



TPL-007-3

Transmission System Planned Performance for Geomagnetic Disturbance Events

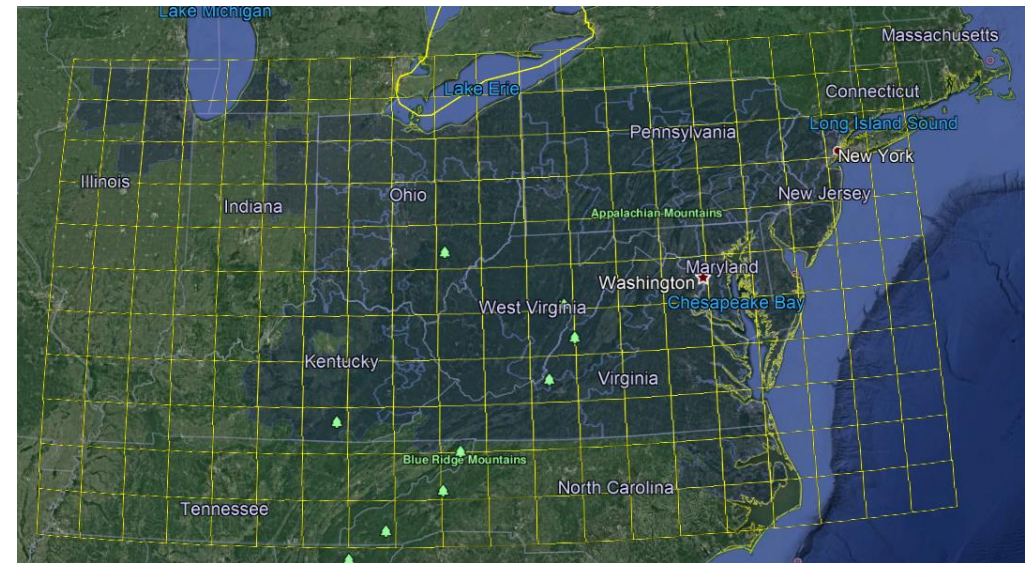
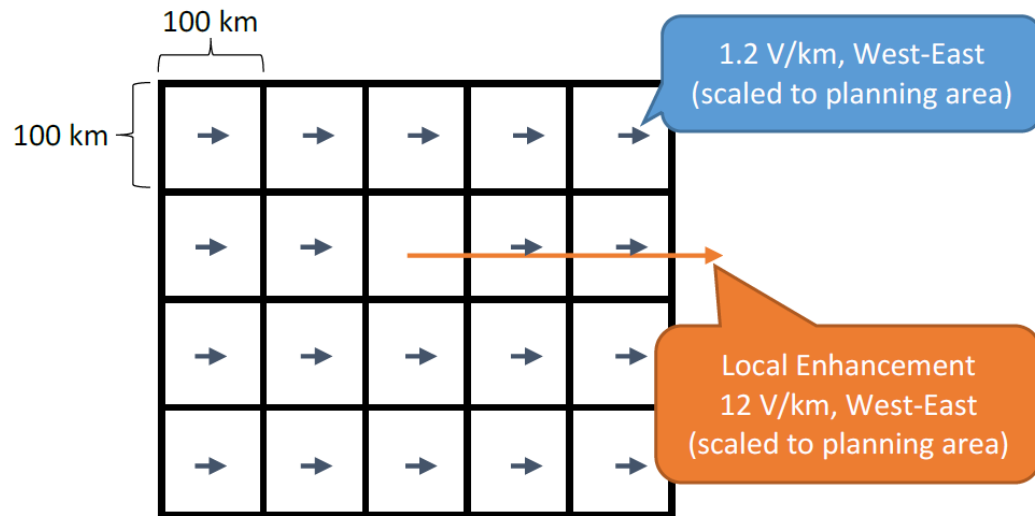
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Transmission Planning
Planning Committee Meeting
February 4, 2020

- Purpose:
 - Establish requirements for Transmission system planned performance during geomagnetic disturbance (GMD) events
- Applicable to:
 - Planning Coordinator (PC)
 - Transmission Planner (TP)
 - Transmission Owner (TO)
 - Generator Owner (GO)
- Facilities:
 - Facilities that include power transformer(s) with a high side, wye-grounded winding with terminal voltage greater than 200 kV

- TPL-007-3 R1
 - PJM presented individual and joint responsibilities of the standard at Planning Committee, Joint SOS and RSCS meetings in 2019 Q2
- TPL-007-3 R2
 - PJM collected new and updated GMD data to match 2018 Series RTEP (2023 5-year) Summer Case in 2019 Q2 and Q3
 - GOs submitted GMD data to PJM via [Gen Model Tool](#)
 - TOs submitted GMD data to PJM via NERC.Transmission.Planner@pjm.com
 - PJM exchanged GMD model with MISO, NYISO, TVA and DECDEP.
- TPL-007-3 R5 and R9
 - PJM completed DC GIC analysis during benchmark and supplemental GMD events
 - PJM provided GIC flows to impacted TOs and GOs in 2019 Q4 (R5.1 and R9.1)

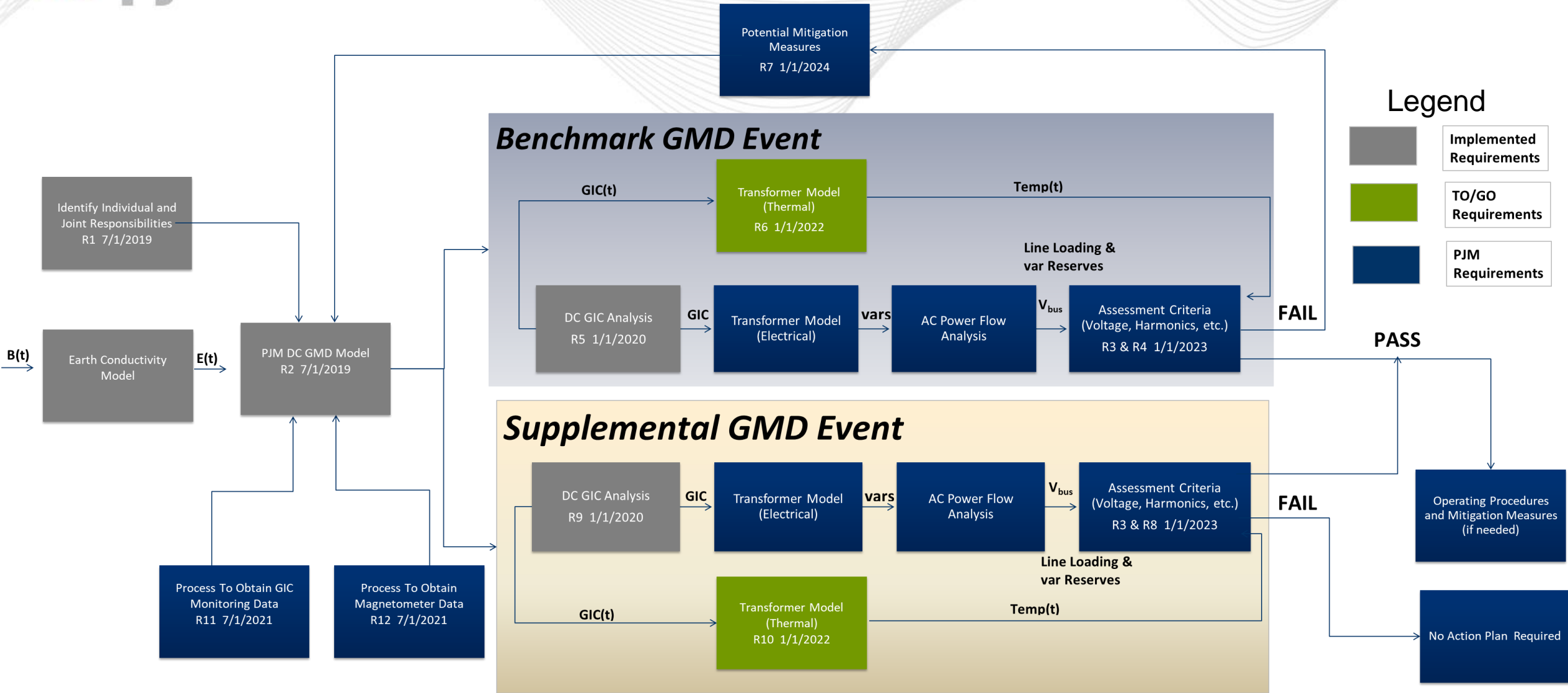
- Supplemental GMD Vulnerability Assessment
 - PJM followed NERC Implementation Guidance for Reliability Standard TPL-007-4 to create methodology during supplemental GMD event.

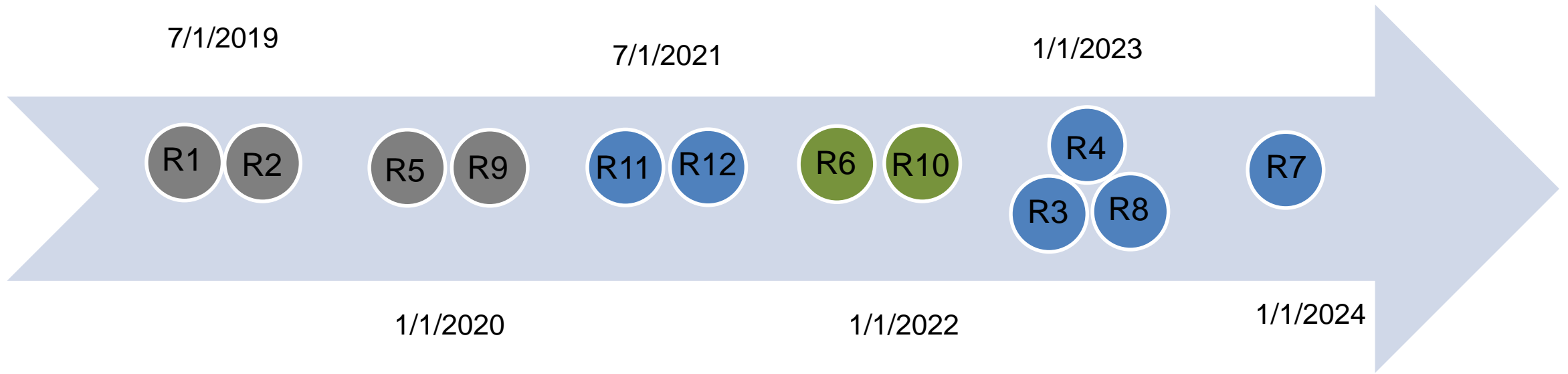
https://www.nerc.com/pa/Stand/Project201901ModificationstoTPL0073/Draft%20Implementation%20Guidance_TPL-007-4.pdf
 - PJM systematically moved the position of the local enhancement through out the entire PJM Planning area



- PJM has identified BES power transformers exceed thresholds
 - 4 transformers exceed the threshold of 75 Amps per phase during benchmark GMD event
 - AEP
 - Appalachian Power Company (AEP Generation)
 - 1 transformer exceeds the threshold of 85 Amps per phase during supplemental GMD event
 - METED

- Impacted TOs and GOs will perform transformer thermal impact assessment during benchmark and supplemental GMD events (1/1/2022). The assessment shall:
 - Be based on the effective GIC flow information (R6.1 & R10.1)
 - If any TO or GO require effective GIC time series, GIC(t), submit a written request to PJM via NERC.Transmission.Planner@pjm.com. PJM will provide this information within 90 calendar days of receipt of the written request (R5.2 and R9.2)
 - Document assumptions used in the analysis (R6.2 and R10.2)
 - Describe the suggested actions and supporting analysis to mitigate the impact of GICs, if any (R6.3 and R10.3)
 - Be performed and provided to PJM within 24 calendar months of receiving GIC flow information (R6.4 and R10.4)





Legend ● Implemented ● PJM ● TO/GO

- Harmonics
 - PJM issued a data request of devices 115 kV and above such as Capacitor Banks, SVC, STATCOM, HVDC, Synchronous Condensers that would be affected by harmonics during GMD events through PJM Relay Subcommittee in 2019 Q4.

- Capacitor Banks
 - 115 kV and above.

High: trip (N-k)
 Low: trip (N-1)
 None: No trip

Bus Number	Name	kV	Protection Scheme	Digital, Electro-mechanical	Harmonic Filtering	Fuse-less, Internal, External	Risk: High, Low, None
		115	Neutral Unbalance	Electro-mechanical	Analog	Internal (I ² ?)	High
		115	Neutral Unbalance	Electro-mechanical	Analog high dB	Fuse-less	Low
		500	Differential per phase	Digital	Digital full cosine	Fuse-less	None

- Revision History
 - V1 - 1/28/2020 – Original Version Posted to PJM.com