PJM Large Computational Load (LCL)

Operational Review

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Planning Committee Special Session
Large Load Ride-Through Education Session
September 15, 2026

Agenda

Discuss Operational Impetus for Large Load Ride-Through Requirements

- Review PJM Customer-Initiated Load Reduction (CILR) Events
- Review FERC & NERC Large Load Efforts

NERC 2026 State of Reliability
Customer-Initiated Load Reduction Events

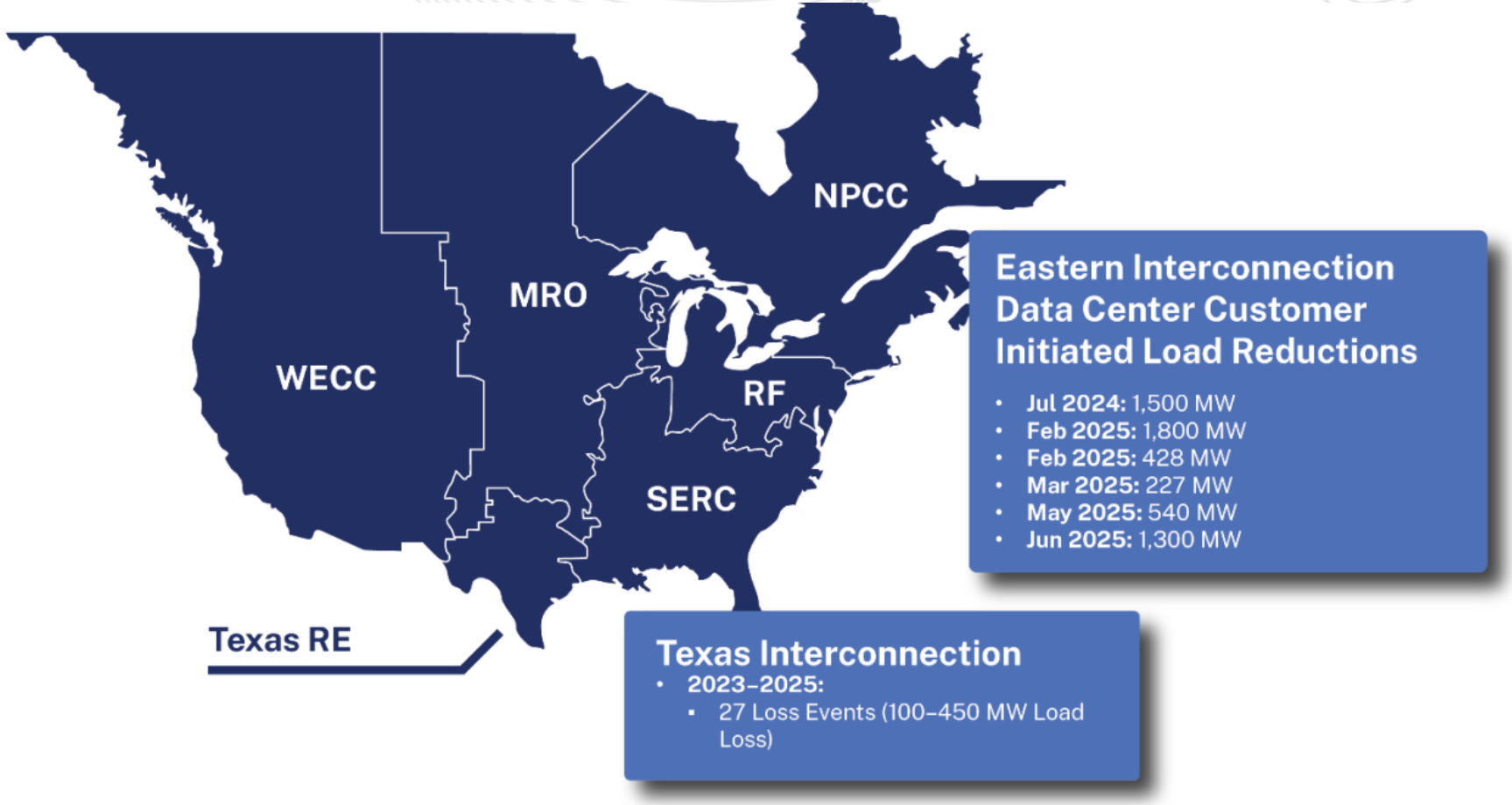
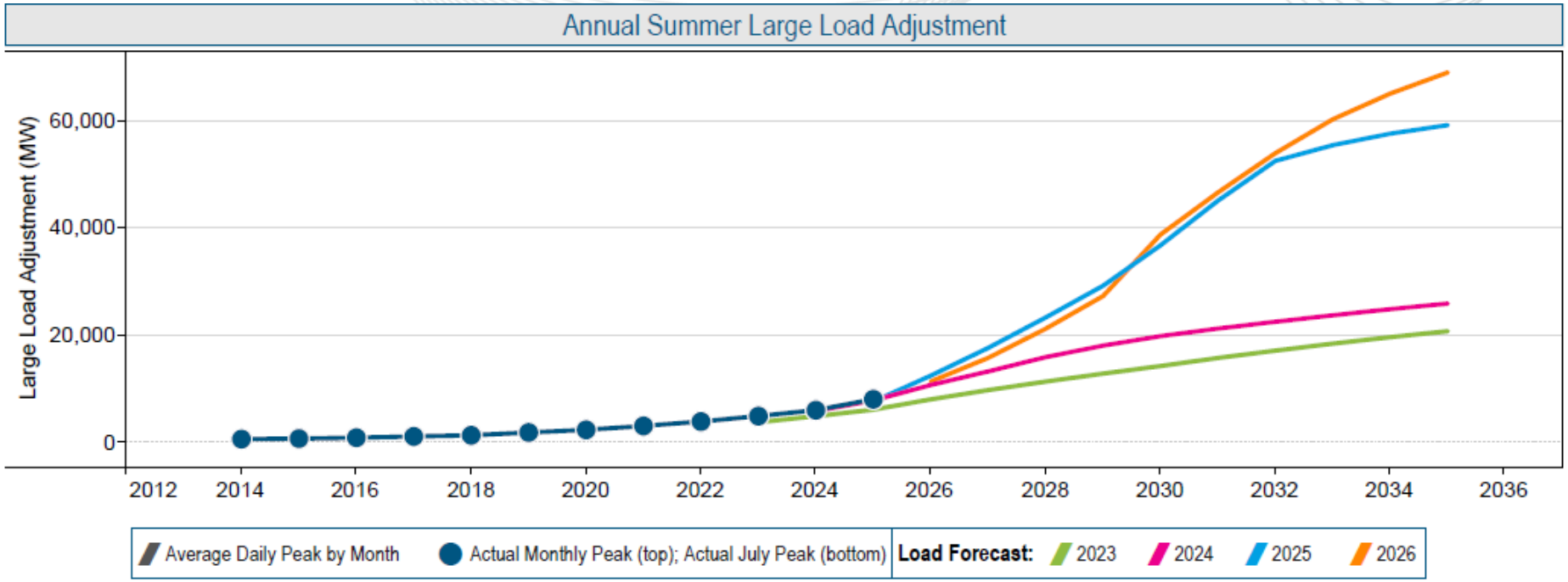


Figure 3: Customer-Initiated Load Reduction Events

Forecasted Data Center Load Growth



Actual July Peak from historical large load data	**Load Forecast July Peak** from 2023 thru 2026 PJM Load Forecasts

June 5, 2026 – Load Analysis Subcommittee

Load Adjustment Accuracy Report

Large Load Ride-Through Impetus

Large Load disconnections during and post normal cleared faults

1. July 10, 2024, approximately 1,500 MW of load transferred to backup generation.
2. February 17, 2025, approximately 1,800 MW of load transferred to backup generation.
3. July 22, 2026, approximately 3,900 MW of load transferred to backup generation.

Events raising system reliability and regulatory concerns

July 10, 2024 (Approximately 1,500 MW)

- A permanent 230 kV transmission line fault due to a lightning arrestor failure
- Three auto-reclosing attempts at each end of the line
  - Resulted in six successive system faults within an 82-second period
  - Fault cleared properly.
- Frequency increased to 60.047 Hz.
- Voltage went to 1.07 per unit (p.u.).
  - Operators removed shunt capacitor banks to return voltages to normal operating values.

February 17, 2025 (Approximately 1,800 MW)

- A sustained Single Line-to-Ground (SLG) 230 kV transmission line fault
- One terminal locked out immediately, and the opposite terminal completed its auto-reclosing sequence.
  - Four voltage sags across the area
- Fault clearing time was 5.9 cycles (0.0983 seconds).
  - Fault cleared properly.
- Frequency increased to ~60.042 Hz.
- Voltage increased to ~1.05 p.u.

July 22, 2026 (Approximately 3,900 MW)

- This was the largest CILR event to date.
- It was precipitated by a fault on a 230 kV transmission line following a mechanical failure.
  - Fault cleared properly.
- There were two stages to the load transfer with about ~2,900 MW transferring initially followed by roughly ~1,000 MW of CILR a minute later.
- Frequency in the Eastern Interconnection reached 60.092 Hz.
- Voltages increased with a peak of ~1.138 p.u.

LCL Load Transfer Event #3
July 22, 2026

Disclaimer: While materials are current at the time of publishing, applicable requirements may change. PJM Governing Documents control.

Event Summary

On Wednesday, July 22, at 07:56, approximately 3,900 MW of load transferred to backup power when a 230 kV transmission line fault occurred within the Dominion zone.

Load transferred to backup generation.

The load transfer caused high voltage conditions and triggered the transfer of additional load to backup generation.

Fault cleared properly.

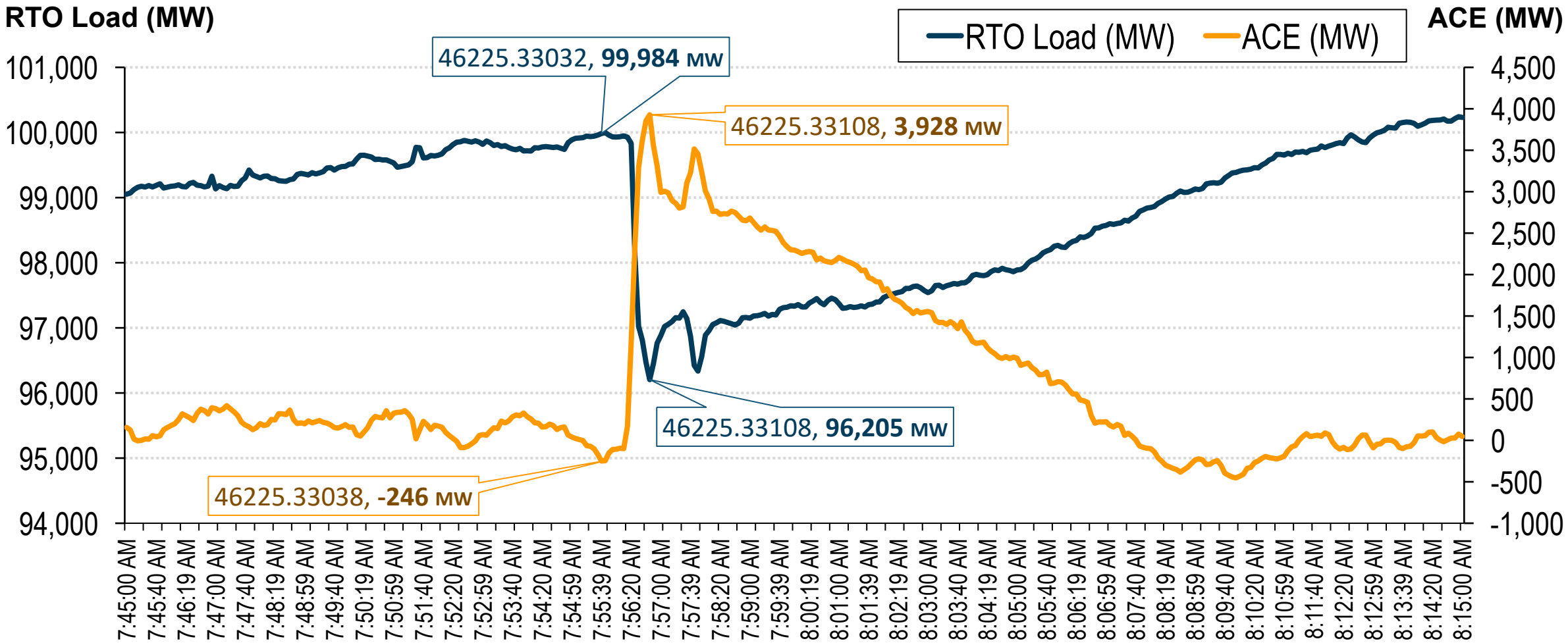
- There were no relay misoperations or stuck breakers.

The load transfer is due to Large Load voltage ride-through performance.

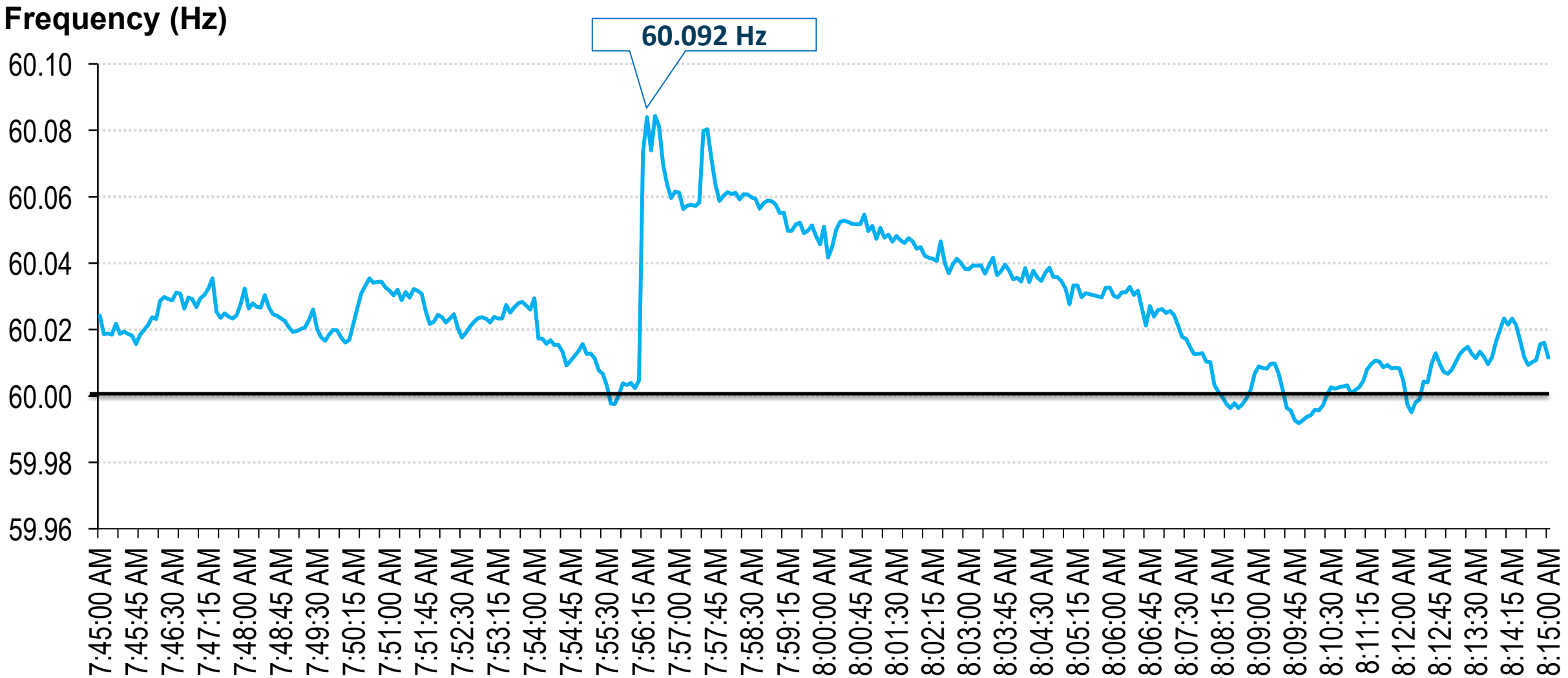
Impacts to the Grid

1. Reporting ACE reached +3,928 MW.
2. Frequency in the Eastern Interconnection reached 60.092 Hz.
3. Highest voltage recorded was ~1.138 p.u. (~261.74 kV).
4. Energy Management System (EMS) Alarms:
   - 655 Rate of change alarms (kV, MW and MVAR)
   - 428 frequency alarms

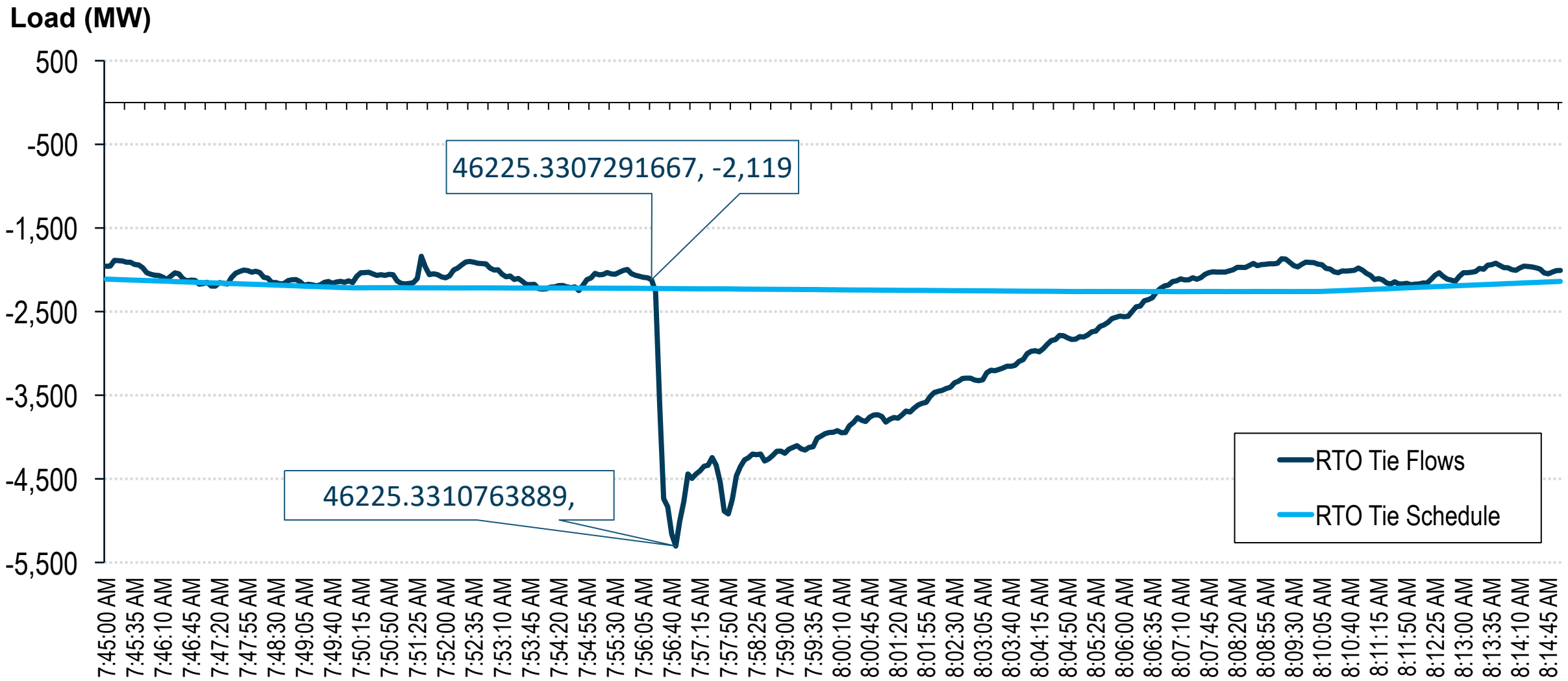
RTO Load vs. ACE



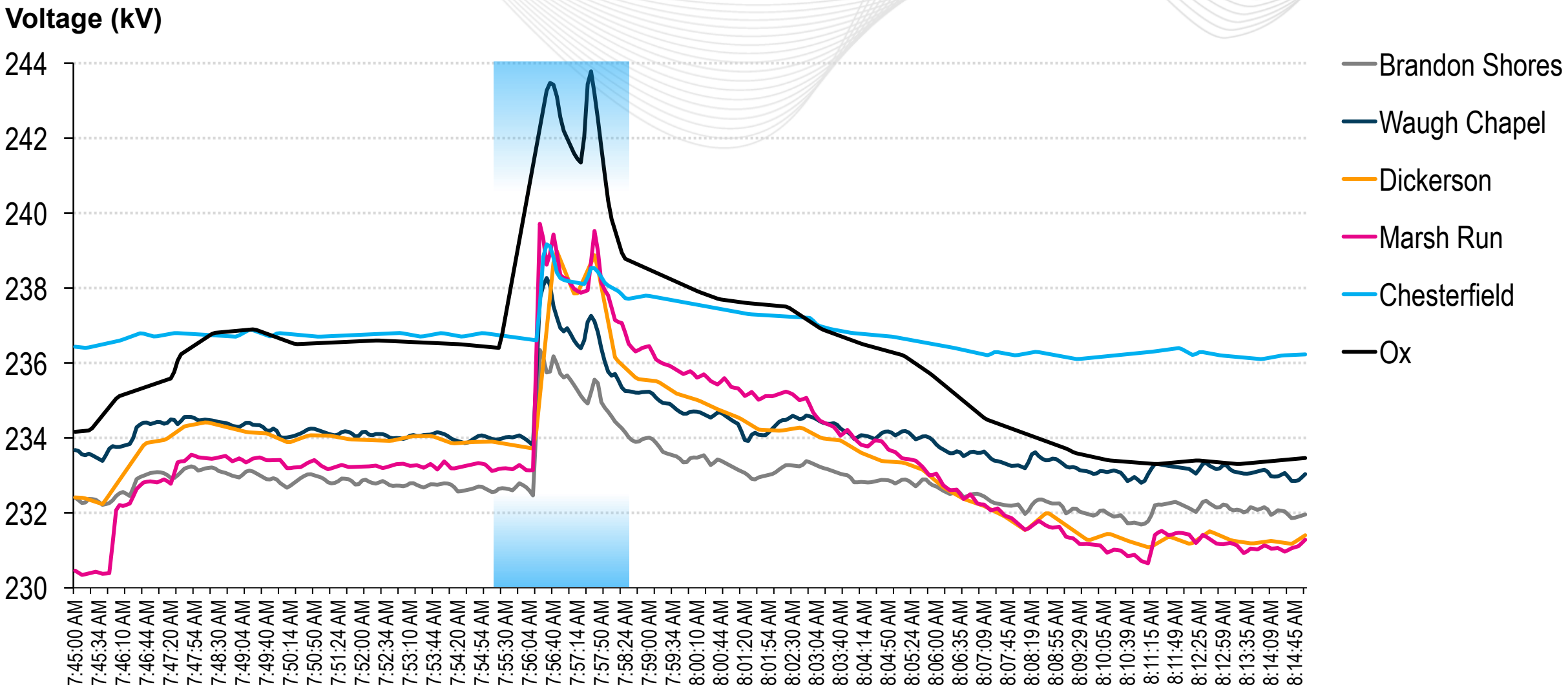
July 22, 2026 – Frequency



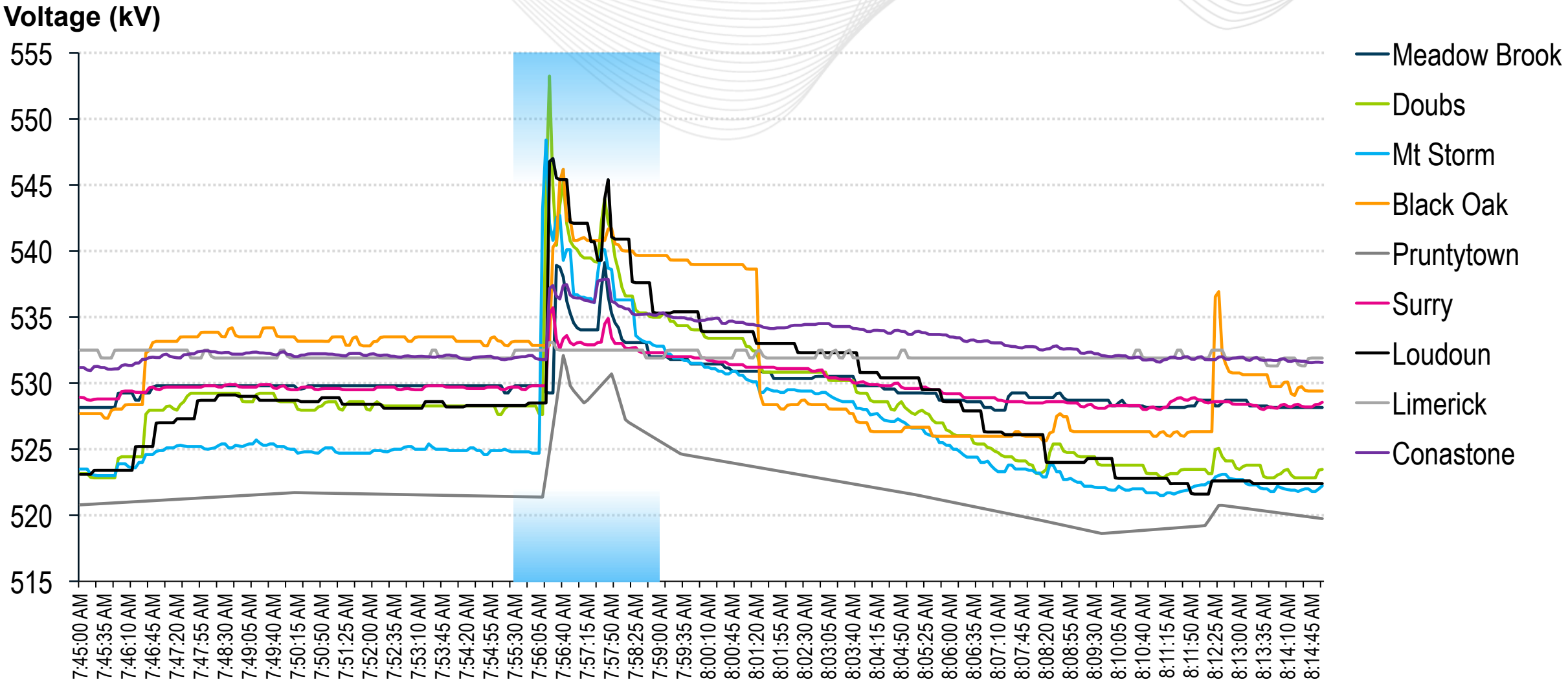
RTO Tie Flows vs. RTO Schedule



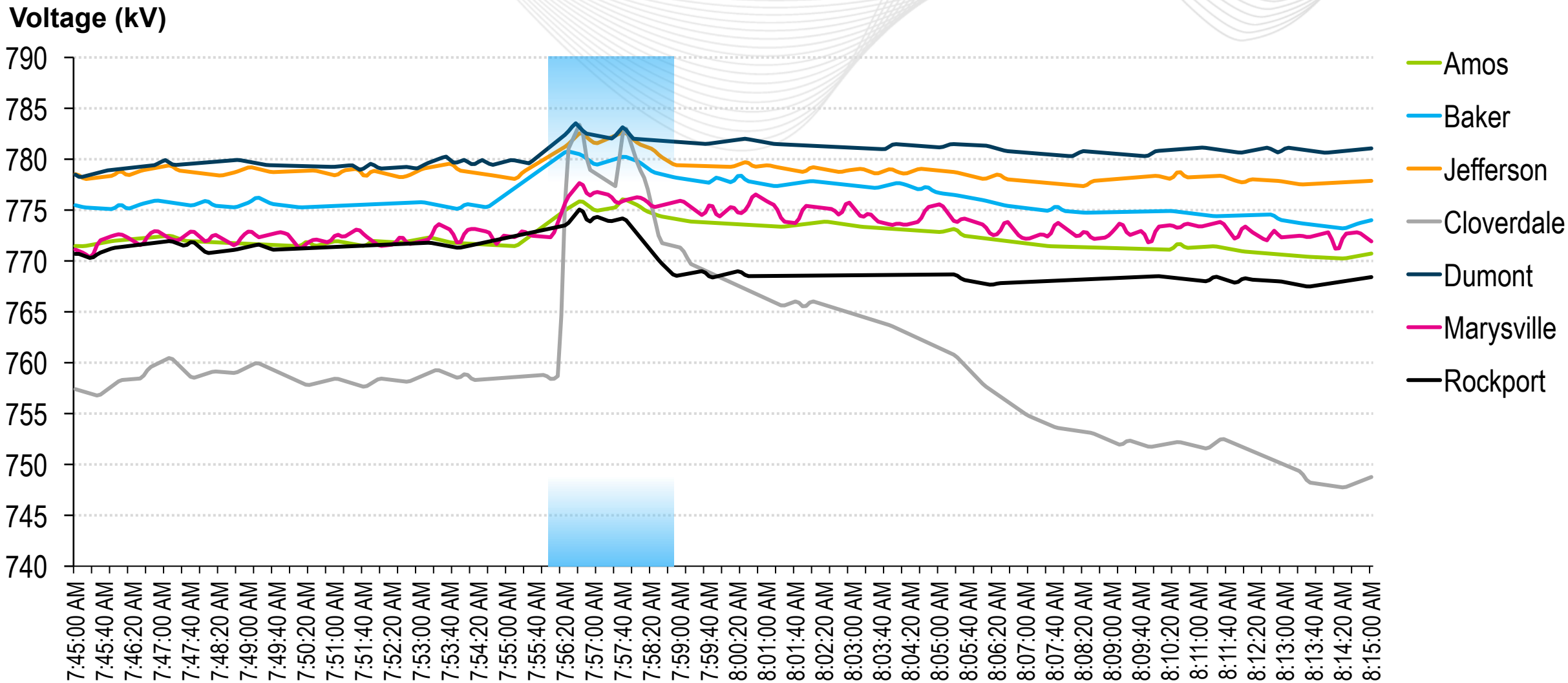
230 kV Voltages



500 kV Voltage



765 kV Voltage



NERC & FERC

NERC Large Load Action Plan

1. **NERC White Papers:**
   - Characteristics and Risks of Emerging Large Loads (July 2025)
   - Assessment of Gaps in Existing Practices, Requirements, and Reliability Standards for Emerging Large Loads (March 2026)
   - Large Load Disturbance Performance (Expected December 2026)
     - SAR – Reliability Standards to Address Computational Load Disturbance Performance
2. NERC issued a Level 3 Alert: Essential Actions to Industry: Computational Load Modeling, Studies, Instrumentation, Commissioning, Operations, Protection and Control
3. **Proposed Reliability Standards:**
   - Project 2026-02 Computational Loads
   - FERC Docket RD26-7-000 directing NERC to file by Dec. 31, 2026
4. Jim Robb Letter to CEOs outlines near-term actions on large loads and standards development process.
5. NERC LLWG – Standard Authorization Request Road Map

Proposed Foundational Reliability Standards

CLO-001-1	**Computational Load Interconnection, Studies, & Modeling Data** addresses the planning-facing integration work: interconnection requirements, studies, commissioning, qualified changes and modeling data.
CLO-002-1	**Computational Load Operational Data and Communications** addresses the operating-facing integration work: operational data, interpersonal communications, Operating Instructions, and response to Operating Instructions.
CLO-003-1	**Computational Load Protection Coordination & Disturbance Monitoring** addresses protection and monitoring equipment integration work: protection coordination and disturbance monitoring data needed for event analysis.

Draft LLWG Recommendations

Applicability and Effective Dates	• Develop criteria for applicability and implementation timelines, including consideration of both new and existing computational load sites. • Ensure existing sites are addressed, requiring compliance unless technical limitations are documented, since all observed Customer Initiated Load Reduction (CILR) events have involved already operational facilities and excluding them would leave the identified reliability risk unmitigated.
Voltage Ride-Through Requirements	• Consider ERCOT's Voltage Ride-Through (VRT) requirements as the minimum baseline while extending ride-through obligations to cover the full duration of credible disturbances and simplifying the voltage-time steps. • Address the applicability of VRT requirements to cooling load by providing some flexibility to the extent practical (based on studies and reliability risk assessment).

Draft LLWG Recommendations

Post-Fault Active Power Recovery (PFAPR)	• A default recovery level of at least 90% of pre-disturbance consumption with modification based on system studies
Frequency Ride-Through (FRT) and Rate of Change of Frequency (RoCoF) Requirements	• Establish minimum FRT and RoCoF withstand performance requirements at the Interconnection level, considering the IEEE 2800-2022 and PRC-029-1 criteria. • Consider whether the duration associated with the high-frequency requirement requires adjustment so that generation and load do not disconnect simultaneously during an over-frequency excursion. • Consider existing under-frequency load shedding (UFLS) schemes to ensure that FRT requirements do not interfere with UFLS schemes.
Current Consumption	• Establish requirements for the maximum current consumption of the computational load site during a disturbance.

FERC EL26-67-000 (Large Load Show Cause Order)

On June 18, 2026, FERC issued a Section 206 Show Cause Order to determine whether PJM's Tariff adequately addresses Large Loads integration. *FERC News Release (Item E-7)

Identifies gaps in processes for evaluating reliability impacts and transmission needs of Large Loads

Among other things, asks whether additional requirements are needed for:

- Ride-through performance during system disturbances
- Ramp-rate limitations and load restoration behavior

PJM plans to file revisions to address FERC's concerns (target: November 2026).

Q and A

Contact

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PJM LCL Ride-Through Requirements

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PROTECT THE POWER GRID

THINK BEFORE YOU CLICK!

pjm

BE ALERT TO MALICIOUS PHISHING EMAILS

Report suspicious email activity to PJM.

Call (610) 666-2244 or email it_ops_ctr_shift@pjm.com

Appendix

PJM Baseline Voltage Limits

PJM Baseline Limits	LD	EL	NL	NH	Vdrop Warning	Vdrop Limit
765 kV						
kV	688.5	703.8	726.8	803.3	5.0%	8.0%
P.U.	0.90	0.92	0.95	1.05	n/a	n/a
500 kV						
kV	475.0	485.0	500.0	550.0	2.5%	5.0%
P.U.	0.95	0.97	1.00	1.10	n/a	n/a
345 kV						
kV	310.5	317.4	327.8	362.3	5.0%	8.0%
P.U.	0.90	0.92	0.95	1.05	n/a	n/a
230 kV						
kV	207.0	211.6	218.5	241.5	5.0%	8.0%
P.U.	0.90	0.92	0.95	1.05	n/a	n/a