

FACT SHEET

UNLOCKING THE GRID: INCREASING CLEAN ELECTRICITY SUPPLY TO MEET RISING DEMAND IN VIRGINIA

Demand for electricity is growing more now than it has in the last half century, driven partly by rapid growth of data centers and other large energy users. The power grid is straining to meet this increasing demand, and utility bills are on the rise.¹ To keep electricity flowing and affordable, we need to connect new resources to the grid—especially wind, solar, and batteries, which provide low-cost electricity without fuel costs and supply risks.

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Developers are ready to build new power plants. **But the power grid is overburdened and outdated, struggling to interconnect new power supply at the rate needed to match demand.**² This results in higher electricity prices and lost potential jobs and investment from new power plant development.

When a power plant developer wants to connect to the grid, the region’s grid operator (in Virginia’s case, PJM) must conduct an interconnection study to determine whether the power grid can support it. If the study finds that network upgrades (i.e., new transmission lines, new substations, or replacements of existing infrastructure) are needed to connect the power plant, the developer is responsible for the full cost of those upgrades.³ Unfortunately, these required upgrades are becoming more extensive as the system ages.

The cost and timeline of necessary network upgrades are causing real problems for the grid:

1. If network upgrades are too expensive, developers withdraw from the interconnection process and the power plants never get built, even if development makes economic sense otherwise. When this happens repeatedly in the same location, it’s a sign that the grid is overburdened. These specific parts of the grid are the most critical to fix.

2. New power plants face multiyear delays if network upgrades take a long time to complete. Delayed resource interconnections lead to subsequent economic losses for communities.

Network upgrades in Virginia have already forced 10,000 megawatts (MW) of new resources out of the queue since 2018 and could delay an additional 4,100 MW for at least four years, until 2030 or later.

This issue brief identifies opportunities for Virginia to speed up the connection of more new power plants by analyzing the network upgrades holding them up, including location and cost.

EXPENSIVE AND DELAYED NETWORK UPGRADES STALL ENERGY GROWTH IN VIRGINIA





In total, since 2018, 103 power plants have either withdrawn or been delayed by network upgrade bottlenecks in Virginia. The lost and delayed power comes from a variety of sources, including offshore wind, solar, and batteries. The location and resource type of the withdrawn and delayed plants from PJM’s most recent queue cycle are shown in figures 1 and 2, below, along with the needed upgrades.

Eighty-three withdrawn power plants since 2018: Fifteen network upgrades that have yet to be built prevented 83 Virginia power plants, representing a total of 10 gigawatts (GW), from interconnecting since 2018 (see Appendix, table A1).⁴ There are also five network upgrades in neighboring North Carolina that are inhibiting Virginia power plants from interconnecting. Most of these 83 resources require multiple network upgrades to connect to the grid.



Figure 1: Withdrawn Generation from PJM’s Most Recent Interconnection Cycle and Network Upgrades in Virginia

5,000 MW of Withdrawn Power









Generation Fuel Type

-  Solar
-  Storage
-  Solar and Storage
-  Offshore Wind

Network Upgrades

-  Substation
-  Line

Virginia Transmission

-  69 kV
-  115 kV
-  138 kV
-  161 kV
-  230 kV
-  345 kV
-  500 kV
-  765 kV

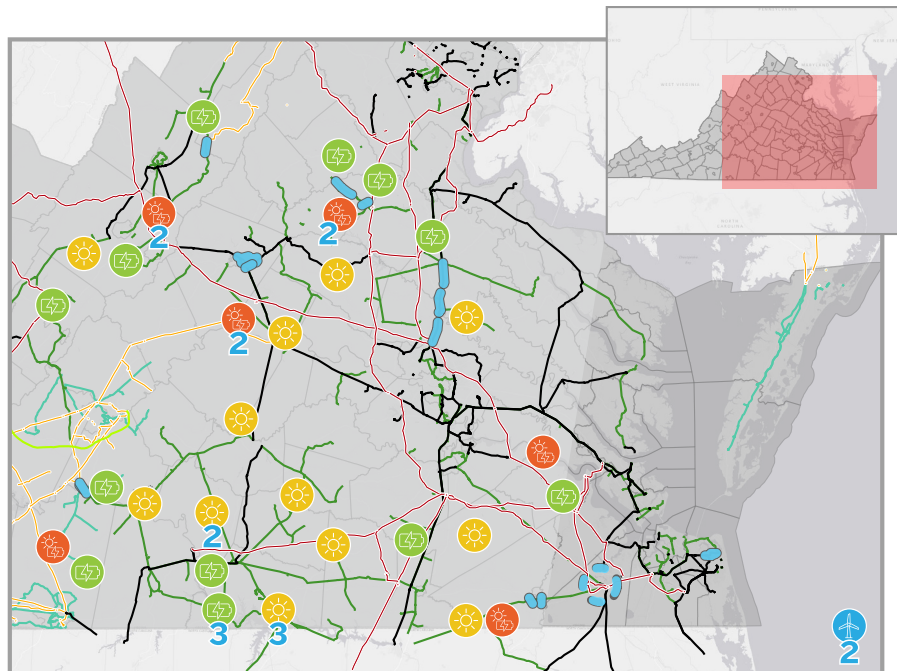







Figure 2: Delayed Clean Generation and Network Upgrades for Virginia

4,100 MW of power delayed until 2030









Generation Fuel Type

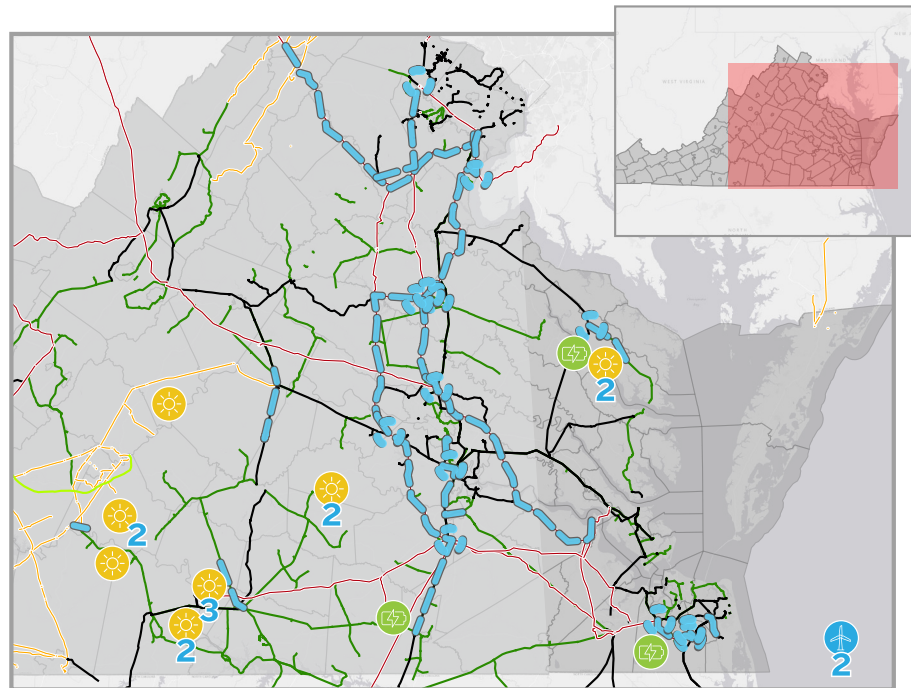
-  Solar
-  Storage
-  Offshore Wind

Network Upgrades

-  Substation
-  Line

Virginia Transmission

-  69 kV
-  115 kV
-  138 kV
-  161 kV
-  230 kV
-  345 kV
-  500 kV
-  765 kV



Of these 83 Virginia power plants, 40 (out of 112) withdrew their plans in the most recent interconnection study performed by PJM (completed in December 2025), due in part to high network upgrade costs.⁵ These resources would have supplied 5,000 MW of maximum power output, enough to power over a million Virginia homes.⁶

Twenty delayed power plants: A total of 20 power plants in Virginia have successfully completed PJM’s most recent interconnection study but will not be able to connect to the grid until 2030 or later, due to delays and long lead times for network upgrades. This means more than 4,100 MW of new resources cannot come online for at least four years, even though the power plants themselves could be ready within 18 months. Most of these 20 power plants require more than one network upgrade to connect to the grid.

Fifty-three necessary network upgrades in Virginia are responsible for these delays (see Appendix, table A2). Nine of these network upgrades in Virginia could also delay interconnection of more than 150 MW in North Carolina. While we don’t know the exact causes of these delays, they could include supply chain challenges, labor shortages, and siting and permitting timelines, among others.⁷ The upgrades identified in table A2 are in various stages of development, with some in the engineering and procurement period and others having only just begun the planning phase.

TRANSMISSION PLANNING AND PURSUIT OF INNOVATIVE FUNDING MECHANISMS CAN SPEED INTERCONNECTION IN VIRGINIA

Network upgrades are preventing and delaying gigawatts of new power from connecting in Virginia. The Virginia State Corporation Commission (SCC) has several opportunities to engage with PJM, utilities, and the state legislature to ensure that enough transmission gets built to meet the state’s energy needs. The SCC can:

Engage in PJM’s transmission planning process. In 2024, the Federal Energy Regulatory Commission (FERC) issued Order 1920, which contains a provision to help regions plan for and pay for large, common network upgrades. Order 1920 requires system operators to check their historic interconnection queues for common network upgrades triggered by two or more planning cycles—exactly the analysis we performed here—and the large facilities (≥200 kV, ≥\$30 M) must be evaluated for inclusion in their Regional Transmission Expansion Plans. In Virginia, this will help ensure that large, common network upgrades that will benefit the broader PJM system are paid for by the entire system, rather than by individual resources. PJM recently submitted its compliance filing for Order 1920 and, upon approval, will soon be refining the implementation details of this new process.⁸ The SCC can engage with PJM to ensure that network upgrades in Virginia that meet the Order 1920 criteria are accurately reflected in PJM’s planning.

Encourage PJM to evaluate whether network upgrade needs can be mitigated with alternative transmission technologies. Alternative transmission technologies like dynamic line ratings, advanced conductors, and power flow controls are faster and cheaper than many traditional network upgrades. One study found that alternative transmission technologies could cost-effectively integrate 6.6 GW of new wind, solar, and storage projects into PJM by 2027, saving hundreds of millions of dollars in capital costs per network upgrade.⁹ The SCC can request that PJM evaluate alternative transmission technologies instead of traditional network upgrades to reduce costs and delays of interconnecting new resources in Virginia.

Pursue innovative funding mechanisms for network upgrades. States like Virginia could explore using state funds for all or some

of the up-front cost of these upgrades and billing beneficiary resources once they start selling electricity. Virginia could also potentially pursue the State Agreement Approach to fund upgrades in partnership with other states.

Work with utilities to understand why network upgrade delays are occurring and how to overcome them. The electricity utility companies AEP and Dominion are ultimately in charge of constructing network upgrades. The SCC can require them to provide updates on network upgrade construction and study specific bottlenecks that are causing delays, either through regularly posting public data on network upgrade projects or through oversight hearings. The SCC can then work with these utilities to identify and implement solutions to these bottlenecks, such as advance joint purchasing programs for key grid components or workforce training programs.¹⁰

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APPENDIX: NETWORK UPGRADE DATA

TABLE A1: LOCATIONS OF NETWORK UPGRADES THAT HAVE PREVENTED 83 NEW RESOURCES (10 GW) FROM INTERCONNECTING IN VIRGINIA SINCE 2018









Location	Voltage (kV)	Upgrade Needed	Cost Estimate ¹¹	Impacted VA Power (Nameplate MW)	Type of Impacted Resources	Utility
IN-STATE TRANSMISSION INHIBITING VA INTERCONNECTIONS						
Alta Vista–Otter	138	Rebuild transmission line	\$2,740,849	712		AEP
Franklin–Union Camp	115	Rebuild transmission line & make station upgrades	\$6,394,000	377		Dominion
Oak Grove–Unionville	115	Rebuild transmission line & make station upgrades	\$1,552,000	212		Dominion
Hampton–Watkins	115	Rebuild transmission line & make station upgrades	\$1,916,000	301		Dominion
Virginia Beach–Birdneck	230	Rebuild transmission line & make station upgrades	\$9,061,250	3,200		Dominion
Four Rivers–Hanover	115	Rebuild transmission line	\$13,693,050	435		Dominion
Hanover–Elmont	115	Rebuild transmission line	\$7,969,500	1,255		Dominion
Virginia Beach–Bains Store	115	Reconductor	\$3,744,000	3,200		Dominion

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Location	Voltage (kV)	Upgrade Needed	Cost Estimate ⁴	Impacted VA Power (Nameplate MW)	Type of Impacted Resources	Utility
Virginia Beach–Lynnhaven	230	Rebuild transmission line	\$13,200,000	2,400		Dominion
Four Rivers–St. John	230	Rebuild transmission line	\$44,611,250	595		Dominion
Unionville–Locust Grove	115	Reconductor	\$3,300,000	362		Dominion
Pine Glade–Paytes Tap	115	Reconductor & replace switch	\$4,380,000	322		Dominion
Charlottesville–Proffit	230	Rebuild transmission line	\$25,156,250	1,263		Dominion
Hollymead–Cash Corner	230	Rebuild transmission line	\$12,276,250	1,068		Dominion
Suffolk	230/115	Add transformer	\$6,500,000	197		Dominion

OUT-OF-STATE TRANSMISSION INHIBITING VA INTERCONNECTIONS

Carolina	230/115	Add transformer	\$6,500,000	1856		Dominion (NC)
Everetts–Greenville	230	Rebuild transmission line	\$39,923,299	405		Dominion (NC)
Earleys	230/115	Add transformer	\$6,500,000	577		Dominion (NC)
Tunis–Ahoskie	115	Reconductor	\$17,498,000	77		Dominion (NC)
Ahoskie–Earleys	115	Reconductor & replace switch	\$15,017,000	77		Dominion (NC)

Importantly, the Franklin–Union Camp, Hampton–Watkins, and the Suffolk line proposals are also inhibiting more than 700 MW of nameplate capacity in North Carolina.



TABLE A2: LOCATION AND TYPE OF NETWORK UPGRADES THAT COULD DELAY 20 GENERATION PROJECTS (4.1 GW) FROM INTERCONNECTING IN VIRGINIA

Location	Voltage (kV)	Location	Cost Estimate ⁵	Impacted VA Power (Nameplate MW)	Types of Impacted Resources	Utility	Estimated Years of Delay
IN-STATE TRANSMISSION THAT COULD DELAY VA INTERCONNECTIONS							
Elmont–Chickahominy	500	Transmission Line	\$110,660,000	2,489		Dominion	1
Loudoun, Morrisville	500	Transmission Line	\$175,620,000	3,767		Dominion	5
Meadow Brook, Loudoun	500	Transmission Line	\$65,860,000	3,767		Dominion	5
Wishing Star	500	Substation	\$12,300,000	3,767		Dominion	5
Vint Hill, Wishing Star	500	Transmission Line	\$87,810,000	3,767		Dominion	5
Morrisville, Vint Hill	500	Transmission Line	\$101,890,000	3,767		Dominion	5
St. Johns, Ladysmith CT	230	Transmission Line	\$37,890,000	2,489		Dominion	2

TABLE A2: LOCATION AND TYPE OF NETWORK UPGRADES THAT COULD DELAY 20 GENERATION PROJECTS (4.1 GW) FROM INTERCONNECTING IN VIRGINIA

Location	Voltage (kV)	Location	Cost Estimate ⁵	Impacted VA Power (Nameplate MW)	Types of Impacted Resources	Utility	Estimated Years of Delay
IN-STATE TRANSMISSION THAT COULD DELAY VA INTERCONNECTIONS							
Elmont, Ladysmith	230	Transmission Line	\$26,090,000	3,767		Dominion	4
Elmont	230	Substation	\$2,190,000	3,767		Dominion	4
Ladysmith	230	Substation	\$8,720,000	3,767		Dominion	4
North Anna, Kraken	500	Transmission Line	\$186,670,000	3,767		Dominion	5
Kraken, Yeat	500	Transmission Line	\$394,710,000	3,767		Dominion	5
Kraken	500	Tie-in	\$5,000,000	3,767		Dominion	4
Kraken	500	Substation	\$84,410,000	3,767		Dominion	4
Ladysmith	500	Relay	\$40,000	3,767		Dominion	5
Possum Point	500	Relay	\$40,000	3,767		Dominion	5
Ladysmith, Kraken	500	Transmission Line	\$3,600,000	3,767		Dominion	5
Possum Point, Kraken	500	Transmission Line	\$3,600,000	3,767		Dominion	5
Yeat	765	Substation	\$197,100,000	3,767		Dominion	4
ALTVSTA-050TTER 138 kV line	138	Transmission Line	\$2,740,000	305		AEP	2
Pocaty–Landstown	230	Transmission Line	\$6,555,756	2,489		Dominion	1
Fentress–Yadkin	500	Substation	\$80,172,278	3,767		Dominion	3
Fentress	500	Substation	\$19,945,879	3,767		Dominion	3
Yadkin	500	Substation	\$16,207,123	3,767		Dominion	2
Chesterfield	230	Transmission Line	\$87,030,447	2,989		Dominion	4
Midlothian and Carson	500	Transmission Line	\$245,455,768	2,989		Dominion	6
Fentress and Thrasher	115	Transmission Line	\$33,297,247	2,589		Dominion	4
North Anna–Midlothian	500	Transmission Line	\$256,706,175	2,989		Dominion	7
Fork Union–Bremo	115	Transmission Line	\$7,947,612	2,489		Dominion	4
Elmont	500/230	Transformer	\$38,254,469	2,726		Dominion	5
Buckingham–Farmville	230	Transmission Line	\$40,414,822	1,106		Dominion	4

TABLE A2: LOCATION AND TYPE OF NETWORK UPGRADES THAT COULD DELAY 20 GENERATION PROJECTS (4.1 GW) FROM INTERCONNECTING IN VIRGINIA

Location	Voltage (kV)	Location	Cost Estimate ⁵	Impacted VA Power (Nameplate MW)	Types of Impacted Resources	Utility	Estimated Years of Delay
IN-STATE TRANSMISSION THAT COULD DELAY VA INTERCONNECTIONS							
Buckingham–Bremono	230	Transmission Line	\$44,465,922	1,106		Dominion	4
Fentress	230	Bus Tie	\$25,304,902	3,767		Dominion	4
Surry–Chckahm	500	Transmission Line	\$582,006	2,989		Dominion	1
Basin - Chesterfield	230	Wave Trap	\$396,021	2,989		Dominion	2
Northern Neck–Moon Corner	115	Transmission Line	\$45,730,074	3,767		Dominion	4
Finneywood	230/115	Transmission Line, Transformer	\$89,468,616	3,767		Dominion	4
Vint Hill	230	Transmission Line	\$307,000,000	3,767		Dominion	4
Tyler, Poe	230	Transmission Line	\$20,610,000	700		Dominion	5
Clubhouse–AE2-033	230	Transmission Line	\$59,572,939	792		Dominion	4
Northern Neck	230/115	Transformer	\$7,242,347	197		Dominion	5
Sapony–Carson	115	Transmission Line	\$38,691,326	792		Dominion	4
Carson	230	Wave Trap	\$521,941	792		Dominion	2
AE2-033–Sapony	230	Transmission Line	\$6,764,273	792		Dominion	4
Carson	500/230	Transformer	\$37,801,301	3,231		Dominion	4
Midlothian	500/230	Transformer	\$37,836,293	2,989		Dominion	4
Ladysmith	500/230	Transformer	\$37,587,605	2,626		Dominion	4
Fentress	230	Reactive Device	\$49,163,341	2,489		Dominion	4
Northern Neck–Moon Corner	115	Transmission Line	\$28,476,954	197		Dominion	4
249/86 to 249/93	230	Transmission Line	\$3,042,004	792		Dominion	2
Otter–Johnson Mountain	138	Transmission Line	\$8,400,000	305		AEP	4
Johnson Mountain–New London	138	Transmission Line	\$7,680,000	215		AEP	4

Endnotes

- 1 Lalit Batra et al., *Rising Current: America's Growing Electricity Demand*, ICF, 2025, https://www.icf.com/-/media/files/icf/reports/2025/energy-demand-report-icf-2025_report.pdf.
- 2 Will Gorman et al., "Grid Connection Barriers to Renewable Energy Deployment in the United States," *Joule* 9, no. 2 (February 2025), <https://doi.org/10.1016/j.joule.2024.11.008>.
- 3 Joe DeLosa III, Johannes P. Pfeifenberger, and Paul Joskow, *Regulation of Access, Pricing, and Planning of High Voltage Transmission in the U.S.*, Working Paper no. 32254, National Bureau of Economic Research, March 10, 2024, <https://doi.org/10.3386/w32254>.
- 4 Included projects were those that withdrew from PJM's interconnection queues dating back to 2018 and were impacted by transmission facilities identified using the following two criteria: (1) The transmission facility caused resources to withdraw from PJM's most recent interconnection study, and (2) The transmission facility appeared in at least one prior study since 2018 with withdrawn resources, ensuring that all withdrawn projects from 2018 to 2025 were captured. Source for historical interconnection queue data: PJM, "Serial Service Request Status," accessed December 23, 2025, <https://www.pjm.com/planning/service-requests/serial-service-request-status>.
- 5 PJM, *New Service Requests, System Impact Study Executive Summary Report, Transition Cycle I—Final (Retool I)*, no. v1, 2025, https://www.pjm.com/pjmfiles/pub/planning/project-queues/Cluster-Reports/TCL/TCL_FINAL_Executive_Summary.htm. Other factors may have also led to resource withdrawals, including long permitting and siting processes, supply chain issues, high interest rates, and worker shortages. Daniel Shawhan et al., *Power Delayed: Economic Effects of Electricity Transmission and Generation Development Delays*, Resources for the Future, May 12, 2025, <https://www.rff.org/publications/working-papers/power-delayed-economic-effects-of-electricity-transmission-and-generation-development-delays/>.
- 6 Virginia has approximately 3.2 million housing units with an average annual electricity consumption of 12,846 kWh. Number of homes that could be powered by withdrawn capacity = $(MWE \times CF \times 8,760 \times 1,000) / E$, where MWE = energy interconnection capacity of withdrawn capacity reported by PJM (MW), CF = technology-specific capacity factor, E = average annual electricity consumption of a household in Virginia (kWh), and 8,760 = hours per year. Capacity factors used: solar PV, 23%; offshore wind, 45%. Storage resources assume 4-hour duration and 85% annual utilization. For storage, annual energy production = $MWE \times 4 \times 365 \times 0.85$. U.S. Energy Information Administration, "Residential Energy Consumption Survey (RECS)," version 2020 RECS Survey Data, Consumption & Expenditures, March 2023, <https://www.eia.gov/consumption/residential/data/2020/>. Capacity factors derived Capacity factors derived from U.S. Energy Information Administration, *Electric Power Annual 2024*, Table 4.08.B, "Capacity Factors for Utility Scale Generators Primarily Using Non-Fossil Fuels," https://www.eia.gov/electricity/annual/html/epa_04_08_b.html; National Laboratory of the Rockies, "Offshore Wind," *2024 Annual Technology Baseline, Conservative Scenario, fixed-bottom*, 2026, https://atb.nrel.gov/electricity/2024/offshore_wind.
- 7 Shawhan et al., *Power Delayed*
- 8 "PJM Outlines Long-Term Transmission Plan in FERC Filing," *PJM Inside Lines*, December 16, 2025, <https://insidelines.pjm.com/pjm-outlines-long-term-transmission-plan-in-ferc-filing/>.
- 9 Katie Mulvaney et al., *GETting Interconnected in PJM: Grid-Enhancing Technologies (GETs) Can Increase the Speed and Scale of New Entry from PJM's Queue*, RMI, February 2024, <https://rmi.org/insight/analyzing-gets-as-a-tool-for-increasing-interconnection-throughput-from-pjms-queue/>.
- 10 National Caucus of Environmental Legislators, "Network Upgrades Are Delaying New Energy Generation—States Can Act to Accelerate Solutions," December 8, 2025, <https://www.ncelenviro.org/articles/network-upgrades-are-delaying-new-energy-generation-states-can-act-to-accelerate-solutions/>.
- 11 If cost information was not available in PJM's most recent interconnection study, we used cost values from PJM's Project Status & Cost Allocation web page. PJM, "Project Status & Cost Allocation," accessed December 18, 2025, <https://www.pjm.com/planning/m/project-construction>.