be functional and meet industry standard reliability requirements.

E3's grid modeling covers the period from 2025 to 2050 because VCEA requires all carbon emitting generation owned by Dominion and APCO to be retired by 2045 and for the utilities to have all energy from non-carbon emitting sources by 2045 (Dominion) or 2050 (APCO). However, because energy demand forecasts and generation options become more speculative in further out years, this report only shows model results up to 2040. The model's results for later years are detailed in E3's final report to JLARC staff.

Energy + Environmental Economics cost of service and rate impact analysis (project 2)

For the cost-of-service analysis, E3 examined how costs were being incurred and allocated to different customer classes under the rate structures in place at Dominion Energy, NOVEC, and MEC. The purpose of this analysis was to determine if the current rate structures were wholly recovering costs from the customers who are incurring those costs. E3's cost-of-service analysis was done using industry standard approaches and tools for electric utility planning purposes. Additional details on the exact methods and assumptions used in this analysis are detailed in E3's final report to JLARC staff.

For the rate impacts analysis, E3 focused on how changing demand could affect generation and transmission costs for residential ratepayers in Dominion's distribution service territory. Dominion was chosen because of its large size and concentration of data centers. Residential rate changes were a key focus because they show how Virginia households could be affected by growing data center demand and are indicative of how other customers, such as businesses, might be affected.

E3's analysis of rate impacts followed three steps. First, E3 estimated total costs that would be attributable to the Dominion transmission zone, under the different energy demand scenarios discussed above, using its grid model. Second, for the Dominion distribution service territory, E3 estimated how costs would be allocated to residential customers, assuming that the company regularly reallocated costs to its different customer classes using current state- and federally approved allocation methodologies. Third, E3 translated these costs into the incremental cost per kilowatt-hour that would be passed on to residential ratepayers.

E3's rate impact analysis was limited to generation and transmission cost increases that could be attributed to growing data center demand. The analysis captures the cost of transmission needed to increase capacity into the Dominion transmission zone (interzonal transmission) and to interconnect with new generation sources. A significant portion of potential future transmission costs, associated with transmission projects *within* the Dominion transmission zone (intrazonal transmission), were not captured because these projects and their costs cannot easily be predicted. The analysis did not consider potential changes to distribution rates because most increases in distribution costs from the data center industry are effectively allocated to and recovered from these customers. E3's analysis also did not consider how Dominion's allowable profit margin would factor into rate impacts.

JLARC staff converted E3's rate impact data to show how a typical residential customer, using 1,000 kilowatt-hours of energy per month, could be affected. JLARC staff's conversion included an adjustment to account for Dominion's allowable profit margin but did not incorporate several other costs that affect the total residential bill. Consequently, Dominion's total residential bill projections, from its integrated resource plan, show much larger overall increases than the numbers presented in this report. Dominion's projections apply to the whole residential bill and include several costs that are not captured in JLARC's analysis, such as distribution costs and the cost of some additional transmission and generation projects that may not be solely attributable to data centers. Dominion's residential bill projections are also in nominal dollars that have been adjusted upward using an inflation assumption whereas JLARC's are held in constant (or real) 2024 dollars to show the real growth of costs that consumers will experience, independent of inflation. The demand forecast that Dominion uses in its rate projections is similar to the WCC unconstrained demand forecast but substantially higher than the half of unconstrained demand forecast.

Site visits

JLARC staff conducted site visits to two operational data centers in Virginia, including one in Loudoun and one in Henrico. Staff conducted these site visits to better understand how data centers are designed and operated. For example, staff observed the data halls, power and cooling systems, and backup generators, and listened to noise levels throughout the facilities. Staff also spoke with a variety of personnel at the data centers, including facility operations managers and operational and maintenance staff.

Additionally, JLARC conducted multiple site visits to observe areas with data center development and neighborhoods with nearby data centers. Two of these site visits were led by stakeholder groups with extensive participation in local zoning processes and studies of data centers. JLARC visited eight neighborhoods close to operational data centers or data centers in various stages of development. At all but one of those locations, JLARC staff spoke with residents about their perspectives on the data centers. Additionally, JLARC visited a commonly used trail adjacent to a data center and visited land within Manassas National Battlefield next to property rezoned for a data center.

Data center inventories

JLARC staff developed an inventory of the operational data centers in Virginia. This inventory was used to map the presence of the industry in Virginia. The inventory was based on data provided by DEQ listing data center sites with active air emissions permits (which all Virginia data centers have for their diesel generators). This data was as of August 2024. Staff used the address field in this data to search county real estate assessment records, using these records to (i) confirm the address was associated with a data center and (ii) identify the size of the site (in terms of acres), the number of buildings on the site, when they were built, and their size (in terms of square feet). In a few instances, county records did not list the size of the building. In these instances, JLARC staff estimated the size of the building(s) on the site based on the total capacity (megawatts) of the generators permitted by DEQ.

Staff cross-referenced this information where possible, using publicly available information from data center company websites, the Existing and Proposed Data Centers map developed by the Piedmont

Environmental Council, and other websites that track the data center industry, such as Datacenter-Hawk. From this cross-referencing, JLARC staff identified a few sites that appeared to be data centers but were not associated with a DEQ permit. In these instances, JLARC staff estimated the capacity of the site (megawatts) based on the size of the building(s) listed on the site's real estate assessment record.

JLARC staff also developed a list of data center sites currently under construction, planned, or proposed in Virginia. This information was used to assess where data center growth is expected to occur in the state. To develop this inventory, staff monitored media articles announcing new and proposed data center development, such as those published by Data Center Dynamics and local news outlets. Staff also identified information about proposed data center sites by reviewing local data center-related zoning and permitting requests.

Data collection and analysis

Local data center tax revenue

JLARC staff calculated the proportion of local revenue that comes from data centers by collecting data center tax revenue from localities and comparing it to their total local revenue reported in the Auditor of Public Accounts' Comparative Report of Local Government Revenues and Expenditures for FY23.

Data center generator permit, emissions, and violations data

DEQ provided JLARC staff air permit data for Virginia data centers (who were identified by DEQ), including data center permitted generator numbers and energy capacities, maximum allowed annual emissions, and actual emissions from 2015–2023. Additionally, JLARC staff used DEQ annual point source emission data, enforcement action data (including notices or violations and any charges assessed), and National Emissions Inventory data for Northern Virginia in 2017 and 2020.

JLARC staff created summary statistics of data center permit information (such as generator numbers and maximum allowed emission) and actual emissions and examined trends across time, regions, and localities. Using a map generated through JLARC's data center inventory, JLARC staff also examined clusters of data centers and cumulative local emissions from data centers.

To understand how data center emissions compare to other industries and contribute to overall emissions, JLARC staff compared data center emission and violation data to that of other Virginia air permit holder groups from 2015–2023. Additionally, JLARC staff estimated the current and potential portion of Northern Virginia air emissions resulting from data centers using 2020 National Emissions Inventory data.

Data center water use

JLARC staff received 2023 data center water usage information from water utilities serving Fairfax, Henrico, Loudoun, Mecklenburg, and Prince William counties as well as the town of Wise. Usage was typically reported for anonymous, individual data center buildings. However, one utility shared combined data for all of their data centers buildings, and one shared all water meter data for data center companies but did not combine use by building. (Some data centers have multiple water lines.) Reclaim water use amounts were identified in the data. Two utilities shared annual usage data; three shared monthly usage data; and one shared daily usage data. Five utilities were able to share some amount of information related to data center water use trends since 2019 or later. All utilities shared their total annual customer base water usage for 2023.

JLARC staff used this data to calculate individual and cumulative data center water usage amounts, including the portion of a local utility's water that goes to data centers. JLARC also examined data center water usage seasonal trends and trends in recent years. JLARC analyzed data center water usage relative to other industries and water users in Virginia based on DEQ's 2023 Annual Water Resources reports; non-agricultural, non-public utility withdrawal data shared by DEQ; and the U.S. Energy Information Administration's 2012 Commercial Buildings Energy Consumption Survey water use statistics.

Land conversion due to data centers

JLARC estimates of land conversion due to data centers are based on data center development land area summary statistics calculated in JLARC's data center inventory. These land area amounts were compared to statewide and locality natural land losses recorded in the U.S. Department of Agriculture's 2022 Census of Agriculture state-level data and the federal Multi-Resolution Land Characteristics Consortium's National Land Cover Database Enhanced Visualization and Analysis tool.

Proximity of data centers to residential zones

JLARC staff analyzed the distance between operational Virginia data center sites and residential zoning. This analysis was limited to eight localities that account for the vast majority (93 percent) of data center sites in the state. JLARC measured the distance between each operational data center site and the nearest residential zoning using the interactive maps on localities' websites. This measurement indicates the distance between property lines, but the distance between data center buildings and homes is greater because data center buildings tend to be located away from the property line. JLARC staff captured the smallest distance to residential zoning across the multiple parcels that comprise a single data center site. JLARC focused on residential zoning because the zoning classification reflects uses of a property permissible under current local ordinances. However, this approach sometimes *overstates* the distance between a data center site and residences in situations where land is zoned residential but contains no homes. The reverse is also true; this approach sometimes *understates* the distance between data center sites and residences in situations where land contains homes but is not zoned residential. JLARC summarized the proportion of data center sites very close to residential zoning (defined as within 200 feet, which is approximately half the length of a football field) and somewhat close to residential zoning (defined as within 500 feet, which is approximately 1 ½ times the length of a football field) (Table B-1).

JLARC also analyzed the change over time in the proportion of data center sites near residential zoning. For each data center site in the analysis, JLARC identified whether the site existed in 2015 using annual DEQ data about air emission permits, which Virginia data center sites have for their diesel generators. For the group of data center sites with any generators reported to DEQ in 2015, JLARC calculated the proportion within 200 and 500 feet of residential zoning. JLARC then compared those proportions to the proportions of all data center sites within those specified distances to examine whether data center proximity to residential zoning has increased over time.

TABLE B-1
Proportion of data center sites near residential zoning varies by Virginia locality

Locality	Proportion of data center sites within specified distance of residential zoning: 200 feet	500 feet	Total data center sites
Loudoun	24%	34%	71
Prince William	21%	21%	24
Fairfax	55%	70%	20
Henrico	38%	38%	8
Chesterfield, Culpeper, Fauquier, Virginia Beach [a]	25%	38%	8
Total	29%	37%	131

SOURCE: JLARC analysis of localities' interactive map websites and JLARC inventory of operational data centers.
NOTE: Six data center sites were excluded from the analysis because data on proximity to residential zoning was not available or reliable.
[a] These four localities are combined because the number of data center sites in each locality is very small.

Document and research literature review

JLARC staff reviewed numerous documents and literature pertaining to data centers, such as:

- Virginia state laws, regulations, and policies relevant to energy, natural and historic resources, land use, and noise;
- studies, reports, data, and other information on data center market size and forecasting data center industry growth;
- reports, presentations, and regulatory filings from Dominion Energy, electric cooperatives, and the PJM regional transmission organization, including those related to energy load, load forecasts, and transmission, generation, and distribution projects;
- research literature and stakeholder reports on natural and historic resources; data center backup power and cooling technologies; and data center, other land use, and technology impacts on natural and historic resources;
- federal, state, and local government reports, assessments, webpages, and other documents on natural and historic resources, data center, other land use, and technology impacts on these resources, land use best practices;
- local comprehensive plans, ordinances, and policies relevant to land use and noise;
- local government presentations and reports relating to data centers including documents prepared by staff, consultants, and workgroups;
- summaries of local approaches to data center regulation and recommended practices;
- documents and journal articles describing the science of sound waves, sound modeling processes, ways to reduce sound levels, and government approaches to regulating sound; and
- local, national, and international news media coverage of the data center industry.

Review of local ordinances and specific data center requests

JLARC staff conducted an in-depth examination of the way nine localities in Virginia govern data centers. The review included localities with the most existing data centers in Virginia (Loudoun, Prince William, Fairfax, Henrico, Mecklenburg), as well as several localities that have recently approved their first data centers (Caroline, Fauquier, Stafford, Warrenton). JLARC staff searched for ordinances specific to data centers, as well as other ordinances applicable to data centers due to their location or use category. The review focused on local rules regarding density (e.g., height, lot coverage), architecture (e.g., building materials), site layout (e.g., building setbacks), landscaping, and equipment screening. When specific to data centers, local rules related to environmental, water use or cooling systems, and electricity infrastructure were also identified.

Additionally, JLARC reviewed staff reports for 19 specific data center requests to local elected officials. These reports provided elected officials with information about requests for rezonings, special permits, and exceptions to local ordinances. JLARC staff reviewed reports from Caroline, Fairfax Henrico, Loudoun, and Prince William counties and the town of Warrenton. The purpose of reviewing these staff reports included learning about the types of potential positive and negative impacts from data centers, the types of conditions beyond minimum requirements that developers committed to, the standards against which local staff evaluated data centers, the frequency of data center development that was not by right, and the alignment between staff recommendations and the decision of elected officials.

Appendix C: Agency responses

As part of an extensive validation process, the state agencies and other entities that are subject to a JLARC assessment are given the opportunity to comment on an exposure draft of the report. JLARC staff sent relevant portions of the exposure draft to the State Corporation Commission (SCC), Virginia Economic Development Partnership (VEDP), Virginia Department of Environmental Quality, Virginia Department of Historic Resources, Dominion Energy, Northern Virginia Electric Cooperative, and Rappahannock Electric Cooperative.

Appropriate corrections resulting from technical and substantive comments are incorporated in this version of the report. This appendix includes response letters from the SCC and VEDP.

JEHMAL T. HUDSON
COMMISSIONER

SAMUEL T. TOWELL
COMMISSIONER

KELSEY A. BAGOT
COMMISSIONER

COMMONWEALTH OF VIRGINIA

STATE CORPORATION COMMISSION

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November 22, 2024

Mr. Hal E. Greer, Director
Joint Legislative Audit and Review Commission (JLARC)
919 East Main Street, Suite 2101
Richmond, VA 23219

Dear Mr. Greer:

The State Corporation Commission appreciates the opportunity to review the draft of relevant portions[1] of the JLARC report, *Data Centers in Virginia* provided to Staff on November 13, 2024. The Commission Staff provided its high level feedback to JLARC Staff during a meeting held on Friday, November 22, 2024.

Please let us know if we may be of further assistance.

Respectfully submitted,

Jehmal T. Hudson
Chairman, State Corporation Commission

[1] Sections 3 and 4, and Appendices F, G, I, and J.

VEDP | Virginia Economic Development Partnership

November 21, 2024

Mr. Hal E. Greer, Director
Joint Legislative Audit & Review Commission
919 East Main Street, Suite 2101
Richmond, VA 23219

Re: VEDP response to the draft JLARC report, *Data Centers in Virginia*

Dear Mr. Greer:

Thank you for providing an opportunity for us to review relevant sections of chapters 1, 2 and 7 of the Joint Legislative Audit & Review Commission's (JLARC's) draft report, *Data Centers in Virginia*.

The content we reviewed provides a helpful overview of the data center industry and its importance to the Commonwealth. As the report highlights, data centers are key hubs of the world's digital infrastructure, and their concentration in Virginia has helped establish the Commonwealth as a global tech hub. We particularly appreciate your meticulous survey of the data center industry's presence in Virginia, which accounts for over 63 million square feet of data center space across 150 sites and directly employs more than 8,000 people, in addition to supporting tens of thousands of additional jobs.

Since your last comprehensive review of the industry in 2019, the geographic distribution of data centers across Virginia has changed considerably. Although many of the legacy assets are still concentrated in Northern Virginia, the industry has become an important opportunity for the entire Commonwealth. This expansion, particularly into rural areas, has been facilitated by technologies such as Artificial Intelligence, which are less constrained by latency requirements compared to other applications. Reflecting this trend, seven localities that previously lacked data centers have either approved new campuses or have pending applications, including several rural and "distressed" areas. VEDP's current project pipeline suggests that the spread of data centers across more localities is expected to continue, provided that Virginia continues to offer a competitive sales and use tax exemption.

Your report also demonstrates the significant and far-reaching impact of the data center industry. Notably, the analysis estimates that the data center industry supports an impressive 74,000 jobs, $5.5 billion in labor income, and $9.1 billion in Virginia GDP overall to the state economy annually. In particular, we appreciate that your report shines a spotlight on the significant knock-on effects of the industry that extend to virtually every corner of the Commonwealth.

VEDP strongly agrees with the report's finding that the sales and use tax exemption has been an important part of the industry's growth and continues to drive site selection and expansion

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decisions. VEDP has responsibility for administering, in cooperation with the Department of Taxation, this important program on behalf of the Commonwealth and is pleased to see that new data collected by VEDP is serving to strengthen transparency. Your analysis adeptly leverages this data to demonstrate the significant state and local tax revenues generated by the industry.

This valuable report comes at a critical juncture for the data center industry. Coming on the heels of significant growth in recent years, the industry is expected to see continued, strong growth driven by demand for digital services and the emergence of new technologies, like Artificial Intelligence. These trends raise important questions about the implications of this growth.

Your report underlines various considerations that legislators will need to balance as they think about the future of the state's support for the data center industry. You correctly point out that sustaining the growth of the industry and its critical contribution to Virginia's economy will require action on the current 2035 sunset of the data center sales and use tax exemption. Allowing the existing exemption to sunset would result in development shifting to competing markets, and those effects are likely already beginning to be felt given the long timeframes the industry uses to analyze their investments.

Nonetheless, VEDP recognizes that balancing competing interests may prompt legislators to seek out a new paradigm for support that navigates a challenging middle ground. The report is helpful in providing a number of different policy options for them to consider. In the context of thinking about these different options, we strongly agree with the report's warning that saddling an incentive program with competing policy priorities is not sound economic development practice. Furthermore, VEDP would caution against any action that could constitute a legal or moral failure to deliver on commitments to companies that have chosen to invest in Virginia and have entered into performance agreements or memoranda of understanding with the Commonwealth. This could expose the Commonwealth to legal risks and seriously undermine our credibility with prospective investors in the future.

As always, we appreciate the professionalism and engagement of JLARC staff during the project and compliment your team on its insightful analysis and reporting.

Sincerely,

Jason El Koubi
President & CEO

Appendix D: Economic impact modeling of the data center industry

Weldon Cooper Center staff conducted economic impact analyses of Virginia's data center industry using IMPLAN (IMpact analysis for PLANning) software. IMPLAN has been used in many economic impact studies and is one of the most common tools used in economic impact analysis. Models here were built using 2022 IMPLAN Pro data released in November 2023 that utilizes a 546-sector IMPLAN sector scheme (IMPLAN® model. n.d.). Tables were customized for Virginia and two of its regions using the software.

Input-output analysis using the model produces industry-specific multipliers that indicate how economic activity in one sector of the economy affects the overall state or regional economy. For this study, we were interested in how changes in the data center industry affect the state and regional economy. Outcome variables examined include total employment, state GDP, and labor income.

For estimating the impact of the industry net of the state data center exemption, the opportunity cost of state funds was accounted for by increasing government spending, equivalent to the exemption amount.

Analysis included customization of IMPLAN sector for data centers to better reflect nature of the industry

Tracking the size and growth of the data center industry is challenging because of the absence of a specific industrial classification in government statistics. Data center activity often appears merged with the primary business operations of their parent firms, making their identification difficult[i].

The North American Industrial Classification System (NAICS) code 518210—Data Processing, Hosting, and Related Services—is typically used as a proxy for data centers, but this approach introduces what is usually referred to as "aggregation bias," as this category encompasses various unrelated activities that have a far higher representation in the sector than only data centers. For instance, an analysis of Virginia's 2016 employment data for that sector (518210) reveals that only 15 percent of the total employment in the sector was data center employment, with other data centers, cloud computing, and cybersecurity-related support services making up perhaps 2–5 percent more. Indeed, most employment in this sector involves other IT services, such as document scanning and software development, particularly in federal IT contracting in Northern Virginia. (See *Data Centers and Manufacturing Incentives*, JLARC 2019).

Data center employment is also dispersed across other industries. An examination showed that only 41 percent of data center jobs were classified under data processing, hosting, and related services. Significant portions were found in sectors like "wired telecommunications carriers" (30 percent), "telecommunications resellers" (10 percent), and "all other telecommunications carriers" (4 percent). This analysis excluded many enterprise data centers and colocated firms, whose employment is often reported under other business functions, further complicating efforts to track the industry accurately.

The IMPLAN sector for data centers that corresponds to the 518210 NAICS code for data centers is "436 - Data processing, hosting, and related services." However, using this sector introduces significant bias, as data centers represent only a small portion of its total activity. More importantly, the expenditure patterns of this IMPLAN sector do not reflect the specific characteristics of data center operations. Because of this, there is a substantial mismatch between the commodity demand and value-added characteristics of the IMPLAN sector 436 and what we know of data center expenditure patterns. For instance, in 2020, IMPLAN data showed that less than 1 percent of gross output is spent on "electricity transmission and distribution" (0.68 percent) and water, sewage, and other systems (0.02 percent) even though data center industry reports estimate that electricity alone accounts for 40 percent of data center operating expenditures[ii]. Data center representatives also estimated energy accounts for about 40 percent of their operating costs during structured interviews. Similarly, employee compensation is overestimated in the IMPLAN model, accounting for 24 percent of output compared with 15 percent in industry-specific studies. This may lead to an inflation of induced economic impacts by overstating the income distributed to households.

In income distribution, little is known about other aspects of data center value added that are important for estimating activity impact, such as profit generation, distribution, and taxes paid. Indeed, data centers have the potential to contribute to local economies through tax payments, which are then reinvested via local government spending. However, IMPLAN's tax estimation methodology is quite generic and may not accurately reflect county- and state-level tax structures and exemptions. Therefore, modeling alternative tax scenarios with more realistic assumptions can help better estimate the local economic impacts of data centers.

The reliance on conventional and standardized IMPLAN sectors, particularly when key inputs are significantly misrepresented, leads to biased results in economic impact studies. Best practices in economic analysis suggest customizing expenditure patterns to more accurately reflect the unique characteristics of data center operations. Therefore, the expenditure patterns for IMPLAN sector 436 regarding electricity were increased to 40 percent and employee compensation was reduced to 15 percent. Sensitivity analysis was performed to see how changing these percentages affected results. For operational impacts, for example, customizing the IMPLAN sector to include 40 percent of electricity consumption lowers the employment multiplier for data center operations approximately 20 percent.

Analysis includes two modeling phases

This analysis was split into two phases, the construction phase (capital spending for initial development of the data center) and the operations phase (ongoing) to help policymakers better understand the industry's short-term and long-term impacts. The construction phase corresponds to the initial years of data center development and what must be put in place before a data center "works." The operations phase accounts for the impact of all the expenditures after the data center opens independent of whether they are considered capital or operational expenditures in their budget.

Construction phase

Information collected by VEDP from data centers using the exemption was used to determine amounts of capital spending by data centers to include in the analysis (Table D-1). The percentages of spending by capital spending category are consistent with other research[iii].

TABLE D-1
Initial capital spending of data centers using the exemption (by year)

Year	Land acquisition	Building and site improvements	Exempt equipment or software	Other
2021	$865 M	$3,927 M	$14,333 M	$940 M
2022	1,030	2,264	9,614	1,615
2023	1,689	5,309	16,009	1,002
Total	**$3,585 M**	**$11,501 M**	**$39,957 M**	**$3,557 M**
%	6.1%	19.6%	68.2%	6.1%

SOURCE: VEDP.

The VEDP data includes only data centers that benefited from the tax exemption. These data centers correspond to 92 percent of the data center activity in Virginia, according to DEQ records and JLARC staff analysis of locality real estate records to obtain data center square footage. Statewide, 8 percent of data centers were not included in those numbers. By region, it is estimated that only 5.45 percent of the data centers in Northern Virginia are nonexempt (94.55 percent are exempt) and 21 percent in other regions of Virginia are nonexempt. Capital spending was increased to account for the nonexempt data centers, and this new amount was assumed to be the direct impact of the industry (Table D-2).

TABLE D-2
Initial capital spending of data centers using the exemption (by region)

Year	Land acquisition	Building and site improvements	Exempt equipment or software	Other
Northern Virginia	$3,316 M	$10,638 M	$36,955 M	$3,290 M
Other regions	632	2,027	7,041	627
Virginia total	**$3,948 M**	**$12,664 M**	**$43,997 M**	**$3,917 M**

SOURCE: Weldon Cooper Center.

However, not all of this spending impacts Virginia's economy, and a critical assumption of economic impact analysis is the share of capital expenditures that are generated locally. Land acquisition is not traditionally included in impact models since this represents a monetary flow or transfer of funds that will not necessarily translate into a shock in local production. The acquisition of computer and related IT equipment is not necessarily done locally, so it should be assumed that part of this equipment comes from outside the region. This is even more true as we examine smaller geographical areas that might not include the entities associated with wholesale, transportation, and production of this type of equipment. Only building and site improvements (construction) should be included as local production. To estimate the indirect impacts, the model included 100 percent of the building and site improvements as construction (specifically IMPLAN industry sector "51 – construction of new manufacturing structures") and 25 percent of the exempt equipment and software expenditures.

The assumptions described above were used to generate indirect and induced impacts of data center capital investment in Virginia, according to average annual capital investment between FY21 and FY23

(Table D-3). Impact estimates were also produced for Northern Virginia and other regions of the state. Analysis of the results indicates that most of the impacts are construction-related (for example 80 percent of the direct employment is construction-related) rather than from manufacturing and installation of IT equipment.

TABLE D-3
Impacts of initial capital investment in Virginia and by region, annual average FY21–FY23

Impact	Employment	Labor income	Virginia GDP	Total output
Statewide				
Direct	35,110	$2,646.6 M	$3,342.1 M	$7,887.7 M
Indirect	9,945	843.8	1,504.2	2,806.8
Induced	13,992	791.9	1,570.9	2,596.8
Total	**59,047**	**$4,282.4 M**	**$6,417.2 M**	**$13,291.3 M**
Northern Virginia				
Direct	27,703	$2,368.5 M	$2,957.6 M	$6,625.6 M
Indirect	5,577	585.4	1,30.1	1,733.3
Induced	7,510	490.3	963.7	1,488.2
Total	**40,790**	**$3,444.2 M**	**$4,951.4 M**	**$9,847.0 M**
Other regions of the state				
Direct	5,761	$406.5 M	$517.0 M	$1,262.5 M
Indirect	1,584	116.6	212.5	418.0
Induced	2,106	107.3	219.6	373.4
Total	**9,451**	**$630.4 M**	**$949.2 M**	**$2,053.9 M**

SOURCE: Weldon Cooper Center economic impact analysis using IMPLAN.

The statewide results do not match the sum of the results for Northern Virginia and other regions of Virginia because, for the sake of simplicity, a multi-regional input-output model was not used. Data center investment in other regions of the state affects Northern Virginia, and vice versa, but they are not accounted for because the model accounts for the impacts in one region only.

Operation phase

As explained above, to accurately describe the impacts of the ongoing operation, the model was customized to include a better perspective of energy and labor costs. For this analysis, the model assumed that 40 percent of operational expenditures are associated with electricity consumption, and that 15 percent of the industry spending was direct labor costs.

Several adjustments were made to VEDP employment information collected from data centers. The employment information VEDP collected from data centers was used to estimate data center direct employment, statewide, in Northern Virginia, and in other Virginia regions. This number was adjusted in several ways. First, the employment number was reduced by half because the VEDP information on employment tends to boost the number of jobs as data centers can account for the jobs associated with contractors or the employees of contractors in addition to data center employees. In input-output terminology, this is an indirect impact of the industry. Several data center representatives stated that 50 percent of their jobs were associated with third-party hiring and the other 50 percent with direct jobs. Because the jobs reported by VEDP were all full time (or full-time equivalents), a factor was applied to transform these jobs to full-time and part-time employment as required by the model. Like for capital spending, employment was increased to account for the nonexempt data centers. This new amount was assumed to be the direct impact of the industry (Table D-4).

TABLE D-4
Model was adjusted to incorporate data center operating characteristics

Region	Employment	Labor income	Total output
Northern Virginia	3,426	$357.4 M	$2,382.7 M
Other regions of Virginia	947	62.0	413.1
Virginia statewide	**4,373**	**$419.4 M**	**$2,795.8 M**

SOURCE: Weldon Cooper.

The results obtained for the impacts of ongoing operation for Virginia are far less than the impacts of capital spending (Table D-5). For example, total employment impacts from a year of data center operations are estimated to be 14,817 jobs compared with total employment impacts of 59,047 jobs for a year of initial capital spending.

TABLE D-5
Impacts of data center operations in Virginia and by region, annual average FY21–FY23

Impact	Employment	Labor income	Virginia GDP	Total output
Statewide				
Direct	4,373	$419.4 M	$1,051.1 M	$2,795.8 M
Indirect	6,615	552.2	1,217.8	2,188.1
Induced	3,830	216.8	430.2	711.1
Total	**14,817**	**$1,188.4 M**	**$2,699.0 M**	**$5,695.0 M**
Northern Virginia				
Direct	3,426	$357.4 M	$956.2 M	$2,382.8 M
Indirect	4,333	441.8	963.9	1,552.5
Induced	1,966	128.4	252.5	389.9
Total	**9,725**	**$927.6 M**	**$2,172.5 M**	**$4,325.1 M**
Other regions of the state				
Direct	947	$62.0 M	$116.5 M	$413.1 M
Indirect	1,106	78.3	185.6	356.9
Induced	556	28.3	58.0	98.6
Total	**2,609**	**$168.6 M**	**$360.0 M**	**$868.5 M**

SOURCE: Weldon Cooper Center economic impact analysis using IMPLAN.

Data center industry impact

Mostly because of the impact associated with initial capital expenditures, data centers in Virginia generate 73,864 jobs per year, corresponding to almost $5,471 million of labor income, $9,166 million of Virginia GDP, and an increase in output of $18,986 million (Table D-6).

TABLE D-6
Summary of initial capital spending and operations impact statewide, annual average FY21–FY23

Impact	Employment	Labor income	Virginia GDP	Total output
Direct	39,483	$3,066 M	$4,393 M	$10,684 M
Indirect	16,560	1,396	2,722	4,995
Induced	17,822	1,009	2,001	3,308
Total	**73,864**	**$5,471 M**	**$9,116 M**	**$18,986 M**

SOURCE: Weldon Cooper Center economic impact analysis using IMPLAN.

Another aspect is that the state government could also opt to spend the exemption money on alternative sources. The alternative scenario was modeled to estimate impacts if the state would use the annual average exemption amount between FY21 and FY23 ($573 million per year) in alternative expenditures (Table D-7). These impacts were used to determine the impact of the industry accounting for the cost of the exemption. Accounting for this alternative use of the exemption amount (or opportunity cost), reduces additional jobs by about 5,000 (to 69,000 additional jobs on net) and reduces additional income and Virginia GDP by $0.4 billion and $0.5 billion, respectively, which are a small fraction of their total impacts (Table D-6).

TABLE D-7
Impacts to the state if the exemption amount was used instead for alternative government expenditures, annual average FY21–FY23

Impact	Employment	Labor income	Virginia GDP	Total output
Direct	3,534	$277.4 M	$359.1 M	$448.0 M
Indirect	403	27.7	48.3	88.5
Induced	1,197	67.8	134.5	222.4
	5,134	**$372.9 M**	**$542.0 M**	**$758.9 M**

SOURCE: Weldon Cooper Center economic impact analysis using IMPLAN.

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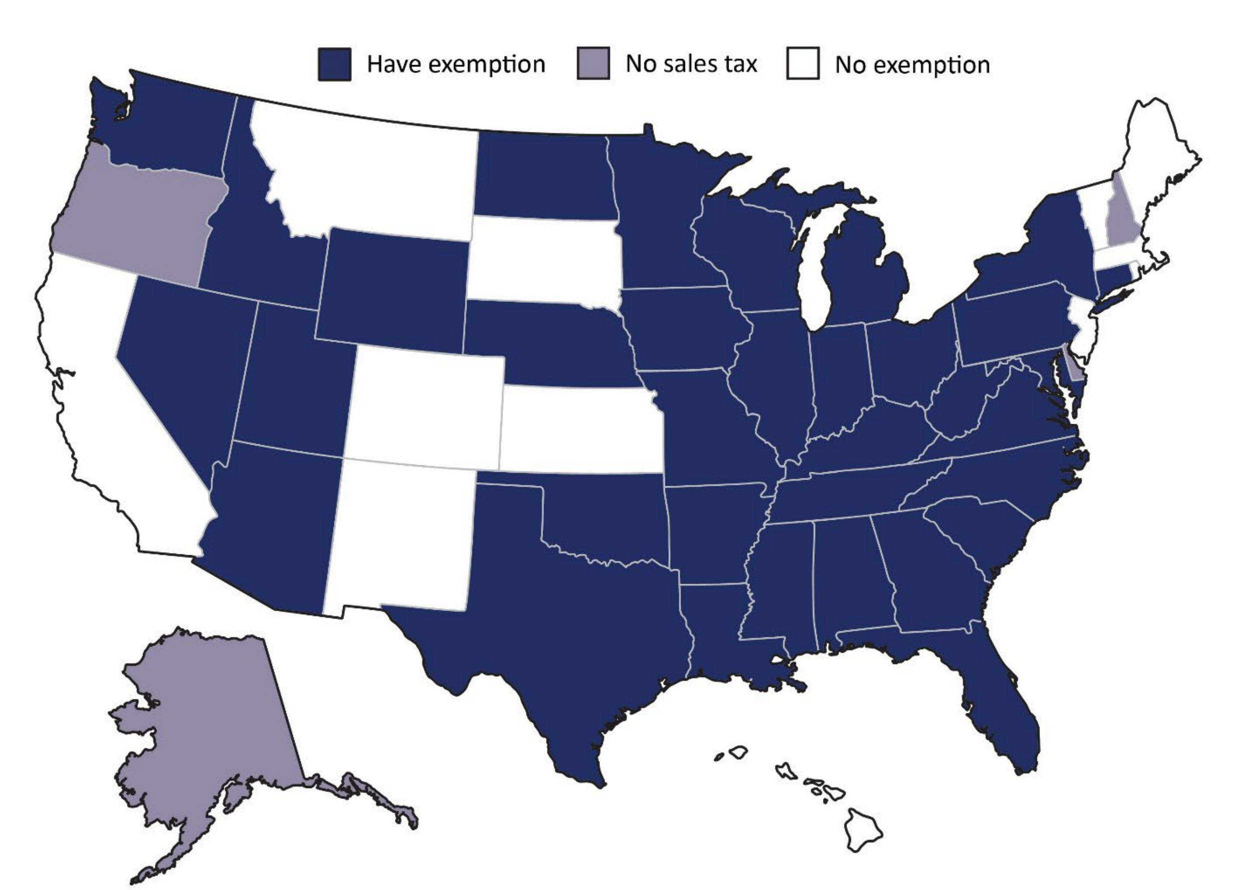
[i] Byrne, David, Carol Corrado, and Daniel E. Sichel. 2018. The rise of cloud computing: Minding your p's, q's and k's. NBER Working Paper 25188.
[ii] Day, Tim and Nam D. Pham. 2017. *Data centers: Jobs and opportunities in communities nationwide.* U.S. Chamber of Commerce Technology Engagement Center.
[iii] Day, Tim and Nam D. Pham. 2017. *Data centers: Jobs and opportunities in communities nationwide.* U.S. Chamber of Commerce Technology Engagement Center.

Appendix E: States with data center sales tax exemptions

Most states either have a sales tax exemption for data centers (34) or do not have a sales tax (Figure E-1). All states bordering Virginia provide a sales tax exemption to data centers.

FIGURE E-1
Nearly all states offer a sales tax exemption for data centers (2024)



SOURCE: State Tax Notes and JLARC staff review of state websites.

Appendix F: Energy infrastructure project impacts and regulation

Construction of new generation and transmission infrastructure can affect the communities and environments where they are built. The extent of any impacts will vary substantially for generation and transmission projects. State and local governments regulate these projects, through review and approval processes. Regulatory processes seek to minimize negative impacts but do not necessarily avoid them altogether. Utilities can implement several grid enhancing technologies to help reduce the need for major new generation and transmission projects, but this does not eliminate the need for new projects.

Construction of new generation and transmission infrastructure can have environmental impacts and is often opposed by local communities

On the generation side, a significant portion of new generation is expected to be solar, and solar facilities have large land demands that can have widespread impacts. For example, a modest 100 MW solar facility would require about 5,000 to 1,000 acres of land in Viriginia. (The rule of thumb is that 5 to 10 acres of solar can generate up to 1 MW of power.) Because of the large land demands, most solar facilities are built in rural areas. Constructing solar facilities typically involves clearing forest land or converting agricultural land to this use, which can have several environmental impacts from habitat loss to affecting stormwater runoff.

Some communities in rural Virginia have been increasingly opposed to new solar facilities, with several counties placing restrictions on solar development or outright denying projects. Community opponents site environmental concerns, impacts on local agriculture, and the effects of solar facilities' industrial appearance on the rural character of their counties. Opponents also often assert that solar facilities do not offer significant economic or other benefits to their communities.

The extent to which a solar project affects the environment and generates community opposition depends on the project. For example, a project that involves clearing 5,000 acres of forest land with multiple streams would have a more substantial environmental impact than a project that is installed on 2,000 acres of fallow pastureland. Similarly, a development located near a residential area or that is visible from the surrounding area could generate more community opposition than one that is hidden from view.

On the transmission side, new transmission lines can fragment forest habitats, create water quality risks at stream and wetland crossings, and reduce scenic quality of nearby historic and recreational resources. Communities are sometimes opposed to new or expanded transmission lines for these reasons. Communities also sometimes oppose new transmission lines because of their undesirable appearance, effect on the use of private properties that are under or adjacent to the lines, effect on the value of nearby properties, and health concerns.

Similar to the generation side, the potential environmental and community impacts of a transmission project can vary greatly from one project to the next. Generally, a "green field" project that involves acquisition of new right-of-way and construction of transmission lines where none currently exist is going to have the highest impact. A project where new lines are built in or adjacent to an existing transmission line will be less impactful, and a project where an existing line is "wrecked and rebuilt" would be the least impactful.

State and local regulation is intended to minimize the impacts of new generation and transmission projects on communities and the environment

Construction of major new generation and transmission facilities is regulated by the state to minimize impacts. Many of these projects are approved by the SCC through a formal case process to determine if a Certificate of Public Convenience and Necessity (CPCN) should be granted. The SCC considers several factors before approving a project and granting a CPCN. These factors include the potential impacts of the project on property owners, the environment, and cultural and historic resources (Table F-1). While these impacts may not be completely avoided, the process encourages the selection of projects and options that best minimize impacts without placing large cost burdens on ratepayers.

Smaller renewable generation projects (<150 MW) can be reviewed and approved by the Department of Environmental Quality through a separate "Permit by Rule" process. While this is not a litigated case process like an SCC approval, projects are reviewed to ensure they conform with the state's requirements.

Localities have some authority over generation projects and transmission and distribution substations but minimal authority over transmission lines. Generation facilities and substations are subject to the same types of local zoning processes as other land uses. Local zoning ordinances specify which zoning districts allow them, whether they require a special permit from elected officials, and whether any design standards (such as landscaping) apply. Additionally, state law requires local reviews of certain entities—including substations—before development to evaluate their alignment with the local comprehensive plan. For transmission lines, CPCN approval deems the transmission line to be in compliance with local comprehensive plans and ordinances. In effect, this means localities do not have any direct authority over most transmission line project approvals or routes. (Although localities can play a role in approving 138 kilovolt transmission lines, which exist in a few parts of the state.)

Solar and similar projects are required to attempt to coordinate an agreement with their host locality. State law requires applicants for solar or energy storage projects to notify localities of their intent to develop and to meet with the locality to negotiate a "siting agreement." This siting agreement can include conditions such as mitigating negative impacts, and if created, must receive a public hearing. However, there is no requirement for this process to culminate in a siting agreement. Failure to achieve a siting agreement does not prevent a developer from initiating the usual local zoning processes for new developments.

Localities do not have approval authority over transmission line projects but can participate in SCC cases either as respondents or public witnesses. As a public witness, a locality can submit written comments, or local representatives can provide comments in person at commission hearings. As a respondent, a locality becomes a participant in the case and can take several additional actions, such as filing for discovery (e.g., to obtain copies of utility analysis or documents supporting the application for a project), filing briefs, providing expert witnesses, and participating in cross examination of witnesses (e.g., utility staff). No matter which approach is followed, the SCC is required to hear and weigh all evidence equally.

TABLE F-1
Criteria that the SCC must evaluate before approving a project and granting a CPCN

Criteria that must be met

- Is not against the public interest [a]
- Will have no material adverse affect on system reliability
- Will have no material adverse affect on rates
- For transmission projects,
  a. the line is needed, [b]
  b. proposed method of installation is justified, [b]
  c. will avoid or minimize adverse impact on (a) scenic assets, (b) historic and cultural resources, (c) the environment, and (d) human health and safety, and
  d. why existing rights-of-way cannot adequately serve the need (presumably only applies when an expanded or new right-of-way acquisition is being requested as part of the project)

Criteria that must be considered

- Environmental impacts
- Human health and safety impacts
- Historical and cultural resource impacts
- Economic impacts, including job creation
- Improvement to service reliability
- Environmental justice considerations

Criteria that are considered, if requested

- Conformance with local comprehensive plans (locality must request) [c]
- Costs, economic benefits, and effect on construction timeline of undergrounding transmission lines (locality must request)

SOURCE: The Code of Virginia § 2.2-235, § 56-265.2, § 56-580, and § 56-46.1.
NOTE: SCC regulations provide additional information on what must be submitted to meet requirements and details what must be provided for transmission projects. SCC guidance also includes a planning and design attachment that provides detailed guidelines to applicants on how to ensure facilities protect natural and historic resources. SCC guidance provides additional information on when a transmission project requires a CPCN, based on specific characteristics. SCC guidance notes that certain transmission projects, such as reconductoring, do not require a CPCN.
[a] This is a general criterion that can be interpreted as the cumulation of all the other criteria weighed against each other. The Code declares some projects meet this goal—such as small renewable generation projects and projects in VCEA—and so do not require SCC to make a determination.
[b] Based on applicant's load flow modeling, contingency analysis, and presented reliability needs.
[c] Localities are explicitly granted right to present evidence that shows existing corridors, as designated in the comprehensive plan, can serve the identified need.

Localities also have three additional authorities under Code. First, localities can request that the SCC consider the costs, economic benefits, and effects on construction timelines of undergrounding transmission lines. Second, localities can establish transmission corridors in their comprehensive plans and provide evidence that new lines should be within those corridors, but it appears this latter authority has been rarely (if ever) used. Third, localities can establish special tax districts that pay for the additional costs of undergrounding transmission lines, although it appears this authority has never been used.

Some stakeholders have said that local governments should have more authority to determine transmission routes and, especially, when transmission lines should be buried underground. While this would make transmission projects more responsive to local needs, undergrounding transmission lines is substantially more expensive and those added costs are currently spread across all utility ratepayers. Any changes to give localities more authority to require undergrounding of transmission lines would need to be accompanied by a change in how costs are allocated to prevent local government decisions from affecting rates paid by customers who do not benefit from undergrounding projects.

Utilities can use grid enhancing technologies to help reduce the need for new generation and transmission infrastructure

Utilities use grid enhancing technologies (GETs), such as reconductoring existing transmission lines, to increase capacity of the transmission system and more effectively use existing generation. For example, Dominion reports that it uses advanced conductors for all its 230 kV reconductor and new build projects, which can increase line capacity by 50 percent. Dominion reported adding or replacing 800 miles of line with advanced conductors as of the end of 2023. Dominion also reports deploying and piloting several other GETs to improve system stability and efficiency. Utilities have an economic incentive to deploy GETs so that they can provide enough transmission capacity to serve fast-growing demand.

SCC staff indicated that, before approving a new transmission line project, they consider whether a quicker and lower-cost approach, such as reconductoring, could be used instead. Staff make this determination by looking at the project proposal, the state need, and whether reconductoring will address the need. SCC staff carry out their own power flow studies and verify thermal issues, voltage issues, and generator deliverability (if applicable).

Appendix G: Virginia Clean Economy Act

The Virginia Clean Economy Act (VCEA) was enacted in 2020 and was intended to drive investment in renewable resources and phase out carbon-emitting generation in the state by 2050. VCEA was passed when energy demand in Virginia was projected to remain relatively flat. Now that demand is growing, largely because of data centers, it will be more challenging to meet these goals than originally contemplated.

The main way VCEA intends to decarbonize generation is by requiring an increasing share of energy sold by Dominion and APCO to come from renewable sources. The share of generation from renewables—the Renewable Portfolio Standard (RPS) requirement—increases each year until it reaches 100 percent (Table G-1). The utilities can meet the RPS requirement by directly building and claiming credit for new renewable generation facilities (mainly solar and wind) and entering into power purchasing agreements with third parties that operate renewable facilities. Utilities receive Renewable Energy Certificates (RECs) for energy from these sources, which are then credited toward their RPS requirement. Utilities can also purchase RECs from the PJM market and use purchased RECs to offset energy produced through carbon generation. Starting in 2025, 75 percent of Dominion's RECs must be from in-state generation sources. VCEA financially penalizes utilities that do not comply with in-state renewables requirements by levying deficiency payments, but in practice utilities may choose to pay those deficiency payments if it is more economical or feasible than securing new renewable generation. The cost of deficiency payments is recovered from utility customers. VCEA sets aside nuclear power as a third category of generation, which in effect can be used to reduce the total amount of renewable energy required.

TABLE G-1
VCEA requires growing share of energy sold in Virginia to come from renewable generation sources, with full decarbonization by 2050

	Percentage of total power sold required to come from renewables (excluding nuclear)	
	Dominion	APCO
2021 (year one)	14%	6%
2025	26	14
2030	41	30
2035	59	45
2040	79	65
2045	100	80
2050	-	100%

SOURCE: The Code of Virginia § 56-585.5.
NOTE: Percentages are the RPS program requirements for selected years; statute sets a percentage for every year. Nuclear power is excluded from the RPS calculation. For example, if one-third of Dominion power is nuclear, then the RPS percentage applies only to the remaining two-thirds of power that is not nuclear. Renewable energy is credited toward meeting RPS requirements through the purchase and retirement of Renewable Energy Certificates (RECs). RECs can be used to offset carbon emissions.

The VCEA's RPS requirements, and their associated REC requirements, do not apply to electric co-operatives (co-ops). This has significant implications because a majority 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. (This is based on JLARC's consultant forecasts, and is corroborated with utility forecasts, utility construction and service agreements, and JLARC staff review of data center projects that are actively under development). Unlike Dominion and APCO, state law allows co-ops to secure energy to meet their growing demand from non-renewable and out-of-state generation sources.

VCEA directs the Virginia Air Pollution Control Board to develop regulations to gradually reduce carbon emissions. VCEA states the board "may establish, implement, and manage an auction program" or "utilize an existing multistate trading system" to achieve this purpose. Initially the state entered into the Regional Greenhouse Gas Initiative (RGGI) to reduce carbon emissions. The state has since withdrawn from RGGI, although the legality of that withdrawal is being challenged in court. A recent state circuit court decision ruled that the regulatory actions the state took to remove Virginia from RGGI were unlawful, but this decision could be appealed to a higher court.

Finally, VCEA requires carbon-emitting generation in Virginia owned by Dominion and APCO to be retired by 2045. However, VCEA allows these utilities to continue operating carbon-emitting generation plants in Virginia past 2045 if taking the plant off-line "would threaten the reliability or security of electric service to customers." Utility decisions to keep plants operating past 2045 must be approved by the SCC.

VCEA also has a presumption against the SCC approving new carbon-emitting generation plants, which applies to investor-owned utilities and co-ops. However, new carbon-emitting plants can be built if the SCC determines they are needed to address threats to the reliability or security of electric service to the utility's customers.

Appendix H: Grid modeling generation capacity and energy source results

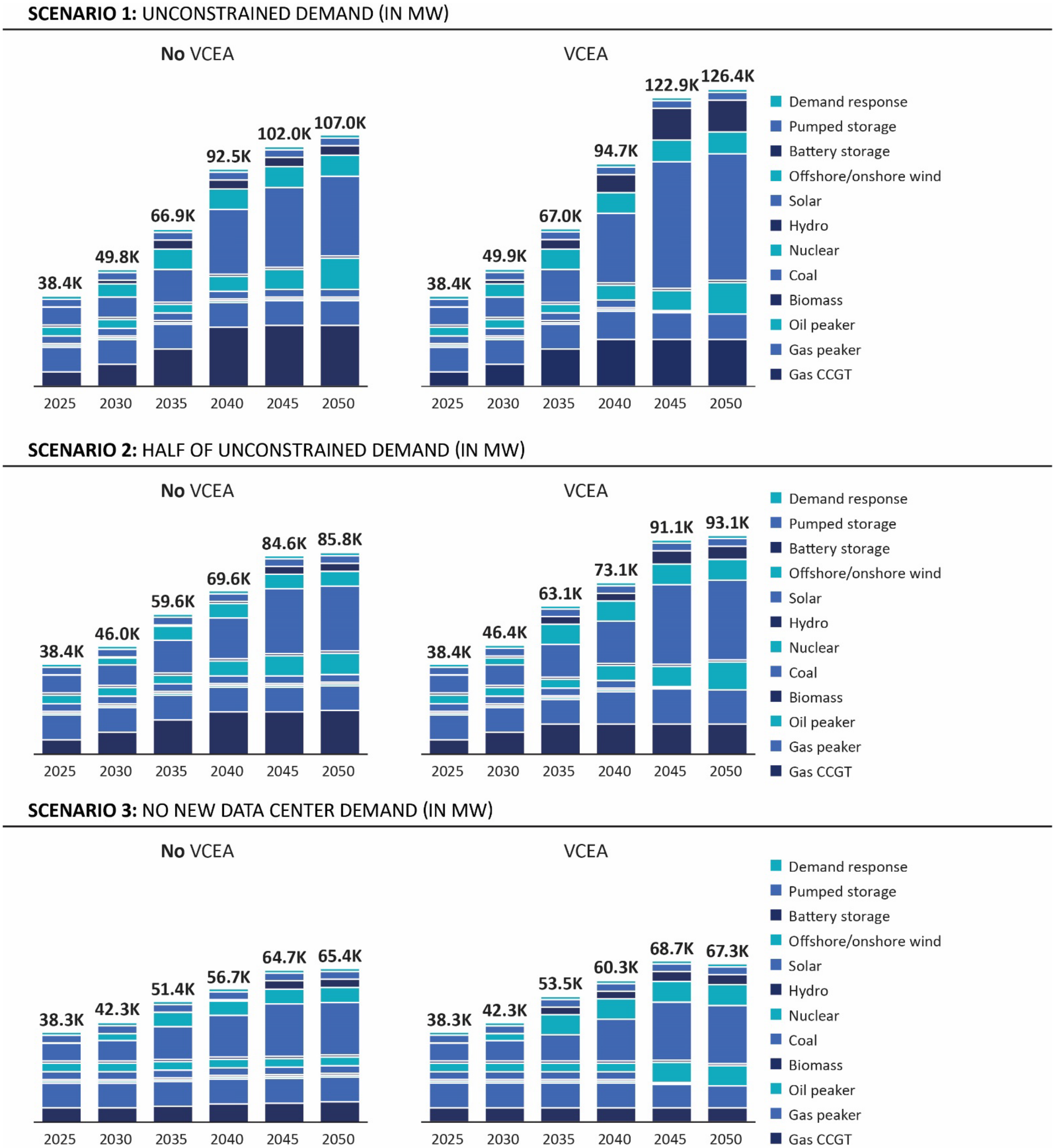
JLARC staff commissioned Energy + Environmental Economics (E3) to develop an independent grid model and project the future generation and transmission infrastructure that would be needed to meet three different demand scenarios. For each of the demand scenarios, the model considered the most feasible and economical approaches to meeting infrastructure needs with and without the requirements of the Virginia Clean Economy Act (VCEA).

- Scenario 1: unconstrained demand, with and without VCEA. E3 also modeled variations where unconstrained demand and VCEA requirements could be met by using high levels of nuclear and renewable generation or by better regional coordination across PJM (not shown in this report).
- Scenario 2: half of unconstrained demand, with and without VCEA.
- Scenario 3: no new data center demand, with and without VCEA.

This appendix provides E3's grid modeling Virginia-level results for the (a) in-state generation capacity that would be needed to meet each demand scenario, by type of generation source and (b) the amount of energy that would be used from each type of generation source. Generation capacity is given in megawatts (MW) of nameplate capacity that would be needed, which can be significantly higher than the firm amount of capacity available from a resource. For example, Virginia solar facilities produce at around 25 percent of nameplate capacity. Generation energy is given in annual tera-watt hours (TWh) of energy used. E3's grid model assumes natural gas plants would be converted to hydrogen fuel in each scenario when VCEA compliance is assumed, starting in 2045. The model assumes that new nuclear generation will not be available until 2035. For additional discussion of E3's grid modelling methodology, see Appendix B.

Results begin on next page.

FIGURE H-1
Generation capacity required 2025 to 2050



SOURCE: E3 grid modeling analysis.
NOTE: Capacity shown is nameplate capacity.

TABLE H-1
Generation capacity required 2025 to 2050, Scenario 1: Unconstrained demand (MW)

No VCEA

Resource	2025	2030	2035	2040	2045	2050
Gas CCGT	6,141	9,391	15,891	25,149	25,937	25,937
Gas Peaker	10,499	10,499	10,499	10,499	10,499	10,499
Oil Peaker	813	813	813	813	813	813
Biomass	765	765	765	765	765	765
Coal	3,230	3,230	3,230	3,230	3,230	3,230
Nuclear	3,708	3,708	3,708	6,388	8,532	13,356
Hydro	929	929	929	929	929	929
Solar	7,596	8,673	13,939	27,503	33,880	33,880
Offshore/onshore Wind	-	5,580	8,656	8,756	8,856	8,956
Battery Storage	116	1,608	3,835	3,835	4,008	4,008
Pumped Storage	3,241	3,241	3,241	3,241	3,241	3,241
Demand Response	1,354	1,354	1,354	1,354	1,354	1,354
Total	**38,393**	**49,792**	**66,861**	**92,462**	**102,043**	**106,967**

VCEA

Resource	2025	2030	2035	2040	2045	2050
Gas CCGT	6,141	9,391	15,891	19,945	19,945	19,945
Gas Peaker	10,499	10,499	10,499	11,976	11,342	10,863
Oil Peaker	813	813	813	813	316	-
Biomass	765	765	765	765	15	-
Coal	3,230	3,230	3,230	3,230	630	-
Nuclear	3,708	3,708	3,708	6,388	8,532	13,356
Hydro	929	929	929	929	929	929
Solar	7,596	8,673	13,939	29,622	53,880	53,880
Offshore/onshore Wind	-	5,580	8,656	8,756	9,216	9,316
Battery Storage	116	1,667	4,014	7,645	13,511	13,511
Pumped Storage	3,241	3,241	3,241	3,241	3,241	3,241
Demand Response	1,354	1,354	1,354	1,354	1,354	1,354
Total	**38,393**	**49,851**	**67,040**	**94,665**	**122,911**	**126,394**

SOURCE: E3 grid modeling analysis.
NOTE: Capacity shown is nameplate capacity.

TABLE H-2
Generation capacity required 2025 to 2050, Scenario 2: Half of unconstrained demand (MW)

No VCEA

Resource	2025	2030	2035	2040	2045	2050
Gas CCGT	6,141	9,391	14,626	18,021	18,021	18,605
Gas Peaker	10,499	10,499	10,499	10,499	10,499	10,499
Oil Peaker	813	813	813	813	813	813
Biomass	765	765	765	765	765	765
Coal	3,230	3,230	3,230	3,230	3,230	3,230
Nuclear	3,708	3,708	3,708	6,388	8,532	9,119
Hydro	929	929	929	929	929	929
Solar	7,596	8,673	13,939	17,340	27,589	27,589
Offshore/onshore Wind	-	2,940	6,016	6,116	6,216	6,316
Battery Storage	116	494	494	892	3,375	3,375
Pumped Storage	3,241	3,241	3,241	3,241	3,241	3,241
Demand Response	1,354	1,354	1,354	1,354	1,354	1,354
Total	**38,393**	**46,038**	**59,615**	**69,589**	**84,565**	**85,835**

VCEA

Resource	2025	2030	2035	2040	2045	2050
Gas CCGT	6,141	9,391	12,856	12,856	12,856	12,856
Gas Peaker	10,499	10,499	10,499	13,709	15,013	14,534
Oil Peaker	813	813	813	813	316	-
Biomass	765	765	765	765	15	-
Coal	3,230	3,230	3,230	3,230	630	-
Nuclear	3,708	3,708	3,708	6,388	8,532	11,854
Hydro	929	929	929	929	929	929
Solar	7,596	8,673	13,939	17,883	33,880	33,880
Offshore/onshore Wind	-	2,940	8,576	8,676	8,776	8,876
Battery Storage	116	878	3,216	3,231	5,590	5,590
Pumped Storage	3,241	3,241	3,241	3,241	3,241	3,241
Demand Response	1,354	1,354	1,354	1,354	1,354	1,354
Total	**38,393**	**46,422**	**63,126**	**73,075**	**91,132**	**93,114**

SOURCE: E3 grid modeling analysis.
NOTE: Capacity shown is nameplate capacity.

TABLE H-3
Generation capacity required 2025 to 2050, Scenario 3: No new data center demand (MW)

No VCEA

Resource	2025	2030	2035	2040	2045	2050
Gas CCGT	6,042	6,042	6,759	7,728	8,016	8,642
Gas Peaker	10,499	10,499	10,499	10,499	10,499	10,499
Oil Peaker	813	813	813	813	813	813
Biomass	765	765	765	765	765	765
Coal	3,230	3,230	3,230	3,230	3,230	3,230
Nuclear	3,708	3,708	3,708	3,708	3,708	3,708
Hydro	929	929	929	929	929	929
Solar	7,596	8,673	13,939	17,733	22,340	22,340
Offshore/onshore Wind	-	2,940	6,016	6,116	6,216	6,316
Battery Storage	116	116	116	609	3,583	3,583
Pumped Storage	3,241	3,241	3,241	3,241	3,241	3,241
Demand Response	1,354	1,354	1,354	1,354	1,354	1,354
Total	**38,293**	**42,310**	**51,369**	**56,725**	**64,695**	**65,421**

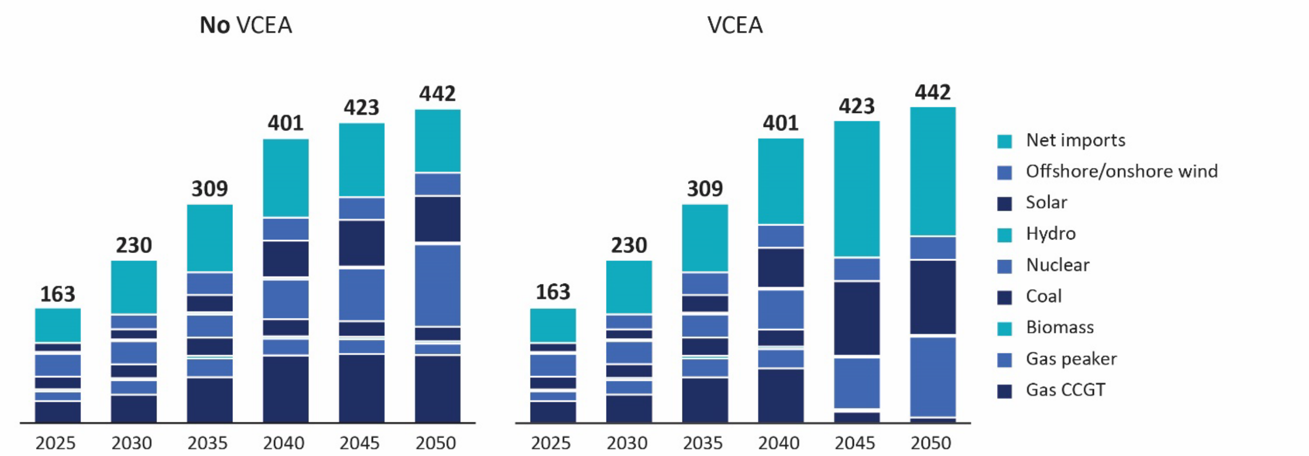
VCEA

Resource	2025	2030	2035	2040	2045	2050
Gas CCGT	6,042	6,042	6,042	6,042	6,042	6,042
Gas Peaker	10,499	10,499	10,499	10,499	9,865	9,386
Oil Peaker	813	813	813	813	316	-
Biomass	765	765	765	765	15	-
Coal	3,230	3,230	3,230	3,230	630	-
Nuclear	3,708	3,708	3,708	3,708	8,532	8,532
Hydro	929	929	929	929	929	929
Solar	7,596	8,673	11,092	17,783	24,669	24,669
Offshore/onshore Wind	-	2,940	8,576	8,676	8,776	8,876
Battery Storage	116	116	3,216	3,216	4,313	4,313
Pumped Storage	3,241	3,241	3,241	3,241	3,241	3,241
Demand Response	1,354	1,354	1,354	1,354	1,354	1,354
Total	**38,293**	**42,310**	**53,465**	**60,256**	**68,682**	**67,341**

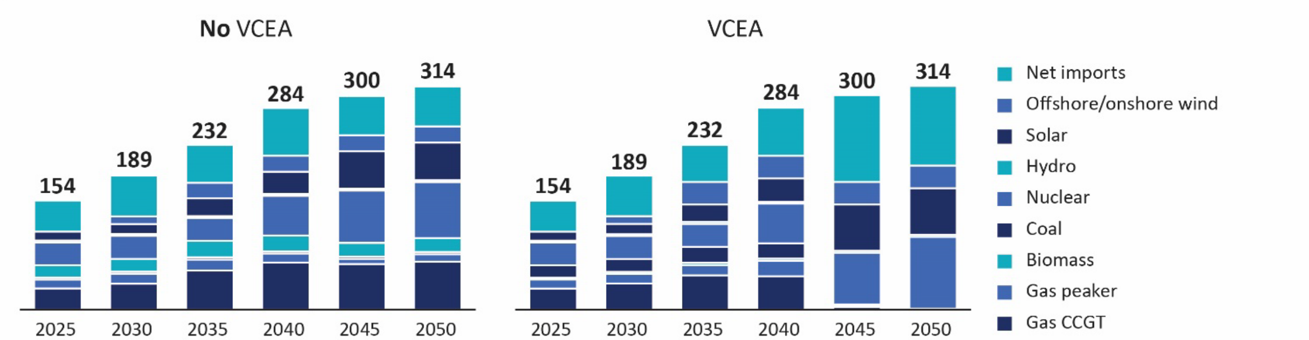
SOURCE: E3 grid modeling analysis.
NOTE: Capacity shown is nameplate capacity.

FIGURE H-2
Energy sources 2025 to 2050

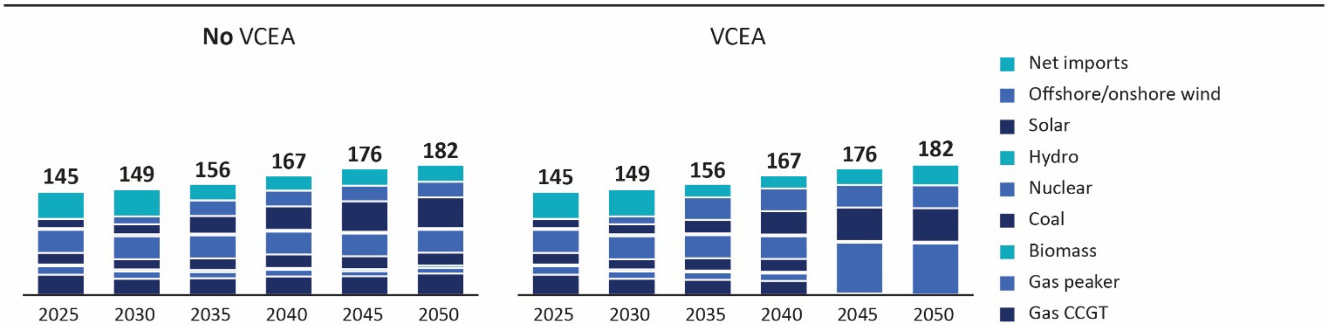
SCENARIO 1: UNCONSTRAINED DEMAND (IN TWH)



SCENARIO 2: HALF OF UNCONSTRAINED DEMAND (IN TWH)



SCENARIO 3: NO NEW DATA CENTER DEMAND (IN TWH)



SOURCE: E3 grid modeling analysis.

TABLE H-4
Energy sources 2025 to 2050, Scenario 1: Unconstrained demand (TWh)

No VCEA

Resource	2025	2030	2035	2040	2045	2050
Gas CCGT	31	40	65	96	98	96
Gas Peaker	14	20	27	23	21	16
Oil Peaker	-	-	-	-	-	-
Biomass	3	3	3	3	3	3
Coal	18	19	26	24	22	21
Nuclear	32	32	32	56	74	116
Hydro	3	3	3	3	3	3
Solar	13	14	25	52	66	66
Offshore/Onshore Wind	-	21	32	32	32	33
Battery Storage	(0)	(0)	(0)	(0)	(1)	(1)
Pumped Storage	(0)	(0)	(0)	(0)	(0)	(0)
DR	0	0	0	0	0	0
Net Imports	50	77	97	112	105	90
Total	**163**	**230**	**309**	**401**	**423**	**442**

VCEA

Resource	2025	2030	2035	2040	2045	2050
Gas CCGT	31	40	65	77	16	8
Gas Peaker	14	20	27	27	1	-
Oil Peaker	-	-	-	-	-	-
Biomass	3	3	3	3	0	-
Coal	18	19	26	24	2	-
Nuclear	32	32	32	56	73	114
Hydro	3	3	3	3	3	3
Solar	13	14	25	57	105	106
Offshore/Onshore Wind	-	21	32	32	33	33
Battery Storage	(0)	(0)	(0)	(1)	(2)	(1)
Pumped Storage	(0)	(0)	(0)	(1)	(3)	(3)
DR	0	0	0	0	0	0
Net Imports	50	77	97	123	194	183
Total	**163**	**230**	**309**	**401**	**423**	**442**

SOURCE: E3 grid modeling analysis.

TABLE H-5
Energy sources 2025 to 2050, Scenario 2: Half of unconstrained demand (TWh)

No VCEA

Resource	2025	2030	2035	2040	2045	2050
Gas CCGT	30	37	55	66	64	67
Gas Peaker	13	14	15	13	7	11
Oil Peaker	-	-	-	-	-	-
Biomass	3	3	3	3	3	3
Coal	17	18	23	22	19	20
Nuclear	32	32	32	56	74	79
Hydro	3	3	3	3	3	3
Solar	13	14	25	32	53	53
Offshore/Onshore Wind	-	11	22	22	23	23
Battery Storage	(0)	(0)	(0)	(0)	(1)	(1)
Pumped Storage	(0)	(0)	(0)	(0)	(1)	(1)
DR	0	0	0	0	0	0
Net Imports	44	57	54	67	56	56
Total	**154**	**189**	**232**	**284**	**300**	**314**

VCEA

Resource	2025	2030	2035	2040	2045	2050
Gas CCGT	30	37	48	47	4	2
Gas Peaker	13	14	15	22	1	-
Oil Peaker	-	-	-	-	-	-
Biomass	3	3	3	3	0	-
Coal	17	18	23	22	3	-
Nuclear	32	32	32	56	73	101
Hydro	3	3	3	3	3	3
Solar	13	14	25	33	66	66
Offshore/Onshore Wind	-	11	32	32	32	32
Battery Storage	(0)	(0)	(0)	(0)	(1)	(1)
Pumped Storage	(0)	(0)	(0)	(0)	(1)	(1)
DR	0	0	0	0	0	0
Net Imports	44	58	53	68	123	112
Total	**154**	**189**	**232**	**284**	**300**	**314**

SOURCE: E3 grid modeling analysis.

TABLE H-6
Energy sources 2025 to 2050, Scenario 3: No new data center demand (TWh)

No VCEA

Resource	2025	2030	2035	2040	2045	2050
Gas CCGT	29	23	23	26	26	30
Gas Peaker	11	10	9	10	7	8
Oil Peaker	-	-	-	-	-	-
Biomass	3	3	3	3	3	3
Coal	16	14	16	19	18	18
Nuclear	32	32	32	32	32	32
Hydro	3	3	3	3	3	3
Solar	13	14	25	33	43	43
Offshore/Onshore Wind	-	11	22	22	22	22
Battery Storage	-	(0)	(0)	(0)	(1)	(1)
Pumped Storage	(0)	(0)	(0)	(0)	(1)	(1)
DR	0	0	0	0	0	0
Net Imports	38	38	23	21	24	24
Total	**145**	**149**	**156**	**167**	**176**	**182**

VCEA

Resource	2025	2030	2035	2040	2045	2050
Gas CCGT	29	23	21	20	0	0
Gas Peaker	11	10	11	10	0	0
Oil Peaker	-	-	-	-	-	-
Biomass	3	3	3	3	0	-
Coal	16	14	17	18	2	-
Nuclear	32	32	32	32	71	72
Hydro	3	3	3	3	3	3
Solar	13	14	19	33	47	47
Offshore/Onshore Wind	-	11	32	32	32	32
Battery Storage	-	(0)	(0)	(0)	(1)	(1)
Pumped Storage	(0)	(0)	(0)	(0)	(1)	(1)
DR	0	0	0	0	0	0
Net Imports	38	38	19	19	23	29
Total	**145**	**149**	**156**	**167**	**176**	**182**

SOURCE: E3 grid modeling analysis.

Appendix I: Data center on-site generation

Instead of relying on utilities, many data center companies are looking at ways to generate their own power using on-site power generation. On-site generation can take a variety of forms, including utility-owned generation on or adjacent to a data center site, "behind the meter" generation that is owned by the data center, or a "microgrid" where the site operates its own generation and may not be connected to the larger grid. Of the current technologies available, only natural gas appears viable for on-site generation, and it can be deployed only close to pipeline infrastructure that has sufficient capacity to serve generation needs. Other technologies, such as small modular nuclear reactors, are being actively pursued by the industry as a potential future power source, but most stakeholders believe these will not realistically be available until 2035.

On-site generation is most likely to be used at new data center sites, where they can be incorporated into the site design. It appears unlikely existing sites, especially those that are fully built out, could be switched to on-site generation because of space constraints and financial considerations. Additionally, data center companies may have regulatory and public relation challenges trying to place some technologies, such as nuclear reactors, in suburban localities like Loudoun and Prince William.

On-site generation could help solve data center companies' power problems, but they may not substantially reduce generation and transmission infrastructure needs. 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.

On-site generation could also shift new infrastructure costs to other customers, because infrastructure costs are recaptured through utility billings, and a data center using a on-site generation would not be regularly billed for services. It is possible that utilities could reach agreements with data center companies to provide reduced or non-firm levels of service if only serving in a backup capacity, which would reduce the need for additional utility infrastructure and cost impacts on other customers. However, it is not clear whether data centers would enter into such agreements. State law could be changed to address the potential issue of stranded costs from data centers that use on-site generation, but as of today, this is not occurring and only one data center site in Virginia appears to actively rely on on-site generation for a substantial share of its energy needs.

Appendix J: Power usage effectiveness (PUE) ratios

The efficiency of cooling and other building systems in data centers is commonly measured using a Power Usage Effectiveness (PUE) ratio. For example, a PUE of 1.3 indicates that 1.0 of energy is used for computing activity, and 0.3 is used for all other building systems. A PUE of 1.0 would indicate perfect efficiency, where all energy is used for computing activity, and none is used for any other purpose. Importantly, PUE does not measure how energy efficient a data center's computing is, because energy used for computing is always set equal to 1.0. Consequently, a lower PUE does not indicate if a data center is energy efficient as a whole. PUE only measures the efficiency of cooling and other building systems that support facility operations.

The data center industry has a strong market incentive to be energy efficient because energy is one of data centers' largest operating costs. Data centers regularly upgrade their computing equipment to take advantage of newer, more powerful and energy efficient computer chips. Computer chips' performance per watt has improved annually for decades. Data centers have also made big efficiency gains with their building systems. As recently as 10 years ago, PUEs of 1.9 or above were common across smaller enterprise and colocation data centers. With the consolidation of the industry into large hyperscale facilities, large companies now report fleetwide average PUEs of 1.1 to 1.4. However, some companies may continue to have less efficient building systems because there are also strong market incentives to avoid changes that could disrupt operations, such as installing more efficient cooling systems.

At least one European country, Germany, has passed legislation requiring data centers to achieve lower PUE in the near future (1.2 to 1.3, depending on when the data center was constructed), and similar legislation has been proposed in Virginia. A PUE requirement could have two unintended consequences: (1) it could encourage more water use by the industry, because water-dependent cooling uses less energy, and could make it harder for companies that use dry cooling systems to comply, and (2) companies that operate colocation data centers may be less able to comply because they do not control operational decisions that can affect PUE calculations, such as how much computing space tenants use. A PUE requirement for existing data centers would also create fairness issues, because companies that have chosen to use cooling systems that are more water efficient but less energy efficient may be unable to comply with the requirement, solely based on the type of cooling they chose before a PUE requirement was established.

Appendix K: Additional natural resource considerations

Additional concerns about data center operations' impacts on natural resources, including their wastewater discharges, disposal of electronic waste, and diesel fuel carbon footprint, have also been raised. While significant adverse impacts to Virginia's natural resources may not occur from these, an environmental management standard, such as ISO 14001, could encourage data centers to reduce their impacts where possible. (See Chapter 5 for more information on environmental management standards.)

Because of existing regulations, data center wastewater discharges do not appear to pose ecological harms

Data centers that use water in their cooling systems typically discharge only a small portion of it, but when discharges do occur, the discharges may contain relatively large concentrations of salts, other dissolved solids, and chemical additives. Some stakeholders expressed concern that data centers and/or wastewater treatment plants do not filter out the salts and any other chemicals before discharging the water to a Virginia surface water source, contributing to the degradation of water quality.

Federal and state wastewater regulations appear to protect against these risks. DEQ requires permits for wastewater discharges from utilities and other large dischargers. These permits set limitations on the contents of discharges and require water quality monitoring to ensure that discharges do not degrade water sources. Some data centers have their own discharge permits, but most send their discharges to a wastewater utility. In either case, the permit holder must ensure any wastewater is appropriately treated before discharging it into a water source. If a wastewater utility is not capable of adequately treating discharge from a data center customer, the utility can require the data center to pretreat its discharges.

Some stakeholders were concerned that existing wastewater regulations were not sufficient to protect water resources, but any potential shortcomings would be true for other development types, so data center-specific standards are not necessary. However, a certification to ISO 14001, which requires companies to meet all environmental regulations, may encourage additional voluntary commitments from data centers to reduce any wastewater impacts.

Electronic waste faces little regulation, but existing practices divert some servers from landfills

Data centers are packed full of thousands of servers, and these servers are replaced every three to five years. Servers can contain rare and toxic materials. The process to procure these materials for use in servers can be environmentally harmful, as can improper disposal of the toxic materials. The reuse or recycling of servers and server parts can minimize environmental impacts.

Data centers, like other businesses, are not required by federal or state law to reuse or recycle electronic waste, but existing practices divert some servers from Virginia landfills. Many data center companies have sustainability goals related to electronic waste, including reusing, recycling, or donating old servers or old server parts. Additionally, not all local waste management services and landfills in Virginia accept commercial waste and/or electronic waste, which would force data centers to seek other alternatives to dispose of their old servers.

Requiring data centers to meet an environmental management standard, such as ISO 14001, would require data centers to consider any environmental impacts caused by their waste generation. This could complement existing practices and discourage disposal of data center servers in Virginia landfills, if, and where, it does occur.

Few data centers currently use diesel fuel alternatives because of supply limitations

Use of diesel fuel—the fuel commonly found in data centers' backup generators—leads to greenhouse gas emissions. Data center operators are interested in expanding the data center industry's use of alternative fuels, such as hydrotreated vegetable oil (HVO), to lower data centers' carbon footprints. These alternatives can be used in most existing diesel generators. However, while these fuel alternatives are available for and used by data centers in Europe and California, the East Coast does not have a supply chain for these fuels. This makes it more expensive and logistically challenging for Virginia data centers to use these fuel alternatives.

Some data center companies are making efforts to expand the use of alternative fuels. For instance, some have requested DEQ permit approval to use HVO in their generators—as DEQ approval of fuel choice is needed as part of emission regulations—and the industry has reached out to the Virginia Economic Development Partnership about exploring ways to attract the fuel alternative industry to Virginia to increase local availability. While a requirement to use a fuel alternative may not currently be feasible, an ISO 14001 requirement could further encourage industry efforts to review and seek opportunities to limit their carbon footprints where possible.

Appendix L: Data center planning and zoning changes in Fairfax, Loudoun, and Prince William

In recent years, the three Virginia localities with the most data centers have revised their approaches to regulating the industry and initiated studies to consider additional changes. Sites in Loudoun, Prince William, and Fairfax account for 80 percent of data centers in the state. Since 2019, all three localities have adopted changes to their ordinances or other policies relating to data centers. For example, all three localities added minimum requirements for data centers to their zoning ordinances. Additionally, all three localities began official studies of their data center policies, with Loudoun and Prince William planning votes in 2026 by their boards of supervisors in response to study findings. Table L-1 summarizes key changes by Fairfax, Loudoun, and Prince William related to data center planning and zoning processes since 2019.

TABLE L-1
Fairfax, Loudoun, and Prince William have updated data center policies since 2019

Locality	Planning and zoning actions
Fairfax	**Comprehensive zoning update with changes specific to data centers (effective 7/1/2021)** • Recognized data centers as distinct use instead of being considered a type of telecommunications facility • Prohibited data centers in residential and certain commercial zones; requires special permit in certain commercial and industrial zones if exceeds specified size • Established county's first design standard specific to data centers: requiring enclosure of equipment in certain zones **Data center study (initiated 5/9/23)** • Process included public meetings and stakeholder interviews • Produced two staff reports and a consultant report **Zoning changes (effective 9/11/24)** Board of Supervisors considered study's recommendations and implemented several rules to better manage data center development • Prohibited data centers in additional zone; converted several zones from allowing data centers by right to allowing by special permit; expanded requirement for special permit if exceeding specified size to another industrial zone • Required 200 feet between data center building and residential property; required 300 feet (or a building) between equipment and residential property • Required 1 mile between data center and Metro station • Required sound studies at two stages of new projects • Required several architectural standards (e.g., façade differentiation) of by right development, with more flexibility but the same goals for special permit developments
Loudoun	**Rewrite of comprehensive plan (adopted 6/20/2019)** Items for priority future action included performance standards for data centers **Series of meetings about data center policies by legislative committee (2022)** Initiated to review county staff research and develop process for considering changes to data center policies **Comprehensive zoning update includes changes specific to data centers (effective 12/13/2023) [a]** Goal to align zoning ordinances relevant to data centers with comprehensive plan

	• Converted two zones from allowing data centers by right to allowing by special permit; permitted data center in an additional industrial zone • Expanded applicability of data center standards (e.g., façade architecture, screening of mechanical equipment) from four zones to all locations • Created standards for data centers regardless of location including windows, main entrance features, loading bay location, and proactive sound measuring • Created standards for data centers adjacent to residential areas including separation of mechanical equipment, minimum 200-foot setback between buildings and property border, parking setbacks, time limits on generator testing, and acoustical barriers around mechanical equipment **Study of potential changes to comprehensive plan and zoning ordinances for data centers and substations (initiated 2/6/2024)** • First phase focusing on appropriate locations for data centers per the comprehensive plan and zoning ordinance, expected to conclude early 2025 • Second phase to focus on policies and zoning ordinances to implement data center standards (e.g., aesthetics, natural resources), expected to conclude 2026
Prince William	**Additional standards required in data center overlay district (adopted 6/18/2019)** • Created requirements for data centers in the data center overlay district, including for building façade and fence design, screening mechanical equipment and substations near residential areas and certain roads, and buffer yards of data centers near residential areas • To encourage data center development in the overlay, increased density allowed by right within the overlay • Adjusted borders of data center overlay on map **Comprehensive review of data center overlay (initiated 3/2/2021)** • Scope included zoning ordinance, comprehensive plan, and other formal county policies • Products included reports by county's economic development office and two consultants regarding data center industry trends, appropriate land in Prince William, and recommended standards for development • Process included public meetings and stakeholder interviews **Data center ordinance advisory workgroup (created 2/28/2023)** Responsible for continuing review of county's data center policies. Draft timeline includes Board of Supervisors vote on noise ordinance amendments in spring 2025 and vote on policy changes relevant to other topics later in 2025. **Expanded noise ordinance applicability to data centers (adopted 2/28/2023)** • Limited exemption for nighttime cooling systems to residential homes • Originally planned to sunset in a year but extended to provide time to "assess the noise impacts associated with data centers"

SOURCE: JLARC review of local ordinances, review of planning and zoning department documents, and interviews with local staff.
NOTE: Table describes significant changes since 2019 and is not a summary of current ordinances. Table focuses on planning and zoning processes and excludes changes to economic development and tax policy. Table excludes requirements limited to particular projects (e.g., rezoning commitments). "Special permit" is used for consistency, but the terminology for this process depends on the locality.
[a] Updates do not apply to certain parts of the county, which are administered under an older zoning ordinance.

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Item 3.

JLARC
JOINT LEGISLATIVE AUDIT
AND REVIEW COMMISSION

December 9, 2024

Data Centers in Virginia

Commission Briefing

Study resolution

- Directs JLARC to review the impacts of data centers in Virginia and state and local policies regarding data centers
  - Projected growth of the data center industry in Virginia
  - Impact on energy consumption and infrastructure and customer costs
  - Impact on residents and natural and historic resources
  - State and local regulation of siting and construction
  - Impact on economy and tax revenues
  - State policies and incentives for data centers

Commission resolution (December 11, 2023)

Primary research activities

- Over 300 interviews, including data center companies, utilities, local governments, state agencies, Virginia residents, and other stakeholders and experts
- Reviews of reports, state and local regulations, and other relevant documentation
- Analyses of data related to the size and distribution of data centers, environmental impacts, and economic and revenue impacts
- Forecast of future energy demand and modeling of energy infrastructure needs, costs, and rate impacts (Completed with assistance of consultants)

In brief

- Data centers provide economic benefits and can generate substantial local tax revenues for localities that have them.
- Data center industry is driving immense increase in energy demand, and building enough new generation and transmission infrastructure to address demand will be difficult.
- Data centers are currently paying full cost of service, but growing energy demand will likely increase costs for other customers and create additional financial risks for utilities.

In brief

- Data center backup generators emit pollutants, but their use is minimal, and existing regulations largely curb adverse impacts.
- Data center water use is currently sustainable, and state ensures future sustainability through regulation.
- Increasing number of data centers are being built close to residential areas and can negatively impact residents; some localities have taken steps to address this concern, but noise impacts can be difficult to resolve.

In brief

- Virginia's sales tax exemption for data centers could be (1) extended to maintain data center growth and economic benefits, (2) allowed to expire to slow growth and reduce energy impacts, or (3) modified to balance these priorities.
- Sales tax exemption could also be changed to address policy concerns related to energy efficiency, natural and historic resources, and local residential impacts, but changes could make the exemption a less effective economic development tool.

In this presentation

Background

Economic and Fiscal Impacts

Energy Impacts

Energy Costs

Natural and Historic Resource Impacts

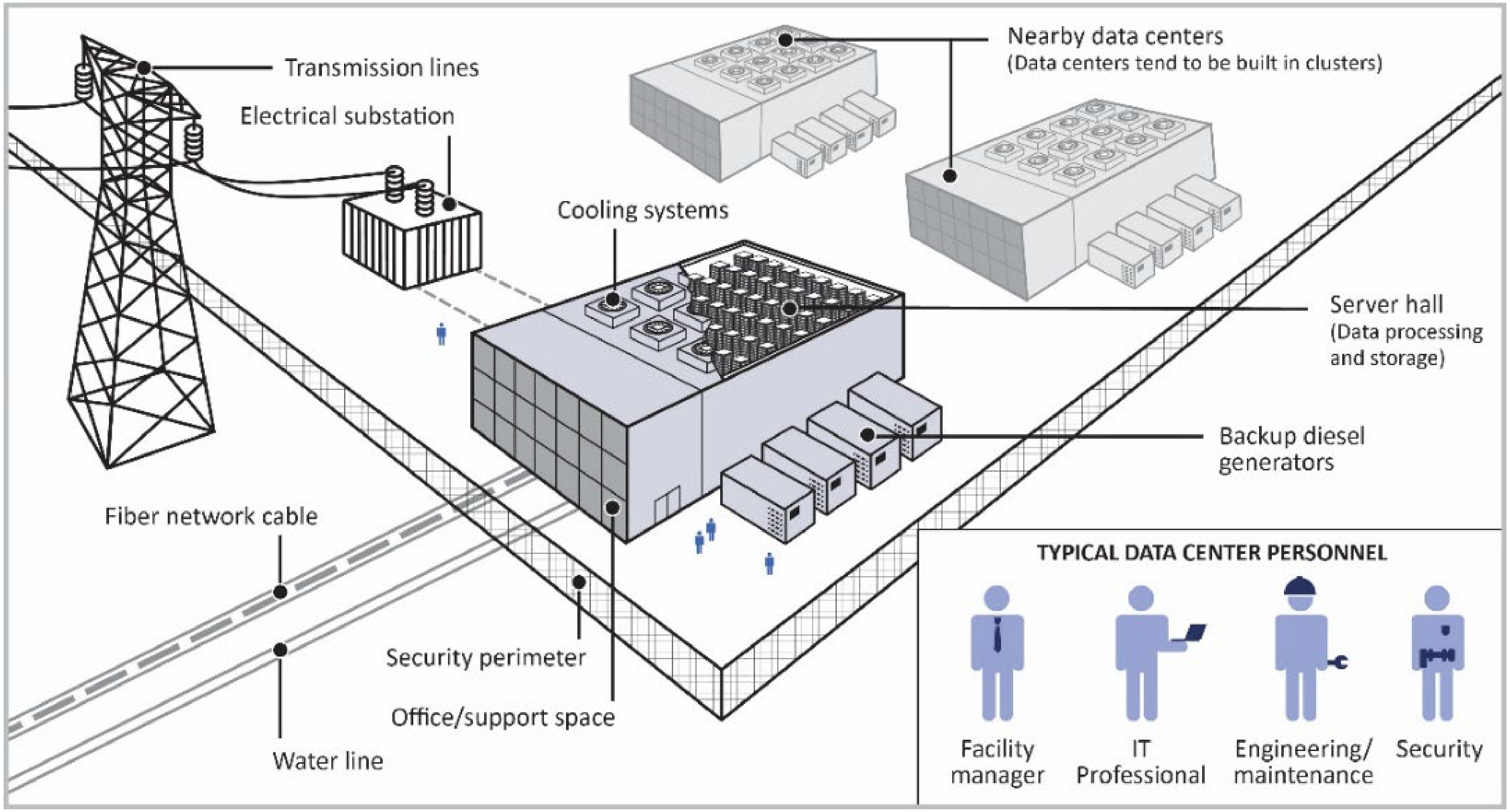
Local Residential Impacts

Using Data Center Exemption to Address Policy Concerns

Data centers are key hubs of world's digital infrastructure

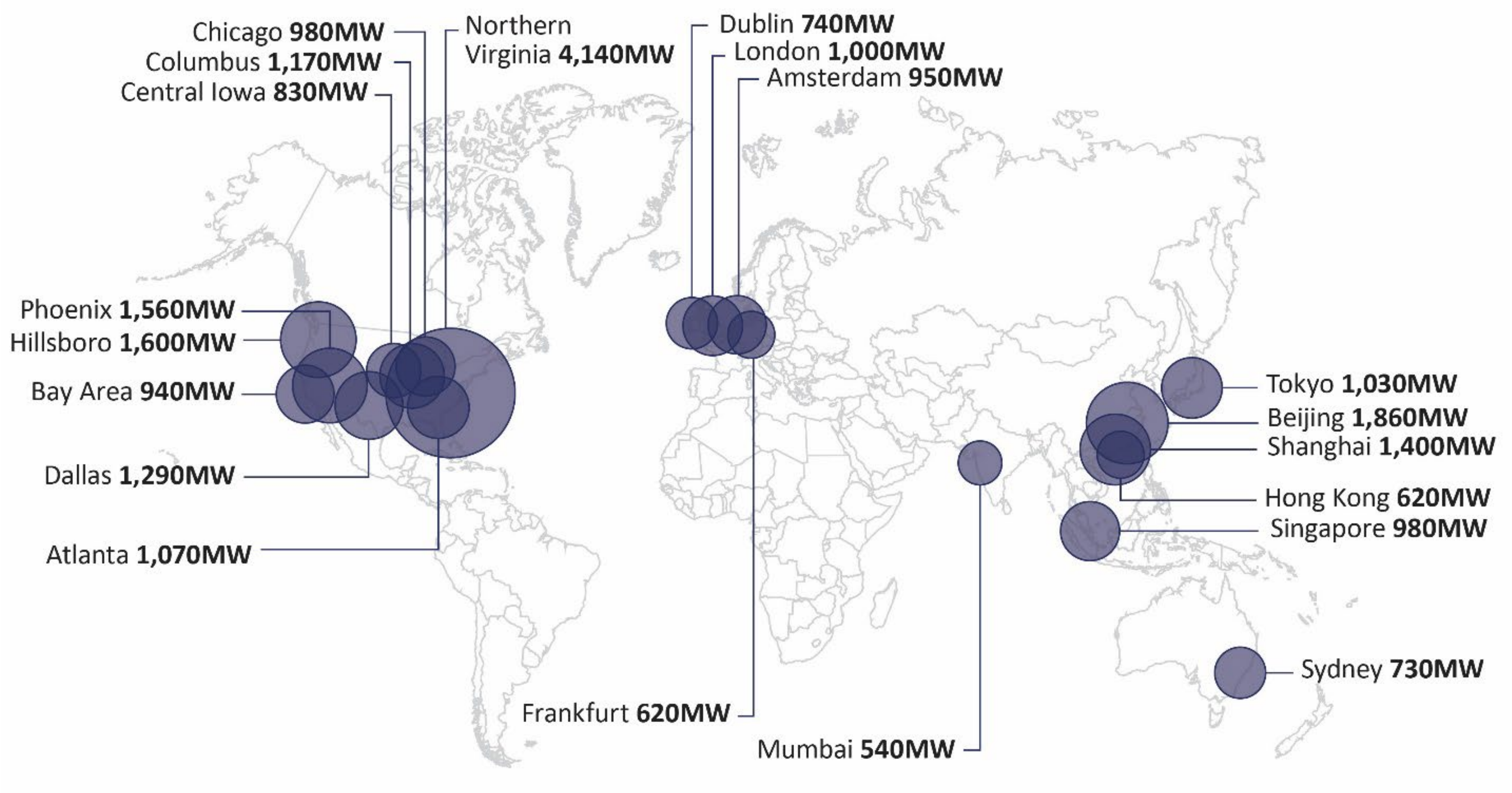
- Enable modern digital services and economy
  - Internet, cloud services (business, personal), media streaming, apps, financial transactions
- Industry is growing rapidly, driven by a combination of established and emerging trends
  - Existing uses accelerated by COVID-19 pandemic
  - Emergence of artificial intelligence
- Dominated by a few large companies
  - Amazon Web Services, Google, Meta, Microsoft

Modern data centers are large industrial buildings, increasingly located together on "campuses"



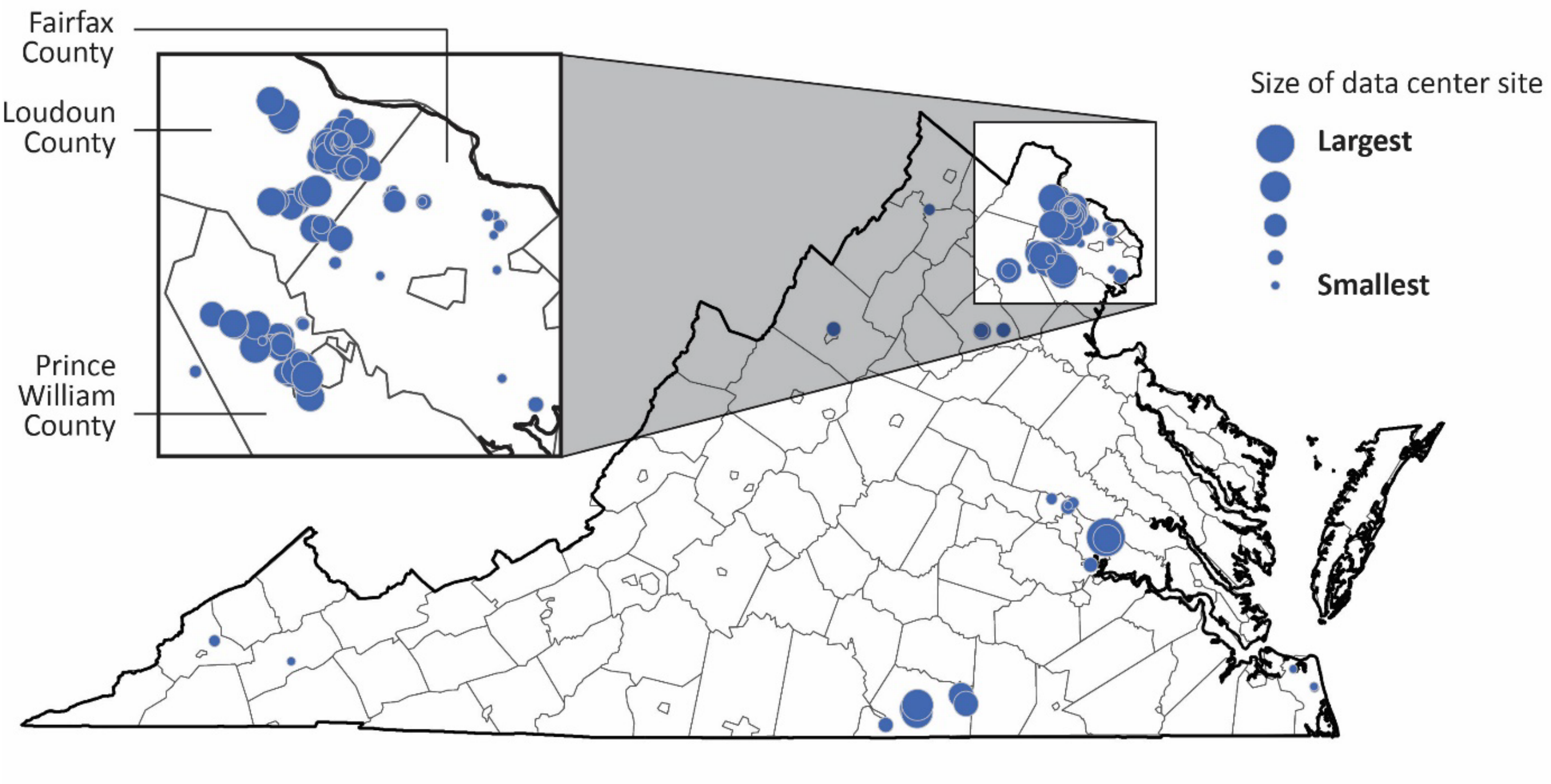
JLARC

Northern Virginia is the largest data center market in the world



JLARC analysis of Cushman & Wakefield 2024 Global Data Center Market Comparison

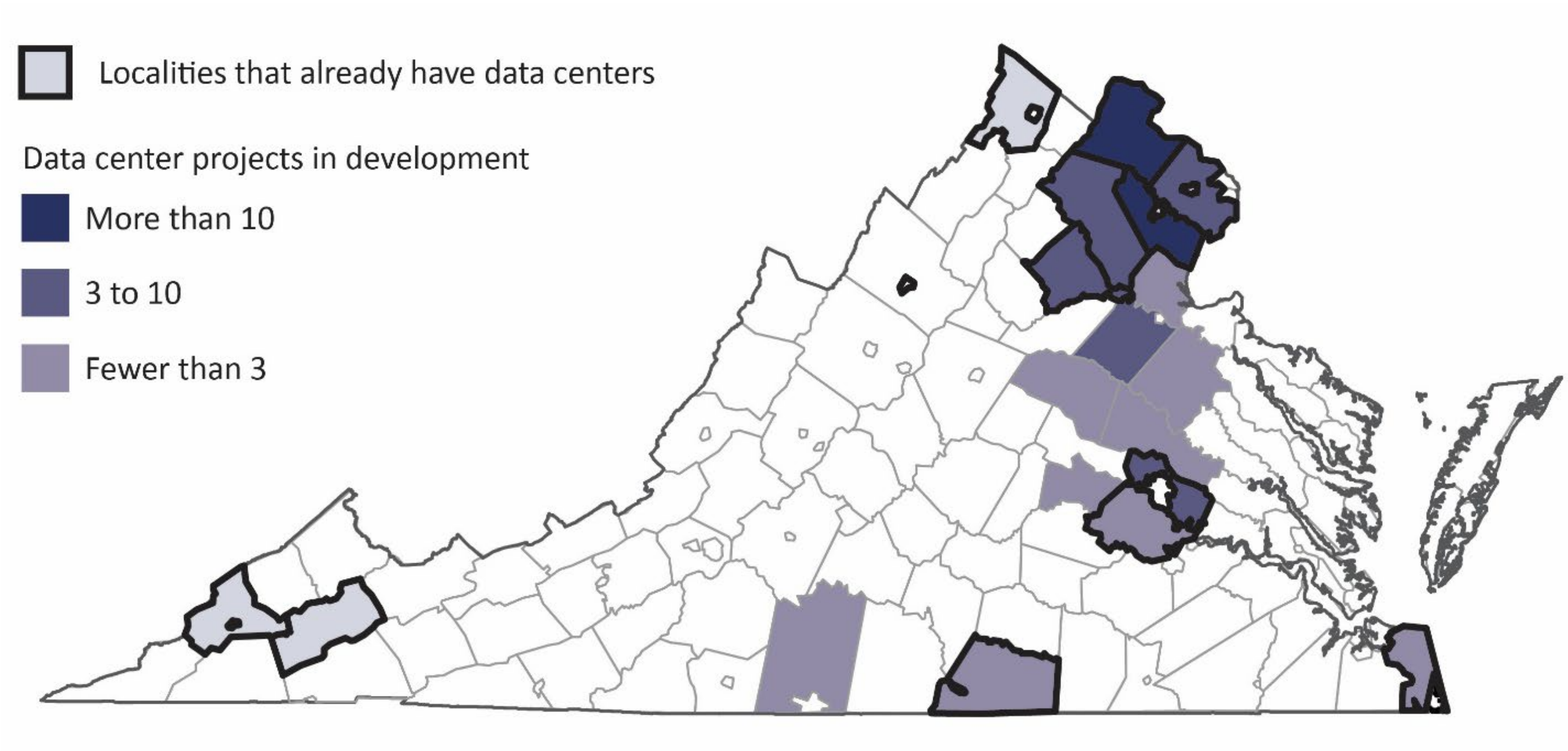
Most of Virginia's data center industry concentrated in Northern Virginia



Data center size is measured using operational capacity, given in megawatts of power.

Item 3.

Virginia's data center industry is starting to expand into new localities, mostly along I-95 corridor



In this presentation

Background

Economic and Fiscal Impacts

Energy Impacts

Energy Costs

Natural and Historic Resource Impacts

Local Residential Impacts

Using Data Center Exemption to Address Policy Concerns

Finding

Data centers provide economic benefits, mostly during their initial construction.

Data center industry has economic benefits, with most benefits occurring during construction

Economic impact	Annual average* Construction	Operations	Total impact
Jobs	59,000 jobs	15,000 jobs	74,000 jobs
Labor income	$4.3B	$1.2B	$5.5B
Virginia GDP	$6.4B	$2.7B	$9.1B

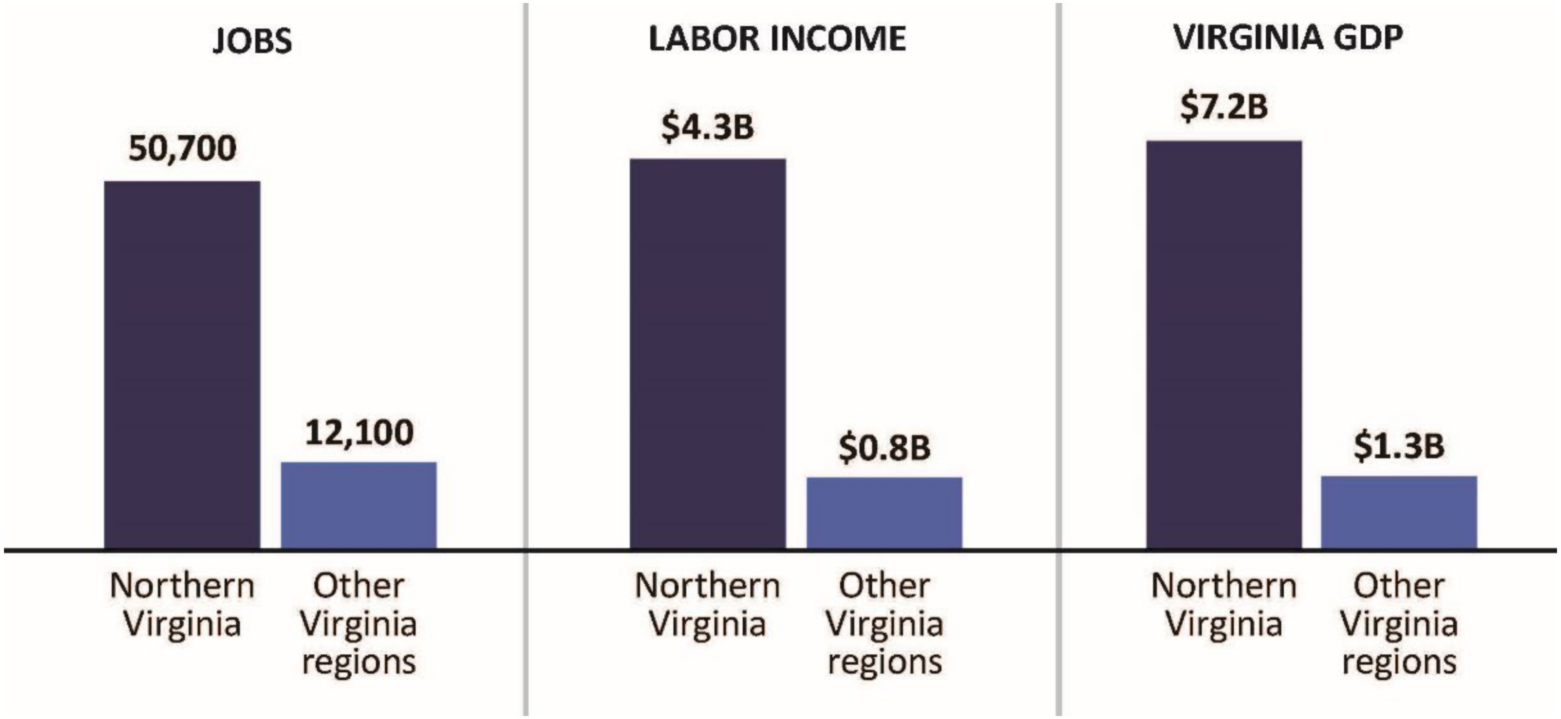
*Direct and indirect economic effects, based on capital investment and related operation spending

JLARC

Data center industry creates jobs and is a significant source of capital investment in Virginia

- During construction, a data center site can employ up to 1,500 workers, including skilled construction and trades
- During operations, typically employ small number of workers relative to facility size (~50)
  - Facilities, engineers, IT, trades, security
  - Most jobs are relatively high-paying
- Significant source of capital investment ($24B in FY23)
  - ~20% for construction, much of which stays in-state
  - Most computer & equipment investment to out-of-state companies

Economic impact is concentrated in Northern Virginia



Totals for Northern Virginia and other Virginia regions do not sum to statewide totals shown in previous slide because the regional method of analysis does not account for impacts from activity in Northern Virginia occurring in other Virginia regions and vice versa.

Finding

Data centers can generate substantial local tax revenues for localities that have them.

Localities with data centers can collect substantial tax revenues from the industry

- Local tax revenues primarily from business personal property and real property (real estate) taxes
- Amount of local revenue depends on several factors, such as size of data center market and local tax rates
  - Some localities have greatly reduced rates to try and attract data centers, which greatly reduces potential revenue
- For localities with relatively mature data center markets, revenues ranged from <1% to 31% of total revenues
  - Loudoun $733M (31%), Prince William $110M (7%)*

*Cannot report totals for counties with small number of data centers to protect taxpayer confidentiality

Localities in economically distressed areas could have difficulty attracting the industry

- To attract data centers, a locality must have access to transmission lines and large, flat areas of land
- Localities that are close to data center customers and population centers have historically had an advantage
  - Rural localities may be better able to compete for new data centers running artificial intelligence (AI) workloads
- Localities are more attractive if they have “shovel-ready” industrial sites suitable for data centers
  - VEDP’s Virginia Business Ready Sites Program provides grants for site development

VEDP = Virginia Economic Development Partnership

Recommendation

VEDP should clarify that potential data center sites are eligible for grants under the Virginia Business Ready Sites Program.

In this presentation

Background

Economic and Fiscal Impacts

Energy Impacts

Energy Costs

Natural and Historic Resource Impacts

Local Residential Impacts

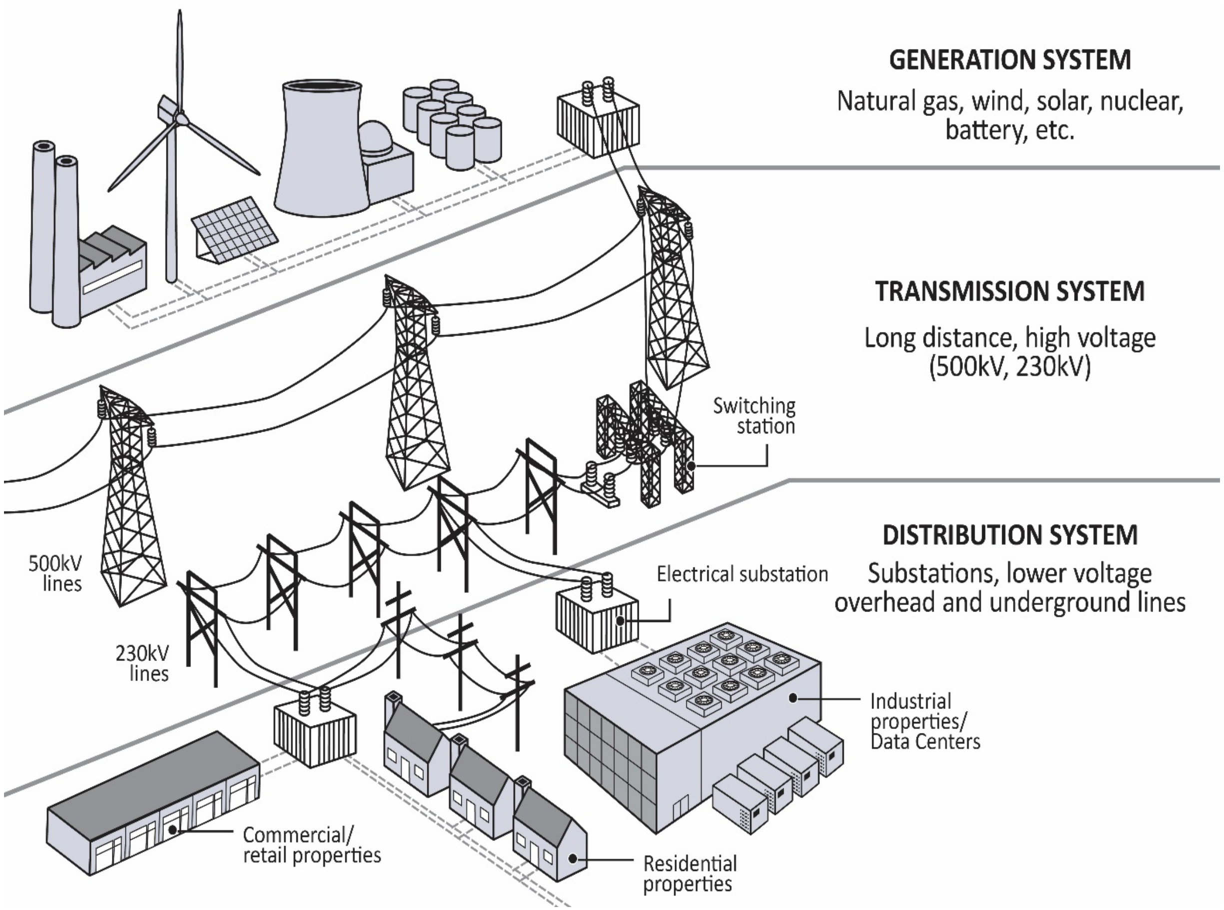
Using Data Center Exemption to Address Policy Concerns

Modern data centers use substantially more energy than other commercial or industrial operations

- Small 18 MW data center power capacity is roughly equivalent to a mid-sized automobile assembly plant, 60 large commercial office buildings, or 4,500 homes
- Largest new data centers draw from 100 to over 200 MW, more than most industrial consumers
- Planned data center campuses are expected to consume well over 1,000 MW
  - More than the 950 MW generation capacity of Virginia's largest nuclear reactor

MW = megawatts of power used in an instant, which is the common metric for measuring data center size

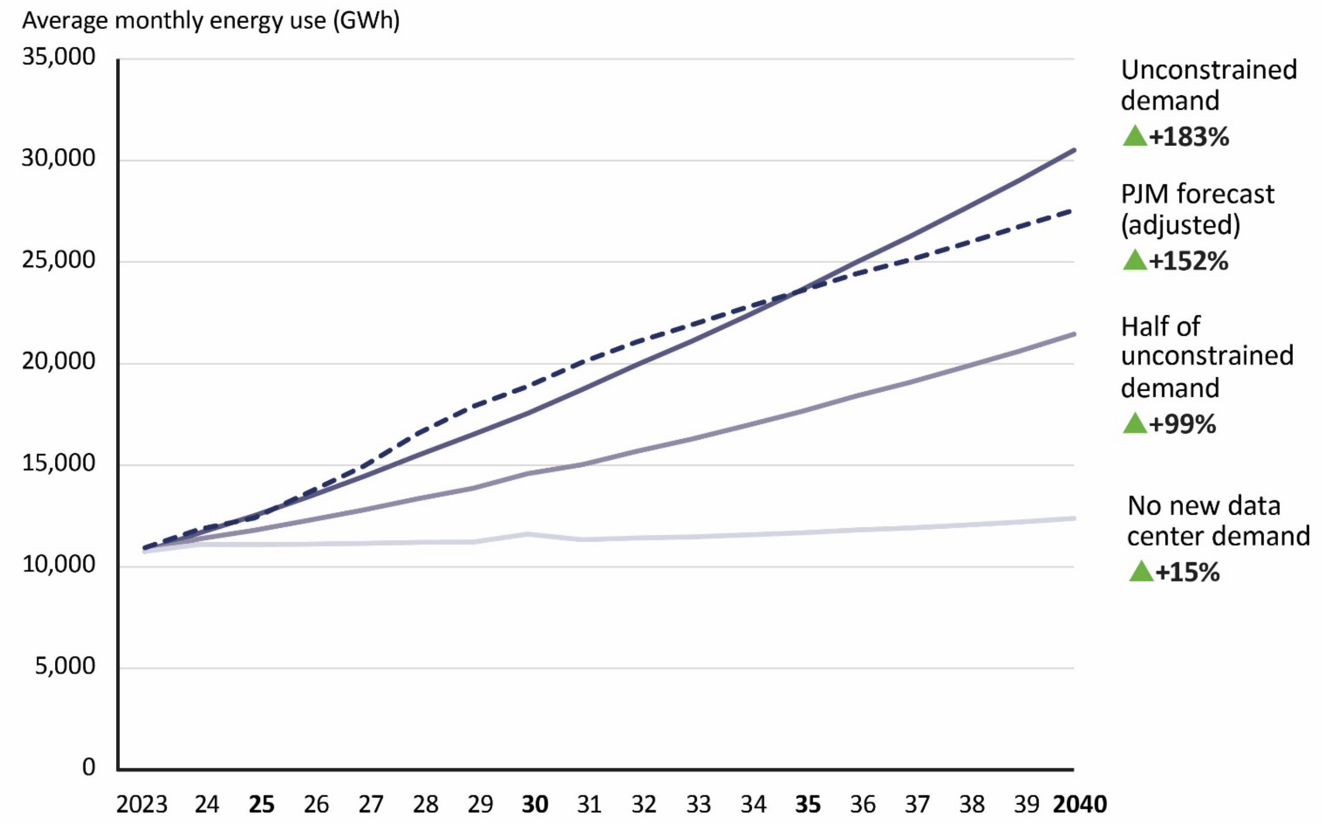
Energy comes from a complex grid composed of generation, transmission, and distribution systems



Finding

Data center industry is driving immense increase in energy demand, and building enough new generation and transmission infrastructure to address demand will be difficult.

Data center industry is forecast to drive immense increase in Virginia's energy demand



PJM is the regional organization responsible for coordinating generation and transmission for Virginia and several other eastern and midwestern states

New generation and transmission infrastructure will need to be built to help address energy demand

- New generation infrastructure needed includes
  - Renewable solar and wind facilities
  - Natural gas plants
  - Nuclear plants
  - Battery storage and "demand response" resources
- New transmission needed includes
  - "Interzonal" lines to bring power into and across Virginia
  - "Intrazonal" lines to disperse power to local distribution points
  - Transmission substations

Addressing energy demand would require substantially increasing current system capacity and energy imports

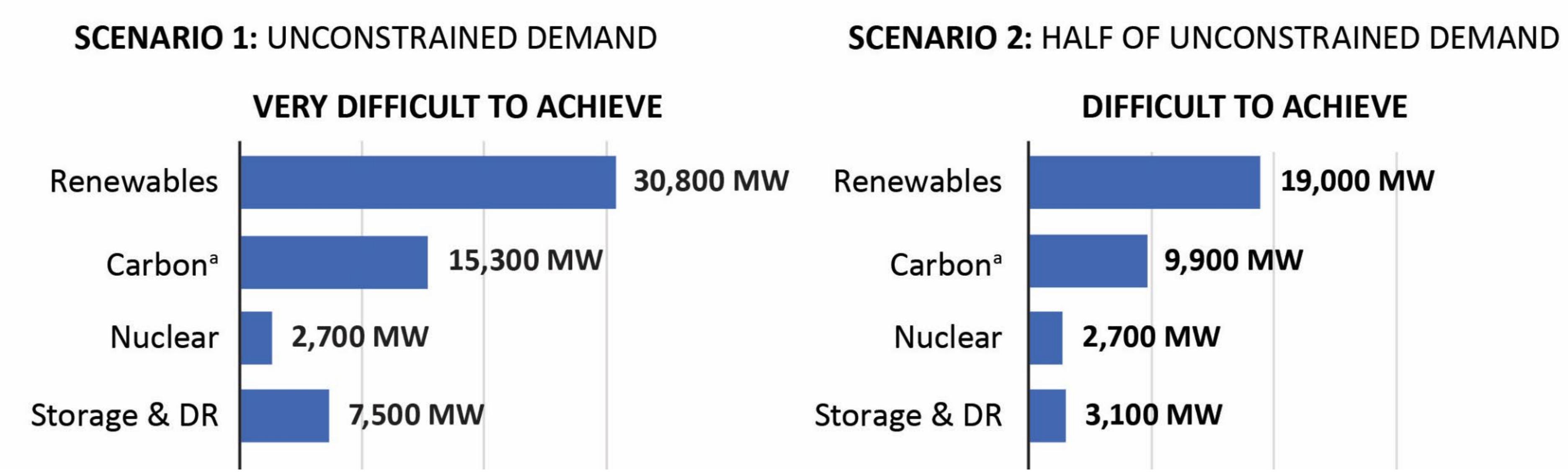
	Change from 2025 to 2040	
	Scenario 1: Unconstrained demand	Scenario 2: Half unconstrained demand
Generation (in-state)	+150%	+90%
Transmission (Interzonal)*	+40%	+35%
Imported energy (net)	+150%	+55%

Scenarios shown assume that Virginia Clean Economy Act (VCEA) renewable requirements are met.
*Transmission capacity is only interzonal lines to and from the Dominion transmission zone, where most data centers are located and most growth is expected to occur.

Building enough infrastructure to meet growing data center demand will be difficult

- Scenario 1: Unconstrained demand very difficult to achieve
  - Solar added each year at 2x rate added in 2024
  - Large natural gas plant added almost every 1.5 years
  - Wind capacity exceeding all secured offshore capabilities
  - New nuclear plants using technologies not yet proven viable
- Scenario 2: Half of constrained demand difficult to achieve
  - Less new solar and natural gas, similar wind and nuclear
- Both scenarios would require many new transmission lines, especially in and around Northern Virginia, and could require new gas pipeline capacity

Breakdown of generation capacity that would need to be added (2025 to 2040)



Scenarios shown assume that Virginia Clean Economy Act (VCEA) renewable requirements are met.
[a] Carbon generation is from natural gas baseload and peaker plants. However, starting in 2045 (not shown), grid model assumes natural gas plants would be converted to hydrogen fuel.

Finding

Demand growth raises concerns about system capacity and reliability, but existing utility requirements and processes limit risks.

Demand growth raises grid reliability concerns, and utilities are responsible for ensuring reliability

- Unprecedented pace of energy demand growth raises concerns
  - Availability of sufficient generation capacity
  - Ability of transmission system to reliably deliver power
- Utilities have obligation to serve new data center customers, but **foremost responsibility is to ensure grid reliability**
- Regulated by federal agency and international standards

The Federal Energy Regulatory Commission (FERC) oversees the nation's electrical grid.
The North American Electrical Reliability Corporation (NERC) sets reliability standards for the grid.

Regulatory requirements and planning reduce reliability risks from growing energy demand

- **Transmission** reliability concerns appear to be effectively addressed through existing planning processes
- **Generation** capacity concerns partially addressed through existing requirements, but some risk remains
  - Addition of new generation to regional grid not centrally planned
  - Demand could increase faster than new generation is added, regional *reserve* capacity projected to be insufficient by 2030
  - Issue must be addressed at federal & regional level
- Delaying addition of new data centers, as needed, would address risks

Recommendation

The General Assembly may wish to consider clarifying that electric utilities have the authority to delay, but not deny, service to customers when the addition of customer load cannot be supported by the transmission system or available generation capacity.

Finding

State could encourage or require data centers to take actions to help address their energy impacts, but actions would have small effect on demand.

Data centers could take actions to help address energy impacts

- Data centers could invest more in renewable and other energy generation to help meet generation needs
  - Would not lower energy demand
  - Unclear if on-site generation would substantially reduce need for new grid infrastructure
- Participation in demand response programs could offset some energy demand and reduce infrastructure needs
- Improving data center efficiency (e.g., PUE) makes better use of energy but has marginal impact on total energy use

PUE = Power Usage Effectiveness ratio, which measures efficiency of cooling and other building systems, but not computing activity that makes up most data center energy use

Recommendation

The General Assembly may wish to consider expanding Virginia's statutory Accelerated Renewable Buyers program, which effectively encourages large utility customers to invest in solar and wind projects, to include battery storage.

The General Assembly may wish to consider requiring utilities to establish demand response programs for large data center customers and requiring that these customers participate in those programs.

Policy option

The General Assembly could consider requiring that, as a condition of receiving the sales tax exemption, data center companies meet and certify to an energy management standard.

Virginia's sales tax exemption for data centers is discussed in more detail in the last section of this presentation.

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Using Data Center Exemption to Address Policy Concerns

Finding

Data centers are currently paying full cost of service, but growing energy demand is likely to increase costs for other customers.

Data centers are currently paying full cost of service

- Independent review of utility rate structures and cost allocations found costs incurred by data centers are currently being fully recovered from them
- **Generation and transmission** costs are either passed through to individual data center customers or allocated to customer classes that largely consist of data centers
- **Distribution** costs are directly charged to data center customers or collected through contractually obligated minimum payments

Review of current rates focused on three utilities that currently have large data centers: Dominion Energy, Mecklenburg Electric Cooperative (MEC), and Northern Virginia Electric Cooperative (NOVEC)

Growing data center energy demand is likely to increase costs, including for other customers

- Generation and transmission costs could increase $10B to $18B by 2040, mostly because of data center demand
- Portion of "fixed costs" associated with new infrastructure would be billed to non-data center customers
- It would be difficult to provide enough energy supply to keep pace with growing demand, so energy prices would increase for all customers
- Utilities would need to import more power and could be more susceptible to spikes in energy market prices

Cost increases are for the unconstrained and half of unconstrained demand scenarios, assuming that Virginia Clean Economy Act (VCEA) renewable requirements are met.

Example: projected increase in generation and transmission charges for residential customer

Typical monthly residential generation and transmission charges (Dominion Energy)

	2023	2030	2040
Scenario 1: Unconstrained demand	$90	+$23	+$37
Scenario 2: Half unconstrained demand	$90	+$7	+$14

Typical monthly residential charges are the sum of the amount billed to Dominion Energy residential customers assuming typical use of 1,000 kWh. Dominion Energy is Virginia's largest electric utility and is responsible for providing generation and transmission to much of the state, including areas where most of the state's data center industry is concentrated. Charges shown assume that Virginia Clean Economy Act (VCEA) renewable requirements are met. Constant 2024 dollars.

Utilities, under SCC regulation, could help insulate customers from systemwide cost increases

- Utility rates not designed to account for rapid cost increases to serve a small number of very large customers
- Utilities could help insulate non-data center customers by
  - Creating a separate data center customer class
  - Adopting new cost allocation methods
  - Adjusting rates more frequently
- Utility cost allocation and rate design are highly technical; practicality & legality of changes require detailed analysis
- SCC is in best position to address and has scheduled a technical conference on cost concerns for December 2024

SCC = Virginia State Corporation Commission, which regulates state electric utilities

Finding

Data center growth creates additional financial risks to utilities and their customers.

Data center growth creates additional financial risks to utilities due to sheer size of energy use

- Data center demand could drive infrastructure to be overbuilt, stranding costs with existing customers
- Data centers pose particular risks to electric co-ops
  - Could account for 80 percent or more of energy sales for some co-ops by 2030
  - Delayed or disputed payments from a single large customer could create substantial financial liabilities
- Data center company participation in retail choice program could shift generation costs to other customers

Electric cooperatives (co-ops) are not-for-profit electric utilities.
Retail choice is a statutorily established program that allows large electric customers to purchase energy through third-parties instead of their incumbent utility.

Recommendation

The General Assembly may wish to consider directing Dominion Energy to develop a plan for addressing the risk of generation and transmission infrastructure costs being stranded with existing customers and file it with the SCC.

Dominion Energy is Virginia's largest electric utility and is responsible for providing generation and transmission to much of the state, including areas where most of the state's data center industry is concentrated.

Policy options

The General Assembly could consider amending the Code of Virginia to allow electric cooperatives to create for-profit subsidiary companies to provide energy services to customers with load capacity of over 90 MW.

The General Assembly could consider amending the Code of Virginia to require that electric utilities establish caps on participation in retail choice, and that such caps be approved by the SCC.

In this presentation

Study examined data center industry impacts on natural and historic resources

- Impacts examined include
  - **Air emissions from backup generators**
  - **Water use**
  - Water quality
  - Land conservation
  - Electronic waste
  - Historic resource preservation
- Regulations are in place to help protect these resources

Water quality (stormwater runoff, protection of streams and wetlands, wastewater discharge), land conservation, electronic waste disposal, and historic resource preservation are discussed in the full JLARC report but are not included in this presentation.

Finding

Data center backup generators emit pollutants, but their use is minimal, and existing regulations largely curb adverse impacts.

Data centers rely on large number of diesel generators for backup power (average 54 per site)

- Emit several harmful air pollutants, such as nitrogen oxides, carbon monoxide, and particulate matter
- Regulated by DEQ using state and national standards
  - All backup generators permitted and monitored by DEQ
  - Limits use and allowable emissions to protect air quality
- Backup generators rarely run for prolonged periods
  - Routine maintenance (10-30 minutes per month)
  - Few actual power outages (operators reported 0 to 2 outages at their facilities in last two years, lasting from 1 to 5 hours)

DEQ = Virginia Department of Environmental Quality

Backup generator emissions unlikely to harm regional air quality; localized effects under study

- Backup generators <4% of regional nitrogen oxides emissions and 0.1% of carbon monoxide and particulate matter
  - Emissions only 7 percent of what permits allowed (2023)
  - Regional air quality has improved while industry has grown
- A "worst-case" prolonged, large-scale *regional* outage could contribute to temporary air quality issues
  - Such outages are rare, and air quality would return to normal after the event
- To identify any *localized* concerns, DEQ launched study to monitor data center generator emissions in Northern Virginia

Policy option

The General Assembly could consider requiring that, as a condition of receiving the sales tax exemption, all new data center developments in the Northern Virginia Ozone Nonattainment Area use only Tier 4 generators, Tier 2 generators with selective catalytic reduction systems, or generators with equivalent or lower emission rates.

Virginia's sales tax exemption for data centers is discussed in more detail in the last section of this presentation.

Finding

Data center water use is currently sustainable, and state ensures future sustainability through regulation.

Most data centers use the same amount of water (or less) as an average large office building

- Most data centers (83 percent) used the same amount of water as, or less than, an average large office building (2023)
- Water use varies depending on cooling system
- Data center water use accounted for
  - 2% to 21% of total water use at six water utilities
  - <0.5% of total state withdrawals

State regulates sustainability of water withdrawals, but some localities should consider local impacts

- DEQ regulates water withdrawals and requires permits for large scale withdrawals (surface, groundwater)
  - DEQ models withdrawal impacts on water availability, flora, and fauna when permits are issued and renewed
- Virginia is relatively water rich, but some localities have limited water resources (e.g., lack direct access to surface waters or are in groundwater management areas)
- Localities should consider whether data center projects could affect ability to meet future residential demand or pursue other development opportunities

Recommendation

The General Assembly may wish to consider expressly authorizing local governments to (i) require proposed data center developments to submit water use estimates and (ii) consider water use when making rezoning and special use permit decisions related to data center development

Policy option

The General Assembly could consider requiring that, as a condition of receiving the sales tax exemption, data center companies meet and certify to an environmental management standard.

Virginia's sales tax exemption for data centers is discussed in more detail in the last section of this presentation.

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Using Data Center Exemption to Address Policy Concerns

Local governments are responsible for managing land development in their jurisdictions

- Establish zoning ordinances for residential, commercial, and industrial development
- Approve development projects and exceptions or changes to zoning
  - By-right (staff)
  - Special permit (elected officials)
  - Rezoning (elected officials)

Finding

Growing number of data centers are being built close to residential areas, impacting nearby residents, and some localities have taken steps to minimize impacts.

Data centers are industrial facilities that are largely incompatible with residential uses

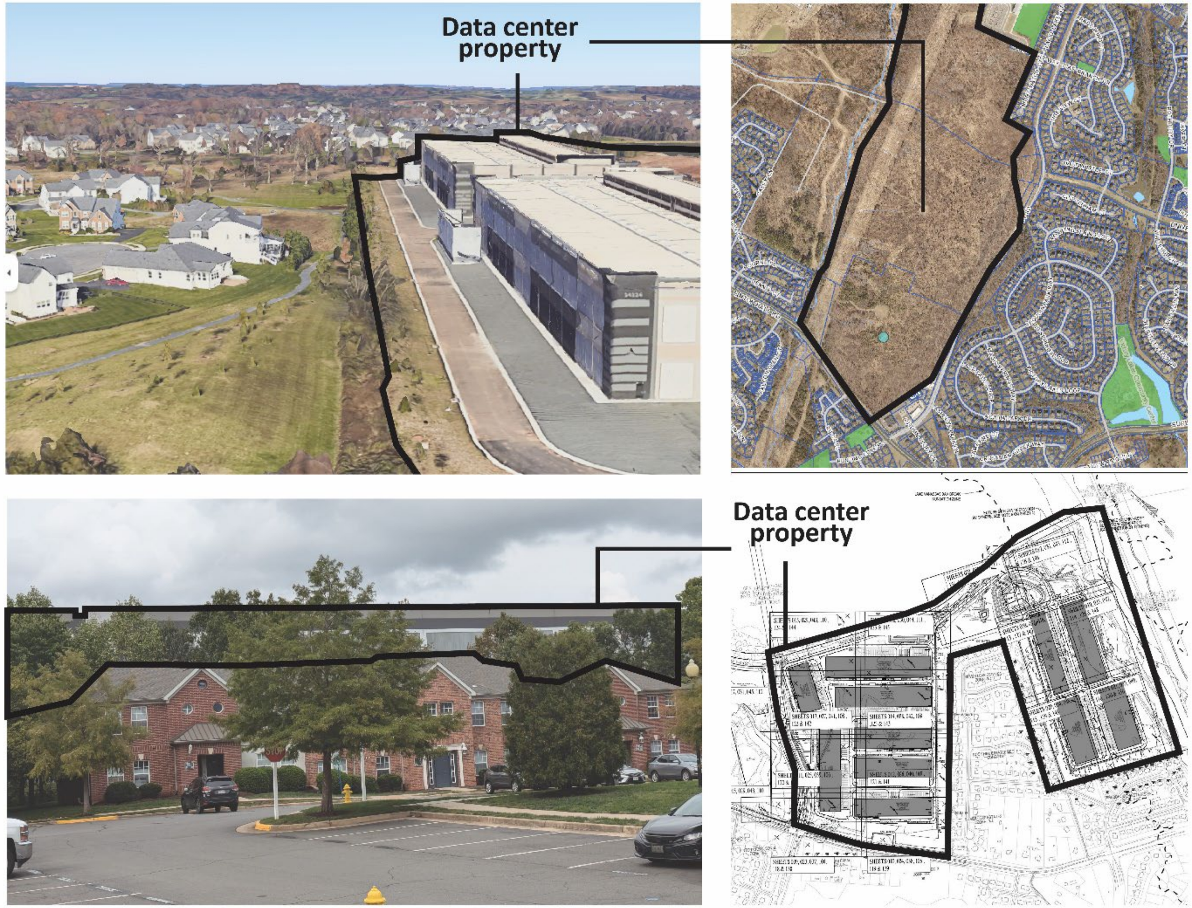
Generators

Cooling equipment

Electric substation

Transmission line

One-third of data centers are near residential areas, and industry trends make future impacts more likely



Some localities have allowed data centers near neighborhoods but are now taking steps to minimize future impacts

- Some localities have allowed data centers next to residential areas because of
  - Inadequate planning and zoning
  - Elected officials changing or granting exceptions to zoning requirements designed to reduce residential impacts
- Several Virginia localities have made or are considering zoning ordinance changes to reduce risk of residential impacts
- Effectiveness ultimately depends on elected officials

Localities should implement several practices to minimize residential impacts

- Classify data centers as industrial use
- Revise zoning maps to prevent by-right data centers next to residential
- Ensure sufficient minimum requirements for data center developments are sufficient (setbacks, building heights)
- Designate optimal locations for data center development (away from residential, close to transmission)
- Require pre-development sound modeling and revise ordinances to better prevent and address noise conflicts

Finding

In a few cases, noise from data centers has negatively affected nearby residents, and noise impacts can be difficult to resolve.

Noise has been an issue for a minority of data centers but can negatively affect nearby residents

- Only some data centers audible past property line, and noise has only been a problem when close to residential
  - Noise is typically a low-frequency “drone” or “hum” and is not loud enough to damage hearing
- In a few cases, noise has been significant enough to affect well-being of nearby residents
- Resolution has been difficult because noise ordinances are ineffective at addressing complaints
- Localities can take steps to mitigate data center noise, but some are unsure of their authority to do so

Recommendation

The General Assembly may wish to consider expressly authorizing local governments to require sound modeling studies for data center projects prior to approval.

The General Assembly may wish to consider authorizing local governments to establish and enforce maximum allowable sound levels for data center facilities, including (i) using alternative low frequency noise metrics and (ii) setting noise rules and enforcement mechanisms in their zoning ordinances, separate from existing noise ordinances.

Policy option

The General Assembly could consider requiring that, as a condition of receiving the sales tax exemption, data center companies conduct a sound modeling study prior to the development of a proposed data center that is to be located within a certain distance of a residential area.

Virginia's sales tax exemption for data centers is discussed in more detail in the last section of this presentation.

In this presentation

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Local Residential Impacts

Using Data Center Exemption to Address Policy Concerns

Since 2010, Virginia has offered a sales tax exemption to attract large-scale data centers

- Qualifying data centers and tenants can purchase computers and other equipment without paying sales tax
- Exemption considered valuable by the industry
  - Provided $928.6M savings in FY23 (by far Virginia's largest economic development incentive)
  - Used by 90% of industry (as measured in MW of power)
  - Industry indicates exemption is a key factor in location and expansion decisions
- Main policy lever state has for addressing concerns about data center industry

Findings

Exemption could be (1) extended to maintain data center growth and economic benefits, (2) allowed to expire to slow growth and reduce energy impacts, or (3) modified to balance these priorities.

Policy Options

General Assembly could change data center sales tax exemption in one of the following ways

- **Maintain industry growth and economic benefits** by extending exemption expiration date from 2035 to 2050
- **Slow industry growth and reduce future energy impacts** by allowing exemption to expire in 2035 (current statutory date)
- **Balance competing priorities** by extending a *partial* exemption from 2035 to 2050

Note: If a change is made, the General Assembly would need to determine how to treat the large subset of data centers that qualify for the special 2040 or 2050 extension. Extension currently pertains only to Amazon Web Services, but other companies may be interested in qualifying.

Findings

Exemption could be changed to address policy concerns related to energy efficiency, natural and historic resources, and local residential impacts, but changes could make the exemption a less effective economic development tool.

Policy Options

General Assembly could make eligibility for data center tax exemption contingent upon one or more of the following:

- Adopting energy and/or environmental management standards (*all* data centers)
- Using lower emission generators (*new* data centers in Northern Virginia)
- Conducting Phase 1 historic resource and viewshed studies (*new* data centers)
- Conducting sound modeling studies to identify potential noise issues (*new* data centers)

SCR = Selective Catalytic Reduction system

JLARC staff for this report

Kimberly Sarte, Associate Director

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Consulting support provided for this report

Energy + Environmental Economics -- grid modeling and rate analysis

Weldon Cooper Center for Public Service -- energy demand modeling and economic impact analysis

Article 3 Zoning Districts and Map

Amended by Town Council: March 11, 2008
February 12, 2013
April 12, 2016
June 14, 2016
August 9, 2016
December 11, 2018
August 11, 2020
August 10, 2021
April 12, 2022
September 13, 2022
XXXXX, 2025

Contents (Sections)

3-4.12 I Industrial District

3-4.12.3 Permissible Uses (by special use permit upon approval of the Town Council)

- Automobile body shop
- Automobile and truck repair and service
- Commercial Kennels
- Contractor's storage yard
- ~~Data Center~~
- Farm equipment, motorcycle, boat and sport trailer sales and service
- Fuel, coal, oil distribution storage yards
- Lumber and building supply with undercover storage.
- Maintenance and equipment shops with screened outside storage
- Outdoor storage of any kind
- Plumbing and electrical supply with undercover storage
- Restaurant or cafeteria, drive-thru or otherwise
- Self-service mini-warehouse
- Temporary fair and show grounds
- Tire and battery sales and service, tire recapping and retreading
- Transmission and receiving towers of height greater than one hundred twenty-five (125) feet.
- Treatment plants, water storage tanks, major transmission lines or pipelines, pumping or regulator stations, communications towers, storage yards and substations, and cable television facilities and accessory buildings

Article 9 Supplemental Use Regulations

Amended by Town Council: February 12, 2013
July 8, 2014
August 9, 2016
December 11, 2018
April 9, 2019
December 10, 2019
August 10, 2021
April 12, 2022
June 11, 2024
XXXXX, 2025

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~~9-26 Data Centers~~

~~Data Centers, as defined in Article 12, are permissible in the Industrial (I) District, subject to the following requirements.~~

~~9-26.1 Additional Standards~~

~~A. Minimum Lot Size: 25 acres. Town Council may approve a data center on parcels less than 25 acres as part of the special use permit application.~~

~~B. The data center shall utilize recycled water or air chillers, in conjunction with using recycled water, for cooling purposes. Potable water shall not be used for cooling.~~

~~C. All electric service lines from the substation to the data center shall be placed underground.~~

~~D. Setbacks: Per Section 3-4.12.4 ("All principal manufacturing and processing uses in industrial parks").~~

~~1. Town Council may approve building heights greater than 35 feet during the review of the Special Use Permit. Buildings must be setback one (1) additional foot (horizontally) from the required setback line for each additional one (1) foot (vertically) greater than 35 feet. Building heights shall be in conformance with the Comprehensive Plan.~~

~~2. The data center building shall be setback a minimum of one-hundred (100) feet from property lines.~~

~~E. Parking: In accordance with "Assembly or Manufacturing Uses" per Section 7-7 of the Zoning Ordinance.~~

~~F. Building Facades:~~

~~1. Building facades shall include at least two of the following design elements:~~

~~a. Change in building height;~~
~~b. Building step-backs or recesses;~~
~~c. Fenestration (25% minimum);~~
~~d. Change in building material, pattern, texture, or color;~~
~~e. Use of accent materials.~~

~~G. Mechanical Equipment:~~

~~1. Mechanical equipment shall be completely screened through the use of walls, fences or evergreen vegetation so that no part of the mechanical equipment can be seen from adjoining properties or right-of-ways.~~

~~2. All generators shall be equipped with mufflers to reduce emissions and noise.~~

~~H. Security:~~

~~1. The facility shall provide access to Town and County emergency services staff at all times.~~

~~I. Landscaping:~~

~~1. In addition to the landscape planting requirements of Article 8 of the Zoning Ordinance, any portion of the data center (including equipment) visible from a park or adjoining/across the street from a residential district shall be screened by vegetation consisting of a double staggered row of evergreen trees planted 15 feet on center. A minimum 3-foot berm planted with a double staggered row of evergreen shrubs planted 10 feet on center may be used in place of the double staggered row of evergreen trees required above.~~

~~J. Substations:~~

~~1. Substations associated with the data center shall be screened from adjacent properties and right-of-ways through the use of opaque fencing in addition to evergreen trees and shrubs.~~

Article 12 Definitions

Amended by Town Council: **February 12, 2013**
June 14, 2016
August 9, 2016
December 11, 2018
April 9, 2019
September 10, 2019
December 10, 2019
March 10, 2020
December 13, 2020
August 10, 2021
April 12, 2022
XXXXX, 2025

For the purpose of this Ordinance, certain words and terms are used in a limited or special sense as defined herein. Words used in the present tense include the future; the singular number includes plural and the plural singular; the word "structure" includes "building"; the word "used" includes arranges, designed, constructed, altered, converted, rented, leased, or intended to be used; and the word "shall" is mandatory and directory.

Any word, term or phrase used in this ordinance not defined below shall have the meaning ascribed to the word in the most recent edition of Webster's Unabridged Dictionary, unless in the opinion of the Zoning Administrator, established customs or practices of the Town of Warrenton justify a different or additional meaning.

A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | R | S | T | U | V | W | Y | Z

~~**Data Center:** A facility containing one or more large-scale computer systems used for data storage and processing for off-site users. Typical supporting equipment includes back-up batteries and power generators, electric substations, cooling units, fire suppression systems, and enhanced security features.~~

Prince William County, Virginia
Data Center Fiscal Impact Analysis

July 7, 2022

PFM Group Consulting LLC
BNY Mellon Center
1735 Market Street
42nd Floor
Philadelphia, PA 19103

Contents

Executive Summary

Background
The data center industry is an important part of the Prince William County economy, with approximately 5.5 million square feet devoted to current operations, another 1.8 million square feet under construction, and 5.7 million square feet in the pipeline. Data center developable space is expected to reach 35 million square feet by mid-century. As the Board of County Supervisors examines the impacts of new and existing data centers, it is helpful to analyze the County costs and benefits of the industry.

For this report, PFM identified tax revenue associated with the data center industry: both tax revenue generated by the facilities as well as tax revenue generated by data center employees, and related activities. PFM also analyzed the expenditure side of the County budget, identifying (where possible) expenditures associated with the data center industry, both activities that support the data centers themselves, and activities that support data center employees.

County Revenue Structure
The Virginia county tax revenue structure is limited to those taxes allowed by state statute. As a result, the real property tax is the largest revenue source for the County; it made up nearly two-thirds of general fund revenue in the FY 2021 County budget. Personal property taxes were the second largest source, making up over 20 percent of County general fund revenue in the FY 2021 County budget. Together, they made up 86 percent of County general fund revenue. As a result, any discussion of County revenues should focus on real and personal property taxes.

The data center industry has benefited from a favorable personal property tax structure for computer peripherals and equipment, which were taxed at a rate of $1.25 per $100 of assessed value, while most personal property was assessed at a rate of $3.70 per $100 of assessed value. It is likely that this helped fuel the growth of the County data center industry, although other factors are as, or more important to the industry, including high quality fiber, readily available and reasonably priced electric power, suitable land, proximity to clients and suppliers. In recent years, the County has started to increase the personal property tax rate on computer equipment and peripherals, intending to gradually increase the rate to $2.00 per $100 of assessed value.

Data Center Industry Trends, Impacts, and Key Issues
Virginia (and Northern Virginia in particular) is the largest data center market in the U.S. While Loudoun County has been the epicenter of the Northern Virginia market, Prince William County has made steady progress and, in terms of data center square footage, is now second among comparable Virginia local governments. It is expected that the industry will continue to experience strong growth in the foreseeable future, including within Prince William County.

The industry continues to evolve, and data center characteristics are changing. For example, facilities are becoming larger and denser. It appears that data centers are taking longer to equip facilities and are holding that equipment longer. These impact personal property tax revenue from data centers, as the effective tax rate declines for equipment as it ages.

Data Center County Impacts
Besides the revenue impacts (which are substantial) and the effects on land values in certain key areas, there are other characteristics of the data center industry to consider. Many data centers require a lot of land. This relates both to the square footage necessary for equipment and other center components, as well as perimeter for security. In many cases, data centers are part of a larger campus that allows for future additions.

Data centers employ fewer workers than other manufacturing or industrial facilities of similar size. While the number of employees is not as large, the data center jobs are generally high paying, with average salaries of over $100,000. An advantage of the smaller numbers of data center employees is that there is less need for County investments in infrastructure and ongoing operational support for public safety and other services. In fact, data centers generally have their own security, sophisticated fire suppression systems, and relatively few visitors. These all mean that data centers are not large consumers of basic County services. Data centers are significant consumers of certain resources, such as electric power and water. There may also be concerns about noise pollution and other environmental impacts.

Data Center Cost Benefit Analysis
Conducting a cost benefit analysis on an entire industry is an inexact science. Among other things, data centers vary widely in how long they have been in operation, their business model, and the equipment they house. As a result, the analysis focuses on broad characterizations of the industry, which will not identify issues associated with individual facilities.

This exercise generally employs an input-output economic impact model. These models identify the millions of interconnected transactions that occur within an economy, in this case focused on the data center industry. PFM used the IMPLAN model, which is a commonly used tool for this analysis.

Tax Revenue
For the benefit component of the analysis, the project team primarily relied on the direct property tax revenue associated with data centers. While this will also include sales and use tax revenue, the Commonwealth of Virginia exempts much of this for qualified data centers.

Besides the direct revenue, the analysis also takes into consideration indirect revenue, which is associated with purchases by firms supplying goods and services to the data centers, and induced revenue, which is associated with spending by data center employees. This would include their share of consumption taxes, such as the sales and use tax.

County Expenditures
For the data center industry, PFM used what is known as the **average cost** approach, where costs assigned to a new or existing development are based on the average cost of providing the service per unit (i.e., per household, student, or employee) multiplied by the number of service units. Because the data center industry is well established in the County, the costs of providing service to the industry are already reflected in existing County average costs of service.

There are generally two methods for expressing government cost of providing services, on a **per capita basis** or as a **value-added ratio.** The per-capita model classifies expenditures as either education or non-education related and uses these to create ratios to determine the costs and revenues to the County based on the number of employees related to the industry. The value-added ratio methodology uses ratios based on expenditure classifications identifying costs as people-related or business-related.

PFM found the per-capita multiplier methodology to more realistically capture the County's net costs associated with data centers. Under this approach, the current cost of public services per resident, household, or pupil is multiplied by the expected increase in population, housing units or school-aged children the data center industry has or will create.

The Northern Virginia Technology Council's (NVTC) biennial study of the Impact of Data Centers on the State and Local Economies of Virginia also used the per-capita multiplier approach.[1] This focuses on the largest costs that any business imposes on a local government – the costs associated with providing primary and secondary education, public works, public safety, and other county services to the employees of that industry. The study's authors perform this analysis for Prince William County for 2020 in its most recent iteration of the biennial report. The PFM team replicated the methodology for 2021 and 2022.

The project team has the greatest degree of confidence in the cost benefit analysis of direct fiscal impacts alone. Using this approach, the net benefit to the County was significantly positive, $9.67 per $1.00 of investment in 2020, $11.76 in 2021, and $13.41 in 2022.

There are limitations associated with this (or any) methodology. As previously noted, combined costs and benefits will generalize some costs that, for some facilities, are a bigger issue for residents and other businesses than for the industry as a whole. Additionally, as with many commercial or industry activities, there will be externalities associated with it. In discussions with internal and external stakeholders, it was noted that data centers may impact on residential sight lines, create noise pollution, and generate CO2 emissions. These are all notable concerns, but they are not readily quantifiable, and they have not been assigned a cost for this analysis.

Summary

The key high-level findings that are addressed throughout the report include:

- The data center industry within Virginia, Northern Virginia, and Prince William County is a significant economic driver.
- Prince William County has experienced rapid growth within the Northern Virginia data center concentration.
- It is likely that the data center industry will continue to grow in the coming years.
- Taxes paid by the data center industry have shown similarly large growth in recent years.
- Data center County service needs are less intense than many other commercial activities.
- Many other data center service needs are paid for by the individual facilities.
- There are negative externalities associated with data centers that are not conducive to quantitative cost benefit analysis.
- Qualitative impacts are difficult to quantify and were not attempted for this analysis. Applying cost benefit analysis is easier for a specific facility and more difficult for an entire industry.
- Even though the exact ratio of costs to benefits varies by methodology, this and previous studies generally conclude that the data center industry is a net benefit to the County.

[1] In addition to its biennial studies on behalf of the NVTC, Mangum Economics uses this approach in its analysis of the potential impact of large data center development in Maryland on behalf of the Maryland Chamber Foundation. See Maryland Chamber Foundation, "Potential Impact of Large Data Center Development in Maryland," (March 2020). Accessed electronically at https://netchoice.org/wp-content/uploads/2020/07/Maryland-Data-Center-Report-2020.pdf

1. Introduction and Project Background

Background
The data center industry is an important part of the Prince William County (County) economy, with approximately 5.5 million square feet devoted to current operations, another 1.8 million square feet under construction, and 5.7 million square feet in the pipeline. In 2021, the Board of County Supervisors initiated a Comprehensive Plan Amendment (CPA2021-00004) to study the impacts of creating a “Digital Gateway” along Pageland Lane. This project includes multiple tasks, including a data center market study completed in October 2021 that estimated the economic impact of the data center industry.

PFM conducted an earlier study for the County that touched on the data center industry. As part of the 2019 County budget process, PFM reviewed revenue alternatives, including a proposal by then-Chair of the Board of Supervisors Corey Stewart to increase the County tangible business personal property tax on computer equipment from $1.25 to $3.70 per $100 of assessed value – nearly a 300 percent increase. At that time, PFM’s analysis concluded that the proposed tax increase would likely have a negative impact on the existing data center industry and prospects for industry growth in the County.

Issue
As the County considers additional land use applications, it is helpful to understand the general return on investment for the County related to data center locations. To do so, it is necessary to identify both the revenues generated by the data center industry and the County service costs for these facilities.

This would include direct revenues (primarily real and personal property taxes) as well as revenue generated by data center employees and related data center activities. In addition, these revenues should, if possible, be categorized by the types of data centers to determine if certain types of facilities are preferable from a revenue generation perspective.

Data center costs to the County would include direct costs (such as fire and rescue services, police protection, street maintenance, etc.) as well as necessary infrastructure and other investments to support the industry, and indirect costs associated with data center industry employees. An example of an indirect cost from employees would be school division costs for data center employee’s children in public schools.

Project Scope of Work[2]
The following were identified as the key activities and deliverables for the fiscal impact analysis:

- Interviews with stakeholders and subject matter experts.[3]
- Review of Prince William County real and personal property tax records for existing data centers.
- Analyze the types of tax generated to determine the methodology.
- Determine the fiscal costs to the government for a data center (i.e., schools, police, fire and rescue services, etc.).

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[2] A summary of the PFM team’s project approach is provided in Appendix A.
[3] A list of interviews conducted by the PFM team is provided in Appendix B.

The PFM project team wishes to thank the many individuals from Prince William County government and other County stakeholders who shared their knowledge and insight related to the issues addressed in this report. They contributed much of their time and provided the project team with a solid understanding of the issues the County has faced and will continue to deal with in the present and future. Of course, the findings and recommendations should not be attributed to any of those individuals, and any errors or omissions are the sole responsibility of the PFM project team.

2. Prince William County Profile

Overview

Throughout most of its history since its founding in 1731, Prince William County has been a farming community. Its economy diversified in the 20th century; Marine Corps Base Quantico opened after World War I, and the National Park Service opened Prince William Forest Park. Following World War II, the County accelerated its development as a suburb of the nation's capital. At present, approximately 19 percent of County land is federally owned.

Prince William County has had a County Executive form of government since 1972. It has eight County Supervisors elected to four-year terms, seven of whom represent individual districts and one at-large chair.. They appoint a County Executive to serve as the chief administrative officer and execute the County Supervisors' policies.[4]

Economic and Demographic Indicators

The following table provides a summary of key County demographic and economic characteristics; additional detail is provided in the sections that follow.

Table 1: Prince William County Economic and Demographic Characteristics

2021 County Population	488,629
Land Area	348 square miles
Per Capita Personal Income	$43,388
Median Household Income	$107,132
Total Employment	139,704
Unemployment Rate	5.2%
Poverty Rate	5.8%
Public School Enrollment	89,991
County and School FTE	16,509
Bond Ratings	Moody's: Aaa S&P: AAA Fitch: AAA

Source: Prince William County Department of Information Technology Annual Population Estimates, Prince William County FY 2022 Adopted Budget, Prince William County Public Schools FY 2022 Approved Budget, ESRI Demographic and Income Profile: Prince William County, ESRI Population Summary: Prince William County

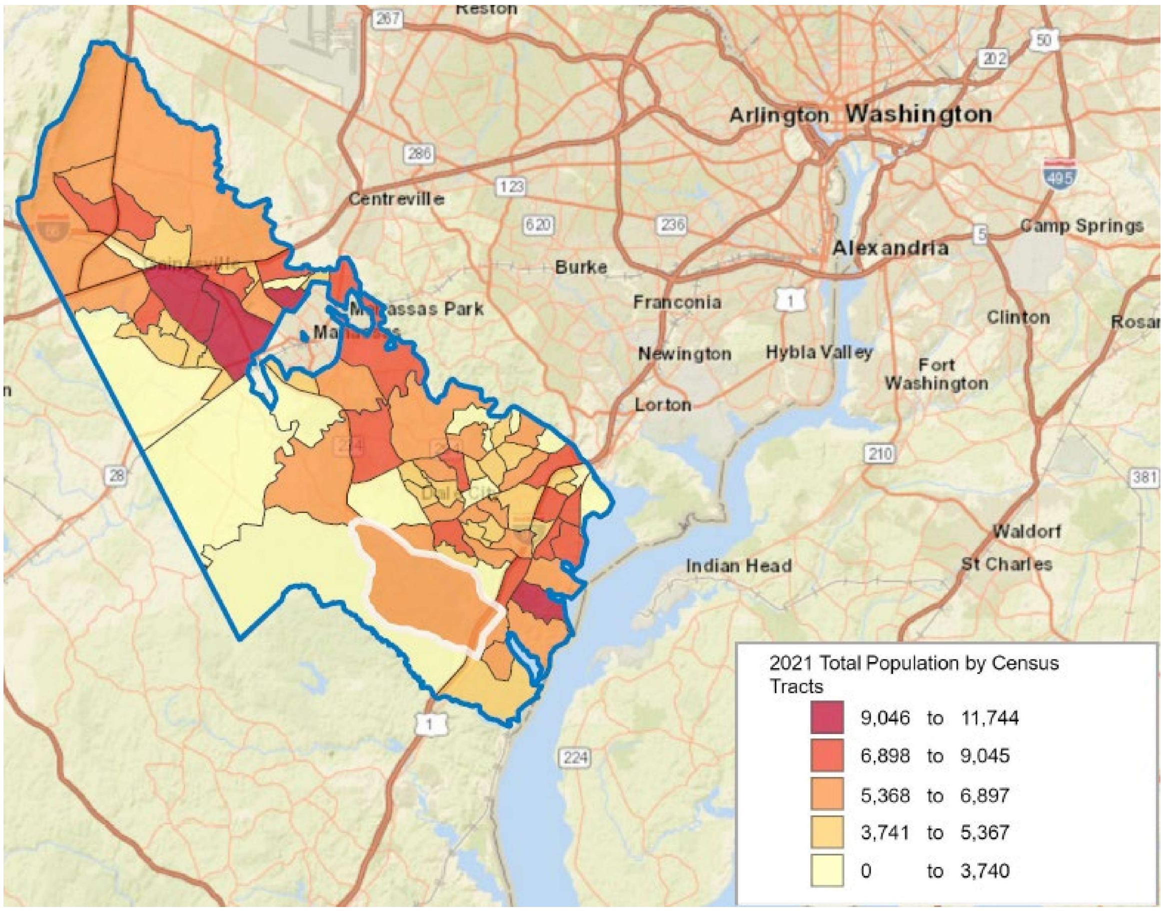
Population

The County has a history of steady growth. The County population increased by 15.7 percent between 2010 and 2021, from 402,002 to 488,629 individuals, which is a compound annual growth rate (CAGR) of 1.8 percent.[5] It is projected to grow to 530,300 by 2030, increasing 0.9 percent per year.[6]

[4] PWC Adopted Budget and PWCS Adopted Budget, FY 2022.
[5] The Compound Annual Growth Rate (CAGR) is the mean annual growth rate over a specified period of time longer than one year.
[6] Prince William County Department of Information Technology Annual Population Estimates.

Prince William's current population ranks it as the second largest Virginia county. Most of the County's population is concentrated towards the center and eastern edge of the County, outside of its "rural crescent" (mostly shown in yellow in Figure 1).

Figure 1: Prince William County 2021 Population by Census Tracts



Source: ESRI 2021 Total Population by Census Tracts: Prince William County, VA

In 2021, Prince William County's daytime population was less than its total population. During the day, it contained approximately 189,000 workers and 230,000 residents. This suggests that more residents commute outside the County to their place of employment than those who enter the County to work.[7] It is an open question as to whether the work from home (WFH) changes brought on by the COVID-19 pandemic will lead to permanent structural changes in the migration patterns for workers who live in the County. There is evidence that a far larger share of the workforce will not have to commute to their place of employment – if not permanently, at least not as often as pre-pandemic. If this is the case, the daytime population may grow. This may also impact certain types of revenue collections within the County, where workers are making fewer taxable purchases of goods and services during the workday outside of the County.

[7] ESRI Market Profile: Prince William County, VA

Industry and Employment

More than two-thirds (68.9 percent) of Prince William County's labor force works in "white collar" professions, including professional services (28.1 percent), and management, business, and finance (22.1 percent). Of employed individuals over 16 years of age, 16.3 percent work in "blue collar" professions, including transportation and material moving (6.1 percent) and construction and extraction (5.4 percent).[8]

As of 2020, the County's top ten employers (by number of employees) were:[9]

1. Prince William County School Board
2. Prince William County
3. U.S. Department of Defense
4. Walmart
5. Morale Welfare and Recreation
6. Sentara Healthcare
7. Target Corporation
8. Wegmans Store #07
9. Northern Virginia Community College
10. MJ Morgan Group

One of the notable features of County employment is that companies in the data center industry are not major employers. This is a characteristic for the industry as a whole – it is associated with large capital investments (and property tax payments), but little direct employment. At the same time, the data center permanent employees are generally paid above the County average wage, and there may be associated support industries that will locate in the County to be near their data center customers.

Prince William County Revenue Structure

Prince William County is similar to other local governments in Virginia: its primary tax revenue source is the real property tax. Real property tax is the largest tax revenue source for local governments throughout the Commonwealth and for the U.S. as a whole. Of the County's General Fund budgeted FY 2022 revenue, 56.7 percent comes from real property taxes, and 17.0 percent comes from other general property taxes. This is consistent with FY 2021's General Fund revenue as well.[10] The following table summarizes Prince William County's budgeted FY 2021 General Fund revenue sources.

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[8] ESRI Market Profile: Prince William County, VA [9]
Prince William County Adopted Budget, FY 2022.
[10] Prince William County FY 2022 Adopted Budget

Table 2: Prince William County Adopted General Fund Revenue by Source, FY 2021 (Amount in Thousands of Dollars)

General Fund Revenue Source	Amount	Percent of Total
Real Estate Taxes	$722,258	66.1%
Personal Property Taxes[11]	$220,440	20.2%
Other Local Taxes[12]	$124,629	11.4%
Additional Revenue Sources[13]	$23,612	2.2%
Interest on Taxes	$1,744	0.2%
Total	**$1,092,683**	**100.0%**

Source: Prince William County FY 2022 Adopted Budget

Real Estate Tax Rate

After remaining constant between Tax Year (TY) 2015 and TY 2020, Prince William County lowered its real property tax rate in TY 2021 and TY 2022.[14]

Table 3: Prince William County Historical Real Property Tax Rates

Tax Year	Real Property Tax Base Rate
2014	$1.148
2015	$1.122
2016	$1.122
2017	$1.125
2018	$1.125
2019	$1.125
2020	$1.125
2021	$1.115
2022	$1.030

Source: Prince William County Department of Finance

Personal Property Tax

Prince William County levies a tax on personal property for both individuals and businesses. In TY 2022, the County levied this tax at $3.70 per $100 of assessed value of personal property as of January 1.[15] A different rate applies to different categories of business general personal property. Computer equipment and peripherals (CEP) used in data centers are taxed at $1.50 per $100 of

[11] Includes vehicles and business tangible property.
[12] Includes 11 local taxes, including BPOL and Local Sales Taxes.
[13] Includes revenue from money and property, state revenue, federal revenue, and miscellaneous revenue. [14] "Tax Rates," Prince William County Department of Finance, accessed electronically at https://www.pwcva.gov/department/finance/tax-rates
[15] Prince William County FY 2022 Adopted Budget

assessed value.[16] The Board of Supervisors has also communicated the intent to raise the rate over time to $2.00 per $100 of assessed value.

This class of personal property has exhibited very strong growth in recent years. CEP personal property tax revenue from data centers has increased by a compound annual growth rate of 35.5 percent between FY 2013 and FY 2022.

Table 4: Prince William County Personal Property Net Tax Revenue Attributable to Data Centers, FY 2013 – FY 2022 (Amounts in Thousands of Dollars)

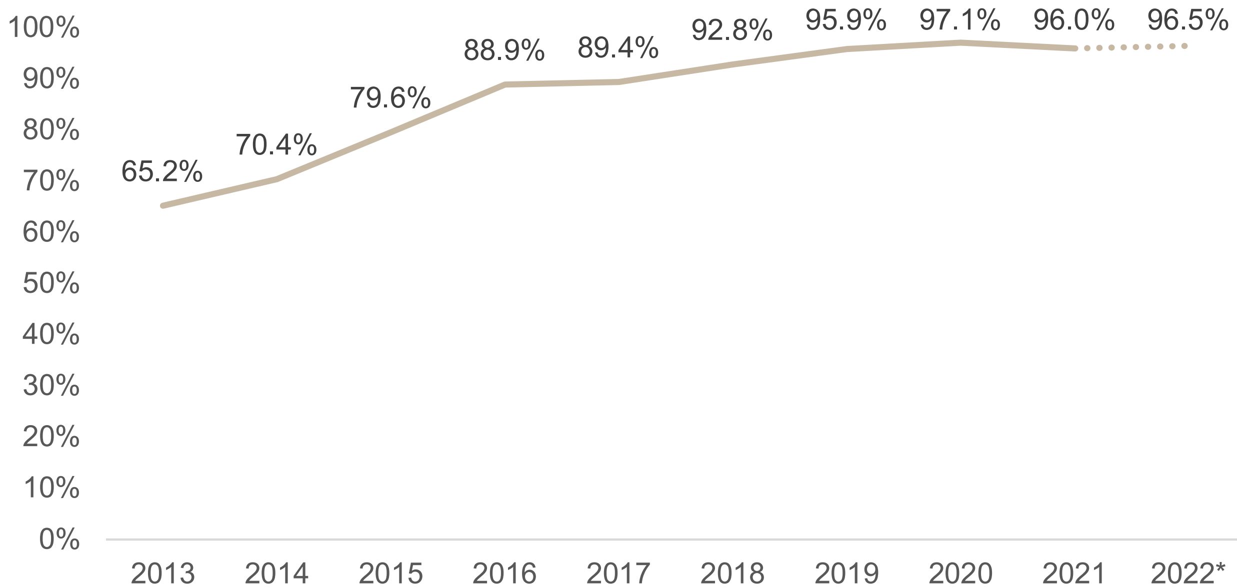
Fiscal Year	Furniture and Fixtures Net Tax Revenue	Computer Equipment and Peripherals Net Tax Revenue	Total Data Center Business Tangible Property Tax Revenue
2013	$467	$2,446	$2,913
2014	$893	$2,949	$3,842
2015	$3,431	$4,115	$7,546
2016	$5,771	$6,926	$12,697
2017	$7,493	$9,290	$16,783
2018	$8,744	$10,830	$19,574
2019	$10,228	$15,625	$25,853
2020	$11,419	$20,879	$32,298
2021	$16,676	$24,876	$41,552
2022*	$20,266	$34,118	$54,384
2013 - 2022 CAGR	**52.0%**	**34.0%**	**38.4%**

**FY 2022 includes preliminary data.*
Source: Prince William County Department of Finance

Over the past decade, the percent of computer equipment and peripherals personal property tax revenue from data centers has increased substantially, and it is forecast to be above 96 percent of total CEP personal property tax revenue in FY 2022.

[16] "Tax Rates," Prince William County Department of Finance, accessed electronically at https://www.pwcva.gov/department/finance/tax-rates

Figure 2: Data Center Tax Revenue Percent of Total CEP Personal Property Tax Revenue



**FY 2022 includes preliminary data.*
Source: Prince William County Department of Finance

The share of personal property tax revenue from data centers has increased over the past decade. Its growth has outpaced all other forms of personal property tax revenue, with a CAGR of 35.5 percent between FY 2013 and FY 2022.

Over the last 10 years, tax revenue from business tangible property has more than doubled as a portion of the County's overall tax revenue. In FY 2013, business tangible property tax revenue was estimated at $19.9 million,[17] or 2.5 percent of total General Fund tax revenue. By FY 2022, it was estimated at $63.4 million, or 5.5 percent of total General Fund tax revenue:

Table 5: Estimated General Fund Revenues by Source
(Dollar Amounts in Thousands of Dollars)

	FY 2013 Amount	% of Total	FY 2022 Amount	% of Total
Real Estate Taxes	$519,369	65.7%	$763,024	66.6%
Other Revenue	$138,244	17.5%	$155,826	13.6%
Other Personal Property Taxes	$112,782	14.3%	$163,620	14.3%
Business Tangible Property Taxes*	$19,903	2.5%	$63,431	5.5%
Total	**$790,298,135**	**100.0%**	**$1,145,901,059**	**100.0%**

Source: Prince William County FY 2013 Revenue Estimates and FY 2022 Adopted Budget
** Including data centers*

[17] Calculated as 15 percent of total personal property taxes; Prince William County FY 2013 Revenue Summary, accessed at: https://www.pwcva.gov/assets/documents/management-budget/13BUD--05--Revenue%20Summary--00.pdf

3. Data Center Industry: History, Trends, and Impacts

Background
Dating to the 1960s, the Internet and the World Wide Web grew out of the need for academic communication and information exchange. Over the next 30 years, this network expanded, became searchable, and reached mainstream audiences through the introduction of Web browsers. By the mid 1990's, major companies launched Internet-based applications, as did Microsoft's Internet Explorer as part of Windows 95. In the 21st century, mobile Internet devices, smart phones and wireless hand-held Internet access all evolved. These developments have led to greatly increased needs for data storage, access, processing, and transmitting.

By the decade beginning in 2010, data usage and needs led to the development of hyperscale data companies. Users and generators of this level of data usage are common household company names, including Microsoft Azure/Office 365, Facebook, Alphabet's Google Cloud, IBM Cloud, Oracle Cloud, Apple, Alibaba, Yahoo!, Uber, LinkedIn, and Dropbox, among others. These data applications continue to expand, driven by e-commerce, wireless networks, social media, streaming content, software-as-a-service (SaaS), artificial intelligence, machine learning, virtual reality, gaming, and machine-to-machine communication, also known as the Internet of Things (IoT).

Everyday life, including banking, communication, health care, recreation, entertainment, education, work, and social lives are increasingly conducted online. Data centers are the generators of much of the digital content that we use. These include personalized shopping recommendations; on-the-fly driving directions; online assistance with selecting a restaurant, hotel, or plane flight; digital retail or online shopping coupons; machine-generated responses to banking and billing inquiries, etc. These are all made possible by data centers.[18]

There is an expectation that these common features of daily life will drive the need for additional data centers well into the future. As uses expand throughout the universe of business applications, an increasing share of businesses will use these services and applications. This drives the need for both cutting-edge hyperscale data centers and online data and access needs requiring more intensive data services. Some data centers are dedicated single tenant/single user facilities, and some are multi-tenant facilities managed by professional data center service providers.

Virginia's Emergence
Virginia is home to the largest concentration of data centers in the world, with Northern Virginia alone accounting for more than 100 (out of 504 known) hyperscale data centers worldwide. The Northern Virginia hyperscale data centers total more than 13.5 million square feet of data center space – and continue to grow. Synergy Research Group estimates that 25 percent of U.S. hyperscale data centers are located in Virginia.

In Northern Virginia, network connectivity traces its roots to the U.S. government's experiments in wide-area fiber optic networking in the 1960s. Today, an intersection of mission-critical fiber backbones connects Virginia to all major markets in the U.S., which includes the highest density of dark fiber in the world.

[18] "The Impact of Data Centers on the State and Local Economies of Virginia," Northern Virginia Technology Council, January 2020, p.4.

Beyond the physical, technological, and demand-based aspects that have supported data center development, Virginia has positioned itself to attract and accommodate data center development through exemptions for sales and use taxes on equipment and software. Virginia exempts from sales and use tax data center equipment purchased (DC Exemption) when a data center investment exceeds $150 million, accompanied by creation of at least 50 new jobs with an average wage of 150 percent of the local wage rate. Even a colocation (non-single user) data center may qualify for the exemption where both the data center and its tenants, combined, would qualify for, and use, the DC Exemption. These tax incentives have substantially supported statewide development of the data center industry. One evaluation determined that only 10 percent of all data center development would have occurred in Virginia without the state sales tax exemption.[19] This has helped make Virginia highly competitive in the development and attraction of data centers.

The Commonwealth has continued to enact legislation that may be considered favorable to the data center industry. During the 2022 session, HB 791 was approved with unanimous votes in both the House and Senate, and Governor Youngkin signed the bill. It provides that if data center fixtures are taxed as part of the real property where they are located, they must be valued based on the cost approach. The bill defines cost approach as assessing value by determining the cost to construct a reproduction or suitable replacement of fixtures and deducting physical, functional, and economic depreciation sustained by such fixtures.[20] The bill takes effect on July 1, 2022.

Virginia data center growth increased rapidly beginning in 2012, which, as previously noted, coincided with the year Virginia significantly revised its data center tax incentive. By 2016, Northern Virginia had become the largest data center market in the U.S., as measured by megawatts of power capacity.[21] This growth has accelerated: Northern Virginia more than doubled its total data center capacity between 2018 and 2021.[22]

The concentration of data centers in Virginia, and its place as industry leader in the U.S., is highly significant, and the data center concentration is highly dense. The Virginia megawatt power capacity of data centers is larger than the concentration of markets two through six in size combined.

This is due in part to the direct fiber Network Access Point (NAP) located in Virginia, as well as the recent installation of undersea fiber cables constructed to enhance network connectivity between North America, Latin America, South America, and Europe. These new cables are major

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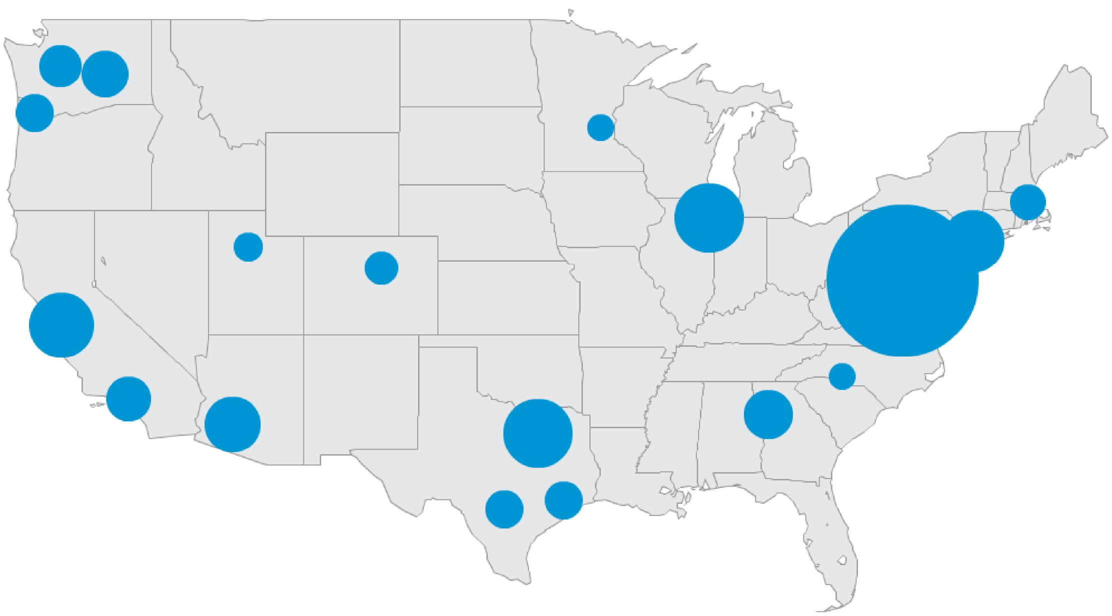
[19] "The Impact of Data Centers on the State and Local Economies of Virginia," Northern Virginia Technology Council, January 2020, p. 2.
[20] Under HB 791, fixtures would include generators, radiators, exhaust fans, and fuel storage tanks; electrical substations, power distribution equipment, cogeneration equipment, and batteries; chillers, computer room air conditioners, and cool towers; heating, ventilating, and air conditioning systems; water storage tanks, water pumps, and piping; monitoring systems; and transmission and distribution equipment. Computer equipment and peripherals would not be considered fixtures.
Under current law, localities may tax the listed items as either real or personal property. There are three methods that may be used for assessing real estate: (1) the sales comparison method; (2) the replacement cost less depreciation method; and (3) the capitalization of income method. If these items are taxed as personal property, they are valued by means of a percentage or percentages of original cost. See HB 791 Fiscal Impact Statement, Virginia Department of Taxation, accessed electronically at https://lis.virginia.gov/cgi-bin/legp604.exe?221+oth+HB791FER161+PDF
[21] CBRE, Large Supply Pipeline Sets Stage for Market Growth in 2019 North American Data Center Report H1 2019
[22] "The Impact of Data Centers on the State and Local Economies of Virginia", Northern Virginia Technology Council, March 2022, p.6.

advancements in communications infrastructure. These lines land in Virginia Beach and terminate in Richmond, providing enhanced network connections in parts of Virginia that are outside of the Northern Virginia region. This positions Virginia to remain an industry leader while providing opportunities for data center growth elsewhere throughout the state, outside of Northern Virginia alone.

Figure 3: Relative Sizes of Largest U.S. Data Center Markets (MW capacity), 2021



Source: The Impact of Data Centers on the State and Local Economies of Virginia, Northern Virginia Technology Council, March 2022

Employment

While data centers do not have high levels of ongoing employment, most of Virginia data center employment (88 percent of statewide employment in the industry) is located in Northern Virginia (an additional 6 percent is in Southern Virginia, 5 percent in Central and Coastal Virginia, and 1 percent in the Valley and Western Virginia).[23] Data center employment has grown in Northern Virginia since 2012, to 10,663 jobs in 2018, when Northern Virginia provided 75 percent of all private data center employment statewide.

Industry Growth Prospects

More and more, the U.S. (and world) economy is centered around information. The data center has a key role in that economic transformation. While some believe that new advances may render data centers less critical, there is little present evidence of that. One recent market research report noted that cloud, technology, and social media companies continue to drive near-record levels of demand across the globe.[24] Power consumption is one indicator of increased demand. This market research report noted that U.S. data center construction ramped up from 611.8 MW in the end of 2020 to

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[23] "The Impact of Data Centers on the State and Local Economies of Virginia", Northern Virginia Technology Council, March 2022, p.6

[24] "H1 2021 Data Center Outlook: Insight into the Industry's Top Trends in the First Half of 2021," JLL Research, September 8, 2021

680.8 MW in the first half of 2021. Another study found that more than 527.6 MW of capacity was under construction in primary markets at the midway point of 2021, up 42 percent from the same period in 2020. Over half of that construction was located in Northern Virginia.[25]

Most market trends reports indicate that the data center industry will continue on a strong growth trajectory. For example, one research study on the data center construction market forecasts that by 2027, the market size will nearly double in comparison to 2019 – growing from $64.2 billion to $121.6 billion.[26] Another research report forecasts that the data center construction market will achieve a compound annual growth rate of 11.6 percent from 2021 to 2026.[27]

Industry Trends

The data center market is relatively fluid, and hot markets can cool rapidly. Data center utilization, location, and relocation can be volatile. The purchase of new equipment, ongoing real estate and business property taxes, technology changes and the evolution of connectivity requirements and availability, among other factors, can influence and create significant uncertainty in the durability and sustainability of data center concentrations in any one location. The proximity of Virginia Beach to the previously discussed undersea fiber cables is a new comparative advantage for that region in comparison to Northern Virginia, and these ebbs and flows may occur going forward.

Several data center industry developments also have the potential to impact Prince William County's tax revenue. Major trends identified by the project team through research and interviews with industry representatives involve data center equipment pricing, equipment refreshment rates, and equipment density.

Equipment Pricing

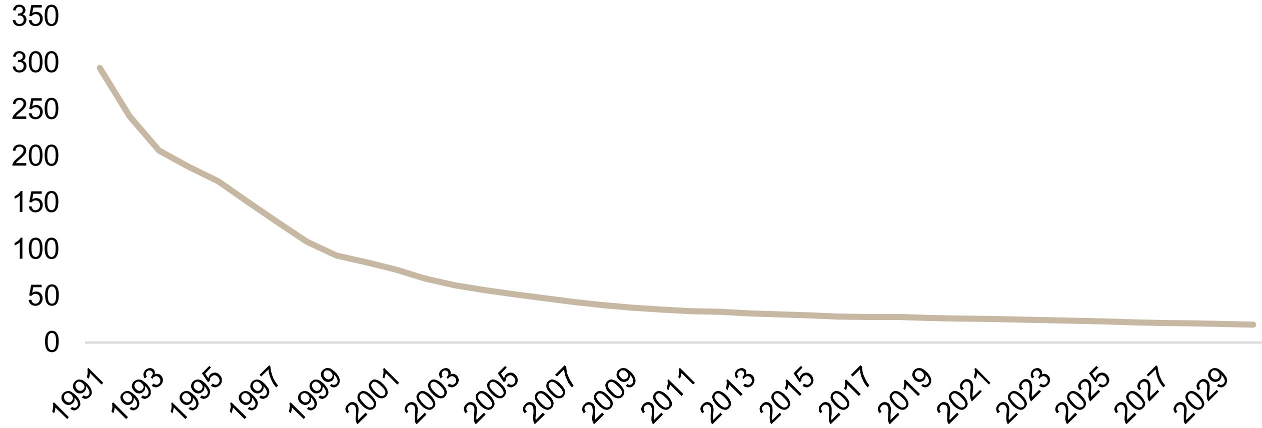
The price of equipment used in data centers has trended down, as technology has improved, and the equipment has become more affordable. This is expected to continue in the future, as shown on the following chart. The price of equipment is expected to continue to decrease slowly over the next decade, as forecasted by Moody's Analytics.

[25] "Digital Infrastructure in 2021: The Search for Land, Space, Power and Connectivity," CBRE Research, 2021.

[26] "Data Center Construction Market: Market Estimates and Trend Analysis to 2027," Grand View Research, 2020.

[27] "United States Data Center Construction Market – Growth, Trends, COVID-19 Impact, and Forecasts (2021-2026), Mordor Intelligence, 2021.

Figure 4: Computers and Equipment Producer's Price Index



Source: U.S. Bureau of Labor Statistics and Moody's Analytics Forecast

Equipment Replacement/Refresh Rates

Data centers are beginning to extend replacement rates for their equipment, meaning they are holding onto it longer. This is driven primarily by the performance of new data center equipment, which is improving at a slower rate than in the past. A common expectation in the data computing world has been that the performance of microchips would improve significantly, while the cost would continue to decline. This historic trend is referred to as Moore's Law.[28] However, in recent years, this trend has not matched prior performance. Moore's law relies on putting more circuitry on smaller and smaller microchips. However, the newest Intel fabrication plant, meant to build chips with minimum feature sizes of 10 nanometers, was much delayed, delivering chips in 2019, five years after the previous generation of chips with 14-nanometer features. Numerous other prominent computer scientists have declared Moore's Law dead, and in 2019, the CEO of the large chipmaker Nvidia agreed.[29]

As a result, firms replace equipment later, because there is little to no performance improvement by purchasing new equipment. As an example, in its public filing,[30] Amazon noted it has officially extended the useful life of its server equipment from three to four years as of January 1, 2020.[31] As this trend continues, it may reduce tax revenues as the amount of older equipment assessed at lower personal property tax rates increases, and less new equipment is added.

[28] Moore's Law refers to Gordon Moore's perception that the number of transistors on a microchip doubles every two years, though the cost of computers is halved. Moore's Law states that we can expect the speed and capability of computers to increase every couple of years, and they will cost less. Another tenet of Moore's Law asserts that this growth is exponential. Accessed electronically at https://www.investopedia.com/terms/m/mooreslaw.asp

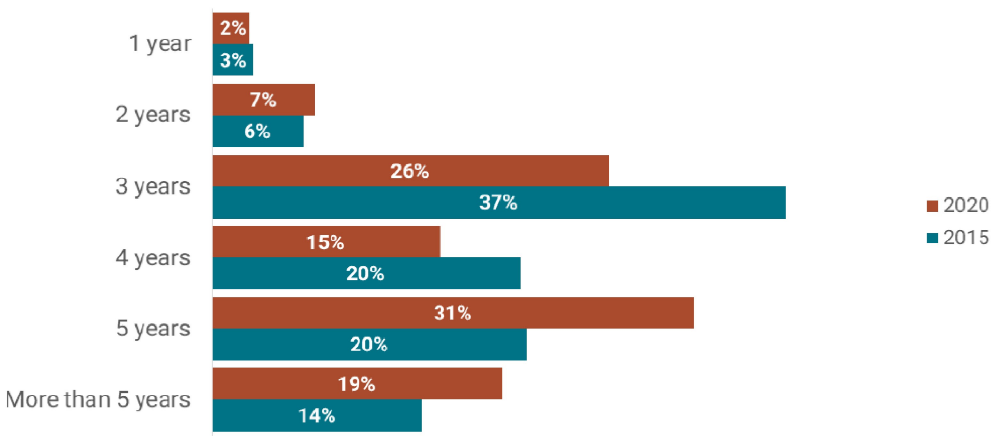
[29] David Rotman, "We're Not Prepared for the End of Moore's Law," MIT Technology Review, February 24, 2020, accessed electronically at https://www.technologyreview.com/2020/02/24/905789/were-not-prepared-for-the-end-of-moores-law/

[30] A U.S. Securities and Exchange Commission (SEC) Form 10-K is a required annual report that gives a comprehensive summary of a company's financial performance.

[31] Amazon, Form 10-K, 2020, Page 43, accessed electronically at: https://www.sec.gov/ix?doc=/Archives/edgar/data/1018724/000101872421000004/amzn-20201231.htm

A 2020 survey by the Uptime Institute related to data center operations supports this trend toward longer refresh rates. In fact, data center respondents in 2020 listed 5 years as their average length of time, compared to 3 years in 2015.[32]

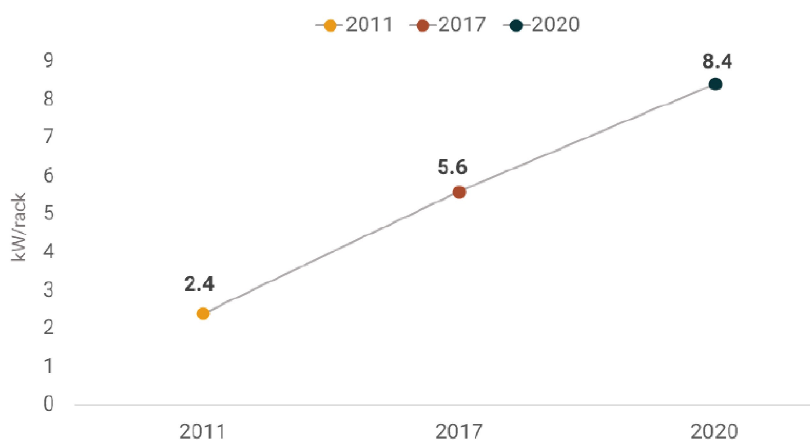
Figure 5: Data Center Equipment Refresh Rates, 2020 and 2015



Source: Uptime Institute

Equipment Density
The density of equipment in data centers has increased significantly over the last decade. One survey of data center operators found average server rack density increased at an annual rate of 15 percent between 2011 and 2020, as shown in the following figure.[33]

Figure 6: Average Overall Server Rack Density (kW/Rack)



Source: Uptime Institute

[32] Uptime Institute, "Rack Density is Rising," December 7, 2020, accessed electronically at: https://journal.uptimeinstitute.com/rack-density-is-rising/#:~:text=Eliminating%20respondents%20with%20above%2030,provisioned%20range%20of%20most%20facilities
[33] Uptime Institute, "Rack Density is Rising," December 7, 2020, accessed electronically at: https://journal.uptimeinstitute.com/rack-density-is-rising/#:~:text=Eliminating%20respondents%20with%20above%2030,provisioned%20range%20of%20most%20facilities.

This suggests that when equipment is replaced, more equipment takes its place. This trend may partially offset the potential declines in tax revenue driven by declining prices and delayed replacement of equipment.

Development Lead Time
Development of physical building space may not coincide with growth in the assessed value for tax revenue forecasting purposes. This is due to the lag in the time from a building being completed for occupancy, to tenant leasing or occupancy, and then to equipment outfitting. Based on recent discussions with data center industry executives, outfitting and full building utilization generally takes 12 months from completion to full occupancy. However, full utilization and outfitting may, in some instances, take as long as 36 months. This depends on business conditions, customer demand, and the construction/timing of advanced facilities and facilities planning needed to provide services as quickly as possible when demand arises.

A trend that may be developing relates to longer planning time periods for data centers. Data center users and operators may pre-position buildings well in advance of need. This is so the time delay between when tenants or demand occurs to when functional data center space can be delivered may be a few weeks to a few months, compared with the time and advance planning needed to construct buildings and facilities, which may take a year or more. This was a point of discussion in project interviews. This has also been an area of concern - that data center land purchases are crowding out other possible land use.

Environmental Issues
Data centers consume a significant amount of natural resources. It is estimated that data centers account for approximately 1.8 percent of electricity used in the U.S. Large amounts of water are also required to operate data centers, both directly for liquid cooling, and indirectly to produce electricity. Approximately 0.5 percent of total U.S. greenhouse gas emissions are attributed to data centers.[34] These are U.S. totals and not solely attributable to data centers in Prince William County or the Commonwealth of Virginia.

Firms operating data centers are often seeking to become more efficient and environmentally friendly, as it can reduce input costs. Google and Microsoft have each shared plans to reduce waste associated with data center operations.[35] Data centers are moving away from planned obsolescence and toward longevity where possible. Server equipment will be increasingly designed for repairability to extend useful life, furthering the trend of later replacement of equipment.

Because of their power needs, data centers are also increasingly locating in and/or advocating for increased use of renewable energy, which may be less susceptible to certain types of supply disruption and may also reduce the overall carbon footprint of the industries through use of electricity generated by wind and solar power sources.

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[34] Md Abu Bakar Siddik, Arman Shehabi, and Landon Marston, “The Environmental Footprint of Data Centers in the United States,” Environmental Research Letters, May 21, 2021, accessed electronically at https://iopscience.iop.org/article/10.1088/1748-9326/abfba1/pdf

[35] Microsoft, “Microsoft Commits to Achieve ‘Zero Waste’ Goals by 2030,” August 4, 2020, accessed electronically at: https://blogs.microsoft.com/blog/2020/08/04/microsoft-direct-operations-products-and-packaging-to-be-zero-waste-by-2030/
Google, “A Circular Google,” June 2019, accessed electronically at: https://services.google.com/fh/files/misc/circular-google.pdf

Of course, there are many data centers that have been in place for 10 or even 20 years. Many of these older facilities will not have the same levels of environmental efficiency. This is another example of why the performance of individual data centers will differ from aggregate measures.

4. Prince William County Data Center Key Issues

Prince William County Data Center Trends

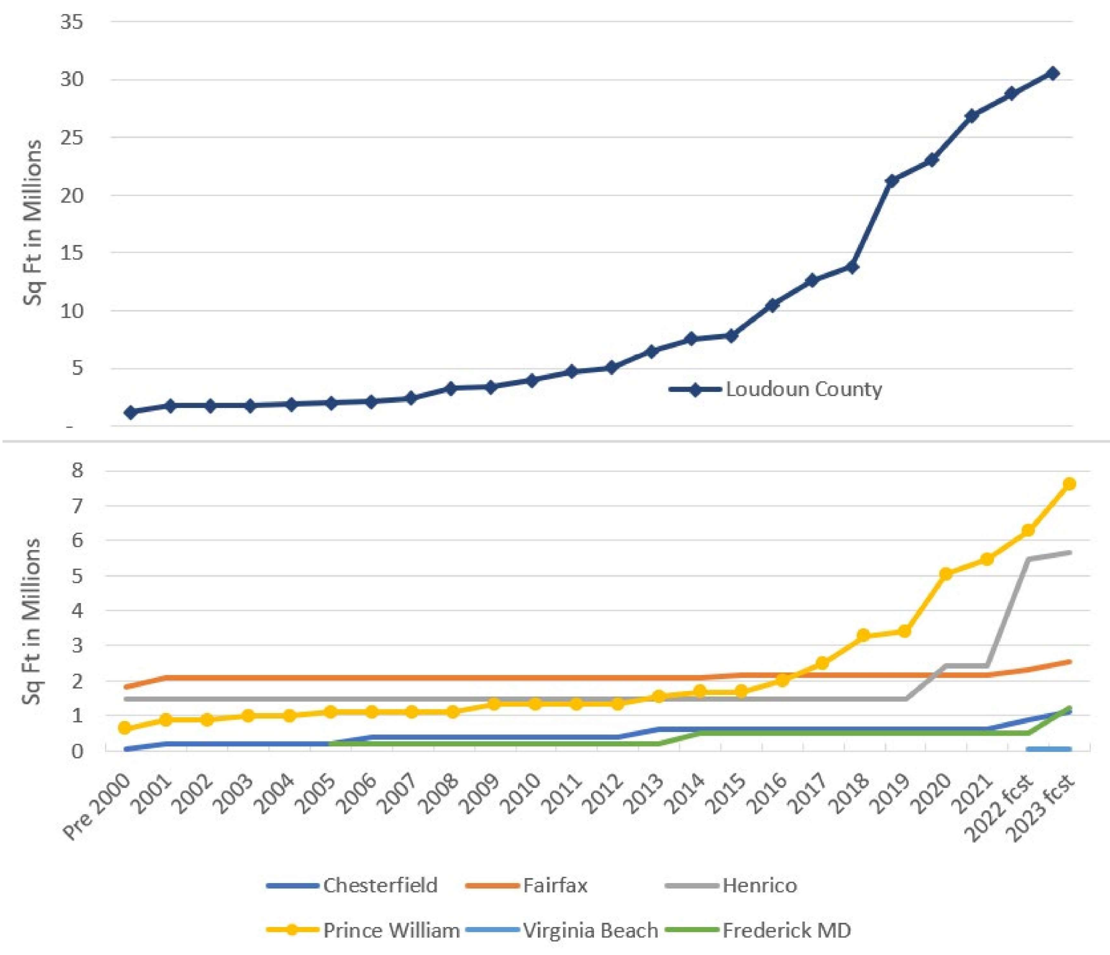
The County has made a concerted effort to attract data centers. This is evidenced by several reductions in the business tangible personal property tax rate for computer equipment and peripherals. In 1999, the rate was decreased from $3.70 to $1.50 per $100 of assessed value; in 2001, the rate was lowered again, to $1.25. As the industry has matured and the County has become a more significant industry location, the Board of County Supervisors has elected to gradually increase the tax rate. On April 28, 2020, the rate was increased to $1.35 for FY 2021, and $1.50 for FY 2022. The adopted FY 2023 budget includes an increase in the rate to $1.65 per $100 of assessed value.[36]

Additionally, in 2016, the County designated approximately 9,000 acres of land as a Data Center Opportunity Zone Overlay District. This zoning permits the development and operation of data centers in all industrial, office, and commercial zoning within the District (by-right zoning). It also promotes fast-track rezoning approvals for data centers within the district.

The success of these efforts is evident, as Prince William County's data center square footage is second in the Commonwealth only to that of Loudoun County (expected to reach 30 million square feet by 2023), which had something of a head start. The following compares square footage in key data center markets:

[36] This is a common approach in the use of tax policy to attract a nascent industry. The reduced rate for computer equipment and peripherals was a consideration for data centers locating in the County. Once a sort of 'critical mass' of the industry within the County is reached, it is reasonable to gradually increase the tax rate to reflect costs associated with a more mature industry.

Figure 7: Data Center Square Footage Comparison, Select Jurisdictions



Source: PFM, CoStar, Prince William County and Loudoun County Economic Development Departments

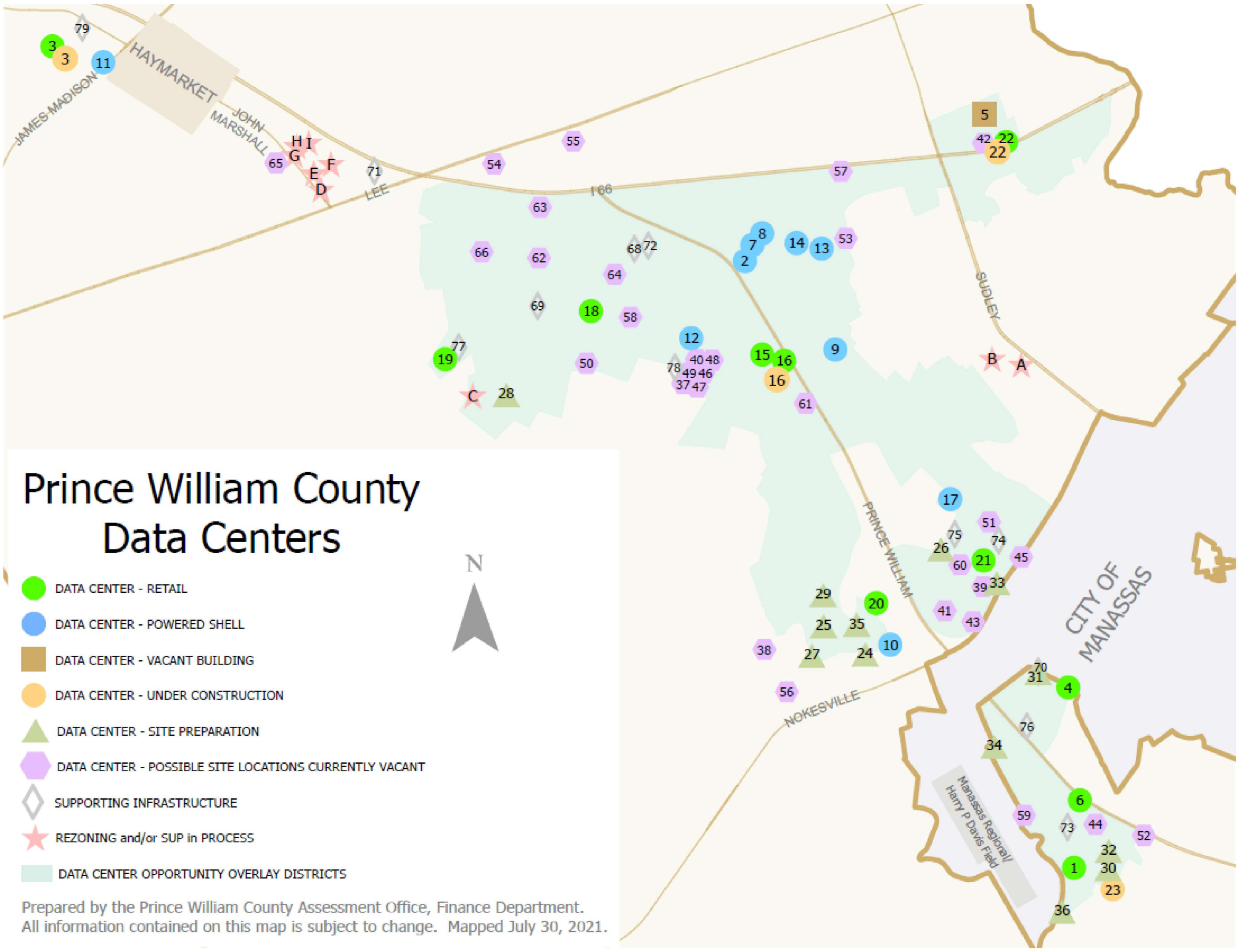
Table 6: Data Center Square Footage Comparison, Select Jurisdictions

	Chesterfield	Fairfax	Henrico	Loudoun	Prince William	Virginia Beach	Frederick MD	All Benchmark Areas
Prior 2000	33,440	1,827,960	1,470,053	1,211,384	626,771			5,169,608
2001	191,840	2,083,960	1,470,053	1,778,897	874,324			6,399,074
2002	191,840	2,083,960	1,470,053	1,778,897	874,324			6,399,074
2003	191,840	2,083,960	1,470,053	1,778,897	983,867			6,508,617
2004	191,840	2,083,960	1,470,053	1,879,018	983,867			6,608,738
2005	191,840	2,083,960	1,470,053	1,966,578	1,093,667		206,838	7,012,936
2006	384,435	2,083,960	1,470,053	2,115,295	1,093,667		206,838	7,354,248
2007	384,435	2,083,960	1,470,053	2,402,160	1,093,667		206,838	7,641,113
2008	384,435	2,083,960	1,470,053	3,263,784	1,093,667		206,838	8,502,737
2009	384,435	2,083,960	1,470,053	3,379,720	1,317,839		206,838	8,842,845
2010	384,435	2,083,960	1,470,053	3,924,559	1,317,839		206,838	9,387,684

	Chesterfield	Fairfax	Henrico	Loudoun	Prince William	Virginia Beach	Frederick MD	All Benchmark Areas
2011	384,435	2,083,960	1,470,053	4,690,289	1,317,839		206,838	10,153,414
2012	384,435	2,083,960	1,470,053	5,040,110	1,317,839		206,838	10,503,235
2013	626,477	2,083,960	1,470,053	6,494,858	1,556,973		206,838	12,439,159
2014	626,477	2,083,960	1,470,053	7,541,937	1,684,673		506,838	13,913,938
2015	626,477	2,177,960	1,470,053	7,850,297	1,684,673		506,838	14,316,298
2016	626,477	2,177,960	1,470,053	10,497,376	1,996,219		506,838	17,274,923
2017	626,477	2,177,960	1,470,053	12,618,527	2,503,802		506,838	19,903,657
2018	626,477	2,177,960	1,470,053	13,834,810	3,277,415		506,838	21,893,553
2019	626,477	2,177,960	1,470,053	21,287,239	3,404,415		506,838	29,472,982
2020	626,477	2,177,960	2,420,053	23,064,893	5,029,868		506,838	33,826,089
2021	626,477	2,177,960	2,420,053	26,905,148	5,456,681		506,838	38,093,157
2022 fcst	876,477	2,316,420	5,455,053	28,808,588	6,261,274	31,000	506,838	44,255,650
2023 fcst	1,126,477	2,556,420	5,645,053	30,591,309	7,607,302	31,000	1,206,838	48,764,399

The map on the following page identifies the locations of existing data centers in Prince William County, which are largely clustered around Prince William Parkway (Virginia Route 234):

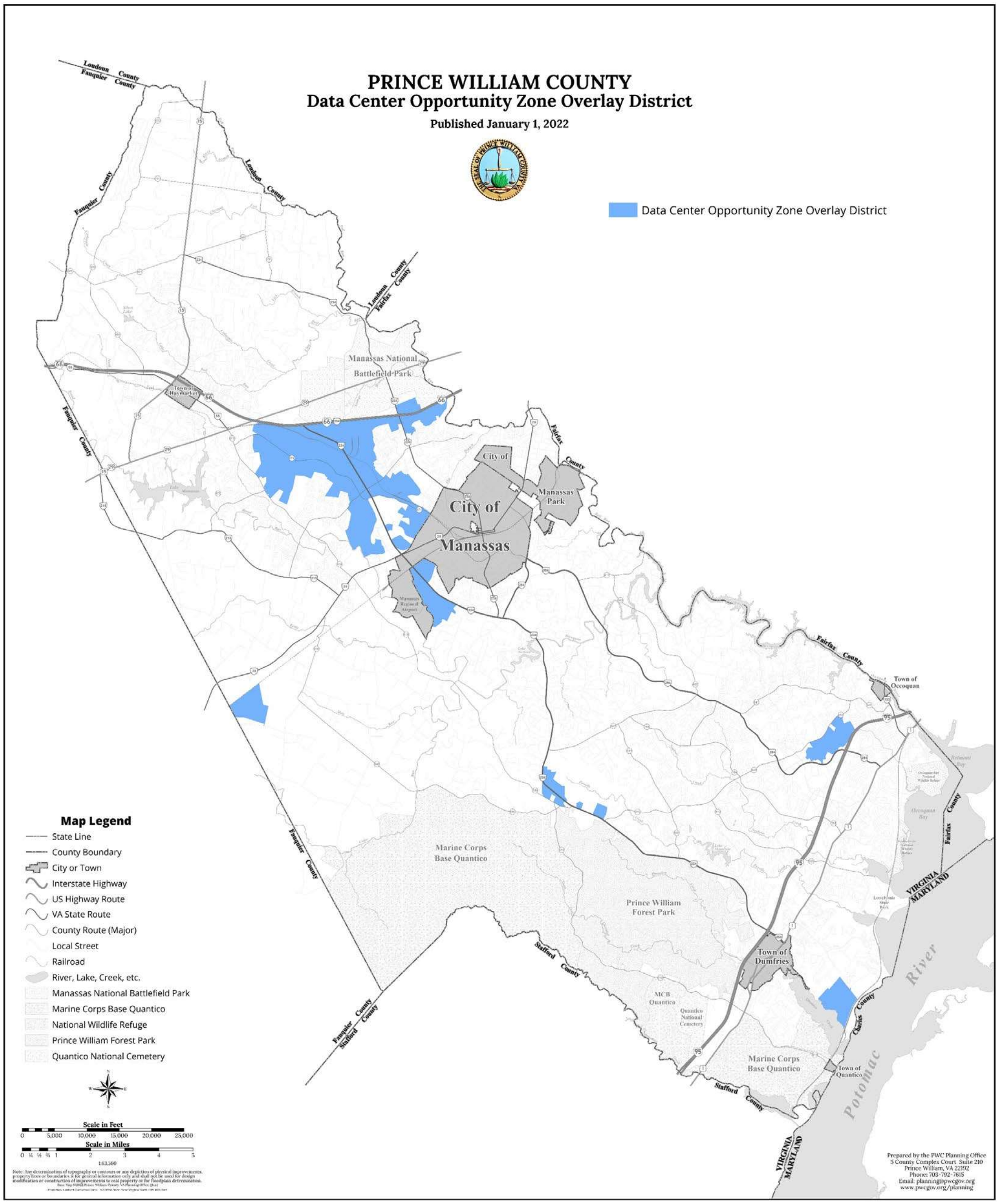
Figure 8: Prince William County Data Center Locations



Source: Prince William County Finance Department

The map on the following page identifies the existing Prince William Opportunity Zone Overlay District:

Figure 9: Map of Prince William County Opportunity Zone Overlay District



For the Prince William County Opportunity Zone Overlay District, local tax incentives are no longer a mechanism for attracting or retaining individual data centers or the data center industry. Instead, the primary advantage relates to by-right zoning and fast-track re-zoning approvals. This is important when discussing cost benefit analysis, as there are no tax incentives that would have to be deducted from taxes paid by the data centers within the County.

As it relates to available land, one of the advantages of the Overlay District is that it allows more structural density on properties located within it. The allowable floor area ratio (FAR)[37] within the District is 1.0, while outside the District it is 0.5. In essence, a structure within the District can have twice as much building square footage to property square footage as outside the District. Given that there is a need for access roads, parking, and perimeter security, a FAR of or approaching 1.0 would require a multi-floored building, and this is occurring more often.

Historically, the FAR for data centers has been in the range of 0.3 to 0.5, but that number is trending higher, and most new construction is for multi-floor facilities. Given the high price of land, it makes sense for the industry to look toward greater density. In this case, the limiting factor (besides the 1.0 FAR) becomes the ability to provide sufficient power to support the more-dense data center operation.

There is interest in Prince William County in expanding the primary locations for data centers. There has been put forward a Zoning Text Amendment to evaluate the expansion of the Data Center Opportunity Zone Overlay District and a Comprehensive Plan Amendment (Amendment) to create an additional Digital/Technology Corridor along Pageland Lane. Property owners and developers have also submitted various applications for data center projects outside of the Overlay District, and some have been approved. One rationale for these applications for development of data centers outside of the overlay area is these sites are already served with high voltage power transmission lines, which are critically necessary to power and serve data centers.

Historic Data Center Development in Prince William County

Over the past 25 years, Northern Virginia has evolved into the epicenter of the data center industry. Despite data center facilities expanding nationally and globally, Northern Virginia maintains its leadership position in terms of the inventory of facilities.

As has been noted, Prince William County is among the leading locations for the data center industry. The industry is both comparatively new and subject to rapidly changing technological demands and advancements. This places significant pressure on these businesses to remain competitive. The industry is also comparatively decentralized in terms of the number of industry establishments and participants. The combination of the pace of recent development and emergence of the industry, combined with the diversity and decentralization of industry players, makes detailed tracking of the industry difficult. Adding to the complexity of reporting and data tracking, the industry is generally reluctant to reveal functional details that may affect their competitive standing.

Finally, data center development and utilization are not “one size fits all”. For example, data centers are developed by internet service providers, such as AOL or Yahoo. Telecommunications companies such as Verizon and CenturyLink also provide data center services. Systems software companies such as Microsoft and Apple develop very significant data center operations. Expansive and fast-growing e-commerce companies such as Amazon and Google rely heavily on data

[37] Floor area ratio, or FAR, is the total amount of usable floor area that a building has, or has been permitted to have, and the total area of the lot on which the building stands. A higher ratio indicates more density – and structures with more than one floor can significantly increase the ratio, as each floor’s square footage is part of the calculation.

centers. Further, the digitization of health care records and services requires large scale secure data centers.

In addition, “retail” data centers provide data center services and facilities for rent to multiple tenants, each with data storage, e-commerce, and processing requirements to be fulfilled by data centers. The landscape of the types of data center industries is generally termed “enterprise” for those single tenant or self-owned data centers and the remainder are termed “colocation” data centers, where data center space is rented out on a retail basis.

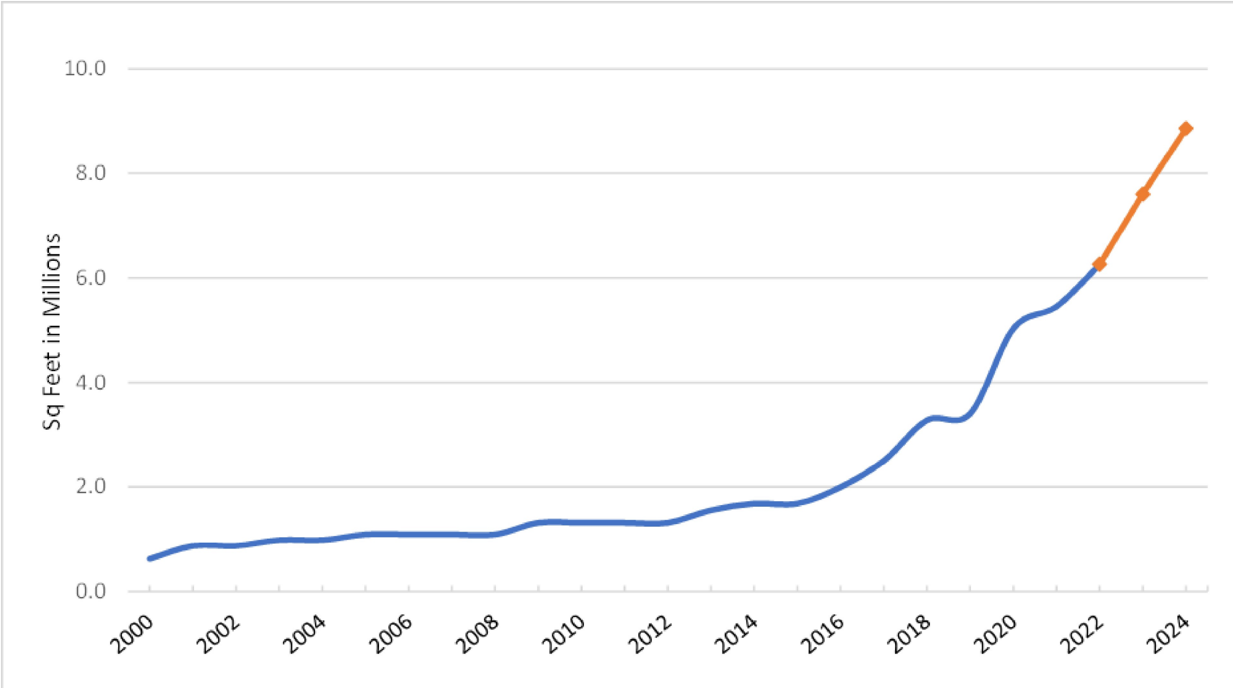
As a result, characteristics of data centers vary both from place to place and according to the mix of users (enterprise or colocation). While the U.S. Bureau of Labor Statistics has a designated industry category for data centers, data center employment may also be found within telecommunications, e-commerce, software, and other employment categories. As a result, government reporting of data center employment, wages, and establishments is spread among these industries as well as many others. Further, some industries reporting under NAICS code 518210 for the data center industry have nothing to do with data centers. As explained in a 2018 Washington State Department of Commerce report, “data centers do not report into a single NAICS category, and the primary category in which they do report (518210 – Data Processing, Hosting, and Related Services) has a lot of other components.”[38]

As a result, the data center employment and wage data used for the Prince William County economic impact analysis in this report is a compiled estimate based on known industry standards, published reports from other organizations, such as the Northern Virginia Technology Council (NVTC), and reported data under NAICS code 518210 from the U.S. Bureau of Labor Statistics (BLS).

While industry employment and wages may be difficult to determine, some data center industry information is better known and documented, such as the square footage inventory of data center space. Data center square footage used in this report has been compiled and reconciled using information from CoStar Inc., the Prince William County Real Estate Assessment Office, the Prince William County Office of Management and Budget, and the Prince William County Department of Economic Development. Figure 10 shows the historic development through 2021 and short-term development outlook through 2024 of the inventory of data center square footage in Prince William County.

[38] “State of the Data Center Industry,” Washington State Department of Commerce, Office of Economic Development and Competitiveness, January 2018, Page 18.

Figure 10: Prince William County Data Center Growth (in square feet)



Source: PFM, Prince William County, CoStar Inc.

As of 2021, there were 5.5 million square feet of data center space in Prince William County. This inventory includes more than 2.0 million square feet of building space added during 2020 and 2021 combined. The short-term outlook for the data center inventory includes space that is planned, announced, or currently under construction. Over the short-term, the County inventory is expected to grow by 3.4 million square feet of data center space through 2024. This represents annual data center space additions of over 1.0 million square feet per year.

Outlook for Data Center Development in Prince William County

As this study was nearing completion, in May 2022 Camoin Associates released its Targeted Industry Land Need Analysis for Prince William County. The study's findings are blended into the following discussion related to the outlook for data center development.

PFM determined that known data center land sales, currently owned parcels, and known acreage amounts in the data center planning overlay district include approximately 1,600 acres of land developable for future data center space. Full buildout of this space may take from 20 to 30 years, depending on industry demand, the building density per acre, and technological advances of data storage and data processing computer equipment.

PFM estimates that under the current conditions of known developable land inventory and development patterns, Prince William County is likely to host more than 35 million square feet of data center inventory space at buildout. In its study, Camoin Associates developed high, midrange and low demand scenarios. Under their high demand scenario, demand exceeds **current** buildout capacity by 2029. In the high demand scenario, demand exceeds **future** buildout capacity by 2034.

Under their midrange demand scenario, data center demand would exceed current buildout capacity by 2034.[39]

This development outlook does not include potential changes/additions to future developable lands inventory. There are development regulation changes under discussion and evaluation. If approved, they may significantly increase the future development capacity within the County. These considerations may include the expansion of the Data Center Overlay planning designation; additional flexibility added to future land use designations or zoning categories; and designation of proposed new data center development areas known as the "Digital Gateway." Changes in any or all these areas will increase the expected maximum development capacity of data centers in the county.

Data Center Operational Employment in Prince William County

The BLS reported just over 300 full time Prince William County data center jobs during year 2021, in the dedicated data center industry NAICS code 518210. It is known that this employment figure under-represents all data center employment in the County due to enterprise and telecommunications industries, which also generate data center employment.

The Northern Virginia Technology Council estimated that in 2020 there were 500 full time direct data center employees in Prince William County.[40] This corresponds with approximately 9,000 square feet per employee. The 9,000 square feet per employee average is a representative average for the data center industry in Prince William County. It is consistent with recently announced data center facilities, including Apple in Waukee, Iowa, with announced facility expectations of 8,000 square feet per employee, and a new Facebook data center in Huntsville, Alabama, with announced facility expectations of 10,000 square feet per employee. These are both similar to the types of facilities found in Prince William County. Finally, the 2021 BAE Urban Economics Data Center Market Study for Prince William County prepared an impact analysis of a prototypical Northern Virginia data center using as its model a facility with 9,000 square feet per employee, based on consensus research conducted by BAE.[41]

Taking these data into consideration, PFM estimates that in 2022 there are 650 permanent data center employees working in Prince William County. This is based on the 2022 estimated data center inventory of 6.3 million square feet of data center building space, at 9,000 square feet per employee, adjusted for estimated vacancy. Figure 10 on page 34 illustrates the history of the growth of data center building space in Prince William County.

Based on these data, 125 new direct data center employees have been added in the County since 2020. This represents a 24 percent increase in data center industry employment in just two years in the County.

[39] "Targeted Industry Land Need Analysis, Prince William County, VA," Camoin Associates, May 2022, p. 5.

[40] "The Impact of Data Centers on the State and Local Economies of Virginia," Northern Virginia Technology Council, March 2022, Page 24.

[41] "Data Center Market Study Prepared for Prince William County, Virginia," BAR Urban Economics, October 20, 2021, pages 4 and 25.

Examining wage data from the BLS, the BAE study, and the 2022 NVTC study, PFM estimates average annual employee compensation, representing wages, salaries, and benefits, exceeds $150,000 per year.

Single Tenant and Colocation Facilities

Data center buildings may be characterized by a single user occupying the building (enterprise data centers), for example a large technology company such as Facebook/Meta, or Google/Alphabet. Among large single users, very large companies with extensive digital capability needs may also fully occupy a building or multiple buildings. These users would include the U.S. government, national security agencies or the U.S. Military. Alternatively, there are “retail” data center operators who build data center space and lease out portions of buildings to smaller users with data center needs. These retail or colocation data centers are characterized by multiple tenants housed with a single building.

PFM has summarized the mix between single tenant and colocation data centers using the data available. This includes data from the Prince William County Real Estate Assessments Office and CoStar, Inc. Based on these data, the project team estimates that the 2022 mix of data centers is 67 percent single tenant and 33 percent multi-tenant/colocation space.

The outlook for future space through 2024 is less certain, because final ownership/occupancy may not be announced until after building completion. Experience suggests this tends to bias characterization of future space toward multi-tenant/colocation space. However, since 2016, development has trended away from enterprise/single user facilities to large hyperscale cloud facility providers, with buildings occupied by multi-tenant users. As a result, the mix of future space, as is currently known, is 91 percent multi-tenant/colocation space and 9 percent single tenant. With an additional 2.6 million square feet planned between 2022 and 2024 (more than a 40 percent increase over 2022 levels) the single/colocation mix is expected to shift to 50 percent colocation and 50 percent single user by 2024, if all planned space is occupied as is currently projected.

Table 7: Current and Future Data Center Footage by Type (In Thousands)

	Existing as of 2022		Future - 2023-2024		Total Through 2024	
Multi-Tenant/Colocation	2,046	33%	2,360	91%	4,406	50%
Single User	4,216	67%	243	9%	4,459	50%
Total	**6,261,274**	**100%**	**2,603,408**	**100%**	**8,864,682**	**100%**

Source: PFM; Prince William County; Costar

5. Data Center Cost Benefit Analysis

As previously noted, PFM was tasked with determining (1) the average real and personal property tax generated by data centers; (2) the estimated cost of providing County services (schools, police, fire, etc.) because of data center development; and (3) the net fiscal impact to the County.

The project team used the IMPLAN input/output model for this project. An explanation of input-output economic impact models is included in Appendix D, and the PFM team's revenue model assumptions are provided in Appendix E.

For net fiscal impact, the project team used actual data for 2020, unaudited data for 2021, and the adopted forecast for 2022. It should be noted that in 2020, primarily because of the COVID-19 pandemic, the U.S. economy experienced the sharpest and briefest recession in the nation's history. The ramifications of the changes in the US economy (both during and immediately after the 2020 recession) are generally considered to be wide-ranging, and they may have influenced the data center industry, as it did many other industries throughout the U.S. and the global economy. It is beyond the scope of this study to determine whether the impacts in 2020 are an anomaly for the data center industry, but there is a realistic possibility that the financial and economic data from 2020 may not reflect a typical year.

Calculation of Revenue from Data Centers

Prince William County staff track, at a detailed level, the real and business personal property tax revenues generated by the data centers housed within its borders. PFM relied on this information in estimating the County property tax revenue associated with the industry. Data centers also pay business license taxes; however, they are not included because the small number of data center taxpayers for business license taxes could expose confidential taxpayer liability information. This excluded tax revenue doesn't materially impact the cost benefit analysis.

Table 8: Direct Fiscal Impacts: County Taxes Paid by Data Centers (Numbers in Thousands of Dollars)

Tax Source	FY 2020 (Actual)	FY 2021 (Unaudited)	FY 2022 (Adopted Forecast/Projected)
Real Property Taxes	$20,087	$22,646	$32,294
Business Personal Property Taxes	$32,298	$41,552	$54,384
Computer Equipment and Peripherals	$20,879	$24,876	$34,118
Furniture and Fixtures	$11,419	$16,676	$20,266
Sales Taxes[42]	$249	$272	$307
Total	**$52,634**	**$64,470**	**$86,985**

Source: Prince William County Finance Department; IMPLAN, Direct Effect, County Tax Impacts

Of course, there are additional tax and other revenues that are contributed to the County by the data center industry. As will be explained in the discussion of the economic impact modeling, there is tax revenue associated with data center activities, primarily sales and use tax revenue, that result

[42] Estimate provided by IMPLAN. While the data center industry is exempt from paying sales tax on computer equipment, there are still sales tax revenues from other operations and maintenance expenditures such as software, disaster recovery, continuous power supplies, and physical building maintenance.

from consumption within the County fueled by wages paid to data center employees. These are included within the PFM model and the cost benefit analysis. There are other fees associated with the industry, particularly related to the construction phase of data centers, and they are also captured within the model but are minor in comparison to the property tax and sales and use tax collections. The following table illustrates the enhanced (i.e., indirect and induced) revenue impacts when accounting for indirect and induced tax revenue generation.

Table 9: Indirect and Induced Fiscal Impacts:
Additional County Revenue from Data Centers
(Numbers in Thousands of Dollars)

	2020	2021	2022
Data Center Sales Tax			
Sales Tax Indirect Impact	$381	$417	$469
Sales Tax Induced Impact	$194	$212	$239
Data Center Property Tax			
Property Tax Indirect Impact	$4,008	$4,384	$4,939
Property Tax Induced Impact	$2,009	$2,198	$2,476
Total	**$6,591**	**$7,211**	**$8,122**

Source: IMPLAN

Economic Impacts of Data Centers
In the PFM team's model calculations, both direct and indirect fiscal impacts are derived from data center economic activity. The IMPLAN model provided impact variables for the calculations. In addition, IMPLAN includes the previously mentioned fiscal impacts in its economic output calculations. The combined economic output for data center operations is provided in the following table:

Table 10: Economic Impacts of Data Centers
(Numbers in Thousands of Dollars)

	2020	2021	2022
Direct	$533,400	$579,200	$647,700
Indirect	$283,400	$310,000	$349,100
Induced	$54,500	$59,700	$67,300
Total	**$871,300**	**$948,900**	**$1,064,100**

Source: IMPLAN

Economic Impacts of Data Center Operations Employment
As of 2022, there are an estimated 650 data center operations employees in Prince William County, with estimated average annual wages, salaries, and benefits of over $150,000 per year, per employee. The IMPLAN model estimated the economic impacts of the permanent employment within the Prince William County data center industry. The following table illustrates the direct, indirect, and induced effects of economic activity resulting from the industry's permanent operations. The following table represents the economic impacts of permanent data center operational employment only and does not include impacts of data center construction activity.

Economic impacts for years 2020 and 2021 are found in Appendix F.

Table 11: Economic Impacts of Permanent Data Center Operational Employment, Prince William County, 2022 (Dollar Values in Thousands of Dollars)

Impact	Employment	Labor Income	Output
Direct	650	$103,400	$647,700
Indirect	2,560	$114,900	$349,100
Induced	450	$17,800	$67,300
Total	**3,660**	**$236,100**	**$1,064,100**

Source: PFM; IMPLAN 2022

With permanent operations employment of 650 persons, the data center industry supports an additional 3,010 indirect and induced jobs. For each direct industry job created, an additional 4.6 jobs are supported within the Prince William County economy. Total labor income paid is more than twice the direct industry labor income, with $236.1 million in total labor income from operations, paid annually. Total economic impacts of data center operations reach nearly $1.1 billion annually in Prince William County.

Based on the development pipeline, it is estimated the county's direct industry employment will continue to grow at a compound annual growth rate of 5.6 percent per year, over the long-term industry development horizon.

Calculation of Costs Associated with Data Centers

The local government costs that arise from any economic activity are those directly related to the activity plus any additional expenditures required to support its growth. Direct costs might include public infrastructure expenditures specific to the industry or activity (such as improvements in water and sewer systems and roads) and any incentives, grants or other financial assistance used as an inducement for a prospective business or industry. These direct, project-specific costs can be readily identified.

The other costs associated with the expected growth that will occur due to the industry or specific project will correspond to local budget expenditure categories that might include education, public works, public safety, parks and recreation, public health, social services, etc.

While the tax revenue associated with data centers is relatively straightforward and closely monitored by the County, estimating the County costs associated with data centers is less clearly quantifiable, and multiple methods have been used in prior data center studies of fiscal impacts. The more commonly used methods for estimating costs are based on calculating data centers' **average cost** or **marginal cost**, summarized in the following:

- The **average cost** approach, as its name implies, uses the average cost to provide a service and applies that to new or existing development or activities. It is generally expressed on a unit cost basis (i.e., per household, student, or employee), which is multiplied by the number of service units.

- The **marginal cost** approach takes into consideration the capacity of a jurisdiction's infrastructure, existing capital facilities and unique demand-based requirements in determining the incremental cost of serving an additional unit. This can be useful when considering the cost of service where there is either rapid industry growth or decline, as the estimates may more accurately represent the actual costs to local government of new development, particularly when there are unique and identifiable costs associated with a specific type of development. An example of a marginal cost factor would be a new development that requires construction, equipping, and staffing of an additional fire station.

PFM determined that the average cost approach was more appropriate for this analysis. The primary determining factor was the data center industry itself, which is well established within the County. Because this cost benefit analysis is not being conducted on a new industry or development, the marginal cost basis would not be appropriate for existing data centers, which have already been factored into the cost of providing County services.

Within the average cost approach, there are two methods that have been used to calculate industry costs to government. These are either a **value-added ratio** or a **per-capita multiplier methodology.** Within these methods, the project team calculated the net benefit of the data center industry to the County both with and without construction budget impacts, which reflects what can be divergent views on data center's impact on the construction industry and its employees. The per-capita model classifies expenditures as either education or non-education related, and it uses these to create ratios to determine the additional costs and revenues to the County based on the number of additional employees related to the industry. The value-added ratio methodology uses ratios based on expenditure classifications and identifies costs as people-related or business-related.

PFM determined that the per-capita multiplier methodology more realistically captures the County's net revenues and expenditures from data centers, both with and without incorporating construction activity related to the industry. For the sake of completeness, the results of the Value-Added Ratio methodology are included in Appendix H.

PFM also determined that it was more appropriate to separate out the construction industry from the calculations of costs and benefits. For the sake of completeness, the cost benefit calculations and discussion including the construction industry are included in Appendix G.

Fiscal Impact Approach: Average Per-Capita Cost Multiplier Technique

The per-capita multiplier, PFM's preferred methodology, is the most common technique used when applying an average cost methodology. Under this approach, the current cost of public services per resident, household, or pupil is multiplied by the population, housing units or school-aged children the industry employs or creates.

The Northern Virginia Technology Council's (NVTC) biennial study of the Impact of Data Centers on the State and Local Economies of Virginia also uses the per-capita multiplier approach.[43] These studies use multiple sources to quantify the budgetary costs that data centers and their employees impose on localities. The analysis uses data from the Virginia Department of Education on local elementary and secondary education expenditures per student, and data from the Virginia Auditor of Public Accounts on local non-education expenditures per county resident. This approach focuses

[43] In addition to its biennial studies on behalf of the NVTC, Mangum Economics uses this approach in its analysis of the potential impact of large data center development in Maryland on behalf of the Maryland Chamber Foundation. See Maryland Chamber Foundation, "Potential Impact of Large Data Center Development in Maryland," (March 2020). Accessed electronically at https://netchoice.org/wp-content/uploads/2020/07/Maryland-Data-Center-Report-2020.pdf

on the largest costs that any business imposes on a local government – the costs associated with providing primary and secondary education, public works, public safety, and other county services to the employees of that business.

In its most recent iteration of the biennial report, the NVTC study's authors performed this analysis for Prince William County for 2020. The PFM team has replicated the methodology for 2021 and 2022, discussed in the following (in other words, 2020 calculations are based on the NVTC study, while calculations for other years are based on PFM analysis).

Predictably, the County's return on investment is highest when including total economic impacts. However, this is not an 'apples to apples' comparison, as economic impacts are included in revenue calculations but cannot be included in expenditure calculations, as IMPLAN does not provide expenditure data. As a result, while the PFM team completed the analysis using the range of inputs, the team preferred using only the direct fiscal impacts to understand the net fiscal impact. The other methodologies are included in Appendices G through I.

Preferred Methodology: Per Capita Multiplier Technique Including Direct Fiscal Impacts Only

PFM's preferred methodology is to include only direct fiscal impacts and exclude construction activity. This is the methodology also used in the NVTC study. **Using this methodology, the County's total fiscal impact is $9.67 per $1.00 in expenditures in 2020, $11.76 in 2021, and $13.41 in 2022.**

Table 12: Data Center Cost-Benefit Analysis of Direct Fiscal Impacts, Per Capita Multiplier Technique

	2020	2021	2022
Education-Related Expenditures			
Data Center Employment[44]	525	570	650
Students per County Employed Resident[45]	.73	.63	.62
Local Education Expenditures per Student[46]	$6,626	$7,125	$7,433
Total Education-Related Expenditures[47]	**$2,552,295**	**$2,551,432**	**$3,000,229**
Non-Education Expenditures			
County Residents per All Employees[48]	3.78	3.45	3.44
Non-Education Costs per Resident[49]	$1,455	$1,491	$1,562

[44] Per Prince William County Department of Economic Development
[45] Per Virginia Department of Education and U.S. Bureau of Labor Statistics. Derived by dividing total county elementary and secondary school enrollment by total county employment. Total County employment for 2022 is projected based on a 1.7 percent growth rate from Moody's Baseline Forecast. 2022 school enrollment is calculated using the 2018-2020 compound annual growth rate as the 2021-2022 growth rate. Numbers may be rounded.
[46] Annual Prince William County Budget Transfer to Schools
[47] Calculated as county private sector employment in data centers x students per County employed resident x per student education expenditures.
[48] Per Prince William County Department of Information Technology Population Estimates and U.S. Bureau of Labor Statistics. Calculated by dividing total county population by total county employment. Model uses 2019-2021 data for the years 2020-2022, respectively.
[49] Per Prince Willliam County FY 2022 Adopted budget, including special revenue funds and component units, and U.S. Census Bureau. Derived by dividing total county non-educational expenditures by total county population.

	2020	2021	2022
Total Non-Education Expenditures[50]	**$2,890,924**	**$2,932,447**	**$3,487,848**
All Data Center Types			
Data Center Revenues	$52,633,784	$64,470,160	$86,984,718
Data Center Expenditures[51]	$5,443,219	$5,483,879	$6,488,077
Net Fiscal Impact	**$47,190,565**	**$58,986,282**	**$80,496,642**
Net Fiscal Impact per $1 in County Budget Expenditures	**$9.67**	**$11.76**	**$13.41**

There are limitations associated with this (or any) methodology. For example, this generalizes some costs that, for some facilities, are a bigger issue for residents and other businesses. Additionally, as with many commercial or industrial activities, there will be externalities associated with it. In discussions with stakeholders, there is an understanding that data centers may impact on residential sight lines, create some level of noise pollution, and generate CO2 emissions. These are all notable concerns, but they are not readily quantifiable and often are site specific. As a result, they have not been assigned a cost for this analysis.

There are also some data limitations. In this analysis, given its reliance on per-capita calculations, employment figures are a critical input but not always readily available or known by the County. In fact, the 2018, 2020, and 2022 NVTC biennial reports use three different data sources to estimate data center employment totals, and the inputs in the most recent report are significantly different than those used in the two prior studies, as shown in the following:

Table 13: Data Center Employment Estimate Comparison, NVTC Biennial Reports

	2018 Report	2020 Report	2022 Report
Employment	252 (2016)	241 (2018)	500 (2020)
Description	County Private Sector Employment in Data Processing, Hosting and Related Services	County Private Sector Employment in Data Processing, Hosting and Related Services	County Private Sector Data Center Employment
Source	Virginia Employment Commission	U.S. Bureau of Labor Statistics	County Department of Economic Development

Of course, this can impact on final outcomes. In general, comparisons of results from differing studies within this realm should be done at a relatively high level. **It is notable, however, that both this study and the ones conducted by the NVTC have demonstrated a positive return on investment for the County from data center industry activities.**

[50] Calculated as county private sector employment in data centers x county residents per employee x per resident non-education expenditures.

[51] Calculated as total education costs + total non-education costs.

6. Summary Findings

The topic addressed within this report is complex, and it has been the subject of similar analysis both in Virginia and around the United States. As a result, the project team approached the subject matter from several angles and identified key high-level findings that are addressed throughout the report. These include:

- **The data center industry within Virginia, Northern Virginia, and Prince William County is a significant economic driver.**
  In virtually any discussion of the data center industry, it is noted that Virginia in general, and Northern Virginia in particular, is the largest concentration of data centers in the United States. The need for data centers is, based on the current move toward an information-based economy, expected to increase in the coming years. While the levels of employment within the industry are not as large as, for example, the manufacturing sector, the jobs on average pay well above the County's average wage. There are also significant construction and support services jobs associated with the industry.

- **Prince William County has experienced rapid growth within the Northern Virginia data center concentration.**
  While Loudoun County has long been considered the Northern Virginia data center epicenter, since 2016 Prince William County has, in terms of square footage of data center space, emerged as the second largest data center concentration in the region. It is notable that discussions with the data center industry suggest an interest in maintaining data centers in both Loudoun and Prince William Counties. Given that neither county provides tax incentives for data centers to locate within their county, this suggests that for many providers, locating in both counties is a form of portfolio balancing.

  Of course, one of the issues that is often identified as a constraint in Loudoun County is the lack of suitable land and/or the cost of land. This is becoming more of a concern in Prince William County as well. This can tilt the equation somewhat for data centers when considering total cost of ownership.

- **It is likely that the data center industry will continue to grow in the coming years.**
  The public appetite for data and information continues to grow, and there is a significant data center construction pipeline within the County. Based on projects that are in the planning or construction phase, it is likely that activity in Prince William County will maintain a similar growth trajectory in at least the next few years. Based on the current conditions of known developable land inventory and development patterns, the County could grow from the 5.5 million square feet of data center space to over 35 million square feet at full buildout.

- **Taxes paid by the data center industry have shown similarly large growth in recent years.**
  Data centers require computer equipment and peripherals that are taxable as business tangible personal property. This has become a significant revenue source for the County, growing from $2.4 million in FY 2013 to over $34.1 million in FY 2022 – a compound annual growth rate of 34.0 percent. This is far greater than for any other tax revenue source over this same period of time. It is also notable that, since 2014, the County has made several reductions in its real property tax rate, going from a rate of 1.1480 per $100 of taxable value

in 2014 to a rate of $1.0300 in 2022.

- **Data center County service needs are less intense than many other commercial activities.**
  Because of the sensitive nature of the data and information stored within data centers, to be commercially viable, they must be extremely stable and secure facilities. As a result, they generally have their own security and are designed to deter intrusion. They have sophisticated fire suppression systems and design. There are comparably smaller numbers of individuals working in or visiting the facilities. As a result, there is less need for public safety, public works, or transportation infrastructure – either in terms of capital investment or operational costs. They are often large, in terms of parcels of land, but they do not generate significant needs for services. This can be contrasted with a similarly large manufacturing facility or retail mall, where there is significant vehicle traffic that must be managed and foot traffic that may often require police, emergency medical, or other assistance.

- **Many other data center service needs are paid for by the individual facilities.**
  As with most local governments in Virginia and the United States, Prince William County assesses a variety of fees for services. Fees differ from taxes in that they are to recover the cost of providing specific services (as opposed to general taxes that support public goods and services). Thus, when a new (or existing) data center requires a County service that is specific to it, a fee is assessed. These include, for example, land or building development fees, zoning or rezoning fees, regular and special inspection fees, etc. Likewise, public utilities will also charge rates and fees for new connections. One of the expressed concerns is that other utility users are subsidizing the resource use of data centers. In discussions with utility representatives, rate setting takes into consideration usage and other factors and is meant to capture the costs of specific services for its customers. It is notable that part of the data center community's interest in expansion in certain areas in Prince William County is because of existing electrical transmission lines.

- **There are negative externalities associated with data centers that are not conducive to quantitative cost benefit analysis.**
  It is not uncommon for the wants and needs of residential and commercial property owners to come into conflict. Nearly every major commercial property will come with activity that some residents find objectionable. It may be the facility obstructing views, it may be increased traffic and other activity in the vicinity of the facility, or it may be various forms of pollution. Most of these are not readily quantifiable for this type of analysis – and in some cases, the level of 'bother' may be offset by other qualitative factors.

  In the case of data centers, issues of traffic and associated activity are minimal. Probably the one qualitative complaint that may rise to a level of material concern is noise pollution. It has been documented that (at least some) data centers emit a noticeable hum that can be bothersome to those in proximity to the data center (and even more so for those within it).[52] There are a variety of techniques that have been developed to mitigate the noise pollution

[52] See, for example, Francesca Remigi, "Data Centers: Noise Modelling and Environment Constraints," International Journal of Innovations in Engineering and Technology, October 2018, accessed electronically at http://ijiet.com/wp-content/uploads/2018/11/2.pdf

associated with data centers, which include acoustic louvres, perimeter sound barriers, use of liquid cooling servers (as opposed to using noisy external chillers), etc. While recommendations are outside the scope of this report, this may be an area where a dialogue with the data center industry regarding future planning for facility construction may be worthwhile.

- **Qualitative impacts are difficult to quantify and were not attempted for this analysis.** Most methods for cost benefit analysis focus on tangible calculations. In this respect, some negative externalities are not captured by the analysis. There are studies that seek to monetize these issues, using surveys and other techniques. However, in the limited time and scope for this report, those factors could not be quantified for inclusion.

- **Applying cost benefit analysis is easier for a specific facility and more difficult for an entire industry.**
  While the revenue associated with the data center industry is readily quantifiable (particularly for real and personal property taxes), the expenditures necessary to service the facilities that make up the industry is harder to accomplish. As the discussion notes, data centers are not homogenous – they differ considerably in size, building design, energy use, location, and a variety of other factors. This analysis becomes practically impossible when seeking to project those needs to future data centers where none of this information is known. On the other hand, determining the costs for a specific location where the building size, design, surrounding infrastructure, etc. is known is a much more focused set of calculations.

  The project team approached the expenditure cost analysis from multiple perspectives that have been used in past studies. Each has strengths and weaknesses. None will get around the issues of concern presented in the previous paragraph. That said, the various methods of determining costs and contrasting them with benefits (described both as revenue to the County and economic activity within it) come to a similar general conclusion.

- **Even though the exact ratio of costs to benefits varies by methodology, this and previous studies generally conclude the data center industry is a net benefit to the County.**
  As previously discussed, the revenue benefits to the County from this industry are substantial. In this report, all of the analyzed scenarios (including the scenario presented in the cost benefit analysis chapter, which the project team finds most useful), determine the data center industry is a net benefit to the County. Even if additional infrastructure were required (and that is not an easy argument to make considering the general characteristics of a data center), these are likely to be one-time costs – many (or most) of which would be incurred by the data center itself. In the long run, these costs would be quickly recaptured by the additional revenue generated by the data center.

  Across the country, many state and local governments are providing significant incentives to attract data centers. For many governments, incentives are primarily offered to attract employment or capital investment. In the case of data centers, there are relatively few (albeit well-paying) jobs associated with them. There is, however, significant capital investment – which advances another important industry (construction) and provides a stable source of real and personal property tax revenue. There is strong evidence that this is an important factor in providing the industry incentives to locate there**. It is also a real advantage for the County that it does not have to provide incentives to attract and retain this industry**, which is not the case in many competing regions. That alone is a strong argument for maintaining the data center industry within the County.

7. Appendices

Appendix A: Summary of PFM Project Approach

To complete the project, the PFM project team[53] used a three-phased approach:

1. **Information gathering and analysis.**
   The project team gathered and analyzed a significant amount of data and information from the County. These included historic data, analysis and models on both revenues and expenditures. It included comprehensive financial data included in annual reports as well as county budgets.

   On the revenue side of the budget, this included data on real and personal property taxes, including actual collections by class of property, assessed value and actual taxes paid for the last five years, for data centers and in the aggregate. It also included analysis of historic trends in receipts and collection rates for the last five years for data centers and in the aggregate. It also included detailed historic collection data on other revenue sources, as well as analysis of trends in receipts and/or collection rates.

   On the expenditure side of the budget, this included reviewing line-item detail of the County general fund and other fund budget expenditures for the last five years, as well as capital improvement plans and other documents detailing planned expenditures and initiatives.

   As it relates to community and economic development, the project team obtained and reviewed the County Comprehensive Plan, data and information related to the existing Data Center Opportunity Zone, and the County Comprehensive Plan Amendment to study the expansion of the existing Data Center Opportunity Zone. The project team also reviewed data and information provided by the Department of Economic Development related to the data center industry.

   The project team also obtained data and information about the County's data centers, including locations, size in square footage and other unique features. The project team also reviewed existing County and external reports related to the data center industry.

   As the County and external data and information was being provided and analyzed, the project team scheduled and held over a dozen detailed interviews with County leadership, internal subject matter experts and external stakeholders. These interviews helped to clarify or identify existing County policies and practices. They also were an opportunity for the project team to examine the existing County revenue forecasting model. For external stakeholder interviews, they provided additional insight into the data center industry. A list of the County leadership and staff that were interviewed is contained within the Appendices. Because the interviews were conducted for background purposes and remain confidential, a

[53] The project team was led by PFM Group Consulting LLC Director Randall Bauer, who led the 2019 study for Prince William County and also led a 2021 data center study for Loudoun County, Virginia. PFM Financial Advisors LLC Director Sarah Frey, who serves as financial advisor to the County, was an advisor to the project team related to County finances and financial history. The team also included Senior Managing Consultants Deanna Kimball and Stan Geberer, both who were senior members of the project team for the Loudoun County project. Deanna was also a senior member of the project team for the prior Prince William County project. The team also included Senior Analyst Ellen Ramage and GIS Specialist Jackie Berry.

list of external stakeholders is not provided. In several instances, the interviews and analysis of the information led to follow-on requests for data and information, and the County stakeholders were extremely responsive to those requests.

2. **Modeling the data and information for a cost benefit analysis.**
   Based on the information and analysis, PFM worked to construct a cost-benefit model. In the construction, the project team started by reviewing past financial impact models for specific locations or industries it has constructed. To augment its understanding of modeling methods related to the data center industry, PFM also reviewed other approaches by other consulting firms.

   The modeling was supported by other analysis, including a County data center economic impact analysis and review of possible expenditure impacts related to new and existing data centers.

3. **Project draft and final reports and model deliverables.**
   The report's written analysis as well as the resulting model attempts to provide a full analysis of the factors affecting the cost benefit analysis. As is explained in the body of the report, estimating economic impact, particularly on the expenditure side of the County budget, is an assumption-driven process. While many of the features related to direct revenue provided by data centers and the industry are relatively easy to identify (at least historically), the expenditure side is more difficult. For that reason, the project team worked to validate its approach from several perspectives. The constructed model also relies on a set of assumptions, which are clearly identified (and may be altered) within the resulting model. That model, as well as documentation on its use, has/will be provided to the County.

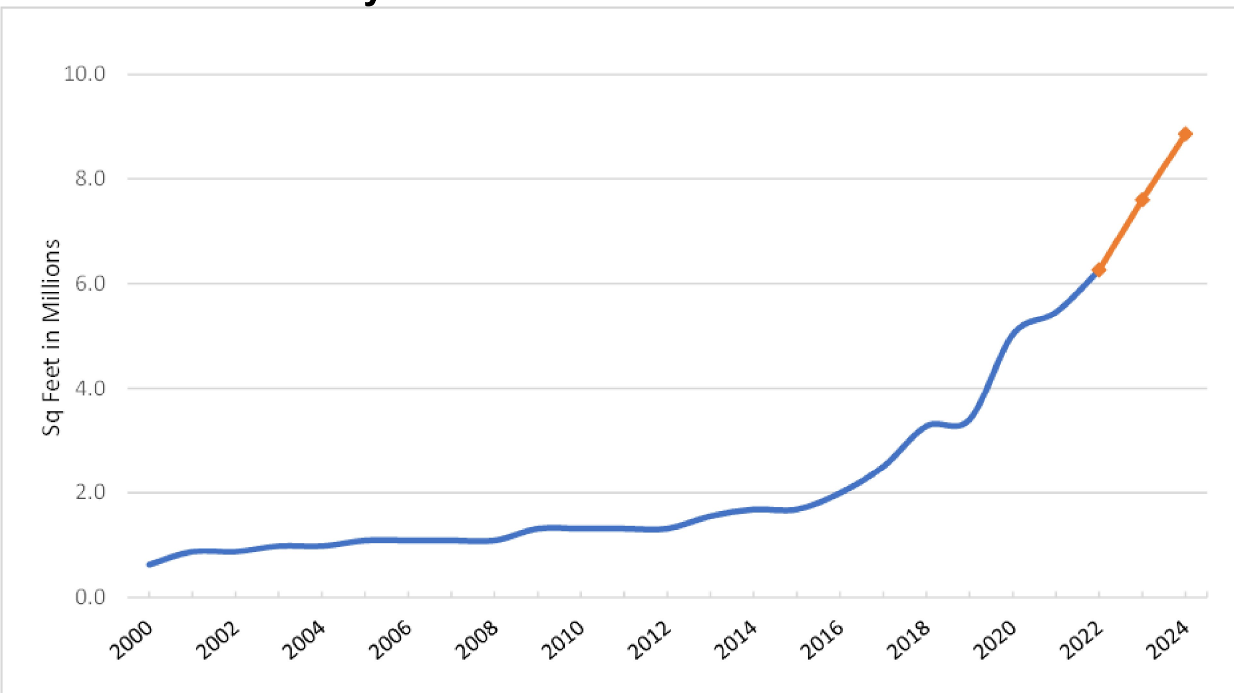
Appendix B: List of Stakeholder Interviews

As noted in the project approach discussion, the PFM team conducted numerous interviews with key stakeholders, including County Department leadership, management, and professional staff as well as external stakeholders representing key components of the County's economy. External stakeholder interviewees were promised complete anonymity, with information provided as background only. As a result, they are not listed here.

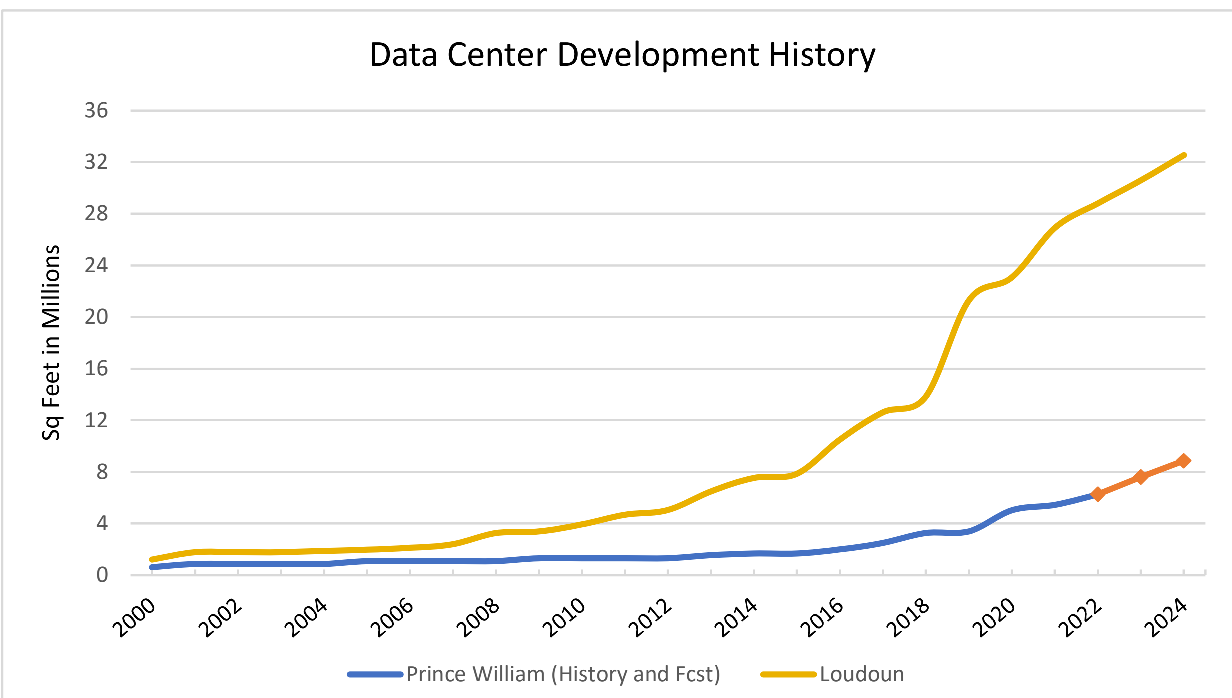
The following are the Prince William County Department leadership, management, and professional staff who were interviewed for the project:

- Christina Winn, Director, Department of Economic Development (Project Co-sponsor)
- Michelle Attreed, Chief Financial Officer(Project Co-sponsor)
- Dave Sinclair, Director, Office of Management and Budget
- Rebecca Horner, Deputy County Executive
- Daniel Alexander, Deputy County Executive
- Tim Leclerc, Deputy Director, Finance Department
- Tom Flynn, Deputy Director, Department of Economic Development
- Jeff Green, Business Development Manager, Department of Economic Development
- Rocio Lamb, Assistant Director of Finance for Tax Administration
- Lillie Jo Krest, Assistant Director of Finance for Treasury Management
- Endora Matei, Principal Fiscal Analyst, Treasury Management
- Robert Fey, Commercial Real Estate Appraiser
- Karem Oner, Assessments Coordinator/Appraisal Manager
- Leslie Stover, Commercial Real Estate Appraiser Supervisor
- Ariel Diaz, Business Tax Auditor, Tax Administration

Appendix C: History of Data Center Building Space Growth in Prince William County



Source: PFM; Prince William County; CoStar



Source: PFM; Prince William County; Loudoun County; CoStar

Appendix D: Explanation of Economic Impact Modeling

Economists use a number of statistics to describe regional economic activity. Four common measures are **Output,** which describes total economic activity and is generally equivalent to a firm or industry's gross sales; **Value Added,** which equals gross output of an industry or a sector less its intermediate inputs; **Labor Income,** which corresponds to wages and benefits; and **Employment,** which refers to jobs that have been created in the local economy.

In an input-output analysis of new economic activity, it is useful to distinguish three types of effects: **direct, indirect, and induced.**

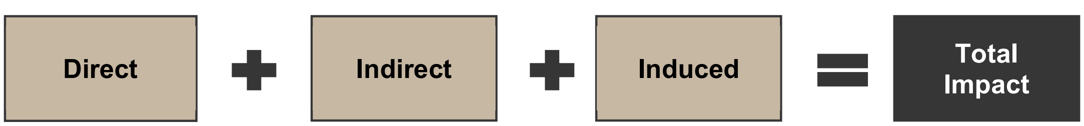
Direct effects are production changes associated with the immediate effects or final demand changes. The payment made by a data center for security services or equipment purchases within Prince William County are examples of direct effects.

Indirect effects are production changes in backward-linked industries caused by the changing input needs of directly affected industries – typically, additional purchases to produce additional output. Satisfying data center demand for security services will require that company to employ staff, purchase and maintain vehicles and other equipment, as will those who sell other equipment or services to the data center. To the extent these downstream purchases affect the economic output of other County merchants, they will be calculated as indirect effects.

Induced effects are the changes in regional household spending patterns caused by changes in household income generated from the direct and indirect effects. Those employed by the data center industry and their suppliers will employ people whose increased income is spent in the local economy.

A multiplier reflects the interaction between different sectors of the economy. An output multiplier of 1.4, for example, means that for every $1,000 injected into the economy, all other sectors produce an additional $400 in output. The larger the multiplier, the greater the impact will be in the regional economy.

The Flow of Economic Impacts



For this project, PFM used IMPLAN. IMPLAN is one of the more commonly used models for this type of analysis and was also used by NVTC in its recent study of the impact of the data center industry on the Commonwealth of Virginia.

Appendix E: Prince William County Data Center Revenue Model Assumptions

- A total of 27.6 million square feet[54] (including 0.6 million added in year 10), with 50 percent attributable to powered shell and 50 percent retail data center
- Powered shell: $160/square foot
- Retail ($/MW): $8.5 million
- kW/square foot: 0.07 (1,000 kW=1 MW)
- C&P/square foot: $6.265
- F&F/square foot: $3.724
- BTP/square foot: $9.989 (TY2021 average)

[54] Square footage is not an optimal method of estimating data center revenue, but it was utilized because power consumption information was not available.

Appendix F: Economic Impacts of Permanent Data Center Operations 2020 and 2021

Economic Impacts of Permanent Data Center Operational Employment: Prince William County, 2020

Impact	Employment	Labor Income	Output
Direct	525	$85,200,000	$533,400,000
Indirect	2,130	$93,000,000	$283,400,000
Induced	375	$14,400,000	$54,500,000
Total	**3,030**	**$195,600,000**	**$871,300,000**

Source: PFM; IMPLAN 2022

Economic Impacts of Permanent Data Center Operational Employment: Prince William County, 2021

Impact	Employment	Labor Income	Output
Direct	570	$92,500,000	$579,200,000
Indirect	2,300	$101,900,000	$310,000,000
Induced	400	$15,800,000	$59,700,000
Total	**3,270**	**$210,200,000**	**$948,900,000**

Source: PFM; IMPLAN 2022

Appendix G: Inclusion of Construction Industry in Impact Calculations

As noted in the report, the economic impacts of the data center construction industry were not considered the best fit for the cost benefit analysis. For comparison purposes, the construction industry impacts were not included in the NVTC's report on data center economic impacts, so this allows a more 'apples to apples' comparison. It is also the case that the construction industry is not siloed, and in the absence of data center construction, it is likely that the industry would engage in other activity within the County. Finally, the industry is relatively mobile, and a significant share of overall activity will be conducted by construction firms located outside of Prince William County. For the sake of completeness, the project team also did a cost benefit analysis that includes the economic impacts of the construction industry.

Economic Impacts of Data Center Construction
Data center construction of 1.0 million square feet per year has been projected to be sustainable in Prince William County over the long-term, build-out horizon. Construction employment is often characterized as temporary, lasting only while the development project is ongoing. In the case of the data center industry in Prince William County, there are multiple known ongoing projects, with planned land development of an estimated 1,600 acres, under direct ownership of data center developers, whether enterprise or colocation facility developers.

In analyzing the industry conditions, it is reasonable to illustrate the economic impacts of data center construction as a permanent industry, with long-term stable expectations to sustain continued construction employment and ongoing annual economic impacts occurring over the long-term.

While the economic impacts of construction are ongoing, growth in the industry does not necessarily continually increase construction employment. Rather, construction employment remains a stable part of the economy as workers transition from one building to the next as new building construction is completed. New roads, new housing and new school stations are not necessarily generated by the ongoing construction employment, in contrast to the infrastructure costs associated with new permanent data center operations. Other fiscal costs associated with data center construction activity, such as support services for the construction industry, are largely private costs or enterprise fund-based, and there is limited new fiscal cost associated with ongoing data center construction employment. For these reasons, construction activity is often illustrated in the economic impacts of the data center industry but not included in the fiscal/budget analysis of data center industry impacts. The NVTC treated data center construction employment activity in this fashion in its most recent report on data centers.

Consensus analysis of earlier U.S. Department of Commerce and 2021 BAE studies indicates construction costs for data centers, excluding computer equipment, is $1,100 per square foot. This includes materials cost for shell construction, plus specialty construction surrounding electrical service, air conditioning, water/water circulation and other aspects of data center construction. Per square foot construction costs have been increasing in recent years as materials and supply chain issues affect price, and the demand for skilled specialty workers impacts wages. Specialty construction wages have increased 10 percent over the period 2017-2021 in Prince William

County.[55] For the purposes of this analysis, construction costs of $1,200 per square foot are used to reflect ongoing supply chain issues and wage rate increases.

It is assumed that 50 percent of construction spending will take place in Prince William County. Under this assumption, the remainder of construction spending will occur outside the County for the purchase of specialty materials, trade specialist labor and other equipment. Recent construction reports have described how new data centers can be built as modular components with segments of buildings manufactured off site, then shipped and assembled on site. This results in less local spending of construction dollars. Given these conditions, of the expected $1.2 billion in construction, the annual direct construction dollar spending in Prince William County is estimated to be $600 million per year for construction, development, and delivery of new data center inventory space countywide.

The IMPLAN model was used to estimate the economic impacts of the $600 million in annual construction spending of the data center industry. The following table illustrates the direct, indirect, and induced effects of the annual construction activity.

Table 14: Direct, Indirect, and Induced effects of Annual Data Center Construction Activity, Prince William County, 2022
(Dollar Values in Thousands of Dollars)

Impact	Employment	Labor Income	Output
Direct	3,200	$240,800	$623,100
Indirect	600	$37,200	$120,400
Induced	850	$33,700	$127,400
Total	**4,650**	**$311,700**	**$870,900**

Source: PFM; IMPLAN 2022

With construction employment of 3,200 persons, the industry supports an additional 1,450 indirect and induced jobs. Thus, in total, the data center construction industry supports 4,650 jobs within the Prince William County economy. Total construction and related labor income are estimated at $311.7 million, paid annually. Total economic impacts of the data center construction industry are estimated to be $870.9 million annually in Prince William County. Notably, because of the expansive data center development pipeline and industry demand, economic impacts of construction activity and the related employment and wages should be viewed (at least in the foreseeable future) as permanent, ongoing activity in Prince William County.

Proposals to add significant volumes of developable lands to the inventory of data center development capacity are currently being contemplated at the County level. These proposals include addition of the Digital Gateway, expansion of lands in the Data Center Overlay and other considerations, such as density increases and other land use flexibility. If some, or all, of these initiatives are successful, economic impacts of data center construction could double on an average annual basis.

[55] Source: “Quarterly Census of Employment and Wages, Prince William County,” Bureau of Labor Statistics.

Appendix H: Alternate Fiscal Impact Approach, Value-Added Ratio

Value-Added Ratio Methodology

In this methodology, County expenditures are classified as related to either people or the data center industry. This methodology was used by the University of Nebraska Lincoln's Bureau of Business Research in 2019 to quantify the fiscal impact of data centers in Sarpy County, Nebraska.[56]

To apply this methodology, PFM allocated County expenditures by whether they could be applied to data center operations, or the additional employees directly associated with the data center. Expenditures were considered in the aggregate on the department level. Departments were selected based on their identification in stakeholder interviews, including the Police, Fire and Rescue, Public Works, Economic Development, and Planning and Zoning Departments.

Identified County expenditures were totaled and multiplied by the ratio of data center employees to total residents to determine total County expenditures related to data center operations. The total operations expenditures were divided by the total value-added sourced from IMPLAN to create a ratio of the increased cost of each dollar of data center business. This ratio was multiplied by the total data center direct impact from IMPLAN to provide total additional expenditures for data center operations.

The same methodology was applied to expenditures related to additional people employed in data centers. The County expenditures related to individuals is calculated by subtracting data center operation expenditures from total County expenditures. The project team used this new total to calculate a cost per capita by dividing total people-related expenditures by the total County population. This ratio was then multiplied by the number of data center employees to generate total expenditures for the individual working in the data centers.

Including data center construction costs, the County's total economic return using this methodology ranges between $1.6 billion in 2020 and $1.9 billion in 2022. These impacts are at the upper range of all economic and fiscal impacts PFM calculates in this report, as this methodology includes total economic impacts and all related construction costs.

Table 15: Data Center Cost-Benefit Analysis, Value-Added Ratio Technique (Inclusive of Construction Activity)

	2020 (Actual)	2021 (Unaudited)	2022 (Adopted Forecast)
Businesses			
County Expenditures	$2,585,374	$2,392,952	$2,469,504
Value-Added	$294,500,000	$321,000,000	$353,400,000
County Expenditures per Economic Value-Added	$0.009	$0.008	$0.007
Impact	$1,028,607,583	$1,118,942,107	$1,241,861,760
Expenditures	**$9,030,001**	**$8,341,354**	**$8,677,937**

[56] "Economic and Fiscal Impacts of Sarpy County Data Centers," Bureau of Business Research, Department of Economics, University of Nebraska-Lincoln, April 8, 2019, accessed electronically at https://www.omahachamber.org/wp-content/uploads/2019/10/Sarpy-DC-Impact-Final-Report.pdf

	2020 (Actual)	2021 (Unaudited)	2022 (Adopted Forecast)
People			
County Expenditures	$3,184,601,584	$3,392,266,027	$3,423,575,737
County Population	473,901	482,204	488,204
Cost Per Capita	$2,735	$2,782	$2,900
Industry Employees	3,725	3,770	3,850
Expenditures	**$10,187,352**	**$10,489,589**	**$11,164,388**
Total Economic Impacts	$1,575,428,250	$1,715,020,339	$1,906,091,780
Total Expenditures	$19,217,353	$10,489,589	$11,164,388
Total Economic Return	**$1,556,210,897**	**$1,696,189,397**	**$1,886,249,456**

As shown in the following table, without including construction costs, this methodology found that the County's total economic return due to data center activity is $866 million in 2020, $943 million in 2021, and $1.1 billion in 2022 (significantly lower than the results when including construction activity).

Table 16: Data Center Cost-Benefit Analysis, Value-Added Ratio Technique (Excluding Construction Activity)

	2020 (Actual)	2021 (Unaudited)	2022 (Adopted Forecast)
Businesses			
County Expenditures	$424,163	$426,345	$501,618
Value-Added	$161,781,934	$175,683,495	$196,435,101
County Expenditures per Economic Value-Added	$0.003	$0.003	$0.003
Impact	$533,407,583	$579,242,107	$647,661,760
Expenditures	**$1,398,498**	**$1,405,361**	**$1,653,874**
People			
County Expenditures	$1,298,213,943	$1,343,643,528	$1,417,681,881
County Population	473,901	482,204	488,204
Cost Per Capita	$2,739	$2,786	$2,904
Data Center Employment	525	570	650
Expenditures	**$3,518,255**	**$4,158,668**	**$4,756,142**
	2020	**2021**	**2022**
Total Economic Impacts	$871,328,250	$948,920,339	$1,064,091,780
Total Expenditures	$2,836,694	$2,993,645	$3,541,390

	2020 (Actual)	2021 (Unaudited)	2022 (Adopted Forecast)
Total Economic Return	**$868,491,556**	**$945,926,694**	**$1,060,550,390**

Source: Prince William County Department of Finance, IMPLAN, Prince William County FY 2022 Adopted Budget, PFM Calculations

Compared to the per capita cost multiplier approach, this is not the project team's preferred methodology. Defining expenditures between businesses and people is not necessarily an exact science and can be open to interpretation. The PFM team defined business-related expenditures as everything related to data center operations. People-related expenditures used to calculate the cost per employee were based on total county expenditures minus the business-related expenditures. This is a broad categorization of data center expenditures.

Appendix I: Alternative Costing Methodologies, Per Capita Multiplier Technique

As noted in the report, this was not the project team's preferred method. It is included here for the sake of completeness.

First, PFM calculated net revenues using the total economic impacts of the data center industry. This did not match the inputs NVTC used; however, this methodology still provides insight on how much the data center industry can impact the County, when considering indirect and induced economic output.

Second, PFM calculated net revenues using all fiscal impacts of the data center industry and related construction activity. This includes the direct, indirect, and induced fiscal impacts.

Third, PFM used the same methodology, but only included the direct fiscal impacts of the data center industry and related construction activity. This mimics the technique NVTC used. NVTC compared per capita costs to direct fiscal impacts only. For the purposes of this study, PFM defines direct fiscal impacts as the sales and property taxes generated by the industry to the County. Property taxes include personal property taxes and taxes on production and imports related to the construction industry. Data center direct fiscal impacts include real property taxes, business personal property taxes, and sales taxes.

Construction and data center-related expenditures will remain constant in each methodology. For the sake of brevity and clarity, PFM shows expenditures for the first scenario only but will show net revenue calculations for all three. PFM considers expenditures in the aggregate, at the department level. County departments were selected based on the project team's experience with County operations and expenditures as well as their identification in interviews with subject matter experts. The selected departments for expenditures supporting the data center industry are Economic Development, Fire and Rescue, Planning and Zoning, Police, and Public Works.

Table 17: Data Center Cost-Benefit Analysis of Total Economic Impacts, Per Capita Multiplier Technique (Inclusive of Construction Costs)

	2020 (Actual)	2021 (Unaudited)	2022 (Adopted Forecast)
Education-Related Expenditures			
Data Center Employment	3,725	3,770	3,850
Students per County Employee	0.73	0.63	0.62
Local Education Expenditures per Student	$6,626	$7,125	$7,433
Total Education-Related Expenditures	**$18,109,144**	**$16,875,259**	**$17,770,588**
Non-Education Expenditures			
County Residents per All Employees	3.78	3.45	3.44

	2020 (Actual)	2021 (Unaudited)	2022 (Adopted Forecast)
Non-Education Costs per Resident	$1,455	$1,491	$1,562
Total Non-Education Expenditures	**$20,511,794**	**$19,395,306**	**$20,658,791**
Total Data Center Costs			
Data Center Economic Impacts (With Construction)	$1,575,428,250	$1,715,020,339	$1,906,091,780
Data Center Expenditures	$38,620,938	$36,270,565	$38,429,379
Total Economic Return	**$1,536,807,312**	**$1,678,749,774**	**$1,867,662,402**
County Return on Investment per $1.00 in County Budget Expenditures	**$40.79**	**$47.28**	**$49.60**

Under the per capita multiplier approach, the County costs associated with the data center industry are estimated to be over $5.4 million in 2020, with $2.6 million attributable to education costs and the remaining $2.9 million attributable to non-education costs, as summarized in the following table:

Table 18: Data Center Cost-Benefit Analysis of Total Economic Impacts, Per Capita Multiplier Technique (Excluding Construction Costs)

	2020 (Actual)	2021 (Unaudited)	2022 (Adopted Forecast)
Education-Related Expenditures			
Data Center Employment	525	570	650
Students per County Employee	0.73	0.63	0.62
Local Education Expenditures per Student	$6,626	$7,125	$7,433
Total Education-Related Expenditures	**$2,552,295**	**$2,551,432**	**$3,000,229**
Non-Education Expenditures			
County Residents per All Employees	3.78	3.45	3.44
Non-Education Costs per Resident	$1,455	$1,491	$1,562
Total Non-Education Expenditures	**$2,890,924**	**$2,932,447**	**$3,487,848**
Total Data Center Costs	**$5,443,219**	**$2,932,447**	**$3,487,848**
Data Center Economic Impacts (Without Construction)	$871,328,250	$948,920,339	$1,064,091,780
Data Center Expenditures	$5,443,219	$5,483,879	$6,488,077
Total Economic Return	**$865,885,030**	**$943,436,461**	**$1,057,603,704**
County Return on Investment per $1.00 in County Budget Expenditures	**$160.08**	**$173.04**	**$164.01**

Source: NVTC and PFM analysis

As previously noted, economic impacts may translate to positive outcomes for the County. However, for comparison purposes in a cost benefit analysis it is more logical to compare revenue to the County to the costs associated with data centers. There isn't necessarily a causal connection between economic impact to the County and County expenditures to support the industry.

Excluding total economic impacts and including only total fiscal impacts instead shows the County's return on investment for the data center industry, including construction, to be much lower, ranging between $1.82 and $2.81 in revenue for every $1.00 in expenditures.

Table 19: Data Center Cost-Benefit Analysis of Total Fiscal Impacts, Per Capita Multiplier Technique (Including Construction Costs)

With Construction	2020	2021	2022
All Data Center Types			
Data Center Revenues (With Construction)	$70,221,227	$82,044,646	$108,121,524
Data Center Expenditures	$38,620,938	$36,270,565	$38,429,379
Net Fiscal Impact	**$31,600,289**	**$45,774,081**	**$69,692,145**
Net Fiscal Impact per $1 in County Budget Expenditures	**$1.82**	**$2.26**	**$2.81**

Excluding construction costs provides a higher return on investment, ranging between $10.88 and $14.66 per $1.00 in expenditures between 2020 and 2022.

Table 20: Data Center Cost-Benefit Analysis of Total Fiscal Impacts, Per Capita Multiplier Technique (Excluding Construction Costs)

Without Construction	2020	2021	2022
All Data Center Types			
Data Center Revenues (Without Construction)	$59,225,196	$71,680,906	$95,106,833
Data Center Expenditures	$5,443,219	$5,483,879	$6,488,077
Net Fiscal Impact	**$53,781,977**	**$66,197,027**	**$88,618,756**
Net Fiscal Impact per $1 in County Budget Expenditures	**$10.88**	**$13.07**	**$14.66**

The most accurate scenario for determining the net fiscal impact of data center construction includes only the direct fiscal impacts of data centers. The following table demonstrates the net fiscal impact of this methodology when factoring in construction costs.

Table 21: Data Center Cost-Benefit Analysis of Direct Fiscal Impacts, Per Capita Multiplier Technique (Including Construction Costs)

With Construction	2020	2021	2022
Education-Related Expenditures			
Data Center Employment	3,725	3,770	3,850
Students per County Employee	0.73	0.63	0.62
Local Education Expenditures per Student	$6,626	$7,125	$7,433
Total Education-Related Expenditures	**$18,109,144**	**$16,875,259**	**$17,770,588**
Non-Education Expenditures			
County Residents per All Employees	3.78	3.45	3.44
Non-Education Costs per Resident	$1,455	$1,491	$1,562
Total Non-Education Expenditures	**$20,511,794**	**$19,395,306**	**$20,658,791**
All Data Center Types			
Data Center Revenues (With Construction)	$55,670,047	$67,623,154	$90,578,382
Data Center Expenditures	$38,620,938	$36,270,565	$38,429,379
Net Fiscal Impact	**$31,600,289**	**$45,774,081**	**$69,692,145**
Net Fiscal Impact per $1 in County Budget Expenditures	**$1.82**	**$2.26**	**$2.81**

From the project team's perspective, these methodologies do not provide the most accurate version of the County's net revenues related to data centers and associated construction activity, because indirect and induced fiscal impacts cannot be accounted for in expenditure calculations. As a result, the final methodology, which includes only direct fiscal impacts, probably more accurately describes the County's overall net revenues using the per capita multiplier methodology.

When including construction impacts, the County's net revenue is the lowest among all six scenarios, ranging from $1.82 per $1.00 in expenditures in 2020 to $2.81 in 2022. It should be noted that 2020, which was significantly impacted by the COVID-19 Pandemic, is often considered an outlier in calculations of economic activity.

Appendix J: Marginal Cost Approach, Comparable Local Government Technique

While the methods already discussed have been most relied upon for this type of cost benefit analysis, there is a marginal cost approach that relies on comparisons of costs to other local governments. The comparable city technique represents a proportional relationship of average expenditures of local governments of various sizes and growth rates, with multipliers based on growth rates and community size. The method estimates increases or decreases in future gross expenditures for basic municipal services.

A March 2018 report commissioned by Eagle Mountain City, Utah assessed the impact of constructing and operating a potential data center, focusing on the effect it would have on the operations of the City and its residents.[57] The impact on local government spending was considered both overall and through more detailed consideration of specific functions. A review of case studies regarding the experiences of other jurisdictions was the focus of the analysis, which examined the following expenditure categories:

- General government operations overall (total general government expenditures, excluding debt service and capital projects, per capita and adjusted for inflation[58]
- General government administrative expenditures per capita, adjusted for inflation[59]
- Public safety operating costs per capita, adjusted for inflation[60]
- Utility Spending

For example, if a government spent $450 per capita in 2007 (the first year of the new data center) for public safety after adjusting for inflation, then constant dollar spending per capita for all years would be divided by $450. The result is expressed as a percentage. A value of 105 percent in 2010 indicates that per capita spending in 2010 was 5 percent higher than in 2007.

The findings from the study led to a recommendation that the City anticipate increases of 2.0-2.5 percent of expenditure levels for general government and public safety; there was no indication that the local school district or fire operations would be affected by the addition of a data center.

A key strength of this approach is that it can be undertaken relatively quickly, given the availability of required data. However, there are shortcomings and limitations associated with using this technique to determine data center fiscal impacts – particularly within Prince William County and other prominent data center locales. For example:

- Prince William County is already well established as a leading community for data center development. The comparable city technique is most applicable when a government has no precedent for the type or scale of development to predict costs.

[57] Eagle Mountain City, "Fiscal Impact of an Eagle Mountain Data Center," (March 2018). Accessed electronically at https://i84005.com/wp-content/uploads/2018/05/i84005-iNSIDER-Eagle-Mountain-data-center-report-14Mar2018.pdf

[58] General government expenditures do not include business-type activities, such as water and wastewater.

[59] Also included in total general government expenditures

[60] Also included in total general government expenditures

- The technique is intended for communities where population gains or increases in growth rates are likely because of large-scale development or school/municipal redistricting. Given the low employment levels associated with the data center industry, this method is not ideal.

- The validity of expenditure multipliers is questionable because this technique assumes local and capital expenditures related to growth are similar for cities of comparable size and growth rate. These average expenditures may not, however, exactly match those of the community under study.

From the project team's perspective, the limitations of this approach outweigh its advantages, and the project team did not use it for the cost benefit analysis.

Appendix K: Glossary of Terms

Financial and Government

- ACS: American Community Survey, U.S. Census Bureau
- BEA: Bureau of Economic Analysis, U.S. Department of Commerce
- BLS: Bureau of Labor Statistics, U.S. Department of Labor
- BTPPT: Business Tangible Personal Property Tax
- By-right Zoning: Allows projects that comply with zoning standards to not have to go through a discretionary review process
- CAGR: Compound Annual Growth Rate, which is the mean annual growth rate over a specified period of time that is longer than one year.
- DED: Prince William County Department of Economic Development
- Digital Gateway: the area within the County to be added to lands which may accommodate future data centers, however not by right as granted in the data center overlay
- FAR: Floor area ratio, which is the square footage of the structure divided by the square feet of the parcel land area
- FY: Fiscal Year
- GDP: Gross Domestic Product
- IMPLAN: A proprietary input-output model that can be used to determine the economic impact of activities within a county, region, or state. Input-output models are based on statistical information about the flow of goods and services among various industries.
- JLARC: Virginia Joint Legislative Audit Review Commission
- MSA: Metropolitan Statistical Area
- Overlay, the: Prince William County's data center enterprise zone
- PFM: PFM Group Consulting LLC and/or PFM Financial Advisors LLC
- Revenue 1: The Prince William County application that contains the majority of historic tax administration data
- ROI: Return on Investment, a measure of the money that an entity earns as a percentage of the total value of its assets that are invested
- SWOT: Strengths, Weaknesses, Opportunities, and Threats

- TY: Tax Year

Data Centers

- Build to Suit: A term describing a particular property, developed specifically for a certain tenant to occupy, with structural features, systems, or improvement work designed specifically for the needs of that tenant. A build-to-suit can be leased or owned by the tenant. In a leased build-to-suit, a tenant will usually have a long-term lease on the space.
- Cabinet: Device for holding IT equipment, also called a rack.
- Capex: Capital Expense, the cost of purchasing capital equipment.
- Cloud Computing: A general term for anything that involves delivering hosted services over the Internet.
- Colocation Data Center: One data center owner selling space, power, and cooling to multiple enterprise and hyperscale customers in a specific location. Colocation data centers offer interconnection to Software as a Service (SaaS) such as Salesforce, or Platform as a service (PaaS) like Azure. This enables businesses to scale and grow their business with minimum complexity at a low cost. Customers can rent from a fraction of a Cabinet to 100 Cabinets and can house hundreds of individual customers.
- Converged Infrastructure: A modular data center that relies on a specific vendor and the vendor's partners to provide pre-configured bundles of hardware and software.
- Dark Fiber: Unused optical fiber that has been laid but is not currently being used in fiber-optic communications. Fiber optic cable transmits information in the form of light pulses – a ‘dark’ cable refers to one where light pulses are not being transmitted.
- Data Center: A facility used to house computer systems and associated components, such as telecommunications and storage systems. It generally includes redundant or backup power supplies, redundant data communications connections, environmental controls (e.g., air conditioning, fire suppression) and security devices. Also includes colocation, a subset of data centers.
- Data Center Shell: A building that has been readied for power and telecom access, with or without any other improvements, and amenable to data center development and use. May become a single-tenant property or colocation.
- Dedicated Hosting: The provider operates and/or rents server capacity to single customers. Server space is not shared by multiple customers. Typically, the customer maintains full control over the server, excluding maintenance.
- Deploy: to install, test, and run hardware or software in a live environment.

- Downtime: A period of time, or a percentage of a time span, that a system is unavailable or offline. This is usually a result of the system failing to function because of an unplanned event, or because of routine maintenance.

- Enterprise Data Center: A facility owned and operated by the company it supports; often built on-site but may be off-site. Has anywhere from 10 Cabinets upwards and can be as large as 40+ MW.

- Green Data Center: A data centers that provides greater energy efficiency and sustainability and reduced environmental impact.

- Hosting: The service of running servers on behalf of another party, allowing those organizations to focus on managing their applications, instead of hardware and operating system administration. There are various levels of service and various kinds of hosting offered (for example. dedicated, shared, virtual, etc.).

- Hybrid Cloud: Combining public and private clouds together, allowing for workloads to be processed on public cloud infrastructure, while others are run in private clouds.

- Hyperscale Data Center: A data center owned and operated by the company it supports. They generally have upwards of 500 cabinets and are at least 10,000sq ft. in size. They usually have a minimum of 5,000 servers linked with an ultra-high speed, high fiber count network.

- Infrastructure as a Service (IaaS): Also known as cloud infrastructure services. It provides computer infrastructure as a service, typically via a platform virtualization environment. Rather than purchasing servers, software, data center space or network equipment, clients instead buy those resources as a fully outsourced service.

- Internet of Things (IoT): Describes the network of physical objects (“things”) that are embedded with sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the internet (ranging from ordinary household objects to sophisticated industrial tools).

- Kilowatt (kW): A measure of power equal to one thousand watts.

- Managed Hosting: A business model where a service provider leases dedicated servers and associated hardware to a single client. The equipment is at the hosting provider's facility and managed there by the service provider.

- Megawatt (MW): A measure of power equal to one million watts. Often used to describe the size of data centers in terms of power capacity.

- Platform as a Service (PaaS): A way to rent hardware, operating systems, storage, and network capacity over the Internet. This allows the customer to rent virtualized servers and associated services for running existing applications or developing and testing new ones.

- Preleased Space: The amount of space in a building that has been leased prior to its construction completion date, or certificate of occupancy date.

- Private Cloud: Computing services provided over the Internet or a private internal network and only to select users instead of the general public. This provides additional control and customization available from dedicated resources over a computing infrastructure hosted on-premises.

- Public Cloud: Cloud infrastructure available to the general public and owned by a large provider of cloud services.

- Rack: Device for holding IT equipment, also called a cabinet.

- Server Cabinets: A cabinet designed to hold a network device that combines hardware and software to provide and manage shared services and resources on the network.

- Server Room: A location specifically designed to house a high concentration of information technology equipment.

- Shared Hosting: A situation where multiple customers share server capacity.

- Software as a Service (SaaS): A software distribution model where a cloud provider hosts applications and makes them available to end users over the Internet. In this model, an independent software vendor may contract with a third-party cloud provider to host the application. Or, with larger companies, such as Microsoft, the cloud provider might also be the software vendor.

- UPS: Uninterruptible Power Supply, a device placed in series with the supply of power from the utility with energy storage so that the supply of power from the UPS is continuous even when the utility supply is removed.

- WPSF: Watts per Square Foot, a unit of power density. In a data center this refers to the total load in a space divided by the total area of that space. This is a design parameter for total capacity of the cooling and power systems.

Heather Jenkins

From:	Denise Harris
Sent:	Thursday, May 15, 2025 9:00 AM
To:	Heather Jenkins
Cc:	Rob Walton
Subject:	FW: Time to Speak Up -- if you want to prevent data centers in Warrenton

FYI

Denise M. Harris, AICP
Planning Manager
Community Development Department

EXPERIENCE WARRENTON VIRGINIA

21 Main Street
Warrenton, VA 20186
(540) 347-1101 x145
warrentonva.gov

From: James Lawrence <jlawrence@warrentonva.gov>
Sent: Thursday, May 15, 2025 8:43 AM
To: Denise Harris <dharris@warrentonva.gov>
Subject: Fwd: Time to Speak Up -- if you want to prevent data centers in Warrenton

Please add to citizen comments as part of next weeks Public Hearing.

Sent from my iPad

Begin forwarded message:

> **From:** Cindy Burbank <cindy.burbank@comcast.net>
> **Date:** May 7, 2025 at 9:57:14 AM EDT
> **To:** PJ Leary <pjleary1@gmail.com>, katybarber20186@gmail.com, Kevin Ramundo <ramundok@gmail.com>, Patricia Browne <pbrowne319@gmail.com>, Juan Archilla <jcarchil@gmail.com>, Tim Hoffman - PowerlineFighterinFauq <hfthoffman3@gmail.com>, Christina Gagnon <tinytina3@verizon.net>, keenanlori@gmail.com, Sam Mitchell <smitchell4273@gmail.com>, jamesedwardrich@aol.com, suwaru47@gmail.com, Bob Lee <gboblee@icloud.com>, WALDO WARD <waldow53@comcast.net>, autodidact1000@aol.com, Christopher Bonner <bonner.chris@gmail.com>, dcb11653@gmail.com, Geoff Grambo <ggrambo@gmail.com>, dianemhayes79@gmail.com, Bernardine Connelly <connellybj@gmail.com>, karnay@yahoo.com, Chuck Cross <ccross7791@gmail.com>, Mary Judkins <maryjdkns@gmail.com>, Terence Nyhous <tnyhous900@aol.com>, Mark

Smith <MarkRSmith@hotmail.com>, dosnomads@comcast.net, Ken Alm <moon5195@comcast.net>, mkoko@segmentalwall.com, David Norden <david@hsnaia.com>, Mike Fultz <mike.j.fultz@gmail.com>, Denise Schefer <denise.schefer@gmail.com>, Dave Gibson <davegibson3@gmail.com>, Pat Ewing <ewing.pat210@gmail.com>, Peggy <peggydivincenzo@gmail.com>, John McCarthy <jmccarthy@pecva.org>, Douglaslarson46@gmail.com, 1aliZarabi1@gmail.com, Lee Owsley <latitudesfairtrade@gmail.com>, blairwlawrence71@gmail.com, Tandeowsley@gmail.com, Joanne Charles <jcharles1331@gmail.com>, Cal Hickey <tgteer@comcast.net>
Subject: Time to Speak Up -- if you want to prevent data centers in Warrenton

[EXTERNAL EMAIL] DO NOT CLICK links or attachments unless you recognize the sender and know the content is safe.

Friends in Warrenton and Fauquier -
Do you want to avoid more battles over data centers in Warrenton?

If so, now is the time to speak up. The 2021 data center zoning ordinance is still on the books. If you think it should be removed -- **if you think there is NO PLACE IN THE SMALL TOWN OF WARRENTON FOR A DATA CENTER -- you need to let the Warrenton Planning Commission know, because they are holding a hearing and a vote soon -- on Tuesday May 20 at 6:30 pm.**

Unfortunately, there are indications that some of the Planning Commission -- maybe a majority -- are thinking of recommending it be kept in place.

Please email the Planning Commissioners now -- because they are forming their views now -- and please plan to attend and speak at the 5/20 hearing.

Here are some messages you might consider sending and speaking -- but please use your own words!

- *Members of the Planning Commission: Please recommend revoking the 2021 data center zoning ordinance.*
- *Warrenton is a small historic town. There is no conceivable place for a data center within the 4 square miles of this special town.*
- *In 2022-2023, Town and County citizens erupted in anger over the proposal to approve a massive data center on the entrance to Town.*
- *Citizens were equally angry over the NDAs, the withheld FOIAs, the cozy relationship between Town staff and Amazon, and the secretive, "done deal" process behind the ordinance and the data center itself.*
- *In 2022-2023, citizens of the Town and County sent an overwhelming message of opposition to the Warrenton data center on Blackwell Road -- and opposition to ANY data center in the small town of Warrenton.*
- *The Town's own records show over 2,800 citizens went on record against the data center. Only 11 individuals went on record in support.*

- *Yet the 2023 Town Council voted 4-3 to approve the Amazon data center, after citizens packed Fauquier High School's auditorium on Valentine's Day 2023 and spoke into the late hours in opposition.*
- *If you are thinking of retaining the data center zoning amendment, go back to the recording of the Valentine's Day hearing to re-live what citizens said and what happened: https://www.regionalwebtv.com/warrentontc*
- *If the Planning Commission votes to recommend keeping the 2021 data center zoning ordinance, you are repudiating these citizens and this dark history.*
- *If you vote to keep the 2021 data center zoning ordinance, you are saying you think there is a place in Warrenton for a data center.*
- *Please tell us exactly WHERE you think a data center would be allowable in Warrenton.*
- *Vote to remove the data center zoning ordinance, to protect Warrenton from data centers, and to rebuke the process that played out in 2021-2023.*

Email addresses for Planning Commission:

Ryan Stewart, Chair	rstewart@warrentonva.gov
Terry Lasher, Vice Chair	tlasher@warrentonva.gov
Darine Barbour	dbarbour@warrentonva.gov
James Lawrence	jlawrence@warrentonva.gov
Steve Ainsworth	sainsworth@warrentonva.gov

Notice of May 20 public hearing and Planning Commission vote, at 7:00 pm:

TOWN OF WARRENTON
NOTICE OF PUBLIC HEARING

Notice is hereby given that the Planning Commission of the Town of Warrento
a Public Hearing on Tuesday, May 20, 2025, at 7:00 PM in the Warrenton
Council Chambers (First Floor) located at 21 Main Street, Warrenton, Virgin
following item(s):

ZOTA-25-1 - A Zoning Ordinance Text Amendment to Remove Data Cen
Permissible Use in the Industrial District. As initiated by Town Council on
2025, this Zoning Ordinance Text Amendment will amend Articles 3, 9, and
Town of Warrenton Zoning Ordinance, for the purpose of removing Data Cer
Permissible Use within the Industrial District, and therefore make Data C
impermissible Use Within the Town of Warrenton.

People having an interest in the above are invited to attend the hearing and
opinion regarding the issues. The public may also choose to submit written
through the Town's website or by emailing citizencomment@warrentonva.gov
public comment period which will end at noon the day of the public hea
Planning Commission may make a recommendation to the Town Council,
hold a public hearing at a later date. Information is available for viewing on
website www.warrentonva.gov. If there are any questions, please call 540-34
visit Town Hall located at 21 Main Street, Monday through Friday, 8:30 AM to 4

The Town of Warrenton desires to make its programs, services, facilities, and
accessible to persons with disabilities. If you need accommodations or
services, please contact the Town as far in advance as possible.

Heather Jenkins

From: Denise Harris
Sent: Tuesday, May 13, 2025 3:19 PM
To: Heather Jenkins
Subject: FW: Please undo the 2021 Zoning Amendment mistake

Denise M. Harris, AICP
Planning Manager
Community Development Department

21 Main Street
Warrenton, VA 20186
(540) 347-1101 x145
warrentonva.gov

From: Chuck Cross <ccross7791@gmail.com>
Sent: Tuesday, May 13, 2025 2:38 PM
To: Planning Department <Planning@warrentonva.gov>; Darine Barbour <dbarbour@warrentonva.gov>; Ryan Stewart <rstewart@warrentonva.gov>; Terry Lasher <tlasher@warrentonva.gov>; James Lawrence <jlawrence@warrentonva.gov>; Steve Ainsworth <sainsworth@warrentonva.gov>
Subject: Please undo the 2021 Zoning Amendment mistake

[EXTERNAL EMAIL] DO NOT CLICK links or attachments unless you recognize the sender and know the content is safe.

Some people who received this message don't often get email from ccross7791@gmail.com. Learn why this is important

May 12, 2025

Dear Warrenton Planning Commission,

Please recommend that the Town Council reverse the zoning amendment that allowed the Amazon data center application to move forward in Warrenton. You are likely aware of the overwhelming public outcry and legal process that ensued from the 2021 code amendment and subsequent Amazon data center application. Far from benefiting Warrenton, the singular decision to alter the zoning code in 2021 launched the town of Warrenton down a dark and extremely expensive path. I encourage you to now be part of the solution, rather than the continuance of the problem.

First, it is likely that the resolution of the court matter alleging that the 2021 rezoning was handled incorrectly under Virginia law will be resolved against the town and Amazon. The arguments are simple. Town staff, the Council, and Amazon rushed to amend the code and in so doing, failed to follow key state requirements. Consider that any future data center applied for or approved under the original flawed legal process will likely be presented with the same public challenges and costly battles.

Second, the concern of Warrenton citizens over the original zone change was and is so great it will not go away. As you know, it grew into a two-year fury that saw an entire turnover of the town Council. The only path to reconciliation with most local constituents is to reverse the wrong that originally allowed data centers to apply for an exception in the first place. I urge you to see this truth and make a recommendation to correct the matter.

Despite the Mayor's repeated assertions that there is a silent majority in favor of data centers, this is simply not true and not supported by the record. The record shows at least 2,000 against data centers and only 11 in favor. If there is any silent majority, logic tells us that these silent people are almost certainly against data centers not for them. Silent majorities still vote, and we have a new town Council majority that was elected from an anti-data center platform.

As part of the public and governmental decision-making process, you have the responsibility to consider the public will, the extensive cost and disruption the zoning change has had on this town, and whether that should continue. In other words, a decision by you to ignore the opportunity to begin correcting the problem will certainly result in:

- More legal cost and political anxiety for Warrenton.
- A major public battle each time a data center application is proposed.
- Continued public mistrust of process and a community divided against its town.

Please be bold and do your part to return Warrenton to where it was before the zoning mistake occurred.

Sincerely,

Chuck Cross
Lees Ridge Rd
Warrenton, VA

Heather Jenkins

From:	Denise Harris
Sent:	Friday, May 16, 2025 3:57 PM
To:	Heather Jenkins
Subject:	FW: Please undo the 2021 Zoning Amendment mistake

Denise M. Harris, AICP
Planning Manager
Community Development Department

21 Main Street
Warrenton, VA 20186
(540) 347-1101 x145
warrentonva.gov

From: Chuck Cross <ccross7791@gmail.com>
Sent: Friday, May 16, 2025 3:55 PM
To: Planning Department <Planning@warrentonva.gov>; Darine Barbour <dbarbour@warrentonva.gov>; Ryan Stewart <rstewart@warrentonva.gov>; Terry Lasher <tlasher@warrentonva.gov>; James Lawrence <jlawrence@warrentonva.gov>; Steve Ainsworth <sainsworth@warrentonva.gov>
Subject: Re: Please undo the 2021 Zoning Amendment mistake

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Dear Warrenton Planning Commission:

Having just taken a moment to review the Planning Commission's minutes from the April 22 meeting, I feel compelled to amend my earlier comments. First, I'm dumbfounded at the current Planning Commission's understanding of the zoning amendment process that occurred, or more correctly, failed to occur in 2021. While my earlier comments stand as written, this addition addresses specific understandings or questions by the Planning Commission in the April minutes:

1. Questions were raised about the need for this undertaking and concerns about the necessity for reconsideration of the zoning amendment, that it feels arbitrary, and whether there was any basis for the change.

The Town Council, as a higher governmental body, has already determined the need for consideration of this matter. The Town Council passed a resolution to begin text amendments to the zoning ordinance. I do not believe the Town Council asked the Planning Commission to determine whether they were thinking clearly when they made this resolution. Rather, the Planning Commission has been tasked with considering text amendment language.

There is nothing arbitrary about this request or the desire to consider amending the ordinance. Anyone living in Warrenton for the last several years knows that this matter is the most contentious, damaging matter to come before the town in decades, possibly ever, and that it all ties back to the original text amendment in 2021. The matter has survived judicial review without being found arbitrary or without merit and the court has found that there is clearly a basis for that challenge.

2. Apparent concerns that this matter was not raised previously and that this current request is a result of "political winds."

The political winds felt today are simply a residual breeze left behind by a several-year hurricane. The matter was raised previously. Over and over and over, with an ever-increasing intensity. It resulted in a lawsuit because the prior Town Council was too deaf to reverse its original change of the inappropriate amendment. I, along with many others stood in front of this Planning Commission and the Town Council in 2022 and 2023 challenging the ordinance change and everything that ensued from that change. This is not new. It is not arbitrary. Please review your own history before believing such.

3. The town needs to stand by its decision in order to provide predictable guidance to land owners.

No. The Town needs to acknowledge that it fell victim to deception, misrepresentation, and big corporate influence to the detriment of citizens. This is why the Town Council asked you to begin this undertaking. Why the Town Council is seeking to follow good process by including you in the mechanisms of government rather than excluding you and bypassing an important part of the system like the prior Council did in 2021 and 2022. Were you consulted on the zoning amendment brought forth in 2021? Nope.

4. The Town had conducted public hearings, vetted the matter and found the change to be in the best interests of the Town.

Again, no. The Town disguised the matter inside a consent agenda. Only one citizen even noticed that this was happening and appeared to raise voice. No one else, including council members at that time realized what they were approving.

*The term "consent agenda," sometimes called consent calender, refers to a specific section of a meeting agenda that groups **routine, non-controversial** items for quick approval. Instead of discussing and voting on each individual item separately, the group can approve all items on the consent agenda at once.*

The use of a consent agenda to sneak the amendment passed everyone and avoid discussion and debate was diabolical and intentional as evidenced by the town administrator's own statement to

Amazon's attorney that she had "slipped" it into a consent agenda. You know the rest of the stor She did this working hand in hand with Amazon. Then Town staff in response to specific questions, stated that there were no known interested data centers at the time; clearly false. And then once the amendment was passed allowing data centers, the Town administrator promptly accepted a position with Amazon.

There was no vetting of this matter other than how it might be snuck through the system unnoticed. In fact, the zoning amendment in 2021 was put forth in the consent agenda on the very day the Town Council approved the Planning Commission's recommendation of the Comprehensive Plan; a plan that did not even contemplate data centers inside Warrenton. If nothing else, this Commission should be so upset by that deception that you should be the first in line to explain why this now needs to happen.

Not only was there no vetting, no discussion, no debate, no consideration. There was no compliance with state law when the town amended the zoning ordinance (see lawsuit against the Town of Warrenton).

Virginia Code 15.2-2486(A)(7): Whenever the public necessity, convenience, general welfare, or good zoning practice requires, the governing body may by ordinance amend, supplement, or change the regulations, district boundaries, or classifications of property.

There was no consideration or showing of "*public necessity, convenience, general welfare, or good zoning practice"* in 2021. This Council is trying hard to follow correct process, follow law and do things the way they should have been done in 2021.

5. The creation of precedence setting special rules for special processes.

Again no. The Town Council is trying to reverse a matter that resulted from "special rules" and "special processes" that benefitted some Town staff and Amazon in 2021. The precedence for dishonesty and avoidance of law was already established with this matter. The only precedence you risk setting here is that Warrenton "can" do things the right way.

6. Concern that no other jurisdiction has disallowed data centers.

The more relevant concern should be whether any other jurisdiction has violated state law in amending a zoning ordinance under the cloak of darkness, obscured by the use of a consent agenda to the detriment of its own citizens.

7. Concerns about revenue loss.

There should be greater concerns about the cost already expended by the Town in defending its improper and dishonest actions set in motion in 2021. Rather than the Town's future opportunity cost with no data centers, please consider the money the Town will save by no longer continuing to battle a situation that should have never occurred in the first place.

I am not arguing that you have an obligation to see things the way the majority of local citizens see them. I'm arguing that you have a responsibility to give your full consideration of a zoning text amendment as the Town Council has requested.

Sincerely,

Chuck Cross
Lees Ridge Rd
Warrenton, VA

On Tue, May 13, 2025 at 2:37 PM Chuck Cross <ccross7791@gmail.com> wrote:

May 12, 2025

Dear Warrenton Planning Commission,

Please recommend that the Town Council reverse the zoning amendment that allowed the Amazon data center application to move forward in Warrenton. You are likely aware of the overwhelming public outcry and legal process that ensued from the 2021 code amendment and subsequent Amazon data center application. Far from benefiting Warrenton, the singular decision to alter the zoning code in 2021 launched the town of Warrenton down a dark and extremely expensive path. I encourage you to now be part of the solution, rather than the continuance of the problem.

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- A major public battle each time a data center application is proposed.
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Please be bold and do your part to return Warrenton to where it was before the zoning mistake occu

Sincerely,

Chuck Cross
Lees Ridge Rd
Warrenton, VA

Heather Jenkins

From:	David Dobson <dobsondm@aol.com>
Sent:	Monday, April 28, 2025 2:25 PM
To:	Heather Jenkins
Subject:	Hi Heather - I hope this message finds you well, and enjoying a fine spring day. I enjoyed attending Last Tuesday evening's Planning Commission meeting, and hearing everyone's points on the Data Center text amendment issue. It was a good, smart discuss...

[EXTERNAL EMAIL] DO NOT CLICK links or attachments unless you recognize the sender and know the content is safe.

You don't often get email from dobsondm@aol.com. Learn why this is important

Hi Heather - I hope this message finds you well, and enjoying a fine spring day. I enjoyed attending Last Tuesday evening's Planning Commission meeting, and hearing everyone's points on the Data Center text amendment issue. It was a good, smart discussion and I look forward to the Public Hearing on this. Technology is moving so very, very fast these days - fortunately with better, safer and much quieter cooling, recycling, Liquid Immersion Cooling/LIC, power efficiency and especially super low sewer & water use compared to the technology of 2021, four years ago, when the Data Center text was first adopted. Fortunately things are much different and better now, completely different now for the better. If only companies would always commit to using the very best technology.

On sewer & water for example, for planning for the future, things have greatly changed for the better in the Town. The Town has substantially invested in sewer & water improvements and continues to do so in this year's budget. This year's Town budget shows strong continued capital investment for improving Town sewer & water capacity. Our **current capacity is 3M GPD**, as recently confirmed publicly by Town Council Member Bill Semple in the March Town Council Meeting. To help even more, I have done much research to find simple, low-cost ways to easily increase Town sewer & water capacity. **The good thing is that the Town can dramatically increase its sewer & water capacity today with already well established, simple, super low-cost sewer & water conservation programs that can effectively add up to 1M more GPD by simply replacing older toilets, faucets and showerheads with EPA WaterSense products like dual flush toilets, low flow toilets, water efficient faucets, showerheads and rain barrels too. Dramatic, easy and super low-cost savings of Town sewer & water, yielding much, much more effective capacity. And it would be easy to begin this program with swapping out at Town and County government offices, schools, apartments, and hotel/motel units, and of course older homes.**

So I wanted to share what I have seen. Our neighbors in Charlottesville and Albemarle County have been **running water conservation programs for 20 years** very successfully! These are proven efforts that have contributed to their sewer & water capacity at super low cost and simple effort. Their water conservation is saving them **68.9 million gallons of water annually** (according to their 2022 Water Conservation Report: **https://www.charlottesville.gov/495/Water-Conservation**). These are very simple and super low-cost ways to conserve the Town's sewer & water - most notably their rebate program or Swap-Out Program for replacing older toilets, faucets and showerheads with more water-efficient **EPA WaterSense** products like dual flush toilets, low flow toilets, water efficient faucets, showerheads and rain barrels too.

The Charlottesville Sewer & Water Conservation Program Director, Jennifer Patterson, said it well fro their experience, **"Just think, 1,161 old-fashion toilets replaced here in just the last two (2) years with a basic replacement rebate program of just $150 per old-fashioned toilet and showerhead (and with no installation/removal help either!) - and each fixture replaced represents several houses saved on sewer & water use."** Here is Charlottesville & Albemarle's Water Conservation Program details:

1) Toilet Rebate Program: Provides a rebate of up to $150 to any city or county water customer who purchases and installs a low flow WaterSense toilet to replace older high flow models. **Since its inception in 2003, the number of toilet rebates issued is 7,234, saving 68.9 million gallons of water a year!** A note about these rebates: Multi-unit properties and businesses also receive rebates and they will be on the hunt for ways to save money and water moving forward.

2) Rain Barrel Rebate Program: Provides up to 2 $30 rebates for rain barrels purchased per water service address. This program encourages homeowners to use harvested rainwater for outside uses like washing cars, watering plants and irrigating landscapes. Since its inception in 2009, the City of Charlottesville has provided 873 rebates.

3) Free Water Conservation Kits: Kits to residents from the City's Utility Billing Office and passing them out at community events. Each kit includes these water saving devices:

- City of Charlottesville Rebate brochure (information on Toilet and Rain Barrel Rebate Programs)
- WaterSense labeled 1.5 gallon per minute faucet aerator, good for kitchen use
- WaterSense labeled 0.5 gallon per minute faucet aerator, good for bathroom use
- WaterSense labeled self-cleaning, massaging showerhead plus 1 roll of extra duty Teflon tape for installation
- 2 toilet leak detection dye tablets, to help with detecting a running toilet

4) Fix A Leak Week: A national campaign which seeks to inform the public on how to identify and fix leaks. Fix a Leak Home Scavenger Hunt with participants are entered to win a prize of $50 gift card to a local gardening business. Also features a youth art contest to show why we must value and save water.

These ideas can work today for the Town of Warrenton for sewer & water conservation, and I have more resources which I will send. The Town has a sewer & water conservation advocate in me, and I have offered my support and assistance to Mayor Nevill; Town Manager Frank Cassidy; Town Council and to Town staff like Seth Cannonier, Superintendent of Public Utilities; Steven Friend, Director of Public Utilities; Paul Bernard, Director of Public Works; Rob Walton, Director of Community Development; and Denise Harris, Planning Manager. **I have even asked Mayor Nevill if the Town can form a simple Swap-Out Program to implement these savings to benefit our Town. We can effectively add up to another 1M more GPD to our 3M GPD current capacity by establishing a Swap-Out Program for the Town. All virtually at no cost!**

These are simple and super low-cost ways to help increase the Town's sewer & water capacity by large amounts - just like the successful programs used for 20 years in nearby Charlottesville and Albemarle. I will also send more details on the Town of Warrenton that I have been working on, and how we can do a Swap-Out Program here. It really will work well at super low cost and effort for Warrenton. **I will send you more ideas too as I keep working on this.** I think there are great easy and low-cost savings ahead. I look forward to seeing you at the next Planning Commission meeting. Best regards, David

David Dobson
Premium Business Parks International, LLC
Office: 540-937-7010
Cell & Text: 540-229-7010
Email: DobsonDM@aol.com

Toilet Rebates
City of Charlottesville
https://www.charlottesville.gov ›
Toilet-Rebates A rebate of up to $150 can be used to cover the cost of the toilet

Community embraces water conservation practices
Jennifer Patterson, Project Manager of Charlottesville Water Conservation Program
Utilities Outreach Office, 434.970.3800, waterconservation@charlottesville.gov
9 Steps To Curb NRW & Maintain Water & Sewer Systems
Ground Penetrating Radar Systems
Leaks in pressurized water pipelines can lead to significant water loss and increased non-revenue water (NRW). Proactively utilizing industry-leading smart ...

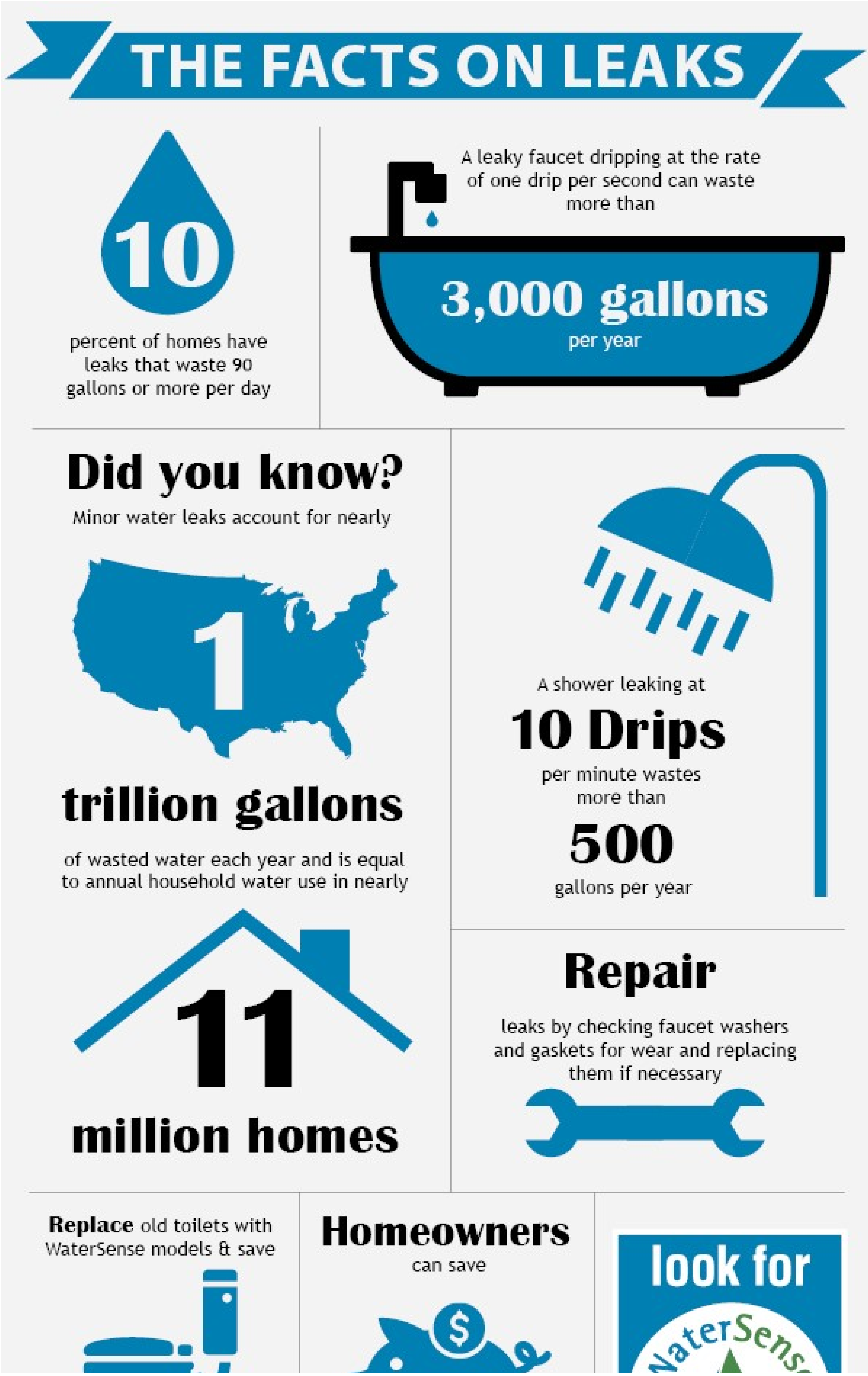
Water Loss and Conservation for Small Utilities
WaterOperator.org
Water loss is an unavoidable part of distribution systems, yet too much can stress the supply and efficiency of your utility

Understanding and Managing Losses in Distribution Networks
Globally, water demand is rising and resources are diminishing, so water losses from distribution networks that can reach as high as 50% in some cities...

https://www.epa.gov/watersense

https://serviceauthority.org/customerservices/water-conservation/

https://www.charlottesville.gov/501/Water-Rebates-Incentives


THE FACTS ON LEAKS
10
percent of homes have leaks that waste 90 gallons or more per day
A leaky faucet dripping at the rate of one drip per second can waste more than
3,000 gallons
per year
Did you know?
Minor water leaks account for nearly
1
trillion gallons
of wasted water each year and is equal to annual household water use in nearly
11
million homes
A shower leaking at
10 Drips
per minute wastes more than
500
gallons per year
Repair
leaks by checking faucet washers and gaskets for wear and replacing them if necessary
Replace old toilets with WaterSense models & save
Homeowners
can save
look for

Heather Jenkins

From:	Denise Harris
Sent:	Thursday, May 15, 2025 9:01 AM
To:	Heather Jenkins
Subject:	FW: Hi Jim - I hope this message finds you well, and coming off a nice weekend with your family.

Denise M. Harris, AICP
Planning Manager
Community Development Department

21 Main Street
Warrenton, VA 20186
(540) 347-1101 x145
warrentonva.gov

From: James Lawrence <jlawrence@warrentonva.gov>
Sent: Thursday, May 15, 2025 8:44 AM
To: Denise Harris <dharris@warrentonva.gov>
Subject: Fwd: Hi Jim - I hope this message finds you well, and coming off a nice weekend with your family.

Please add to citizen comments as part of next weeks Public Hearing.

Sent from my iPad

Begin forwarded message:

> **From:** David Dobson <dobsondm@aol.com>
> **Date:** May 12, 2025 at 1:18:38 PM EDT
> **To:** James Lawrence <jlawrence@warrentonva.gov>
> **Subject: Hi Jim - I hope this message finds you well, and coming off a nice weekend with your family.**

[EXTERNAL EMAIL] DO NOT CLICK links or attachments unless you recognize the sender and know the content is safe.

Hi Jim - I hope this message finds you well, and coming off a nice weekend with your family. Tomorrow's Town Council Meeting will review the discussion I attended at the April 22 Planning Commission work session on amending Data Centers as a Permissible Use within the Town's Industrial Districts. My point - removing Data Centers as a potential Permissible Use seems premature and a bit hasty. Data Centers are now a really very normal part of our everyday life. They just need to use cutting edge technology, get quieter, look prettier and adopt the rapid improvements now available in the industry - with many more technical improvements arriving every month now. **Let's give technology and future Town Councils this chance and choice.** Technology keeps improving on Data Centers and technology is moving very fast - with better, safer and much quieter cooling, recycling, Liquid Immersion Cooling/LIC, power efficiency and especially super low sewer & water use compared to the Data Center technology of 2021, when the Data Center text was first adopted. Things are much better now, completely different now for the better. For sure we need the Data Center companies to commit to using the very best technology in our communities! In short, let's give better technology and future Town Councils a chance at deciding this.

Just as one example, a major improvement to provide very quiet, no-water and energy efficient Data Centers is the great new technology now being used - **Liquid Immersion Cooling/LIC.** It involves submerging electronic components, like servers, in a dielectric fluid (a non-conductive liquid) that efficiently absorbs and dissipates heat. This method offers super quiet, no vibration, superior cooling compared to traditional air or water cooling, allowing for increased server density and performance while greatly reducing energy consumption, noise and vibrations - helping to eliminate them for top "neighborliness". Technology is fast eliminating negatives - so the future gets much, much better every year.

LIC is now known as the industry's new standard for offering excellent cooling efficiency. I recently received a **flyer** (streamed below) from **nVent Data Solutions** for an **LTA Sidecar** liquid cooling solution for existing Data Centers. **The most remarkable note for this LTA Sidecar is that it completely bypasses public water systems! That means there are ways to cool Data Centers without even using the Town's sewer & water systems.** The LTA Sidecar is a completely integrated liquid-to-air heat rejection systems that enables up to **two racks of liquid cooled IT equipment with no public water.** The technology used for this device cools liquid by pulling air over coils and rejecting heat into the hot aisle. **This method avoids the complexities of facility water, reducing operational costs while maintaining high performance.** This new technology is like the difference between today's quiet EVs with no noise or vibrations running on clean batteries compared to an old rumbling Model T with no muffler using leaded gas!

The use of new technology can aid us in our new normal, allowing for more efficient use of resources. And this is just one example - just one example - of how Data Center technology is quickly changing for the better. The LTA Sidecar could help Warrenton decision makers, as just 20 of these devices will disconnect a major Data Center from public sewer & water use, and quiet things way, way down. Just wanted to share this exciting new development, and show how all this new technology today and tomorrow makes the Town's Data Center text amendment unnecessary. I have also streamed below several links that offer more information on LIC that help. Best regards, David

David Dobson
Premium Business Parks International, LLC
Office: 540-937-7010

Cell & Text: 540-229-7010
Email: DobsonDM@aol.com

Liquid Cooling: A Year in Review
We'll examine some of the biggest updates in the Liquid Immersion Cooling industry and how these new innovations will impact your Data Center.

The 2025 Outlook for Data Center Cooling
Rapidly increasing server rack densities and 24/7 uptime requirements will increase demand for liquid and hybrid cooling systems, including retrofits,...

Data Centers Look to Immersion Cooling as a Path to Sustainability - and Lower Costs
Data Center usage is rapidly increasing, driven to a great degree by demand for artificial intelligence. This technology revolution could...

Quiet of Immersion Cooling Improves Quality of Life

Data centers are **noisy places** – both inside and out. On the inside, high velocity fans on IT equipment and the HVAC system create an ...

Immersion Cooling Solution for Data Centers - Gigabyte

The scalable, faster, and energy-efficient way to cool your **data center**, **immersion cooling** can save more for your business and is overall more reliable.

Liquid Immersion Cooling for Data Centers | ICEraQ | GRC

GRC is the leader in **liquid immersion cooling** for **data centers**. Our ICEraQ™ micro-modular systems increase efficiency and lower CAPEX & OPEX by 50%.

Immersion Cooling with 3M Fluids for Data Centers

Immersion cooling is a method for cooling **data center** IT hardware by directly immersing the hardware in a non-**conductive liquid such as 3M™ Fluorinert™ ...**

----- Forwarded Message -----
From: nVent Data Solutions <datacenters@nvent.com>
To: "dobsondm@aol.com" <dobsondm@aol.com>
Sent: Thursday, May 8, 2025 at 10:18:25 AM EDT
Subject: Deploying Liquid Cooling without Facility Water - nVent LTA Sidecar

e efficiency of existing data centers. The nVent Liquid-to-Air Sidecar Heat Rejection Unit is a completely integrated liquid-to-air heat

and rejecting heat into the hot aisle. This method avoids the complexities of facility water, reducing operational costs while maintaini

Intelligent design: The LTA Sidecar comes standard with 14 hot–swap fans in N+1 configuration, a reservoir pump unit with N+N hot–swap pumps, a hot–swap controller, a hot–swap concurrently maintainable redundant filtration system, 6 x N+N redundant power supplies, integrated leak detection, leak–free hose connections, and an LED Light Path status panel.

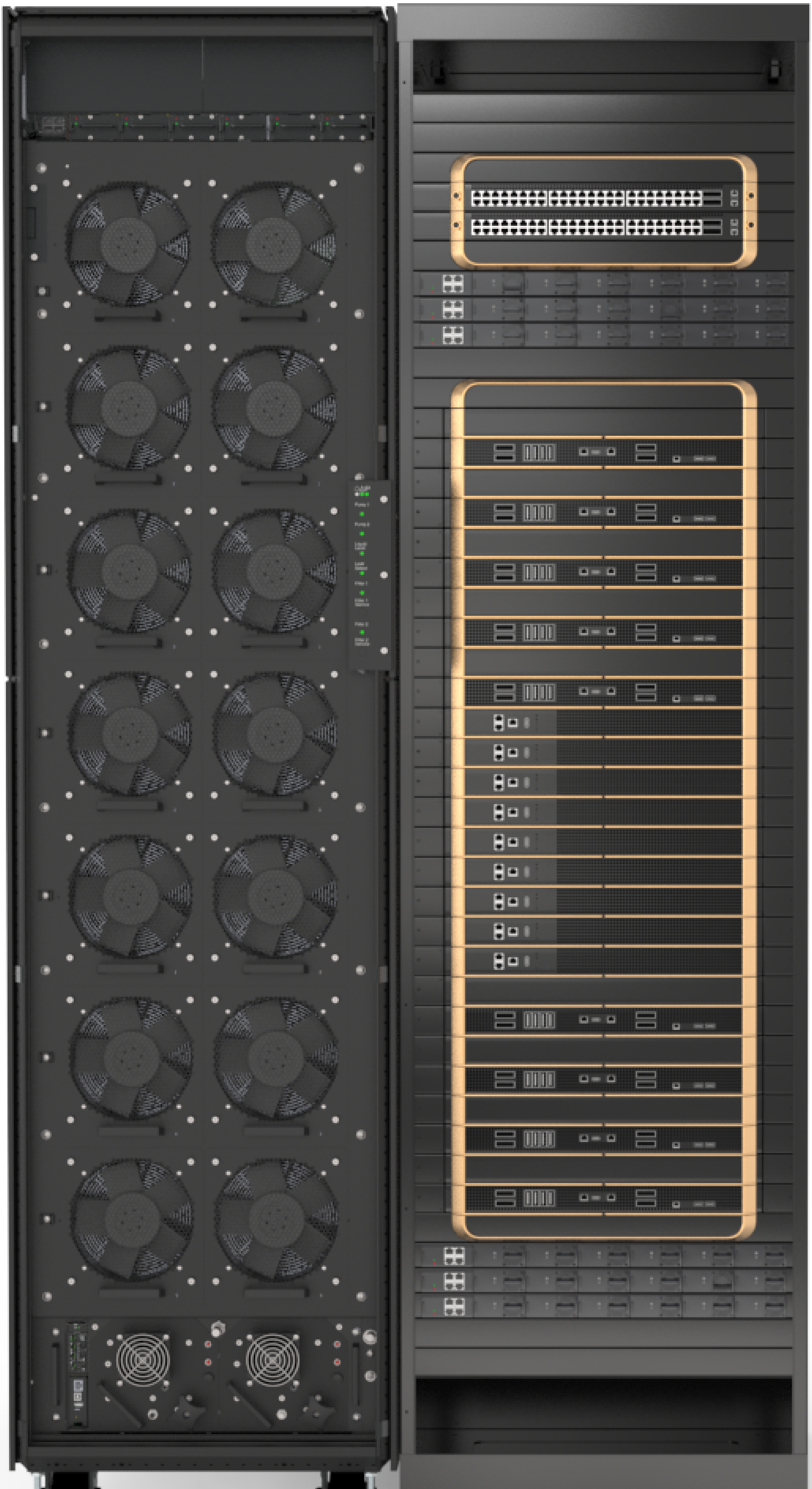
Deploying liquid cooling: colocation data centers can now deploy liquid cooling inside of existing data centers with minimal infrastructure changes.

Minimizing leaks and failures: Integrated internal and external leak detection.

Hot swap and serviceability: toolless hot-swap, redundant pumps, fans power supplies, temperature and pressure sensors.

Flexible hose connections allowing installation flexibility.

Designed to enable up to two racks when
is no Facility Water System



Nvidia NVL36 Configuration

GB200 NVL36 rack supported by a single Sidecar HRU (1:1)


nVent
nVent

Nvidia NVL72 Configuration

GB200 NVL72 rack supported by two Sidecar HRUs (2:1) in parallel

Learn More!

Heather Jenkins

From: Shellenberger, Adam <Adam.Shellenberger@fauquiercounty.gov>
Sent: Wednesday, April 30, 2025 10:25 AM
To: Rob Walton
Cc: Heather Jenkins
Subject: FW: 2021 data center ZOTA.

[EXTERNAL EMAIL] DO NOT CLICK links or attachments unless you recognize the sender and know the content is safe.

Rob-

Please see below. It looks like this was intended for you all and not us.

-Adam

ADAM SHELLENBERGER
CHIEF OF PLANNING

FAUQUIER COUNTY
COMMUNITY DEVELOPMENT
16 Courthouse Square Suite 100
Warrenton, VA 20186
www.fauquiercounty.gov
PH: 540-422-8200

From: Meixner, Meredith <meredith.meixner@fauquiercounty.gov>
Sent: Wednesday, April 30, 2025 10:22 AM
To: Shellenberger, Adam <Adam.Shellenberger@fauquiercounty.gov>
Subject: FW: 2021 data center ZOTA.

MEREDITH S. MEIXNER
DEPUTY CLERK TO THE PLANNING COMMISSION

FAUQUIER COUNTY COMMUNITY DEVELOPMENT
16 Courthouse Square, Suite 100
Warrenton, VA 20186
www.fauquiercounty.gov
PH: 540-422-8200

From: Mary Judkins <maryjdkns@gmail.com>
Sent: Wednesday, April 30, 2025 10:15 AM
To: Meixner, Meredith <meredith.meixner@fauquiercounty.gov>
Subject: 2021 data center ZOTA.

CAUTION: This email originated from outside of the organization. Do not follow instructions, click links, or open attachments unless you know the content is safe.

Please circulate to the Planning Commission members:

> Shortly after they took office, the new Town Council asked the Planning Commission to reconsider the 2021 data center ZOTA. That was a great move -- **and should be an easy decision.. do not let the mayor influence you to cover up his past mistakes.**

> Let us make intelligent Common Sense decisions for our future.

Mary Judkins
Warrenton

Heather Jenkins

From: Florence Keenan <keenanlori@gmail.com>
Sent: Wednesday, May 7, 2025 5:39 PM
To: Ryan Stewart; Terry Lasher; Darine Barbour; James Lawrence; Steve Ainsworth
Subject: ZOTA-25-1

Dear Planning Commissioners,

As a Fauquier resident for over a quarter century, I'm concerned about including data centers in the zoning for our county seat, Warrenton. Data centers are large, noisy, industrial complexes that should not be near any residential or mixed use area. They also require transmission lines and substations that reach beyond Warrenton into the surrounding county, taking by eminent domain private property for rights of way. In addition, all ratepayers currently pay for data centers' power infrastructure, to the detriment of our rising electric bills.

The legality of the prior ZOTA that included data centers as an acceptable use in Warrenton is an issue that is currently being litigated. That ZOTA was introduced by a flawed resolution on the same date as the Warrenton Comprehensive Plan's approval which explicitly stated that data centers are not appropriate in Warrenton. So why would you keep data centers as a potential use in Warrenton? There was and currently is a direct conflict between the Comprehensive Plan and that ZOTA. What was the Comprehensive Plan about if not good planning for Warrenton's future?

Warrenton's citizens have protested the Amazon data center and voted to expel those counsel people who supported that folly. Why would you, the Planning Commissioners vote to maintain such democratically rejected zoning? Data centers are not consistent with Warrenton's town character and should not be included as a possible use in Warrenton.

Please vote to remove data centers as a permissible use in Warrenton's industrial district.

Sincerely yours,

Florence Keenan
Tax Paying Fauquier Resident

Heather Jenkins

From: Denise Harris
Sent: Thursday, May 15, 2025 9:01 AM
To: Heather Jenkins
Cc: Rob Walton
Subject: FW: Data Center Zoning Ordinance

Denise M. Harris, AICP
Planning Manager
Community Development Department

21 Main Street
Warrenton, VA 20186
(540) 347-1101 x145
warrentonva.gov

From: James Lawrence <jlawrence@warrentonva.gov>
Sent: Thursday, May 15, 2025 8:43 AM
To: Denise Harris <dharris@warrentonva.gov>
Subject: Fwd: Data Center Zoning Ordinance

Please add to citizen comments as part of next weeks Public Hearing.

Sent from my iPad

Begin forwarded message:

> **From:** PJ Leary <pjleary1@gmail.com>
> **Date:** May 7, 2025 at 10:29:41 AM EDT
> **To:** Steve Ainsworth <sainsworth@warrentonva.gov>, Darine Barbour <dbarbour@warrentonva.gov>, Ryan Stewart <rstewart@warrentonva.gov>, Terry Lasher <tlasher@warrentonva.gov>, James Lawrence <jlawrence@warrentonva.gov>
> **Subject: Data Center Zoning Ordinance**

[EXTERNAL EMAIL] DO NOT CLICK links or attachments unless you recognize the sender and know the content is safe.

Some people who received this message don't often get email from pjleary1@gmail.com. Learn why this is important

To members of the Town of Warrenton Planning Commission:

Warrenton is no place for data centers. Surely you felt the pulse with the many who spoke out against the Amazon data center. There is no new information to change that position. In fact, thanks to nationally recognized industry experts and diligence of local organizations such as PEC, CFFC, Protect Fauquier and Protect Catlett along with on going reports from Loudon and Prince William, there are volumes of new and emerging information to give you and your constituents every reason to JUST SAY NO.
I became a Warrenton resident in 1962. I thought I'd seen the worst of it with residential and service area development. To even consider industrial use of large tracts within the Town of Warrenton is just plain ludicrous.
Please, remove the data center zoning ordinance and do not entertain industrial use of land nor attendant transmission lines, sub stations, along with their noise, pollution, water use that devalue the quality of life in small town Warrenton.

Thank you for considering my concerns.

PJ Leary

540-270-5205

Heather Jenkins

From: Denise Harris
Sent: Thursday, May 15, 2025 9:01 AM
To: Heather Jenkins
Subject: FW: 2021 Data Center Zoning Ordinance

Denise M. Harris, AICP
Planning Manager
Community Development Department

21 Main Street
Warrenton, VA 20186
(540) 347-1101 x145
warrentonva.gov

From: James Lawrence <jlawrence@warrentonva.gov>
Sent: Thursday, May 15, 2025 8:43 AM
To: Denise Harris <dharris@warrentonva.gov>
Subject: Fwd: 2021 Data Center Zoning Ordinance

Please add to citizen comments as part of next weeks Public Hearing.

Sent from my iPad

Begin forwarded message:

> **From:** Denise Schefer <denise.schefer@gmail.com>
> **Date:** May 7, 2025 at 10:54:13 AM EDT
> **To:** Ryan Stewart <rstewart@warrentonva.gov>, Terry Lasher <tlasher@warrentonva.gov>, Darine Barbour <dbarbour@warrentonva.gov>, James Lawrence <jlawrence@warrentonva.gov>, Steve Ainsworth <sainsworth@warrentonva.gov>
> **Subject: 2021 Data Center Zoning Ordinance**

[EXTERNAL EMAIL] DO NOT CLICK links or attachments unless you recognize the sender and know the content is safe.

Good morning -

I am writing to you this morning to request that you remove/repeal the 2021 Data Center Zoning Ordinance. This ordinance came about under less than ideal circumstances, being proposed by Brandie Schaeffer who later left her Town of Warrenton position to go work for Amazon; and Amazon having played a role in the drafting of the provision. During 2022-2023, hundreds of Town of Warrenton residents/property owners made it abundantly clear over the course of several Planning Commission/Town Council public hearings that we were very concerned about the impacts of the Amazon data center and that we do not want to see additional data centers within the Town of Warrenton. Prior to that, several hundred local residents spent months creating the Warrenton 2040 Plan - their vision and plan for Warrenton over the next twenty plus years - and it did not include data centers. Now is the time to repeal this ordinance. THERE IS NO PLACE IN THE SMALL HISTORIC TOWN OF WARRENTON FOR A DATA CENTER.

Below is the link to the Town Council Feb 14th meeting in which the Fauquier High School gym was packed with Town residents, Town property owners and Fauquier County residents speaking out against the data center. I invite you to go back and watch the comments that were made that evening. *https://www.regionalwebtv.com/warrentontc*

Denise Schefer
Highlands Townhome Owner
Fauquier County Resident

EXPERIENCE WARRENTON VIRGINIA EST. 1810

ZOTA-25-1

A Text Amendment to Remove Data Centers as a Permissible Use within the Industrial District

Planning Commission Public Hearing
May 20, 2025

Text Amendment – ZOTA-25-1

- March 11, 2025 – Town Council initiates a Zoning Ordinance Text Amendment to remove data centers as an allowable use.
- April 22, 2025 – Planning Commission holds a Work Session on the text amendment.
- May 20, 2025 – Planning Commission holds a Public Hearing on the text amendment.

Next Steps:

- Planning Commission makes a recommendation.
- Town Council holds a Work Session.
- Town Council holds a Public Hearing.
- Town Council makes a final decision.

The Planning Commission must make a recommendation to Town Council by no later than 100 days after the first meeting.

100-day deadline – Thursday, July 31, 2025.

Potential Planning Commission meeting dates for final recommendation:
Tuesday, July 15, 2025
Tuesday, July 22, 2025
Special Meeting

Data Center Ordinance Timeline

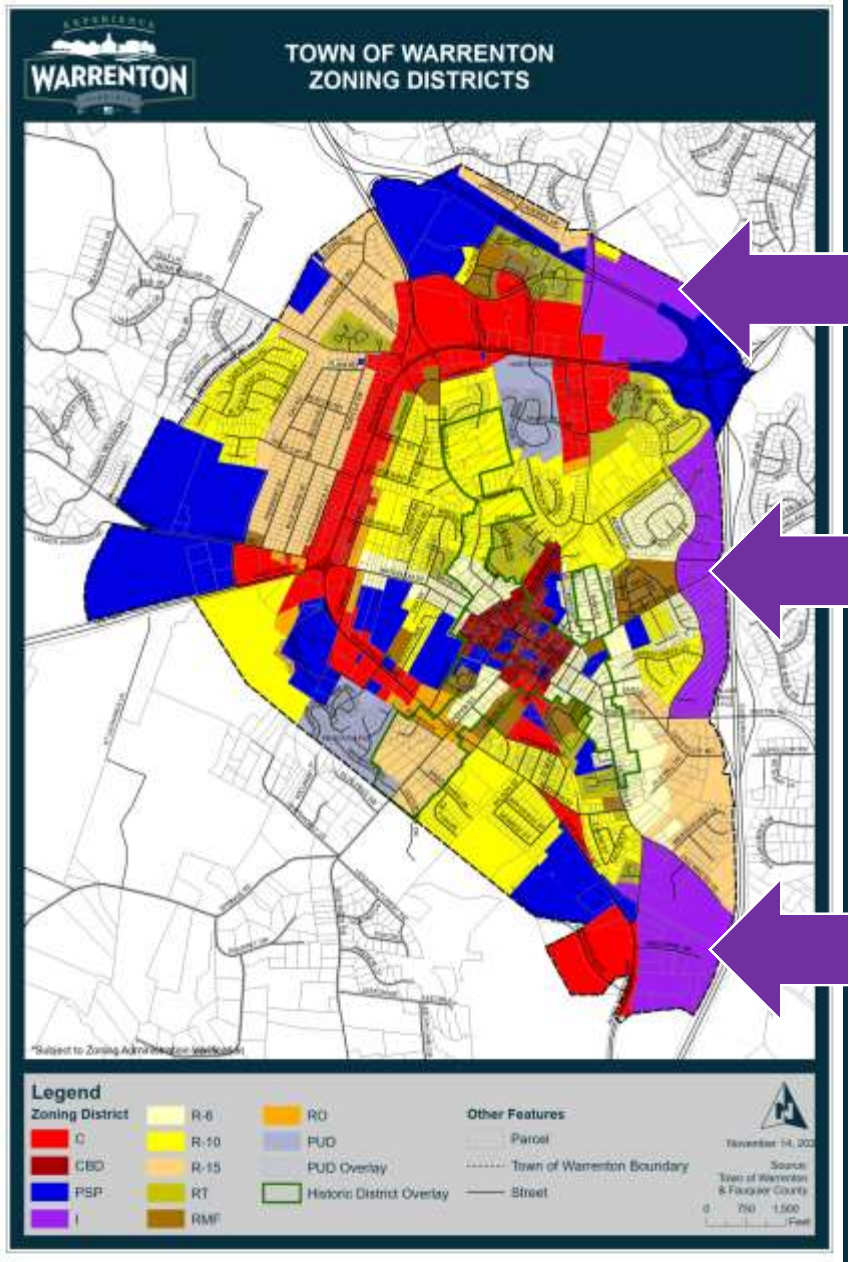
- July 11, 2017 – Town Council initiates a Zoning Ordinance Text Amendment to research industrial areas and the possibility of adding data centers.
- The originally initiated Text Amendment was not pursued with the Planning Commission nor Town Council.
- April 13, 2021 - Town Council initiates a Zoning Ordinance Text Amendment to allow data centers in the I District with the approval of a Special Use Permit.
- May 25, 2021 – Planning Commission holds a Work Session on the text amendment.
- June 15, 2021 – Planning Commission holds a Public Hearing on the text amendment.
- July 20, 2021 – Planning Commission holds a Public Hearing on the text amendment. Recommended approval 5-1.
- August 10, 2021 – Town Council holds a Public Hearing on the text amendment. Approves text amendment 7-0.

Warrenton Data Center SUP Timeline

May 6, 2022 – Special Use Permit application accepted for processing.

December 20, 2022 – Planning Commission Public Hearing; Motion to Deny.

February 14, 2023 – Town Council Public Hearing; Motion and Resolution to Approve



Current Zoning Ordinance Provisions for Data Centers

Industrial-Zoned Properties

Data Centers

Section 3-4.12.3: Permissible Uses in the Industrial District

By Special Use Permit upon approval of the Town Council

– added August 10, 2021

Current Zoning Ordinance Provisions for Data Centers

Zoning Ordinance Article 3 – Zoning Districts
Section 3-4.12.3: Permissible Uses in the Industrial District

By Special Use Permit upon approval of the Town Council

- Automobile body shop
- Automobile and truck repair and service
- Commercial Kennels
- Contractor's storage yard
- ***Data Center*** ***– added August 10, 2021***
- Farm equipment, motorcycle, boat and sport trailer sales and service
- Fuel, coal, oil distribution storage yards
- Lumber and building supply with undercover storage
- Maintenance and equipment shops with screened outside storage
- Outdoor storage of any kind
- Plumbing and electrical supply with undercover storage
- Restaurant or cafeteria, drive-thru or otherwise
- Self-service mini-warehouse
- Temporary fair and show grounds
- Tire and battery sales and service, tire recapping and retreading
- Transmission and receiving towers of height greater than one hundred twenty-five (125) feet.
- Treatment plants, water storage tanks, major transmission lines or pipelines, pumping or regulator stations, communications towers, storage yards and substations, and cable television facilities and accessory buildings

Zoning Ordinance Article 12

Data Center: A facility containing one or more large-scale computer systems used for data storage and processing for off-site users. Typical supporting equipment includes back-up batteries and power generators, electric substations, cooling units, fire suppression systems, and enhanced security features.

- Added August 10, 2021

Current Zoning Ordinance Provisions for Data Centers

Zoning Ordinance Article 9 – Supplemental Use Regulations

9-26 Data Centers

Data Centers, as defined in Article 12, are permissible in the Industrial (I) District, subject to the following requirements.

9-26.1 Additional Standards

A. Minimum Lot Size: 25 acres. Town Council may approve a data center on parcels less than 25 acres as part of the special use permit application.

B. Cooling: The data center shall utilize recycled water or air chillers, in conjunction with using recycled water, for cooling purposes. Potable water shall not be used for cooling.

C. Electric Service: All electric service lines from the substation to the data center shall be placed underground.

D. Setbacks: Per Section 3-4.12.4 ("All principal manufacturing and processing uses in industrial parks"). Town Council may approve building heights greater than 35 feet during the review of the Special Use Permit. Buildings must be setback one (1) additional foot (horizontally) from the required setback line for each additional one (1) foot (vertically) greater than 35 feet. Building heights shall be in conformance with the Comprehensive Plan. 2. The data center building shall be setback a minimum of one-hundred (100) feet from property lines.

E. Parking: In accordance with "Assembly or Manufacturing Uses" per Section 7-7 of the Zoning Ordinance.

F. Building Facades: 1. Building facades shall include at least two of the following design elements: a. Change in building height; b. Building step-backs or recesses; c. Fenestration (25% minimum); d. Change in building material, pattern, texture, or color; e. Use of accent materials.

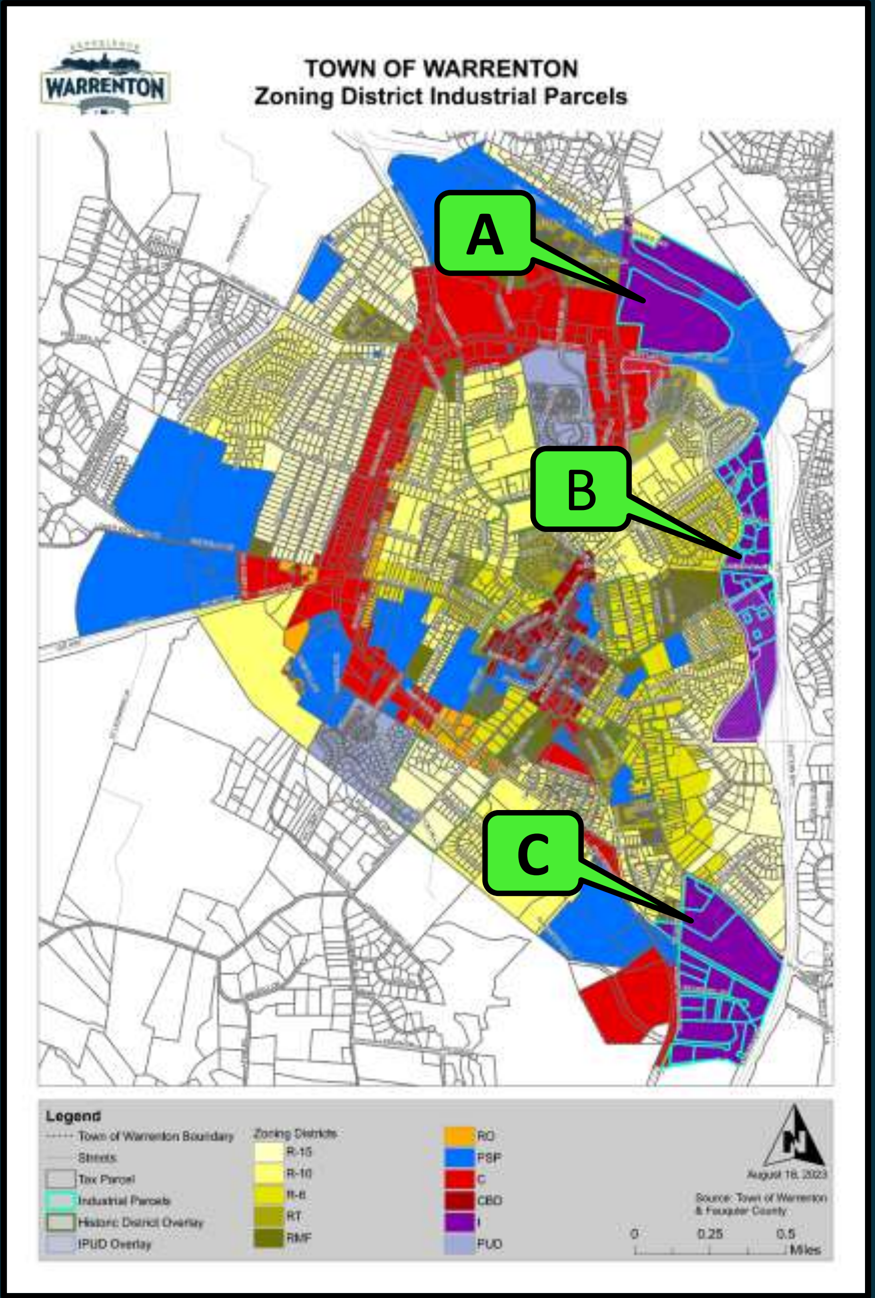
G. Mechanical Equipment: 1. Mechanical equipment shall be completely screened through the use of walls, fences or evergreen vegetation so that no part of the mechanical equipment can be seen from adjoining properties or right-of-ways. 2. All generators shall be equipped with mufflers to reduce emissions and noise.

H. Security: 1. The facility shall provide access to Town and County emergency services staff at all times.

I. Landscaping: 1. In addition to the landscape planting requirements of Article 8 of the Zoning Ordinance, any portion of the data center (including equipment) visible from a park or adjoining/across the street from a residential district shall be screened by vegetation consisting of a double staggered row of evergreen trees planted 15 feet on center. A minimum 3 foot berm planted with a double staggered row of evergreen shrubs planted 10 feet on center may be used in place of the double staggered row of evergreen trees required above.

J. Substations: 1. Substations associated with the data center shall be screened from adjacent properties and right-of-ways through the use of opaque fencing in addition to evergreen trees and shrubs.

- Added August 10, 2021



Industrial Zoned Parcels

Location & Development Status

Industrial District - Total Tax Parcel Land
76 Parcels
290 Acres of Tax Parcel Land

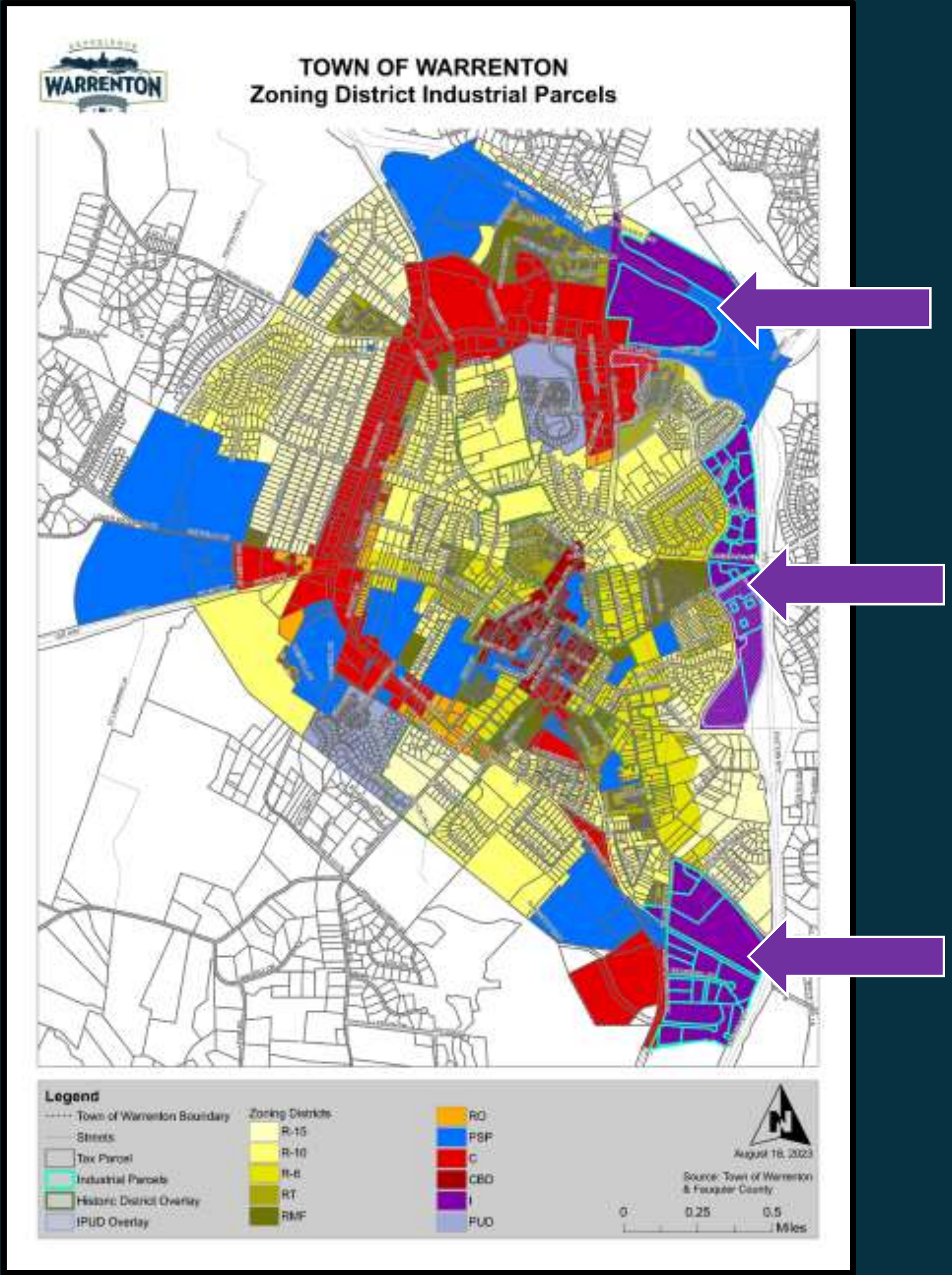
58 Developed Parcels
18 Undeveloped Parcels

- Includes Amazon & Walker Drive Rezoning – Areas A & B
- Includes likely candidates for Redevelopment – Area C

139 Acres Developed Land
151 Acres Undeveloped Land

- 52% of All Industrial Zoned Land is currently vacant
- Majority in Area C (*land with no legislative approvals*)

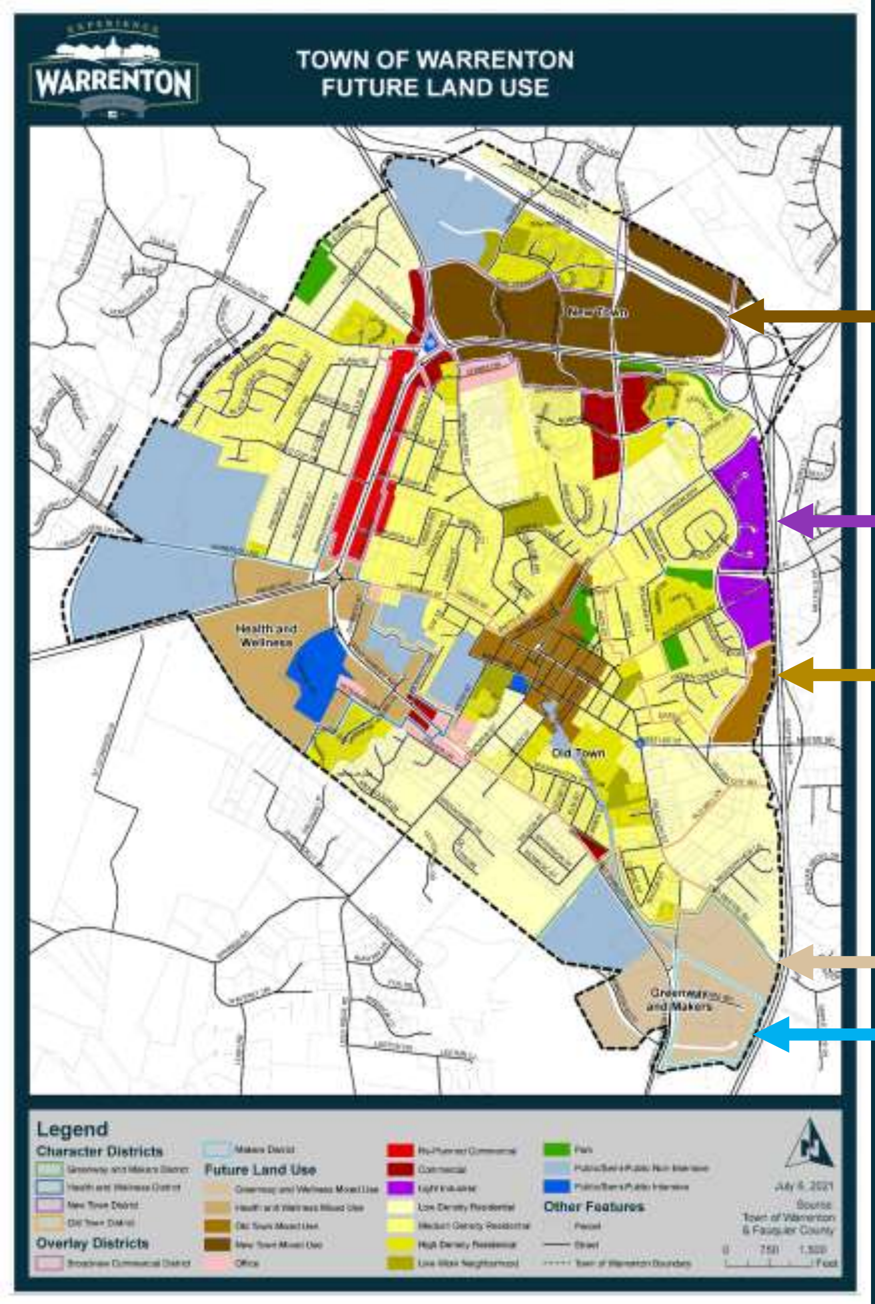
Current Zoning Map



Zoning Ordinance Article 3 – *Zoning Districts and Map*
Section 3-4 – Requirements for Base Zoning Districts

3-4.12.1 Legislative Intent

It is the intent of this district to implement the Town's Comprehensive Plan by providing for a variety of light manufacturing, fabricating, processing, wholesale distributing, warehousing, and limited assembly uses appropriately located for access by highways and providing a controlled environment within which signing is limited, uses are to be conducted generally within completely enclosed buildings, and a moderate amount of landscaping is required. In order to preserve the land for industry, to reduce extraneous traffic, and avoid future conflicts between industry and other uses, business and service uses are limited primarily to those which will be useful to employees in the district and future residential uses are restricted.



Future Land Use Map

Comprehensive Plan – Plan Warrenton 2040

Current Zoning Map – Industrial District

Future Land Use Map:

- New Town Character District/New Town Mixed Use
- Light Industrial
- Old Town Character District/Old Town Mixed Use
- Greenway & Makers Character District/Greenway and Wellness Mixed Use
- Makers Character District

Comprehensive Plan Considerations

Area A

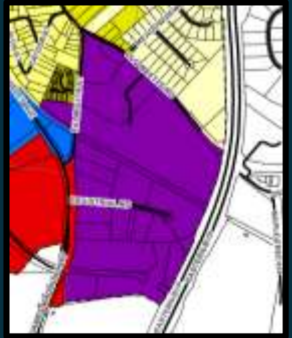
New Town Mixed Use/New Town District

Large lots, direct access from Route 29, and high visibility, a location for a signature office/jobs center; with greater intensity of mixed use and strong live, work, and play options.

Area B

Light Industrial/Old Town District

Continue to promote Old Town as the signature cultural, social and historic hub. Encourage infill housing and adaptive reuse of structures; maintain historic character and scale.



Area C

Greenway & Wellness Mixed Use/Makers District

Maximize use of industrial areas for maker space with a food and arts focus, create connective elements to the greenway, enhance gateway form and function.

Comprehensive Plan Considerations

New Town Mixed Use/New Town District

Character District Summary

Large lots, direct access from Route 29, and high visibility, a location for a signature office/jobs center; with greater intensity of mixed use and strong live, work, and play options.

Land Use Goal

Support the revitalization of the commercial shopping malls with walkable development, green space, public amenities, as well as provide a location for a major employer.

Existing Businesses

None – undeveloped.

Area A - Undeveloped Parcels

- Dobson, David – 21.8 ac.
- Amazon Data Services – 41.7 ac. *(SUP Approval)*

Total Undeveloped Area = 63.5 ac.

Comprehensive Plan Considerations

Light Industrial/Old Town District

Character District Summary

Continue to promote Old Town as the signature cultural, social and historic hub. Encourage infill housing and adaptive reuse of structures; maintain historic character and scale.

Land Use Goal

Include a mix of infill and new development that is designed to maintain Old Town's historic character.

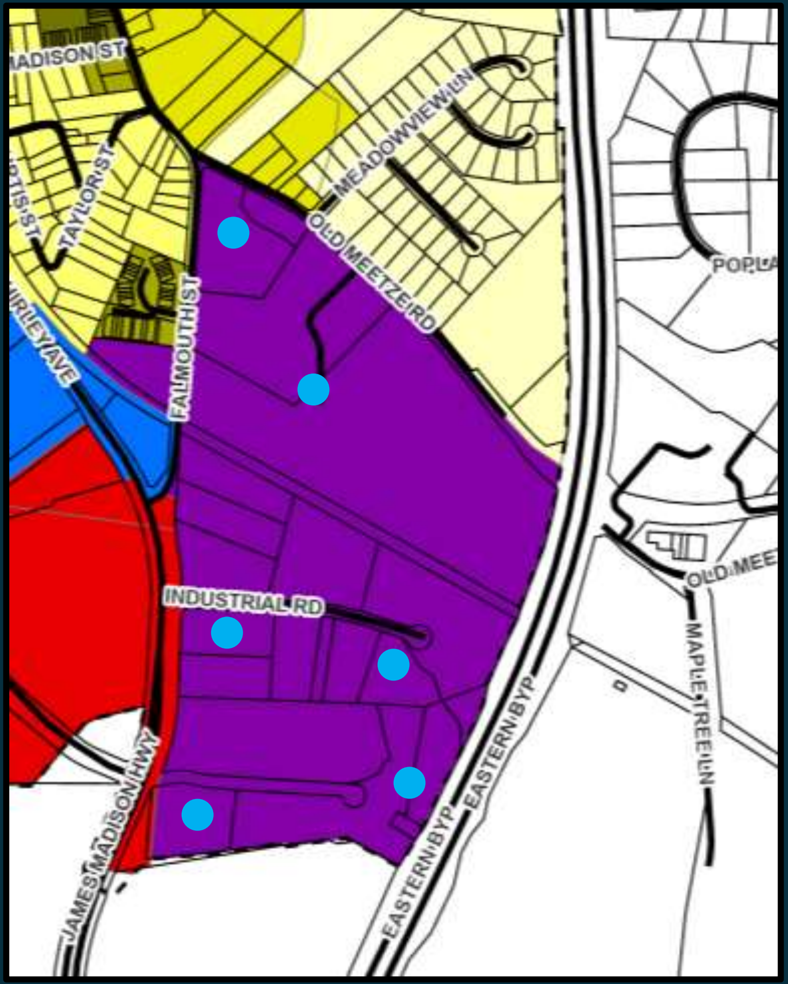
Existing Businesses

- 6 Industrial-type
- 14 Light Industrial/Office
- 4 Assembly

Area B - Undeveloped Parcels

- Brandon Land Investments/1.2 ac.
- Town of Warrenton/1.9 ac.
- Gibson, Lori/0.5 ac.
- 341 Academy Hill Road LLC/1.8 ac.
- Walker Dr. Investment Group/3.5 ac. *(IPUD – Land Bay E)*
- Springfield Properties LLC/8.5 ac. *(IPUD – Land Bays B, C, D)*
- Remland LLC/11.6 ac. *(IPUD – Land Bays A, B, C)*

Total Undeveloped Area = 29 ac.



Comprehensive Plan Considerations

Greenway & Wellness Mixed Use/Makers District

Character District Summary
Maximize use of industrial areas for maker space with a food and arts focus, create connective elements to the greenway, enhance gateway form and function.

Land Use Goal
Promoted as the southern gateway and maintain critical linkages between education, civic uses, surrounding neighborhoods and the remaining industrial uses in the Town.

Future Land Use Description – Light Industrial

- Incorporate previous uses envisioned for Light Industrial.

Existing Businesses

- 8 Industrial
- 1 Light Industrial/Retail
- 2 Assembly

Area C - Undeveloped Parcels/Parcels for Redevelopment

- Worsham, Suzanne & William/5.2 ac. *(Alwyngton Manor)*
- Premium Business Parks International LLC/37.4 ac. *(Wire Factory)*
- Red Road INC/2.2 ac.
- Brown, Ricky/2.2 ac.
- The Drew Corporation/8.6 ac. *(floodplain)*
- 819 JMH LLC/3.0 ac. *(floodplain)*

Total Undeveloped Area = 58.6 ac

Remove Data Center Use

Planning Commission Work Session Discussion
April 22, 2025

JLARC Data Centers in Virginia (2024)

Brief Summary of Report Contents:

- Primary financial benefit is during initial construction.
- Tax revenues increase – but are *highly variable*.
- Exempt from sales tax for computers & equipment; other types of tax exemptions.
- Increasing energy demand & need for electrical power infrastructure - may increase energy costs for all users.
- Use of water for cooling - water demand must be managed to match local capacity to ensure supply for other users.
- Air pollution concerns from use of generators – currently generators cannot be used for principal power source.
- Noise (equipment) and visual (building) impacts to residential areas – localities must consider location and potential impacts.

JLARC report includes recommendations for legislation and policy changes.
The 2025 State data center reform bill (HB1601) was vetoed.

Zoning Ordinance Criteria for Consideration of Text Amendments

When there is a request for a zoning ordinance text amendment, the Planning Commission and Town Council shall consider the following matters:

Section 11-3.9.13
Two Main Considerations for Text Amendments:

1. Whether the proposed text amendment is consistent with the Comprehensive Plan.
2. Whether the proposed text amendment is consistent with the intent and purpose of the Zoning Ordinance.

Section 11-3.9.12
Fourteen Additional Considerations – Use only those that are *Relevant* to the Proposed Text Amendment

1. Does it further the public interest, and conforms with the goals, objectives, and policies of the Comprehensive Plan?
2. Is it consistent with the Future Land Use Plan and the established character and land use patterns?
3. Is it justified by changed/changing conditions?
4. Would it create an isolated district that is unrelated to adjacent districts?
5. Are there now, or could there be built, adequate infrastructure and utilities to serve the use?
6. Is it compatible with properties in the vicinity, and would have no adverse impact on these properties?
7. Are there adequate sites elsewhere in the Town for the use?
8. Would there be traffic impacts that cannot be mitigated?
9. Is there already a reasonable and viable economic use of the property?
10. Would it have a negative impact on natural resources that is not compatible with the Comprehensive Plan?
11. Does it encourage economic development in areas deigned suitable by the Comprehensive Plan, provides desirable employment and enlarges the tax base?
12. Does it consider the current and future needs of the community, as determined by population and economic studies?
13. Does it enhance the opportunity for moderate housing for residents of the Town?
14. Does it negatively effect natural, scenic, archaeological, or historic features of significant importance?

Questions?

TOWN OF WARRENTON, VIRGINIA

PLANNING COMMISSION

BY-LAWS

PREAMBLE- These By-laws set forth the rules for the transactions of business by the Planning Commission of the Town of Warrenton which operates under the authority of the laws of Virginia and the ordinances of the Town of Warrenton.

ARTICLE 1 – OBJECTIVES

1-1 Per §15.2-2210 of the Code of Virginia, every locality shall by resolution or ordinance create a local planning commission in order to promote the orderly development of the locality and its environs. In accomplishing the objectives of § 15.2-2200 the local planning commissions shall serve primarily in an advisory capacity to the governing bodies.

1-2 The Planning Commission, as established by the Town Council, has adopted the subsequent Articles in order to facilitate its powers and duties under Title 15.2, Chapter 22, 2, Code of Virginia.

1-3 The official title of this Commission shall be the Town of Warrenton Planning Commission.

ARTICLE 2 – MEMBERS

2-1 The Warrenton Planning Commission shall consist of not less than five nor more than fifteen members, appointed by the Town Council all of whom shall be residents of the locality, qualified by knowledge and experience to make decisions on questions of community growth and development; provided, that at least one-half of the members so appointed shall be owners of real property. Advisory non-voting members shall include one member of Town Council.

2-2 The members shall be appointed for terms of four years. Any vacancy in membership shall be filled by appointment by the Town Council and will fulfill the unexpired term of the member being replaced. Any member missing three consecutive meetings or four meetings within a twelve month period may be removed from office by the Town Council and may be replaced after proper advertising. Members may be removed for malfeasance in office.

2-3 The Planning Commission shall inform the Town Council when a member's term is expiring to allow time for the Town Council to advertise a new Planning Commission term appointment. Seated Planning Commission members may choose to reapply for a new term but reappointment is not assumed without Town Council action.

2-4 The Commission members are strongly encouraged to attend training sessions sponsored by the State of Virginia or other planning agencies, in order to more effectively carry out their responsibilities to meet the objectives of the Planning Commission.

ARTICLE 3 – OFFICERS

3-1 The Commission shall appoint a Secretary who need not be a member of the Commission.

3-2 Nomination of officers shall be made from the floor of the regular meeting held at the first meeting of the calendar year.

3-2-1 Each candidate for office shall be nominated by and seconded by one member of the Commission.

3-3-2 A candidate for an office of the Commission receiving a majority vote of the members shall be declared elected and shall take office immediately upon the conclusion of the regular meeting and serve for one year or until his successor shall take office.

ARTICLE 4 – DUTIES OF OFFICERS

4-1 The Chairman shall:

4-1-1 Preside at all meetings and call the meetings to order at the appointed time;

4-1-2 Announce the business in its proper order;

4-1-3 Preserve order and decorum;

4-1-4 State and put all questions properly brought before the Commission;

4-1-5 Rule on all procedural questions. Such rulings may be reversed by a majority vote of the members present.

4-1-6 Be informed immediately of any official communication and report the same at the next regular meeting;

4-1-7 Affix his/her signature to all correspondence issued by the commission and all official minutes; and

4-1-8 Appoint committees as necessary.

4-2 The Vice Chairman shall assume the duty of the Chairman in the Chairman's absence or in the Chairman's inability to act.

4-3 The Secretary or the Secretary's appointee shall:

4-3-1 Keep a written record of all business transacted by the Commission;

4-3-2 Notify all members of all meetings;

4-3-3 Keep a file of all official records and reports of the Commission;

4-3-4 Certify all records and reports of the Commission;

4-3-5 Attend to correspondence of the Commission;

4-3-6 Serve notice of all hearings and public hearings;

4-3-7 Keep a set of minutes of all meetings which shall become a public record; and

4-3-8 Prepare and be responsible for publishing of advertisements relating to public hearings.

4-3-9 Ensure all meeting packet materials are submitted to Planning Commission members one week prior to a meeting.

4-3-10 Submit minutes of Planning Commission meetings to the Town Council.

ARTICLE 5 – DUTIES OF THE PLANNING COMMISSION

To effectuate this chapter, the local planning commission shall:

5-1. Exercise general supervision of, and make regulations for, the administration of its affairs;

5-2. Prescribe rules pertaining to its investigations and hearings;

5-3. Supervise its fiscal affairs and responsibilities, under rules and regulations as prescribed by the governing body;

5-4. Keep a complete record of its proceedings; and be responsible for the custody and preservation of its papers and documents;

5-5. Make recommendations and an annual report to the governing body concerning the operation of the commission and the status of planning within its jurisdiction;

5-6. Prepare, publish and distribute reports, ordinances and other material relating to its activities;

5-7. Prepare and submit an annual budget in the manner prescribed by the governing body of the county or municipality; and

5-8. If deemed advisable, establish an advisory committee or committees.

ARTICLE 6 – MEETINGS

6-1 When applications or other Commission business are pending, regular meetings of the Commission shall be held the third Tuesday of each month. Work sessions will be held the fourth Tuesday of each month. As a general practice, regular meetings and work sessions shall not be held on the same night unless approved by the Chair of the Planning Commission prior to public notice requirements.

6-2 When a meeting falls on a legal holiday, the meeting shall be held on the following Tuesday unless otherwise designated by the Chairman or by a vote of the Commission.

6-3 When no application or other business is pending, no meeting will be held. The Commission shall meet at least once a year.

6-4 The meetings shall begin at 7:00 p.m.

6-5 A regular meeting may be adjourned if all business cannot be addressed on the meeting date set. The meeting may be reconvened at a later date, as set at the meeting, or properly advertised.

6-6 Special meetings of the commission may be called by the Chairman or by two members upon written request to the Secretary. The Secretary shall mail to all members, at least five days in advance of a special meeting, a written notice fixing the time and place of the meeting and the purpose thereof. Written notice of a special meeting is not required if the time of the special meeting has been fixed at a regular meeting, or if all members are present at the special meeting or file a written waiver of notice.

6-7 A member, other than the Chairman, may introduce a motion. Any member of the Commission may second a motion. Motions shall be restated by the Chairman before a vote is taken. The names of persons making and seconding motions shall be recorded.

6-8 Parliamentary procedure in Commission meetings shall be governed by Robert's Rules of Order, revised.

6-9 A quorum of the Commission shall consist of majority of the members, and no action of the Commission is valid unless authorized by a majority vote of those present and voting.

ARTICLE 7 – ORDER OF BUSINESS REGULAR MEETING

7-1 The order of business for a regular meeting shall be:

A. Call to order by the Chairman and determination of a quorum;
B. Adoption of minutes;
C. Hearing of public hearing items;
D. New Business;
E. Worksession items (if approved by the Chair of the Planning Commission);
F. Comments from the Commission;
G. Comments from the Staff;
H. Adjournment.

ARTICLE 8 – PROCEDURES FOR HEARING ITEMS

8-1 The order for the public hearing shall be:

8-2 A staff presentation on each item prior to the applicant's comments.

8-3 The applicant or his representative should appear at the public hearing and shall be afforded the privilege of making a statement.

8-4 All interested parties desiring to be heard shall have an opportunity to speak at the public hearing.

8-5 The applicant or his representative may have the opportunity for rebuttal and answer further questions by the Planning Commission.

8-6 The Chairman shall then close the public hearing and the Planning Commission shall deliberate on the application and make its recommendation to the Town Council. Only input from the staff shall be permitted at this time, however, the Commission may ask specific questions of the applicant or his representative.

8-7 The Chairman may impose time limits for presentations by the applicant and other persons wishing to speak at the public hearing. All information relating to a public hearing must be submitted to staff at least eighteen calendar days prior to the public hearing. Any new information submitted after that time will not be considered by the Planning Commission until the next scheduled Regular Public Hearing Meeting, unless waived by the Planning

Commission Chair.

ARTICLE 9 – ORDER OF BUSINESS FOR WORK SESSIONS

9-1 The order of business for work sessions shall be:

A. Call to order by the Chairman
B. Work Session Items
C. Administrative Items
D. Comments from Commission
E. Comments from Staff
F. Adjournment

ARTICLE 10 – AMENDMENTS

These by-laws may be amended by a majority vote of the entire membership of the Commission at a regularly scheduled meeting, provided notice of intent to amend these by-laws has been given at a prior regularly scheduled meeting by at least two members.

ADOPTED: December 17, 1996
Revised December 16, 1997
Revised December 20, 2013
Revised September 20, 2016

TOWN OF WARRENTON, VIRGINIA

PLANNING COMMISSION

BY-LAWS AND PROCEDURES

PURPOSE STATEMENT: The Planning Commission of the Town of Warrenton acts in conformance with Town Council adopted policies and regulations, including the Comprehensive Plan and Zoning Ordinance. As required by ~~the Virginia State~~Va. Code § 15.2-2210, the Planning Commission serves in an advisory capacity to the Town Council to assist in the promotion of orderly development of the Town and its environs. The Planning Commission is charged with assisting the Town Council with ensuring~~-~~:

[…] the public health, safety, convenience, and welfare of the Town citizens and to plan for the future development of communities to the end that transportation systems be carefully planned; that new community centers be developed with adequate highway, utility, health, educational, and recreational facilities; that the need for mineral resources and the needs of agriculture, industry, and business be recognized in future growth; that the concerns of military installations be recognized and taken into account in consideration of future development of areas immediately surrounding installations and that where practical, installation commanders shall be consulted on such matters by local officials; that residential areas be provided with healthy surroundings for family life; that agricultural and forestal land be preserved; and that the growth of the community be consonant with the efficient and economical use of public funds.

PREAMBLE - These By-laws and procedures are set forth the rules for the transactions of business by the Planning Commission of the Town of Warrenton which operates under the authority of the laws of Virginia and the ordinances of the Town of Warrenton.

ARTICLE 1 – ~~OBJECTIVES~~ GENERAL DUTIES

1-1 Per Va. Code §15.2-2210 ~~of the Code of Virginia~~, The Town of Warrenton Town Council established the ~~every locality shall by resolution or ordinance create a local P~~planning ~~C~~Commission ~~in order to promote the orderly development of the locality and its environs. In accomplishing the objectives of § 15.2-2200 the local planning commissions shall serve primarily in an advisory capacity to the governing bodies.~~

~~1-2 The Planning Commission, as established by the Town Council, has adopted the subsequent Articles in order~~ to facilitate its powers and duties under Title 15.2, Chapter 22, Article 2, Code of Virginia. The Planning Commission has the authority through Virginia State Code and the Town of Warrenton Town Code important duties and responsibilities related to land use, including but not limited to, through a motion to recommend to Town Council:

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Commented [DH1]: Exact language of State Code 15.2-2210 and 15.2-2200 and used by Vienna and Manassas. Town Code is not more specific in the PC powers and duties.

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Commented [DH2]: Checked against State Code - correct, although redundant with the added Purpose Statement.

- Comprehensive Plan
- Rezoning Map Amendments
- Zoning Text Amendments
- Comprehensive Permit "2232 Review"
- Special Use Permits
-
- Capital Improvement Plan Conformance with the Comprehensive Plan when a new public land use project is proposed or if the Comprehensive Plan has been updated and adopted.

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~~1-3 The official title of this Commission shall be the Town of Warrenton Planning Commission.~~

ARTICLE 2 – MEMBERS

2-1 The Warrenton Planning Commission are appointed by the Town of Warrenton Town Council per Virginia State Code and Town of Warrenton Town Code, Chapter 2, Article V. ~~shall consist of not less than five nor more than fifteen members, appointed by the Town Council all of whom shall be residents of the locality, qualified by knowledge and experience to make decisions on questions of community growth and development; provided, that at least one-half of the members so appointed shall be owners of real property.~~ The Town Council may require each member of the ~~C~~commission to take an oath of office. One member of the Town Council ~~shall~~ may be appointed as ~~an advisory non-voting~~ a member of the Planning Commission and one member may be a member of the administrative branch of the Town.

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2-2 ~~The members shall be appointed for terms of four years. Any vacancy in membership shall be filled by appointment by the Town Council and will fulfill the unexpired term of the member being replaced. Any member missing three consecutive meetings or four meetings within a twelve month period may be removed from office by the Town Council and may be replaced after proper advertising. Members may be removed for malfeasance in office.~~ Members may be removed for malfeasance in office. Notwithstanding the foregoing provision, a member of the Planning Commission may be removed by the Town Council without limitation in the event that the Commission member is absent from any three consecutive meetings of the Commission or is absent from any four meetings of the Commission within a 12 month period. In either event, a successor shall be appointed by the Town Council for the unexpired portion of the term of the member that has been removed.

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Commented [DH6]: State Code 15.2-2212

2-3 The Planning Commission shall inform the Town Council when a member's term is expiring to allow time for the Town Council to advertise a new Planning Commission term appointment. Seated Planning Commission members may choose to reapply for a new term but reappointment is not assumed without Town Council action.

2-4 The Commission members are strongly encouraged to attend training sessions sponsored by the ~~State~~ Commonwealth of Virginia, professional planning and allied professional organizations, or other planning agencies, in order to more effectively carry out their responsibilities to meet the objectives of the Planning Commission.

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ARTICLE 3 – OFFICERS

3-1 Per ~~State Code~~ Va. Code §~~-~~15.2-2217, t~~T~~he Planning Commission shall elect from the appointed members a Chair and a Vice Chair, whose terms shall be for one year. Officers may serve more than one term; however, the Planning Commission should strive to periodically rotate or select a new Chair to accommodate normal turnover and perpetual nature of the ~~The~~Commission. The Commission shall elect or appoint a Secretary who need not be a member of the Commission.

Commented [DH7]: Per State Code 15.2-2217

Commented [DH8]: Suggested language from Vienna Article II Section II for consideration.

3-2 Nomination of officers shall be made from the floor of the regular meeting held at the first meeting of the calendar year.

3-2-1 Each candidate for office shall be nominated by and seconded by one member of the Commission.

3-3-2 A candidate for an office of the Commission receiving a majority vote of the members shall be declared elected and shall take office immediately and serve for one year or until a successor takes office.

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3-3 The Town clerk or staff will call the first meeting of the calendar year to order and accept the nomination for Chair. Once a Chair is duly elected as prescribed above, the Chair will immediately preside over the meeting.

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ARTICLE 4 – DUTIES OF OFFICERS

4-1 The Chair~~man~~ shall:

4-1-1 Act as the liaison between the Planning Commission and Town Council based on the actions of the Planning Commission body as a whole.

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4-1.2 Set the meeting agendas in consultation with the Vice Chair and Community Development staff.

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4-1.3 Preside at all meetings and call the meetings to order at the appointed time;

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4-1-4~~2~~ Announce the business in its proper order;

4-1-5~~3~~ Preserve order and decorum;

4-1-6~~4~~ State and put all questions properly brought before the Commission;

4-1-7~~5~~ Rule on all procedural questions. Such rulings may be reversed by a majority vote of the members present.

4-1-8~~6~~ Be informed immediately of any official communication and report the same at the next regular meeting;

4-1-9~~7~~ Affix his/her signature to all correspondence issued by the commission and all official minutes; and

4-1-10~~8~~ Appoint committees as necessary.

4-2 The Vice Chair~~man~~ shall assume the duty of the Chair~~man~~ in the Chair~~man~~'s absence or in the Chair~~man~~'s inability to act and consult the Chair on the meeting agendas.

4-3 The Secretary or the Secretary's appointee shall:

4-3-1 Keep a written record of all business transacted by the Commission;

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4-3-2 Notify all members of all meetings;

4-3-3 Keep a file of all official records and reports of the Commission;

4-3-4 Certify all records and reports of the Commission;

4-3-5 Attend to correspondence of the Commission;

4-3-6 Serve notice of all hearings and public hearings;

4-3-7 Keep a set of minutes of all meetings which shall become a public record; and

4-3-8 Prepare and be responsible for publishing of advertisements relating to public hearings.

4-3-9 Ensure all meeting packet materials are submitted to Planning Commission members one week prior to a meeting.

4-3-10 Submit minutes of Planning Commission meetings to the Town Council.

ARTICLE 5 – DUTIES OF THE PLANNING COMMISSION

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Per Va. Code ~~State Code~~§-15.2-2221~~To effectuate this chapter~~, the P~~local p~~lanning C~~c~~ommission shall:

5-1. Exercise general supervision of, and make regulations for, the administration of its affairs;

5-2. Prescribe rules pertaining to its investigations and hearings;

5-3. Supervise its fiscal affairs and responsibilities, under rules and regulations as prescribed by the governing body;

5-4. Keep a complete record of its proceedings; and be responsible for the custody and preservation of its papers and documents;

5-5. Make recommendations and an annual report to the governing body concerning the operation of the commission and the status of planning within its jurisdiction;

5-6. Prepare, publish and distribute reports, ordinances and other material relating to its activities;

5-7. Prepare and submit an annual budget in the manner prescribed by the governing body of the county or municipality; and

5-8. If deemed advisable, establish an advisory committee or committees.

ARTICLE 6 – MEETINGS

6-1 When applications or other Commission business are pending, regular meetings of the Commission shall be held the third Tuesday of each month. Work sessions will be held the fourth Tuesday of each month. As a general practice, regular meetings and work sessions shall not be held on the same night unless approved by the Chair of the Planning Commission prior to public notice requirements.

6-2 When a meeting falls on a legal holiday, the meeting shall be held on the following Tuesday unless otherwise designated by the Chairman or by a vote of the Commission.

6-3 ~~When no application or other business is pending, no meeting will be held. The Commission~~

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~~shall meet at least once a year.~~ The Planning Commission shall adopt its annual meeting schedule at its first meeting of the calendar year and meet at least every two months.

6-4 ~~The meetings shall begin at 7:00 p.m.~~ The Planning Commission shall fix the time for holding regular meetings. The Planning Commission, by resolution adopted at a regular meeting, may also fix the day or days to which any meeting shall be continued if the chair, or vice chair if the chair is unable to act, finds and declares that weather or other conditions are such that it is hazardous for members to attend the meeting. Such finding shall be communicated to the members and press as promptly as possible. All hearings and other matters previously advertised for such meeting shall be conducted at the continued meeting and no further advertisement is required per ~~Virginia State Code~~Va. Code §-15.2-2214. The Planning Commission shall cause a copy of such resolution to be inserted in a newspaper having general circulation in the locality at least seven days prior to the first meeting held pursuant to the adopted schedule.

6-5 A regular meeting may be adjourned if all business cannot be addressed on the meeting date set. The meeting may be reconvened at a later date, as set at the meeting, or properly advertised.

6-6 Special meetings of the commission may be called by the Chair~~man~~ or by two members upon written request to the Secretary. The Secretary shall mail to all members, at least five days in advance of a special meeting, a written notice fixing the time and place of the meeting and the purpose thereof. Written notice of a special meeting is not required if the time of the special meeting has been fixed at a regular meeting, or if all members are present at the special meeting or file a written waiver of notice.

6-7 A member, other than the Chair~~man~~, may introduce a motion. Any member of the Commission may second a motion. Motions shall be restated by the Chair~~man~~ before a vote is taken. The names of persons making and seconding motions shall be recorded.

6-8 Parliamentary procedure in Commission meetings shall be governed by Robert's Rules of Order for Small Boards, Newly R~~r~~evised, as long as applicable by the number of members present.

6-9 A quorum of the Commission shall consist of a majority of the members, and no action of the Commission is valid unless authorized by a majority vote of those present and voting.

6-10 Closed meetings may be called for any purpose permitted by the Virginia Freedom of Information Act.

ARTICLE 7 – ORDER OF BUSINESS REGULAR MEETING

7-1 ~~7-1~~ The order of business for a regular meeting shall be:

~~A.~~ Call to order by the Chair~~man~~ and determination of a quorum;

Commented [DH11]: State Code 15.2-2214

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A.
B. Pledge of Allegiance
C. Adoption of minutes;
D. P~~Hearing of p~~ublic hearing items;
E. Work Session items (if approved by the Chair of the Planning Commission);
~~E.~~F. Other~~New~~ Business;
~~F. 6-6 Worksession items (if approved by the Chair of the Planning Commission);~~
G. Comments from the Commission;
H. Comments from the Staff;
I. Adjournment.

ARTICLE 8 – PROCEDURES FOR HEARING ITEMS

8-1 The order for the public hearing shall be:

8-2 A staff presentation~~ on each item prior to the applicant's comments~~.

8-3 The applicant or his representative should appear at the public hearing and shall be afforded the privilege of making a statement and/or presentation.

8-4 The Chair shall open the public hearing and invite a~~A~~ll interested parties desiring to be heard shall have an opportunity to speak at the public hearing.

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8-5 The applicant or his representative may have the opportunity for rebuttal and answer further questions by the Planning Commission.

8-6 The Chairman shall then close the public hearing and the Planning Commission shall deliberate on the application and make its recommendation to the Town Council. Only input from the staff shall be permitted at this time, however, the Commission may ask specific questions of the applicant or his representative.

8-7 The Chairman may impose time limits for presentations by the applicant and other persons wishing to speak at the public hearing. All information relating to a public hearing must be submitted to staff no later than the time of the public hearing ad deadline. ~~at least eighteen calendar days prior to the public hearing,~~ Any new information submitted after that time will not be considered by the Planning Commission until the next scheduled Regular Public Hearing Meeting, unless waived by the Planning Commission Chair.

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8-8 Written comments from the public are accepted by the Planning Commission per the public notice legal ad for the applicable item under consideration. The Chair will, during the Public Hearing, acknowledge the written comments have been received by the public notice deadline and recorded as part of the proceedings.

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ARTICLE 9 – ORDER OF BUSINESS FOR WORK SESSIONS

9-1 The order of business for work sessions shall be:

A. Call to order by the Chairman
B. Work Session Items
C. Administrative Items
D. Comments from Commission
E. Comments from Staff
~~F.~~ Adjournment
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ARTICLE 10 – SPECIAL RULES

10-1 Planning Commission members shall make every attempt to remain neutral and uncommitted on issues and applications coming before the Commission until said issues and applications have been presented to the Planning Commission and any proponents and opponents have been heard through the established public process.

10-2 Per Va. ~~irginia State~~ Code § 2.2-3700 *et seq*., the Planning Commission is subject to the Virginia Freedom of Information Act (FOIA).

10-3 Per Va. Code ~~Virginia State Code~~ §2.2-3100 *et seq*., the Planning Commission is subject to the Virginia Local Government Conflict of Interest Act ("COIA").

10-4 The Planning Commission shall be subject to any additional rules of conduct as adopted by the Town Council for the Commission, such as Code of Ethics and Electronic Meeting Policies.

10-5 It is understood that Planning Commission meetings are best conducted through the adopted Regular Meeting and Work Session schedule. Meeting held outside the adopted schedule with the public, business interests, or applicants shall be conducted in the following manner:

Commented [DH16]: Following language included in Vienna and Leesburg.

10-5.1 All meetings shall be conducted pursuant the Va. Code §~~Virginia State Code~~ 2.2-3700, *et seq*.

10-5.2 Planning Commissioners shall disclose all meetings by reporting them verbally at the next Planning Commission meeting before any subsequent vote is taken on the subject the meeting was related to in part or in whole. Such disclosures shall include whether the matter is a conflict of interest or a personal interest of the Planning Commissioner pursuant to ~~Virginia State~~Va. Code 2.2-3100, *et seq*.

10-5.3 The purpose of such meetings is limited to fact finding and clarification for all parties.

10-5.4 Planning Commissioners shall not make a commitment of their voting intent in such meeting.

10-5.5 Planning Commissioners are encouraged to contact the Community Development Department staff prior to such meetings to gather facts on the subject matter and to be aware of any potential legal ramifications before speaking to the subject matter. Staff will attend such meeting.

10.5-6 Any information received by an individual Planning Commissioner, whether in person, by telephone, in writing, or by electronic means, that is relevant to the matter before the Planning Commission should be forwarded to the Community Development Department staff for distribution to the entire Planning Commission.

10.5-7

The term "public" in this section does not include persons employed by the Town of Warrenton or elected or appointed to any seat on the Town of Warrenton Town Council or Planning Commission.

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ARTICLE 11~~0~~ – AMENDMENTS

These by-laws may be amended by a majority vote of the entire membership of the Commission at a regularly scheduled meeting, provided notice of intent to amend these by-laws has been given at a prior regularly scheduled meeting by at least two members.

ADOPTED: December 17, 1996
Revised December 16, 1997
Revised December 20, 2013
Revised September 20, 2016
Revised XX, XXXX 2025

TOWN OF WARRENTON, VIRGINIA

PLANNING COMMISSION

BY-LAWS AND PROCEDURES

PURPOSE STATEMENT: The Planning Commission of the Town of Warrenton acts in conformance with Town Council adopted policies and regulations, including the Comprehensive Plan and Zoning Ordinance. As required by Va. Code § 15.2-2210, the Planning Commission serves in an advisory capacity to the Town Council to assist in the promotion of orderly development of the Town and its environs. The Planning Commission is charged with assisting the Town Council with ensuring:

> […] the public health, safety, convenience, and welfare of the Town citizens and to plan for the future development of communities to the end that transportation systems be carefully planned; that new community centers be developed with adequate highway, utility, health, educational, and recreational facilities; that the need for mineral resources and the needs of agriculture, industry, and business be recognized in future growth; that the concerns of military installations be recognized and taken into account in consideration of future development of areas immediately surrounding installations and that where practical, installation commanders shall be consulted on such matters by local officials; that residential areas be provided with healthy surroundings for family life; that agricultural and forestal land be preserved; and that the growth of the community be consonant with the efficient and economical use of public funds.

PREAMBLE - These By-laws and procedures are set forth the rules for the transactions of business by the Planning Commission of the Town of Warrenton which operates under the authority of the laws of Virginia and the ordinances of the Town of Warrenton.

ARTICLE 1 – GENERAL DUTIES

1-1 Per Va. Code §15.2-2210, The Town of Warrenton Town Council established the Planning Commission to facilitate its powers and duties under Title 15.2, Chapter 22, Article 2, Code of Virginia. The Planning Commission has the authority through Virginia State Code and the Town of Warrenton Town Code important duties and responsibilities related to land use, including but not limited to, through a motion to recommend to Town Council:

- Comprehensive Plan
- Rezoning Map Amendments
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- Comprehensive Permit “2232 Review”
- Special Use Permits
- Capital Improvement Plan Conformance with the Comprehensive Plan when a new

public land use project is proposed or if the Comprehensive Plan has been updated and adopted.

ARTICLE 2 – MEMBERS

2-1 The Warrenton Planning Commission are appointed by the Town of Warrenton Town Council per Virginia State Code and Town of Warrenton Town Code, Chapter 2, Article V. The Town Council may require each member of the Commission to take an oath of office. One member of the Town Council may be appointed as a member of the Planning Commission and one member may be a member of the administrative branch of the Town.

2-2 Members may be removed for malfeasance in office. Notwithstanding the foregoing provision, a member of the Planning Commission may be removed by the Town Council without limitation in the event that the Commission member is absent from any three consecutive meetings of the Commission or is absent from any four meetings of the Commission within a 12 month period. In either event, a successor shall be appointed by the Town Council for the unexpired portion of the term of the member that has been removed.

2-3 The Planning Commission shall inform the Town Council when a member's term is expiring to allow time for the Town Council to advertise a new Planning Commission term appointment. Seated Planning Commission members may choose to reapply for a new term but reappointment is not assumed without Town Council action.

2-4 The Commission members are strongly encouraged to attend training sessions sponsored by the Commonwealth of Virginia, professional planning and allied professional organizations, or other planning agencies, in order to more effectively carry out their responsibilities to meet the objectives of the Planning Commission.

ARTICLE 3 – OFFICERS

3-1 Per Va. Code §15.2-2217, the Planning Commission shall elect from the appointed members a Chair and a Vice Chair, whose terms shall be for one year. Officers may serve more than one term; however, the Planning Commission should strive to periodically rotate or select a new Chair to accommodate normal turnover and perpetual nature of the Commission. The Commission shall elect or appoint a Secretary who need not be a member of the Commission.

3-2 Nomination of officers shall be made from the floor of the regular meeting held at the first meeting of the calendar year.

3-2-1 Each candidate for office shall be nominated by and seconded by one member of the Commission.

3-3-2 A candidate for an office of the Commission receiving a majority vote of the members shall be declared elected and shall take office immediately and serve for one year or until a successor takes office.

3-3 The Town clerk or staff will call the first meeting of the calendar year to order and accept the nomination for Chair. Once a Chair is duly elected as prescribed above, the Chair will immediately preside over the meeting.

ARTICLE 4 – DUTIES OF OFFICERS

4-1 The Chair shall:

4-1-1 Act as the liaison between the Planning Commission and Town Council based on the actions of the Planning Commission body as a whole.

4-1.2 Set the meeting agendas in consultation with the Vice Chair and Community Development staff.

4-1.3 Preside at all meetings and call the meetings to order at the appointed time;

4-1-4 Announce the business in its proper order;

4-1-5 Preserve order and decorum;

4-1-6 State and put all questions properly brought before the Commission;

4-1-7 Rule on all procedural questions. Such rulings may be reversed by a majority vote of the members present.

4-1-8 Be informed immediately of any official communication and report the same at the next regular meeting;

4-1-9 Affix his/her signature to all correspondence issued by the commission and all official minutes; and

4-1-10 Appoint committees as necessary.

4-2 The Vice Chair shall assume the duty of the Chair in the Chair's absence or in the Chair's inability to act and consult the Chair on the meeting agendas.

4-3 The Secretary or the Secretary's appointee shall:

4-3-1 Keep a written record of all business transacted by the Commission;

4-3-2 Notify all members of all meetings;

4-3-3 Keep a file of all official records and reports of the Commission;

4-3-4 Certify all records and reports of the Commission;

4-3-5 Attend to correspondence of the Commission;

4-3-6 Serve notice of all hearings and public hearings;

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4-3-8 Prepare and be responsible for publishing of advertisements relating to public hearings.

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4-3-10 Submit minutes of Planning Commission meetings to the Town Council.

ARTICLE 5 – DUTIES OF THE PLANNING COMMISSION

Per Va. Code §15.2-2221, the Planning Commission shall:

5-1. Exercise general supervision of, and make regulations for, the administration of its affairs;

5-2. Prescribe rules pertaining to its investigations and hearings;

5-3. Supervise its fiscal affairs and responsibilities, under rules and regulations as prescribed by the governing body;

5-4. Keep a complete record of its proceedings; and be responsible for the custody and preservation of its papers and documents;

5-5. Make recommendations and an annual report to the governing body concerning the operation of the commission and the status of planning within its jurisdiction;

5-6. Prepare, publish and distribute reports, ordinances and other material relating to its activities;

5-7. Prepare and submit an annual budget in the manner prescribed by the governing body of the county or municipality; and

5-8. If deemed advisable, establish an advisory committee or committees.

ARTICLE 6 – MEETINGS

6-1 When applications or other Commission business are pending, regular meetings of the Commission shall be held the third Tuesday of each month. Work sessions will be held the fourth Tuesday of each month. As a general practice, regular meetings and work sessions shall not be held on the same night unless approved by the Chair of the Planning Commission prior to public notice requirements.

6-2 When a meeting falls on a legal holiday, the meeting shall be held on the following Tuesday unless otherwise designated by the Chairman or by a vote of the Commission.

6-3 The Planning Commission shall adopt its annual meeting schedule at its first meeting of the calendar year and meet at least every two months.

6-4 The Planning Commission shall fix the time for holding regular meetings. The Planning Commission, by resolution adopted at a regular meeting, may also fix the day or days to which any meeting shall be continued if the chair, or vice chair if the chair is unable to act, finds and declares that weather or other conditions are such that it is hazardous for members to attend the meeting. Such finding shall be communicated to the members and press as promptly as possible. All hearings and other matters previously advertised for such meeting shall be conducted at the continued meeting and no further advertisement is required per Va. Code §15.2-2214. The Planning Commission shall cause a copy of such resolution to be inserted in a newspaper having general circulation in the locality at least seven days prior to the first meeting held pursuant to the adopted schedule.

6-5 A regular meeting may be adjourned if all business cannot be addressed on the meeting date set. The meeting may be reconvened at a later date, as set at the meeting, or properly advertised.

6-6 Special meetings of the commission may be called by the Chair or by two members upon written request to the Secretary. The Secretary shall mail to all members, at least five days in advance of a special meeting, a written notice fixing the time and place of the meeting and the purpose thereof. Written notice of a special meeting is not required if the time of the special meeting has been fixed at a regular meeting, or if all members are present at the special meeting or file a written waiver of notice.

6-7 A member, other than the Chair, may introduce a motion. Any member of the Commission may second a motion. Motions shall be restated by the Chair before a vote is taken. The names of persons making and seconding motions shall be recorded.

6-8 Parliamentary procedure in Commission meetings shall be governed by Robert's Rules of Order for Small Boards, Newly Revised, as long as applicable by the number of members present.

6-9 A quorum of the Commission shall consist of a majority of the members, and no action of the Commission is valid unless authorized by a majority vote of those present and voting.

6-10 Closed meetings may be called for any purpose permitted by the Virginia Freedom of Information Act.

ARTICLE 7 – ORDER OF BUSINESS REGULAR MEETING

7-1 The order of business for a regular meeting shall be:

A. Call to order by the Chair and determination of a quorum;
B. Pledge of Allegiance
C. Adoption of minutes;
D. Public hearing items;
E. Work Session items (if approved by the Chair of the Planning Commission);
F. Other Business;
G. Comments from the Commission;
H. Comments from the Staff;
I. Adjournment.

ARTICLE 8 – PROCEDURES FOR HEARING ITEMS

8-1 The order for the public hearing shall be:

8-2 A staff presentation.

8-3 The applicant or his representative should appear at the public hearing and shall be afforded the privilege of making a statement and/or presentation.

8-4 The Chair shall open the public hearing and invite all interested parties desiring to be heard shall have an opportunity to speak at the public hearing.

8-5 The applicant or his representative may have the opportunity for rebuttal and answer further questions by the Planning Commission.

8-6 The Chairman shall then close the public hearing and the Planning Commission shall deliberate on the application and make its recommendation to the Town Council. Only input from the staff shall be permitted at this time, however, the Commission may ask specific questions of the applicant or his representative.

8-7 The Chairman may impose time limits for presentations by the applicant and other persons wishing to speak at the public hearing. All information relating to a public hearing must be submitted to staff no later than the time of the public hearing ad deadline. Any new information submitted after that time will not be considered by the Planning Commission until the next scheduled Regular Public Hearing Meeting, unless waived by the Planning Commission Chair.

8-8 Written comments from the public are accepted by the Planning Commission per the public notice legal ad for the applicable item under consideration. The Chair will, during the Public Hearing, acknowledge the written comments have been received by the public notice deadline and recorded as part of the proceedings.

ARTICLE 9 – ORDER OF BUSINESS FOR WORK SESSIONS

9-1 The order of business for work sessions shall be:

A. Call to order by the Chairman
B. Work Session Items
C. Administrative Items
D. Comments from Commission
E. Comments from Staff
F. Adjournment

ARTICLE 10 – SPECIAL RULES

10-1 Planning Commission members shall make every attempt to remain neutral and uncommitted on issues and applications coming before the Commission until said issues and applications have been presented to the Planning Commission and any proponents and opponents have been heard through the established public process.

10-2 Per Va. Code § 2.2-3700 *et seq*., the Planning Commission is subject to the Virginia Freedom of Information Act (FOIA).

10-3 Per Va. Code §2.2-3100 *et seq*., the Planning Commission is subject to the Virginia Local Government Conflict of Interest Act ("COIA").

10-4 The Planning Commission shall be subject to any additional rules of conduct as adopted by the Town Council for the Commission, such as Code of Ethics and Electronic Meeting Policies.

10-5 It is understood that Planning Commission meetings are best conducted through the adopted Regular Meeting and Work Session schedule. Meeting held outside the adopted schedule with the public, business interests, or applicants shall be conducted in the following manner:

10-5.1 All meetings shall be conducted pursuant the Va. Code § 2.2-3700, *et seq*.

10-5.2 Planning Commissioners shall disclose all meetings by reporting them verbally at the next Planning Commission meeting before any subsequent vote is taken on the subject the meeting was related to in part or in whole. Such disclosures shall include whether the matter is a conflict of interest or a personal interest of the Planning Commissioner pursuant to Va. Code 2.2-3100, *et seq*.

10-5.3 The purpose of such meetings is limited to fact finding and clarification for all parties.

10-5.4 Planning Commissioners shall not make a commitment of their voting intent in such meeting.

10-5.5 Planning Commissioners are encouraged to contact the Community Development Department staff prior to such meetings to gather facts on the subject matter and to be aware of any potential legal ramifications before speaking to the subject matter. Staff will attend such meeting.

10.5-6 Any information received by an individual Planning Commissioner, whether in person, by telephone, in writing, or by electronic means, that is relevant to the matter before the Planning Commission should be forwarded to the

Community Development Department staff for distribution to the entire Planning Commission.

10.5-7 The term “public” in this section does not include persons employed by the Town of Warrenton or elected or appointed to any seat on the Town of Warrenton Town Council or Planning Commission.

ARTICLE 11 – AMENDMENTS

These by-laws may be amended by a majority vote of the entire membership of the Commission at a regularly scheduled meeting, provided notice of intent to amend these by-laws has been given at a prior regularly scheduled meeting by at least two members.

ADOPTED: December 17, 1996
Revised December 16, 1997
Revised December 20, 2013
Revised September 20, 2016
Revised May 20, 2025