Data Centers & Virginia's Clean Energy Future

Piedmont Environmental Council

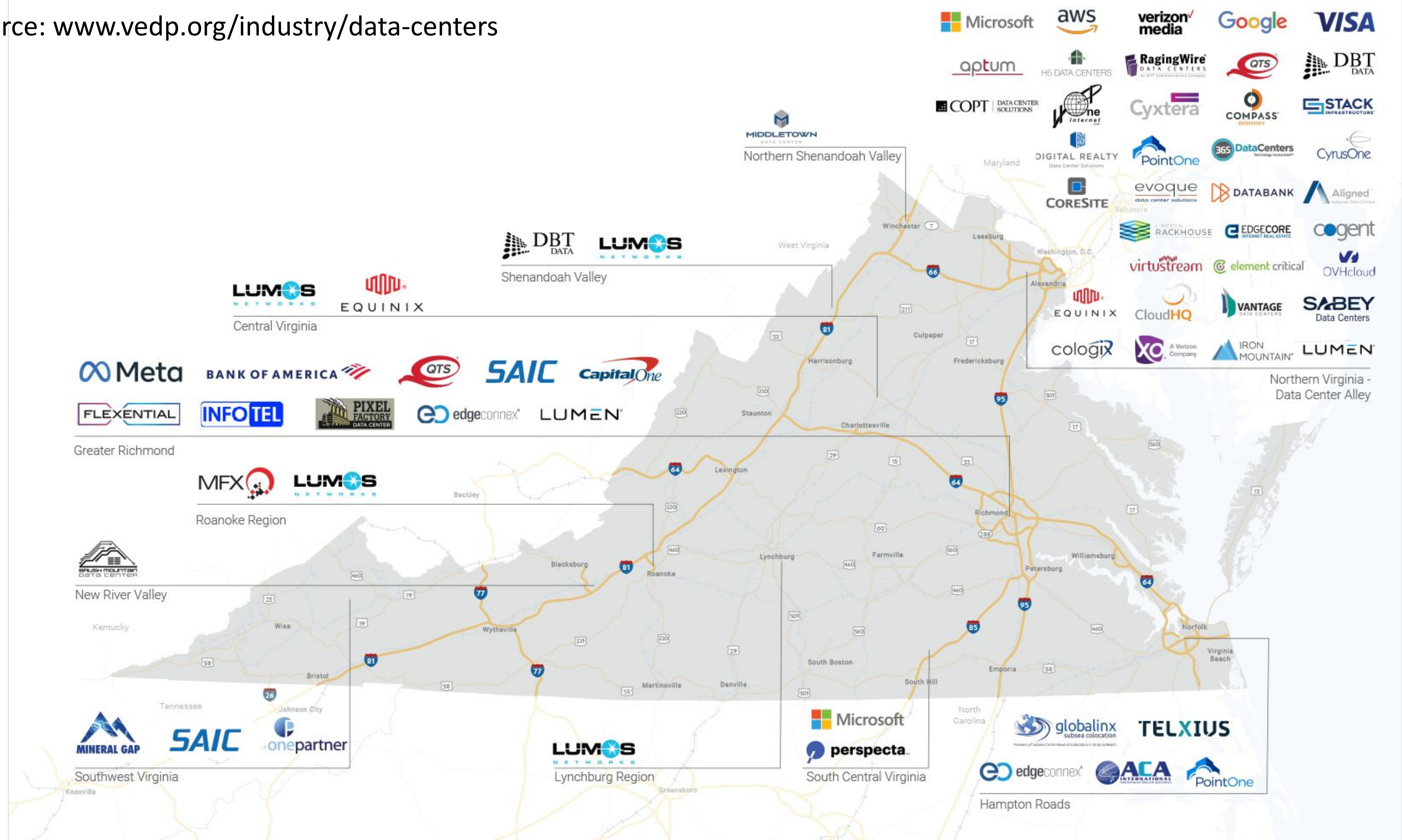
Christopher G. Miller, President

RLEP Rappahannock Town Hall
Rappahannock County Library
July 30, 2025

Today's Presentation

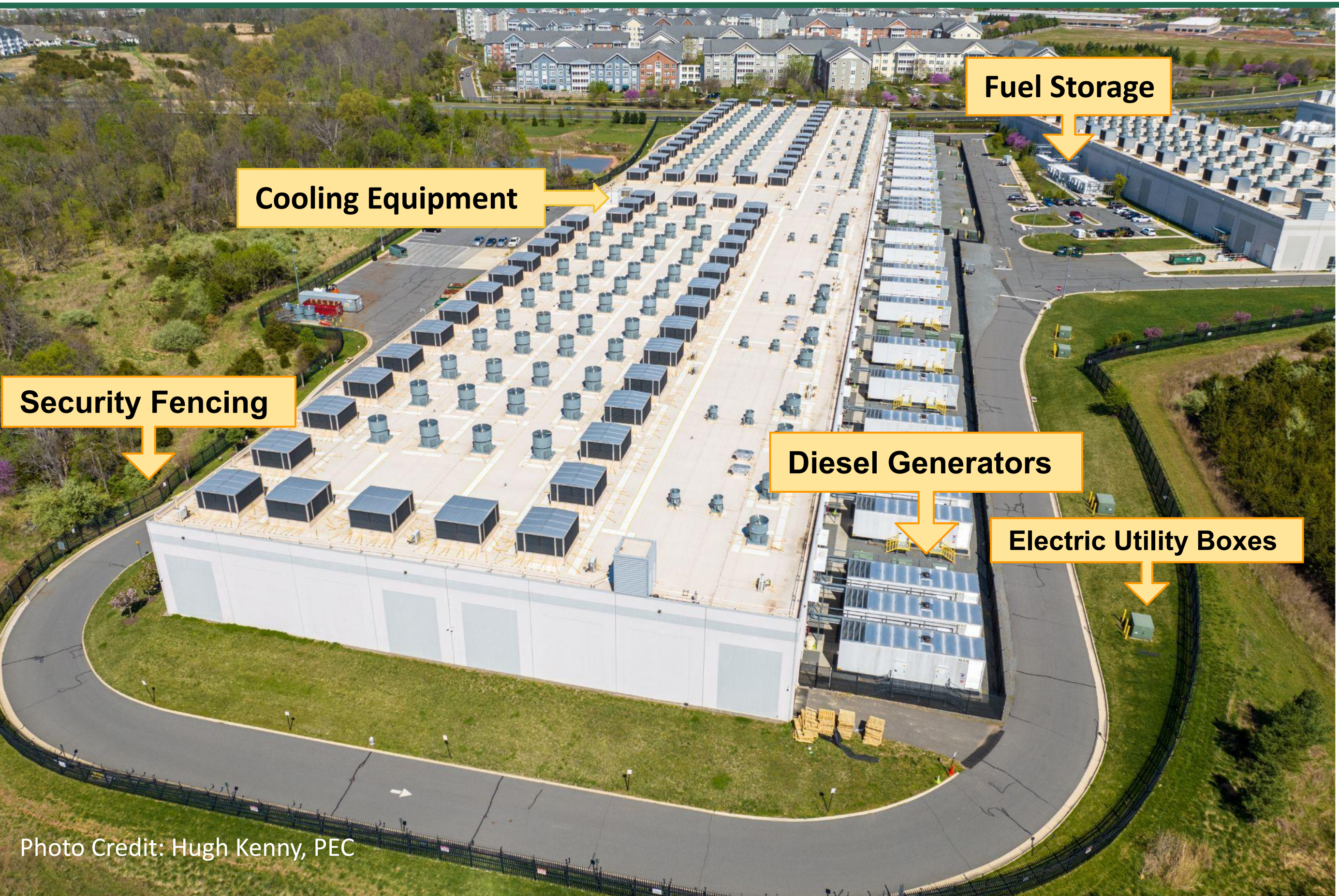
- Exploding Data Center Energy Demand
- Impact on Communities and the Environment
- Getting to Solutions
- Climate Action in the Face of These Challenges

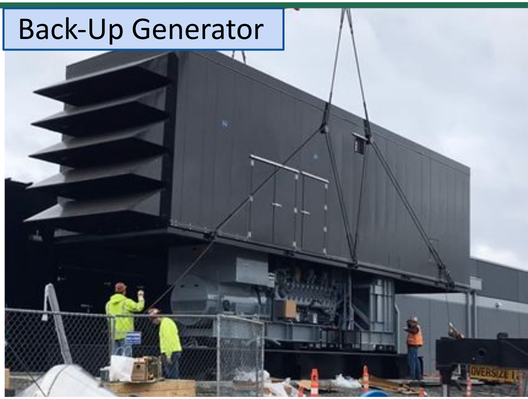
Source: www.vedp.org/industry/data-centers



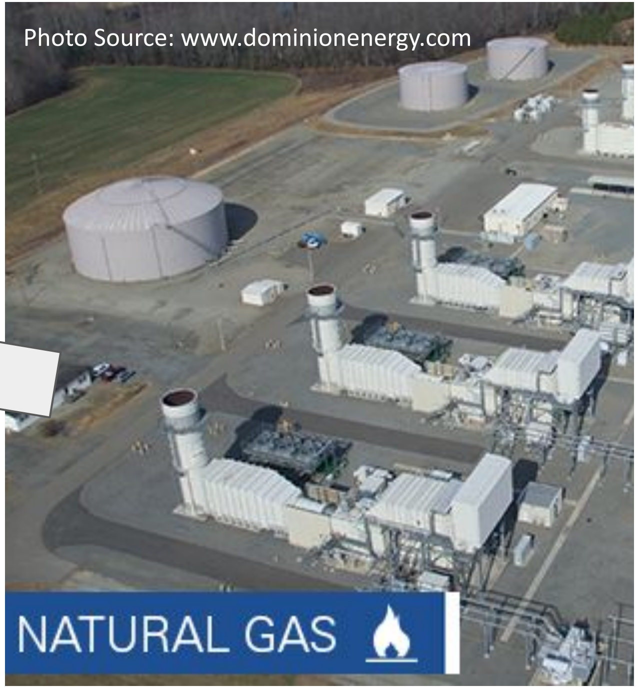
What is a Data Center?

Top Photo Source: www.globalpwr.com
Bottom Photo: Christopher Bowns, Wikimedia Commons





Data Centers Consume a Huge Amount of Electricity

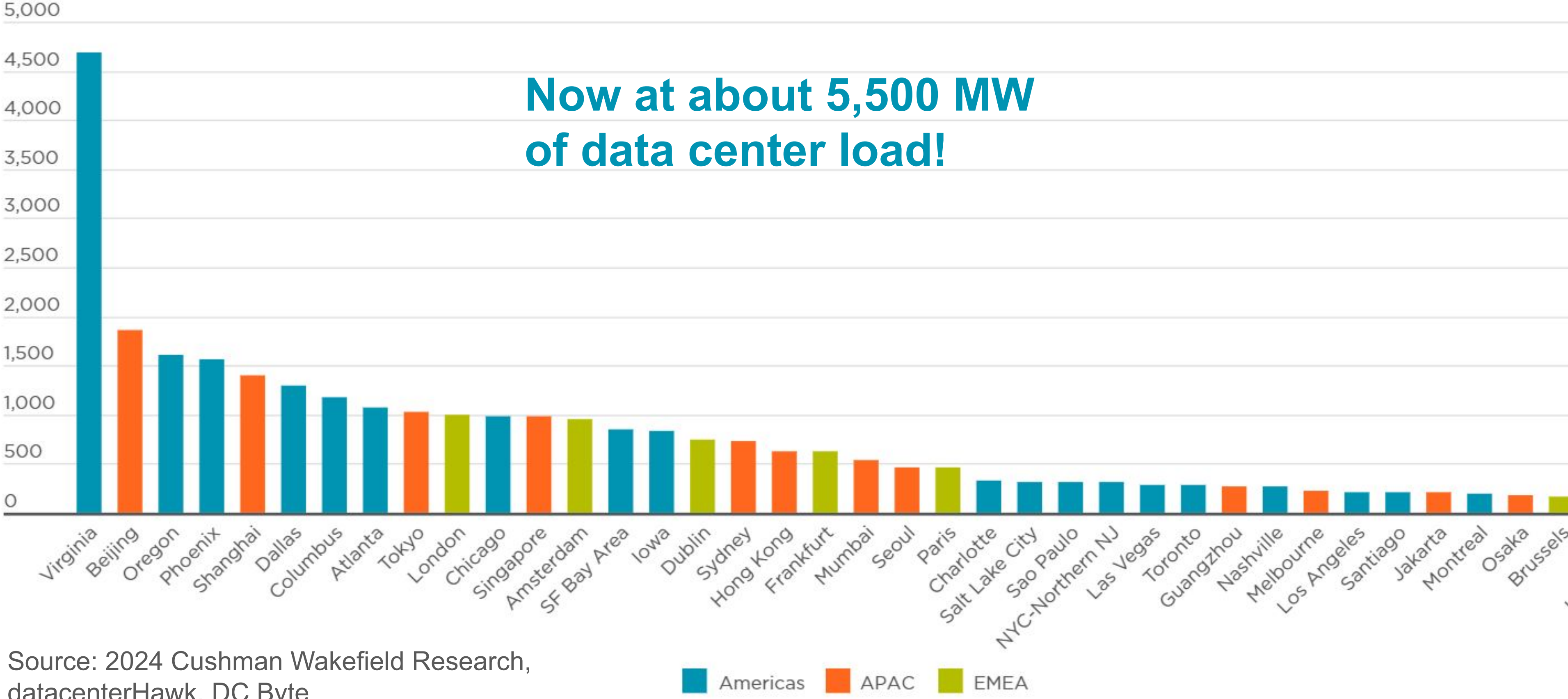


CUSHMAN & WAKEFIELD

People | Properties | **Insights** | Services | Industries

Operational IT Load (MW)

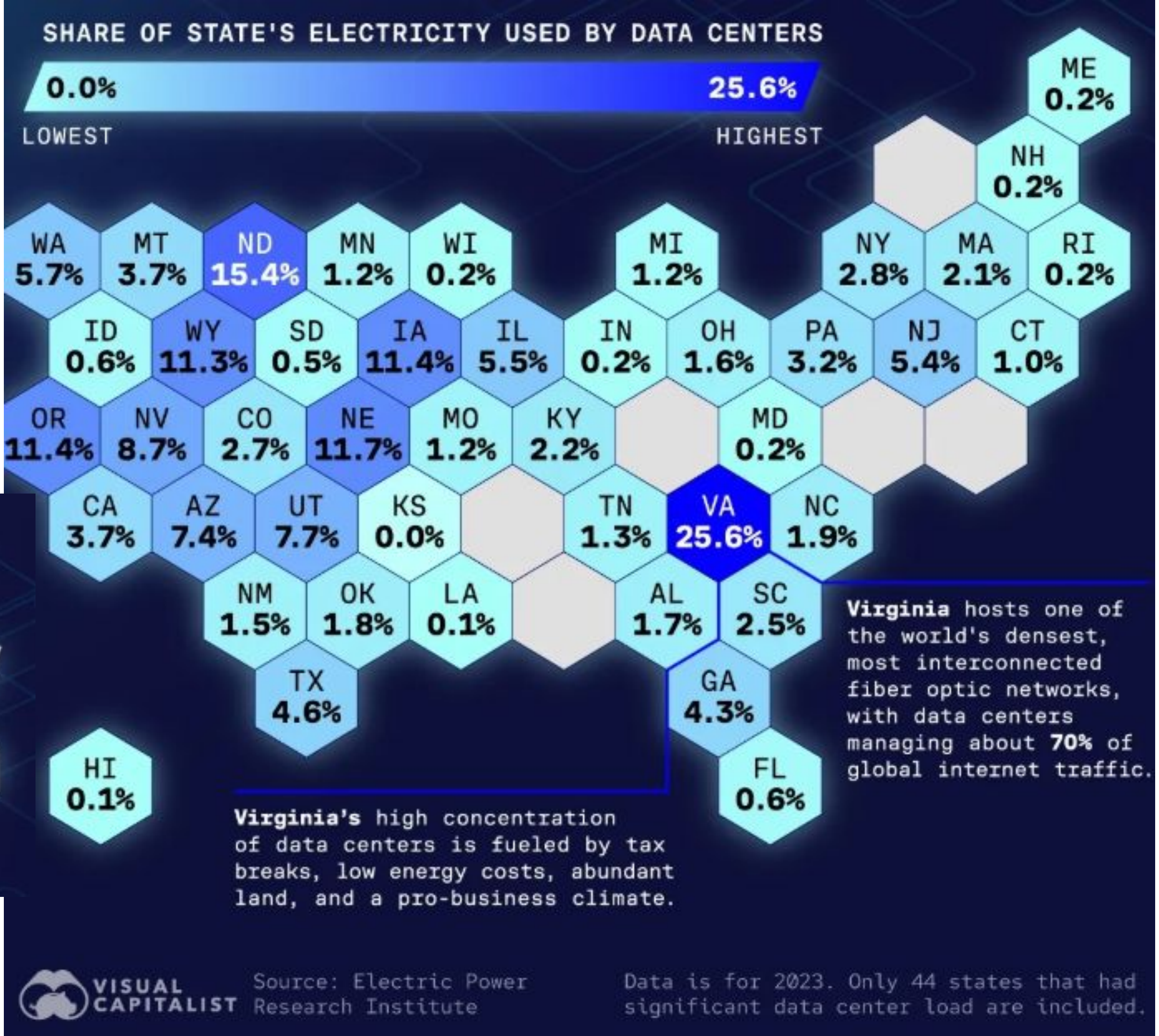
Now at about 5,500 MW of data center load!



Source: 2024 Cushman Wakefield Research, datacenterHawk, DC Byte

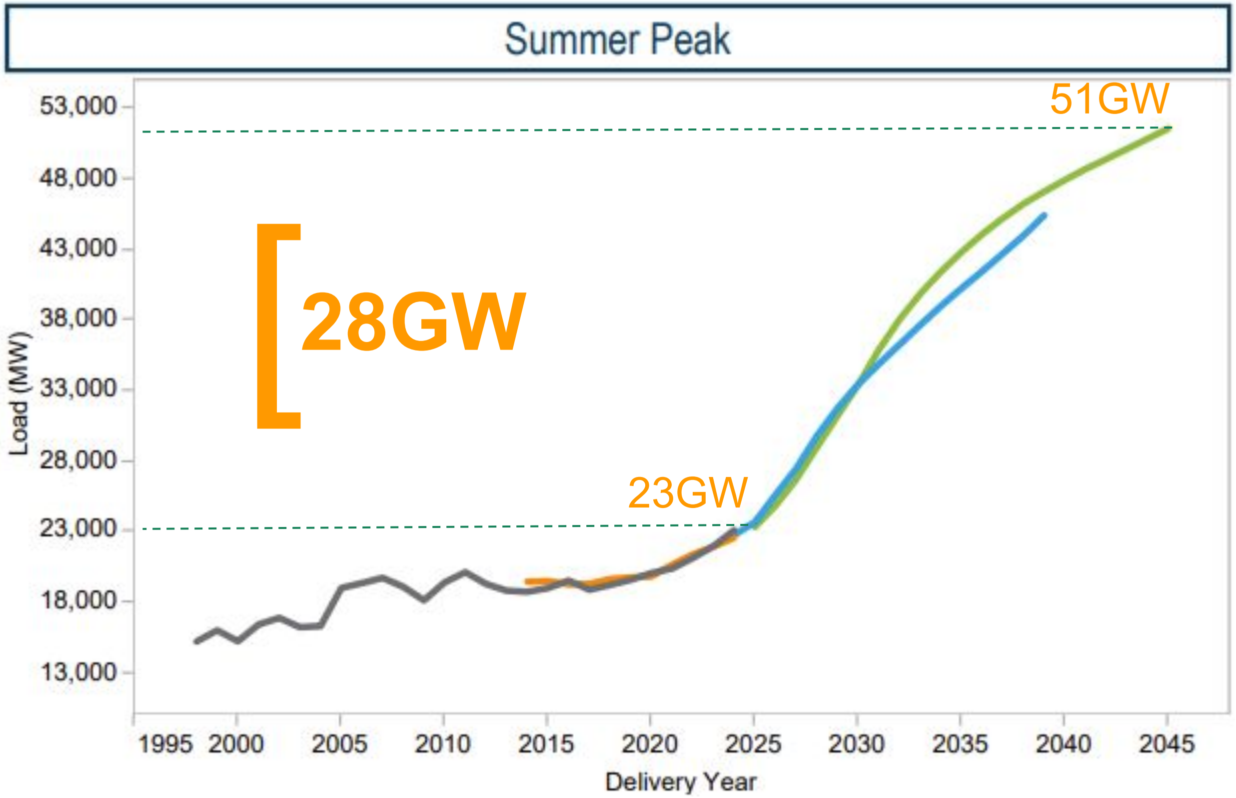
Data Center Electricity Consumption

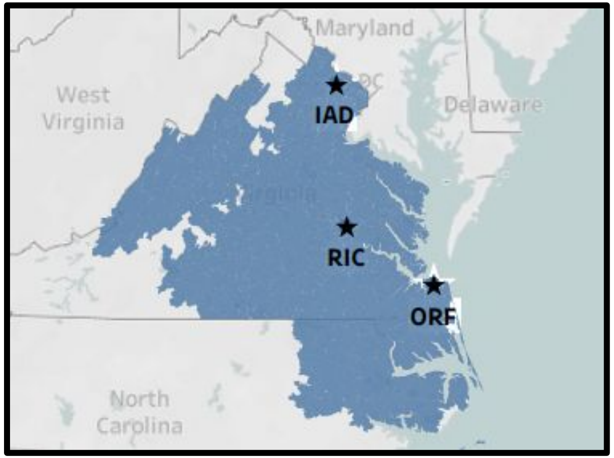
BY STATE



Skyrocketing Load Demand

Dominion Energy's 20 Year Forecast





Green = 2025 projection
Blue = 2024 projection

Demand Driving Data Centers

- Outsourcing of information technology functions
- Advancing smartphone technology and apps (5G)
- Expansion of rural broadband
- Digitization and data storage
- Cloud computing
- GenAI such as large language models, and machine learning

What makes data center development different?

- Boom in AI has led to explosive growth and lots of speculation
- Buildings are bigger and taller than most other uses in suburban/rural area
- They use much more energy than other uses; a campus can use more than a manufacturing plant or a steel mill
- Onsite backup power requirements necessitate more generators than any other use including hospitals and factories
- Facilities tend to cluster, leading to cumulative impacts on air and water quality, water consumption, and energy infrastructure.

Dominion Energy Virginia

2 Data center request process

Typical data center request process from contact to connection

1 High level assessment — Local

- Identify infrastructure requirements

2 Substation Engineering Letter of Authorization — SCC

- Detailed engineering plan
- Costs reimbursed to Dominion Energy

3 Construction Letter of Authorization

- Authorizes construction
- Customer must reimburse Dominion Energy for all spent costs should they walk away

4 Install infrastructure

- Substation(s)
- High voltage transmission lines
- Distribution lines

5 Electric Service Agreement

- Defines how the customer will take service and structure to recover costs
- Includes revenue requirement whether customer takes service or not

Development and infrastructure costs are incurred by the customer

This has created a "Crisis by Contract"

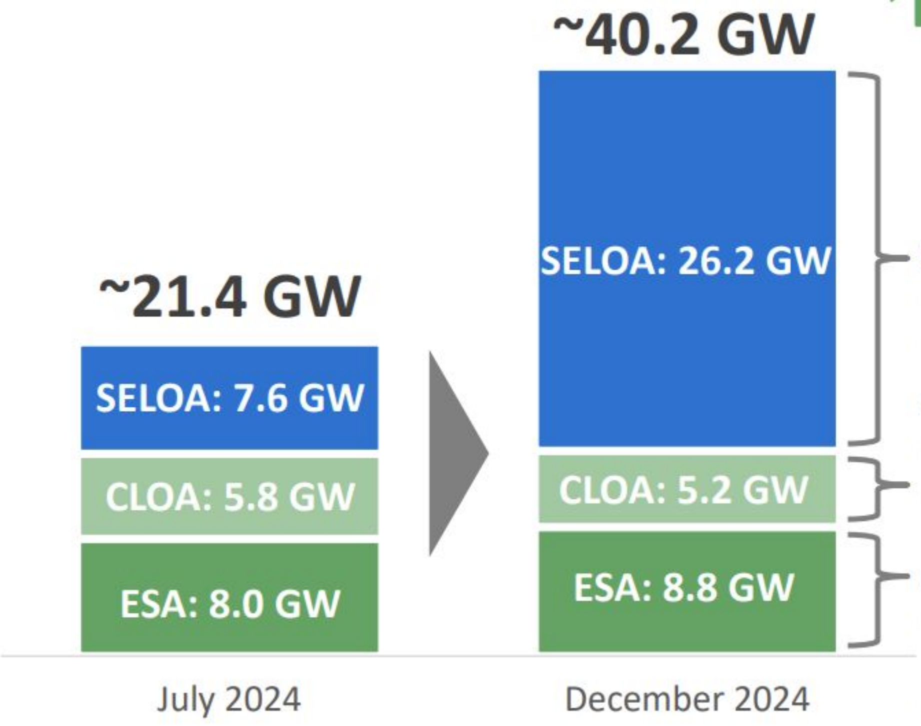
1. Developer proposes project with localities and utility (often using NDA's)
2. Localities approves project and construction begins
3. Utility and developer agree to engineering contract and utility shares substation proposals with PJM for review
4. Line routing discussions may begin in the community
5. Utility and developer agree to construction contract and utility summits route to SCC for approval (CPCN- Certificate of Public Convenience and Necessity)
6. Utility and developer agree to service agreement usually with a small amount of power initially with a planned ramp up for more over time.

In the background, all three types of contracts are used to establish their load forecast and justify new regional transmission line projects and generation facilities such as gas plants that also require a CPCN

Dominion Energy Virginia

Data center contracted capacity (updated)

~19GW/88% *vs. July 2024 data center contracted capacity*



Substation Engineering Letter of Authorization (SELOA)
- Detailed engineering plan
- Costs reimbursed to Dominion Energy

Construction Letter of Authorization (CLOA)
- Authorizes construction
- Customer must reimburse Dominion Energy for all spent costs should they walk away

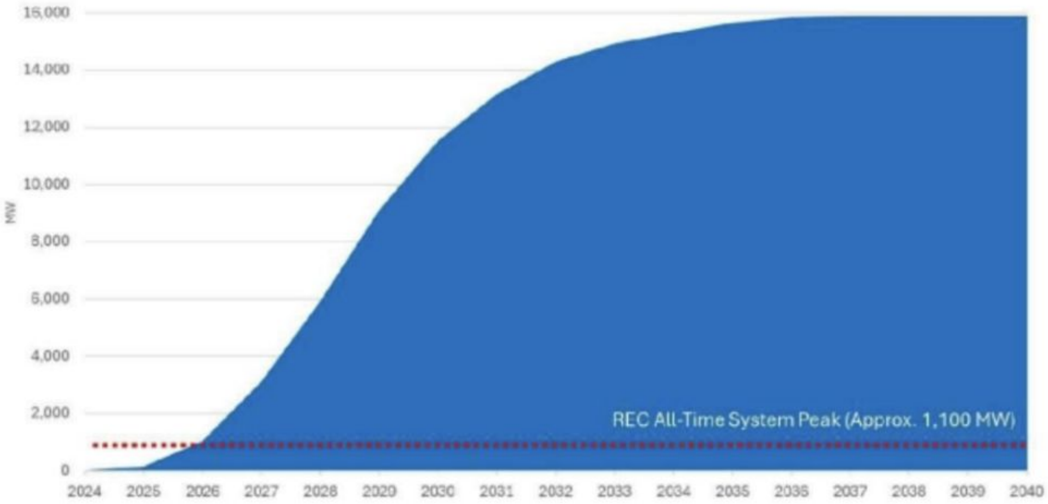
Electric Service Agreement (ESA)
- Defines how the customer will take service and structure to recover costs
- Includes revenue requirement whether customer takes service or not

Rappahannock Electric Projections (from Sierra Club testimony)

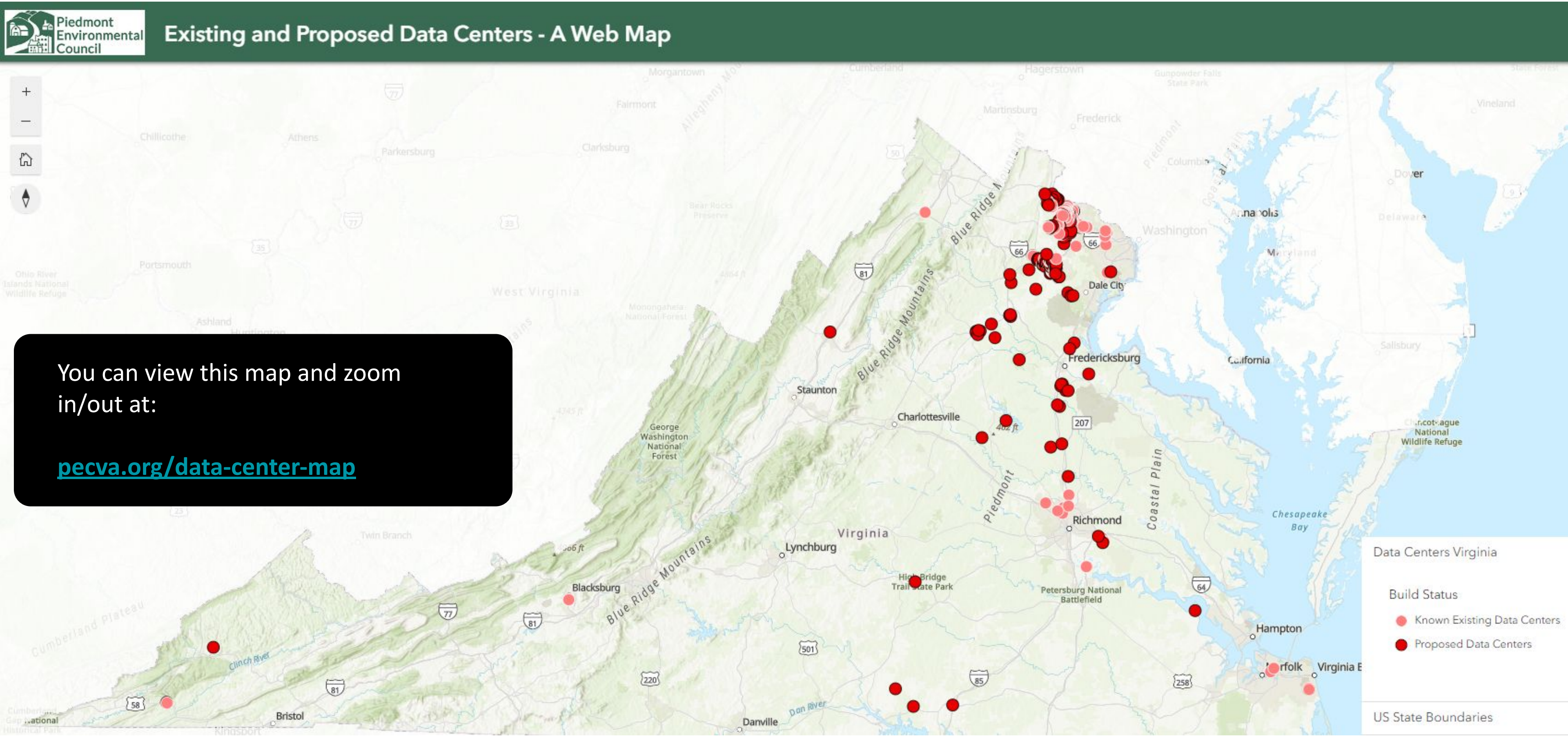
REC's data center load growth is expected to go from negligible to 16,700 MW by 2040, sixteen times higher than REC's all-time system peak of 1,100 MW.   More importantly, according to this chart, REC will see the majority of this growth in the next 7 years. This exponential growth, in such a short amount of time, underscores the importance of designing a tariff that will protect REC's existing customers from paying for the infrastructure buildout necessary to meet 16,700MW of load growth. A concept that REC wholeheartedly agrees with: "[without safeguards, the potential for cost shifts from large-use customers to existing cooperative members could undermine the financial stability of cooperatives and erode member trust. Proper rate structures and policies are critical to maintaining this balance.

REC is expecting a staggering 445% increase in its projected load growth over the next five years.[9] In comments submitted to the Commission's data center load technical conference in Case No. PUR-2024-00144, REC President and CEO John D. Hewa provided the following projected and requested data center load for the REC service territory from 2024 to 2040:[10]

Fig. 1: Projected and Requested Data Center Load in REC Service Territory



Data Center Proposals In Virginia

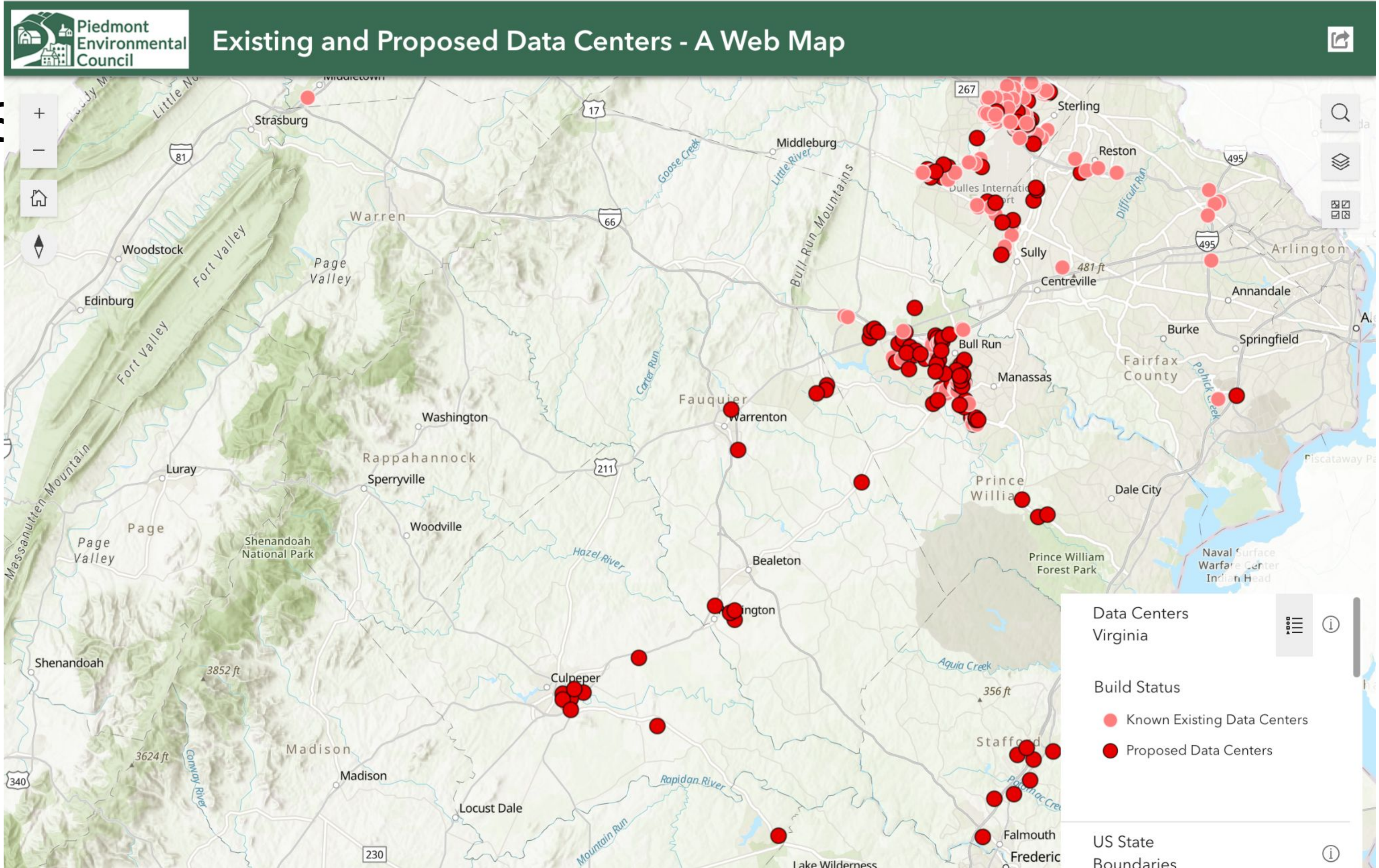


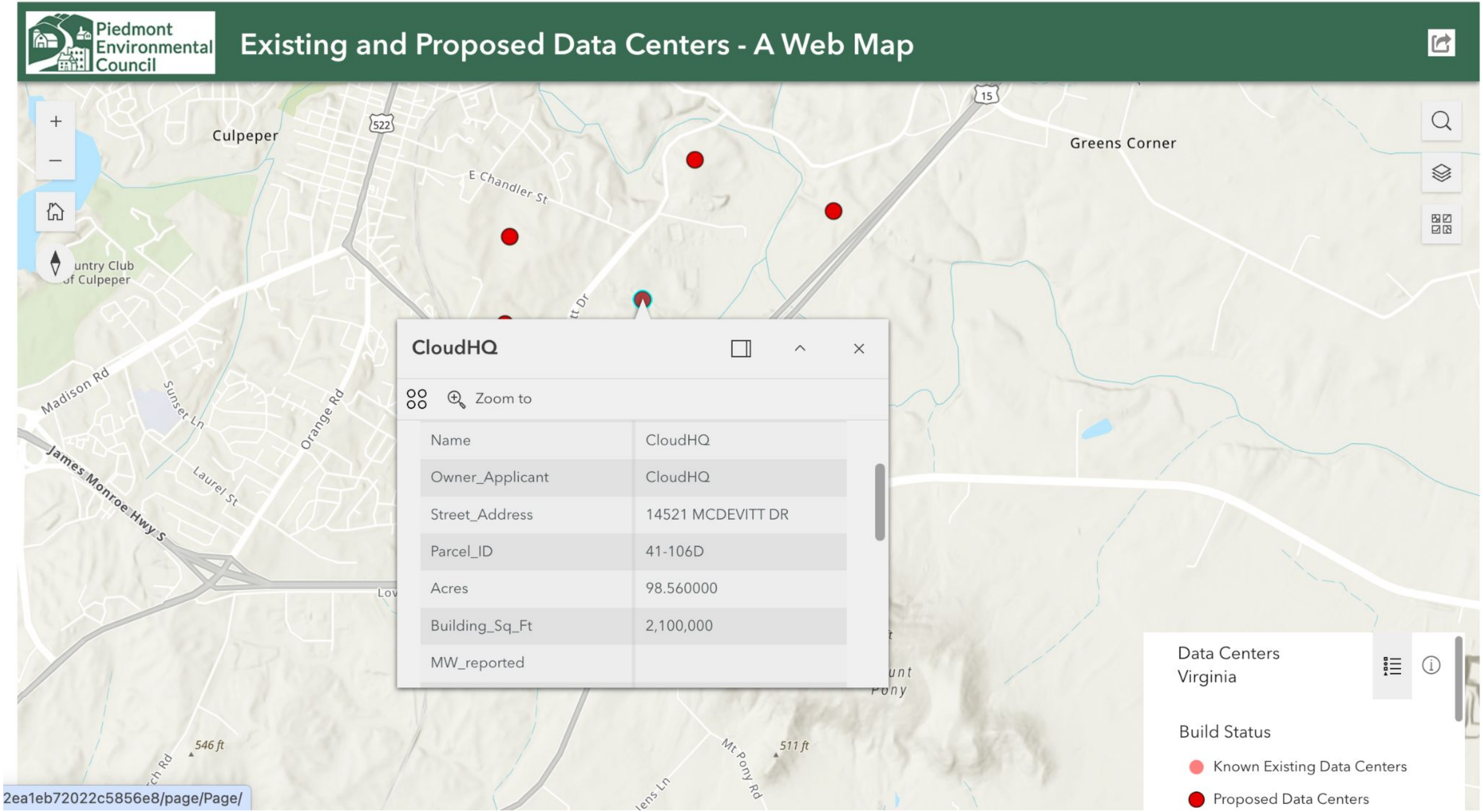
You can view this map and zoom in/out at:

pecva.org/data-center-map

Currently about 60 million square feet existing or being constructed in the state

There's another 200 million square feet approved or in the pipeline…


Piedmont Environmental Council
Existing and Proposed Data Centers - A Web Map
Data Centers Virginia
Build Status
Known Existing Data Centers
Proposed Data Centers
US State Boundaries
Strasburg
Woodstock
Edinburg
Fort Valley
Massanutten Mountain
Luray
Page
Page Valley
Shenandoah
Shenandoah National Park
Warren
Washington
Rappahannock
Sperryville
Woodville
Madison
Locust Dale
Middleburg
Goose Creek
Little River
Bull Run Mountains
Carter Run
Fauquier
Warrenton
Bealeton
Hazel River
Culpeper
Rapidan River
Mountain Run
Lake Wilderness
Sterling
Reston
Dulles International Airport
Difficult Run
Sully
Centreville
Arlington
Annandale
Burke
Springfield
Fairfax County
Pohick Creek
Bull Run
Manassas
Prince William
Dale City
Prince William Forest Park
Naval Surface Warfare Center Indian Head
Aquia Creek
Stafford
Potomac Creek
Falmouth
Piscataway Park


Piedmont Environmental Council
Existing and Proposed Data Centers - A Web Map
Culpeper
Greens Corner
E Chandler St
Madison Rd
Sunset Ln
Orange Rd
James Monroe Hwy S
Laurel St
Country Club of Culpeper
522
15
CloudHQ
Zoom to
Name
CloudHQ
Owner_Applicant
CloudHQ
Street_Address
14521 MCDEVITT DR
Parcel_ID
41-106D
Acres
98.560000
Building_Sq_Ft
2,100,000
MW_reported
546 ft
511 ft
Mt Pony Rd
Data Centers Virginia
Build Status
Known Existing Data Centers
Proposed Data Centers
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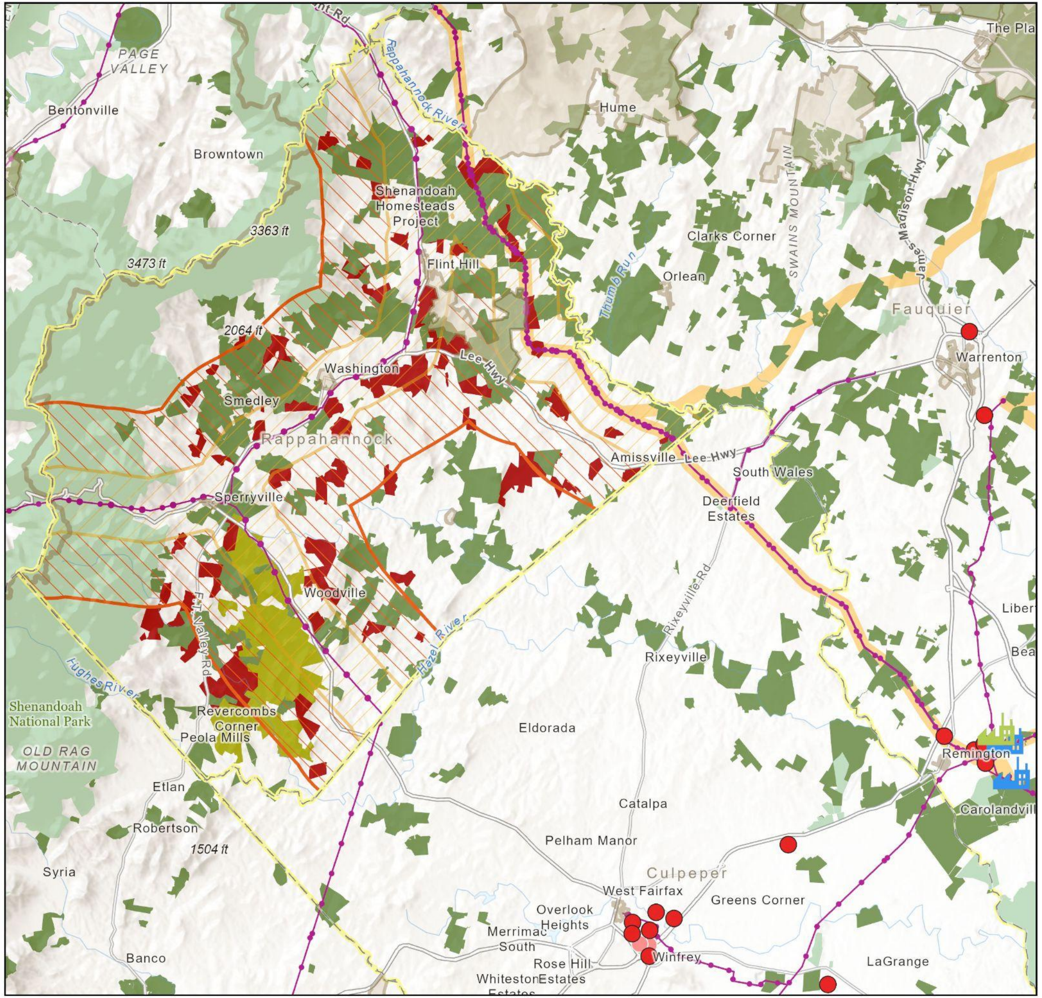
Rappahannock County Transmission Lines

Piedmont Environmental Council

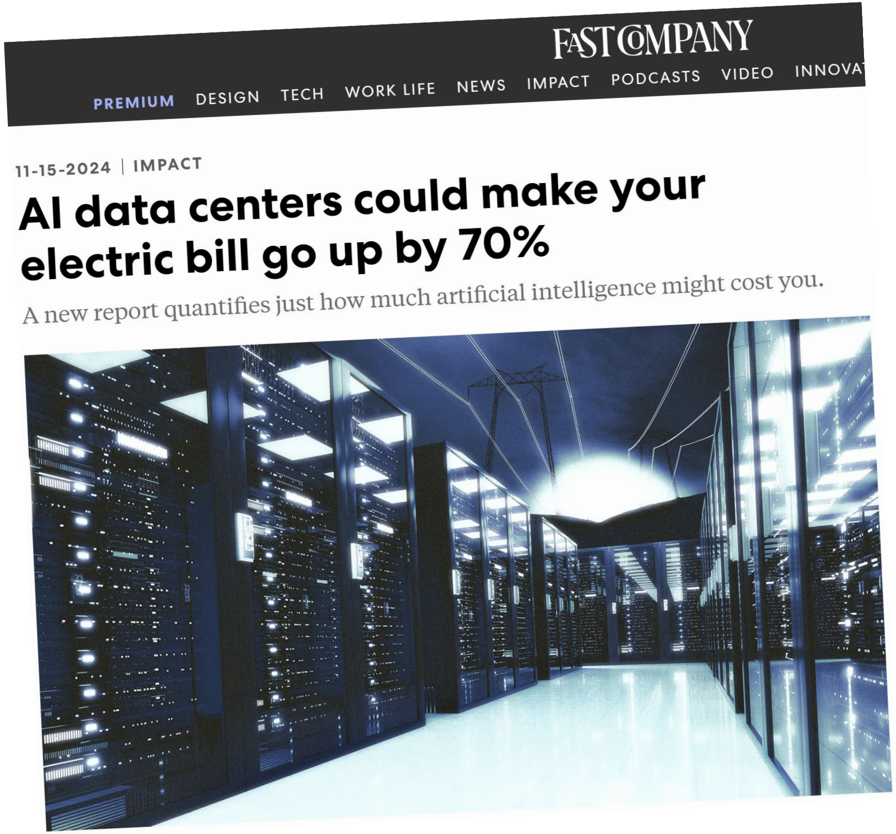


- Existing Data Center
- Proposed Data Center
- Natural Gas Powerplant
- Solar Powerplant
- Current Transmission Lines
- Parcels with 100 or More Acres within 3 Miles of a Transmission Line
- 1 Mile Buffer
- 3 Mile Buffer
- Historic Districts
- Eldon Farm
- Conservation Easements
- Publicly Owned Land
- PJM 2022 Window 3: Initial Transmission Proposals (from 9/5/23)

Map created by PEC for presentation purposes only. Although efforts have been made to verify data, accuracy can not be guaranteed.
07/29/2025

0 5 Miles

Who will pay?



FAST COMPANY

PREMIUM DESIGN TECH WORK LIFE NEWS IMPACT PODCASTS VIDEO INNOVAT

11-15-2024 | IMPACT

AI data centers could make your electric bill go up by 70%

A new report quantifies just how much artificial intelligence might cost you.

THE WALL STREET JOURNAL.

World Business U.S. Politics Economy Tech **Markets & Finance** Opinion Arts Lifestyle

BUSINESS | ENERGY & OIL | HEARD ON THE STREET Follow

AI Is About to Boost Power Bills—Who'll Take Heat for That?

High prices are a windfall for power-plant owners but are starting to raise difficult questions

By Jinjoo Lee Follow

Aug. 12, 2024 7:00 am ET

Share Resize 155 Listen (3 min)

BUSINESS | ENERGY & OIL Follow

Who Pays? AI Boom Sparks Fight Over Soaring Power Costs

Utilities and technology companies are at odds over who should pay for electricity costs in unprecedented data-center build-out

By Katherine Blunt Following

July 29, 2025 5:30 am ET

169 Gift unlocked article Listen (6 min)

An Amazon Web Services data center in Manassas, Va. PHOTO: NATHAN HOWARD/BLOOMBERG NEWS

Harvard Law Research Paper

Extracting Profits from the Public: How Utility Ratepayers Are Paying for Big Tech's Power

New paper from the Harvard Electricity Law Initiative uncovers how utilities are forcing ratepayers to fund discounted rates for data centers

March 5, 2025

Ari Peskoe , Eliza Martin

Download paper (PDF)

A new paper by Legal Fellow Eliza Martin and Electricity Law Initiative Director Ari Peskoe explores how the public is paying the energy bills of some of the largest ompanies in the world. Amazon, Google, Meta, Microsoft, and other technology

Dominion estimated that it will have to invest more than $40 billion in the state over the next five years to serve data-center demand, meet clean-energy targets and complete other necessary work. That is roughly equal to the value of its entire system there.

“We think this is the most important decision that’s being made in America about who pays for energy,” said Chris Miller, president of the Piedmont Environmental Council, which advocates to protect smaller utility customers. “How do you make sure residential users aren’t being asked to subsidize these giant global corporations?”

The State Corporation Commission has scheduled a hearing of Dominion Energy Virginia's 2025 biennial review of rates

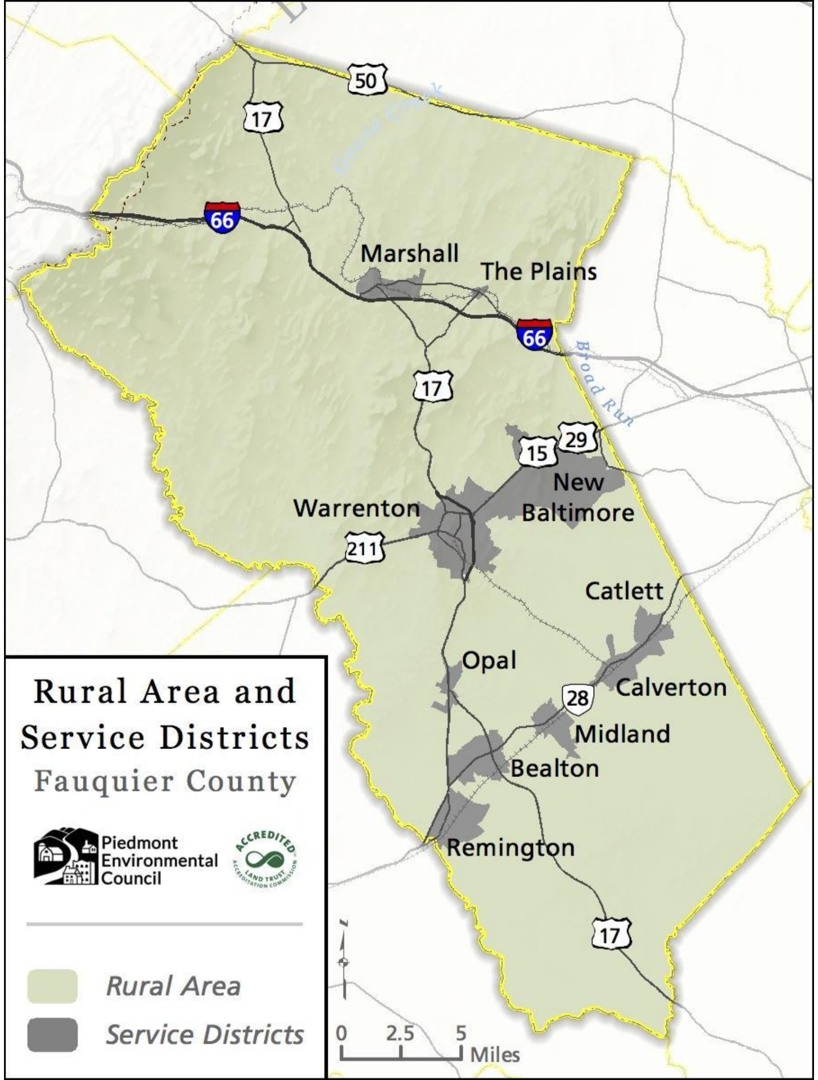
The SCC has scheduled a public witness hearing to begin at noon on September 2, 2025, followed by an evidentiary hearing. Public witnesses intending to provide oral testimony must pre-register with the SCC by 5 p.m. on August 26, 2025. Both the evidentiary hearing and the public witness hearing will be webcast.

Public witnesses wishing to provide oral testimony may pre-register in one of two ways:

- Completing a public witness form for case number PUR-2025-00058 on the SCC's website.
- Calling the SCC at 804-371-9141 during normal business hours (8:15 a.m.-5 p.m.) and providing your name and the phone number you wish the Commission to call to reach you during the hearing.

To promote fairness for all public witnesses, each witness will be allotted five minutes to provide testimony.

Let’s zoom in on local impacts…



A Local Example for Scale:

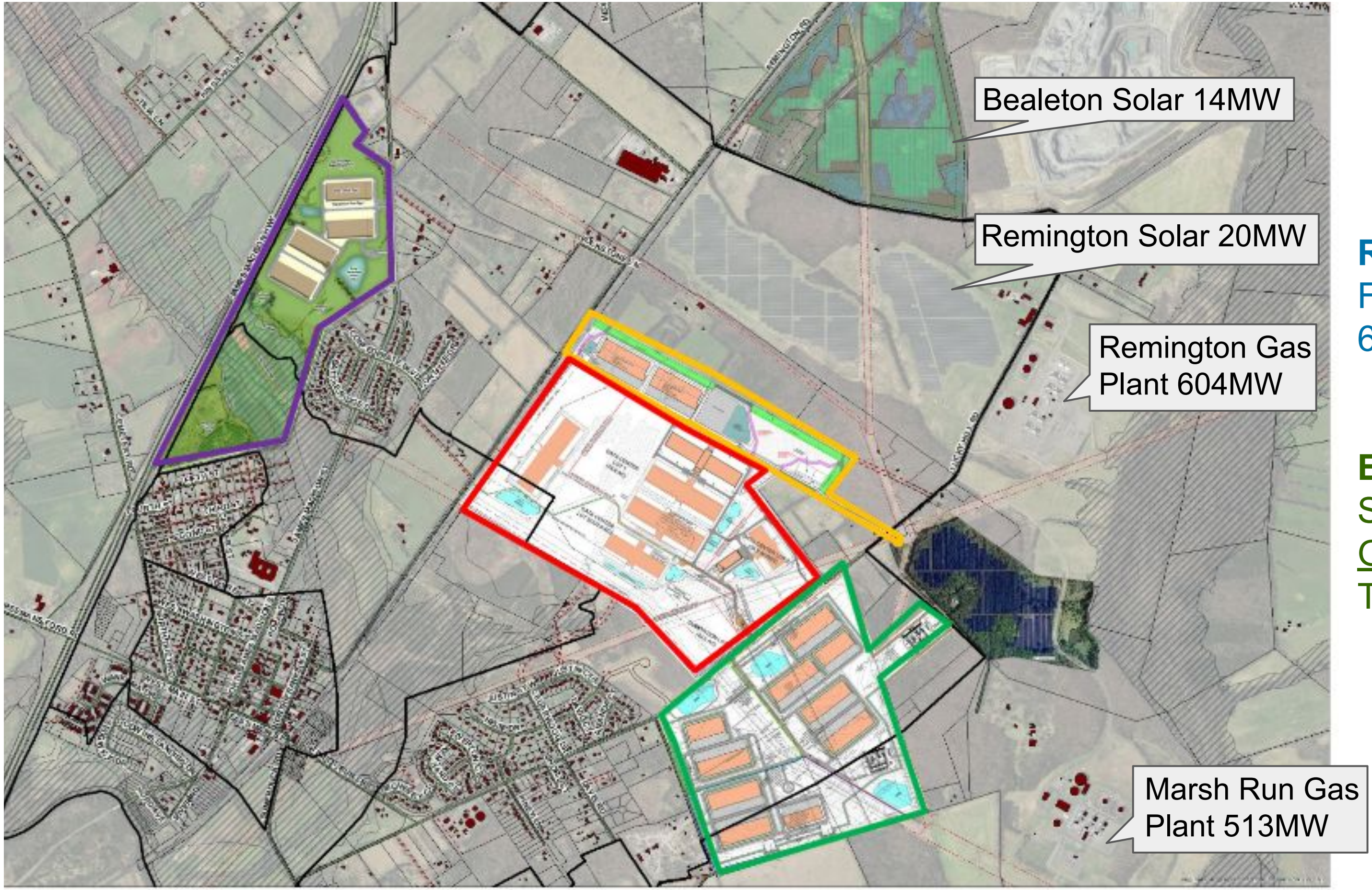
Fauquier Data Center Proposals and Energy Infrastructure

Residential Consumption:

Fauquier ≈ 26,000 homes

26,000 homes ≈ 60 MW – 100 MW

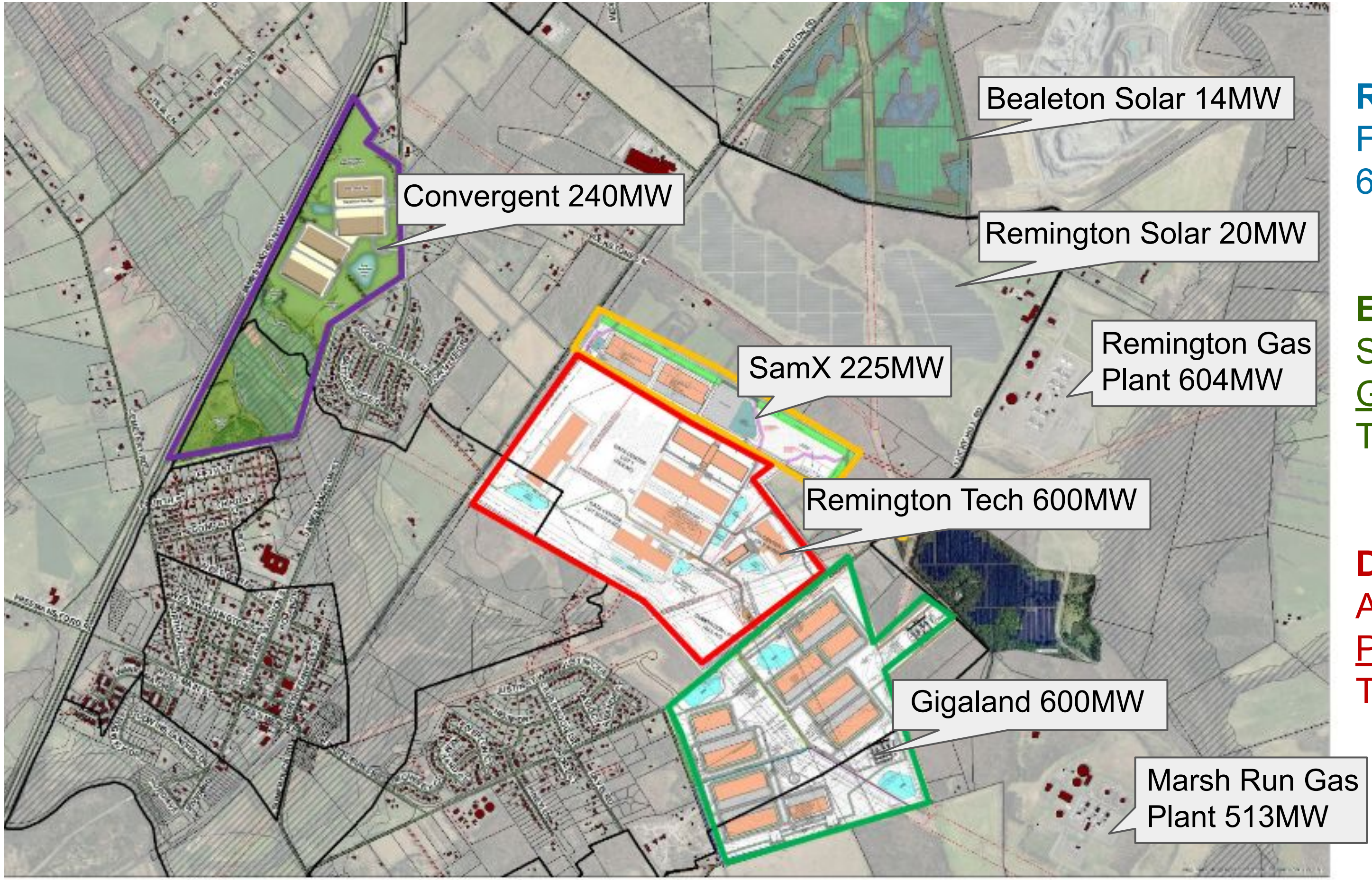
Fauquier Data Center Proposals and Energy Infrastructure



Residential Consumption:
Fauquier ≈ 26,000 homes
60-100 MW ≈ 26,000 homes

Energy Production:
Solar = 34 MW
Gas = 1,117 MW
Total – 1,151 MW

Fauquier Data Center Proposals and Energy Infrastructure



Residential Consumption:
Fauquier ≈ 26,000 homes
60-100 MW ≈ 26,000 homes

Energy Production:
Solar = 34 MW
<u>Gas = 1,117 MW</u>
Total – 1,151 MW

Data Center Consumption:
Approved – 600 MW
<u>Proposed – 1,065 MW</u>
Total – 1,665 MW

Evaluating Local Data Center Proposals

What makes data centers different?

- Boom in AI has led to explosive growth and lots of speculation
- Buildings are bigger and taller than most other uses in suburban/rural area
- They use much more energy than other uses; a campus can use more than a manufacturing plant or a steel mill
- Onsite backup power requirements necessitate more generators than any other use including hospitals and factories
- Facilities tend to cluster, leading to cumulative impacts on air and water quality, water consumption, and energy infrastructure.

Why Do Localities Find Data Center Attractive?

- They generally don’t usually create a lot of traffic

- They don’t require school seats

- They create some jobs (although not as much as many other forms of economic development)

- Opportunity to attract additional economic development

#1 Reason is tax revenue:

- **Personal Property Tax**
- **Real Estate Tax**

Local Land Use Impacts of Data Centers Vary…

- Traffic
- Compatibility w/Adjacent Uses
- Lighting
- Building Design
- Energy Usage
- Onsite Power/Air Quality
- Noise
- Water Usage and Wastewater
- Water Vapor Plumes
- Fire Protection and Fuel Storage

Photo Credit: Hugh Kenny, PEC

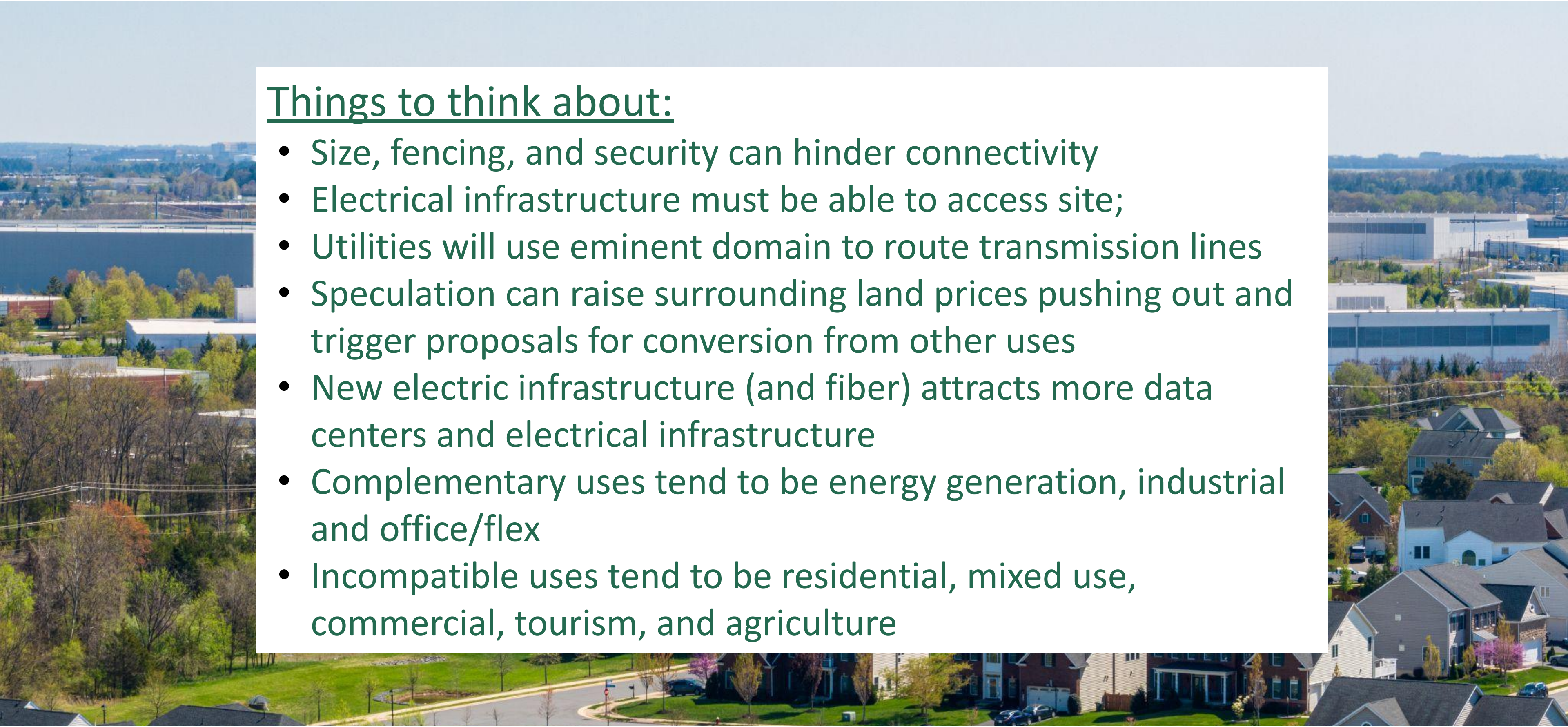
We're going to cover…

- Traffic
- **Compatibility w/Adjacent Uses**
- Lighting
- Building Design
- **Energy Usage**
- **Onsite Power/Air Quality**
- Noise
- **Water Usage** and Wastewater
- Water Vapor Plumes
- Fire Protection and Fuel Storage

Compatibility with Adjacent Uses

Photo Credit: Hugh Kenny, PEC

Compatibility with Adjacent Uses/Consistency with Comp Plan

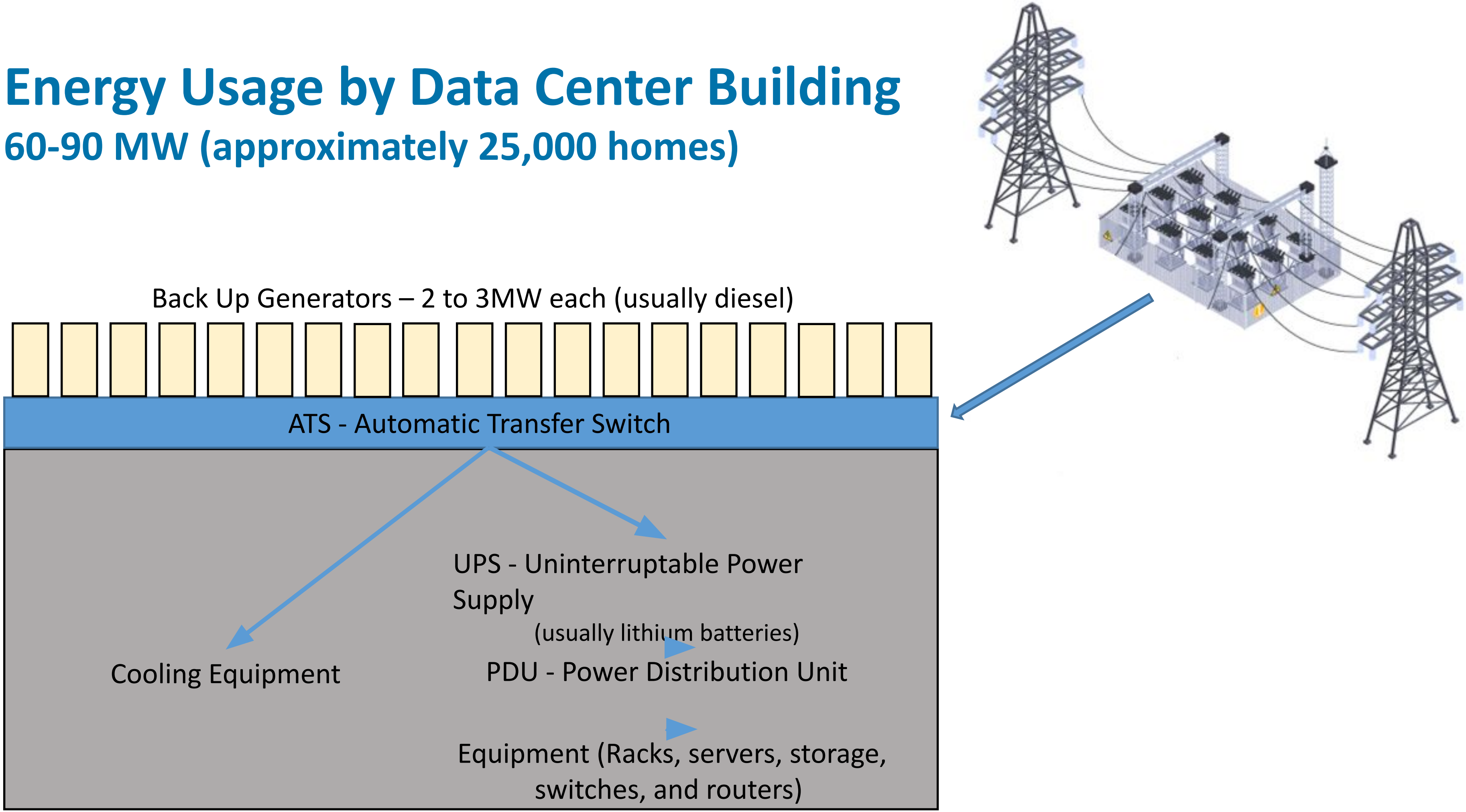


Things to think about:

- Size, fencing, and security can hinder connectivity
- Electrical infrastructure must be able to access site;
- Utilities will use eminent domain to route transmission lines
- Speculation can raise surrounding land prices pushing out and trigger proposals for conversion from other uses
- New electric infrastructure (and fiber) attracts more data centers and electrical infrastructure
- Complementary uses tend to be energy generation, industrial and office/flex
- Incompatible uses tend to be residential, mixed use, commercial, tourism, and agriculture

Energy Usage by Data Center Building

60-90 MW (approximately 25,000 homes)



Energy: Knowing the right questions to ask

Data Centers (Where will buildings be and what square footage? Total power needed for build-out?)

- Data centers usually require between 60-90MW per building but can be higher with multi-story buildings
- Rule of thumb for estimating power is 150 to 300 watts per square foot if you don't have end user

Substations (What size? Where? How many?)

- Direct-connect load at any substation is limited to 300 MW (due to reliability criteria)
- Local government regulates permitting (siting, zoning, and site plan) of substations.
- If not reserved on-site, Dominion will place substation offsite triggering speculation for more data centers around infrastructure

Transmission lines (Is there access to a nearby substation or line? What is the remaining capacity of the substation and line? Upgrades needed? Is right-of-way reserved on-site):

- Most data centers (over 30 MW) will require a transmission line rather than a distribution line.
- Transmission to directly serve data centers is typically 230kV
- A CPCN (certificate of convenience and public necessity) is needed for most lines over 138kV. The State Corporation Commission must approve the routes of these transmission lines, including decisions on overhead or underground.

Utilities have an obligation to serve all load requests for land uses approved by localities and have authority to request use of eminent domain from the state through a Certificate of Public Convenience and Necessity (CPCN)

Code of Virginia

Table of Contents » Title 56. Public Service Companies » Chapter 10. Heat, Light, Power, Water and Other Utility Companies Generally » Article 2. Services, Rates, Charges, Etc. » § 56-234. Duty to furnish adequate service at reasonable and uniform rates

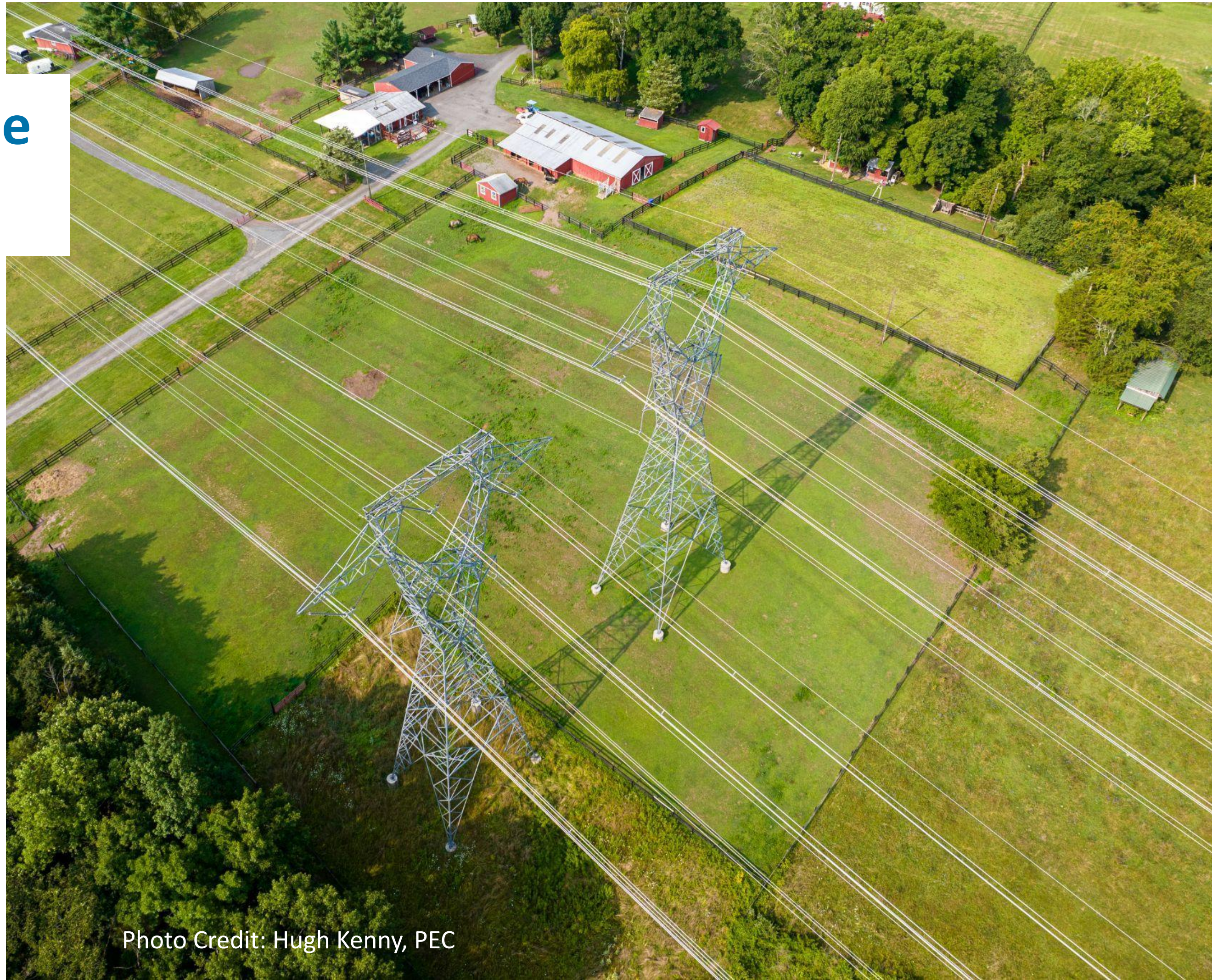
§ 56-234. Duty to furnish adequate service at reasonable and uniform rates.

A. It shall be the duty of every public utility to furnish reasonably adequate service and facilities at reasonable and just rates to any person, firm or corporation along its lines desiring same. Notwithstanding any other provision of law:

Substations in Loudoun


Photo Credit: Hugh Kenny, PEC

500kV lines in Prince William County



230 kV line in Loudoun

Backup Generators

How many? What type? Will they be for emergency use only? What emissions will be released? How often will they run for maintenance or other uses?

Whole House Generators are from 7.5kW to 26kW

Photo credit: www.homedepot.com

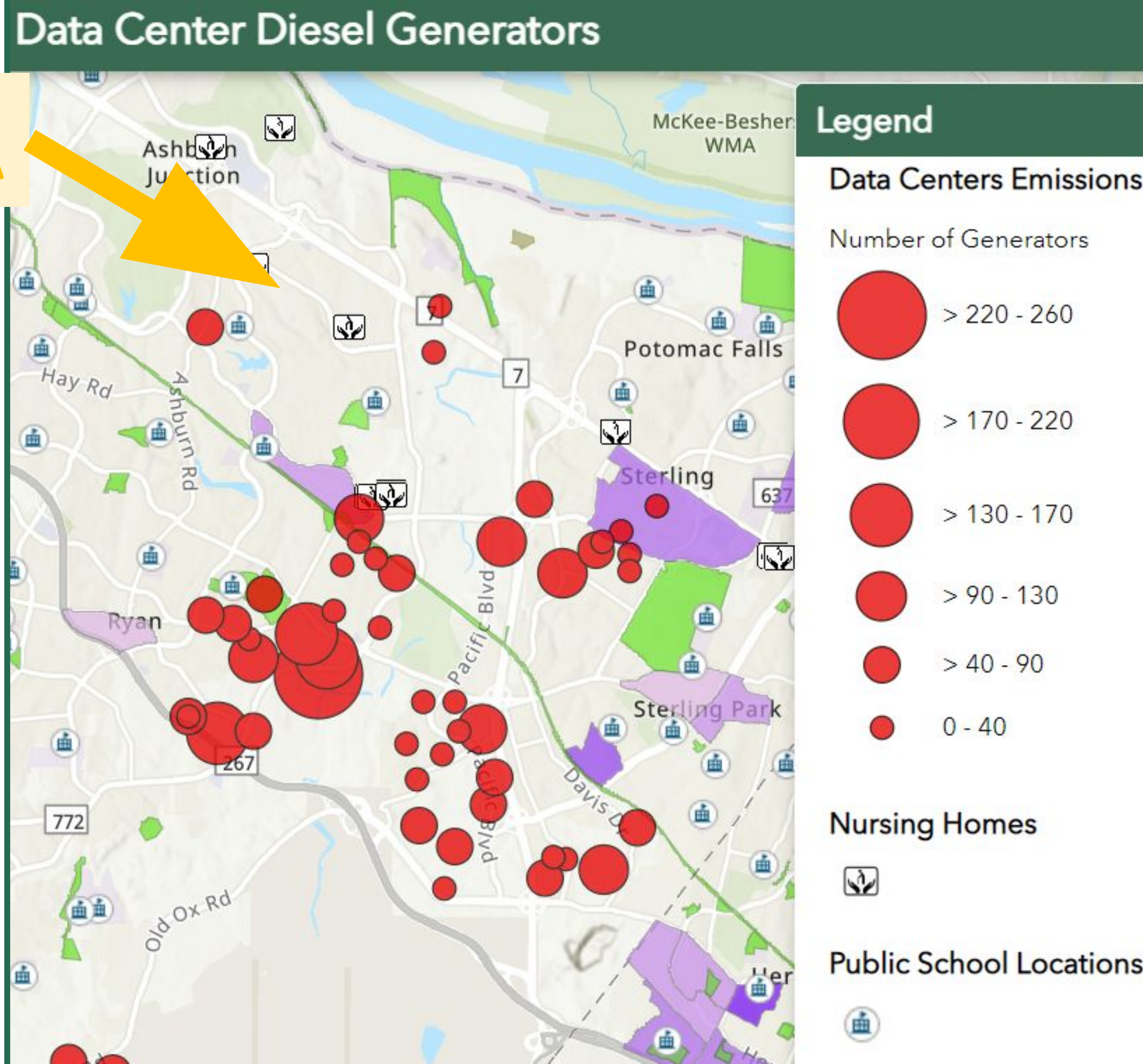
Commercial Generators run from 2000kW to 3500kW

Photo credit: peo-acwa-flickr-cc

Backup Generators

Ashburn, VA

There are over 9000 diesel generators permitted at data centers in Virginia, **over half are in northern Virginia!**



www.pecva.org/work/energy-work/data-centers-diesel-generators-and-air-quality-pec-web-map/

Generator Regulations

EPA Generator Tiers:

Tier I - first set of emission standards covering all new non-road mobile diesel engines

Tier II - Adopted 1999. Addressed NOx, carbon monoxide, unburned hydrocarbons and particulate matter (PM)

Tier III - Implemented between 2006 and 2008. Restricting exhaust emissions further.

Tier IV – Implemented 2008 to 2015. Mandated reduction of sulfur content and 90 percent reduction of PM and NOx emissions. Uses the best emissions-reduction technology available

Virginia DEQ Emergency vs. Non Emergency Standards:

Emergency Generators (Tiers 1-3, most are 2)

- Use of low sulfur diesel fuel oil
- Must use good operating practices and perform appropriate maintenance
- Emission limit = 6.0 g/hp-hr

Non-Emergency Generators (Tier 4)

- Use of low sulfur diesel fuel oil
- Emission limit = 0.60 g/hp-hr
- Requires diesel particulate filters (DPF)
- Requires diesel oxidation catalyst (DOC)
- Requires open or closed loop SCR (Selective Catalytic Reduction) systems

AI's deadly air pollution toll

UC Riverside and Caltech study reveals AI's toxic air pollution footprint and toll on people's health

AUTHOR:

DAVID DANELSKI

December 9, 2024

SHARE THIS:

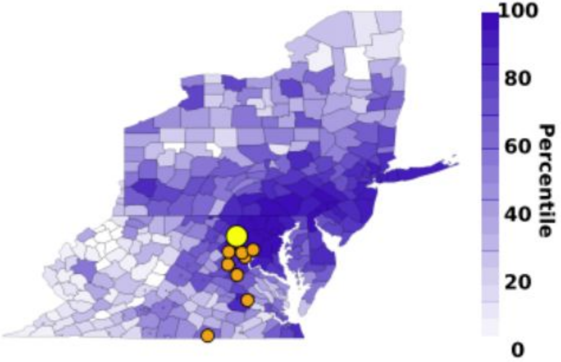
Computer processing demands for artificial intelligence, or AI, are spurring increasing levels of deadly air pollution from power plants and backup diesel generators that continuously supply electricity to the fast-growing number of computer processing centers.

This air pollution is expected to result in as many as 1,300 premature deaths a year by 2030 in the United States, and its public health costs from cancers, asthma, other diseases, and missed work and school days are approaching an estimated $20 billion a year.

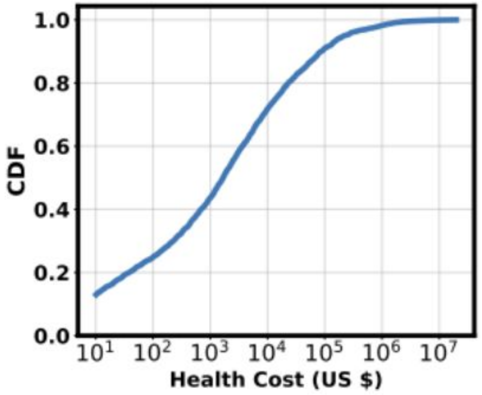
Such are findings of a study by UC Riverside and Caltech scientists published online this week. Yet, these human and financial costs appear overlooked by the tech industry.

A power plant in New Eagle, Pa.. (Jeff Swensen/Getty Images)

Air Pollution Modeling Using EPA modeling tool - COBRA



(*a*) *Health cost map*



(*b*) *CDF of county-wide health cost*

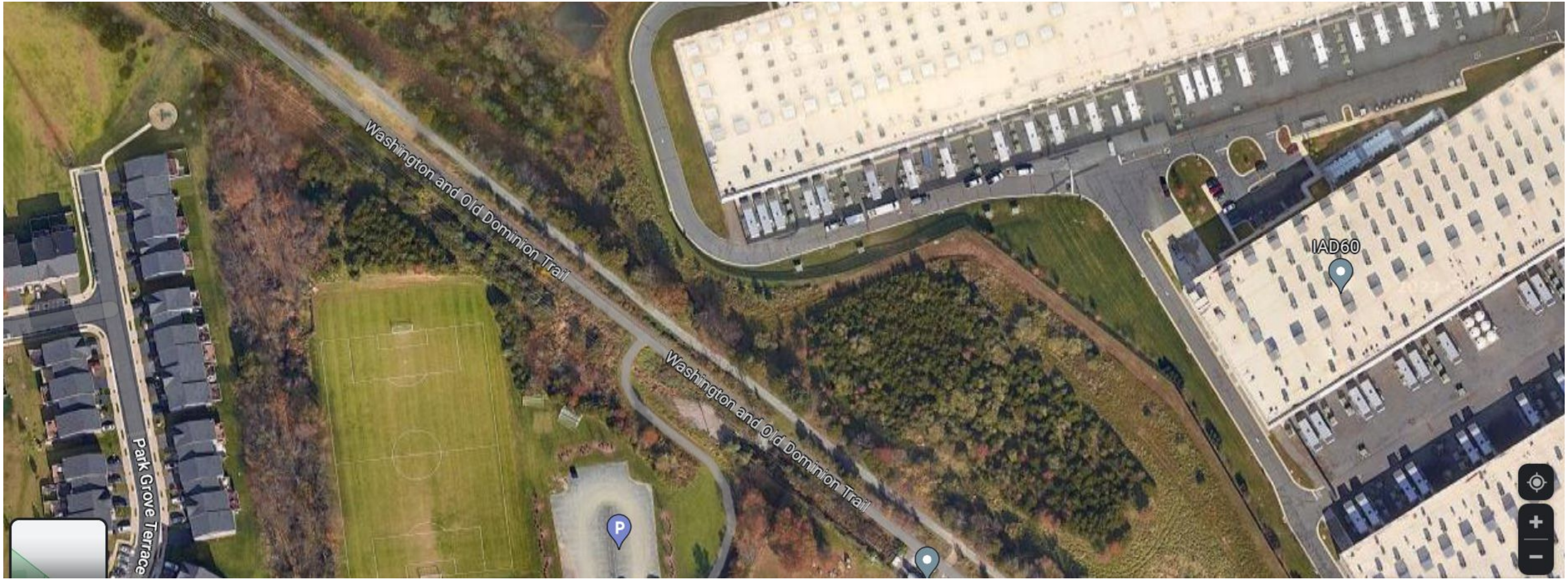
State	County	Health Cost (million $)
MD	Montgomery	**19.9** (17.3, 22.4)
VA	Fairfax	**18.9** (16.6, 21.2)
MD	Prince Georges	**8.9** (7.5, 10.4)
MD	Baltimore	**8.3** (7.0, 9.6)
DC	District of Columbia	**7.6** (6.2, 9.0)
MD	Anne Arundel	**6.3** (5.5, 7.2)
MD	Baltimore City	**6.0** (4.8, 7.1)
VA	Loudoun	**5.4** (4.7, 6.1)
VA	Prince William	**5.0** (4.4, 5.7)
MD	Frederick	**4.6** (3.9, 5.2)

(*c*) *Top-10 counties by health cost*

Figure 1: *The county-level total scope-1 health cost of data center backup generators operated in Virginia (mostly in Loudoun County, Fairfax County, and Prince William County)* [57]. *The backup generators are assumed to emit air pollutants at 10% of the permitted levels per year.*

Source: The Unpaid Toll: Quantifying the Public Health Impact of AI - https://arxiv.org/abs/2412.06288

Proximity to sensitive receptors such as parks, trails, schools, hospitals, elderly, or low income communities



Google Map Clipped Image 2023

Grid Constraints are Leading to Onsite 24/7 Power Generation

Vantage Data Center in Sterling - 100 MW natural gas turbines

Source: Vantage Data Center in Sterling permitted for over 100 MW natural gas turbines July 28, 2024. CNBC Interview: www.youtube.com/watch?v=MJQIQJYxey4 and https://www.deq.virginia.gov/home/showpublisheddocument/25986/638633875365530000

VIRGINIA MERCURY

ENERGY + ENVIRONMENT

Natural gas projects accelerate as Virginia's energy needs soar

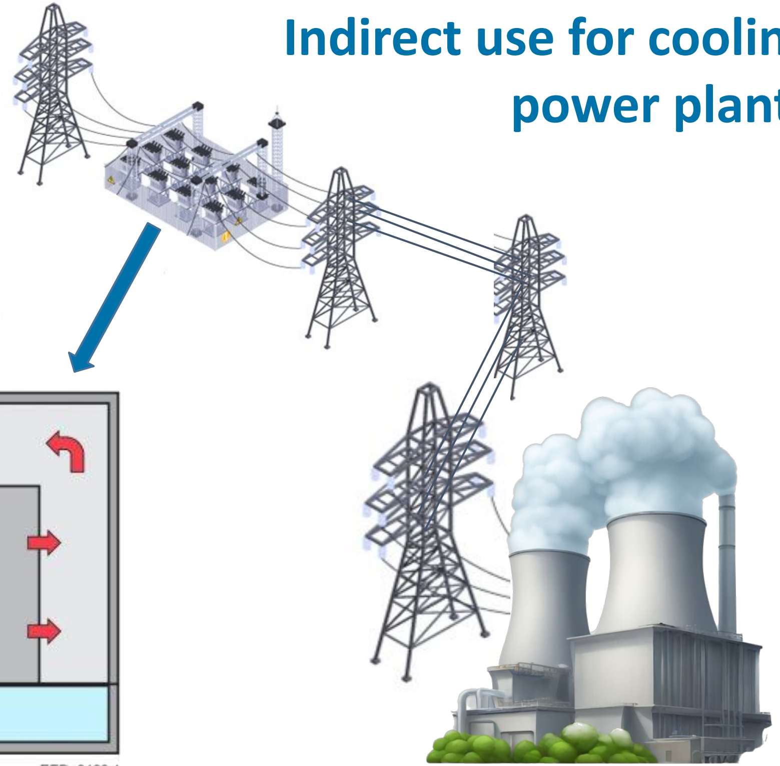
Proposed pipelines and data center developments raise questions about environmental impacts and community pushback.

BY: **CHARLIE PAULLIN** - DECEMBER 23, 2024 5:30 AM

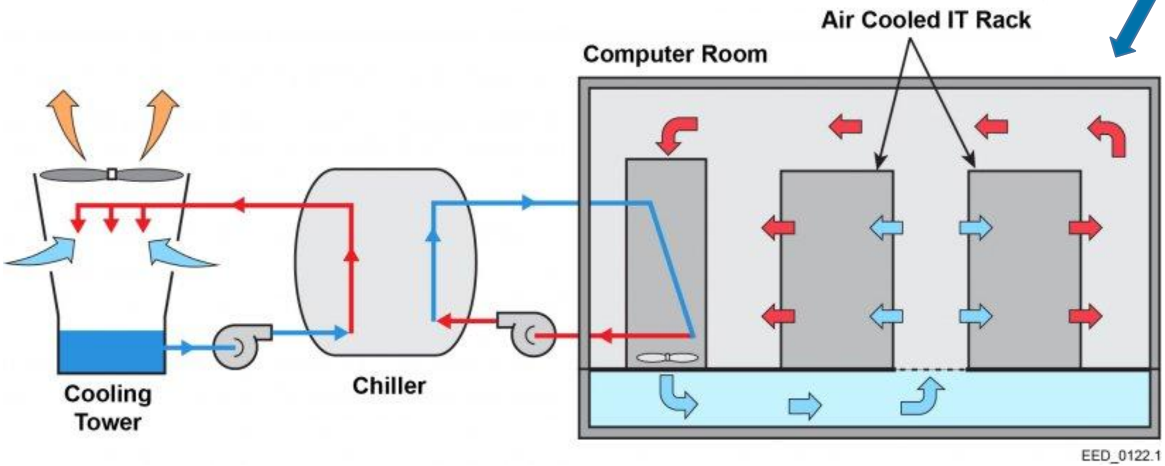
Mountain Valley Pipeline's right of way, seen from Boones Mill on July 25, 2023. (Scott Yates for the Virginia Mercury)

Water: Data centers consume water in two ways…

Indirect use for cooling power plants



Direct use for cooling IT



Source: www.energy.gov/femp/cooling-water-efficiency-opportunities-federal-data-centers

Cooling Techniques (often combination)

Air Cooling - CRAC systems (computer room air conditioner) which provides only air cooling or CRAH (computer room air handler) systems which use cooling coils and a chiller system to remove heat through cooling towers which consume water!

Closed loop cooling design:

- Air-cooled chiller (no water loss)
- Adiabatic cooling has no cooling tower (much less water loss)

Liquid Cooling - Liquid Immersion or direct-to-chip (uses less energy and less water)

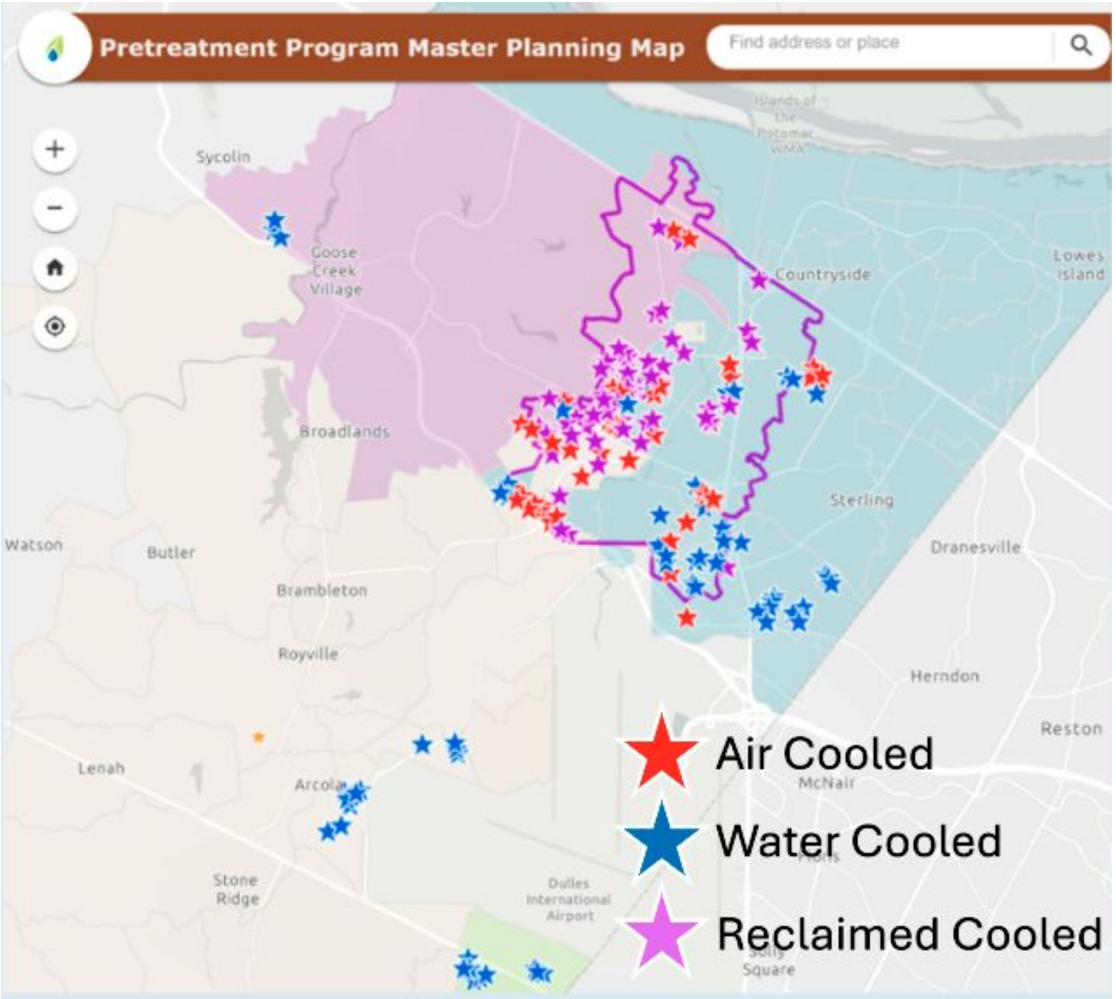
Hybrid Cooling – In row cooling unit or rear-door heat exchangers (uses less energy and less water)

Other industry solutions to reduce water consumption:

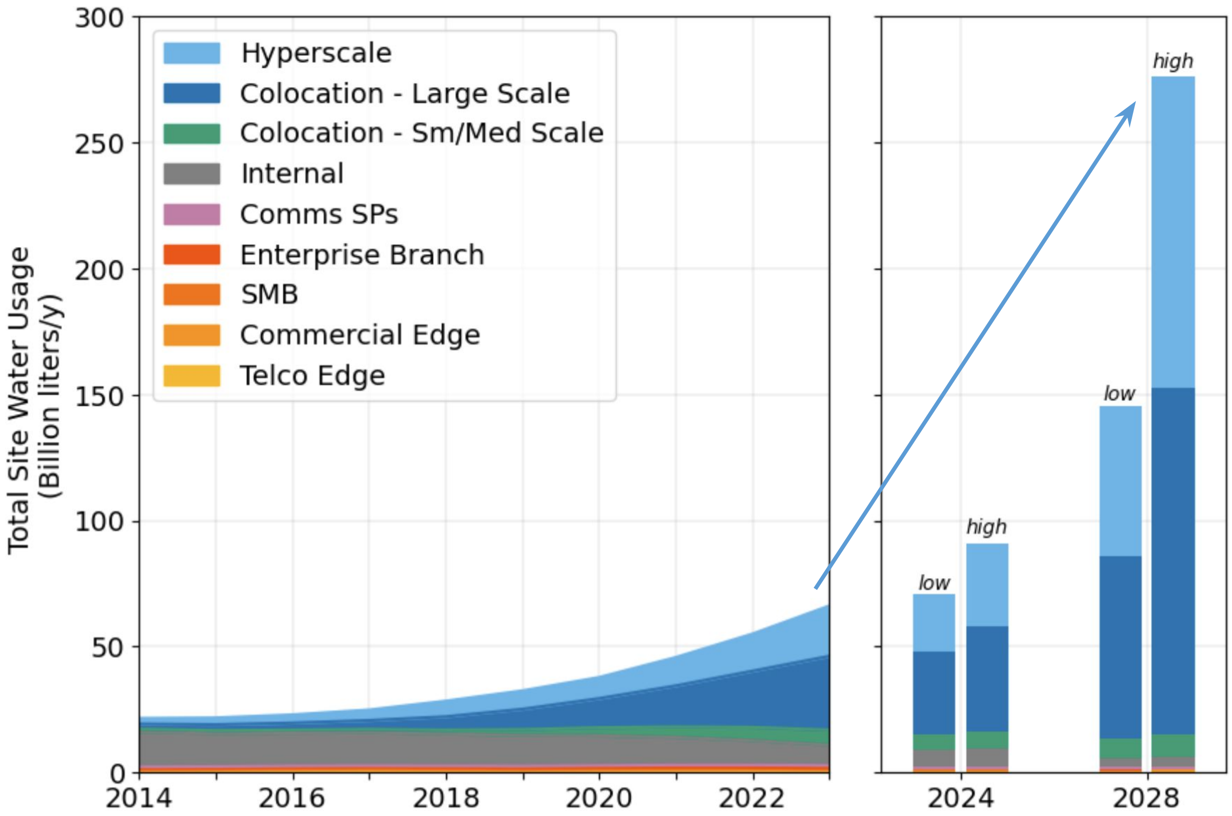
- Free cooling or air- or water-side economizers (utilizing naturally cool air or water)
- Rainwater harvesting and treatment for use in cooling
- Bleed recovery using reverse osmosis units to treat water blown down from evaporative cooling system
- Trigeneration using absorption chillers (onsite power generations using natural gas)

2024 Data Center Water Consumption in Loudoun County

- **Reclaimed** – over 45 connections serving 704 million gallons
- **Potable** – 937 million gallons
- **9% of total system capacity**
- **242 million gallons in August**



U.S. Data Center Water Consumption Projections



The U.S. data center water consumption in 2028, almost entirely driven by AI, will exceed **2 – 4x** the 2023 level

Source: 2024 United States Data Center Energy Usage Report and graph from Making AI Less "Thirsty": Uncovering and Addressing the Secret Water Footprint of AI Models https://arxiv.org/abs/2304.03271

Addressing Cooling and Water Consumption

Regulate impact rather than the technology:

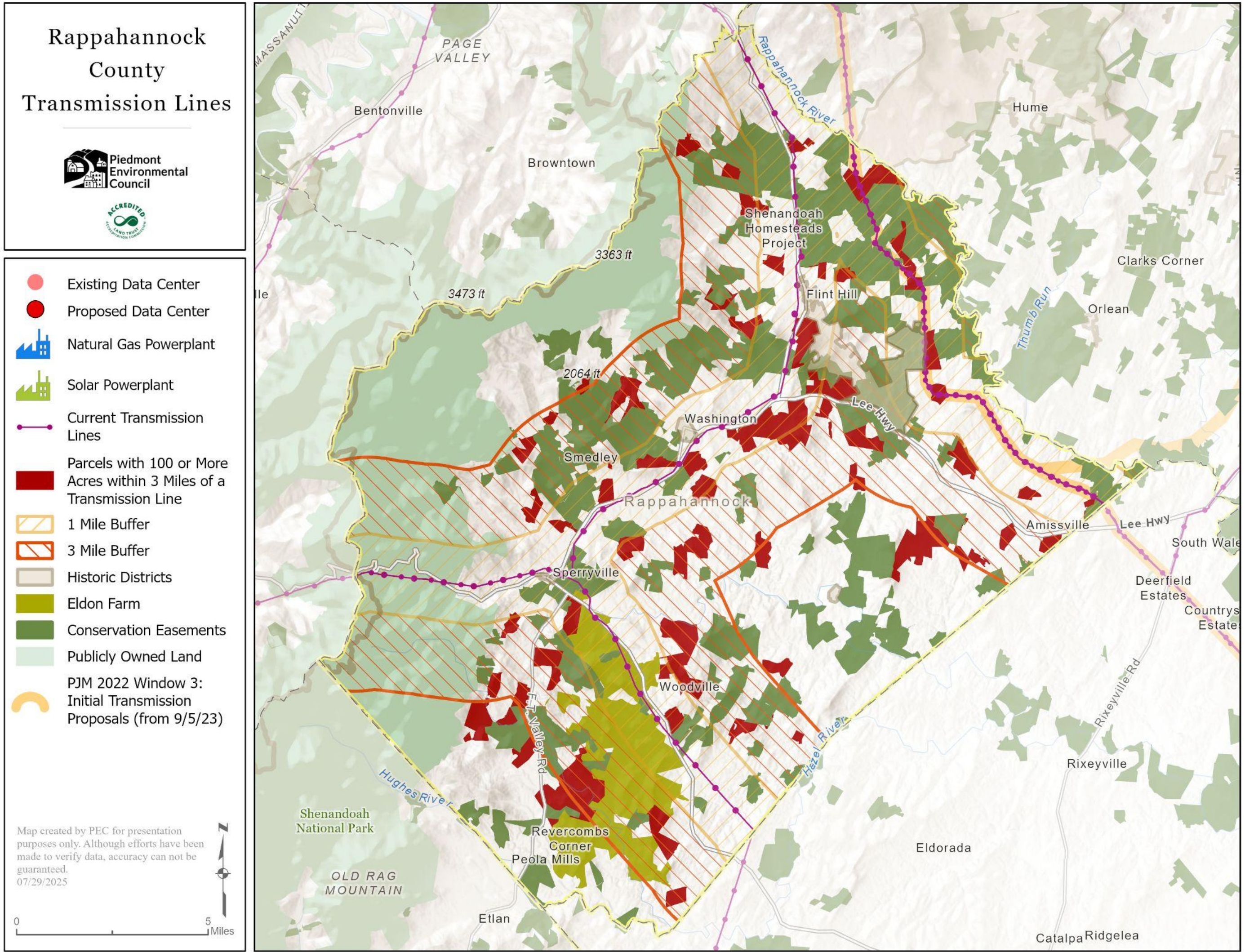
- Prohibit use of potable water or cap water consumption permitted
- Prohibit flushing and large quantity refills during summer and early fall.
- If allowing consumption of water require use of reclaimed water

Other things to keep in mind:

- Energy Usage – Air cooling without cooling towers uses more energy
- Noise – Use and location of HVAC equipment (fans, condensers, compressors, and cooling towers) can cause noise problems
- Blowdown – The capacity of wastewater treatment facility to handle amount and concentration of projected blowdown should be discussed
- Water Vapor Plumes – Cooling tower plumes are harmless but can be unsightly
- Trigeneration – Additional community impact of onsite natural gas power plant; rarely appropriate except in cases where there is an existing gas facility

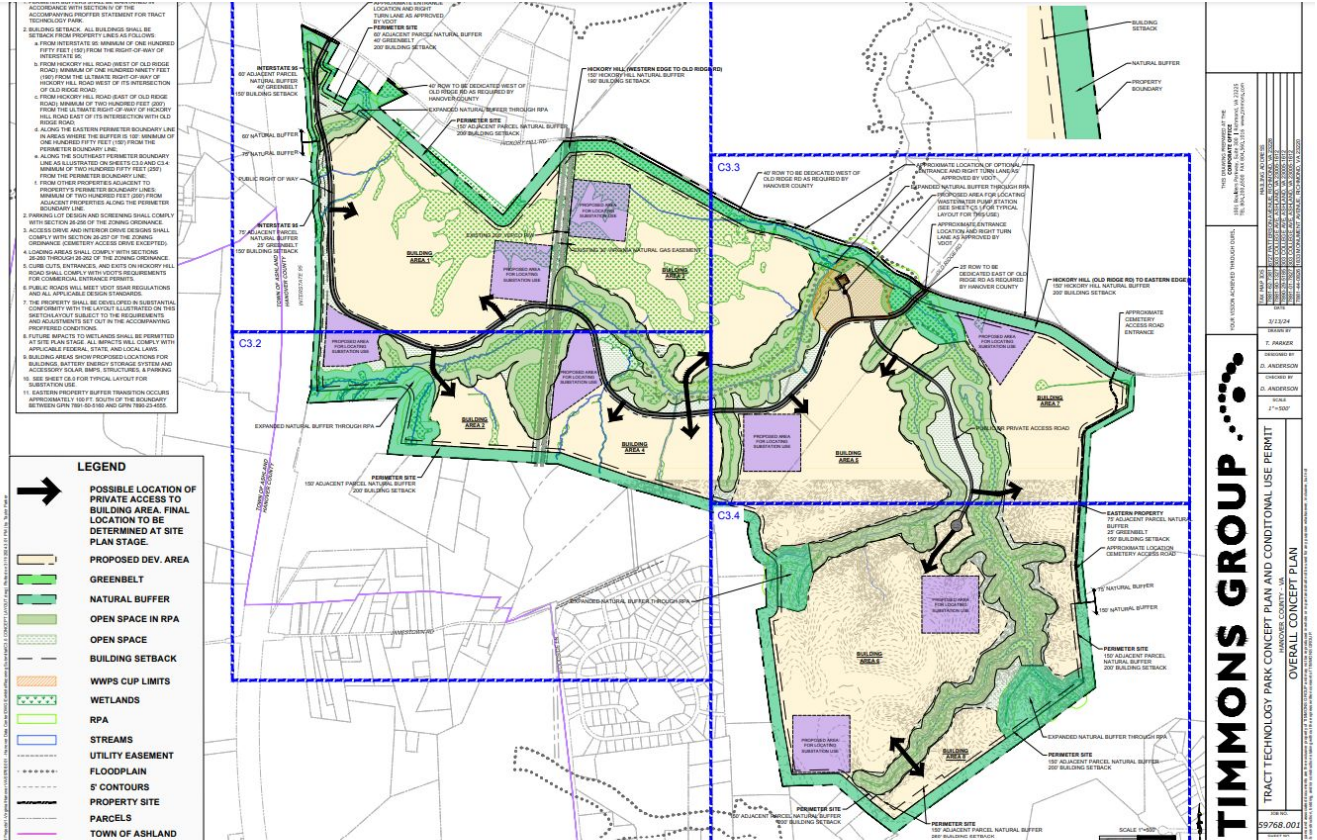
Could data centers come to Rappahannock?

100 Acre parcels within three miles of existing transmission line corridors



Recommendations for Best Practices

To adequately protect public health safety and welfare you need information. **Blob plans are not enough to assess impacts**



Recommendations:

- Require SUP - Data center campuses are rapidly changing, pose high potential impact to community, and the market interest is too high to allow this use by-right

- Add definition for data centers - Define data centers/cryptocurrency (possibly separately) and address any onsite power generation allowed or prohibited

- Adopt use-specific standards (require detailed general concept plan, basic information on data center type, cooling system, projected energy use, projected water consumption, plan fire and safety, noise study, etc)

- Make it clear to elected officials that once approved, the utility will need to provide power even if that means using eminent domain to route transmission

Ordinances to look at:

No model ordinance yet but places with interesting ordinances include:

- Loudoun County, VA
- Fauquier County, VA
- Prince George County, VA
- Town of Leesburg, VA
- Henrico, VA
- Frederick County, MD
- Niagara Falls, NY (High Energy Usage Overlay District)
- Chandler, AZ

Final Thoughts on Local Policies

- Don’t sign NDA’s and review FOIA regulations (a robust general concept plan, anticipated power usage, type of generators, water usage, etc is not proprietary information and should be a part of any application)

- Meet with your utilities to discuss electrical and water/sewer infrastructure required during review not after approval! This requires full information on anticipated power demand and water usage as well as a general concept plan

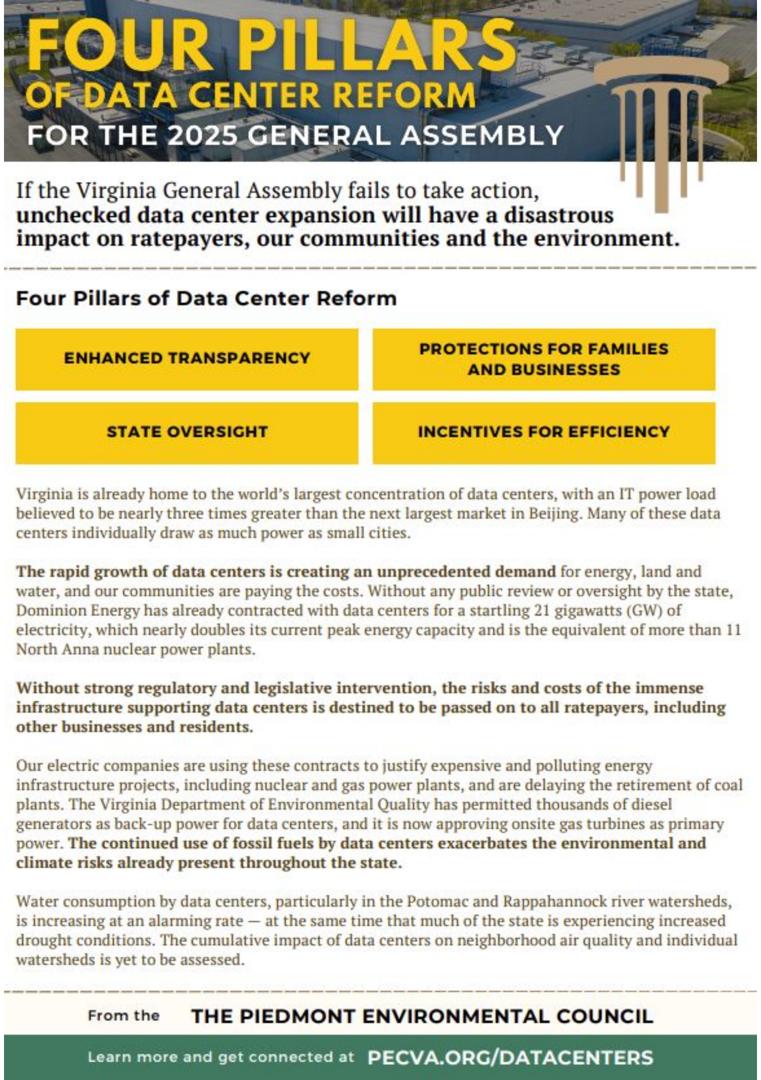
- DEQ oversees the air permitting of generators but to protect the public health safety and welfare localities can regulate the land use; e.g. type, number, and/or location of generators allowed in proximity to sensitive uses such as schools, parks, trails, elderly living facilities, hospitals, etc.

Are there solutions?

YES, but first we need to SLOW DOWN!

1. State Policy Change

- **State review** of data center proposals and oversight of regional and statewide impacts
- **Increased transparency** around energy, water, and emissions
- **Industry pays** for infrastructure through utility tariffs on large load users and fair allocation of costs
- **Incentivize sustainability** through the sales tax exemption or other means and **mitigate impacts**.



FOUR PILLARS OF DATA CENTER REFORM
FOR THE 2025 GENERAL ASSEMBLY

If the Virginia General Assembly fails to take action, **unchecked data center expansion will have a disastrous impact on ratepayers, our communities and the environment.**

Four Pillars of Data Center Reform

ENHANCED TRANSPARENCY	PROTECTIONS FOR FAMILIES AND BUSINESSES
STATE OVERSIGHT	INCENTIVES FOR EFFICIENCY

Virginia is already home to the world's largest concentration of data centers, with an IT power load believed to be nearly three times greater than the next largest market in Beijing. Many of these data centers individually draw as much power as small cities.

The rapid growth of data centers is creating an unprecedented demand for energy, land and water, and our communities are paying the costs. Without any public review or oversight by the state, Dominion Energy has already contracted with data centers for a startling 21 gigawatts (GW) of electricity, which nearly doubles its current peak energy capacity and is the equivalent of more than 11 North Anna nuclear power plants.

Without strong regulatory and legislative intervention, the risks and costs of the immense infrastructure supporting data centers is destined to be passed on to all ratepayers, including other businesses and residents.

Our electric companies are using these contracts to justify expensive and polluting energy infrastructure projects, including nuclear and gas power plants, and are delaying the retirement of coal plants. The Virginia Department of Environmental Quality has permitted thousands of diesel generators as back-up power for data centers, and it is now approving onsite gas turbines as primary power. **The continued use of fossil fuels by data centers exacerbates the environmental and climate risks already present throughout the state.**

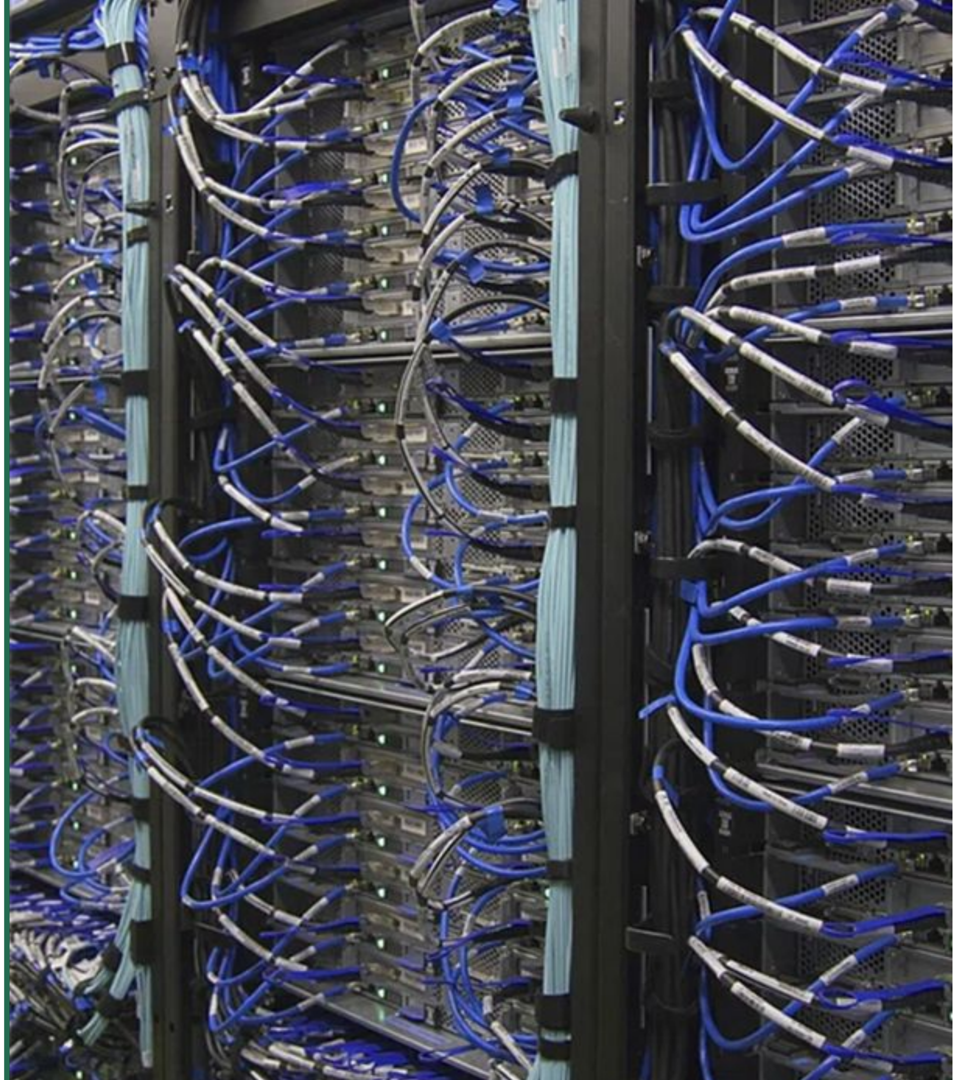
Water consumption by data centers, particularly in the Potomac and Rappahannock river watersheds, is increasing at an alarming rate — at the same time that much of the state is experiencing increased drought conditions. The cumulative impact of data centers on neighborhood air quality and individual watersheds is yet to be assessed.

From the THE PIEDMONT ENVIRONMENTAL COUNCIL

Learn more and get connected at PECVA.ORG/DATACENTERS

2. Market Push Towards Reducing Data Usage –

- Better data center monitoring tools, data management, and data reduction techniques
- Tools and resources to consumers to manage their data usage and make informed decisions
- Smaller AI models and more efficient software design
- Consumer pricing to reflect true cost that triggers price response and reduces waste



3. Required/Incentivized Sustainability Practices

- IT energy efficiency
- Cooling efficiency
- Water conservation practices
- Waste heat utilization
- Geothermal heating and cooling
- Onsite solar, wind, and advanced geothermal power generation
- Onsite battery storage utilized for backup and demand response replacing standard generators

4. State Commitment to Clean Energy and Smart Grid

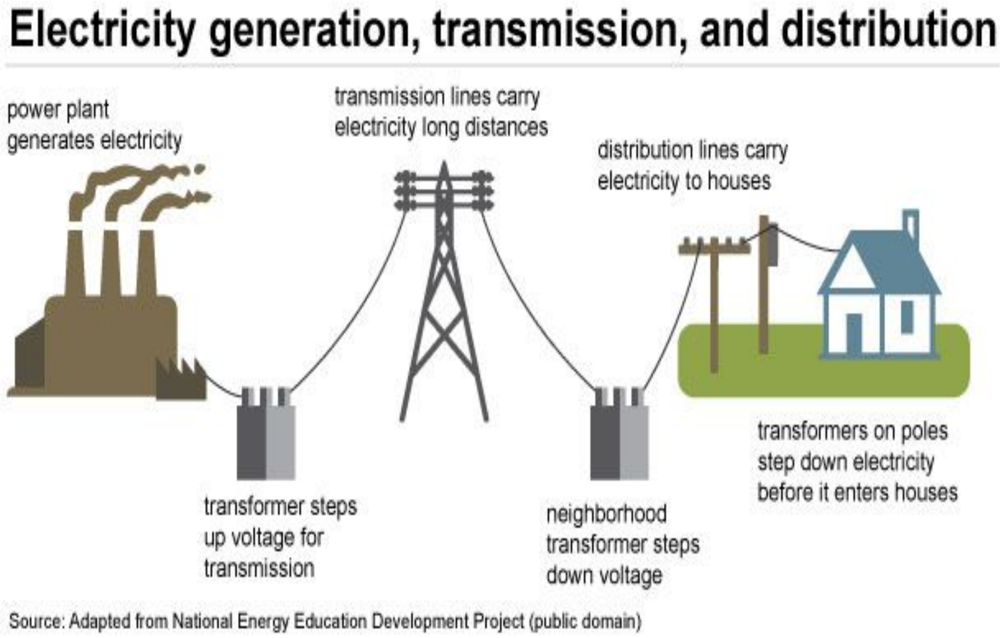
- Well sited and designed utility scale solar
- Innovative grid solutions
  - Advanced conductors/Smart grid technology
  - More battery storage; longer-term storage pilot projects
  - Virtual Power Plants
- Retain Net Metering Rates
- More state incentives: parking lot, brownfield, agrivoltaics, rooftop

Energy Lay of the Land

- **What is the Virginia Clean Economy Act and how is our progress**
- **Large Scale Solar Siting**
- **Advancing Distributed Generation, Storage, Agrivoltaics**

Energy Talk

- **Definitions**
  - 1,000 KW=1 MW
  - 1,000 MW = 1 GW
  - kWh= electricity produced
  - Transmission/Distribution/ Substation



- **We are part of PJM**
  - A regional transmission operator that operates the grid essentially from IL to VA and NJ to NC

Virginia Clean Economy Act

- Mandatory Renewable Portfolio Standard
  - 100% renewable energy by 2045/2050 for Dominion/APCo
  - 16,100 MW solar by 2035

- Distributed Generation Cap → 6%

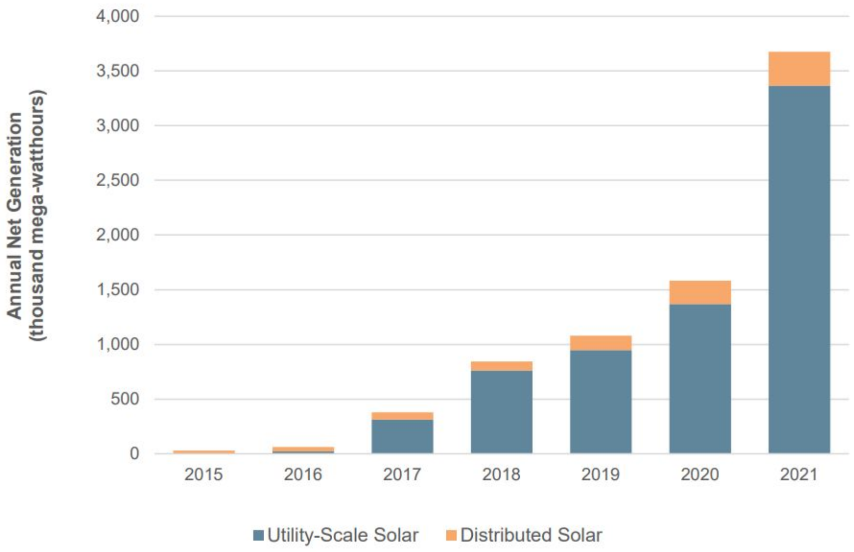
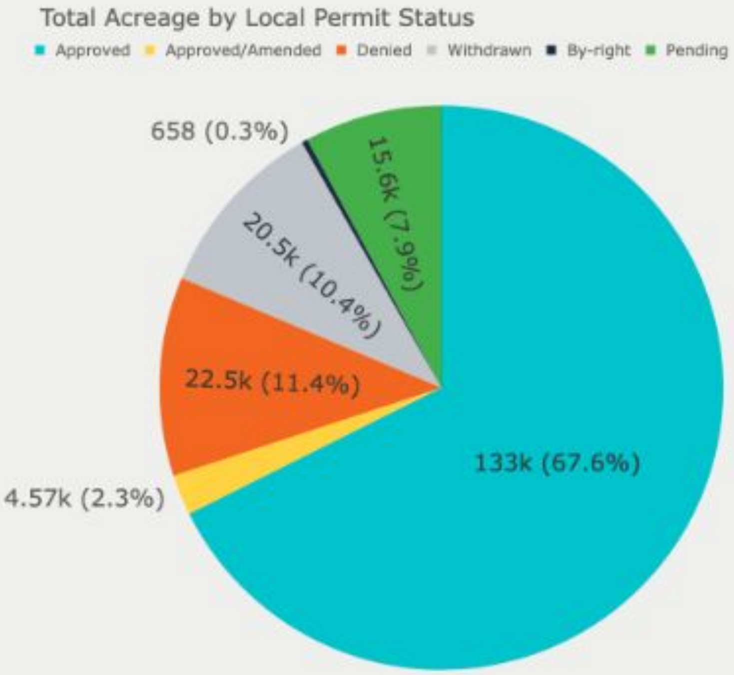
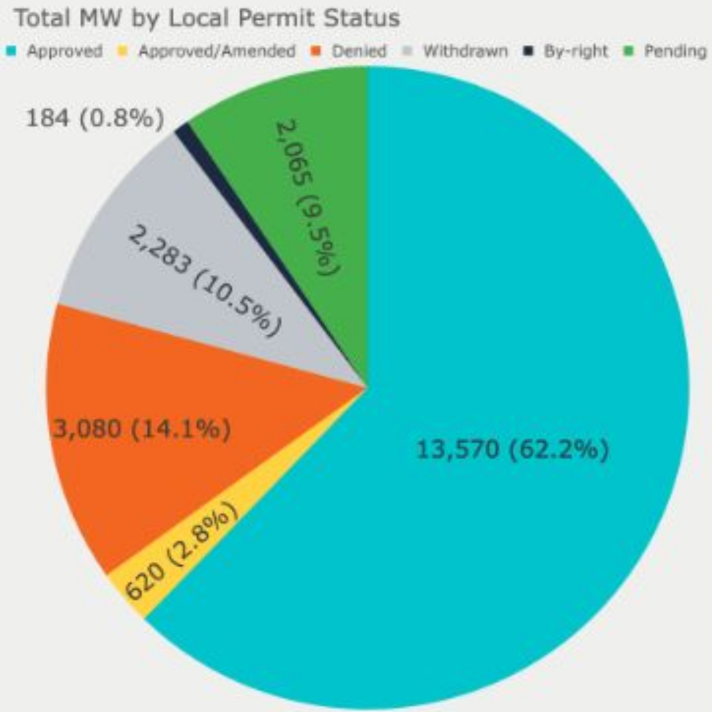


Figure 4. Annual Net Generation from Solar in Virginia
Source: U.S. EIA

Virginia Clean Economy Act Progress



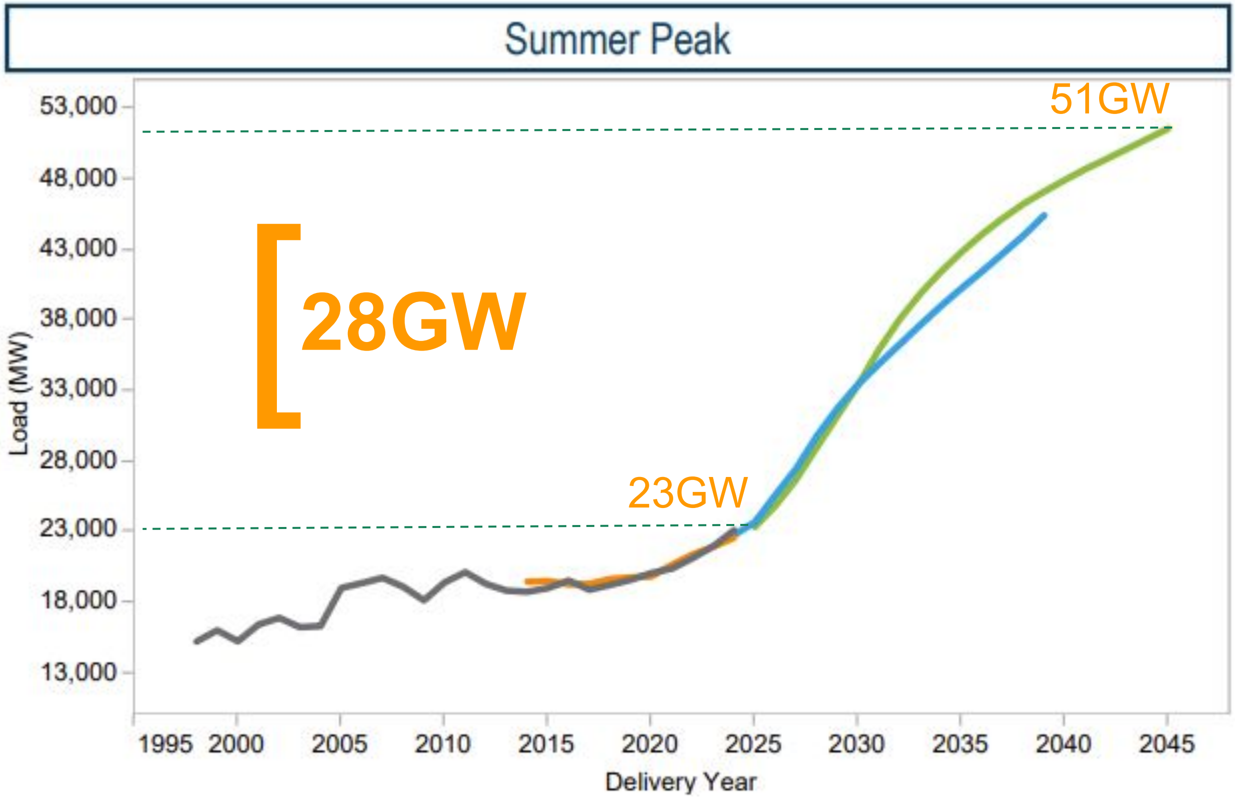


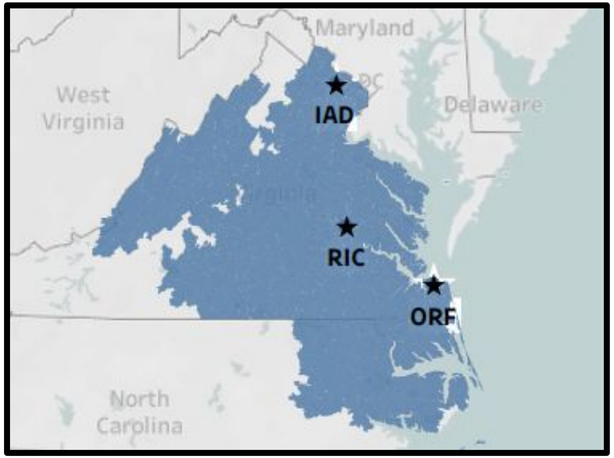
Approval Rates

Source: Preliminary data, Weldon Cooper Center's Virginia Solar Database

Skyrocketing Load Demand in Virginia

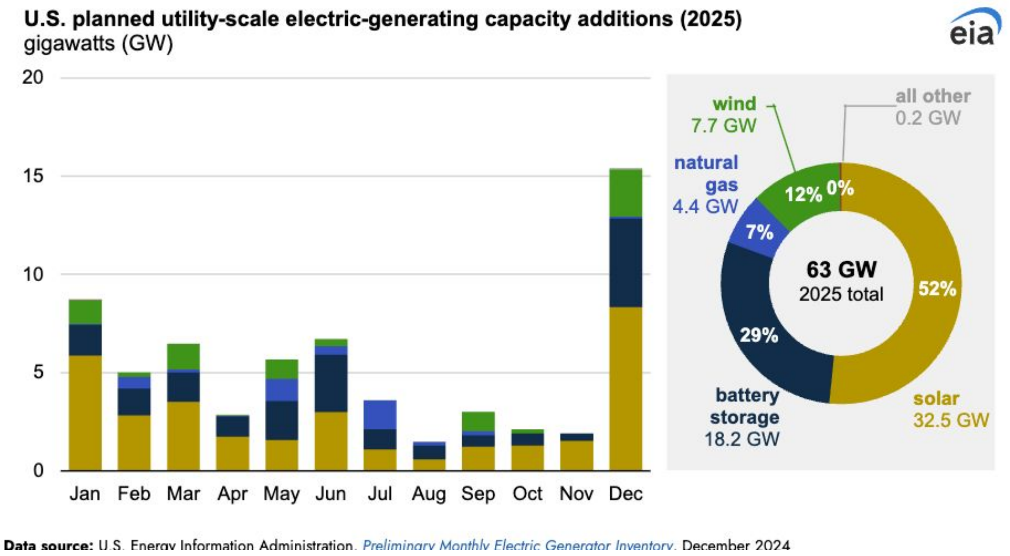
Dominion Energy’s 20 Year Forecast

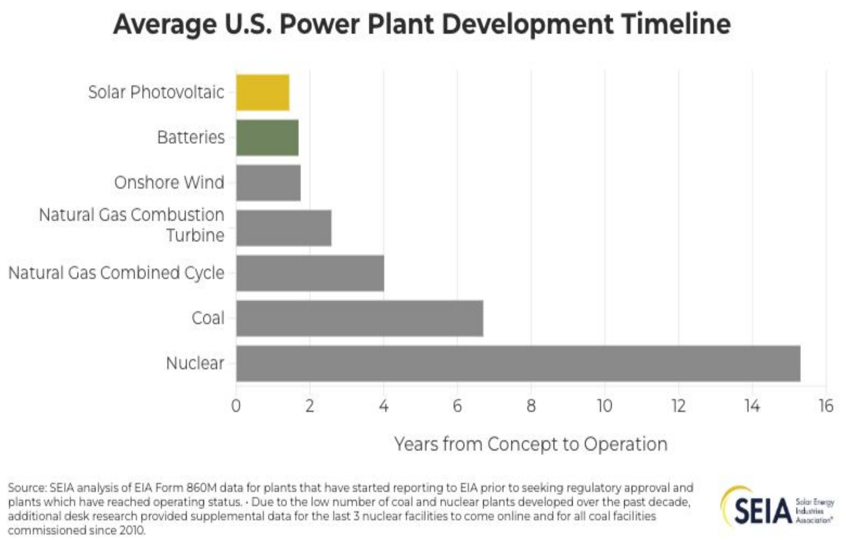




Green = 2025 projection
Blue = 2024 projection

National Perspective on Energy Mix and Development Timelines





Large Scale Best Practices

- PBR (5-150MW)
- Minimize impacts to:
  - Historical, cultural and scenic resources
  - Prime agricultural soils and forested land
  - Wildlife
  - Water Quality
- Minimal grading
- Soil testing
- Construction (acreage, machines, rain events)
- Decommissioning

Solar Siting/HB 206

- **Legislation**
  - HB206 draft regulations process update
  - Local authority issue

- **Related opportunities for best practices**
  - Dual Use
  - All Terrain Trackers (Nevados)

Summary of Utility Scale Solar in VA

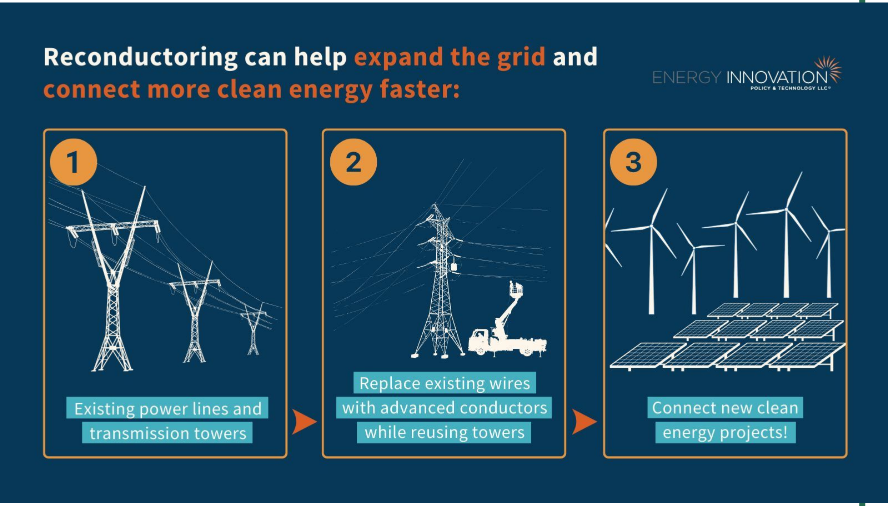
- Large part of solar future
- Best practices critical for present and future
- Data center demand = 100,000s acres of solar
- Increased local resistance/related legislation

Pieces of a Clean and Resilient Future

- Advanced Conductors/Smart Grid
- Data Center Sustainability
- Rooftop/Community Solar
- Brownfield Solar
- Parking Lot Solar
- Batteries/VPP's/Microgrids
- Agrivoltaics

Reconductoring

- Using carbon fiber
- Decrease line temp/sag
- Significantly increase capacity on existing lines
- Faster to implement
- Less expensive



Smart Grids

- Traditional grid designed for centralized generation
- Smart tech more effective way to integrate intermittent and distributed energy
- Sensors and other technology to establish two-way communication.
- Improves load balancing and enhances distribution management

Data Center Sustainability Report: Case Study snippet

Iron Mountain Data Center – Edison, New Jersey

Iron Mountain's colocation data center in Edison, NJ, features a 7.2MW rooftop solar array–the largest of any data center in the US. This 7.2 MW installation generates over 9 million kWh of clean energy annually, offsetting a portion of the facility's reliance on grid electricity. The facility is certified to the BREEAM standard for sustainable building.

Innovative Practices

Rooftop Solar: A 7.2 MW rooftop solar installation generates over 9 million kWh of clean energy annually.

Efficient Cooling Infrastructure: Utilizes efficient cooling technologies, including optimized airflow management and water-side economizers, to minimize energy consumption.

Certifications: BREEAM standard for sustainable building.

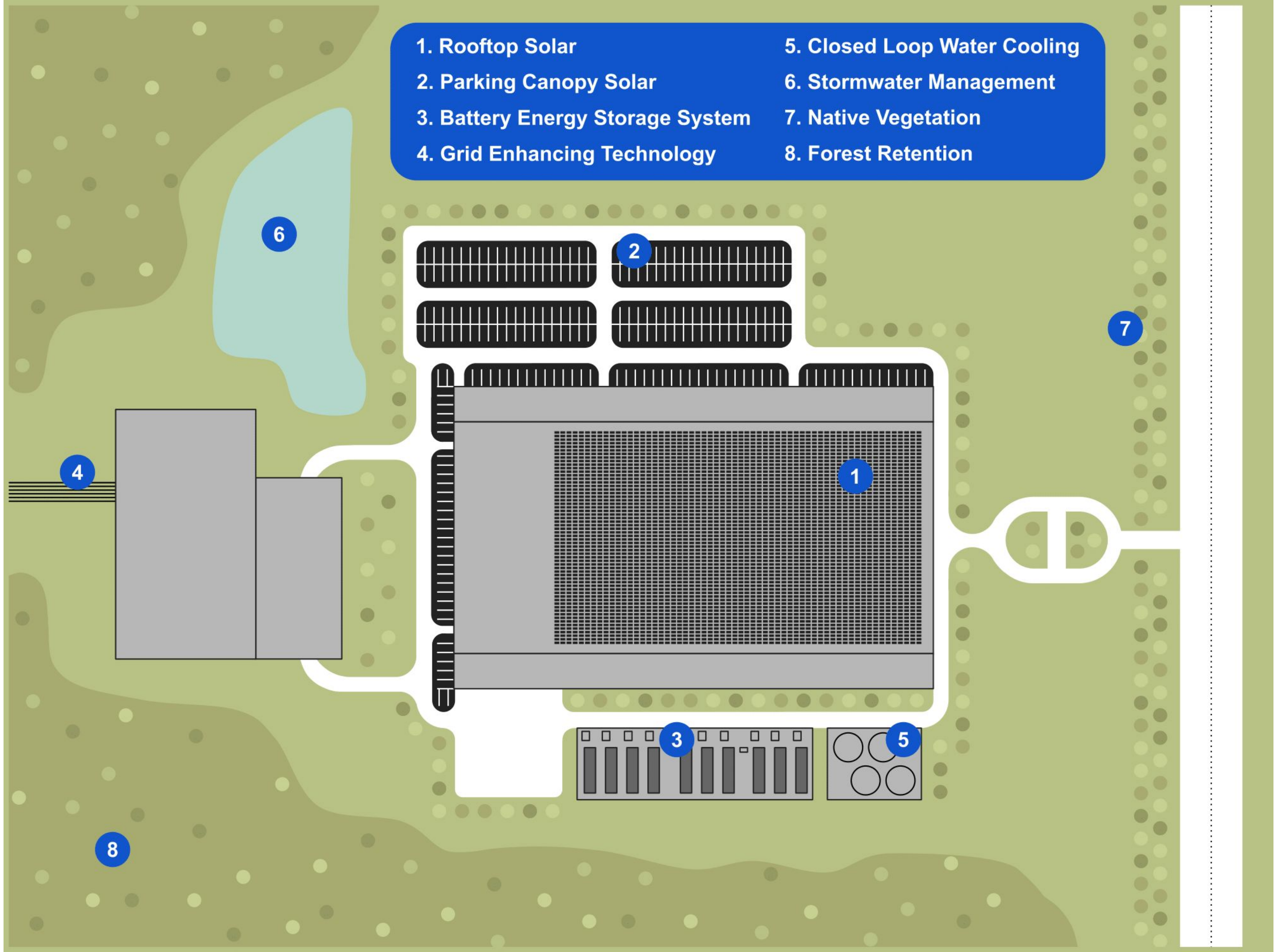


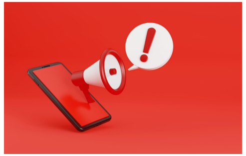
Image credit: Emily Johnson

Benefits of Distributed Generation

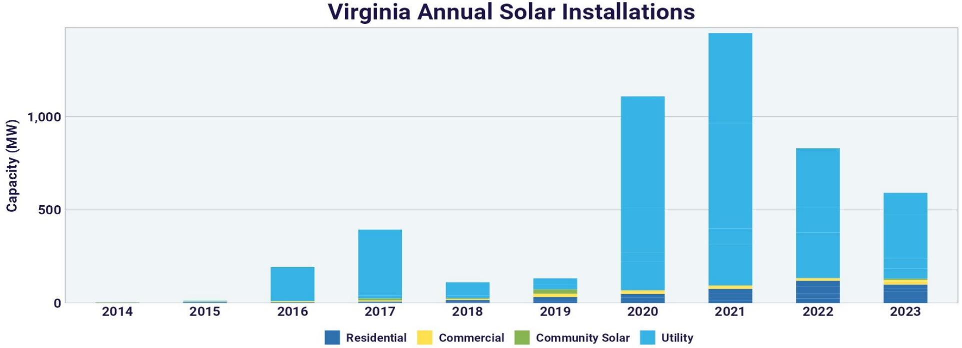
- Benefits the consumer
- Less lost to inefficiency
- Protection against outages
    - Load shifting
    - Battery
- Faster interconnection
- Energy Independence
- Protection against rate increases
- Using Built environment
- Creates more local business

Hurdles to a More Distributed Grid

- **Grids and RTO's set up to be centralized generation/transmission based**
- **Infrastructure yields high guaranteed rates of return for utility**
- **Biased modeling systems in IRPs**
- **"Value of Solar" pending in SCC with Dominion/App Power**
  - **Value of Net Metering**
  - Base Charges
  - The 6% cap



- **Cost prohibitive limits on larger distributed systems (250kW - 1 MW)**
  - Businesses, schools, large ag
  - DTT Standards/Dark Fiber
  - Grid upgrade costs
- **No State Incentives**
- **Risk of Federal Incentives**
- **Size Limits/Rural Limits**



Battery Backup

Advantages:

- Grid resilience & independence
- Benefit to peak load
- Bi-directional EV's
- Virtual power plant/Microgrid
- Federal incentives (30%)

Challenges:

- Cost
- Lack of state incentives

What PEC is Working on in Distributed Generation

- **Solarize Piedmont (annual)**
- **USDA Rural Energy for America**
  - Solar on the Farm event
  - Solar for Rural Businesses event
  - Solar in the Community
- **SolarApp+/SolSmart**
- **Virginia Department of Energy**
  - Solar for All Advisory Group
  - Shared Solar Advisory Group
- **DOE Voucher Recipient ($300k)**
- **Net Metering and Value of Solar**
  - Dunsky Report underway
  - SCC Case
- **Data Center Sustainability Report**

DG and Storage Legislation

- **Parking lot solar:**
  - PEC ran a parking lot solar bill last year that gained significant support from organizations such as Farm Bureau, Agribusiness and Cattlemen's Association.
  - This year's bill gave localities ability to mandate parking lot solar on certain new parking lot developments
- **Long Duration Energy Storage (HB 2537 / SB1394):**
  - Decreases impacts on our natural resources
  - Model ordinances, advisory and built with local consensus
- **HB 1883/SB1040, the Distributed Generation Expansion Act:**
  - *Triples* required solar development on parking lots, brownfields and coal mines.
  - This allows urban and suburban communities to do their part, making use of underutilized impacted sites
  - Meeting demand more efficiently than widely dispersed rural solar projects.

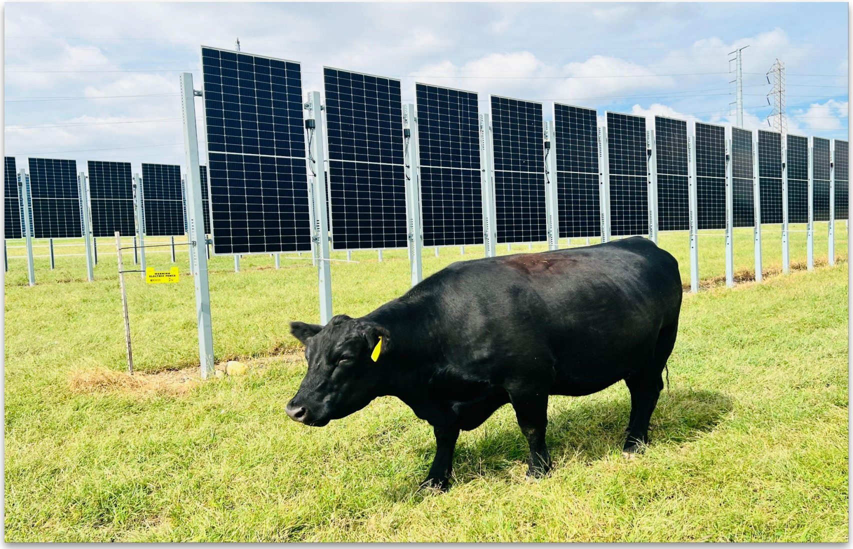
DG and Storage Legislation

- **HB 2346/SB 1100, the Virtual Power Plant Program: PASSED**
  - Innovative, cutting edge program that *incentivizes home batteries*, along with other distributed energy resources, to discharge energy to the grid at those peak times when we need it most. Successful in states such as Texas.
  - For our rural communities, many of whom are end of line users, backup generation is quite common and *1 in 6 Americans* have some type of backup.
  - More natural resource and ratepayer friendly than building new generation.
- **HB 2266/SB 1058, Interconnection bill for distributed resources: PASSED**
  - Many schools and farms in communities across the Piedmont have explored solar. However, onerous grid upgrade costs can stretch into the hundreds of thousands of dollars, making many projects infeasible. Spreading these upgrade costs across a rate class will help take the pressure off of the installing party.
  - This fix encourages development, providing more business for local installers and contractors across the Commonwealth.
  - In addition to cost savings for schools and businesses, this bill will help facilitate projects that preserve our conservation resources.

What is Agrivoltaics

Working towards a consensus definition in Virginia. American Farmland Trust defines agrivoltaics as:

- Production of marketable agricultural products throughout the full life of the solar array, and
- Intentional design of the solar array, done in consultation with farmers or other experts, to ensure that these systems are constructed, installed, and operated so that land within the array is suitable for agricultural production—with flexibility for the farmer to change what they produce in response to market demand throughout the 30-40 year+ life of the project.



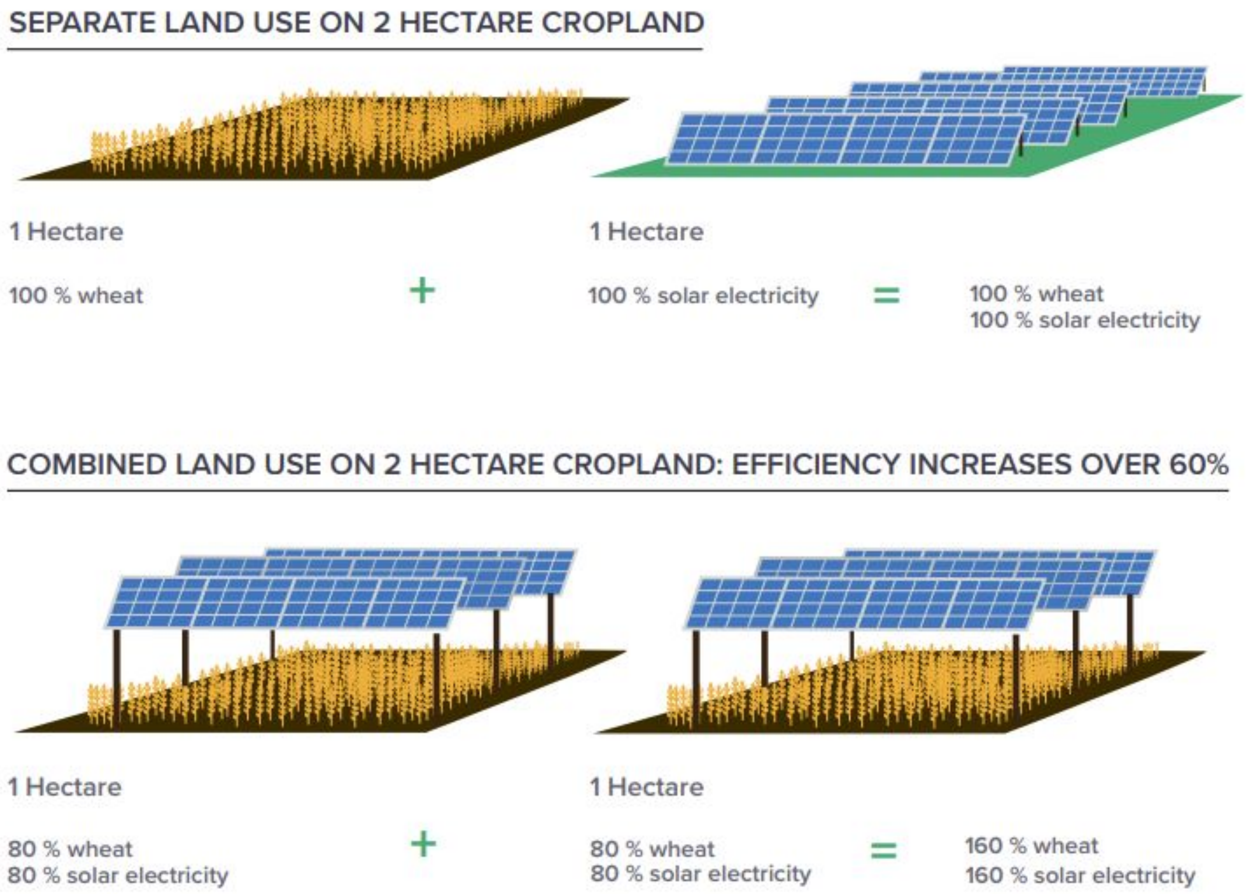


Figure 6: Product visualization under agrivoltaic systems.
Photo source—Fraunhofer Institute for Solar Energy Systems

Challenges of Agrivoltaics

- Need more studies for Virginia climate, soil and crops
- Comp plans are often not clear on agrivoltaics
- Incentives and retention of agricultural tax benefits
- "More expensive than utility scale"
- Ordinances that limit front of meter projects for rural/agricultural zoned properties
- Perception

Advantages of Agrivoltaics

- Farmers diversify income stream
- More positive view from farmers than standard solar
- Cost saving on vegetation management, decreased emissions
- Increased overall use of the land
- Increased efficiency for panels
- Increased moisture content can lead to higher biomass growth and/or nutrient rich content for grazing
- Shade for cows and sheep, mitigation of drought impacts
- Waste as fertilizer
- Cumulative impact/keeping land in ag

Large Scale Agrivoltaics Best Practices

- Thus far this is typically sheep grazing
- Limited grading/use of terrain trackers
- Grazing plan (seed mix, re-vegetation timeline)
- Community benefits to local ag economy
- Land ownership structure for grazer

About the PEC Community Farm at Roundabout Meadows

- **Demonstration farm in Loudoun**
- **Regenerative practices**
- **Certified Naturally Grown (CNG)**
- **About 50,000 pounds of produce per season**
- **All produce donated to local hunger relief organizations**
  - Loudoun Hunger
  - Christ Church Cares/FISH
- **Full time staff/Volunteer Days**
  - Fortune 500 companies, youth groups, church groups, etc.

Agrivoltaics Project at Roundabout Meadows

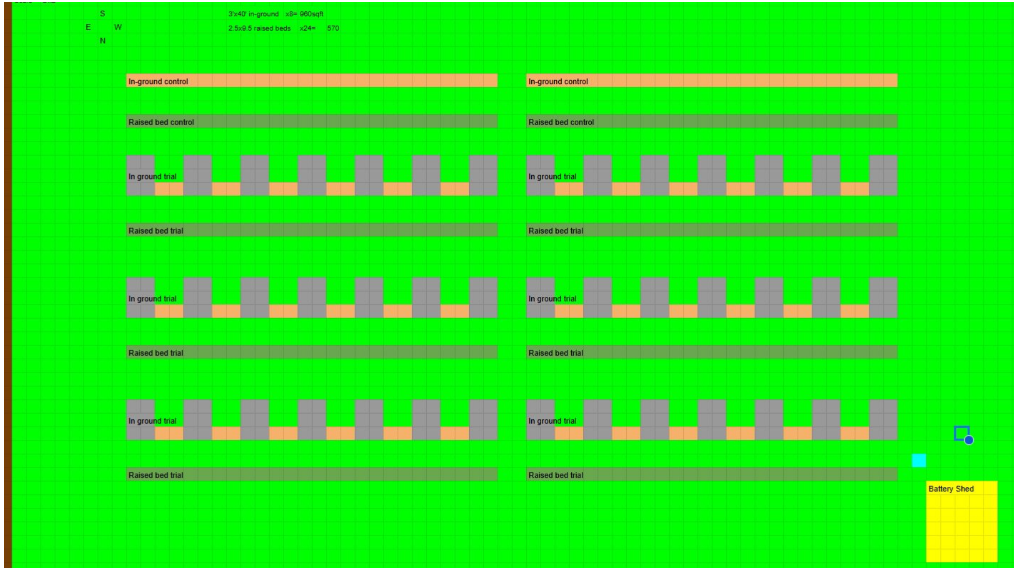
The Solar Setup

- **Technical Assistance from U.S. Department of Energy's National Renewable Energy Lab (NREL)**
- **17Kw Solar System**
- **42 panels/spaced**
- **130% Offset**
- **Full battery backup**
  - Off grid capabilities/resilience
- **6 foot racking**
- **Fixed tilt panels**

Agrivoltaics Project at Roundabout

The Ag Setup

- **1,530 sqft production space, will yield approximately 2,000 lbs, 1,667 meals**
- **Experimental Group/Control group**
- **In ground plantings and Raised beds**
- **Choosing crops and varieties that will likely work (cold weather, shade tolerant), under 4’ tall, non-vining**
- **Crops Include:**
    - Lettuce, Collards, Chard, Kale
    - Cauliflower
    - Turnips, Beets
    - Tomatoes, Peppers
- **Monitoring: Yield, Quality, Irrigation,Soil**



Agrivoltaics Project at Roundabout Meadows

What we expect:

- Yield delta will be greater for hot-weather crops than cool-weather crops
- Trial crops delayed/variable maturity
- Trial crops will require less irrigation
- Disease pressure will be greater in trial
- Soil temperature will be lower in trial
- Fertility will be similar with no contamination

Data we will share:

- Gathering data points relevant to farmers
- Irrigation requirements (irrometer), yield per square foot/days, harvest timeline, biotic pressures (pests/diseases), phenotypic variation, soil temperature, soil fertility, soil contamination (heavy metals), vegetation management challenges

Learning Lessons

- Racking procurement
- Permitting/Local Ordinances
- Grid upgrades
- Project timeline
- Bedrock/Geotech
- Supply Chain
- Insurance
- Scalability/Legislation
- Incentives (ITC, REAP, RECs)

Hammering Through Bedrock

Trenching: Laying the Infrastructure

Racks on Racks on Racks

Raise Up

Piedmont Environmental Council

Thank you!