

**Virginia State Corporation Commission
eFiling CASE Document Cover Sheet**

Case Number (if already assigned)	PUR-2025-00056
Case Name (if known)	Application of Virginia Electric and Power Company for Approval and Certification of Electric Transmission Facilities: 500 kV and 230 kV Golden-Mars Lines, Lockridge 230 kV Loop, Sojourner 230 kV Loop, and Related Projects
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CASE NO. PUR-2025-00056
SUMMARY OF TESTIMONY
Of Theresa Ghiorzi

Theresa Ghiorzi as a resident of Loudoun County and owner of private property within Loudoun County, has an interest in the residential electric rates and reliability of service within the PJM Region as well as the expansion of the grid across North Western Loudoun County to service data center load.

1 Q. What is your name?

2 A. Theresa Ann Ghiorzi

3 Q. Where do you live and what is your property interest in this case?

4 A. I am a resident of Loudoun County and live outside of Lovettsville, Virginia. My property is
5 part of a family subdivision consisting of five family lots with three family homes and an
6 adjoining lot owned by my Aunt. Our properties are likely to be impacted by future
7 applications for 500kv and 765kV lines proposed to import power from West Virginia for
8 these data centers. Neither my property nor those of my family are directly impacted by the
9 project specified in (PUR-2024-00056) .

10 Q. What concerns you about the case (PUR-2024-00056)?

11 A. I am a resident of Loudoun County and I have concerns with the residential electric rates and
12 reliability of service within Virginia. Particularly, with regard to the massive infrastructure
13 cost to support the data center industry and the reliance on electricity imports to satisfy the
14 electric loads. I am also becoming increasingly concerned about the effects these massive
15 HVAC infrastructure projects will have on the environment, the quality of life and the health
16 of the people that live near them. It is also becoming increasing clear the extent to which
17 private property rights are being pushed aside in order to accommodate the business wants of
18 a single class of private for profit businesses. Similarly, the financial cost in the form of

19 property takings and property devaluation is made subservient to the wants of the companies
20 that stand to make billions to trillions of dollars.

21 Q. Have you reached a position on the project described in case (PUR-2024-00056)?

22 A. Yes. These transmission lines are for the data centers in this area and are premised on the
23 business plans of those businesses - increasing the capacity of their computers, adding new
24 building to existing sites and building new campuses. These are the same businesses that
25 already have adequate service and existing campuses. This is an expansion of those
26 private businesses, are private enterprises not public ones, as a point of fact these businesses
27 serve exponentially more national and international customers than then they do the local
28 public. The public in eastern Loudoun does not need 500kV lines on 185' poles. These lines
29 are not a win /win situation. They come at a cost predominately paid by captive rate
30 payers and a discrete set of residential home owners who stand to lose equity in their
31 homes, their quality of life and the enjoyment of the environment that they have built
32 and further do not want to the risk to their health the EMFs pose. These lines serve no
33 benefit to the public. This proposal does not mitigate impacts to residents and does not
34 provide any balance between private business property owners and residential property
35 owners. One group alone stands to gain exponentially and the other stands to lose
36 exponentially. Neither the rate payers nor the residential property owners, nor the citizens
37 that live in the area should be forced to bear the burden of expansion plans of private
38 industries.

39 With regard to property rights, eminent domain is a taking - it says so in the statute, it is
40 not a "gift" of an easement nor are easement takings "collateral impacts of data center

41 expansion" as described by Loudoun County in their October 14, 2025 News Release:

42 Support of Undergrounding the Mars to Golden Transmission Line. (Exhibit D)

43 The code of Virginia section § 1-219.1. Limitations on eminent domain section D:

"Except where property is taken (i) for the creation or functioning of a public service corporation, public service company, or railroad; (ii) for the provision of any authorized utility service by a government utility corporation; or (iii) for sanitary sewer, water or stormwater facilities, or transportation facilities, including highways, roads, streets, and bridges, traffic signals, related easements and rights-of-way, mass transit, ports, and any components of federal, state, or local transportation facilities, by

a public corporation, property can only be taken where: (a) the public interest dominates the private gain and (b) the primary purpose is not private financial gain, private benefit, an increase in tax base or tax revenues, an increase in employment, or economic development." [Emphasis added]

44 No one wants to host a 185' transmission pole with a 500kv line on their property. Electric

45 utility easements come with a significant curtailment of the by right uses of property that

46 has been invested in. Dominion's guidelines for use of real estate encumbered by transmission

47 line easements includes prohibitions on buildings, building extensions, building additions, or

48 any portion of a building, homes, offices, garages, barns, sheds, roof overhangs, gutters,

49 balconies, decks, porches, and covered patios; playground equipment; dumpsters and trash

50 receptacles; debris, scrap or waste materials, fill, spoil material, stumps, large boulders,

51 concrete debris, asphalt debris, and construction debris; building materials; swimming pools,

52 wells, septic tanks, drain fields (to include engineered systems), fuel tanks, and propane tanks;

53 HVAC units; satellite dishes and television antennas. On top of the prohibitions, the property

54 owner must apply to Dominion to get permission for construction activity on the easement -

55 for anything not already expressly prohibited (Exhibit C). Mind you the property owner is still

56 responsible for paying property taxes on the entire property as if they were able to use the

57 property to the full extent of its uses per the zoning ordinance applicable to the property.
 58 Private property owner has to justify or explain why they want to retain the full use of the
 59 property they bought, improved and are in possession of as well as retaining its full intrinsic
 60 value. It is not a small thing to have that inherent value and property right taken away, for
 61 many, the family home is the single largest investment of their lifetime and has been procured
 62 through hard work and sacrifice. Even our elected officials acknowledge this fact, during the
 63 March 18, 2025 Loudoun County Board Of Supervisors Meeting and Public Hearing on "By-
 64 Right" data center development & grandfathering Supervisor Randall stated:

"I'm not going to value a data center over a person's home" A person's home is their home. By percentage, they probably spent just as much , if not more of their income -- percentage of their income on their home as a data center company does on any particular building to have going in a place . Not to mention, if you're my house , my home , to a large degree is my retirement. People are living in their retirement. We should not do anything to that possibly lowers the cost of the value of the home. ... speaking of property rights I'm not going to do anything that devalues a person's home value." (Exhibit E, Page 7)

65 The problem we have in Loudoun County is the actions of our elected leaders do not
 66 comport to their public rhetoric. This was painfully evident in the March 18, 2025 Loudoun
 67 County Board Of Supervisors Meeting and Public Hearing on "By-Right" data center
 68 development & grandfathering. As Supervisor Kershner so elegantly put it in his soliloquy
 on
 69 the property rights of data center developers :

"Quite frankly I am shocked that we even are discussing this motion [*to not grandfather 22 Administrative applications for "by rights" data centers*] it is quite frankly a complete property rights an attempt at a complete property rights snatch, what we are basically saying is we are going to come in at the end of the process after you, as a developer have come in, then everything we asked you to do, met with staff and you spent somewhere between, in some cases, over \$1 million to go through the whole process to get approval. all the engineering has to take place, you sunk all this money and now we are going to say sorry you can't have any grandfathering. You want to talk about a massive chilling effect that would have on every single industry.

The fact Loudoun County went into this. They wouldn't want to come to Loudoun County anymore. I understand alot of my colleagues are trying to split the baby here. I appreciate the thoughtful process. This motion is the most egregious of all the motions we are going to look at tonight. **Can you imagine as a property owner you buy a piece of property you have the right to build a home. Its your dream home. You go through the process, spend all the money at the county, hire engineers get the permits to drill the well. You sunk all these dollars and all of a sudden the county comes along and says sorry you can't build your house.** That is exactly what this motion is doing to the industry. And mind you this is the industry that has allowed us to cut the tax rate to \$3.09 personal property tax car tax. Thats exactly what this motion does its egregious quite frankly its anti-American to do what we are doing quite frankly here because we are built on property rights, yeah I'll say it, it largely is now I understand ... but this motion saying sorry you've spent all this money go away that is just egregious and I cannot support this!" **[Emphasis Added]** (Exhibit E, Page 10 and 11)

70 Ironically, Supervisor Kershner's example in support of data center property rights is exactly
 71 what residents in this area are facing in regard to their property rights and their dream homes.
 72 Not coincidently, Supervisor Mike Turner, in his "*Loudoun County, Virginia: Data Center*
 73 *Capital of the World "A Strategy for a Changing Paradigm"* acknowledges three key stakeholder
 74 groups : Data Centers, Core Utilities and Local Elected Officials Representing the
 75 Community. Conspicuously, absent from the stakeholder list are private property owners.
 76 Equally enlightening is the sole discussion on "By Right" property uses pertain to data center
 77 property , there is no mention of private property owners having the same right to develop
 78 their property unencumbered by infrastructure necessitated by data centers. (Exhibit H,
 Pages
 79 7, 8 and 9). Private property owners and residents have no voice in the economic policies
 80 that continue to encourage data center development. During the March 18, 2025 Loudoun
 81 County Board of Supervisors meeting , with the grandfathering, property owners and
 82 residents were stripped of the ability to comment on and to protest the build out of the
 83 remaining data centers. Loudoun County officials have steadfastly refused to provide

84 detailed numbers as to how many of those applications will no longer be subject to public
 85 hearings. Additionally, our Supervisors added a provision to allow all re-zoning applications
 86 between 1979 - 1993 to add "data center" as a use if they had not already done so - and
 87 grandfathered those as well. While they were at it they retained the footnote that allows minor
 88 changes to an approved site plan of administrative applications without definition or
 89 limitation of what minor is. Allowing further expansion of existing data center campuses.
 90 As Supervisor Tekrony voiced in her concerns :

"An Administrative data center with up to 1M square feet can expand 5% or 50,000 sq feet without coming to the board or having a public hearing . To put this in perspective a football field is @ 57, 000 sq feet. It would include an increase of data centers by 25%, the addition of accessory structure , realignment of principle buildings and parking areas within an approved ...My concern is permitting the expansion of administrative or "by Right" data centers that have not been reviewed by the board or the public." (Exhibit E, Page 6)

91 No one has been successful in getting an exact number of how many properties and what
 92 acreage this unnecessary grandfathering generosity was applied to.

93 Per Supervisor Turner's aforementioned white paper:

"As of this writing, Loudoun County, Virginia—and more precisely, eastern Loudoun County comprising approximately 30 square miles—is home to about 200 data centers. A recent independent analysis by consultant Kimley-Horn indicates there are another 117 data centers in Loudoun County's development pipeline, with **presumably** many of them "by right," not requiring approval by the Loudoun County Board of Supervisors." [Emphasis added]

"Regarding actual data center construction growth, in 2020 we had about 21.5 million sq. ft. of permitted data centers in the county. In 2025, we have about 47 million sq. ft. of data centers permitted.⁷ That's a 119% increase in five years. Moreover, we have at least an additional 40 million sq. ft. in the pipeline (application being reviewed or site plan submitted)."

94 The data centers are private use for private gain - a massive the private gain dominates any
 95 public interest. The tax revenues the data centers bring into Loudoun County are roughly.

96 33% of the county budget at this point. Data centers are part of both Virginia's economic
97 plan and Loudoun County's economic plan. As the recent JLARC study showed,
98 construction revenue is the main source of income. Once the data centers are built revenue
99 from the drops precipitously. Loudoun's budget dependency is leading it to continue to
100 approve data centers to support its budget.

101 Rather than develop guiderails to prohibit the data center developers from destroying the
102 quality of life as well as the property of its residents by enacting legally enforceable data
103 center zoning ordinances, that restrict electricity demand of the data centers, such as was
104 done in York County, Virginia, Loudoun doubles down, literally, in its data center
105 expansion. Instead of protecting property rights of all its citizens. Loudoun County is
106 persisting in pursuing a Comprehensive Plan Amendment to define Transmission
107 Corridors across private property to feed energy to its out of control data center industry.

108 Loudoun County's Comprehensive Plan Amendment on Electrical Infrastructure is available
here:
https://loudoun.granicus.com/MetaViewer.php?view_id=89&clip_id=7836&meta_id=254972

109 While Loudoun County elected officials persist in their delusion that private property can be allocated
110 at will to support electrical infrastructure for data center expansion York County has taken significant
111 steps to protect private property rights and the quality of life for its residents.

112 The Data Center ordinance for York County contains provisions for electric use as a condition of
113 approval of the application as well as requiring the facility to report water and electric use every 5
114 years and constrains the electricity growth to the same amount of electricity as was approved
in the
115 initial application. (Exhibit F)

116 Loudoun County continues to approve additional re- zoning applications for data centers, the

117 latest being in July of 2025 :

As reported by Loudoun Now, (Available at:

https://www.loudounnow.com/news/supervisors-narrowly-approve-data-center-near-leesburg/article_3e355c29-4dbc-42df-bdb9-37d86f3013ad.html) :

"The rezoning application was submitted by JK Land Holdings and would permit up to 556,746 square feet of data center space on a 22-acre tract along Crosstrail Boulevard and Sycolin Road. It would also alternatively permit up to 416,000 square feet of warehouse or distribution uses, or up to 218,000 square feet of industrial uses. The request would rezone the property from Joint Land Management Area to Planned Development - Industrial Park."

118 As further reported in that same article by Loudoun Now:

"Randall reminded supervisors that they are not allowed to take power demand or constraints into consideration when making land use decisions, but said she is working to change that.

"I put legislation in to ask the General Assembly, 'Can we consider power?' But right now, we can't consider power," she said."

119 Loudoun County elected officials continue to insist they need General Assembly action to do
120 what York County, Virginia has already done.

121 Unfortunately, in my opinion, Loudoun County has devolved to a point where encouraging,
122 accommodating and feeding the energy needs of its industrial base, which currently consists
123 of data centers, has co-opted not only the property rights but the quality of life and enjoyment
124 of the environment in which people live.

125 It is not right to take the property rights of one set of property owners so that a different set of
126 private property owners can achieve their own development and economic aspirations. Not
127 only is it not right - it is a limitation on eminent domain.

128 The environmental concerns, quality of life and health concerns are all interrelated. The
129 structures proposed are an eyesore and a blight on visual environment in which people live
130 and work. There are no electrical infrastructure poles of any type in Loudoun County of
131 height 185'. (Exhibit A) For context , the Statue of Liberty is 151' height and 17 story

132 building is 178.5' high. (Exhibit B) The closes electrical structure of this height is on 500kV
133 Line #582 in Surry, Virginia adjacent to the Company's Surry Substation. All of the
134 electrical infrastructure in the area do not exceed 110' in height. On top of the visual blight
135 Residents , especially parents have real and substantive concerns or their health, particularly
136 for their children due to the electromagnetic fields emanating from these structures.
137 An environment such as will be created by these lines cannot be described as one where
138 residents feel safe in their homes and inspired by their surroundings.
139 Loudoun County's "economic policy" stands to destroy not only the quality of life and
140 financial security inherent in the property value of its own citizens, for some it will destroy
141 the investment of a lifetime of and the place they have called home.
142 As a point of fact, the effect of Loudoun County's "economic policy" per its eastern Loudoun data
143 center expansion, is now reverberating across thousands of private property owners in four states,
144 who are now facing multiple 500kV and 765kV transmission lines to support the energy
145 wants of Loudoun County's unconstrained data center businesses.

147 Q: Do you have any other comments on the project?

148 A: Yes. A solution that provides balance between high load customers and private
149 residential property owners would be one that provides service without sacrificing one
150 group to the benefit of the other. All property owners must be treated equally minimizing
151 the "collateral impact" is not equal. The only solution that treats property owners equally
152 and resolves the health and environment concerns of residents is underground High-Voltage
153 Direct Current (HVDC) on existing right-of-ways. Underground HVDC treats all property
154 owners equally, no property owners are forced to sacrifice the use of their property for the

155 benefit of the plans some other property owner has for their property. Additionally, with
156 underground HVDC there is no property devaluation at all - view sheds are preserved along
157 with the enjoyment that comes from living in an environment unencumbered with massive
158 electrical infrastructure. HVDC lines do not produce EMFs so there are no health concerns.
159 HVDC cables can be buried in a trench 5 feet wide by 5 feet deep, a significantly smaller
160 environmental impact than either overhead or underground HVAC lines. For years we have
161 been told the cost is prohibitive. It's not, especially not when you account for the
162 socio-economic costs of overhead transmission lines. This was proven in the "*NextGen*
163 *Highways Feasibility study for the Minnesota Department of Transportation Buried High-*
164 *Voltage Direct Current Transmission*" Available here:

165 <https://nextgenhighways.org/wp-content/uploads/2024/02/NexGen-Highways-Analysis-Report-2.1.24.pdf>)

166 The most expensive part of an HVDC proposal is the converter substations and those have
167 decreased in cost significantly. At this time, a converter substation is only 3.4 times as
168 expensive as an HVAC substation. (Exhibit I). Further, the customer class requiring the
169 infrastructure build out is comprised of multiple, multi-national trillion dollar private
170 business many of which are building co-located generation in other states or refurbishing
171 nuclear reactors. These companies can likewise afford to cover the cost of underground
172 HVDC to serve their businesses in Northern Virginia. More importantly, in the current PJM
173 RTEP 2025 Window 1 Dominion has proposed a portfolio of solutions predicated on an
174 underground HVDC backbone originating in southern Virginia that terminates at the Mosby
175 Substation in Loudoun County. (Exhibit I) I would urge the commission to request
176 Dominion provide an alternative HVDC underground solution for the 500kV portion of this
177 project along existing easements so that the cost-benefit can be compared to the HVAC
178 alternatives.

179 Q: Do you have a recommendation for the commission ?

180 A: Yes, deny these lines. Send Dominion back to the drawing board to provide a system design
181 that serves the needs both its high load customers and the residential communities through
182 which these lines pass. The only impact denial of the lines will have will be a delay to the
183 expansion plans of the data center businesses in eastern Loudoun. These business chose to
184 take advantage of the both the state and county tax breaks and Loudoun's the "by right"
185 zoning. Every one of these business choose to build in an area with no local generation.
186 Dominion has an obligation to serve. Dominion can delay, but not deny, service to
187 customers when the addition of customer load cannot be supported. None of these high load
188 customers should have the expectation that their load requests will be accommodated to meet
189 dates specified in their rapidly changing business plans. Every one of these businesses each
190 has the option to build on-site generation, with the exception of one none have. Every one of
191 these companies have other campuses under development and energy requests in other areas
192 and they can shift their business plans to accommodate a delay. Every one of these business
193 has the option to build elsewhere and do have campuses expanding else ware. The private
194 property owners and residents have no such options. The cost can be negotiated by
195 Dominion with the high load customers that require additional service.

CERTIFICATE OF SERVICE

I hereby certify that on this 21st day of October 2025, a copy of the foregoing was served to, pursuant to Ordering Paragraph (6) of the Order for Notice and Hearing, to:

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Dated this 21st day of October, 2025,
 /S/ Theresa Ghiorzi, *pro se*

Virginia Electric and Power Company
Case No. PUR-2025-00056
Theresa Ghiorzi
Third Set

The following response to Question No. 1 of the Third Set of Interrogatories and Requests for Production of Documents propounded by Theresa Ghiorzi received on October 9, 2025, was prepared by or under the supervision of:

Trey M. Rydel
Supervisor Electric Transmission Engineering
Dominion Energy Virginia

As it pertains to legal matters, the following response to Question No. 1 of the Third Set of Interrogatories and Requests for Production of Documents propounded by Theresa Ghiorzi received on October 9, 2025, was prepared by or under the supervision of:

David J. DePippo
Managing Counsel
Dominion Energy Services, Inc.

Question No. 1

Please provide the location of any existing electrical structure with a height of 185' in Loudoun County.

Response:

The Company objects to this request because the term “electrical structure” is vague and undefined. Notwithstanding and subject to the objection, the Company responds to this request noting that the Company understands “electrical structure” in the context of this request to mean transmission structure. Based on a review of the Company’s GIS database, it determined there is not an existing transmission structure with a height of 185’ in Loudoun County. See also the Company’s response to Ghiorzi Set 02-02.

Virginia Electric and Power Company
Case No. PUR-2025-00056
Theresa Ghiorzi
Third Set

The following response to Question No. 2 of the Third Set of Interrogatories and Requests for Production of Documents propounded by Theresa Ghiorzi received on October 9, 2025, was prepared by or under the supervision of:

Trey M. Rydel
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As it pertains to legal matters, the following response to Question No. 2 of the Third Set of Interrogatories and Requests for Production of Documents propounded by Theresa Ghiorzi received on October 9, 2025, was prepared by or under the supervision of:

David J. DePippo
Managing Counsel
Dominion Energy Services, Inc.

Question No. 2

If there are no electrical structures with a height of 185' in Loudoun County, please identify the nearest location in Virginia of an existing electrical structure with a height of 185'.

Response:

The Company objects to this request because the term “electrical structure” is vague and undefined. Notwithstanding and subject to the objection, the Company responds to this request noting that the Company understands “electrical structure” in the context of this request to mean transmission structure. Based on a review of the Company’s GIS database, the nearest location of a 185’ transmission structure to Loudoun County is on 500 kV Line #582 in Surry, Virginia, adjacent to the Company’s Surry Substation.

Exhibit B

Visual Comparisons of structures of 185' in height as is proposed for this project



Figure 1: Visual comparison of a 185' transmission pole to the statue of liberty and a 2-story home



Figure 2: The height of a 17 story building is

**DOMINION ENERGY VIRGINIA/DOMINION ENERGY NORTH CAROLINA
GUIDELINES FOR USE OF REAL ESTATE ENCUMBERED
BY ELECTRIC TRANSMISSION RIGHTS OF WAY**

Revised March 19, 2020

The purpose of these Guidelines is to inform property owners and developers about the “do’s and don’ts” in and around electric transmission easements. Easements (also called rights of way) allow power companies to use another property owner’s property to construct, operate, and maintain electric power facilities. Easements are generally created by agreements or condemnation orders, which are recorded in the chain of title to the real estate affected by the easements. These documents also usually provide the easement owner with additional rights to access the primary easement and to cut danger trees that are located outside of the right of way.

Landowners generally can continue to use their property in the right of way if the use is compatible with the purpose of the easement. Incompatible uses in the right of way constitute encroachments. An encroachment can be either an improvement on, or incompatible use of, the right of way.

Most easements do not expire and are perpetual in duration. As such, when property is sold and conveyed to another, the easements remain in effect and are binding on the new owner. Each easement agreement or condemnation order provides its own specific terms and conditions. These documents must be reviewed carefully to determine the exact rights and obligations of the landowner and easement holder.

These Guidelines are intended to provide general guidance to landowners for what may or may not be allowed in electric transmission rights of way. These Guidelines are advisory only and do not constitute policies or procedures with respect to right of way matters. These Guidelines do not expand, restrict or otherwise modify either (i) the terms and conditions of recorded easement documents or (ii) the respective rights of Dominion Energy Virginia/Dominion Energy North Carolina or the landowner. As Guidelines, this document provides general information only. Each specific electric transmission easement activity must be evaluated on a case-by-case basis, taking into account, among other things, the terms and conditions of the documents creating the easement, the unique characteristics of the real estate encumbered by the easement, the type of facilities installed on the easement, the future need to install additional facilities on the easement given the ever-changing demand for electricity, certain legal requirements, and other factors that may not be set forth in these Guidelines. Finally, these Guidelines are subject to change without advance notice.

Definitions

For the purposes of these Guidelines, the terms below have the following meanings:

Company – Virginia Electric and Power Company which does business in Virginia as Dominion Energy Virginia and does business in North Carolina as Dominion Energy North Carolina.

Consent Agreement – a written agreement by and between the Company and a landowner or other party that sets forth the Company's permission for an Encroachment to be placed or remain on an Easement. In most circumstances, the Consent Agreement is the equivalent of a license that is revocable by the Company. In most circumstances, the Consent Agreement is nontransferable.

Distribution Lines – lower voltage power lines that conduct electricity from a substation to a Company customer.

Easement – a landowner grants certain rights to use property to another person or entity through an Easement. An Easement is a legal interest in real property that grants the right to use in some specified manner the property of another. Easements are also sometimes referred to as rights of way.

Encroachment – an activity or improvement on the Easement that constitutes a violation of the Easement agreement, condemnation order, or other document creating the Easement. In the case of a prescriptive easement, an "Encroachment" is an activity or improvement on the Easement that interferes with the Easement holder's right to use the Easement.

Facilities – any and all equipment and improvements installed by the Company on an Easement including, by way of example and not limitation, lines, poles, structures, guys, anchors, and counterpoise.

Primary Easement – the Primary Easement for most Company rights of way is the actual designated area of real estate on which Facilities can be constructed (for example, a 150-foot Right of Way).

Requestor – a person or entity requesting a Consent Agreement from the Company.

Right of Way – the term "Right of Way" as used in these Guidelines is interchangeable with the term "Easement."

Secondary Easement – an Easement needed to accomplish the intended purpose of the Primary Easement. With regard to electric transmission rights of way, two important Secondary Easements are (a) the right of general access to and over the landowner's land to access the Primary Easement and (b) the right to cut danger trees outside the Primary Easement. Note that these Secondary Easements are not generally limited to a certain designated area on the landowners' property. Instead, the Secondary Easements are undesignated areas.

Transmission Lines – higher voltage power lines that transmit electricity from a power plant that produces or generates electricity to a substation and power lines that transmit electricity between substations. In some limited circumstances, a transmission line may transmit electricity between a substation and an end-user.

Transmission Easement – an Easement where Transmission Lines are constructed or may be constructed in the future. Note that a Transmission Easement may also include Distribution Lines.

Application to Electric Transmission Rights of Way Only

These Guidelines only apply to electric Transmission Easements. For questions regarding Easements pertaining to Distribution Lines, please contact the Supervisor of Electric Distribution Right of Way, 600 Canal Place, Richmond, Virginia 23219.

Purpose of Electric Transmission Rights of Way

The Company acquires electric transmission Rights of Way to transmit electricity from its power stations to its substations, to transmit electricity between substations, and to transmit electricity from its substations to some of its larger customers. Electric transmission Rights of Way, when connected together, become part of the national electric transmission network. In monitoring activity on its Rights of Way, the Company must consider its current needs to supply its customers with electricity. In addition, the Company must consider its customers' future needs, which may require additional Facilities be constructed within the Rights of Way. Consideration must be made for requirements 50 to 100 years in the future and beyond.

The Company is tasked with the obligation of providing safe and reliable electricity to customers in its service area. Electricity is needed not only for the comfort and convenience of customers, but also for the customers' welfare, health, and safety. Similarly, the Company must plan for the worst of weather conditions (hurricanes, nor'easters, ice storms, blizzards, and tornadoes) and man-made events (whether accidental or intentional). Succinctly stated, the Company cannot simply plan for a beautiful day in May with temperatures in the mid-70s. In determining whether a use or improvement is an Encroachment, the Company must determine whether the Encroachment will impair the Company's ability to provide electric service in the worst of conditions.

In addition, the Company must preserve and protect its Rights of Way to ensure that they are able to effectively and efficiently access its Easements for the purpose of construction, operation, maintenance and repair of the Facilities. Any Encroachment that interferes with the Company's Easement rights must be removed immediately.

Notice of Right of Way

Buyers of real estate can have notice of Rights of Way by several methods. First, buyers should inspect the property before buying it to determine whether an electric Transmission

Easement affects the property. If electric Facilities are located on the property that you are interested in, it is highly likely that the Company has Easement rights across the property. Second, buyers of real estate should have a title search performed on the property that they are purchasing. Proper title searches and surveys can better assist you in determining whether an electric transmission Right of Way affects the subject property and, if so, where the Easement is actually located. While a title search of the property is highly recommended, some Easement documents are recorded well outside the time period normally covered by a regular title search. Consequently, just because the Easement document is not reflected in your owner's title insurance policy does not mean that the Easement does not exist.

In light of the above, and because each of these methods of acquiring notice of a Right of Way have limitations, perspective real estate purchasers should both personally inspect the property and have a title search performed. For example, a mere inspection of the property may not reveal an unoccupied Easement, meaning that a legal Easement has been recorded in the chain of title, but electric Facilities have not yet been constructed upon the Easement or the entire width of the Right of Way has not been cleared. An inspection of the property may also not reveal an Easement providing rights for underground electric Facilities. As for title searches, a title search may not reveal that the Company has acquired certain prescriptive Easement rights, meaning that an Easement document was never recorded, but the Company has had Facilities on the property for a sufficiently long period of time to acquire Easement rights.

Easements can have a significant impact on the landowner's plans to use the property in question. The landowner must, therefore, be aware of whether an Easement encumbers the landowner's property and, if so, what restrictions apply to the landowner's use of the property covered by the Easement.

Right of Way Maintenance

Once an electric power line is installed on an Easement, the Company must keep the line free from outages and interruptions due to contact with vegetation, trees, or other objects. Vegetation management methods include clear cutting or total removal of trees and vegetation, trimming, and herbicide spraying. It is important to note that most Easements allow the Company to cut trees and limbs outside of the Primary Easement area where the trees or limbs might endanger the power lines or other electrical Facilities.

Encroachments

Whether a use of, or improvement to, the Primary Easement area constitutes an Encroachment is determined by numerous factors, including by way of example but not limitation, the following:

- The terms and conditions of the document establishing the Easement;
- The unique characteristics of the real estate encumbered by the Easement;
- The types of Facilities installed on the Easement;
- The Company's specific needs for the Easement; and

- Certain legal requirements.

No Buildings or Structures

Most Easement documents specifically prohibit any buildings or structures in the Right of Way. If this specific requirement is contained in an Easement document, the Company will strictly enforce this prohibition. Even if the Easement document does not contain a specific prohibition of buildings or structures in the Right of Way, however, most of the time such buildings or structures will interfere with the Company's rights and therefore will be implicitly prohibited.

Consent Agreements

Before a landowner makes any change to the topography of, or constructs any improvements on, an Easement, the property owner must request permission from the Company. The Company will then review the pertinent Easement documents as well as operational and legal requirements. If permission is granted by the Company, the Company will issue **through its Electric Transmission Rights of Way Management Representatives in writing** a Consent Agreement, which will contain certain conditions by which the Encroachment will be allowed to take place or remain on the Right of Way. **The Company does not issue verbal consents and any claim of a verbal consent will not be honored by the Company. No other department within the Company has authority to issue a written Consent Agreement other than Electric Transmission Rights of Way Management.** Generally, Consent Agreements are not transferrable and are revocable at the sole discretion of the Company.

Local Permits Are Not a Substitute for a Consent Agreement

In most localities, before you can construct a building or structure, you have to obtain a building permit and certain projects may require zoning and site plan approvals. Generally, local permits are designed to make sure that the building/structure does not violate building code requirements and that the development is in compliance with the local zoning ordinance. **The issuance of building or zoning permits by a local government does not serve as a Consent Agreement.** Before developing/constructing within an Easement, in addition to any local government permits, you must obtain a Consent Agreement from the Company. Even in those situations where a local permit has been issued for a project and a final certificate of occupancy has been issued by locality, if the building or structure is located in a Right of Way the Company has the legal right to require that the building or structure be removed from the Right of Way.

Compliance with National Electrical Safety Code

All uses within an Easement must comply with the National Electrical Safety Code (NESC). The NESC specifies minimum horizontal and vertical clearance requirements for overhead lines. These clearance requirements are mandatory. In addition, the Company abides by its own clearance criteria, which set of standards is stricter than the NESC. These heightened

requirements are intended to provide the Company with an additional safety buffer to ensure NESC compliance.

Note that a use or improvement in the Right of Way does not have to be an NESC violation to constitute an Encroachment. However, all NESC violations within the Right of Way are Encroachments and must be corrected or removed immediately.

Overhead High Voltage Line Safety Act

Virginia's Overhead High Voltage Line Safety Act, which is found at Virginia Code § 59.1-406 et seq., mandates by law certain safety requirements that must be followed when working near overhead power lines in excess of 600 volts. Among other things, contractors and other individuals must call Dominion Energy at 1-866-DOM-HELP (1-866-366-4357) before working near these lines and allow the proper safety arrangements to be put into place before commencing work. More information regarding Virginia's Overhead High Voltage Line Safety Act can be found at the following link:

<https://www.dominionenergy.com/safety/contractors/overhead-high-voltage-line-safety-act>.

Compliance with all Other Applicable Laws

Note that any activity or improvement in the Right of Way must also comply with all other applicable laws, including by way of example and not limitation, (a) laws and regulations promulgated by the Occupational Safety and Health Administration, (b) the National Electrical Code, (c) building codes, (d) zoning ordinances, and (e) Erosion and Sediment control regulations

Encroachment Requests that Generally will be Denied for a Consent Agreement

The following types of Encroachments will generally be denied by the Rights of Way Management of the Company:

- Buildings, building extensions, building additions, or any portion of a building. By way of example and not limitation, the following items generally will not be approved: homes, offices, garages, barns, sheds, roof overhangs, gutters, balconies, decks, porches, and covered patios;
- Playground equipment;
- Dumpsters and trash receptacles;
- Debris, scrap or waste materials, fill, spoil material, stumps, large boulders, concrete debris, asphalt debris, and construction debris;
- Building materials;
- Swimming pools, wells, septic tanks, drain fields (to include engineered systems), fuel tanks, and propane tanks;
- HVAC units;
- Satellite dishes and television antennas;

- Stored trailers, motor homes/recreational vehicles (RV's), and inoperable vehicles;
- Most watercraft;
- Any type of fire or burning;
- Solar panels;
- Sprinkler systems (excluding drip systems);
- Fire hydrants;
- Retaining walls;
- Storm water ponds, BMP's, retention ponds, or any man-made pond; and
- Burial sites, family plots, and cemeteries.

Construction Plans to be Submitted for Consent Agreement Requests

A Requestor shall submit prior to installing, modifying, or removing any Encroachment, construction plans that provide sufficient information and detail for the Company to make an informed decision with regard to a request for a Consent Agreement. The detail and comprehensiveness of the construction plan will be commensurate with the type of encroachment. However, at a minimum, such construction plan must include the following:

1. A detailed description of the Encroachment;
2. A summary of all construction activities;
3. The location of the proposed Encroachment in relation to Dominion Energy's Facilities, e.g. proximity of Encroachment to existing towers/poles, as well as the location where the construction activity will occur as depicted on a site plan, survey or other acceptable drawing;
4. A description of the types and locations of all temporary staging areas;
5. A description of the equipment to be used during the construction, modification, or removal of the Encroachment;
6. A summary of the expected maintenance required for the Encroachment; and
7. A timeline for the construction, modification, or removal activity.

Some of the Factors that will be Reviewed by the Company in Determining Whether an Encroachment may be Permitted through a Consent Agreement

When reviewing an application for a Consent Agreement, the Company may consider, among other things, the following:

- The terms and conditions of the document creating the Easement;
- The specific characteristics of the real estate encumbered by the Easement;
- The current Facilities situated within the Easement;
- The Company's future needs for the Easement, taking into account ever-changing electric demand;
- Whether the proposed Encroachment would be consistent with the reliable and safe operation and maintenance of the Facilities;
- Whether the proposed Encroachment would restrict or interfere with the Company's access to, from, over, across, or along the Right of Way;

- Whether the Encroachment would restrict the Company's design, construction, operation, or maintenance of future Facilities;
- Whether the proposed Encroachment complies with all applicable law, including the NESC and Dominion Energy's internal design criteria; and
- How the Encroachment will impact the Company's ability to access, build, repair, replace, maintain, and operate its Facilities and future Facilities under the worst of conditions, whether natural or manmade.

General Conditions Usually Included in Consent Agreements

As used in these Guidelines, the person or entity to whom a Consent Agreement is granted is referred to as a "Requestor." If the Company issues a Consent Agreement to a Requestor, the Consent Agreement will contain certain general terms and conditions with which the Requestor must comply in order to maintain the Consent Agreement. These terms and conditions are designed to protect, individuals within the easement, the electric transmission corridor, and the company's facilities. If the Requestor does not comply with the terms and conditions of the Consent Agreement, the Consent Agreement may be revoked.

Guidelines Applicable to Temporary Material Storage

A Consent Agreement for temporary material storage may be granted in a Right of Way (excluding any portion of a right of way corridor containing 500 kilovolt lines), if the following conditions are collectively satisfied:

- The material is nonflammable;
- The material is readily removable to avoid conflicts with future construction;
- The material is stored no higher than a maximum height established by the Company for the Right of Way in question;
- The material is stored at a distance determined to be safe by the Company away from the outer conductor area;
- The material, or its handling, does not create an NESC violation, a violation of the Company's internal design criteria, or any governmental laws;
- The material is not within fifty (50) feet of any electrical Facility and does not interfere with access to electrical Facilities along the Right of Way;
- Requestor agrees to remove material upon written notice by the Company, should such material interfere with future construction or maintenance work;
- The material is not household refuse, tires, appliances, brush or any other debris or waste material;
- All loose materials must be secured to prevent wind displacement;
- Fenced material storage areas must conform to Company grounding/access gate guidelines;
- Materials must be removed immediately for emergency restoration requirements;
- The designated storage area must be restored to its previous condition upon completion of its use;
- The designated storage area must be restored to its previous condition upon written

- request by the Company; and
- Any expense incurred to remove the material will be paid or reimbursed by the Requestor.

Additional conditions may be required given the unique characteristics of, among other things, the property, the Right of Way, and the Company's Facilities.

Guidelines Applicable to Underground Utilities Crossing Rights of Way

Underground utilities such as fiber optics, cable lines, gas lines, water lines, storm water lines and sewer lines may be permitted to cross the Rights of Way in locations approved by the Company if, among other things, the following conditions are met:

- No underground utilities shall be installed within fifty (50) feet of any Company structure, foundation, pole, transformer, equipment, guy, or anchor;
- A minimum of thirty-six (36) inches of cover measured from the top of the pipe and/or cable to existing ground elevation is maintained;
- No blasting is allowed until a blasting plan has been provided, reviewed, and approved in writing by the Company;
- If required in writing by the Company, permanent identifying markers are placed and maintained along the pipeline directly over the pipeline where the pipeline is on the Rights of Way, at every angle in the pipeline, and at the points it enters and leaves the Rights of Way, all at the Requestor's expense;
- Pipes will be designed to support constant traffic crossings by heavy construction and maintenance equipment;
- All fire hydrants, manholes, junction boxes or valve boxes must be located outside of the Rights of Way and discharge away from the electric Facilities;
- All above-ground appurtenances such as pedestals and transformers that are related to the Encroachment must be located outside of the Rights of Way;
- Blowdown discharge valves must be located in accordance with the requirements of the U.S. Department of Transportation's Pipeline Safety Regulations. The valves should be located outside of the Rights of Way and discharge away from the electric Facilities;
- If a cathodic protection system is used to protect a pipeline, it must not cause corrosion in the Company's counterpoise or any other part of the Facilities to include any and all underground conductors; and
- The Requestor or its contractor must give the Rights of Way Management Representative at least five (5) days' notice before starting construction on the Rights of Way and pay the cost of the Company in maintaining an inspector on the job.

Additional conditions may be required given the unique characteristics of, among other things, the property, the Right of Way, and the Company's Facilities.

Guidelines Applicable to Signs

Signs are structures and are, therefore, generally not permitted in the right of way. Before placing any signs in the right of way, a Requestor must obtain a Consent Agreement from the Company.

Grading or Digging in Transmission Easement

The Company's Facilities in a typical Transmission Easement include underground components that are not readily apparent at the ground surface. For example, certain structure subsurface foundations flare horizontally away from the base of the above-ground portion of the structure. In addition, most transmission structures include counterpoise. Counterpoise is a type of underground cable electrode used to ground transmission-line towers and structures. It typically is a system of copper, copper coated steel or aluminum wire buried at uniform depth, consisting of several separate legs originating at the base of the structure and spreading out in a radial pattern to a distance of 50 feet or more. Ground rods and/or ground cages may also be part of this system. In addition to these underground improvements, above ground facilities are designed and built based upon existing topography and elevations. Changes in topography or elevation can pose a danger to people and property. Therefore, before grading or digging in a Transmission Easement, you should (a) contact a Rights of Way Management Representative listed at the end of these Guidelines and (b) dial 811 for the appropriate "call before you dig" center (Virginia 811 aka Miss Utility; North Carolina 811 aka NC811). When grading or digging within a Transmission Easement:

- The owner or Requestor must maintain the required Company defined clearances from the ground to the maximum sag of the line.
- The owner or Requestor must maintain a minimum island of undisturbed natural material with a radius of fifty (50) feet at the ground surface around all Facilities.
- The slope ratios (normally 3:1 or less) and transmission line access must be designated by Right of Way Management - Electric Transmission.
- An access lane (a minimum of twenty (20) feet in width) along the Rights of Way and to Company Facilities must be maintained at all times.
- If any counterpoise (ground wire buried 18 to 24 inches deep) is damaged, cut or severed, the property owner must notify the Rights of Way Management Representative immediately so necessary repairs can be made by the Company at the expense of the responsible party.
- All approved grading plans must be verified upon completion by a certified topographic survey to be submitted to the Company within 45 days.
- If it is determined that any grading was not performed as approved, then the Requestor shall be responsible for all costs involved with correcting the deviation from the approved grading requirements.

The Company's facilities are constructed to be in compliance with certain clearance requirements. The topography or elevation within a Transmission Easement should not be changed without prior written approval from the Company.

Additional conditions may be required given the unique characteristics of, among other things, the property, the Right of Way, and the Company's Facilities.

Roads and Parking Lots

Roads and parking lots may be permitted under the following conditions:

- The proposed road or parking lot complies with the terms of the Easement document;
- No road or parking lot shall be within fifty (50) feet of any Company structure, foundation, pole, transformer, equipment, guy, or anchor;
- No excavation, grading or other construction activities are permitted within fifty (50) feet of any Company structure, foundation, pole, transformer, equipment, guy, or anchor;
- The road or parking lot does not permanently obstruct any portion of the Rights of Way;
- No road intersections are allowed within Rights of Way;
- No roundabouts are allowed within Rights of Way;
- No parallel roads (roads running substantially parallel with electric lines) are allowed in Rights of Way;
- All roads shall cross Rights of Way in such a manner that the angle between the center line of the road and the center line of the Right of Way is no less than forty-five (45) degrees and as close to ninety (90) degrees as possible;
- The proposed grade of any road or parking lot must be reviewed and approved by the Company. Clearances between the road and the electric line conductors on the Rights of Way must be adequate for the maximum conductor operating temperature (Line design will control maximum operating temperature). Where clearances are not adequate, Company Facilities may be modified or reconstructed by Company to accommodate the Encroachment provided that the Requestor assumes responsibility for the actual costs involved in such modification or reconstruction;
- The Company's consent for a road or parking lot Encroachment in no way implies that the Company will grant any future request for quitclaim of the Company's Rights of Way occupied by the approved road or parking lot; and
- The Requestor installs and maintains twenty (20) feet or more Department of Transportation standard entrance gutters and protective barriers as required by the Company at a maximum 10% grade.

Additional conditions may be required given the unique characteristics of, among other things, the property, the Right of Way, and the Company's Facilities.

Guidelines for Vehicles in Right of Way

Vehicles may be temporarily parked within Rights of Way provided, among other things, that:

- They do not exceed a height of 13 feet and 6 inches;

- They are parked at least fifty (50) feet from any structure, foundation, pole, transformer, equipment, guy, and anchor;
- They do not obstruct access to, from, up, down, or over the Right of Way;
- They are operable and transient in nature;
- They do not carry propane tanks, explosives or flammable cargo;
- They have current inspection decals and do not violate any local ordinances;
- The owner of the vehicle agrees to remove the parked vehicle upon written notice by the Company;
- Tanker-type trucks, buses, tractor trailers, trailers, shipping containers, recreational vehicles, and recreational trailers shall not be parked or stored on the Right of Way; and
- Such vehicle does not serve as shelter or overnight quarters for humans or animals.

Additional conditions may be required given the unique characteristics of, among other things, the property, the Right of Way, and the Company's Facilities.

Guidelines for Lighting Facilities

Lighting may be permitted provided, among other things, that:

- The Company approves the location and height of light fixtures;
- No lighting facilities are allowed within fifty (50) feet of the Company's Facilities;
- No lighting facilities are allowed within the conductor area;
- The lighting facilities must have their own meter base and not be connected to any residence; and
- Requestor assumes responsibility for damaged lighting fixtures installed at grade.

Additional conditions may be required given the unique characteristics of, among other things, the property, the Right of Way, and the Company's Facilities.

Guidelines for Landscaping and Other Plantings

Landowners should always be aware of how their landscaping or plantings may affect the Company's Easement rights. Landscaping or planting plans must be reviewed by the Company's forestry department. Without prior approval, any plantings are subject to removal by the Company or its contractors. In some instances, lack of prior written approval may result in the property owner being required to remove the Encroachment at their own expense. Any landscaping requested to be placed on an Easement must have a maturity height of less than ten (10) feet. Please note that ten (10) feet in height is the maximum mature height allowed; however, there may be areas within the Company's Right of Way where the mature height must be reduced to ensure proper clearance.

To maintain access to its Facilities and along the Easement, plantings are not permitted in the following locations:

- On any access lane reserved or used by the Company for vehicular travel, the location of which is identified by or designated by the Company or readily observed within the Right of Way, i.e., dirt trails. These access ways are typically twenty (20) feet in width; and
- Within a fifty (50) foot radius of a Company structure, foundation, tower, pole, transformer, equipment, guy, or anchor.

Subject to the considerations above, the planting of selected trees and shrubbery on the Right of Way may be permitted if:

- The plantings conform to the Company's current vegetation guidelines, which guidelines are available upon request;
- The landowner understands that the Company assumes no responsibility for trees, shrubs, or other landscaping planted within the Right of Way which may be damaged as a result of construction or maintenance work, including chemical control of brush; and
- The landowner shall upon notice by Company Rights of Way Management Representative or Company's Forestry Department, trim or remove shrubs or trees identified by the Company. If not so done, the Company may remove such vegetation at the landowners' expense.

Guidelines Generally Applicable to Recreational Uses

Some recreational uses are compatible with the Company's Right of Way. However, no improvements or changes to the Right of Way should be made without prior written approval from the Company. Some items that will not be allowed within a Right of Way are, by way of example and not limitation, dugouts, backstops, bleachers, stadium lighting, press boxes, scoreboards, goals, tents, and concession stands. Recreation trails on Company Rights of Way will be reviewed on a case-by-case basis. If the trail is approved by way of a Consent Agreement, some of the restrictions that may apply are:

- The Company will maintain the right to use the trails as access routes;
- The trails shall not be located within twenty-five (25) feet of any structure, foundation, pole, transformer, equipment, guy, or anchor;
- The trails shall be designed to withstand American Association of State Highway and Transportation Officials (AASHTO) designation HS20-44 wheel loadings (or ASSHTO HL93 truck loading);
- The trails may be temporarily blocked or closed for an extended period of time to permit Company-required maintenance or construction activities;
- The trails shall conform to existing grades; and
- If a trail is an access point to public transportation, it will be the Requestor's responsibility to provide a safe alternate route during any Company maintenance or construction activities.

The Company will not be responsible for any damage caused to trails when exercising its rights under its Easement documents.

Secondary Easement Rights

Landowners and developers should ensure that development of their property will not impair the Company's Secondary Easement Rights, particularly the Secondary Easement Rights of ingress and egress to a Primary Easement. For example, if the Company's Facilities are located in an area that is geographically isolated, such as on a peninsula, development of the property should not block or impair the Company's access to the Primary Easement from the nearest public or private road. In developing property, a landowner or developer should ensure that the Company has a fairly straight, level, and unobstructed access route at least twenty (20) feet in width from the nearest public or private road to the Primary Easement.

Special Consideration for Developers

The Company welcomes the opportunity to meet with developers at the initial design stage of a development to provide guidance on proper uses and improvements to Transmission Easement areas. The Company strongly encourages that such meetings occur prior to the submission of development plans to the applicable city or county. By seeking early input and approval from the Company in the design process, a developer may save substantial time and money in the long run. As an example, even if a developer obtains approvals from the local city or county for the development, such approvals do not affect the Company's ability to enforce its easement rights. For a planning meeting with the Company, please contact the individuals listed at the end of these Guidelines.

Whether or not the developer has taken advantage of a design meeting with the Company, if the development impacts a Transmission Easement, once the developer is ready to submit a final site development plan to the municipality or county in question, the developer must submit a full set of site plans or exhibits representative and compatible with a final site plan to the regional Rights of Way Management Representative to initiate an official request for Encroachment. The Rights of Way Management Representative will contact the developer when the request has been submitted for a final review. The Company understands that some minor property improvement plans will not necessitate formal site plans and, therefore, the Company will accept other drawings.

Rights of Way Management Representatives

To request a pre-development planning meeting, submit a request for Encroachment, or to otherwise pose a question regarding in an electric transmission Right of Way, please contact the following individuals:

Northern Virginia: Justin Cochran, Sr. Rights-of-Way Management Representative,
3072 Centreville Road, Herndon, VA 20171; justin.k.cochran@dominionenergy.com

Central Virginia: Tim Hindman, Sr. Rights-of-Way Management Representative,
5000 Dominion Boulevard, 3rd Floor SW, Glen Allen, VA 23060;
timothy.hindman@dominionenergy.com

Eastern Virginia or North Carolina: Melissa Jordan, Rights-of-Way Management Representative, 902 G Street, Hampton, VA 23661;
melissa.v.jordan@dominionenergy.com

Western Virginia or West Virginia: Jamie Lowry, Sr. Rights-of-Way Management Representative, 2036 Jefferson Highway, Fishersville, VA 22939;
Jamie.w.lowry@dominionenergy.com

FOR IMMEDIATE RELEASE

Date: October 14, 2025

News Release**Support of Undergrounding the Mars to Golden Transmission Line**

Loudoun County, VA – A County/community-led news conference will be held October 16, 2025, to announce unified support for the undergrounding of the Mars to Golden Transmission Line and to unveil the underground plan developed by County and community engineers. This critical infrastructure issue garnered overwhelming support from elected officials, school board members, impacted residents, HOAs, and advocacy groups. Each of whom stand together in pursuit of a smarter, safer, and more community-conscious solution.

The event will highlight the underground plan for the Mars to Golden Transmission line proposal. Other Respondents in the case include Loudoun County, Loudoun County School Board, Piedmont Environmental Council, HOA Roundtable, and Loudoun Valley Estates, 1, 2, and 3.

Expected attendees include Senator Srinivasn, Delegate Singh, Maaz Abbasi, Staffer for Congressman Subramanyam, School Board Member Arben Istrefi, Clerk of the Court, Gary Clemens, and members of the Board of Supervisors, all of whom have shown support for undergrounding and are committed to advocating for long-term, resident-first solutions.

Event Details:

 **Location:** Courtyard of the Loudoun County Government

 **Date:** October 16, 2025

 **Time:** 5:30pm

Key topics of the news conference will include:

- A call for Dominion Energy to support the County/Community's feasible underground plan.
- Public challenges to unfounded "constraints" cited by Dominion and real solutions proposed by the County and community experts.
- A formal request to Amazon and Digital Carver Dulles to allow transition stations to be placed on their parcels without the need for condemnation.
- A direct public appeal to the Data Center Coalition to actively support undergrounding and help mitigate the collateral impacts of data center expansion.

This news conference represents a pivotal moment in the ongoing effort to ensure that Loudoun County's infrastructure development reflects the values and voices of its residents.

Exhibit E

Theresa Ghiorzi Notes during the March 18, 2025 Loudoun County Board of Supervisors Business Meeting and Public Hearing

March 18, 2025 : Discussion & voting on by-right data center development & grand fathering

Public Recording: https://loudoun.granicus.com/player/clip/7909?view_id=90&redirect=true

4:32:47 Start of BOS Data Center Discussion

Zoning Staff Presentation Phase 1

Purpose

To seek Board action on:

1. Proposed amendments to the *Loudoun County 2019 General Plan (2019 GP)* and *Loudoun County Zoning Ordinance (Zoning Ordinance)* for Data Center Standards and Locations, Phase 1; and
2. Grandfathering Resolution.

Motion # 1 for Grandfathering Resolution

Eligibility Criteria

- Administrative Application accepted on or before February 12, 2025
- Data Center use 500+ feet from residential use
- Must be actively pursued without major modifications

Staff Analysis

Criteria	Administrative Applications without prior Legislative Approval	Administrative Applications with prior Legislative Approval
Within the 500 feet of Residential Structure (Not Grandfathered)	3	4
Outside the 500 feet of Residential Structure (Grandfathered)	19	5

Motion # 2 for Grandfathering Resolution

Eligibility Criteria

- Legislative Application formally accepted on or before February 12, 2025
- Diligently pursued to approval with no substantial modification

Staff Analysis

- Planning Commission recommended Board Public Hearing date (February 12, 2025) as the effective date for the Grandfathering Resolution
- At the Board Public Hearing on February 12, 2025, the Board directed staff to use February 12, 2025, as the effective date.
- Fourteen legislative applications for data center uses accepted before February 12, 2025, have not yet gone before the Board for action. Those that receive approval would be grandfathered.

Motion # 3 for Grandfathering Resolution

Update paragraph six so that "substantial modification" includes changing or adding proposed uses or changing or increasing the land area subject to such application

Staff Analysis

Paragraph 6 (now 7 & 8) of the Grandfathering Resolution has been updated to reflect this change:

"For the purpose of this resolution, a "substantial modification" to a legislative application is a modification made after the Effective Date that:... Changes or adds proposed uses, Changes or increases the land area subject to the legislative (§ 7) and administrative (§ 8) application"

Motion # 4 – Zoning Ordinance Table 3.02.05-1

Further revision to Attachment 2 of the March 4, 2025, Board Meeting Action Item reflecting that affected legislative applications approved after December 13, 2023, are deemed to include an approved Special Exception (SPEX) for a data center use.

Staff Analysis

Table 3.02.05-1 has been updated to state:

"Notwithstanding Sections 10.10.01.G and 10.10.05.G, any ZMAP, ZCPA, or ZRTD that: i) was approved on or before March 18, 2025; ii) has proffers detailing a specific data center use, a CDP showing a data center use in detail, or a combination of both that when considered together would detail a specific data center use; and iii) is limited to such data center use; is deemed to include a SPEX approval for that data center use"

Staff Recommendation

- Staff recommends that the Board approve
 - Proposed amendments as presented in the March 18, 2025, Board Business Meeting Action Item (Attachments 1, 2, and 3); and
 - The Grandfathering Resolution (Attachment 4).

BOS Questions for Staff:

Sup. Briskman: If them can move the buildings around to meet the 500ft would they need to come back for a spec - Yes

Sup. Letourneau : **how to define residential property - does the home have to be occupied?** What is a home? There are only two homes that they know of that are vacant and have been for awhile. Place type - Urban Employment place type allows residential

4:47:17 Sup. Kershner: From the chart showing the number of data centers that would not be grandfathered under the current proposal? How many are within 400ft? What is the distance , what is the range? Is one at 490ft? How did we come up with the 500ft? Was that something staff developed ? Where did the 500ft come from was it random?

Staff: 500ft was a board motion but staff feels it was a good distance to use

4:47: Sup. Kershner: You want to elaborate on why that is a good distance to use, if you don't want to you don't have to? **It has occurred to me we're choosing 500ft why not 300ft? When I look at it 300ft is a football field ... 500ft is even further.**

Staff : there is link to state legislation for high energy use to be within 500ft, also from a noise perspective, from a livability perspective this distance is appropriate for a noise generating use it's a good distance

Sup. Kershner: **There is an application for a ZRTD, a few at least one application that I know of that has come in and has been approved and accepted but does not list data center as a specific use. Under the current grandfathering proposal that one will not be considered grandfathered because it does not list a data centers as a specific use. So it would have to come back for a special exception is that correct?**

Staff: if the application does not reference data center at all in its application we did not capture that in our analysis the applications we were looking at were just the ones that show a data center or reference a data center in the justification for the application or a linkage to a specific intent to put a data center on that site. If they don't have data center specific use or in the application then they would not have vested rights to move forward with a data center and would have to come back for a special exception. Some of the motions would allow room in the process for those applications that don't show that level of specificity a [data center use] to go ahead and let them provide it during their application process [for the ZRTD] and then they would be considered grandfathered as part of their application process.

4:21:21 Sup. Kershner: Datacenter .. not an easy issue its a difficult one I think we've gone to far on this

5:01:12 Sup. Randall Motion Adapt Grandfathering Motion - 500ft

5:07:38 Sup. Briskman - Alternative Motion: Delete all provisions from the grandfathering that pertain to the grandfathering of Administrative applications. Discussion: There are 22 in Administrative "by right" applications to my mind that is basically approving 22 more data centers - 61 Million sq of data centers more than doubles the sq foot of data centers in the county wants to review all 22 instead of letting them sail through and be grandfathered.

5:10:13 Sup. Tekrony Thinks there are 24 administrative ones wants them to be reviewed as residents have asked for, Board does not have to grandfather at all, the 2023 grandfathering was very generous, wants better balance with other commercial uses

5:12:15 Sup. Letourneau - does not support removing grandfathering of the administrative applications, he does support the 500ft but wants to exempt the administrative application, Fundamental fairness in not changing the rules in the middle of the process - doesn't want to make everybody start over because we're putting new rules in place .

5:15:03 Sup. Kershner: **"Quite frankly I am shocked that we even are discussing this motion [to not grandfather 22 Administrative applications for "by rights" data centers] it is quite frankly a complete property rights an attempt at a complete property rights snatch,** what we are basically sayng is we are going to come in at the end of the process after you, as a developer have come in, then everything we asked you to do, met with staff and you spent somewhere between, in some cases, over \$1 million to go through the whole process to get approval. all the engineering has to take place, you sunk all this money and now we are going to say sorry you can't have any grandfathering. **You want to talk about a massive chilling effect that would have on every single industry.** The fact Loudoun County went into this. They wouldn't want to come to Loudoun County anymore. I understand alot of my colleagues are trying to split the baby here. I appreciate the thoughtful process. **This motion is the most egregious of all the motions we are going to look at tonight.** Can you imagine as a property owner you buy a piece of property you have the right to build a home. **Its your dream home. You go through the process, spend all the money at the county, hire engineers get the permits to drill the well. You sunk all these dollars and all of a sudden the county comes along and says sorry you can't build your house. That is exactly what this motion is doing to the industry. And mind you this is the industry that has allowed us to cut the tax rate to \$3.09 personal property tax car tax .**

That's exactly what this motion does its egregious quite frankly its anti-American to do what we are doing quite frankly here because we are built on property rights, yeah I'll say it, it largely is ... now I understand ... but this motion saying sorry you've spent all this money go away that is just egregious and I cannot support this!"

5:16: Sup Saines: Says Sup. Kershner's language was way off base

Sup. Randall: I don't think its a logical motion [to remove the grandfathering]

5:21:22 Sup. Brinkman Its not fair to compare the data center industry to more intense industry they're not incinerators, landfills, not prisons, ok. Also the idea that the 9 of us are just seeking the dollar or maybe have personally benefited from data centers, I think it's also completely offensive and completely false... our residents are suffering from fatigue over, they are not happy about the power lines ... Dominion said we will need 50 more substations in Loudoun County if we continue growing like this ... we don't have to have a grandfathering clause, we don't. They don't have a vested interest until they have an approved site plan, they just don't. That the vested interest line an approved site plan. we are not required to grandfather by any stretch of the imagination. **Our residents are begging us to slow it down! They are begging us** and that's why I brought the motion, I don't think it will pass. ...

Motion on Removing the grandfathering failed : 5 - 4

5:26:00 Staff: The 4 legislative ones already came before the board 500ft does not apply to the Legislative ones they would not be grandfathered the way it was written its only for, they are not required to have 500ft setback

Brinkman: makes a motion to grandfather the 4 legislative ones if they modify their site plan to comply with the 500ft

5:33:06 Sup. Letourneau : Wants to allow Administrative Applications that are inside of 500ft to be grandfathered if they modify their application to include a 500ft setback and then they don't have to request an exception.

5:39:10: Sup. Kershner: Motion to allow Administrative Applications that have not specified a data center use to be able to amend their application to add a data center use to their application and that would allow them to build data centers by right as well. I just think its in the abundance of fairness.

Theresa: For zoning conversions done 1972 - 1993 if the developer did a conversion and did not say data center anywhere in the application, this would allow those developers to add data center as a use and they would then have "By Right" to build a data center without having to get a special exemption. The staff has no idea how many additional lots this would allow data centers by right to!

Motion passed 9 to 0 - Lots that were rezoned in 1972 - 1993 can add data center as a use for their site and it would be "By Right" they don't need a special exemption to build a data center but they do have to bring the site plan to the board.

5:54:00 Sup. Kershner: Motion to extend the grandfathering date from February 12 to March 18, I think in some respects we're picking winners and losers. Significant investment has been made ... to me when you go through all those hoops - there are a lot of reasons these get delayed There's a lot of money in investment. ... To be consistent with our greatest partner in this county we should adapt this.

Motion failed 7 to 2

5:58:51 Sup. Randall ... "I'm not going to value a data center over a person's home" A person's home is their home. By percentage, they probably spent just as much, if not more of their income -- percentage of their income on their home as a data center company does on any particular building to have going in a place. Not to mention, if you're my house, my home, to a large degree is my retirement. People are living in their retirement. We should not do anything to that possibly lowers the cost of the value of the home. ... speaking of property rights I'm not going to do anything that devalues a person's home value." "this is uncomfortable for everybody"

Approving grandfathering passed : 5 - 4

6:02:41 Sup. Tekrony Motion to delete footnote 3

Proposed draft footnote permits minor changes to an approved site plan for an administrative application. My issue is minor changes can be significant for an administrative data center that has not had public comment or board approval. An Administrative data center with up to 1M square feet can expand 5% or 50,000 sq feet without coming to the board or having a public hearing. To put this in perspective a football field is @ 57, 000 sq feet. It would include an increase of data centers by 25%, the addition of accessory structure, realignment of principle buildings and parking areas within an approved ... My concern is permitting the expansion of administrative or "by Right" data centers that have not been reviewed by the board or the public. By removing footnote 3 any previously approved applications or grandfathered site plan that want to make minor changes

6:06:06 Sup. Letourneau: Concerned on the impact that a minor change would have we wouldn't allow it and they would have to do a special exception. May understand it we want to narrow it to just the 5%

6:08:26 Sup. Brinkman motion to limit the footnote change to remove the 5% provision - if they want to increase F.A.R they would have to come to the board. Concerned about an increase in sq footage of data centers without having to come back for specs ... The 1.3 M belmont innovation campus, if they came in for 5% increase that would be 65, 000 sq feet, if Zebra East came in for a 5% increase that would be almost 37, 000 square feet.

6:11:37: Sup. Kershner: Don't we need some kind of percentage on this? We have to have some sort of flexibility. ... We put it in the ordinance for other applications. I think the motion on the table is to remove that which ultimately - almost a poison pill. [staff talking } We did not do any research if it should be 1%, that would be a poor decision if we are doing it tonight. We are doing this talking out

loud here. We are making the decision on the fly. We haven't had anybody from the industry to say how it would impact the industry. ... We might get a worse product or no product or we might get far worse product because of the lacks of flexibility on this. Moving or expanding slightly could make a better product. We are removing flexibility without anything to base it on - I think this is a disaster waiting to happen.

Sup. Turner: if we do away with the footnote and they want to adjust by 10ft they would have to do a special exemption - offers 2%

Discussion for deleting the 5% footnote tabled to Phase 2.

Sup. Umstattd: Motionso that the Urban Employment Place Type won't be rezoned - this request is from the industry reason is 82% of the land area of the areas is already data centers and substations - amendment protects existing campuses .. already thoroughly covered by data centers. This only effects the area near gateway metro.

6:24:01 Sup. Letourneau: Supports the motion because the other place type allows residential and we don't want residential use and we would still change it to conditional use.

6:26:22 Sup. Glass does not support the motion - that is where the metro station is there is nothing there but data centers - we need to look at something other than data centers there.

6:27:29 Sup. Saines: Supports the motion they have already cut down all the trees, substations, data centers this metro stop is going to be a data center stop for a period of time ...

6:29:20 Sup. Randall : ... We all know that every piece of land is going to be a data center application ... unless we say the one thing we exclude besides housing is data centers then its going to be data centers, data centers can buy up land if we make this conditional use down the road it will be a data center - set this aside for an industrial use that is not a data center - we're at a place where its data centers or residences - would like to have a business in Loudoun that is not a data center. ... if data centers are allowed data centers will be there

Motion failed: 4 - 4 - 1

Comment on the Main Motion

6:33:15 Sup. Kershner: I'm concerned applications we are seeing today are quite frankly very different, the industry should be complemented ... And good companies have come and - quite frankly, I feel and acted in good faith and have been some of our strongest business partners in the county. But I think under what we are doing, they are being forced to play a very dangerous game of Loudoun County Zoning Roulette ... and I am concerned that they are not winning. The problem with Loudoun County Zoning is the regulatory -- I've talked to many of them about this. This I think -- I want to be a little prophetic. When you spin the wheel, there is a level of uncertainty that permeates all business Not just business - this business, but all businesses. Who are thinking and doing business in the county. We are going to be voting on this process here that we have gone through over the last year and a half or more . I think it will cost alot of businesses. These Businesses some that spoke tonight, primarily data centers but also all

those that service data centers. Some of who we heard from tonight. It's going to impact more than that. The uncertainty is really real. I think a lot of folks came to this country, they start to develop, start to use our zoning , and now some of them are losing out, some of them have had millions of dollars of investment and are going to be losing that investment, no doubt to some degree. Quite frankly, I spoke with industry leader recently, Its not the cost of the building themselves, nearly as much as the cost of whats internally in there. There's alot of jurisdictions, we don't have the latency we don't have the strategic advantage we used to. I think its just a matter of time, it won't happen next year five years from now 7, 8, 9 years from now. This industry ultimately , if we continue down this path will probably leave Loudoun County. They've been such a great partner.

6:37:15 Sup. Umstattd: Voting against the region **concerned in general about taking away by right opportunities for businesses that have invested or for homeowners who have invested . We try to treat everybody on an equal playing field** , there have been millions, hundreds of millions of dollars invested in the county The results we have seen in allowing the tax bill for the average resident and also on the home owners cars. **The data center industry enables us to pay for mental health counseling, child protective services, law enforcement in the county parks acquisition, historical property acquisition, schools, transportation all of what makes this a great county is paid for in large part by the data center industry.** It is an industry that we as citizens of this country and citizens of this county have created the need for **so as we expect there to be farms to provide food for our tables, the data center industry provides the kind of life we have chosen** ... it is fundamentally what we want to be part of our lives so **when we speak in terms that are less than complimentary towards it or try to slap it down or try to restrict it what we are doing is being a bit hypocritical . We created this and we ought to appreciate it.**

6:39:56 Sup. Tekrony: ... I appreciate the data centers and what the data centers bring to the fiscal situation Data centers generate over a third of the county's general fund revenues were 30% of the total general fund **Our approach to data center revenue, and fiscal policy is to limit our reliance on data centers and diversify We have now hit the point that county Administration wants to lower the property tax on data centers and data center personal property tax in particular.** We're getting to much revenue from them ... we really hit the point of diminishing returns policy is to limit our reliance on data centers When I first came into office I wanted to stop the lowering of the tax for the data centers for the data center s That would have happened, it would have gone down I held onto it because residents need to feel the relief , Supervisor Sup. Kershner and I worked on lowering that tax [the car tax] but we have hit that point. I know that the data center industry has been great partners. I want to support the existing community , but I know that residents are really feeling the impacts with the amount of transmission lines we have going through this county. Also the amount of substations ... 50 substations .. is alot for our county residents to put up with. I do think we have the largest concentration of data centers in the world we are over reliant on data centers.

6:42:57 Sup. Letourneau ... we have 400 thousand something bosses and they have asked us to do something , every meeting we hear the horror story - we are dealing with the transmission lines at some point the board has to act I think we need to take a fresh look at phase 2 **we don't need performance standards we made special exceptions so existing data center may be non-conforming. I think we need to prioritize the transmission line corridor above all else** its easy to

look at this in retrospective. If we go back in time, the approach we took was we want to whether we want it or not we created a gold rush Had dozens of applicants coming in ... Be that as it may, the next threat we are going to be facing is on powerlines, it already is and its not just Loudoun its getting down to Prince William County which has a big expansion so **We have to get a handle on those corridors, I think that's an important thing.** I think we need to have a discussion around phase two, what that looks like, and which of these things need to go first ... I will vote no with reservations

6:45:52 Sup. Brinkman: I semi- agree with what Sup. Sup. Letourneau has said ... Supervisors that are the biggest advocates of data centers have no data centers in their districts-Catoctin & Leesburg Disappointed with the grandfathering 41 Million sq feet with the grandfathering potentially another 61 million ... **yes we need data centers in our lives but they don't all need to be in Loudoun County residents have been begging us to do something.** The visual fatigue, they are concerned about pollution they are concerned about transmission lines and substations. The fiscal reliance on the revenue is becoming almost irresponsible .. **great work everyone**

6:48:35: Sup. Glass I think one of the things I hear mostly from my constituents is about data centers .. yes they bring us revenue. I appreciate what they have done in our communities

6:49:45: Sup. Turner : thanks staff I know the kind of work you have been doing ... **All of us involved here are being yelled at on an almost hourly basis by every stakeholder in this discussion, it goes with the job ,** in any event its Yomans work and in many ways **its a thankless job** but I think when you get to a reasonable result, I think you should have some satisfaction and pride.

6:50:43: Sup. Randall: .. I think you are right there is a level of uncertainty but the level of uncertainty is because you are trying to get it right. ...Truthfully ... **this was revised in 2003 before any of us were a peer - we are trying to -- I will say the word correct** I don't mean to be disparaging . I think they did their best they knew to do at the time No one could have known what this was going to do **so I don't blame them but at the same time there are some things that need to be corrected. We have emails almost every day about data centers ... I have people saying ... stop building these** No one can say that the county that has the vast majority of the worlds data centers is not friendly to data centers. No one can say a county that has said no almost never to data centers is not friendly to data centers **We all use cell phones but the entire data center industry does not need to be located in Virginia.**

Motion: Passed 7 - 2

Exhibit F

York County, Virginia's Data Center Ordinance Pages 2 and 3

(Available in its entirety here:

https://library.municode.com/va/york_county/ordinances/code_of_ordinances?nodeId=1367068)

Section 24.1-489.1. - Standards for data centers.

- (a) Any special use permit application submitted under the provisions of this section shall be accompanied by the following items which, in addition to the standards set forth above, shall be considered by the Planning Commission and Board of Supervisors:
 - (1) A letter from the electric utility purveyor indicating sufficient proximity and availability to a substation and transmission lines with sufficient capacity to serve the proposed data center shall be submitted to the Department of Planning and Development Services. The letter shall specify the amount of energy and voltage level the data center will use at full operating capacity.
 - (2) A letter from the public water purveyor indicating sufficient capacity to serve the proposed data center shall be submitted to the Department of Planning and Development Services. The letter shall specify the amount of water the data center will use at full operating capacity.
 - (3) The data center shall submit a letter from the electric utility and public water purveyor every five (5) years, verifying the data center is using the same amount of electricity and water as was approved.

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Page 3

- (4) The data center may expand its usage of electricity or water to no more than twenty-five percent (25%) of the amount originally approved. Any increase of utility use beyond twenty-five percent (25%) shall be subject to the standards and procedures applicable to amendment of special use permits set forth in Section 24.1-115(d) of this chapter.
- (b) All data centers shall be connected to a public water system. The use of wells as a water supply is prohibited.
- (c) The data center shall employ water conservation methods (e.g. rainwater harvesting and water recycling systems). All proposed methods of conservation will be approved by the County, and any necessary conservation improvements shall be shown on the site plan prior to approval.
- (d) Data centers shall adhere to the following noise standards

Virginia Electric and Power Company
Case No. PUR-2025-00056
Theresa Ghiorzi
Third Set

The following response to Question No. 3 of the Third Set of Interrogatories and Requests for Production of Documents propounded by Theresa Ghiorzi received on October 9, 2025, was prepared by or under the supervision of:

Stephen J. Brookman
Business Performance Consultant – Data Center Practice
Virginia Electric and Power Company

As it pertains to legal matters, the following response to Question No. 3 of the Third Set of Interrogatories and Requests for Production of Documents propounded by Theresa Ghiorzi received on October 9, 2025, was prepared by or under the supervision of:

David J. DePippo
Managing Counsel
Dominion Energy Services, Inc.

Question No. 3

How many data center customers in Loudoun have been added within the last 18 months and what is the amount of load they are drawing.

Response:

The Company objects to this request because it is irrelevant to this proceeding and because the term “data center customers” is vague and undefined. Notwithstanding and subject to the objections, the Company responds to this request noting that the Company understands “data center customers” to mean data center customer accounts. With respect to the Company’s customers, during the 18-month period from April 1, 2024, to September 30, 2025, the Company added 20 new data center customer accounts in Loudoun County, with total aggregate contracted capacity of 640 MW and current aggregate demand of 135 MW. This does not include Loudoun County customers in the service territory of Northern Virginia Electric Cooperative.

Loudoun County, Virginia: Data Center Capital of the World “A Strategy for a Changing Paradigm”

*By
Ashburn Supervisor, Mike Turner
Loudoun County, VA Board of Supervisors
October 1, 2025 (Original Edition: July 1, 2024)*

Author’s Preface

The opinions and recommendations in this paper represent those of the author alone and in no way represent those of any other Board member, the Loudoun County Board of Supervisors or Loudoun County Staff. Furthermore, these opinions and recommendations have no legal authority nor are they in any way legally binding on any Loudoun County employee.

Summary of Updates Since the August 1st Edition

- Updates Northern VA power consumption estimates to 2024.
- Updates the natural gas capacity factor.
- Adds a brief description of AI.
- Provides an expanded discussion of blue hydrogen fuel cell disadvantages.
- Introduces long-duration energy storage as an alternative to BESS.
- Provides an expanded discussion of Small Modular Reactors, their fuel and their waste.

Executive Summary (citations included in applicable main body text)

- Loudoun County, VA, and particularly “Data Center Alley” in eastern Loudoun, has the highest concentration of data centers in the world with approximately 200 data centers built and 117 in the development pipeline. There has not been a single day in 15 years when a data center was not under construction in Loudoun County. We have more data centers than the next six U.S. markets combined.
- Two source documents guide and regulate Loudoun County’s approval and placement of data centers: the Comprehensive Plan and the Zoning Ordinance. The Comprehensive Plan is a guide and details the Board of Supervisors’ vision for land development over the next 20 years in the county. It is not legally binding. The Zoning Ordinance provides the legal basis for the Comprehensive Plan and is legally binding. Each parcel of land under the zoning ordinance allows certain types of development “by right,” meaning such development does not need legislative approval from the county Board of Supervisors. Much of Loudoun County’s data center development has been “by right.”
- Key developmental milestones:
 - Late 1990’s: U.S. government’s Advanced Research Project (ARPA) establishes the Metropolitan Area Exchange-East (MAE-East) as a national internet hub. Extensive underground fiber optic network is laid giving Loudoun County the lowest (fastest) latency rates for moving data from point A to point B in the

world. This latency advantage exists to the present day and represents a significant market advantage for data centers located in Loudoun's "Data Center Alley."

- CY 2000: Loudoun County Zoning Administrator determines data centers should be treated as office parks, thereby making any data center development "by right" on land parcels that permit office parks.
- CY 2003: First mention of data centers in the Zoning Ordinance.
- CY 2008: Loudoun County Economic Development launches an aggressive marketing campaign touting our low latency rates to attract data centers to the county. "Data Center Alley" is born.
- CY 2019: County Comprehensive Plan updated fully for the first time in 18 years. Incorporates a wide range of data center performance criteria.
- CY 2022: A landmark year marking the start of a new era of constrained power for the worldwide data center market. After ten years of slightly declining power demand within the Dominion Energy service area, PJM, the northeast Regional Transmission Organization, of which Dominion Energy is a member, recognizes an impending exponential increase in power demand from Loudoun County's "Data Center Alley." Dominion Energy immediately imposes power constraints on "Data Center Alley" which remain in effect today. Loudoun County, VA becomes the constrained power "canary in the mine" for the world data center community.
- CY 2023: Loudoun County Zoning Ordinance updated for the first time in 20 years to align with the 2019 Comprehensive Plan. This increases local legislative oversight of data center applications, thereby limiting "by right" development for the first time.
- CY 2024: Joint Legislative Audit Review Committee releases long-awaited data center report to the Governor and General Assembly.
- CY 2025: The Loudoun County Board of Supervisors ends "by right" data center development in Loudoun County at a March 18th, 2025 Board meeting.²¹
- From 2021-2025, largely before the dawn of Artificial Intelligence (AI), Loudoun County's energy use increased 166%, from 2.0 Gw to 5.33 Gw of power consumption. Using a simple linear extrapolation over the next five years, without accounting for a likely tenfold increase in power required by AI, Loudoun will need 14.2 Gw of power. An independently commissioned Kimley-Horn report has confirmed a similar prediction, estimating 11.59 Gw of power will be needed by 2028. Loudoun County is currently receiving about 9.3 Gw of power, though only a portion of that reaches "data center alley." PJM and Dominion Energy plan to bring an additional 6.3 Gw into Loudoun County by 2028 to meet Loudoun's growing power demands, but it is unclear how much of this additional power will reach "Data Center Alley." None of this development addresses the vast increase in power demand anticipated for AI.
- Demand for data processing is growing exponentially worldwide. With that increase in demand for data processing comes a concomitant exponential increase in demand for

electricity by the world's data centers. The electric utilities serving Northern Virginia (PJM; Dominion Energy) will be unable to build sufficient grid infrastructure to meet the growing demand for power by the region's data centers. This conclusion, originally stated in the preface below in July 2024, was similarly arrived at in the December 2024 JLARC data center report to the Virginia Governor and General Assembly.

- The rapid increase in data center sector demand for power has resulted in a significant increase in constituent resistance to more data centers in their communities. It has also caused both PJM and Dominion Energy to slow or cancel the decommissioning of fossil fuel generation plants throughout the region. Given that the most recent U.N. climate change report indicates 2024 was likely the warmest year on record, this delay or cancellation of fossil-fuel plant decommissioning will likely add to community resistance to more data center development.
- The three key stakeholder groups critical to developing a new strategic paradigm for energy consumption amidst a worldwide data revolution are the data center sector, the electric utility sector and the constituent sector, represented by local, state and federal elected bodies. Heretofore, these groups have rarely collaborated. Systematic collaboration and communication between and among these groups will be essential going forward.
- Certain realities must be acknowledged if we are to successfully meet Loudoun County's energy challenges:
 - The 135-year-old paradigm of power generated by large, remote power plants and transmitted over hundreds of miles of transmission lines to end-user distribution locations will not solve Loudoun County's unique energy challenges.
 - The utilities will likely continue to slow or halt fossil fuel generation plant decommissioning. This will lead to increased community pressure on elected officials to oppose data center development and increased market pressure on data centers to develop onsite, regional or distributed energy networks with a greater reliance on low-carbon or carbon net-zero power.
 - Solar and wind power alone will not be sufficient to solve Loudoun County's data center energy needs.
 - Halting data center construction in Loudoun County will not solve the problem. AI will drive up energy demands for our existing data centers far in excess of Dominion Energy's and NOVEC's (Northern Virginia Electric Cooperative) capacity to meet that demand.
- Immediate steps available to PJM and Dominion Energy to begin to address rising power demand are 1) reconductoring new and existing transmission lines, and 2) considering the development of a regional High Voltage Direct Current (HVDC) network for the exclusive use of the Loudoun County data center sector.
- If, as this paper and the JLARC study predict, the power grid infrastructure in Loudoun County—even with its planned expansion—will be insufficient to meet the future energy

demand of the county's data center market, there are only three possible future scenarios by which that demand can be reduced to manageable levels:

Scenario #1: Government-Imposed Energy Consumption Constraints. In this scenario, the Commonwealth of Virginia, the power utilities or both artificially constrain the energy use of high-energy consumers to ensure grid stabilization for all Virginia energy consumers. This scenario would likely cap continued data center development in Loudoun County and cause new data center development to take place in locations with much lower power constraints.

Scenario #2: Technological Breakthrough. A technological breakthrough occurs significantly reducing the power needed by AI and cloud-based computing. Such a development would stabilize the power grid and could enable the power utilities to meet the stabilized infrastructure needs of the industry. This scenario could lead to significant stranded costs and will likely prove only temporary as data centers fill up empty rack space with newer chips.

Scenario #3: Industry Conversion to Onsite Power. Faced with exponential market demand and possessed with almost unlimited resources to meet that demand, the data center industry rapidly develops the capacity to generate onsite, local or distributed energy power (microgrids) for its operations and, in so doing, significantly reduces its reliance on the regional power grid. Such a development would stabilize the grid and could enable the power utilities to meet the stabilized infrastructure needs of the industry. (Widespread microgrid development in Loudoun County is unlikely due to geographic constraints.) Additionally, this scenario could also lead to significant stranded costs.

- In the future, the three scenarios will likely occur simultaneously but in varying and fluctuating degrees based upon market and grid infrastructure conditions. The utilities have already begun delaying additions of large loads to the grid, and the JLARC study recommends codifying this in state code to allow delays for generation limits in addition to transmission limits (scenario #1). Meanwhile, new GPU chips are emerging that use significantly less power (scenario #2), and we already have examples of data centers in Loudoun County building advanced microgrids to reduce their dependence on grid power (scenario #3). All three scenarios will continue to develop for the foreseeable future.
- Stranded costs occur when a regulated utility, required by law to meet the energy demand of its customers, is forced to build new infrastructure to meet predicted, future demand for energy. If at any time during the infrastructure buildout process the predicted demand is not realized, stranded costs occur. The regulated utility has incurred the costs of the buildout, but the reduced consumer demand can no longer defray those costs. The utility must then absorb the costs or pass them on to residential and small commercial customers. A tool to insulate the utilities from stranded costs is the imposition of preemptive tariffs on high-energy consumers.
- While the 2024 JLARC study concludes it will be very difficult to meet the data center sector's unconstrained energy demand, it offers only two broad approaches to reduce that demand: 1) utilities should be allowed to delay large energy load additions to the grid while local jurisdictions impose performance standards to increase energy

efficiency, and 2) the state should use the sales tax exemption to incentivize greater data center energy efficiencies. These approaches represent an acceptance of scenario #1 above as the only way to decrease energy demand. Approach #1 is occurring already due to physical grid infrastructure limits that will exist for the foreseeable future. Approach #2 would fail to achieve data center energy efficiencies sufficient to adequately reduce stress on the power grid and would cause data centers to leave the Commonwealth.

- Microgrids generally comprise up to five key components:
 - A major power consumer (e.g. data center)
 - A baseload power source (onsite power capable of meeting the major consumer's power needs 24/7/365)
 - A backup power source (e.g. generators, gas turbines, energy storage units, etc.)
 - A connection to the regional power grid (optional)
 - A demand response management system to manage microgrid power sources and determine when and how the microgrid will interface, if at all, with the regional power grid
- There are currently six types of onsite power sources capable of practical application within the next five years:
 - Backup diesel generators
 - Long-Duration Energy Storage units or Battery Energy Storage Systems (BESS)
 - Natural gas turbines
 - Green hydrogen fuel cells
 - Blue hydrogen fuel cells
 - Small Modular Reactors/Advanced Nuclear Reactors (more than 50 variations)
- Only natural gas turbines or generators are immediately capable of delivering baseload, onsite power.
- Small modular reactors have the highest capacity factor (ability to deliver maximum power for the longest duration) and solar power has the lowest.
- Small Modular Reactors and Advanced Nuclear Reactors have the highest potential for delivering maximum, carbon net-zero power, but require at least 10 acres to produce 300 Mw. They also create new types of nuclear waste different than traditional light-water reactors and require onsite waste storage. These three factors would likely prohibit their use in Loudoun County with its very dense data center community located near residential areas.
- The data center industry is facing historic market demand and possesses virtually unlimited resources to meet that demand. History suggests that any market experiencing these two forces simultaneously will derive its own market-based solution.

Loudoun County, through constant collaboration with the data center sector and local utilities, should strive to anticipate in what direction its data center community will choose to move. Towards that end, the county should develop precise performance standards to 1) shape and manage future data center development, and 2) create significant incentives/disincentives to effect environmentally friendly and energy efficient design changes to existing data centers.

Preface

I was elected to the Loudoun County Board of Supervisors in November 2019 and took office in January 2020. For my entire tenure, our bipartisan Board has had to deal with two enduring and overarching issues: data center growth and housing. While the need for attainable housing in Loudoun County, the wealthiest county in America,¹ remains a critical issue, the explosion of data center growth in the past two years, both unprecedented and accelerating, has created urgent policy issues I believe our Board must now address.

This paper is intended to form the factual basis for a new policy regarding data center growth in Loudoun County. Stated simply—based on the data, logic and conclusions offered herein—the existing paradigm of power generation, transmission and consumption this nation has relied on for more than a century is simply not capable of providing sufficient power to Loudoun County data centers (and very likely Prince William County data centers) going forward. The demand from that sector of our market environment is too high, and that demand is accelerating rapidly to historic levels. This same conclusion was reached by the December, 2024 JLARC data center report submitted to the Virginia Governor and General Assembly:

“Data center demand would drive immense increase in energy needs in Virginia, based on JLARC’s independent forecast and other forecasts. Building enough infrastructure for unconstrained data center demand will be very difficult and meeting half that demand is still difficult.”²

I suspect the data center sector and the power utilities will not agree with several of my conclusions expressed in this paper, and I both respect and value their feedback. However, having done the research on this issue, I believe we have all been considering these changes within the context of our historic organizational paradigms. The data centers’ imperative is to meet market demand, and that’s their focus. Dominion Energy and PJM, the Regional Transmission Organization (RTO) for the northeast power grid, are required by law to provide power to all customers, and that’s their focus. And the Board of Supervisors is an elected body responsible for making land-use decisions and encouraging economic growth, and that has been our focus. But the post-COVID world since 2022 has seen a seismic increase in demand for data representing not an evolution, but a revolution of technological change now very likely to overwhelm our existing power infrastructure. Essentially, we’ve invented the airplane but just realized we haven’t yet invented runways. This level of systemic change demands new paradigms at almost every level if we are to avoid an involuntary and likely painful landing.

¹ Ibeh, Kemi. “The Wealthiest County in the U.S. Is Not Where You Think.” Fodor’s Travel. January 23, 2024. <https://www.fodors.com/world/north-america/usa/virginia/experiences/news/heres-where-the-wealthiest-u-s-county-actually-is>

² Joint Legislative and Audit Review Commission. “Data Centers in Virginia, Commission Draft.” Report to the Governor and the General Assembly of Virginia. December 9, 2024, pg. ii-iii. <https://jlarc.virginia.gov/pdfs/reports/Rpt598-2.pdf>

This paper offers a summary of how we got here, presents data to capture the magnitude of the change we are all facing, acknowledges what I believe are the new realities of our current and future data center environment, and proposes the key elements of a new policy going forward. I do not consider the ideas presented or the policy elements I'm proposing the only viable answers to the historic challenges we now face. But my overarching responsibility, and I believe the responsibility of the Loudoun County Board of Supervisors, is to protect the quality of life of our citizens, even if the decisions we make are controversial, politically fraught and decidedly unpopular. My purpose here is to start a conversation based not on our ungrounded hopes but on our fact-based needs. That is the only basis upon which we can, collectively and collaboratively, formulate a transformational strategy for Loudoun County. We are the nexus for the world data center community. We have both a profound responsibility and an historic opportunity to redefine and permanently reshape the digital world and the power infrastructure it relies on. And we must act now.

Introduction

As of this writing, Loudoun County, Virginia—and more precisely, eastern Loudoun County comprising approximately 30 square miles—is home to about 200 data centers. A recent independent analysis by consultant Kimley-Horn indicates there are another 117 data centers in Loudoun County's development pipeline, with presumably many of them "by right," not requiring approval by the Loudoun County Board of Supervisors.³ Combined with the rest of Northern Virginia, we have three times more than the second highest concentration in America.⁴ In 2024, The Joint Legislative Audit Review Commission stated that northern Virginia (Loudoun, Fairfax and Prince William Counties) energy capacity was 4.14 Gw² up from just 1.5 Gw in 2019⁵. That's a 176% increase in the need for electricity in Loudoun County in five years. If we apply just a linear extrapolation of that growth rate in power demand over the next five years—and that is probably an unrealistically conservative growth rate based on the preponderance of growth trends in power demand—that means by 2029 Loudoun County will require about 11.43 Gw of power. An independent analysis by Kimley-Horn arrived at an estimate of 11.59 Gw of power needed by 2028.⁶ Those are remarkably similar, independent analyses, both of which do not bode well for the Loudoun County power grid.

Regarding actual data center construction growth, in 2020 we had about 21.5 million sq. ft. of permitted data centers in the county. In 2025, we have about 47 million sq. ft. of data centers permitted.⁷ That's a 119% increase in five years. Moreover, we have at least an additional 40 million sq. ft. in the pipeline (application being reviewed or site plan submitted).

³ Kimley-Horn staff report to the Loudoun County Transportation and Land Use Committee. "Power Transmission Evaluation of Loudoun County, Virginia." October 17, 2024, item #9, Atch. 2, pg. 4. <https://www.loudoun.gov/3432/Transportation-and-Land-Use-Committee>

⁴ [United States Data Centers: Top 10 Locations in the USA - Dgtl Infra](#)

⁵ Abdulsalam, Sami. "Dominion Northern Virginia Area Immediate Need." Slide #2, "Data Center Alley Area Load Growth and Transmission System." Slide #3, "Dominion 2022 Load Forecast." Data interpolated from data center load forecast line (orange). June 7, 2022. <https://www.pjm.com/-/media/committees-groups/committees/teac/2022/20220712/item-08---dominion-northern-virginia---immediate-need.ashx>

⁶ Op. Cit.

⁷ Yearly data provided by the Loudoun County Commissioner of Revenue.

By every metric, the rate of data center growth in Loudoun County over the past 20 years has been among the highest of any community in the world, and that rate has accelerated exponentially since 2022. All indications suggest that growth will be accompanied by a commensurate increase in demand for power, unless outside factors—governmental action, technological breakthroughs or increased use of onsite power—reduce the demands on the regional power grid to manageable levels.

Our county is at the edge of the frontier in data center development. The lessons we have learned as a community can serve as invaluable roadmaps for communities across the nation, ranging from those contemplating their first data center, to those with modest growth, to those with an established and thriving data center community.

At the same time, because of our uniqueness, many of the challenges we now face have no corollary outside of Loudoun County. Yes, our journey can be instructive to other communities still in the early to moderate growth cycles, but many of the issues our data center community, our utility companies and our local elected leaders are now facing have never before been encountered.

Three Key Stakeholder Groups

There are three core stakeholder groups in Loudoun County with an urgent interest in developing a comprehensive strategy for future data center sector growth: the data center community, the core utilities (electricity, gas, water), and local government representing our citizens who benefit from the data produced by our data centers.

Data Centers. This group involves not just data center owners and land developers, but the land-use attorneys representing them, construction companies, unions who provide labor, non-union laborers, and a wide range of corollary businesses that benefit from the construction, growth and increased impact of data centers on our society. All the members of this stakeholder group are primarily focused on enabling data centers to meet the rapidly increasing demand for data processing in our society. **Their market imperative is to continue to grow.** There are two broad types of data centers:

Hyperscale (Enterprise) Data Centers. Hyperscale (100 Mw or more) or enterprise data centers are generally owned and operated by a single owner and are extremely large with very high power demands. According to an August article in *Enterprise Storage Forum*,⁸ a hyperscale data center is any data center with more than 10,000 sq. ft. of space and more than 5,000 servers. However, by this standard, just about every data center in Loudoun County, including most of our legacy data centers, would be considered hyperscale. For the purposes of this paper, I will distinguish between the two based on function. An enterprise data center is usually owned by a single entity and is designed to process enormous data loads at scale for just that entity or perhaps a handful of partners. According to a major colocation data center owner I talked to recently, hyperscale or enterprise data centers require significantly more power than colocation data centers as defined below. This trend is likely to

⁸ Vyas, Kashyap. "Hyperscale Data Centers vs. Colocation Data Centers." Enterprise Storage Forum. August 24, 2023. <https://www.enterprisestorageforum.com/cloud/hyperscale-vs-colocation/#:~:text=Hyperscale%20data%20centers%20meet%20enterprise%20data%20needs%20by,essential%20resources%2C%20allowing%20for%20cost-effective%20expansion%20and%20management.>

accelerate significantly as hyperscale/enterprise data centers pick up more and more of the generative AI load worldwide.⁹

Colocation Data Centers. Colocation data centers are owned by a company that leases data rack space to tenant companies. It's a shared-space data center often hosting hundreds of clients who own and operate their own servers and infrastructure in an ideal data processing environment. The power requirements of a colocation data center have historically been much less than hyperscale/enterprise data centers. While this is likely to remain true, AI is also going to significantly increase the power demands of colocation data centers.¹⁰

Core Utilities. Though services like internet, phone, cable T.V. etc. can be considered utilities, for the purposes of this discussion, we will limit our focus to just the core utilities of electricity, water and gas. The principal core utility and the one facing the most urgent current demand in Loudoun County due to accelerating data center growth is power (electricity). However, our other two utilities could play increasingly important roles in the future. Submerged data racks using water cooling could significantly lower data center power needs but increase demand for closed, reclaimed water systems. Use of onsite gas-generated electricity is a viable future option and one already being used in Loudoun County. Rapid growth in these sectors would also require more resources. But this paper's principal focus will be on power. There are two major players and one currently minor player in the Loudoun County power space:

Dominion Energy. Dominion Energy is the largest supplier of electricity in the Commonwealth of Virginia and the predominant electricity provider in Loudoun County. It is an investor-owned utility and, **because we are a regulated state, is required by Virginia law to provide power to every customer it serves.** This is a critical point underlying the entire issue of data center growth in Loudoun County and will be addressed later.

PJM. According to the PJM website, "PJM is a Regional Transmission Organization (RTO) that coordinates the movement of wholesale electricity in all or parts of 13 states and the District of Columbia."¹¹ PJM monitors and regulates all the power companies in the northeast region, including Dominion Energy, to ensure the stability and resiliency of the entire northeast power grid. Northern Virginia, and specifically Loudoun County, are among PJM's largest customers due to our data centers. Approximately 60% of the PJM grid is carbon dioxide-producing, and about 40% is carbon-net-zero energy with about 82% of the carbon-net-zero portion being nuclear.¹² As we will note later in this paper, that ratio could change significantly in the years ahead.

Northern Virginia Electric Cooperative (NOVEC). According to their website, "NOVEC is a distribution electric cooperative. NOVEC purchases wholesale power

⁹ McKinsey & Company. "AI power: Expanding data center capacity to meet growing demand." October 29, 2024. <https://www.mckinsey.com/industries/technology-media-and-telecommunications/our-insights/ai-power-expanding-data-center-capacity-to-meet-growing-demand>

¹⁰ Ibid.

¹¹ <https://www.pjm.com/about-pjm>

¹² https://en.wikipedia.org/wiki/PJM_Interconnection

through the PJM marketplace.”¹³ As stated, NOVEC’s principal function is to distribute electricity purchased by wholesale providers such as Dominion Energy. Generally, they provide power to residential customers and commercial businesses not powered directly by Dominion. At present, they are not a major player in the data center space in Loudoun County, but that could change in the near future as well.

Local Elected Officials Representing the Community. In Loudoun County, the senior elected body charged with land-use planning is the nine-member Board of Supervisors (BOS). The BOS works for the citizens of Loudoun County and must be responsive to their needs and concerns. No individual Supervisor may act alone; all proposed actions by the BOS require at least five votes to be implemented.

Regarding the BOS’s role in land-use issues, the extent of BOS involvement in the decision-making process for land development depends on what type of land development is proposed. There are generally two types: “by right” and legislative.

“By Right.” Every parcel of land in the county has permitted uses, and if a landowner decides to develop one of those permitted uses, s/he is not required to obtain BOS approval to develop that land unless they wish to change a “by right” use or add a new use.

Note: Loudoun County ended “by right” data center development by a 7-2 vote at a March 18, 2025 Board of Supervisors meeting. All new data centers in Loudoun County (except for 22 data centers “grandfathered” at the March 18th meeting) now require Board of Supervisors approval.

Legislative. If the landowner decides to modify the use of the land beyond what’s permitted “by right,” s/he must submit a legislative application to county staff and obtain final approval from the BOS.

The Roles of the Comprehensive Plan and the Zoning Ordinance. Key to understanding the planning environment within which these three stakeholders have been operating throughout the period of rapid data center growth is the relationship between the Loudoun County Comprehensive Plan and the Zoning Ordinance. Stated simply, the Comprehensive Plan is the Board of Supervisors’ vision of how land should be developed in the county (plus the transportation infrastructure needed to support that vision). The Zoning Ordinance is the legally binding code landowners must abide by when developing their land, and it is used to implement the vision outlined in the Comprehensive Plan. The Comprehensive Plan is not legally enforceable; the Zoning Ordinance is.

These two documents should always be in alignment and updated every five years. Yet Loudoun County went from 2001 to 2019 without a complete update of its Comprehensive Plan and from 2003 to 2023 without a corresponding update of its Zoning Ordinance. These two decades precisely aligned with the growth, from inception to maturity, of the data center sector in Loudoun County, the largest such sector in the world today. The BOS finally updated the Comprehensive Plan in 2019, but due to COVID, it took four more years to update the Zoning Ordinance in December 2023. These four years of misalignment between the Comprehensive Plan and the Zoning Ordinance occurred just as data centers began exercising their “by right” development options. Additionally, PJM, Dominion, and Aurora Energy, a leading global advisor to energy investors, mark 2022 as the

¹³ https://www.novec.com/About_NOVEC/index.cfm

year data center power demand began increasing rapidly.¹⁴ This plan/ordinance misalignment could not have occurred at a worse time and seriously limited the Board's ability to manage data center growth as envisioned in the Comprehensive Plan.

How We Got Here: A Timeline of the Growth of the Loudoun County Data Center Sector

The following is a timeline of key events shaping the proliferation of data centers in Loudoun County:

- 1993 Update of 1972 Zoning Ordinance: No mention of data centers.
- 1990s (latter half): Metropolitan Area Exchange-East established in Loudoun County; AOL HQ comes to Ashburn in 1997 and expands on existing fiber optic network.
- 2000 Loudoun County Zoning Administrator determination: data centers are viewed as similar to office buildings in the 1993 Zoning Ordinance. Office parks are a hot trend.
- 2001: General Plan (land use) updated.
- 2003: Revised 1993 Zoning Ordinance passed to match the 2001 General Plan: First Mention of Data Centers in the Zoning Ordinance.
- 2008: Loudoun County Economic Development initiates marketing strategy to actively recruit data centers to build on land specifically permitting data centers.
- 2014: Zoning Ordinance Amendment (ZOAM) addressing data center sight, setback, sound.
- 2019: General Plan updated (land use).
- 2022: May-July: The Loudoun County Transportation and Land Use Committee (TLUC) holds a series of three meetings to inventory current and potential locations of data centers, obtain staff recommendations about how best to manage data center growth, and to determine the best process to implement a future data center Comprehensive Plan Amendment (CPAM)/Zoning Ordinance Amendment (ZOAM) to codify those managerial changes. Dominion announces new 500/230 Kv Wishing Star-Mars transmission line.
- 2022: July: PJM informs Dominion Energy it has underestimated power infrastructure needs. Dominion Energy informs "Data Center Alley" it will have less power available for at least five years. The power "constrained area" is created until new power lines can be built by 2027.¹⁵ ¹⁶ PJM announces a new 500 Kv line from Doubs-Aspen.¹⁷
- 2023: Dominion Energy announces a new 500/230Kv transmission line along Route 7 in Loudoun County.¹⁸ This line, the southern Wishing Star-Mars line and a third Golden-Mars line will be connected to form a loop to "Data Center Alley."

¹⁴ <https://auroraer.com/company/about/>

¹⁵ RTO Insider LLC. "PJM Orders Dominion 'Immediate Need' Projects to Serve Load Jump in 'Data Center Alley.'" June 16, 2024. <https://www.rtoinsider.com/30472-pjm-orders-dominion-immediate-need-projects-load-jump-data-center-alley/>

¹⁶ Abdulsalam, Sami. "Data Center Planning and Need Assessment Update." PJM. January 10, 2023. <https://www.pjm.com/-/media/committees-groups/committees/teac/2023/20230110/item-04---data-center-load-planning.ashx>

¹⁷ PJM. "Transmission Expansion Advisory Committee (TEAC) Recommendations to the PJM Board." PJM. Dec. 11, 2023. Slide 44, last entry in table. <https://pjm.com/-/media/committees-groups/committees/teac/2023/20231205/20231205-pjm-teac-board-whitepaper-december-2023.ashx>

¹⁸ Kirby, Jess. "Lansdowne residents oppose Route 7 transmission line proposal." Loudoun Times Mirror. Oct. 5, 2023. https://www.loudountimes.com/news/lansdowne-residents-oppose-route-7-transmission-line-proposal/article_46190288-639f-11ee-9908-7722c63f7ffd.html

- 2023: Dec: Zoning Ordinance Rewrite (ZOR) to align with the 2019 Comprehensive Plan is approved by the BOS. This zoning ordinance rewrite established new, more restrictive construction and performance standards for data centers and attached Special Exceptions (SPEX) to data centers being built on Research and Development Park or Office Park land.
- 2023: Dec: PJM announces acceptance of a NextEra proposal to build a new 500Kv transmission line through western Loudoun County.¹⁹ Public resistance is significant, and PJM later decides to build this line in existing right-of-way.
- 2024: Mar: The Loudoun County Board of Supervisors denies the construction of a 4.9 million sq. ft./600 Mw data center next to a residential neighborhood but approves the application when the applicant reduces its size to 1.3 million sq. ft., the “by right” permitted size, and retains the environmental proffers from the larger application.
- 2025: Mar: The Loudoun County Board of Supervisors ends “by right” data center development in Loudoun County by a 7-2 vote at a March 18, 2025 Board meeting.²⁰

It’s important to note here the strategy initiated in 2008 by the Loudoun County Economic Development Department had the full support of the Loudoun County Board of Supervisors and proved to be enormously successful.

- There has not been a single day in the past 15 years when a data center was not under some type of initial construction or expansion in Loudoun County.
- Loudoun County now has about 200 data centers, more than any other community on Earth.²¹ An additional 117 data centers are in the development pipeline.³
- Loudoun County’s data center market is greater than the next six U.S. markets combined.²²

And the reasons why the Loudoun County BOS fully supported this program are easy to discern:

- Enormous tax revenue: In FY2025, Loudoun County estimated about \$895M in data center real and personal property tax revenue. The county’s entire operating budget was projected to be \$940M.²³
- As a result of data center tax revenue, Loudoun County has the lowest real property tax rate in NOVA; about 25% lower than our neighbors.²⁴
- A data center costs the county \$0.04 per \$1 of tax revenue received, whereas normal businesses cost about \$0.25 per \$1 of revenue.²⁵

¹⁹ Kirby, Jess. “PJM advances proposal for transmission line in western Loudoun.” Loudoun Times Mirror. Dec. 13, 2023. https://www.loudountimes.com/0local-or-not/1local/pjm-advances-proposal-for-transmission-line-in-western-loudoun/article_c0202122-99e3-11ee-9896-b71271fc88fc.html

²⁰ Loudoun County Board of Supervisors business meeting minutes, March 18, 2025. <file:///C:/Users/mike.turner/Downloads/Item%2007%20Data%20Center%20Standards%20&%20Locations%20CPAM-ZOAM%20Phase%201.pdf>

²¹ Zhang, Mary. “United States Data Centers: Top 10 Locations in the USA.” Dgtl Infra. April 11, 2024. <https://dgtlinfra.com/united-states-data-centers/>

²² Vogel song, Sarah. “Virginia Has the Biggest Data Center Market in the World. Can It Also Decarbonize Its Grid?” Inside Climate News. May 24, 2024. <https://insideclimatenews.org/news/24052024/virginia-data-center-market-electricity-demand/>

²³ Loudoun County FY2025 Appropriations Resolution; Commissioner of Revenue. Available on request.

²⁴ “City of Alexandria Revenues.” City of Alexandria. 2024. Pg. 7-19 table. <https://www.alexandriava.gov/sites/default/files/2023-02/Section%2007%20Revenues%20FY24.pdf>

²⁵ Northern Virginia Technology Council. “The Impact of Data Centers on Virginia’s State and Local Economies 5th Biennial Report.” April, 2024. Pg. 7. <https://info.nvtc.org/acton/attachment/45522/f->

- Data centers put very few cars on the road.
- Data centers put very few kids in schools.

Thus, with the full and enthusiastic support of the Board of Supervisors and the visionary foresight of the Loudoun County Department of Economic Development, Loudoun County capitalized on its unique geography (Washington, D.C. and Dulles Airport), its role as a high-tech digital incubator and home of the internet, and its extensive fiber-optic infrastructure touting the lowest latency rates in the industry to become ground zero for historic digital development. Until 2022, though Dominion and the Department of Economic Development had cautioned for years infrastructure would have to be built to accommodate the rapid increase in demand for power, the future looked relatively unconstrained.

Then, in 2022, PJM informed Dominion Energy that Dominion’s infrastructure predictions were significantly underestimating the growing power needs of Loudoun County’s data center sector. In response, Dominion Energy established what is now known as the “constrained area” in Loudoun County and informed the data center sector they would have significant power constraints until 2027 when new transmission lines could be built. This deadline has now been pushed back to June 1, 2028.²⁶ This marked the start of a sobering new reality in Loudoun County: the rapid growth of four competing forces affecting the data center community and the larger Loudoun County community.

Four Accelerating, Co-Dependent, Conflicting Trends

There is no question four co-dependent, conflicting trends are going to dominate the Loudoun County data center landscape for the foreseeable future: 1) Rapidly increasing demand for data, 2) Rapidly increasing demand for power to process that data, 3) Rapidly increasing negative impacts on Virginia climate change initiatives, 4) Rapidly increasing local community resistance to changes in quality of life, changes to neighborhoods, and the proliferation of overhead transmission lines.

Increasing Demand for Data. As shown below, the years between 2016-2024 have seen staggering data center growth in Loudoun County:²⁷

- In 2016, 8.8 million sq. ft. of permitted data center floor space
- In 2017, 10.1 million sq. ft. (14.7% increase)
- In 2018, 13.1 million sq. ft. (29.7% increase)
- In 2019, 18.3 million sq. ft. (39.7% increase)
- In 2020, 21.5 million sq. ft. (17.5% increase)
- In 2021, 26.4 million sq. ft. (22.8% increase)
- In 2022, 28.1 million sq. ft. (6.4% increase)
- In 2023, 31.9 million sq. ft. (13.5% increase)
- In 2024, 41.2 million sq. ft. (29.2% increase)
- In 2025, 47 million sq. ft. (14% increase)

[1c3915e6-b8b1-4914-818e-9fae14877a3d/1/-/-/-/2024%20NVTC%20Data%20Center%20Report.pdf](https://www.loudountimes.com/0local-or-not/1local/dominion-files-scc-application-for-route-7-transmission-lines/article_85f0c24c-f607-11ee-b165-e343f9408d14.html)

²⁶ Kirby, Jess. “Dominion files SCC application for Route 7 transmission lines.” Loudoun Times Mirror. April 8, 2024. https://www.loudountimes.com/0local-or-not/1local/dominion-files-scc-application-for-route-7-transmission-lines/article_85f0c24c-f607-11ee-b165-e343f9408d14.html

²⁷ Data provided by the Loudoun County Commissioner of the Revenue, May 31, 2024.

This steady increase in data center square footage is the result of the growth of our society's dependence on social media, "smart" device technology, personal computing and communication, and a host of other data-dependent advancements our society has come to depend on. And now, Artificial Intelligence (AI) is expected to increase the demand for data exponentially again. A January 2024 article by a major data center realty company suggests consumers and businesses will generate twice as much data in the next five years as was generated in the previous ten.²⁸ That's a statement with staggering implications. The article provides a stark prediction of the speed and magnitude of growth in the data center sector and also illustrates convergence of the three conflicting growth trends:

"With the growing demands of AI, data center storage capacity is expected to grow from 10.1 zettabytes (ZB) in 2023 to 21.0 ZB in 2027, for a five-year compound annual growth rate of 18.5%[1]. Not only will this increased storage generate a need for more data centers, but generative AI's greater energy requirements – ranging from 300 to 500+ megawatts – will also require more energy efficient designs and locations. The need for more power will require data center operators to increase efficiency and work with local governments to find sustainable energy sources to support data center needs."²⁹

Increasing Demand for Power

Growth in data center power demand in Virginia is increasing at a rate far exceeding Dominion Energy's capacity to provide it. A January 2024 Data Center Dynamics article projected data center power consumption will double by 2030.³⁰ This trend is magnified in Loudoun County because of our unique data center load. In a May 2, 2024 article, Bloomberg reports that Northern Virginia data center developers are now asking Dominion Energy for the energy equivalent of several nuclear reactors' output. In a recent quarterly earnings call, Dominion Energy's CEO Bob Blue stated that Dominion Energy is now receiving requests from data center campus developers for "several gigawatts" of power.³¹ This is a staggering increase in data center power demand in just a few years. Below is a summarized timeline of actual power usage in Loudoun County since 2018, the year we first reached approximately 1 Gw (1,000 Mw; a megawatt is one million watts) of power consumption in "Data Center Alley."³²

²⁸ Steele, Kimberly. "Growth of AI creates unprecedented demand for global data centers." Jones Lang LaSalle IP, Inc. January 31, 2024. <https://www.us.jll.com/en/newsroom/growth-of-ai-creates-unprecedented-demand-for-global-data-centers>

²⁹ Ibid.

³⁰ Gooding, Mathew. "Newmark: US Power Consumption to Double by 2030." Data Center Dynamics. January 15, 2024. <https://www.datacenterdynamics.com/en/news/us-data-center-power-consumption/#:~:text=While%20the%20hyperscalers%20typically%20need,up%20from%2017GW%20in%202022.>

³¹ Saul, Josh. "Data Centers Now Need a Reactor's Worth of Power, Dominion Says." Bloomberg. May 2, 2024. https://www.bloomberg.com/news/articles/2024-05-02/data-centers-now-need-a-reactor-s-worth-of-power-dominion-says?utm_source=website&utm_medium=share&utm_campaign=email

³² Abdulsalam, Sami. "Dominion Northern Virginia Area Immediate Need." Slide #2, "Data Center Alley Area Load Growth and Transmission System." Slide #3, "Dominion 2022 Load Forecast." Data interpolated from data center load forecast line (orange). PJM. July 12, 2022. <https://www.pjm.com/-/media/committees-groups/committees/teac/2022/20220712/item-08---dominion-northern-virginia---immediate-need.ashx>

- 2018: 1 Gw (chart interpolation)
- 2019: 1.5 Gw (chart interpolation)
- 2020: 1.6 Gw (chart interpolation)
- 2021: 2.0 Gw (chart interpolation)
- 2022: 2.8 Gw (actual)
- 2023: 3.4 Gw (chart interpolation)³³
- 2024: 4.14 Gw (actual)²
- 2025: 5.33 Gw (actual)³⁴

If we assume a linear growth rate over the next five years similar to the previous five years, Loudoun County will demand 14.20 Gw of power by 2030. As mentioned earlier, an independently commissioned Kimley-Horn report has confirmed a similar estimate almost exactly, estimating 11.59 Gw of power will be needed by 2028.³ But Artificial Intelligence (AI) is raising power demand much faster than a simple linear rate. As the use of AI grows, the need for more computing power within existing data centers means the demand for power within those walls is going to increase commensurately. According to an article in Data Center Knowledge, the average data rack power usage in a typical hyperscale data center today is 6-12 Kw. Because of their much higher reliance on Graphics Processing Units (GPUs) within the data rack, AI applications are going to increase that data rack power consumption to 40-60 Kw.³⁵ An October, 2024 McKinsey & Company report states the new Nvidia GB200 GPU AI chip could increase data rack density to 120 Kw per rack, a tenfold increase in the power required per rack.¹⁰ This increase will affect both new data centers and existing data centers as well as both hyperscale/enterprise data centers and colocation data centers. This means that, using a base year of 2025 and 5.33 Gw of power consumption, by 2030, Loudoun County could easily require as much as 20-30 Gw of power due to AI demands. Put more bluntly, it is unlikely PJM and Dominion are going to be able to build enough grid infrastructure to meet Loudoun County's future energy needs. Moreover, we could stop building data centers today, and that would not stop a significant increase in existing data center demand for more power in the near to mid-term. As noted previously, the JLARC data center study arrived at the same conclusion.²

Increasing, Negative Impacts on Climate Change Initiatives

A disturbing, unintended consequence of this growth has also emerged. A recent New York Times article addressed an industry trend to slow or shelve plans to decommission legacy fossil fuel power plants in an effort to meet demand. According to this article, by 2030, power

³³ Ibid.

³⁴ U.S. Dept. of Energy/National Renewable Energy Laboratory. "Accelerating Speed to Power." <https://maps.nrel.gov/speed-to-power/data-viewer?vL=6834e82591241decedd4ef8c%2C682746c9d58843cf7876093e%2C6838ae2891241decedd4ef8f%2C685c736d77a7c73f0a473a5d&b=%5B%5B-80.01874%2C38.464018%5D%2C%5B-75.119437%2C39.6613%5D%5D>

³⁵ Kleyman, Bill. "Data Center Rack Density Has Doubled. And It's Still Not Enough." Data Center Knowledge, April 15, 2024. <https://www.datacenterknowledge.com/cooling/data-center-rack-density-has-doubled-and-it-s-still-not-enough>

demands by the nation's data centers could triple.³⁶ A February 2023 report by PJM shows the RTO planning to retire about 40 Gw of old power plants by 2030 while expecting about 11 Gw of new orders by that same date.³⁷ Obviously much higher demands for power could significantly alter this plan.

These trends have very serious implications for our efforts to meet our climate change goals established by the Paris Agreement in 2016.³⁸ These global efforts are plainly failing based on the most recent climate change data. In 2024, the World Meteorological Organization reported that global temperatures increased 1.55 degrees centigrade. "The year 2024 was the warmest year in the 175-year observational record, clearly surpassing the previous warmest year, 2023 at 1.45 °C ± 0.12 °C above the 1850–1900 average. For global mean temperature, each of the past ten years, 2015–2024, were individually the ten warmest years on record."³⁹ Six global tipping points will be reached at a ten-year, 1.5-degree rise.⁴⁰

It is fair here to note the data center community is pursuing very aggressive sustainability goals, goals that are far more aggressive than many other business enterprises. Unfortunately, by relying on power provided exclusively by the utility companies, their lofty sustainability goals are going to be negatively impacted if the utility companies continue this trend of postponing or even reversing the decommissioning of fossil-fuel power plants.

Increasing Demand for Power (cont.)

Recognizing this rapid growth in demand for power, and mindful of the legal requirement to provide power to all consumers in a regulated state, PJM, in the summer of 2022, advised Dominion Energy it would need to significantly increase its transmission infrastructure to handle the projected load in Loudoun County and to specifically address the urgent power constraints in "Data Center Alley." First, they needed to get power from the existing Loudoun north/south main transmission line to "Data Center Alley" to relieve the constraint. Then, they needed to bring additional power into Loudoun County from the north and south and connect it to the main north/south line to address the rapid growth in aggregate Loudoun County power demand.

To tackle the first and more urgent challenge, Dominion announced it would build a closed loop connecting the north/south main transmission lines to "Data Center Alley" in eastern Loudoun.

³⁶ Plumer, Brad and Popovich, Nadja. "A New Surge in Power Use is Threatening U.S. Climate Goals." The New York Times. March 14, 2024. <https://www.nytimes.com/interactive/2024/03/13/climate/electric-power-climate-change.html>

³⁷ PJM. "Energy Transition in PJM: Resource Retirements, Replacements & Risks." PJM. February 24, 2023. <https://www.pjm.com/-/media/library/reports-notice/special-reports/2023/energy-transition-in-pjm-resource-retirements-replacements-and-risks.ashx>

³⁸ UNFCCC. "The Paris Agreement. What is the Paris Agreement?" UNFCCC. <https://unfccc.int/process-and-meetings/the-paris-agreement>

³⁹ World Meteorological Organization, WMO-No. 1368. "State of the Global Climate, 2024." https://library.wmo.int/viewer/69455/download?file=WMO-1368-2024_en.pdf&type=pdf&navigator=1

⁴⁰ Singh, Inayat. "At current rates, 5 key climate tipping points are already possible, new study warns." CBC. Sept. 11, 2022. "Climate Tipping Elements" graphic. <https://www.cbc.ca/news/science/tipping-point-climate-change-paris-agreement-1.6577630>

Dominion is now planning a new 500/230 Kv line from the Wishing Star to Mars substations in the southern part of the county and a 500/230 Kv line between the Aspen and Golden substations in the northern part of the county. The loop will be completed with the addition of a third 500/230 Kv line connecting the Golden substation in the northern portion of the loop to the Mars substation in the southern part of the loop. Again, these three lines don't add new power from outside the county, and they won't be built until 2028 at the earliest. They do not, by themselves, address the enormous future increase in demand projections expected for all of Loudoun County as a result of our high concentration of data centers.

To address this future demand and bring more power into the county, in December 2023 PJM accepted a proposal from NextEra, a Florida-based power company, to run a new 500 Kv line from an existing east/west line in West Virginia south through the heartland of western Loudoun County agriculture to connect to the north/south main transmission line. This proposal encountered fierce resistance from Loudoun citizenry, the BOS and environmental groups. As a result, in August 2024, PJM announced it would route the new line through the existing north/south right-of-way.⁴¹ Dominion later announced it would build a second 500 Kv line in the existing right-of-way and is also planning to run a new 500 Kv line from the south to connect to the main Loudoun County line. These three new lines will increase the aggregate size of the Loudoun power grid.

The table below provides an inventory of the main transmission lines of the current Loudoun grid and then adds the three new lines to the mix. To understand the table, one must understand how much power each type of line can deliver. According to several sources, as a rough planning factor, depending on distance, a 500 Kv line can normally deliver between 1.0-1.5 Gw of power and a 230 Kv line can deliver about 500 Mw of power.⁴² However, I've revised these power estimates based on recent conversations with Dominion Energy. According to their team, they've increased the amperage to 5,000 amps on 500 Kv lines and 4,000 amps on 230 Kv lines. Watts=Volts x Amps, so, by increasing the amps on these lines, more power can be delivered. With the increased amps, a 500 Kv line can now deliver an average load of about 2.1 Gw, and a 230 Kv line can deliver about 750 Mw. The table below shows the estimated power now being delivered into Loudoun County and projected with the new lines:

Current Lines Bringing Power Into Loudoun County:⁴³

- From the north: (1) 500 Kv line = 2.1 Gw; (2) 230 Kv lines = 1.5 Gw
- From the south: (2) 500 Kv lines = 4.2 Gw; (2) 230 Kv lines = 1.5 Gw
- Total currently coming into Loudoun = **9.3 Gw**, but not to "Data Center Alley"

Planned new lines by 2028 at the earliest:⁴⁴

⁴¹ Ferguson, Sheila. "Western Loudoun Power Line." Loudoun Wildlife Conservancy. Aug. 28, 2024.

<https://loudounwildlife.org/2024/08/western-loudoun-power-line/>

⁴² Power Engineers. "500 kV AC/DC Extra-High Voltage Transmission Project." Power Engineers. 2024.

<https://www.powereng.com/library/500-kv-acdc-extra-high-voltage-transmission-project>

⁴³ Open Infrastructure Map. <https://openinframap.org/#13.17/39.07107/-77.5192>

⁴⁴ Tesfa, Nebiat. "PJM Regional Transmission Expansion Planning (RTEP) Process." PJM. December 8, 2023. Slide presentation, slide 17. <https://www.pjm.com/-/media/committees-groups/stakeholder-meetings/ipsac/2023/20231208/20231208-item-02-1-pjm-regional-transmission-expansion-planning-process.ashx>

- Aspen/Golden (north E/W line; planned completion date June 1, 2028), Wishing Star/Mars (south E/W line), Golden/Mars line (eastern N/S connector for Aspen/Golden and Wishing Star/Mars). These constitute the closed loop to “Data Center Alley” but add no new power to the Loudoun grid
- New power from the north, Mid Atlantic Resiliency Link (MARL): (1) 500 Kv line = 2.1 Gw; Doubs/Aspen (1) 500 Kv line = 2.1 Gw
- New power from the south, Morrisville-Wishing Star line: (1) 500 Kv line = 2.1 Gw
- Total new Loudoun grid power planned: **15.6 Gw** (existing 9.3 Gw + 6.3 Gw new lines)

Yet as we saw earlier, with the advent of AI, Loudoun could easily see its power demand rise to as much as 20-30 Gw by 2030, far more than will be available through the above buildout schedule. While Dominion and PJM will likely assert this demand can be met by more infrastructure construction, I believe the data indicates these new transmission lines will not keep pace with the rapid increase in future demand in Loudoun County.

Nor have we addressed the 30 million sq. ft. of data centers recently approved in Prince William County immediately adjacent to Loudoun County’s southern border. If we assume a 1 million sq. ft. data center will request from Dominion about 150 Mw of power, the Prince William County campus will require about 4.5 Gw of power. And the lines delivering this added power will almost certainly come through Loudoun County.

Increasing Community Resistance

Prior to 2022, the proliferation of data centers in Loudoun County was largely confined to land parcels intended for data center construction, and they were largely accepted by our citizens. The BOS received occasional complaints about the loss of green space, the visual impact of massive data center buildings, the noise these facilities made both with cooling fans and backup diesel generators, and the environmental impact associated with extremely large power consumption, but this pushback was largely generalized. Our citizens also understood and accepted that Loudoun County data centers kept our real property tax rates about 25% lower than our Northern Virginia neighboring jurisdictions.

But in 2022, the Board of Supervisors began sensing real community resistance to more data centers in Loudoun County. At about that time, data center companies had started running out of industrial land to build on and had begun to exercise their “by right” options to build on parcels they had bought years earlier zoned for office parks, research and development parks and industrial parks, many of which are located near residential neighborhoods. This began to create real tensions between communities, Supervisors and the data center sector. For example, in 2019, there were no data centers in Ashburn District (the community of Ashburn actually encompasses two districts: Ashburn and Broad Run). As of this date, four hyperscale data centers are being planned or constructed in the Ashburn district, all “by right” and all across the street from residential communities.

Community resistance increased dramatically when in 2023, Dominion Energy announced it would need to construct four new overhead transmission lines to relieve the power constraints in the county and specifically in “Data Center Alley.” The previously mentioned Aspen/Golden line would run along Rte. 7, a heretofore unthinkable routing Loudoun County Boards for the

previous 25 years had sworn would never happen. Earlier in 2023, Dominion Energy had already announced development of the Wishing Star/Mars line in southern Loudoun, but that line would run through a flood plain away from houses and drew little community response. Then a new line would connect the new Golden substation in the north to the new Mars substation in the south to close the loop to “Data Center Alley.” Finally, a fourth line, a so-called “green field” transmission line—the previously mentioned MARL line—would run through western Loudoun County between the Potomac and Leesburg cutting across active farmlands, wetlands, tree conservation areas and through the historic village of Waterford. The public outcry was both immediate and predictable. As a result of that outcry, communities along Route 7 launched a year-long resistance movement to force Dominion to bury the 500/230 Kv line along Route 7, and a western coalition of citizens successfully pressured PJM to relocate the route of the new MARL line into the existing right-of-way coming into the county from Maryland. In October 2024, the State Corporation Commission announced it would not require Dominion to bury the Aspen/Golden 500/230 Kv line along Route 7.

Thus, between 2022-2024, community resistance to more data centers, more overhead transmission lines, more substations and more consumption of fossil fuel energy reached unprecedented levels and began to have a major impact on BOS decision-making. As discussed earlier, in March of 2024, for the first time, the BOS voted 5-4 to deny a major data center application to build a 2.9 million sq. ft. data center. The applicant resubmitted the application scaled down to 1.3 million sq. ft., the “by right” permitted size, and, to their credit, retained a substantial environmental package in the application. That scaled down application passed by a vote of 6-3. But that application marked the first time a major, new data center application was denied by the BOS.

The “by right” growth of data center construction since 2022 in Loudoun County has proven to be particularly problematic for the BOS. As a result, in late 2023, the BOS took steps to require BOS review of some of these types of parcels. Yet since 2022, “by right” construction has proliferated as land specifically intended for data centers became scarce.

This trend came to an abrupt end on March 18, 2025 when the Board of Supervisors, in a 7-2 bipartisan vote, ended all “by right” data center development in Loudoun County. With the exception of 22 data centers “grandfathered” with the vote, all new data center development in Loudoun County must now receive Board of Supervisors approval.²¹

To be clear, no one is to blame for this confluence of these three conflicting trends. The speed with which the entire data center environment has evolved is staggering, and each of the stakeholders has, heretofore and understandably, responded to that change largely within their respective silos and process paradigms.

BOS Focus. From the BOS point of view, prior Loudoun County Boards and the Department of Economic Development saw an opportunity to get in on the ground floor of revolutionary technology likely to bring enormous economic growth to our community. It enabled us for almost 20 years to lower taxes even though our population growth was the highest in Virginia for that entire period.

Data Center Focus. Similarly, the data center community was and is simply responding to revolutionary changes in the market and historic demand for data.

Utility Focus. And that demand for data has now translated into an insatiable demand for power. The energy utilities are required by law to provide sufficient power to their customers

even if demand for that power is increasing at an unprecedented rate. Asked at public meetings, including Board of Supervisors meetings, if they will be able to meet growing demand, they always assure their audiences they will—because the law requires them to.

Facing the New Realities

However we got here, we're here now. Going forward, it is incumbent upon all stakeholders—the data center community, Dominion Energy/PJM and the Board of Supervisors—to develop a strategy based on the new realities we face, a strategy that protects the quality of life of every Loudoun County citizen and reflects the tough choices we are clearly going to have to make. Based on the facts thus far presented, I believe the following are some obvious new realities we, as a Board, must address:

- 1. Artificial Intelligence will change, but not substantially diminish, the unique and critical role “Data Center Alley” plays within the world data center market.**

As mentioned previously, AI's demand for power will continue to grow exponentially, a reality we are experiencing every day. But going forward, we must also understand the changing functionality of Loudoun County's “Data Center Alley” with the advent of AI. Recently, I've heard conjecture that AI will obviate the need for our data center density because latency is not as important for AI. My research suggests this is an oversimplification. Here's why.

The key, historic advantage of Loudoun County's data center market is its latency: the speed with which data is transmitted from point A to point B. Because of Loudoun's extensive buried fiber optic network, we have the lowest (fastest) latency rates in the world. While it is true that latency is less important for AI in one regard, it still plays a vital role.

In layman's terms, AI processing occurs in two phases: training and inference. The training phase occurs when an AI process is “trained” to perform certain functions. The inference phase occurs when that trained AI model is then subjected to external inputs and applies its “training” to provide a learned and ever-evolving response.

The AI training phase is heavily dependent on computations within the cloud, computational processes for which Loudoun County's data centers have been historically well suited. Latency—“Data Center Alley's” key advantage—takes on a lesser role during the AI training phase, but, depending on market demands, can still play an important role.

The inference phase, a phase in which the AI model relies on its training to provide learned and evolved responses to the customer, is highly dependent on latency. A lower latency rate means the AI processes are far more responsive to a changing AI market environment.

The key takeaway here is that AI training and AI inference each rely on both cloud computations and latency to perform optimally. For this reason, I don't believe the development of AI will significantly reduce Loudoun County's vital positioning within the global data center marketplace.⁴⁵

⁴⁵ Farmer, Donald. “AI inference vs. training: Key differences and tradeoffs.” Tech Target. November 13, 2024. <https://www.techtarget.com/searchEnterpriseAI/tip/AI-inference-vs-training-Key-differences-and-tradeoffs>

2. **In the author’s opinion, as evidenced by PJM documents citing load violations existing since 2022 and Dominion’s establishment of a “constrained area,” the Loudoun County electric grid is now significantly oversubscribed, and planned new powerline construction will likely lag behind rapidly increasing power demand for years to come. This conclusion was also reached by the JLARC study released in December 2024.**

To be clear, “oversubscribed” does not mean the power grid is insecure; it means large customers with existing Electric Service Agreements (ESAs) will be power constrained—likely for years—by Dominion Energy until sufficient grid infrastructure is built to handle the contracted load. In its 2024 Integrated Resource Plan,⁴⁶ Dominion Energy illustrates how it constrains customer load below the contracted ESA amount for as much as seven years. In a letter to at least one large customer on August 22, 2024, a senior Dominion official confirmed this by stating, “However, the size and quantity of large scale requests requiring supporting backbone expansion results in an extension of planning analysis and project execution lead times. Therefore, we expect the typical duration of the planning and execution process for large (greater than 100 MW) DP [Delivery Point] requests within the Dominion Energy transmission zone (DOM Zone) to increase by 12 to 36 months [from the current 3-4 years to 4-7 years].”⁴⁷

3. **Halting new data center construction will not solve the problem.**

Even if all new data center construction is halted immediately, the oversubscription of the power grid in Loudoun County will continue as our dependence on AI—requiring up to a tenfold increase in processing power within existing data centers—proliferates throughout the world.

4. **“Data Center Alley” rapidly rising power demand will slow the retirement of fossil fuel power plants throughout the PJM/Dominion service area.**

This is the only way PJM/Dominion can meet the increasing demand, because the majority of power being delivered to Loudoun County data centers is derived from fossil fuels. This could be slowed somewhat if PJM/Dominion accelerate their conversion to carbon-net-zero fuels in response to aggressive data center programs demanding the utilities do just that, but the net result of these competing trends is difficult to predict.

5. **Community resistance is going to rapidly increase.**

Thus far proposed are the new 500 Kv MARL line entering Loudoun from the north along the existing north/south corridor, a second 500 Kv line from Doubs to Aspen in the north, a new Morrisville/Wishing Star 500 Kv line coming into Loudoun from the south, and the closed loop to “data center alley” comprising the new Aspen/Golden line proposed along Rte. 7 in the north, the new line from Golden-Mars through “Data Center Alley,” and the Wishing Star/Mars line closing the loop in the south. But as previously stated, this loop adds no new power, and these won’t be enough. A second line down Rte. 7 is probably next up. After that, Dominion will have likely used the last available routing to “Data Center Alley” that won’t require using eminent domain. The next available routes along the W+OD Trail or the Dulles

⁴⁶ “Virginia Electric and Power Company’s Report of Its 2024 Integrated Resource Plan.” Case No. PUR-2024-00184; Docket No. E-100, Sub 204. Pg. 14

⁴⁷ August 22, 2024 email from Dominion Energy official to a large Delivery Point customer. Available upon request.

Greenway will require the use of eminent domain to obtain the necessary right of way. Community resistance will build accordingly. If incumbent elected officials are then voted out of office, they will be replaced by other elected officials with a mandate to vehemently oppose the data center and utility sectors.

6. **Burying 500 Kv transmission lines delivering AC power is possible but challenging and expensive; burying 500 Kv High Voltage DC (HVDC) lines is much easier and more efficient, however historically, HVDC lines have only been used to transmit power over long distances. Loudoun County may offer an excellent opportunity to develop the nation's first underground HVDC regional grid for exclusive use by data centers.**

As stated earlier, in October 2024, the Virginia State Corporation Commission denied the citizens' petition to underground the new 500/230Kv line from Aspen to Golden substations. Undergrounding a 500 Kv AC line has only been done once in the U.S. In 2013, an underground 500 Kv line was constructed traversing 3.7 miles through Chino Hills, CA. The project took three years and cost \$224 million (not including the seven years of court battles).⁴⁸ Underground lines transmitting AC power must be insulated, usually with oil, and buried in a concrete tunnel, require much higher power transmission to deliver the same energy due to energy losses underground, are much harder and take longer to repair, and are not practical over long distances.⁴⁹

Undergrounding HVDC is now a viable alternative, loses very little power when buried, is used in many locations around the world and accepts renewable energy additions to the grid more easily.⁵⁰ While HVDC generally only makes sense for transmission over very long distances, the unique circumstances in Loudoun County, with its very high concentration of data centers within a relatively small geographic area, may offer an opportunity to develop a separate HVDC regional grid for the exclusive use of Loudoun County data centers. This would offer two, major advantages: 1) it would create an entirely separate grid for data centers enabling a separate Dominion billing structure for data center users exclusive of residential and other commercial users, and 2) because HVDC is a more efficient means of transmitting carbon net-zero power, it would facilitate the transmission of carbon net-zero power (solar, wind, etc.) from numerous sources directly to "data center alley." Attachment 1 to this white paper outlines a concept for developing an underground HVDC power grid in Loudoun County, within the existing HVAC rights of way, dedicated exclusively to our data centers.

7. **Solar and wind, by themselves, are not viable alternatives for Loudoun County data centers.**

⁴⁸ Nisperos, Neil. "Edison about to flip the switch on controversial power line project through Chino Hills." Daily Bulletin. October 30, 2016. <https://www.dailybulletin.com/2016/10/30/edison-about-to-flip-the-switch-on-controversial-power-line-project-through-chino-hills/>

⁴⁹ XcelEnergy. "Overhead vs. undergrounding. Information about burying high-voltage transmission lines." XcelEnergy Information Sheet. 2021. <https://www.transmission.xcelenergy.com/staticfiles/microsites/Transmission/Files/PDF/Projects/CO/Avery/Transmission-CO-Avery-Substation-Overhead-Vs-Underground-Info-Sheet.pdf>

⁵⁰ NextGen Highways Fact Sheet. "Buried High-Voltage Direct Current (HVDC) Transmission is Cost Competitive." November, 2022. https://nextgenhighways.org/wp-content/uploads/2023/01/NGH_Buried-HVDC-Cost-Competitive.pdf

- a. **Solar.** The average solar panel has a capacity factor (explained below) of about 24%. This means, due to clouds, darkness and other external factors, solar panels only deliver an average of about 24 percent of their “nameplate” (maximum rated power) per hour during a year. While estimates vary between 5-10 acres required per 1 Mw of nameplate power based on the topography and support structure layout, a reasonable planning factor for a commercial solar field using state-of-the art technology is about 5 acres of land per Mw.⁵¹ Loudoun County had about 200 data centers with 4.14 Gw of power capacity in 2024. Assuming a 100 Mw data center average, and a capacity factor of about 24%, that usage level would require 400,000 acres of solar panels. Loudoun County’s entire land mass is 333,000 acres. If power demand in Loudoun County for the next five years grows at the same rate as the previous five years (this does not account for AI growth), the county will be using 11.43 Gw of power in 2029. Solar power alone is simply not a viable answer for Loudoun County.
 - b. **Wind.** As an illustrative, Vineyard Wind, a 62-turbine wind farm being built off the coast of Martha’s Vineyard, will generate 806 Mw (nameplate) of electricity when complete, but only 193 Mw per hour on average after applying a 34.3% capacity factor.⁵² At completion, this offshore wind farm theoretically will generate enough power to power 400,000 homes in the local area at nameplate power. But in practice, at an average of only 193 MW/hour, it would meet the power needs of about two of Loudoun County’s 200 data centers.
8. **The 135-yr. old paradigm of power generated by large, remote power plants and transmitted across hundreds of miles of transmission lines will no longer work for Loudoun County’s globally unique needs.**

Given the above power demand projections and the time required to build new power infrastructure, it seems highly unlikely our traditional approach of delivering power to a consumer market as large and growing as Loudoun County can safely and effectively serve our needs.

Only Three Possible Scenarios Exist to Reduce or Stabilize Future Data Center Power Demand

If, as this paper and the JLARC study predict, the power grid infrastructure in Loudoun County—even with its planned expansion—will be insufficient to meet the future energy demand of the county’s data center market, there are only three possible future scenarios by which that demand can be stabilized to manageable levels:

Scenario #1: Government-Imposed Energy Use Constraints. In this scenario, the Commonwealth of Virginia, the power utilities or both artificially constrain the energy consumption of high-energy consumers to ensure grid stabilization for all Virginia energy consumers. Such constraints are already in place in Loudoun County and are likely to remain in place for the foreseeable future. As stated earlier, Dominion Energy has already

⁵¹ Community Solar Authority. “How Much Land for 1 Mw Solar Farm: A Quick Guide.” Community Solar Authority. May 31, 2024. <https://communitysolarauthority.com/how-much-land-for-1-mw-solar-farm-a-quick-guide/>

⁵² Vineyard Wind. “Avangrid, CIP Announce First Power from Nation-Leading Vineyard Wind 1 Project.” Vineyard Wind. January 3, 2024. <https://www.vineyardwind.com/press-releases/2024/1/3/cip-avangrid-announce-first-power-from-nation-leading-vineyard-wind-1-project>

extended the planning and execution time for delivering requested power to large consumers from 3-4 years to 4-7 years. In the author's opinion, this extended delay for full-power access will likely only increase. The JLARC study tacitly acknowledges this trend in its recommendation #2:

“The General Assembly my 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)”⁵³

Like many aspects of the Loudoun County data center environment, I believe this de facto power constraint is a harbinger of what's to come globally for the data center market. We are the “canary in the mine.” Data center power constraints were hardly mentioned in large data center conferences I attended in 2023. Now, they are a key topic in virtually every major data center conversation. Artificial caps on available power for data centers will likely become the norm as utilities struggle to achieve their core mission mandate, grid resiliency for all customers. A recent article in AP highlights this growing trend throughout the country.⁵⁴ This reality establishes the foundational argument for two subsequent market evolutions: 1) continuing technological advancements requiring less power within data centers, and 2) the development of microgrids to reduce data center dependency on the grid.

Scenario #2: Technological Breakthrough. Technological breakthroughs are now on the near horizon that are likely to significantly reduce the power needed by AI and cloud-based computing. Such developments will initially reduce strains on the power grid and give the power utilities time to adjust to meet the growing infrastructure needs of the industry. For example, a July, 2024 article in Windows Central discusses the newly emerging chip technology called computational random-access memory (CRAM) that would reduce generative AI's power consumption by 1000-fold potentially achieving a 2,500 percent energy savings.⁵⁵ Note: this scenario could lead to significant stranded costs (discussed below). As discussed below, such technological breakthroughs would likely be iterative and provide only temporary relief.

Scenario #3: Industry Conversion to Onsite Power. Faced with exponential market demand and possessed with almost unlimited resources to meet that demand, the data center industry will likely develop the capacity to generate onsite power through microgrids for its operations and, in so doing, significantly reduce its reliance on the regional power grid. Such developments could eventually stabilize the grid by allowing an industry-wide, demand response system to develop. The JLARC study specifically recommends a change

⁵³ Joint Legislative and Audit Review Commission. “Data Centers in Virginia, Commission Draft.” Report to the Governor and the General Assembly of Virginia. December 9, 2024, pg. xi.

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

⁵⁴ AP. “US electric grids under pressure from energy—hungry data centers are changing strategy.” AP. September 13, 2025. <https://apnews.com/article/big-tech-data-centers-electricity-energy-power-texas-pennsylvania-46b42f141d0301d4c59314cc90e3eab5>

⁵⁵ Okemwa, Kevin. “This breakthrough tech could solve Microsoft's AI power consumption woes and is 1,000x more energy-efficient.” Windows Central. July 29, 2024. <https://www.windowscentral.com/software-apps/this-breakthrough-tech-could-solve-microsofts-ai-power-consumption-woes-and-is-1000x-more-energy-efficient>

to state code requiring data centers to participate in demand response systems that would enable data centers to shift their loads on the grid to stabilize grid resiliency.⁵⁶ This would better enable the power utilities to meet the more predictable infrastructure needs of the industry. This evolution has already begun in Loudoun County (see below). Note: this scenario could lead to significant stranded costs (see below).

Likely Future: All Three Scenarios Occur Simultaneously and Energy Demand Still Grows

The three scenarios will likely occur simultaneously but to differing degrees based upon market conditions. The utilities have already begun delaying additions of large loads to the grid, and the JLARC study recommends codifying this in state code to allow delays for limited generation or transmission capacity (scenario #1). Meanwhile, new GPU (AI) chips are emerging that use significantly less power (scenario #2), and we already have examples of data centers in Loudoun County building advanced microgrids to reduce their dependence on grid power (scenario #3). All three scenarios will continue to develop for the foreseeable future.

But even as these three scenarios evolve in varying degrees and temporarily reduce demand on the power grid, data centers will adjust, increase data processing density to fill the space created by the efficiencies, and once again operate at maximum capacity using all the power available to them. The JLARC study acknowledges this critical point. They quote one data center representative who succinctly captures the phenomenon known as Jevon's Paradox⁵⁷:

“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.’”⁵⁸

And so, in its continuing quest for more power, the data center industry will evolve in order to meet market demand. The utilities will begin to artificially cap that demand, as they eventually must do to preserve grid resiliency (scenario #1), the data industry will produce ever more energy-efficient chips (scenario #2), and data centers will strive to become less reliant on grid power by developing microgrid, onsite/communal/distributed energy baseload, backup and stored power (scenario #3).

I believe the development of onsite microgrid power will reshape the national power grid going forward, though due to geographic constraints and our very dense data center market, its applicability in Loudoun County will be limited. As access to grid power becomes more and more constrained and chip efficiencies constantly evolve, a comprehensive demand response system will become the core of a regional and even nationwide distributed energy system. This is the heart of the new energy paradigm. Local, regional and national demand response systems will enable onsite power sources to stabilize hourly grid operations.

Assessment of the 2024 JLARC Data Center Study⁵⁹

The 2024 JLARC study concurs with the basic premise of this white paper, namely that it will be either “very difficult” or “difficult” to build sufficient infrastructure to meet the projected energy demands of the data center industry. Unfortunately, the study’s underlying premise and all its

⁵⁶ Joint Legislative Audit Review Commission. “Data Centers in Virginia, 2024: Report to the Governor and General Assembly of Virginia.” Pg. 38-40. <https://jlarc.virginia.gov/pdfs/reports/Rpt598-2.pdf>

⁵⁷ Wikipedia. “Jevon’s Paradox.” https://en.wikipedia.org/wiki/Jevons_paradox

⁵⁸ Ibid, pg. 41.

⁵⁹ Joint Legislative Audit Review Commission. “Data Centers in Virginia, 2024: Report to the Governor and General Assembly of Virginia.” <https://jlarc.virginia.gov/pdfs/reports/Rpt598-2.pdf>

recommendations and policy options represent a tacit acceptance of scenario #1 above as the only possible way to reduce the energy demands of the data center sector.

Of the study's eight recommendations, six deal with data center siting or locally imposed performance standards to improve energy efficiencies. Yet the study plainly states improved performance measures would have a limited impact on decreasing data center sector energy demand:

“Improving data center efficiency makes better use of energy but is likely to have only a marginal impact on demand.”⁶⁰

One recommendation suggests allowing utilities to delay but not deny data center construction to protect the grid. This is already occurring; the change would simply legally codify the practice. It also doesn't reduce increasing energy demand.

Finally, the one remaining recommendation addresses stranded costs (see below).

Of the study's ten policy options, eight suggest the General Assembly should use the state sales tax exemption as an incentive to encourage data centers to use less energy. The study acknowledges such actions could have significant, unintended consequences on the data center sector. In fact, this option would have a devastating impact on Loudoun County's economy:

“If the General Assembly wishes to slow down the data center industry's growth in Virginia...it could allow the sales tax exemption to expire.... 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.”⁶¹

In short, the entire study essentially recommends two broad approaches: 1) local governments should use performance standards to improve energy efficiency, measures it acknowledges will have only a limited impact on reducing sector energy consumption, or 2) state government should use the state sales tax exemption to incentivize greater energy efficiency, precisely the type of artificial government intervention described in scenario #1, to reduce sector energy demand. Very brief mention is made of either technological breakthroughs (scenario #2) or onsite/communal power generation through microgrids (scenario #3) as ways to significantly reduce demands on the regional power grid.

Stranded Costs

As mentioned above, scenarios #2 and #3 could easily result in what the utility industry refers to as “stranded costs.” Stranded costs occur when a regulated utility, required by law to meet the energy demand of its customers, is forced to build new infrastructure to meet predicted, future demand for energy, and, at some time during the infrastructure buildout process, that predicted demand is not realized. The regulated utility has incurred the costs of the buildout, but the consumer demand no longer justifies those costs. The utility must then absorb the costs or pass them on to residential and small commercial customers.

Normally, this is not a major challenge as historically, energy demand has been both relatively stable and predictable over time. For example, PJM charts illustrate that energy consumption between 2007-2017 in the Dominion service area decreased slightly, presumably due to realized

⁶⁰ Ibid, pg. 40

⁶¹ Ibid, pg. 88-89.

efficiencies.⁶ In such a stable market, predicting future energy demand, while a complex process, is relatively straightforward.

Since 2022, however, energy demand in Northern Virginia and particularly in Loudoun County, has increased rapidly and exponentially making it extremely difficult to accurately predict future power demand. Despite the turbulence in the marketplace, because Virginia is a regulated state, the investor-owned utilities must plan to build that infrastructure even though the predicted demand may never be realized.

Such is the case with scenarios #2 and #3. If PJM and Dominion Energy build billions of dollars of new generation and transmission infrastructure to meet what at present appears to be enormous future demand, and data centers subsequently find a way to process data using far less energy or move heavily towards microgrids and onsite power generation, the costs to the utility companies of that new infrastructure become “stranded” because demand for grid energy has dropped. The Virginia State Corporation Commission specifically addressed the issue of stranded costs at its December 16, 2024 technical conference.⁶²

One way to insulate utility companies from stranded costs is to allow the utilities to charge major energy consumers an upfront tariff to absorb the cost of the infrastructure development should demand suddenly drop. This tool was used in May, 2024, when AEP Ohio filed a plan with the Public Utilities Commission of Ohio (PUCO) to require data centers to commit to a 10-year plan to make monthly payments equal to 90% of the cost of the energy they said they needed even if they ultimately didn’t use that much energy.⁶³ In July, 2025, over strong objection from the data centers, PUCO approved a modified version of AEP’s request and imposed a data center tariff requiring data centers to pay for 85% of the power they contracted for whether or not they use that much power. The tariff would be in effect for twelve years.⁶⁴ The Virginia State Corporation Commission is considering just such a tariff structure.

Strategies for the Future

Clearly there is no “silver bullet” to meet these complex challenges, especially in Loudoun County. Any approach will require the thoughtful integration of a range of options to meet the growing demand for more power from the data center sector in ways that do not drastically and negatively impact the quality of life of our residents or the stability of our economy. Obviously whatever strategies are developed will be policy decisions for the Board of Supervisors to make by a majority vote.

Offered below are some suggested options by the author and as such are entirely subjective and debatable. They will likely generate considerable discussion, hopefully based upon the factual foundation thus far provided. It seems clear however that, over the next ten years, unless the data

⁶² Pamploni, Hanna. “State Leaders Grapple with Infrastructure, Generation Costs.” Loudoun Times Mirror. December 31, 2024. https://www.loudounnow.com/news/state-leaders-grapple-with-infrastructure-generation-costs/article_ebb47fac-c7b1-11ef-808d-df584e150bf9.html?utm_source=loudounnow.com&utm_campaign=%2Fnewsletter%2Foptimize%2Fdaily-headlines%2F%3F-dc%3D1735676910&utm_medium=email&utm_content=read%20more

⁶³ AEP Ohio. “AEP Ohio Files Plan to Secure Grid Resources for Data Centers, Protect Residential Customers.” AEP Ohio news release, May 13, 2024. <https://www.aepohio.com/company/news/view?releaseID=9539>

⁶⁴ Wolfe, Sean. “Ohio utility regulators approve AEP’s contested data center tariff proposal.” Power Engineering. Factor This. July 10, 2025. [link proprietary]

center industry undergoes a major technological transformation enabling it to significantly reduce its power consumption permanently, the Board of Supervisors will likely be faced with a repeating binary choice:

- 1) Accept the traditional paradigm of AC power generated at massive, remote power plants, transmitted over hundreds of miles of overhead transmission lines, then delivered to customers, including Loudoun's data centers with their historic demand for power. The likely result will be a significant threat to Loudoun County's power grid resiliency and a lattice of overhead transmission lines throughout Loudoun County, or;
- 2) Reject that 135-yr. old power infrastructure paradigm and facilitate the data center sector's market-driven move to a radically new power delivery model and market environment. Large power consumers will find ways to reduce their power needs while simultaneously generating low or carbon-net-zero power onsite or locally to enable them to participate in a demand response system and deliver surplus power onto the regional power grid as part of a nationwide distributed energy network. This is precisely the model the Department of Defense (DoD) has adopted. In a recent update to Title 10, DoD has directed all Services to make select military bases and critical installations energy independent and resilient through the use of onsite, sustainable energy generation, including long-term energy storage and nuclear and hydrogen power generation. This program is now being implemented worldwide.⁶⁵

Here, then, are some possible strategies for consideration:

1. PJM/Dominion Energy: Increase Transmission Capacity.

a. Reconductoring.

The 2025 session of the Virginia General Assembly passed a law requiring all new transmission lines in Virginia to use advanced conductors (transmission lines). Dominion has advised they now plan to replace their existing lines with advanced conductors and use advanced conductors for all new lines in Loudoun County. They will use Aluminum Conductor Steel Supported (ACSS) line. Depending on other upgrades, this will cost about 35% more than the cost of the current type of conductor in use for the past 100 years. ACSS conductors can increase line capacity by 50-100%, are the cheapest of the new alternatives and are proven technology. This type of conductor has been in use since the 1970's but is still considered an "advanced conductor" option because of the capacity increase.

While there are several other advanced reconductor options, the most common new alternative to ACSS is Aluminum Conductor Carbon Core (ACCC) conductors. Developed around 2003, this would also increase capacity by about 100%. It's a lighter line and delivers increased capacity, but is prone to breakage during installation, has

⁶⁵ TITLE 10 / Subtitle A / PART IV / CHAPTER 173 / SUBCHAPTER I / § 2911. May 31, 2024.
[https://uscode.house.gov/view.xhtml?req=\(title:10%20section:2911\(b\)%20edition:prelim\)](https://uscode.house.gov/view.xhtml?req=(title:10%20section:2911(b)%20edition:prelim))

had some recent, unforeseen challenges, has challenges in icing conditions and costs about three times more than ACSS conductors.⁶⁶

The newly reconducted lines would eventually be overtaken once again by rising demand, but, if combined with other measures, could be a valuable tool in building a new energy transmission paradigm.⁶⁷

b. Create an Underground, High Voltage Direct Current (HVDC) Parallel Power Grid in the Existing Dominion HVAC Transmission Line Rights of Way in Loudoun County. (See atch.1 for a Loudoun County concept plan.)

The National Renewable Energy Laboratory (NREL), a Department of Energy laboratory, is exploring the expanded use of HVDC transmission lines in more multiple connection environments.⁶⁸ Recent technological advances now make the use of HVDC transmission lines a real alternative to the present AC-power dependent U.S. power grid. HVDC transmission lines are currently used in many countries. An HVDC transmission line is far more efficient in transmitting high-voltage power across long distances, experiences much less power loss through transmission, can be buried underground much more easily and with little loss of power, and is much better suited to allowing a grid to accept power from renewable and onsite sources.⁶⁹ There are currently three underground HVDC projects in the U.S.: Soo Green, IA, Champlain Hudson Power Express, NY, and Clean Path, NY.⁷⁰

What if PJM, Dominion Energy, the data center community in Loudoun County, the Commonwealth of Virginia and Loudoun County government collaboratively proposed to DoE and NREL the creation of a national pilot project to create a separate, underground, HVDC power grid in Loudoun County specifically to deliver HVDC power directly to Loudoun County data centers, the highest concentration of data centers in the world? This entire HVDC grid, capable of delivering 2 Gw of HVDC power, could be placed underground in a five-foot underground trench within the existing Dominion HVAC overhead transmission line rights of way. TenneT Netherlands is a company specializing in underground HVDC transmission projects and is engaged in several of these types of projects in Europe.⁷¹ Data centers could begin planning to fully convert to internal DC power by 2028, the projected completion date for some of the new lines. At

⁶⁶ Idaho National Laboratory. "Advanced Conductor Scan Report." Idaho National Laboratory. Dec. 2023; revision April, 2024. https://inl.gov/content/uploads/2024/02/23-50856_R8_-AdvConductorsScan-Report.pdf

⁶⁷ Plumer, Brad. "The U.S. Urgently Needs a Bigger Grid. Here's a Fast Solution." The New York Times. April 9, 2024. <https://www.nytimes.com/2024/04/09/climate/electric-grid-more-power.html>

⁶⁸ NREL. "On the Road to Increased Transmission: High-Voltage Direct Current." NREL.gov. June 12, 2024. <https://www.nrel.gov/news/program/2024/on-the-road-to-increased-transmission-high-voltage-direct-current.html>

⁶⁹ Berthou, Andreas. "The Benefits of High-Voltage Direct Current (HVDC) Power." EE Power. October 19, 2020. <https://eepower.com/technical-articles/the-difference-that-dc-makes/#>

⁷⁰ NextGen Highways. "Buried High-Voltage Direct Current (HVDC) Transmission is Cost Competitive." NextGen Highways. November, 2022. https://nextgenhighways.org/wp-content/uploads/2023/01/NGH_Buried-HVDC-Cost-Competitive.pdf

⁷¹ TenneT. <https://www.bing.com/videos/riverview/relatedvideo?q=underground+hvdc&mid=CBFAD8D2D54C82255EC5CBFAD8D2D54C82255EC5&FORM=VAMTRV>

completion of the pilot project, Loudoun County would have two separate power grids, an HVAC grid for residences and normal-sized commercial customers, and an HVDC grid exclusively for data centers.

If PJM and Dominion must build the new HVAC lines anyway, why not make the project a national pilot project and incorporate state-of-the-art technology throughout the pilot project? This would include using all advanced conductors to double overhead HVAC line capacity supplemented by a buried HVDC transmission grid to distribute DC electricity directly to data centers.

The advantages of this admittedly bold concept would be significant:

- 1) The existing HVAC power grid in Loudoun County would immediately stabilize as data centers were moved off that grid;
- 2) A large infusion of DoE funding would relieve PJM and Dominion Energy of the burden of financing the currently planned infrastructure upgrades, a burden existing residential and commercial customers will undoubtedly have to bear;
- 3) Two separate grids would facilitate two separate billing systems for Dominion Energy, thereby relieving residential/small commercial customers from having to help pay the added infrastructure costs associated with the growing power consumption by the data centers;
- 4) The new HVDC power grid could be buried within existing rights of way;
- 5) The new HVDC grid would be much more adaptable to the incorporation of onsite data center microgrids with multiple DC power sources such as natural gas, battery backup, hydrogen fuel cells and distant solar/wind inputs.

In September, 2025, to prove both this concept and the corollary concepts of regional microgrids and long-duration energy storage, the author, in cooperation with Emtel Energy—USA, proposed the creation of just such a pilot project in Loudoun County comprising a regional HVDC underground power grid, a long-duration energy storage field, natural gas turbines and a utility-scale solar field, all contained in a 300-acre installation called NOVA SES-1 (See atch. 1: “NOVA Strategic Energy Storage-1”). NOVA SES-1 would be capable of storing 10 GWh of electricity, could recharge every 2-3 days and would deliver its power directly to participating data centers via a regional underground HVDC grid laid within the existing HVAC rights of way.

2. Loudoun County:

- a. **Create Performance Standards Requiring New Data Centers to Conserve Energy and Develop Microgrids.** We must insist new data centers adhere to rigorous energy-conserving performance standards while incorporating essential microgrid elements into their campus designs enabling them to significantly lower their projected power load on the regional grid.
- b. **Create an Incentive/Disincentive Program to Encourage/Require Existing Data Centers to Operate More Sustainably and Reduce Community Impact.** While retrofitting existing data centers to incorporate microgrids may, at present, be impractical, steps can be taken to reduce emissions, reduce noise levels and

improve viewsheds. It may also be possible in the near future to incorporate several microgrid elements on existing data center campuses.

The planning objective for both new and existing data centers should be to demonstrate a commitment to the Loudoun County Board of Supervisors to reduce their load on the grid and their impact on the surrounding community over time.

Loudoun County's highly dense data center environment is unique in the data center world today. This means we are literally on the frontier of a new digital age. The county's key stakeholders are now faced with a simple binary choice: lead, through innovation and imagination, or wait and react too little, too late to a rapidly expanding traditional power grid infrastructure inappropriate for Loudoun County's needs and unable to solve our unique demand challenges.

What is a Microgrid?

A microgrid generally consists of five elements: 1) a major power "load" or consumer such as a data center, 2) an onsite or nearby communal baseload power source (power delivered continuously to sustain normal, daily operations), 3) an optional backup power source to supplement the baseload power source during times of grid instability or to store excess power, 4) connections to the utility power grid enabling upload of excess power or operation of the microgrid independently in "island" mode, and 5) a system to manage all elements of the microgrid and determine if, when and how the microgrid should interface with the regional power grid.⁷²

If we accept the premise the traditional power grid infrastructure serving the nation, by itself, will ultimately not be able to meet the unprecedented aggregate nationwide increase in demand for power—and some may not accept that premise—then the only viable national-scale alternative is a distributed energy network. Such a distributed energy network would offer nationwide power grid resiliency and redundancy in much the same way information stored in "the cloud" is continuously available through any smart device and not susceptible to any single device failure.

A distributed energy network would comprise thousands of microgrids around the country continuously generating baseload power for their onsite customers, storing energy for periods of grid instability, and uploading excess energy to the national grid when available to increase grid resiliency. These microgrids could be as large as data-center scale microgrids generating hundreds of megawatts of power, smaller scale microgrids to provide backup power to large consumers or even tiny, point source microgrids such as individual electric vehicle charging stations whereby your personal vehicle, once fully charged, begins to discharge onto the local power grid.

The Challenges of Developing Microgrids in Loudoun County

Though the solution for the national power grid may be the development of a nationwide distributed energy network through microgrids, such a solution has limitations for widespread deployment in Loudoun County. While I believe the development of a nationwide distributed energy grid infrastructure is highly likely, such a model presents significant challenges in Loudoun County for one reason: land. Our 200+ data centers are packed into about 30 square miles of real estate in eastern Loudoun County, and "data center alley" is literally a zero-lot-line checkerboard of data centers built on just about every square meter of space. My research suggests microgrids capable

⁷² NREL. "Microgrids." <https://www.nrel.gov/grid/microgrids.html>

of generating the baseload power many of our data centers would require would likely need land that simply isn't available.

However, even with that limitation, an organic evolution within the industry is now gaining momentum in Loudoun County. The Board recently learned of a "by right" natural gas microgrid operating in Loudoun County in "island" mode (not connected to the power grid but operating autonomously) that has been under development for the past two years. Because it was "by right," the application did not come before the Board. In August 2022, the company was forced to develop this microgrid when, after signing a billion-dollar land lease for its property, Dominion Energy informed the landowner it would not be able to provide power for several years. The site is now operating eight natural gas turbines with Selective Catalytic Reduction (SCR; see below) units attached and is in full compliance with federal EPA, Virginia DEQ and Loudoun County emission and noise regulations. They plan to expand the concept to a second campus soon. Similarly, another company recently submitted an application to build a 750 Mw data center campus in Loudoun County powered, at least in part, by blue hydrogen fuel cells (see below).

Thus, while fully autonomous, carbon-net-zero, baseload microgrids may not be immediately feasible for many Loudoun County data centers, several microgrid elements could be adapted and applied to our existing data centers as transitional steps moving us to a distributed energy, fully carbon-net-zero data center environment in the future. For example, the natural gas generators in the example above have SCR units attached. These SCR units reduce Nitrogen Oxides (NOX), inhalable Particulate Matter (PM2.5), and Hydro-Carbons (HC) to Tier IV Final EPA emission standards, the strictest standards in the industry. They remove about 95% of emissions. If Loudoun County were to create incentives or require, through new performance standards, existing data centers to replace their 4,000 diesel generators with either Tier IV diesel generators or natural gas generators, the county would experience a significant reduction in CO2, PM2.5, NOX and HC emissions and noise levels. With this in mind, let's examine the various onsite power generation options either available now or being developed in the near future.

In researching this paper, I encountered a common theme among many I talked to when I raised the issue of carbon-net-zero onsite power production. Many believe such onsite power production is still purely theoretical and that practical demonstrations of this technology are years away. I was one of those people. What I have learned, however, is that there are several working installations delivering onsite power with the potential to provide the Loudoun County data center sector with various options for a viable way forward.

Potential Onsite Power Sources for Loudoun County

Given the current state of our technology, here are the six sources of onsite power that could be tailored to meet Loudoun County's unique microgrid challenges: (I include Small Modular Reactors (SMR) and Advanced Nuclear Reactors (ANR) because, while largely unproven and likely not practical in Loudoun County, they offer the most efficient carbon net-zero solution, and there is global interest in their rapid development) :

Power Source Type	Baseload Capacity	Carbon-Net-Zero	NOX, PM2.5 Free
Diesel Backup Gen. w/SCR		Tier IV	Tier IV
Batt./Long-Duration Storage		✓	✓

Natural Gas Turbine w/SCR	✓	Tier IV	Tier IV
Green Hydrogen Fuel Cells		✓	✓
Blue Hydrogen Fuel Cells			
SMR/ANR	✓	✓	✓

Below are the pros and cons of each power source:

Battery Energy Storage Systems (BESS).⁷³ A lithium battery energy storage system captures energy from various sources and stores it for later use. These are most often used to capture renewable energy produced, for example, from solar or wind installations, but they can be used to store energy from any source. They are typically used as backup power to augment a continuous power supply.

Advantages: Carbon-net-zero; no pollution; no noise.

Disadvantages: Not a source of sustainable, baseload power; lithium for batteries is becoming scarcer, and the fire hazard requires new suppression methods. These batteries must retain 20% of their charge to preserve the life of the battery, only have about a 10-yr. operational life, and have only one discharge rate.

Long-Duration Energy Storage.⁷⁴ While definitions vary, LDES typically refers to energy storage systems capable of delivering power for at least 8–12 hours or longer—well beyond the limits of conventional lithium-ion Battery Energy Storage Systems (BESS). LDES solutions step in where lithium leaves off, offering safer, more sustainable, and more scalable options.

In my research, I have found only one company currently mass-producing LDES at scale: Emtel Energy USA. Their ENVAULT Electrostatic Long-Duration Energy Storage (ELDES) unit offers flexible discharge durations ranging from instantaneous to more than 24 hours. Unlike lithium-based systems, ENVAULT carries no thermal runaway or propagation risk, relies on graphene rather than lithium, and is fully recyclable. It contains no hazardous materials or emissions, has a significantly longer service life, and is designed to complete multiple charge-discharge cycles daily with negligible capacity degradation.

The ENVAULT system units can be mounted on skids for rapid transport, stacked vertically, and configured into high-density arrays. For example, a 24-unit stacked installation can store 10.4 MWh of energy on a pad measuring just 40 feet by 30 feet (including skids, platforms, and a 12-foot forklift lane). At scale, this configuration achieves approximately

⁷³ ABB. “What Are Battery Energy Storage Systems?” <https://electrification.us.abb.com/battery-energy-storage-systems-bess-basics>

⁷⁴ Mullendore, Seth. “Long-Duration Energy Storage: What Is It, Why Do We Need It, and When Will It Get Here?” Clean Energy Group. May 5, 2025. <https://www.cleangroup.org/what-is-long-duration-energy-storage/>

322 MWh of storage per acre. That density is critical for land-constrained applications such as those found in Loudoun County.

Advantages: No fire hazard; versatile charge/discharge options; 20-yr. service life; 98% efficient discharge; no precious metals; bio-degradable materials; high storage density.

Disadvantages: Not a source of baseload power; requires an energy generation source which, in turn, determines its climate change impact.

Natural or Renewable Gas.^{75, 76} Natural gas (local pipeline) onsite power generation is not carbon-net-zero and is a fossil-fuel derived energy source. If used to generate baseload power without active emission controls, it has significant CO₂, NOX, PM2.5, HC and CO emissions. These can be significantly mitigated (by 90-95%) through the use of Selective Catalytic Reduction (SCR) mentioned earlier, a modification that should be mandatory in Loudoun County. Renewable natural gas (RNG or “biomass” gas) is waste gas produced by organic waste, captured, and delivered to the microgrid. Since the waste gas would otherwise be released into the air, using waste gas to run generators can reduce the net CO₂ emissions even considering the CO₂ released in burning the gas. It too may use SCR to reduce emissions.

Advantages: Biomass or renewable natural gas may reduce total CO₂ emissions by capturing and using waste gas that would otherwise be released into the atmosphere; natural gas has lower carbon emissions than diesel and these are significantly reduced by the use of SCR; it can provide sustained, baseload power; it can rely on existing gas lines; it could replace Loudoun’s 4,000 diesel backup generators; a gas microgrid design could easily accommodate a different energy source (hydrogen fuel cells, nuclear) in the future.

Disadvantages: Even with SCR, gas turbines run on fossil fuel, create some emissions, and create sustained noise levels requiring mitigation; they could easily oversubscribe the gas grid with widespread use; natural gas power plants are notorious for leaking methane—up to 80-100 times more harmful to global climate than CO₂—when extracting the natural gas and preparing it for pipeline delivery.⁷⁷

Important Note for Loudoun County: Natural gas turbines can deliver onsite, baseload energy today by tapping into local Loudoun County natural gas lines. It may be the quickest, cheapest option for onsite baseload power for our data centers and could quickly become their local option of choice if not regulated. However, it is essential the county mandate the use of SCR for all natural gas turbines in the county to significantly mitigate emissions. Also, baseload turbines would run 24/7/365, and the one existing natural gas microgrid in the county has a noise level of 65db at the property boundary directly across the street from a

⁷⁵ <https://enchantedrock.com/the-advantages-over-diesel/>

⁷⁶ <https://www.sapphiregasolutions.com/renewable-natural-gas/>

⁷⁷ Climate Portal. “How much does natural gas contribute to climate change through CO₂ emissions when the fuel is burned, and how much through methane leaks?” Ask MIT Climate. July 17, 2023. <https://climate.mit.edu/ask-mit/how-much-does-natural-gas-contribute-climate-change-through-co2-emissions-when-fuel-burned>

residential neighborhood. Our zoning ordinance would have to be changed reducing that noise level to a maximum of 55db at the sending property line.

Hydrogen Fuel Cells.⁷⁸ Hydrogen is present in abundance throughout nature, but it is rarely available in a free form. Instead, it is usually part of the chemical makeup of other energy sources such as oil, gas, biomass or even water. Through a process called reforming, hydrogen molecules are stripped off these compounds, passed through an electrolytic membrane and combined with oxygen. This process produces an electrical charge with a byproduct of water. The source of the hydrogen and the method used to strip off the hydrogen molecules determine the classification of the type of hydrogen. About 95% of hydrogen production in the U.S. is accomplished through natural gas reforming⁷⁹.

Note: Only green hydrogen is carbon-net-zero and fully pollutant free. Blue hydrogen and gray hydrogen “reform” natural gas (primarily methane, a highly potent greenhouse gas) to obtain the hydrogen molecules, but the reforming process leaks methane and produces CO₂ emissions which must be captured and stored. Carbon Capture and Storage (CCS) is a nascent technology with significant infrastructure obstacles and environmental impacts.

Renewable Hydrogen (“Green Hydrogen”): The hydrogen source is water (H₂O), and the reforming process is done using electricity from sustainable sources such as solar or wind.

Decarbonized Hydrogen (“Blue Hydrogen”): Natural gas is reformed to separate hydrogen from the methane leaving carbon dioxide. There are two methods of reforming: Steam Methane Reforming (SMR) or Autothermal Reforming (ATR). The SMR process leaks methane (see natural gas disadvantages above) and releases carbon dioxide during hydrogen production. The carbon dioxide can theoretically be captured through Carbon Capture and Storage (CCS), but this is only being done in three of the existing U.S. hydrogen SMR plants. “Blue hydrogen” is up to 99% carbon-net-zero in the fuel cell itself, but methane leakage in the reforming process and CCS present significant global warming and technological issues.⁸⁰

Traditional Hydrogen (“Gray Hydrogen”): Uses the same natural gas reforming process except the carbon dioxide is not captured.⁸¹ This has major environmental impacts and should not be used in Loudoun County.

⁷⁸ <https://www.energy.gov/eere/fuelcells/hydrogen-and-fuel-cell-technology-basics>

⁷⁹ U.S. Department of Energy. “Hydrogen Production Natural Gas Reforming.” <https://www.energy.gov/eere/fuelcells/hydrogen-production-natural-gas-reforming>

⁸⁰ Schlissel, David and Juhn, Anika. “Blue Hydrogen: Not Clean, Not Low Carbon, Not a Solution.” Institute for Energy Economics and Financial Analysis. September, 2023. <https://www.energy.gov/sites/default/files/2024-02/090.%20David%20Schlissel%20and%20Anika%20Juhn%20C%20IEEFA%20Blue%20Hydrogen%20Not%20Clean%20Not%20Low%20Carbon.pdf>

⁸¹ Shell Oil Company. “Blue Hydrogen Production.” [https://www.shell.com/business-customers/catalysts-technologies/licensed-technologies/refinery-technology/shell-blue-hydrogen-process.html#:~:text=Blue%20hydrogen%20is%20a%20common,and%20autothermal%20reforming%20\(ATR\).](https://www.shell.com/business-customers/catalysts-technologies/licensed-technologies/refinery-technology/shell-blue-hydrogen-process.html#:~:text=Blue%20hydrogen%20is%20a%20common,and%20autothermal%20reforming%20(ATR).)

Hydrogen Fuel Cell Advantages: Green hydrogen is carbon-net-zero; hydrogen fuel cells make no noise and emit no pollutants; could replace diesel backup generators as a cleaner source of backup power

Hydrogen Fuel Cell Disadvantages: Hydrogen fuel cells are not practical as a baseload power source because they generate too little power for use at utility scale; unless the system uses green hydrogen, the gas reforming process has all the disadvantages of unfiltered natural gas as a power source.

Small Modular Reactors (SMR) and Advanced Nuclear Reactors (ANR). A micro nuclear reactor is a small nuclear reactor capable of producing up to 20 Mw of electricity independently. An SMR/ANR is similar but is capable of producing 20-300 Mw of electricity.⁸² There are more than 50 designs for SMR/ANRs. These reactors can be cooled by light water, the existing technology, or by gas, liquid metal or molten salt.⁸³

Advantages: Carbon-net-zero; 93 percent capacity factor (see below); essentially noiseless; no pollutants; relatively small footprint

Disadvantages: Other than the few, traditional, light-water SMRs being developed, the majority of new ANRs produce much higher quantities of nuclear waste and entirely new types of nuclear waste not yet fully evaluated for their storage risk.⁸⁴ Moreover, there is no national repository for nuclear waste, meaning the waste produced by these new SMR/ANRs would be stored locally. Finally, while all current nuclear reactors in the country use 5 percent enriched uranium, the new ANRs propose using High Assay Low-Enriched Uranium (HALEU) which enriches the uranium 5-20 percent, a largely untested and unproven level of enrichment⁸⁵; community resistance would be extreme; there is an extended licensing process; SMR/ANRs are at least two years from construction; they are extremely expensive.

Nuclear Fusion. On December 17, 2024, Commonwealth Fusion System, associated with the Massachusetts Institute of Technology, announced plans to build the world's first nuclear fusion power plant in Chesterfield County, VA. The plant is planned to produce 400 Mw of power by the early 2030's.

Nuclear fusion has been largely theoretical for decades. It combines atomic nuclei from isotopes of hydrogen derived from sea water or lithium to release enormous amounts of energy. This is the process our sun uses. The energy released is completely clean, and the process produces no nuclear waste. The singular disadvantage of fusion is that it requires enormous heat to combine the isotope atomic nuclei. In 2022, after 70 years of experimentation, scientists were able to create a fusion reaction for the first time that produced more energy than it needed to create the reaction.

⁸² Idaho National Laboratory. <https://inl.gov/trending-topics/microreactors/>

⁸³ DoE, Dept. of Nuclear Energy. <https://www.energy.gov/ne/advanced-small-modular-reactors-smrs>

⁸⁴ Krall, Lindsay, McFarlane, Allison, Ewing, Rodney. "Nuclear Waste from Small Modular Reactors." PNAS. May 31, 2022.

https://www.pnas.org/doi/full/10.1073/pnas.2111833119?trk=public_post_comment-text

⁸⁵ Dept. of Energy. "What is High-Assay Low-Enriched Uranium (HALEU)." Office of Nuclear Energy. December 3, 2024. <https://www.energy.gov/ne/articles/what-high-assay-low-enriched-uranium-haleu>

Given the developmental timeframe, I believe the data center sector will be well along the way to meeting its energy needs long before nuclear fusion becomes a practical reality.

Capacity Factor: Choosing A Microgrid Energy Source

A key metric used to determine what type of microgrid is appropriate for any given application is the capacity factor of the power source used in the microgrid. The U.S. Energy Information Administration (EIA) defines the capacity factor of an energy source as:

Capacity factor: The ratio of the actual electrical energy produced by a generating unit for the period of time considered to the electrical energy that could have been produced at continuous full power operation during the same period.⁸⁶

An example illustrates this ratio. Suppose we have an energy source that can generate a maximum of 1 Mw of electricity at its peak operating power. If that energy source operates at peak power for one hour, it is generating 1 megawatt hour (1 MWh) of electricity. There are 8,760 hours in a year. We determine that energy source's historic capacity factor by dividing how many hours in a year that energy source actually operated at full capacity by the total hours in the year. If that 1 Mw energy source actually only delivered an average of .5 Mw per hour for 8,670 hours in a year, it has a capacity factor of 50%: $(.5 \text{ Mw} \times 8,760 \text{ hours}) / 8760 \text{ total possible hours} = .50$ or a 50% capacity factor. Similarly, if that same energy source delivered its maximum power for only 4,380 hours in a year, that too would be a capacity factor of 50%.

U.S. EIA keeps track of the average capacity factors associated with each of the various types of energy sources now available for use in microgrids. The higher the capacity factor, the greater the amount of time that energy source can deliver its maximum possible power. Below is a chart depicting the annual capacity factors for various energy sources in 2024:⁸⁷

2024	Geothermal	Hydroelectric	Nuclear	Biomass	Gas	Solar	Wind
Capacity Factor	65%	34.5%	92.3%	59.0%	59.7%*	23.4%	34.3%

As shown, nuclear power is, by far, the most efficient power source presently available for use in microgrids. It's capable of delivering its maximum power 92.3 percent of the time throughout any given year. It is not weather dependent and not subject to significant external constraints. Solar, on the other hand, only delivers its maximum rated power about 23.4% of the time due to night, weather, length of day, and many other external factors. Thus, a utility-scale solar farm rated at 100 MW will only be able to deliver 100 Mw about 24 percent of the time throughout the year. Here's another way to look at capacity factor in this example: A 100 Mw solar field (nameplate) will actually deliver only about 24 Mw every hour over one year.

⁸⁶ U.S. Energy Information Agency. "Glossary." U.S. EIA.

https://www.eia.gov/tools/glossary/index.php?id=Capacity_factor#:~:text=Capacity%20factor%3A%20The%20ratio%20of,operation%20during%20the%20same%20period.

⁸⁷ U.S. Energy Information Administration. "Table 6.07.B. Capacity Factors for Utility Scale Generators Primarily Using Non-Fossil Fuels" Electric Power Monthly.

https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_6_07_b *An email exchange with EIA suggested the appropriate gas capacity factor is in Table 6.07.A. Also, the gas capacity factor applies to natural gas plants, not onsite natural gas turbines.

Natural gas microgrids using SCR offer a relatively low emission option with a fairly high capacity factor of 59.7%. This capacity factor applies to natural gas plants. The functional capacity factor for onsite natural gas turbines is likely much higher than this. This makes them good candidates for charging energy storage fields or replacing diesel backup systems and may prove to be a viable transitional source of microgrid power in situations where the power grid is constrained such as in Loudoun County.

Geothermal microgrid applications are geographically dependent and largely theoretical for baseload power at present.

Strategy Implementation: Creating a New Paradigm for Loudoun County

Based on the foregoing analysis, what then might a new paradigm for Loudoun County look like? At present, diesel generators, BESS, and possibly hydrogen fuel cells are only best suited for backup power. Given the large number of diesel generators being used in the county, we should, in the near term, incentivize or require a sector-wide transition to Tier IV diesel generators or Tier II generators with SCR units attached. This is one of the recommendations of the JLARC study.⁸⁸ Natural gas turbines incorporating SCR and significant noise mitigation could operate as either backup or baseload power and represent a very viable microgrid option for data centers facing power grid constraints. Loudoun County should immediately develop performance standards and zoning requirements for all of the above microgrid component systems.

Nationally, SMR/ANRs, while likely 3-7 years away, are the only viable long-term option for carbon-net-zero, baseload, onsite power generation, but they are simply not viable until the significant nuclear waste issue is addressed and resolved. They will also face significant community resistance. Given that the only alternatives to SMR/ANRs will be more power lines, gas turbines or a continuously constrained power grid, the greater Loudoun County community—and indeed, the Commonwealth of Virginia—have some very challenging discussions ahead.

Yet even within these practical constraints, we can still identify and provide the data center community with a set of desired data center characteristics based on Loudoun County's unique power grid environment. As technological advances occur, data centers can be encouraged, through a series of tax incentives, or required, through changes to our Comprehensive Plan or Zoning Ordinance, to organically shift away from grid over-reliance towards greater power independence. Such a model would guide future data center development and incentivize existing data centers to strive to incorporate as many desired characteristics as possible. The result could be transformational sector change. If successful, we could become a world pioneer ushering in a new age of data center design supported by a transformed national power grid. At the same time, we could create a thriving new green business market here in Loudoun County.

The following is a proposed list of desired attributes for Loudoun County data centers:

Practical, Immediate Improvements Possible Through Incentives (Existing Data Centers)/Performance Standards (New Data Centers):

- 1. Tier IV or Tier II/SCR Backup Generators**
- 2. Maximum of 55 Db Noise Levels at the Sending Property Line with Pre-/Post-Construction Noise Studies**
- 3. Minimum of 500' Setback from Property Line Facing Residential**

⁸⁸ Op. Cit., pg. 60

4. Significant Visual Screening

Desired Attributes (All Data Centers):

5. Microgrid Elements in Site Plan
6. Low Carbon or Carbon Net-zero Power (baseload and/or backup)
7. Leadership in Energy and Environmental Design (LEED) Gold Certified or above buildings
8. Green Building Initiative “Green Globe” Rating of Three or Higher
9. Total Usage Efficiency of 1.15 or Less (TUE=IT Usage Efficiency x PUE)
10. Liquid-submerged Data Racks
11. Waste Heat Reuse Systems (District Energy)

Summary

While the challenges are great, implementation of a strategy incorporating some or all the elements above would accomplish several urgently needed objectives. It would:

- **Establish Loudoun County as a Pioneer in a Long-Term Transition to a “Green” Data Center Environment.** Loudoun County could become a role model for communities around the world seeking to host “greener” data centers in their community or to transform the data center markets they already have.
- **Increase Loudoun County’s Power Grid Resiliency.** Incentivizing data centers to develop autonomous microgrid elements will increase grid resiliency and reduce the threat to residential and other commercial users posed by rapidly increasing demands on our power grid. Elements such as Long Duration Energy Storage and a separate HVDC underground grid would also help keep rates low for non-data center customers. “Peak shaving” by having numerous microgrids operate in “island mode” or switch to stored energy during peak power demands would help stabilize the grid. Nationally, microgrids could also constitute a major source of distributed energy.
- **Create a New Loudoun County Market for a Burgeoning Green Microgrid Industry.** Just as the sector’s rapid growth over the past twenty years led to an economic boom in Loudoun County, transforming Loudoun County’s data center industry to a wider use of microgrid elements, especially “green” microgrid elements, could have similarly beneficial business revenue effects. Such a change could attract green industry companies to the county and have a significant, positive multiplier effect on Loudoun County’s entire business environment by diversifying our tax revenue with a host of complementary businesses supporting the transformation.

Challenges

Without question, there are major challenges implementing this strategy. Here are a few:

- Will Dominion Energy eventually cap available power to data centers? Such a physical constraint will drive greater innovation within the data center community.
- Though widespread adoption of microgrid designs is probably impractical in Loudoun County, can the Board of Supervisors create a legislative environment encouraging data

centers to adopt various microgrid design elements into their planned and existing campuses?

- Can the Loudoun County Board of Supervisors react quickly enough to shape the outcomes of the rapid change taking place in the energy environment?
- Will Dominion Energy allow point source power generation in its market?
- Will Dominion Energy commit to the development of a separate HVDC power grid in Loudoun County?
- It will take 12-18 months to implement a formal CPAM/ZOAM change. Will BOS votes prior to this codified change reflect a willingness to implement the new strategy?
- What form will incentives/requirements/disincentives take to effect the needed changes in the Loudoun County data center environment?

Likely Future Scenarios

Based on my experience as a County Supervisor and my understanding of the issues addressed herein, let me suggest some likely near- to midterm developments:

- **More Grid Infrastructure.** Of necessity, PJM and Dominion Energy must continue to aggressively pursue their regulated legal requirement to expand and enhance their infrastructure to accommodate increased power demand. This means Loudoun County will likely see more overhead transmission line proposals in the near term. Given that the SCC recently denied a community advocacy effort to bury the Aspen/Golden 500/230 Kv transmission lines, it is unlikely any similar effort in the future will be successful. Pressure to build new lines will only be alleviated by stabilizing large consumer demand on the grid. This will only be possible through three simultaneous occurring conditions: 1) artificially imposed power constraints, 2) technological advancements significantly reducing AI power requirements, and 2) rapid development of data center microgrids or microgrid elements making data centers less grid dependent.
- **Continued Power Constraints for Major Power Consumers.** With a five-year infrastructure buildout likely, Loudoun County data centers will be power constrained until at least 2029, and that assumes a predictable increase in demand. The growth of AI and its attendant power demands could vastly complicate that problem. As we have already experienced here in Loudoun County, this is going to create an organic industry push to develop onsite microgrids to reduce data center dependence on the grid. This transition is likely to happen relatively quickly, and therefore the Loudoun County Board of Supervisors must act now to assert and maintain managerial oversight, through land-use planning and new zoning requirements, of this sector-wide evolution.
- **Development of Natural Gas Turbine Microgrids.** Natural gas turbines with Selective Catalytic Reduction are currently the only near-term microgrid solutions capable of providing baseload power in a constrained power grid environment. This makes them a key component of a transition strategy leading ultimately to nuclear power. In addition to baseload power, they can provide backup power and can act as a power generation source for recharging energy storage fields. Given that one islanded gas turbine site in

Loudoun County has already been built and another is likely within a year, more widespread use of this transitional solution to grid constraints seems likely. The Loudoun County Board of Supervisors must ensure it has continuous visibility over this rapidly evolving sector in the years ahead.

A key question is how much capacity Loudoun County's natural gas infrastructure has to support this transitional evolution. Widespread use of gas turbines for things like data center baseload power, energy storage field recharging power and data center backup power will place enormous demand on the natural gas infrastructure in the county and elsewhere in Virginia.

- **Increasing Community Resistance.** This expansion of the natural gas infrastructure required by an industry-wide move to gas turbines will significantly increase pressure on the utilities to delay or cancel the retirement of fossil fuel power plants, primarily gas plants. These plants are major sources of methane and CO₂ pollution through leakage. In 2024, global temperatures increased to 1.55 degrees above the Paris Agreement levels for the first time. Increased gas plant pollution from highly potent greenhouse gases in the face of this disturbing climate change trend will likely lead, as it should, to major environmental community pushback about the increased use of natural gas in Loudoun County.

At the same time, we can expect the continued proliferation of more power lines in Loudoun County as Dominion Energy strives to meet its legal obligation to provide power to all its customers. More overhead power lines combined with a greater reliance on natural gas will almost certainly increase community opposition to unprecedented levels.

The list of challenges is no doubt long and complex. But the stakes of the game have never been higher for our county. Our task is not to fight the changing environment. Our task as Loudoun County's elected governing body is to learn how our environment is changing and adapt to the changes in a way that preserves our quality of life and protects the people we work for. I believe we're up to the task.

Virginia Electric and Power Company
Case No. PUR-2025-00056
Theresa Ghiorzi
Third Set

The following response to Question No. 8 of the Third Set of Interrogatories and Requests for Production of Documents propounded by Theresa Ghiorzi received on October 9, 2025, was prepared by or under the supervision of:

Bradley S. Lowe
Consulting Engineer, Electric Transmission Planning
Dominion Energy Virginia

As it pertains to legal matters, the following response to Question No. 8 of the Third Set of Interrogatories and Requests for Production of Documents propounded by Theresa Ghiorzi received on October 9, 2025, was prepared by or under the supervision of:

David J. DePippo
Managing Counsel
Dominion Energy Services, Inc.

Question No. 8

For the purposes of question 8 and its sub questions, a simple yes or no answer will suffice. For the 2025 W1 RTEP window VEPCO proposed a series of HVDC Backbone Portfolios (A - D)

For Reference HVDC Portfolio 1A is below, the HVDC segment is in purple



- a. Is any portion of the above referenced HVDC Backbone envisioned to be underground?
- b. The Redacted Proposal refers to Line 5008 (Morrisville to Wishing Star) reference below:

PJM Proposal ID	275
Project title	HVDC backbone - Portfolio 1A
Project description	The following projects make up this violation-free Portfolio: 1. 993606 - New HVDC Transmission Link from Heritage to Mosby (PJM ID: 2025-W1-815) 2. 993610 - Line 560 Rebuild - Possum Point to Burches Hill (PJM ID: 2025-W1-916) 3. 993612 - Line 5008 (Morrisville to Wishing Star) Cut-in into Mosby Substation (PJM ID: 2025-W1-253) 4. 993619 - New 500kV Line - Elmont to Kraken (PJM ID: 2025-W1-306) 5. 993592 - Line 567 Terminal Upgrade - Chickahominy to Surry (PJM ID: 2025-W1-126) 6. 993597 - Line 563 Rebuild - Carson to Midlothian (PJM ID: 2025-W1-238) 7. Planning 01 - New 765/500kV Switching Station - Vontay (PJM ID: 2025-W1-247) 8. Planning 02 - Line 576 Partial Rebuild - North Anna to Vontay (PJM ID: 2025-W1-339) 9. Planning 03 - Line 576 Partial Rebuild - Vontay to Midlothian (PJM ID: 2025-W1-9) 10. Planning 04 - Line 539 Rebuild - Yeat to Ox (PJM ID: 2025-W1-117) 11. 99-3618 - Carson Substation Equipment Upgrade (PJM ID: 2025-W1-243)

- i. Would line 5008 be an HVDC line
- ii. Does this proposal include an HVDC Converter substation co-located at the Wishing Star substation?
- iii. If not does it include an HVDC Converter substation somewhere else in Loudoun County?
- c. In preparing this proposal did the Company provide an estimate for the HVDC to HVAC converter substation?
- d. On a rough order of magnitude was the cost of the converter substation more than 4x the cost of an HVAC substation serving the same load?
- e. Does this proposal have a cost cap as the redacted proposal appears indicate (reference below)?

Is the proposer offering a binding cap on ROE?	Yes
Would this ROE cap apply to the determination of AFUDC?	Yes
Would the proposer seek to increase the proposed ROE if FERC finds that a higher ROE would not be unreasonable?	No

Response:

The Company objects to this request as it seeks information that is beyond the scope of this proceeding and that is not relevant or reasonably calculated to lead to the production of admissible evidence in this proceeding. Notwithstanding and subject to the foregoing objections, the Company provides the following response.

- (a) The HVDC line will be underground.
- (b)
 - (i) No.
 - (ii) No, the end points are Heritage and Mosby Substations.
 - (iii) Yes, it includes an HVDC Converter at Mosby Substation.
- (c) Yes.
- (d) The cost of an HVDC station is approximately 3.5 times greater than that of an equivalent HVAC station. This comparison is based on the operating voltage of each substation type, rather than the amount of load served. This distinction is made because load is not served directly from extra-high voltage (“EHV”) facilities. Instead, EHV substations function as network nodes that facilitate power exchange across the system, influenced by factors such as system configuration, generator dispatch, and overall load demand.
- (e) A cost cap applies only to the engineering portion of this proposal.