

PJM 'Data Center Planning Initiative'

2022 RTEP Window 3

Regional Transmission Expansion Planning

Transmission Planning & Potential Impacts to Fauquier & Fairfax Counties, VA

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**This Deck: Provides maps and high-level breakdown of information provided thru PJM
(only as correct as the information which has been provided):**

- Sources of information
- Description, What is Being Proposed, Where is Power Generated
- Scope, Purpose, Objective of Initiative
- What is 'Reliability'?
- Costs, Competitive Bids, Timeline
- Magnitude of Proposals: Transmission Lines, Substations, ROW
- Maps – PJM service Area, Virginia service area
- **Fauquier & Fairfax Counties VA impacting proposals – 3**
 - Waterways, Historic Communities, Parks impacted
 - Maps, Scope components, Costs, Impacts
 - **Fauquier:**
 - **Dominion 671**
 - **Fairfax:**
 - **PSEG 229**
 - **PSEG 637**
- Prince William, Loudoun, All Other areas - Overview

- Energy providers (PJM, Dominion, et al) are openly declaring that this transmission expansion initiative is to address **overload violations on the grid caused by currently operating Data Centers...**
- → **Violations** occurring on the grid -- **which could cause blackouts** -- **primarily because of all the Data Centers being brought onto the grid in Northern Virginia**
 - **NOTE: Data Centers**, which require many more times the power than ANY OTHER Industrial use, are being approved and tapping into the electrical grid **all across the state of Virginia**
- → Data Centers in Prince William County, VA, being *approved and supported by the current Chair and majority Supervisors on the PWC Board, are significantly contributing to the grid issues*; as well as Data Center approvals coming out of Loudoun County, VA, and other localities
- Although SOME proposals in this initiative would add grid functionality which MAY benefit SOME Data Center applications making their way through the PWC/regional consideration pipeline...
- The power for more yet-to-be approved Data Centers will be served by OTHER and ADDITIONAL PJM/Dominion transmission line and substation projects -- when and if any *other* Data Center plans are approved
- → **As more Data Center applications are approved, there will be EVEN MORE transmission lines and substations added to what is proposed here – This was CONFIRMED by PJM in a 9/5/23 meeting**
- **NOTE:** Data Centers required for Artificial Intelligence (AI) are predicted to require 7-8 times MORE than the power required by today's Data Centers

PJM Descriptions of Regional Transmission Expansion Program 2022 RTEP Window 3 Proposals – Source Documents

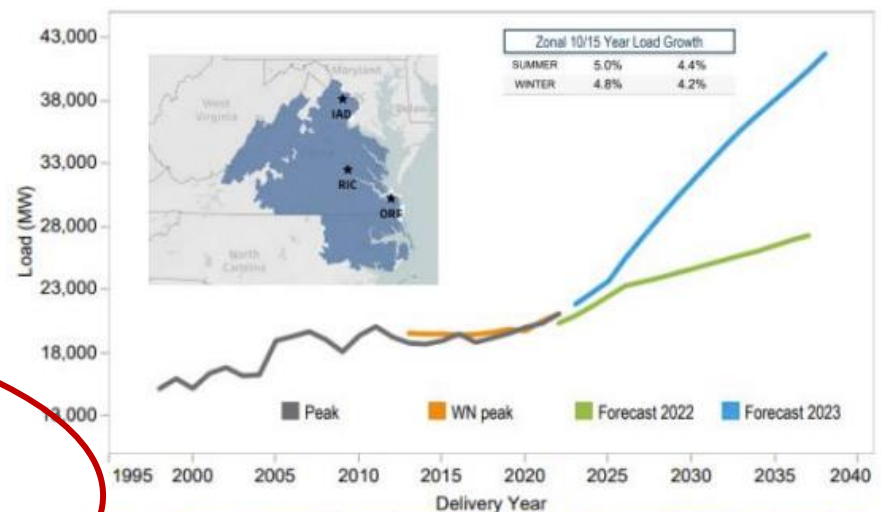
- [PJM - Redacted Public Proposals for Current and Closed Windows](#) : >2022 Window 3 Redacted Proposals
 - 72 Proposals
- **MAPS:**
 - [20230808-item-07---reliability-analysis-update.ashx \(pjm.com\)](#) Updated “complete” deck: August 30, 2023
 - **However, there are still multiple issues with maps in this version as will be noted.**
 - Maps were also provided on August 25, 2023 and July 11 2023, but had many errors, discrepancies, and omissions.
- [PJM Regional Transmission Expansion Planning Update \(pjm.com\)](#)
 - Powerpoint deck (March 27, 2023) explaining the 2022 RTEP Window 3 initiative – Purpose, Objective, Requirements (pages 3-7). ***Data Centers a factor on every page.***
- [PJM 2022 Regional Transmission Expansion Plan - dated March 14, 2023](#)
 - Section 1 - Page 2 -- PJM Backbone Transmission System (as of March 2023) (included on Slide 12)
 - Section 6.11 - Page 221 -- PJM Service Area in Virginia - map of 345, 500, 765 kV transmission lines (as of March 2023). (Included on Slide 13)
 - **Page 44:** (emphasis added)
 - *“In the PJM 2022 Load Forecast Report, Dominion requested that PJM consider a forecast adjustment to account for the growth of data centers in northern Virginia. This adjustment has been in place in some form since the 2014 Load Forecast Report. The rationale for making an adjustment for data centers is that these centers have a load impact that is disproportionate with their economic impact. Data centers generally require minimum staffing and thus would not have a significant impact on economic variables, but do have a considerable impact on energy demand.”*
- **Other presentation decks accessed from PJM and Dominion websites:**
 - [20230207-item-09---2022-window-3-update.ashx \(pjm.com\)](#) Dated Feb. 7, 2023
 - [item-04---data-center-load-planning.ashx \(pjm.com\)](#) Dated Jan. 10, 2023
 - [item-04---data-center-industry-digital-realty.ashx \(pjm.com\)](#) Dated Sept. 12, 2022
 - [item-09---reliability-analysis-update.ashx \(pjm.com\)](#) Dated Aug. 9, 2022
 - [item-08---dominion-northern-virginia---immediate-need.ashx \(pjm.com\)](#) Dated July 12, 2022
 - [reliability-briefing---dominion-data-centers-alley.ashx \(pjm.com\)](#) Dated June 7, 2022
 - Dominion IRP – [2023 Integrated Resource Plan](#) Filed May 1, 2023
- **Access more published information:** [‘PJM’s Data Center Planning Initiative’ / ‘NoVa Dominion Data Center Alley’ – The Coalition to Protect Prince William County \(protectpwc.org\)](#)

PJM RTEP Planning Update – Dated March 27, 2023



2022 Competitive Window 3 – Data Center Load Planning Update

- Earlier in 2022, PJM shared its forecast for 2022 and indicated high Data Center Load growth activity, particularly in Northern VA
- In July 2022, PJM directed an Immediate Need transmission project to enable the integration of the forecasted load within the Dominion Data Center Alley up to and including year 2025
- Since then, Data Center Loads within Northern Virginia has been increasing at an unprecedented rate (2022 Summer Peak recorded 21,156 MW – Forecast 20,424 MW)
- The 2028 timeframe load will require major transfer reinforcements into the Doubs/Northern Virginia region to support high flows and VAR requirements
- PJM is working towards opening a competitive window in early February 2023 to address the identified violations



<https://pjm.com/-/media/library/reports-notice/load-forecast/2022-load-report.ashx>

What Is Being Proposed in the 'PJM Data Center Planning Initiative' 2022 RTEP Window 3?

- Add more NEW transmission lines
 - 230kV
 - 500kV
 - 765kV
- Add more NEW substations
 - 230kV/500kV
 - 500kV
 - 765kV
- Upgrade existing transmission lines from 230kV to 500kV
- Upgrade existing 230kV and 500kV substations with more 500kV functionality
- Increase Amps to 4000 or 5000 Amps; more
- Replace aging equipment
- **Connecting the Dots - What Will Be On New PJM Lines?**

What and Where is the Power Generated for MOST of these Transmission Proposals?

- **Ohio, West Virginia from the West**
 - First Energy's coal-fired Fort Martin Power Station, Fort Martin, WV
 - First Energy's coal-fired Harrison Power Station, Haywood, WV
 - AEP's Ohio fossil fuel plants
- **Pennsylvania from the Northeast**
 - Peach Bottom Atomic Power Station in Delta, PA
 - Gas-fired York Energy Center, Delta, PA
- **Why are new electrical transmission lines having to originate from outside of Virginia?**
- **We are also experiencing a POWER GENERATION problem**

Scope – PJM RTEP Update dated March 27, 2023 - (direct quotes)

Window Opened; February 24, 2023

- PJM posted preliminary planning basecases on January 31st 2023
- Window Closed – May 10, 2023

Purpose:

- **Address reliability needs in the Dominion and APS zones primarily associated with Data Center Load forecasts (up to 7,500 MWs by 2027-28)**
- Seeking robust and flexible solutions to address the reliability needs in those specific areas

Objective:

- Develop robust, holistic and expandable solutions that address the **2027-28 baseline violations** associated with:
 - **Local constraints: resulting from directly serving the data center loads in APS and Dominion zones through the respective 230 kV networks and into the points of delivery:**
 - Goose Creek- Ashburn – Mars - Wishing Star and Brambleton – Loudoun Co VA
 - **Regional constraints resulting from imports into load center areas (500 kV primarily):**
 - Doubs - Goose Creek – Frederick MD-Loudoun Co VA
 - Front Royal - Morrisville – Vint Hill – Loudoun/Mosby - Warren Co-Fauquier Co-Loudoun Co VA
 - Meadow Brook - Loudoun/Mosby – Loudoun Co VA
 - Morrisville – Bristers - Ox – Fauquier Co-Fairfax Co VA
 - Peach Bottom – Conastone – Brighton – Doubs – Maryland
 - **Needed reactive power VAR reinforcements, both static and dynamic as deemed necessary, to address the reactive power needs of the system for the 2027-28 baseline scenario**

Requirements:

- Holistic solutions are to be designed such that they are robust and **expandable as the load grows within the area.**
- **A scalable solution ensures, at a minimum, near-term reliability needs are addressed while also enabling future expansion (beyond the 2027-28 baseline levels) as data center load increases in the Dominion and APS zones.**
 - Consider flexibility, robustness and scalability of 2027-28-baseline solutions against the Interim 2027-28 Summer, Winter and Light Load basecases.
 - Evaluate proposals for **their effectiveness towards existing reactive interfaces in the area, particularly those supporting the Dominion and APS zones.**
 - Evaluate the **effectiveness of the proposed solutions towards the transmission system load deliverability into the Dominion and APS zones (CETL).**

What is 'Reliability'?

- PJM has identified MULTIPLE N-1-1 violations in their transmission region
- N-1-1 means that you could experience interruptions of power on MORE than one transmission line
- N-1-1 = Threats of significant violations that could cause power disruptions ie: BLACKOUTS

2022 RTEP Window 3 – 72 Proposals

Estimated Costs - \$51,192,146,194 - \$51.1B

- Not all proposals, or all components in proposals, will be selected
- Some components and costs are repeated and counted multiple times across multiple proposals

- **PWC Directly Impacting Proposals - 15: \$19,586,399,352 - \$19.5B** [OVERVIEW](#)
 - Include impacts to other Counties and States
- **Loudoun County Directly Impacting Proposals - 28: \$26,745,769,448 - \$26.7B** [OVERVIEW](#)
 - Include impacts to other Counties and States
 - Loudoun County is also impacted by multiple PWC proposals
- **Fauquier County Directly Impacting Proposals - 1: \$320,266,203 - \$320.2M** [This Deck](#)
 - Include impacts to other Counties and States
 - Fauquier County is also impacted by multiple PWC and Loudoun proposals
- **Fairfax County Directly Impacting Proposals - 2: \$895,459,401 - \$895.4M** [This Deck](#)
 - Include impacts to other Counties and States
 - Fairfax County is also impacted by multiple PWC and Loudoun proposals
- **All Other Va. Counties and MD & PA Directly Impacting Proposals - 26: \$3,644,251,790 - \$3.6B** [Overview coming soon](#)
 - These others are also impacted by multiple PWC, Loudoun, Fauquier, and Fairfax proposals

Competitive Bids

- Many TO (Transmission Operator) energy providers have submitted bids to PJM in this 2022 RTEP Window 3 (72 proposals)
- *Not all work possibly to be awarded in the Dominion Zone will be done by Dominion Energy*
- Bids from competitors:
 - AEP - [AEP.com](https://www.aep.com)
 - Exelon - [Exelon Corporation - Home - Exelon](https://www.exeloncorp.com/)
 - First Energy - [FirstEnergy Corp. Home](https://www.firstenergy.com/)
 - LS Power - [LS Power | Innovation and Investment in Energy](https://www.lspower.com/)
 - Nextera - [NextEra Energy](https://www.nexteraenergy.com/)
 - PPL - [PPL Corporation \(pplweb.com\)](https://www.pplweb.com/)
 - PSEG - [PSE&G \(pseg.com\)](https://www.pseg.com/)
 - Transource - [About Us \(transourceenergy.com\)](https://www.transourceenergy.com/)

Timeline

- PJM selection process:
 - **Oct. 3:** Announce top 3-4 “scenarios”- made up from 72 proposals
 - **Oct. 3 – 31:** Stakeholder feedback on “scenarios”
 - 1st read
 - 2nd read
 - **Dec. 5:** PJM TEAC bring final recommended solution to PJM Board from 3-4 scenarios
 - **TBD: Board approval**
 - Dec. 2023 in original timeline – not clear if that is still the plan
 - After PJM Board approval, winning providers take filings to their respective State Commissions (ie VA SCC)

NEW Transmission Lines & NEW Substations

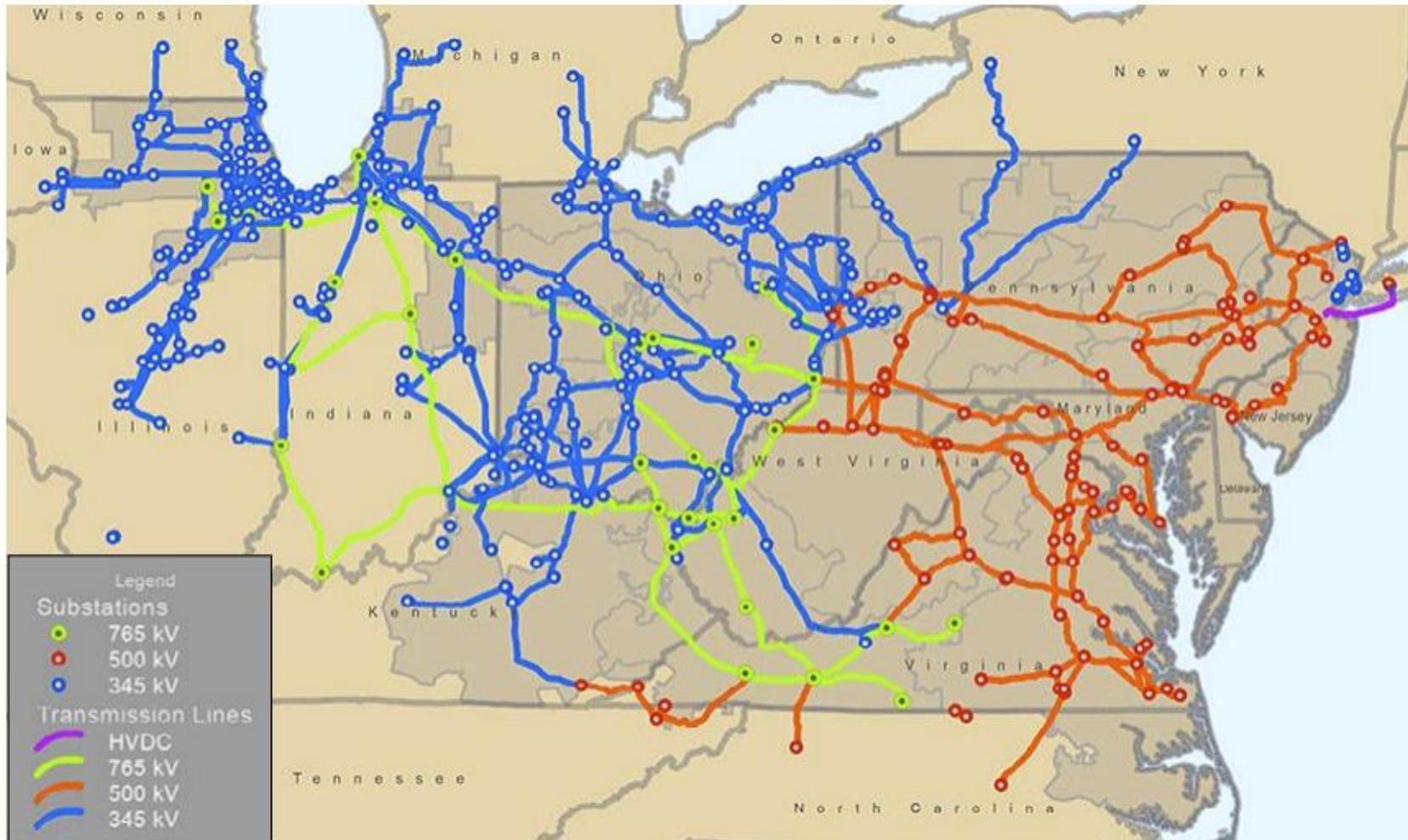
- *Totals are still being verified*
- **NEW 500 kV** transmission lines in **~43 of the 72 proposals**
- **New 500kV** substations in **~37 of the 72 proposals**
- Remaining scope is mostly bringing 500kV upgrades to existing lines and substations **across Virginia and in NJ, DEL, PA, WVA, MD**
- ALL bringing greater capacity to Loudoun and PWC to support current data center load demands and the grid reliability violations they are causing
- **Undergrounding**: Primarily in Loudoun County or under waterways
 - **7 NEW 500kV transmission lines proposed solutions - complete or partial undergrounding: #419, 445, 548, 691, 728, 846, 858**
 - **3 NEW partially undergrounded 230kV lines: 385, 564, 948**

NEW ROWs (Right of Way) & Land Acquisitions

- **NO ROUTES OR LOCATIONS IN THE PLAN ARE FIRMLY ESTABLISHED**
- Transmission providers will not finalize new line or substation routes/locations until later in the process. PJM does not determine routes or substation locations.
- Maps only serve as an *estimate* of line corridor, not a firm route. And a *hoped-for location* for new substation.
- Many proposals are silent as to ROW or land acquisitions
- Much of the specific ROW/Real Estate information is redacted
- Even upgraded substations and lines may require larger footprint/wider ROW
- **ASSUME NEW ROW AND LAND ACQUISITIONS FOR ANYTHING NEW - AND FOR MANY UPGRADES**
- Will involve condemnations and eminent domain “takes” across the region

PJM Backbone Transmission System Map - Existing

Map 1.1: PJM Backbone Transmission System



- Source: [2022-rtep-report.ashx \(pjm.com\)](https://www.pjm.com/2022-rtep-report.ashx) Dated March 13, 2023 Page 2
- **Does NOT show existing 230kV lines and substations**

PJM Service Area in Virginia – Existing

Map 6.46: PJM Service Area in Virginia



- Source: [2022-rtep-report.aspx](https://www.pjm.com/2022-rtep-report.aspx) ([pjm.com](https://www.pjm.com)) Dated March 13, 2023 Page 221
- Does NOT show ANY existing 230kV lines and substations

Fauquier Co & Fairfax Co VA impacting Proposals

- PROPOSALS = 3

- Fauquier VA – ①

- Dominion: 671

- Also impacts Warren Co, VA.

- **ESTIMATED TOTAL COSTS = \$320,266,203**

- Do not include the proposal costs listed/counted in the PWC and Loudoun totals
 - Fauquier is also impacted by PWC and Loudoun impacting proposals (see those separate decks)

- Fairfax VA – ②

- PSEG: 229, 637

- Also impact Frederick Co MD, MD, PA

- **ESTIMATED TOTAL COSTS = \$895,459,401**

- Do not include the proposal costs listed/counted in the PWC, Loudoun and Fauquier totals
 - Fairfax is also impacted by PWC and Loudoun impacting proposals (see those separate decks)

Impacted Waterways

– as noted in 3 Fauquier & Fairfax VA-impacting proposals

Dominion 671:

- Shenandoah River
- Rappahannock River
- Several small streams

No details provided in redacted component info of PSEG 229 & 637

Impacted Historic Communities and Parks

– as noted in 3 Fauquier & Fairfax VA-impacting proposals

Dominion 671:

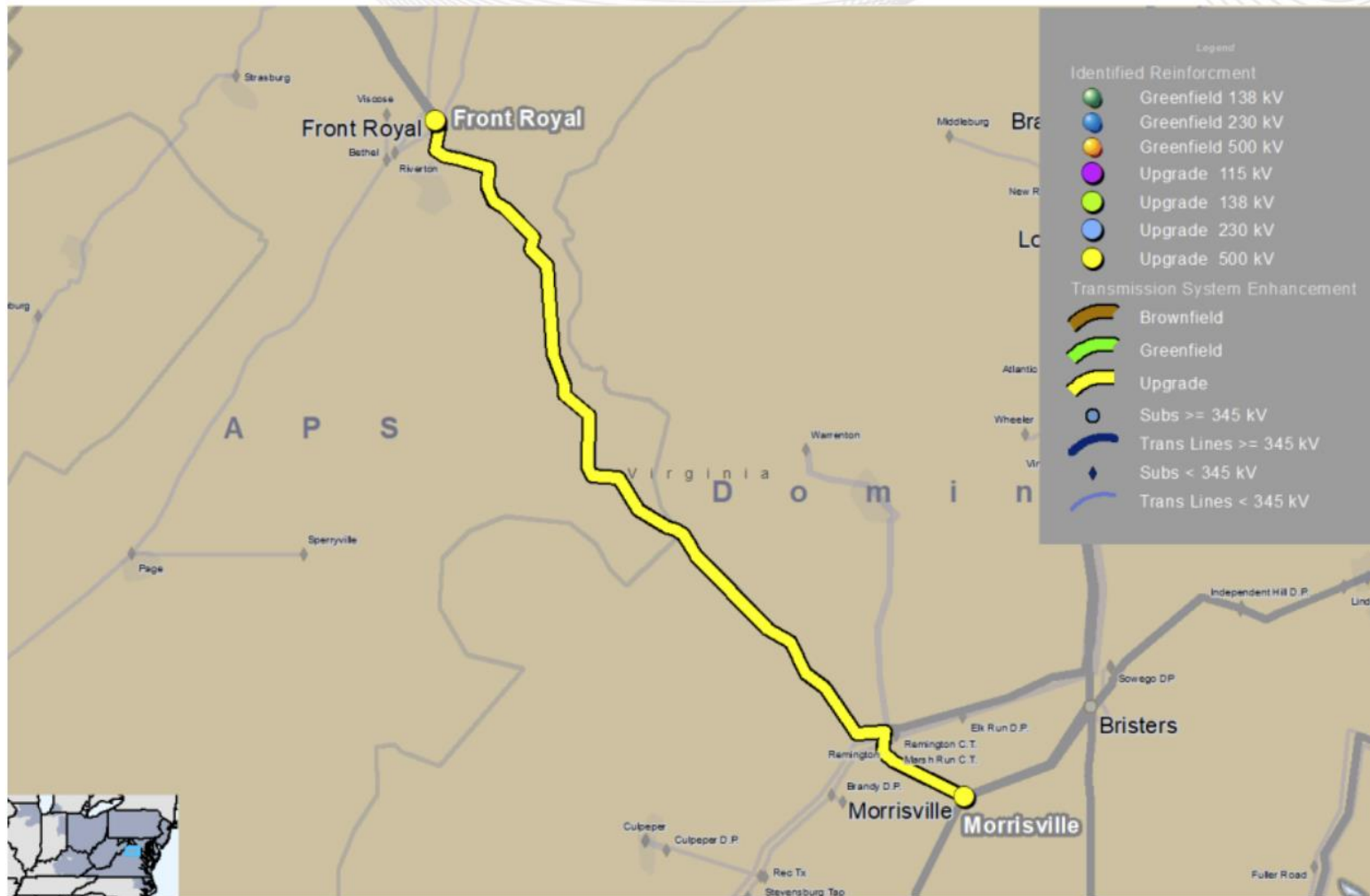
- Appalachian Trail

No details provided in redacted component info of PSEG 229 & 637

Fauquier VA – 1

Dominion: 671

Dominion 671



Impacts:
Fauquier, Warren
VA

- Upgrade Front Royal-Morrisville to 500kV

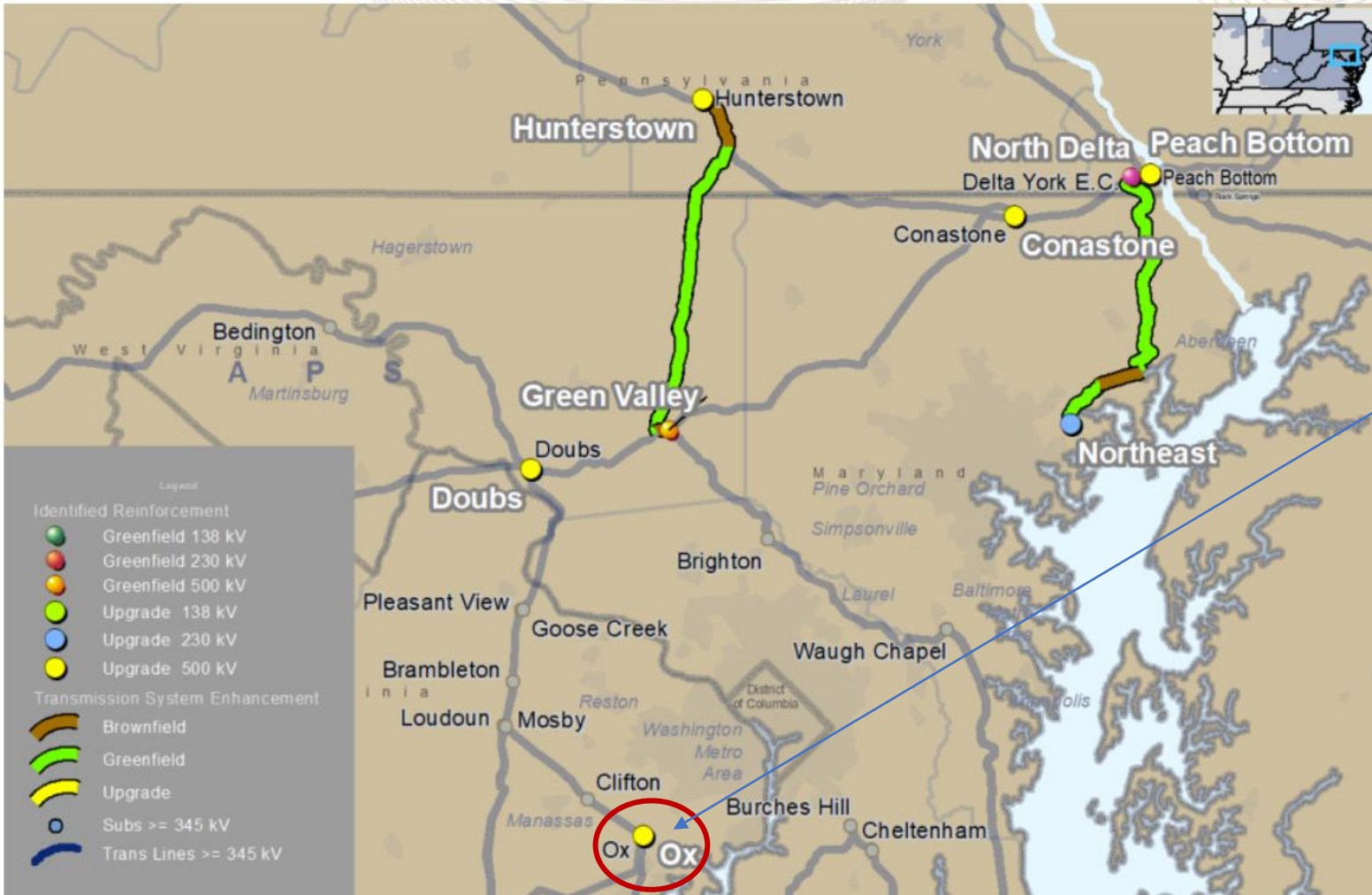
Dominion 671 Components

1. Front Royal Substation Terminal Equipment Upgrade
 2. Morrisville Substation Terminal Equipment Upgrade
 3. Line # 541 (Front Royal to Morrisville) Rebuild
- **Yellow** is Fauquier County VA impacts
 - **Green** is NEW
 - **All in Fauquier-Warren Counties VA**
 - Upgrade Morrisville-Front Royal to 500kV – approx. 47 miles
 - Upgrade Morrisville and Front Royal substations to 500kV
 - **No ROW impacts called out**
 - **Waterways/History/Parks:** Shenandoah and Rappahannock Rivers, several small streams, Appalachian Trail
 - **Estimated Cost:** \$320,266,203
 - Full details: [PJM - Redacted Public Proposals for Current and Closed Windows](#) : >2022 Window 3 Redacted Proposals

Fairfax VA - 2

PSEG: 229, 637

PSEG 229



Impacts: Fairfax Co VA,
Frederick MD, MD, PA

- **Fairfax Co VA scope**

- Ox substation 500kV Upgrade

- **MD-PA scope**

- Multiple NEW and Upgraded 230kV & 500kV lines and substations

Ignore Brownfield

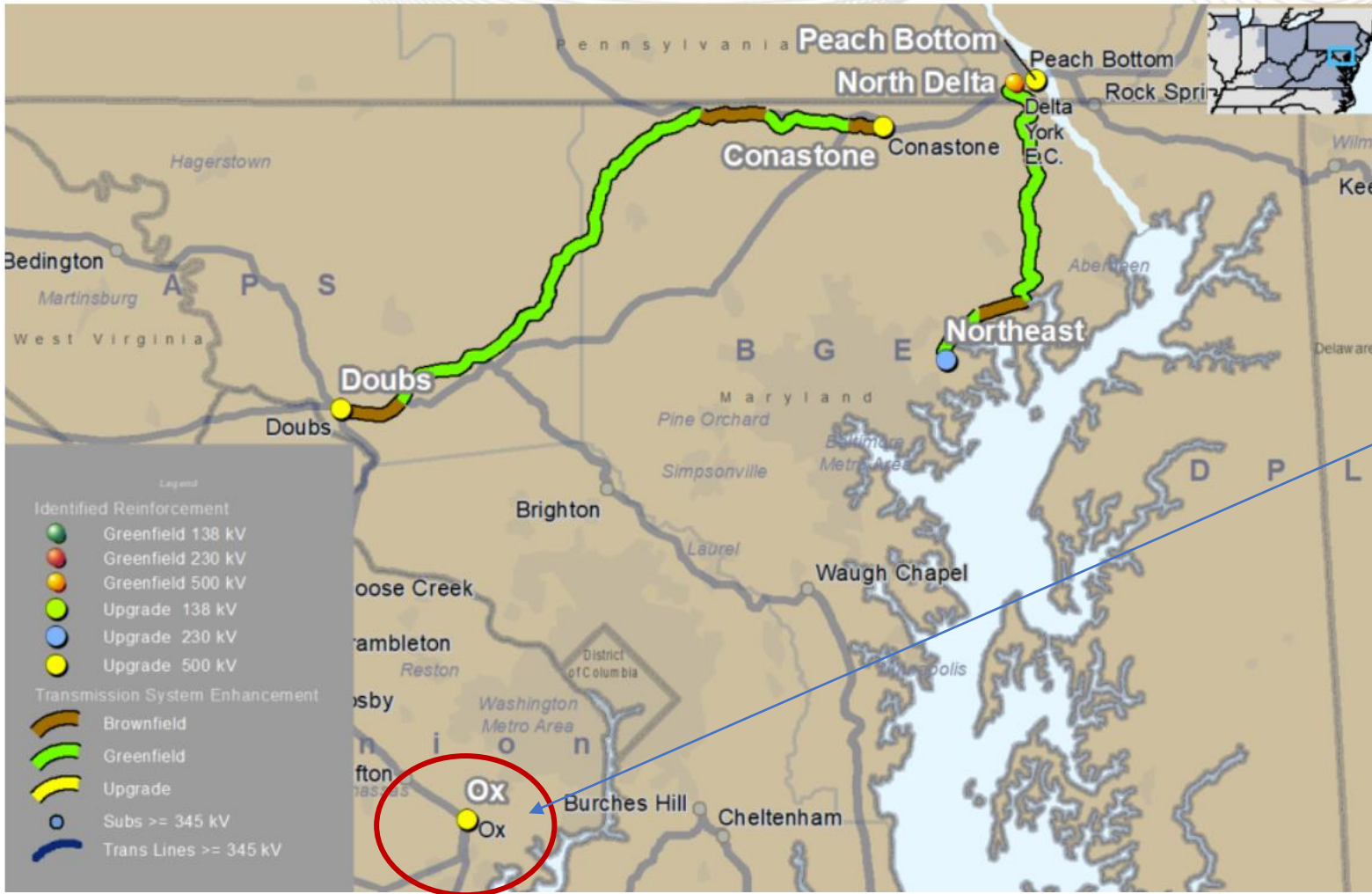
Transmission lines are NEW-
Greenfield

PSEG 229 Components

1. North Delta 500/230kV Upgrade
2. Northeast 230kV Upgrade
3. Peach Bottom 500kV Upgrade
4. Doubs 500/230kV Upgrade
5. Conastone 500kV Upgrade
6. Ox 500kV Upgrade
7. North Delta-Northeast 230kV
8. Hunterstown-New Green Valley 500kV
9. New Green Valley 500kV
10. Hunterstown 500kV Upgrade

- **Yellow** is Fairfax Co VA impact
 - 500kV Ox substation Upgrade
- **Green** is NEW
- **MD-PA Impacts:**
 - NEW New Green Valley MD 500kV substation
 - NEW Hunterstown PA-New Green Valley MD 500kV line
 - NEW North Delta-Northeast 230kV line
 - Multiple 500kV and 230kV MD and PA substation Upgrades
- **ROW:**
 - **NEW North Delta-Northeast 230kV:** New ROW 36.5 miles, 85' wide in residential and 100' wide in farmland
 - **NEW Hunterstown-New Green Valley 500kV:** New ROW 40.1 miles, 150' wide in farmland
 - **NEW New Green Valley 500kV substation:** Land acquisition: "PSEG has identified several properties that are suitable for this proposed solution"
- **Waterways/History/Parks:** No details provided in redacted component info
- **Estimated Cost:** \$575,395,120
- Full details: [PJM - Redacted Public Proposals for Current and Closed Windows](#) : >2022 Window 3 Redacted Proposals

PSEG 637



Impacts: Fairfax Co VA, Frederick MD, MD, PA

- **Fairfax Co VA scope**
 - Ox substation 500kV Upgrade
- **MD – PA scope**
 - Multiple NEW and Upgraded 230kV & 500kV lines and substations

Ignore Brownfield

Transmission lines are NEW - Greenfield

PSEG 637 Components

1. North Delta 500/230kV Upgrade
2. Northeast 230kV Upgrade
3. Peach Bottom 500kV Upgrade
4. Doubs 500/230kV Upgrade
5. Conastone 500/230kV Upgrade
6. Ox 500kV Upgrade
7. North Delta-Northeast 230kV
8. Conastone-Doubs 500kV

- **Yellow** is Fairfax Co VA impact
 - Ox substation 500kV Upgrade
- **Green** is NEW
- **MD-PA Impacts:**
 - NEW North Delta PA-Northeast MD 230kV line
 - NEW Conastone-Doubs MD 500kV line
 - Multiple MD and PA 230kV and 500kV substation Upgrades
- **ROW:**
 - **NEW North Delta-Northeast 230kV:** New ROW 36.5 miles, 85' in residential, 100' in farmland
 - **NEW Conastone-Doubs 500kV:** New ROW 40.1 miles, 150' wide.
- **Waterways/History/Parks:** No details provided in redacted component info
- **Estimated Cost:** \$320,064,281
- Full details: [PJM - Redacted Public Proposals for Current and Closed Windows](#) : >2022 Window 3 Redacted Proposals

Prince William County VA impacting Proposals

- [See PWC impacting proposals overview](#)
- Bring increased 500kV capacity to substations and more 500kV lines to PWC and surrounding counties and states
- **PROPOSALS = 15**
- Proposals: **24, 125, 129, 175, 231, 325, 548, 577, 598, 663, 691, 711, 766, 904, 977**
- **ESTIMATED TOTAL COSTS = \$19.5 BILLION (\$19,586,399,352.00)**
 - Do not include the proposal costs listed/counted in the Loudoun totals
- PWC proposals include Lines/Substations *also* in or through other Va. counties &/or other states:
 - Loudoun = 9 #175, 231, 325, 548, 577, 598, 663, 711, 766
 - Fauquier = 10 #175, 325, 548, 577, 598, 663, 711, 766, 904, 977
 - Fairfax = 2 #711, 977
 - Other VA counties and other states: Amherst, Albemarle, Augusta, Bedford, Buckingham, Campbell, Caroline, Culpeper, Fluvanna, Frederick Co. (VA), Lexington, Louisa, Nelson, North Anna, Orange, Rappahannock, Rockbridge, Saltville, Smyth, Spotsylvania, Stafford, Staunton, Warren, Washington; Frederick, MD, MD, PA, WVA, DEL, NJ
- [PJM - Redacted Public Proposals for Current and Closed Windows](#) : >2022 Window 3 Redacted Proposals

Loudoun County VA impacting Proposals

- [See Loudoun impacting proposals overview](#)
- Bring increased 500kV capacity to substations and more 500kV lines to Loudoun County and surrounding counties and states (but not into PWC VA)
- PROPOSALS = **28**
- **Proposals: #23, 28, 116, 255, 279, 347, 385, 419, 445, 487, 516, 564, 600, 642, 660, 676, 685, 692, 719, 728, 741, 837, 846, 853, 858, 948, 951, 962**
- **ESTIMATED TOTAL COSTS = \$26.7 BILLION (\$26,745,769,448.00)**
 - Do not include the proposal costs listed/counted in the PWC totals
- Loudoun proposals include Lines/Substations *also* impacting other Va. counties &/or other states:
 - PWC = 0
 - Fauquier = 0
 - Fairfax = 1 #516
 - Warren = 1 #487
 - Frederick Co, VA = 9 #279, 347, 642, 676, 685, 719, 846, 853, 951,
 - Frederick Co, MD = 12 #23, 28, 116, 255, 419, 445, 516, 660, 741, 837, 846, 962
 - MD = 18 #23, 28, 116, 255, 385, 419, 445, 487, 564, 600, 660, 728, 741, 837, 846, 948, 962
 - PA = 16 #23, 28, 116, 255, 385, 419, 445, 487, 564, 600, 660, 741, 837, 846, 948, 962
 - WVA = 13 #23, 28, 279, 347, 487, 642, 676, 685, 719, 837, 846, 853, 951
- Loudoun is also impacted by PWC proposals
- **ALL Loudoun proposals are expanding transmission grid in Loudoun to 500kV – multiple new lines and substations, and upgraded lines and substations.**
- [PJM - Redacted Public Proposals for Current and Closed Windows](#) : >2022 Window 3 Redacted Proposals

All Other Va. Counties, MD, & PA impacting Proposals

- [See All Other: VA Counties, MD & PA impacting proposals overview](#)
- Impacts don't come into PWC, Loudoun, Fauquier, or Fairfax, but bring increased 500kV capacity to substations and more 500kV lines
- PROPOSALS = **26**
- Proposals: **#9, 30, 55, 74, 181, 196, 202, 211, 217, 234, 344, 374, 410, 477, 524, 530, 537, 606, 629, 631, 704, 731, 808, 856, 923, 967**
- **PROPOSALS ESTIMATED TOTAL COSTS = \$3.6 BILLION (\$3,644,251,790.00)**
 - Do not include the proposal costs listed/counted in the PWC, Loudoun, Fauquier, and Fairfax totals
- VA counties: Amherst, Augusta, Albemarle, Bedford, Botetourt, Campbell, Caroline, Charlottesville, Fluvanna, Franklin, Fredericksburg, Giles, Gordonsville, Habersham, Leesville, Lexington, Lynchburg, North Anna, Petersburg, Rockbridge, Stafford = 21
- Frederick MD, MD, PA
 - Other Va. Counties and other States are also impacted by PWC, Loudoun, Fauquier, and Fairfax proposals
- [PJM - Redacted Public Proposals for Current and Closed Windows](#) : >2022 Window 3 Redacted Proposals