Dominion Energy GMD Preparedness

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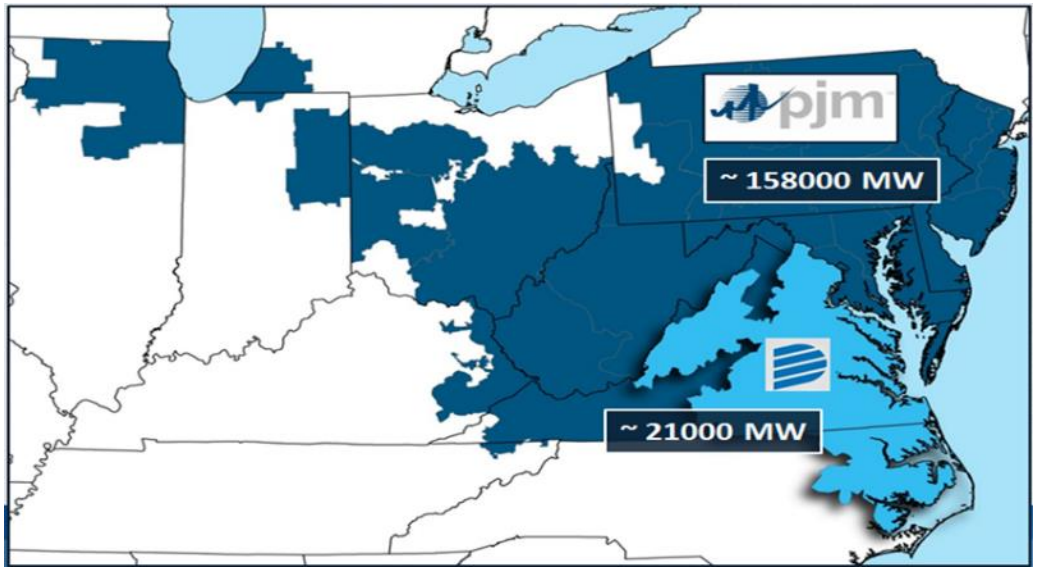
Dominion Energy Electric Transmission at a Glance

- $7.8 billion assets in service
- Virginia, North Carolina and West Virginia
- 6,800 miles of transmission lines
- Over 900 substations
- More than 50,000 transmission structures
- PJM is DEV's Transmission Operator



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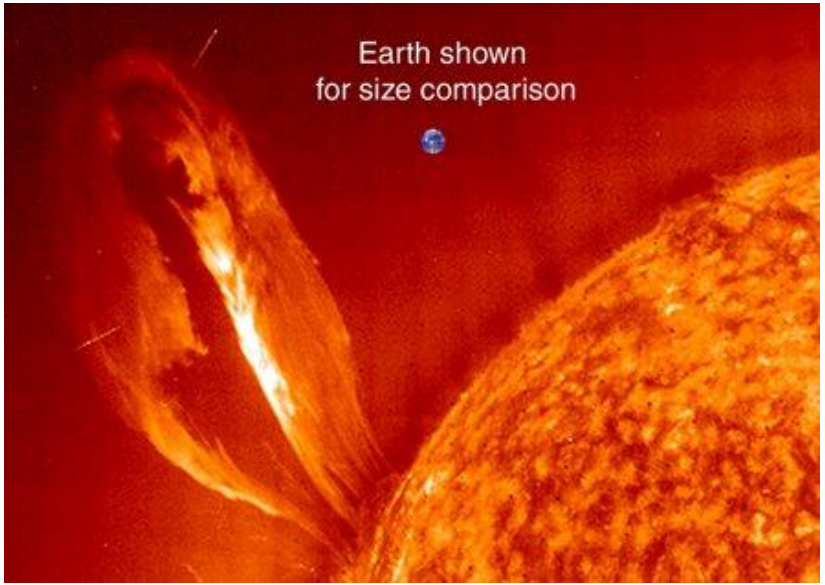
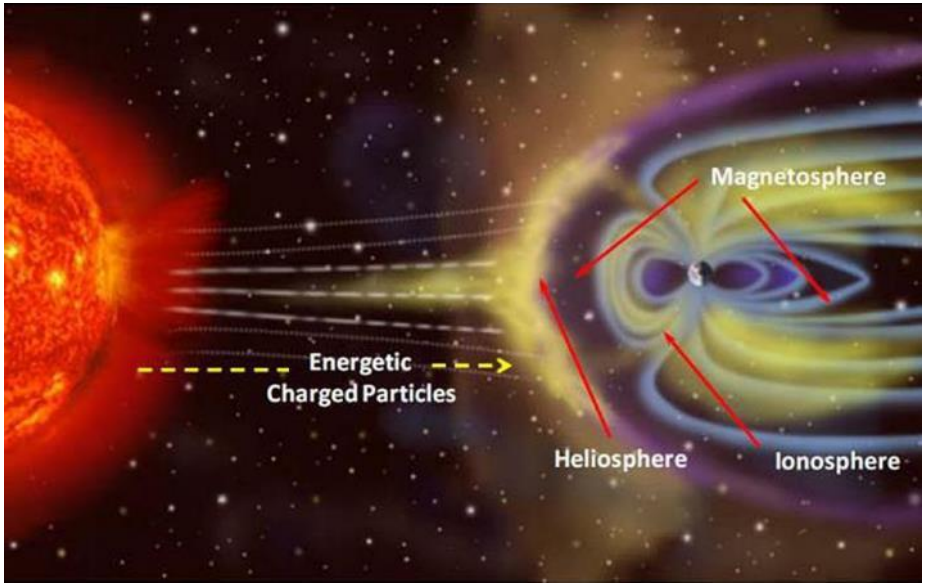
The Sun & Geomagnetic Disturbances (GMDs)





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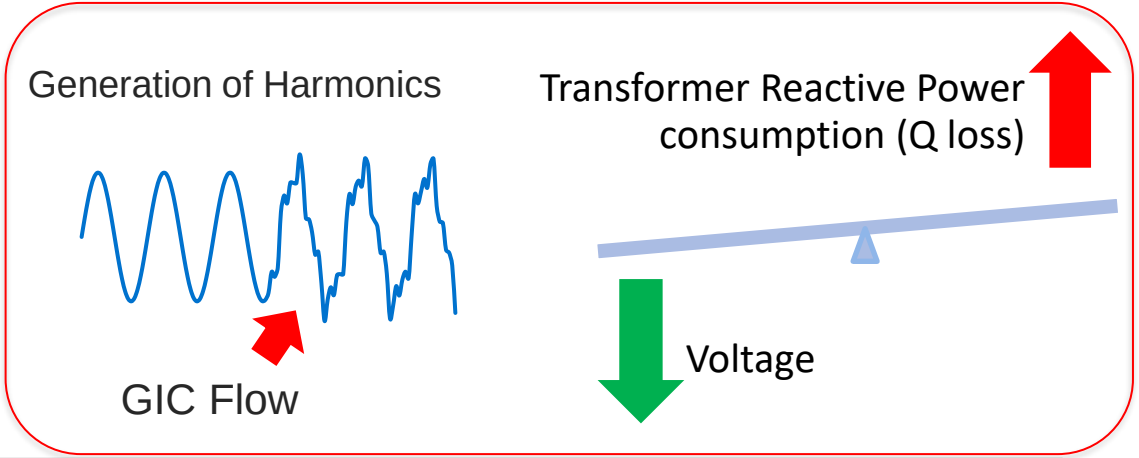
The Power Grid & GMDs Overview

- Geomagnetically induced currents (GICs) induced in the ground and on high voltage transmission lines
- Most consistently a concern on the neutral ground winding of a transformer
  - Core half-cycle saturation, harmonic currents, VAR absorption, excess heating
- Protection from miss operation
  - Legacy EM relays
  - CT saturation
- FACTs/Capacitor Banks
  - Low impedance source to ground



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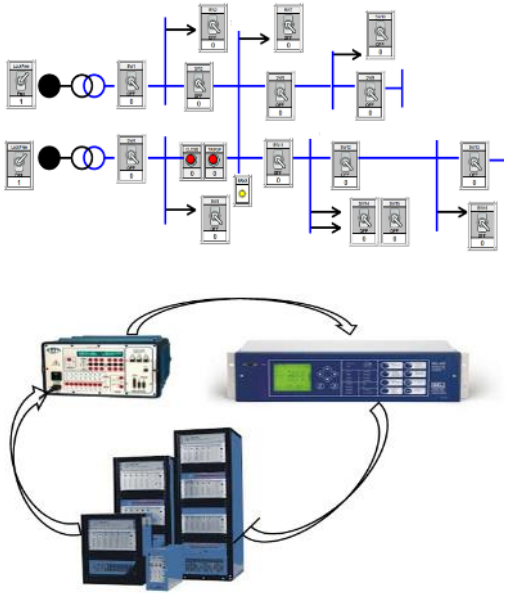
RTDS Lab



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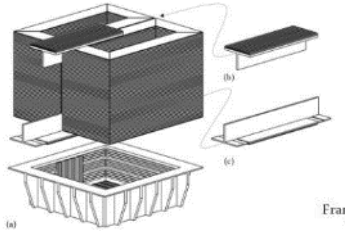
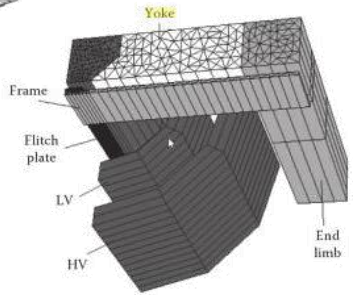
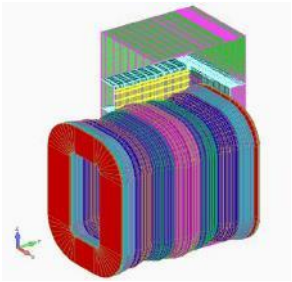
Studies & Equipment Updates

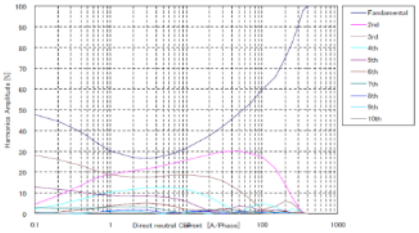
System modeling of the impact of DC current flow has been completed in compliance with TPL-007

- ✓EHV Power Transformers were redesign to avoid magnetic materials in supporting structure that can overheat with DC current injection
  - ✓ Design validated by manufacturers
  - ✓ Verified success with DE's 500kV GIC test in Fall 2022
- ✓Transmission capacitor bank protection moved to voltage differential from current differential in early 2000's









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Wide-Area Monitoring

- ✓ “Hall-effect CTs” have been installed across the service area to monitor DC current across the system
- ✓ System Operations Center has been provided with application to see impact of DC on network components in real time
- ✓ Continuous synchrophasor streams and triggered high resolution DFR oscillography available across the entire transmission system
- ✓ Robust notification and communications protocol with emergency operating procedures if NOAA issues a forecast above Kp = 5

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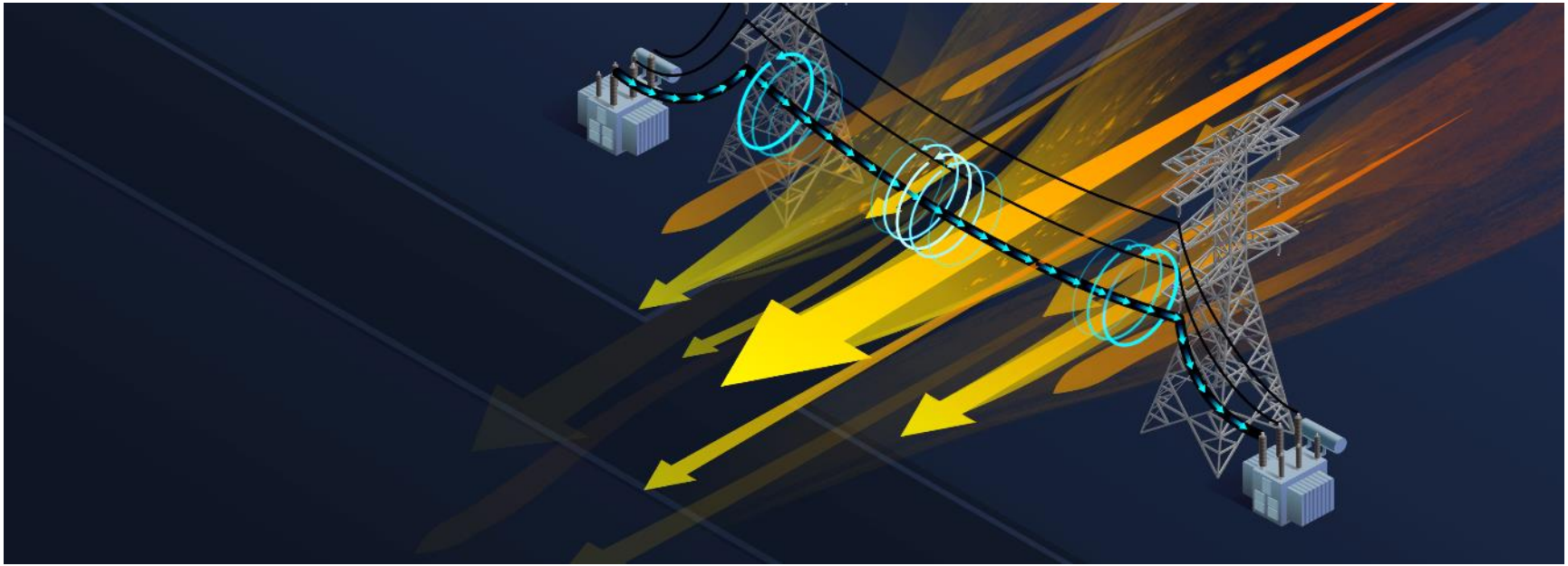
500 kV Transformer Field Test



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A Focus on Grid Reliability

- The two units of the transformer energized from the 500 kV bus while the secondary side is open. This retains an authentic operational environment while maintaining test security.
- The transformer tertiary windings cut to create test windings that are physically separate from the primary and secondary windings.
- Together, this prevents DC current from flowing into grid.
- Dominion's SOC & PJM monitor system reliability during the test
- Test procedures evaluated with detailed engineering models. (PSS/E, ASPEN, PSCAD, RTDS, etc.)
- Test circuit includes coordinated protection so the test can be interrupted manually and automatically.
- *Complete review and external presentation of data starting Q3*

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