An Overview of Data Centers Response to the Recent Large Load Events in Dominion Energy

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ET Strategic Initiatives

Dominion Energy

Outline

- Reviewing two selected large load events in DE zone
  - LLE20240710 (Large Load Event, July 10, 2024);
  - LLE20260418 (Large Load Event, April 18, 2026);
  - Results of the collaboration with customers
- LLE20260722 (Large Load Event, July 22, 2026) analysis

Previous Events Comparison

July 2024 & April 2026

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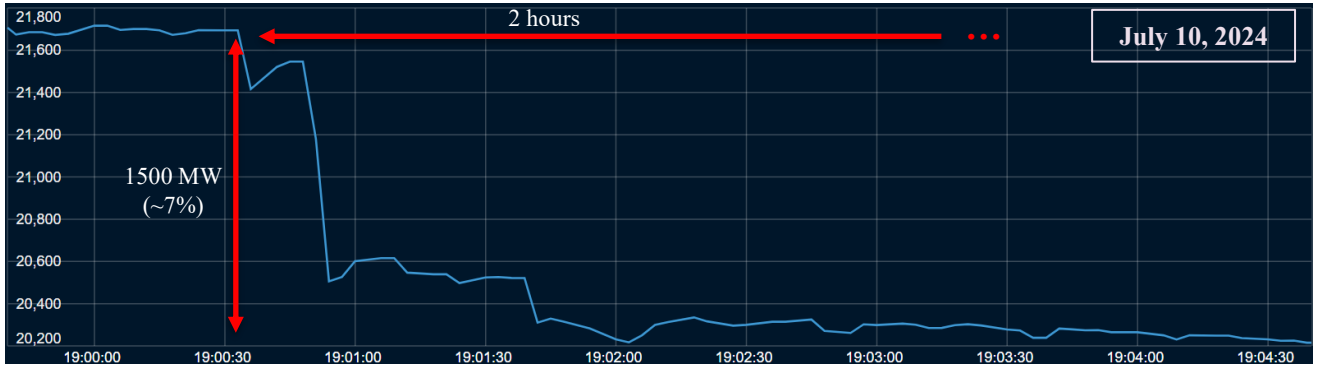
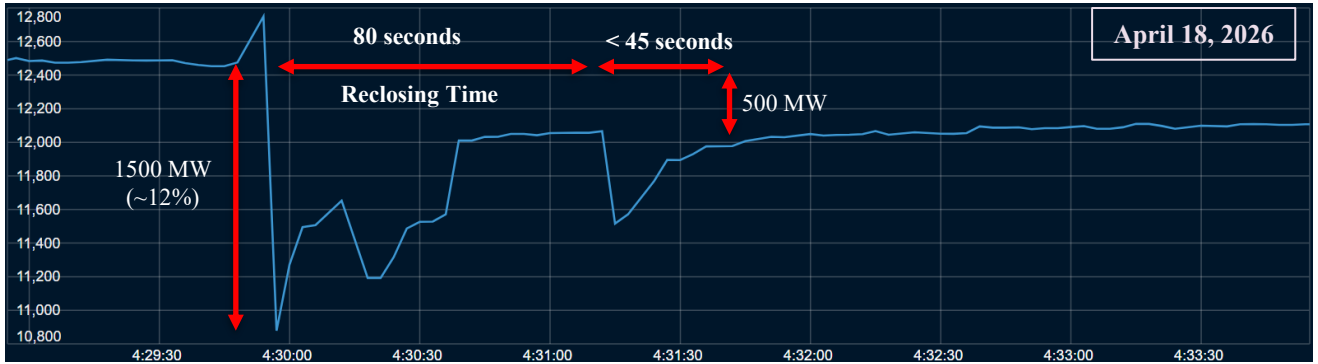
July 2024 and April 2026 Events - System Load Overview

	July 10, 2024	April 18, 2026
Initial Load response (MW)	1500	1500
Sustained Load Transfer (MW)	1500	500
Voltage Sags	6	6
Min V_Sag (%)	68.3	63.6
Max V_Sag duration (ms)	75	67
Sustained Transferred DC	10	1*
Impacted Substations (Threshold: 4MW)	22	22
Fault Recorders Triggered (<0.9 pu)	95	177





Total System Load (MW)

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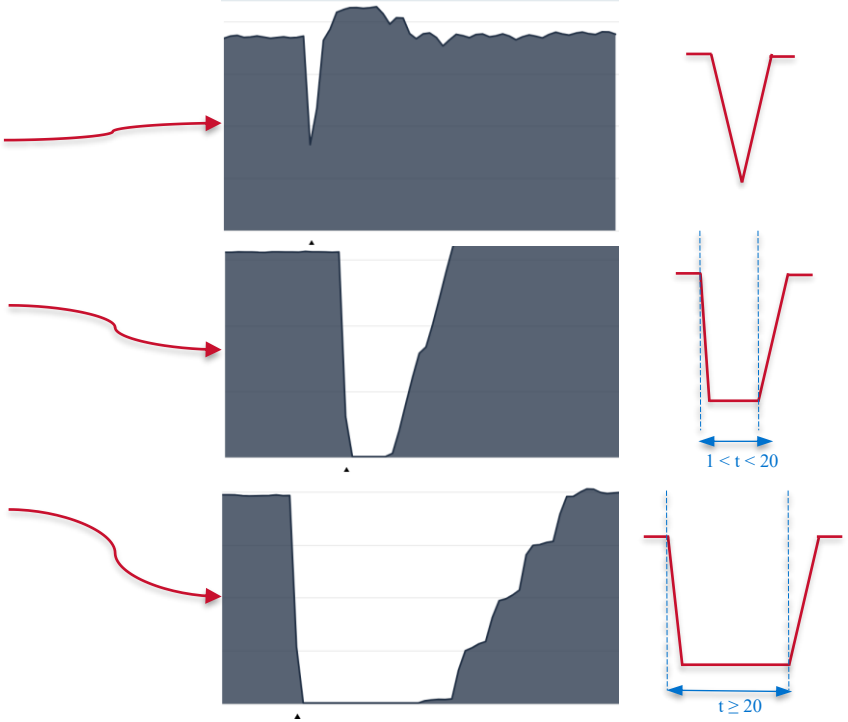
Data Centers' Response Categories:

- **Ride-through**
- **Transient load transfer:** Load drops but immediately ramps up. (Regardless of load drop percentage)
- **Temporary load transfer:** Load drops and stays disconnected for 1- 20 mins than ramps up. (Regardless of load drop percentage)
- **Sustained load transfer:** Load drops and stays disconnected for ≥ 20 mins than ramps up. (Regardless of load drop percentage)



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How did individual data centers react?

50 POI metering were analyzed

Most data centers experienced 6 voltage sags (initial fault and instantaneous reclosing, reclosing at 20 sec and 80 sec, based on Dominion recloser settings)

Event / Response	July 2024			April 2026		
	Min V_sag (%)	Max Transfer Duration	# Data Centers	Min V_sag (%)	Max Transfer Duration	# Data Centers
Ride-Through	67.8	-	28	63.3	-	27
Transient Load Transfer	68.0	-	5	64.0	-	6
Temporary Load Transfer	69.7	17 m	2	64.8	2 m	6
Sustained Load Transfer	68.3	3h 2m	10	65.2	1h 25m	1

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July 2024 and April 18 Comparison - Customer Response

	July 10					April 18				
Data Center	V_Sag Alarm	Voltage (pu)	Max V_Sag Duration	Load loss profile	Sustained transfer	V_Sag Alarm	Voltage (pu)	Max V_Sag Duration	Load loss profile	Sustained transfer
DC 1	N	0.91	0.058	No Load Loss	N	4	0.774	0.058	-	N
DC 2	N	0.92	0.049	No Load Loss	N	4	0.758	0.059	Rode through	N
DC 3	N	1	0	No Load Loss	N	4	0.766	0.058	Rode through	N
DC 4	6	0.8377	0.059	Total loss instantaneously and ramp up, Total loss after 3rd shot	Yes	5	0.713	0.059	Rode through	N
DC 5	6	0.6828	0.075	Total Load Loss after 3rd shot	Yes	6	0.652	0.066	Rode through	N
DC 6	4	0.883	0.042	No load loss	N	6	0.651	0.059	Rode through	N
DC 7	6	0.7446	0.067	Total Load Loss after 3rd shot	Yes	6	0.652	0.058	100% load transfer for 85 mins and then ramp up in 14 mins	Yes
DC 8	6	0.7477	0.067	Total Load Loss after 3rd shot	Yes	5	0.717	0.059	Rode through	N
DC 9	N	0.88	0.057	No Load Loss	N	6	0.711	0.058	Rode through	N
DC 10	6	0.7924	0.058	Minimal drop initially, all off at 15 sec	Yes	6	0.716	0.059	Rode through	N
DC 11	6	0.7905	0.066	Total Load Loss after 3rd shot	Yes	6	0.701	0.058	Rode through	N
DC 12	6	0.8192	0.066	Minimal drop initially, all off at 15 sec	Yes	6	0.636	0.067	Rode through	N
DC 13	6	0.7792	0.058	Total Load Loss after 3rd shot	Yes	6	0.72	0.059	Rode through	N
DC 14	6	0.784	0.067	Total Load Loss after 3rd shot	Yes	5	0.721	0.059	Rode through	N
DC 15	6	0.7847	0.067	Total Load Loss after 3rd shot	Yes	6	0.633	0.067	Rode through	N

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Key Takeaways

- April 18 event happened on a 500kV tie-line between DE (Dominion Energy) and FE (First Energy) on the FE territory, causing a 500 MW transfer on DE load side.
- Relative to the previous comparable events, less load were transferred on April 18, although a broader geographical area was impacted.
- This outcome indicates the effectiveness of coordinated efforts with customers to improve ride-through settings.
- Additional customers were identified for targeted engagement to further enhance system performance under similar conditions.

Large Load Event

July 22, 2026

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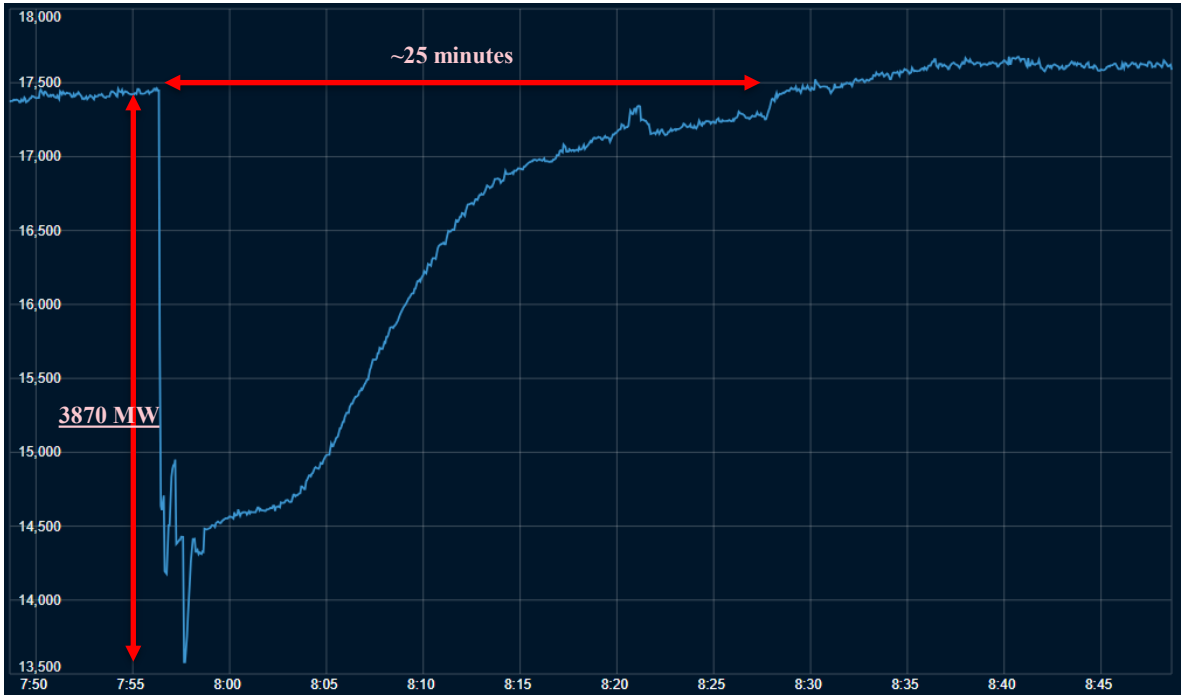
System Load Review

- At 07:56, a 230 kV Line Locked Out.
- At the same time three Capbanks tripped due to abnormal voltage.
- The faulted line saw an A-B fault persisting throughout all reclosing attempts.
- Field personnel reported finding a conductor hardware failure.
- The faulted line is 1.5 miles long in the heart of data center alley.



Total System Load (MW)

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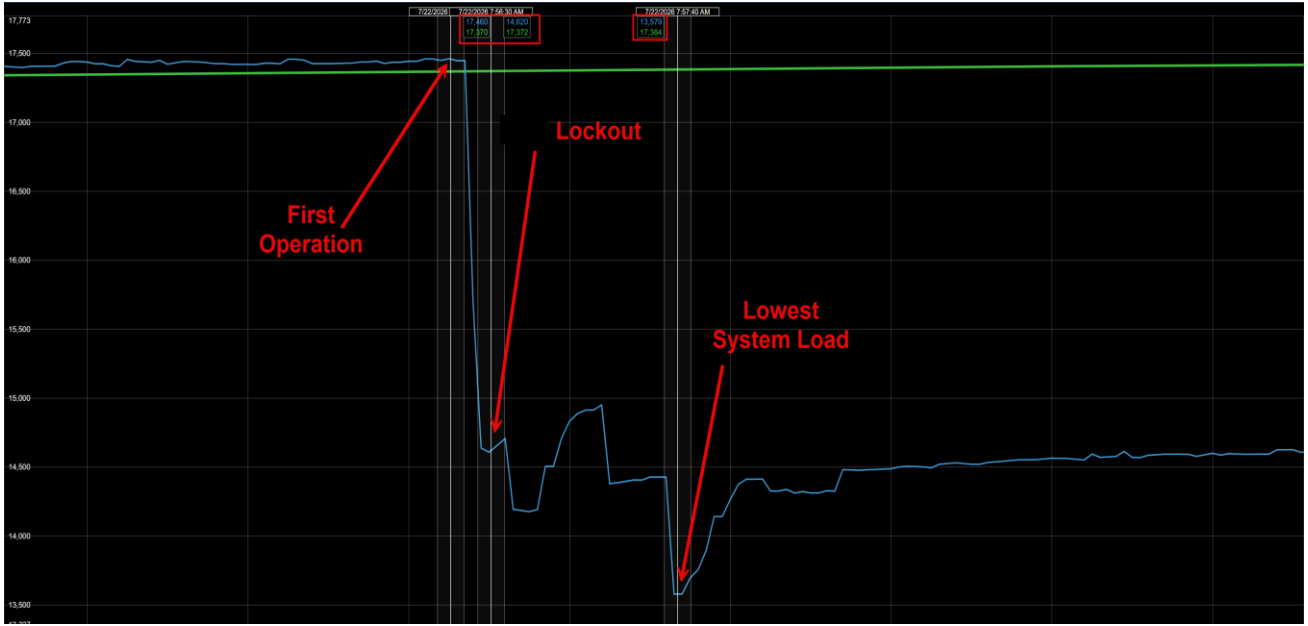
Selected Events Comparison

	July 10, 2024	April 18, 2026	July 22, 2026
Initial Load response (MW)	1500	1500	3900
Load Transfer (MW)	1500 (sustained)	500 (sustained)	2900 (temporary)
Impacted Substations (Threshold: 4MW)	22	22	39
Voltage Sags	6	6	7
Min V_Sag magnitude (%)	**68.3**	**63.6**	**5.09**
Max V_Sag duration (ms)	75	67	76
Sustained Transferred DC	11	1	4

System Load Review

- 07:56:15 – line open and inst reclose
- 07:56:15 – 3 Capbanks received Abnormal Voltage Alarm and tripped
- 07:56:17 – CBs open
- 07:56:29 – CBs reclose
- 07:56:30 – CBs lockout
- 07:57:40 – Cap #4 open
- 07:57:54 – Cap #5 open
- 07:58:14 – Cap #6 open
- 07:59:05 – Reactor #1 closed
- 07:59:55 – Reactor #2 closed



Total System Load (MW)

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How did individual data centers react?

POI metering were analyzed

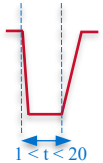
Most data centers experienced 7 voltage sags. The timing of the INST recloses from both ends were not synchronized and came in at 192ms from SUB1 and 380ms from SUB2.

(initial fault and instantaneous reclosing, reclosing at 20 sec and 80 sec, based on recloser settings)

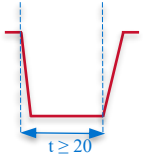
- 3 data centers rode through.
- 17 data centers experienced transient load transfer.
- 12 data centers experienced temporary load transfer.
- 4 data centers experienced sustained load transfer.

Load drops but immediately ramps up. (Regardless of load drop percentage)

Load drops and stays disconnected for 1- 20 mins than ramps up. (Regardless of load drop percentage)



Load drops and stays disconnected for ≥ 20 mins than ramps up. (Regardless of load drop percentage)



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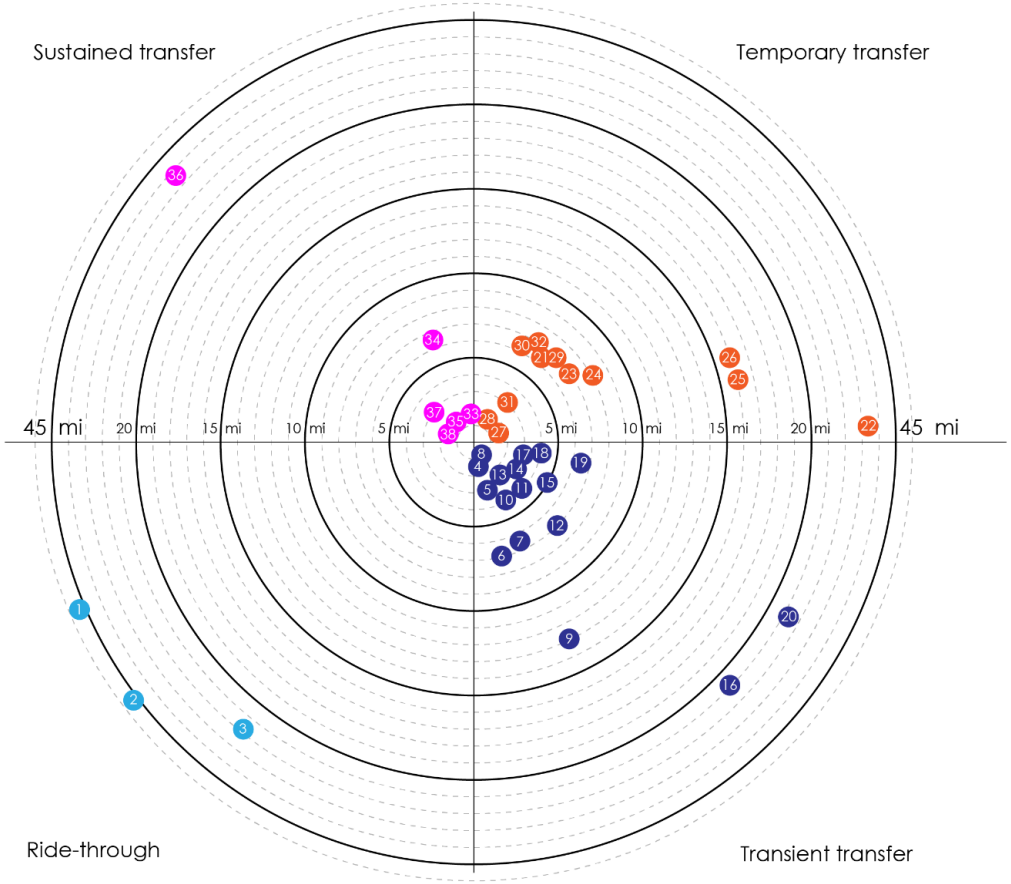
Data Center with POI Monitoring

Event / Response	July 22, 2026	
	Min V_sag (%)	# Data Centers
Ride-Through	58.18	3
Transient Load Transfer	5.43	17
Temporary Load Transfer	6.23	12
Sustained Load Transfer	7.31	6



Data Centers Response Type Based on Their Transmission Path Distance From the Fault (Miles)

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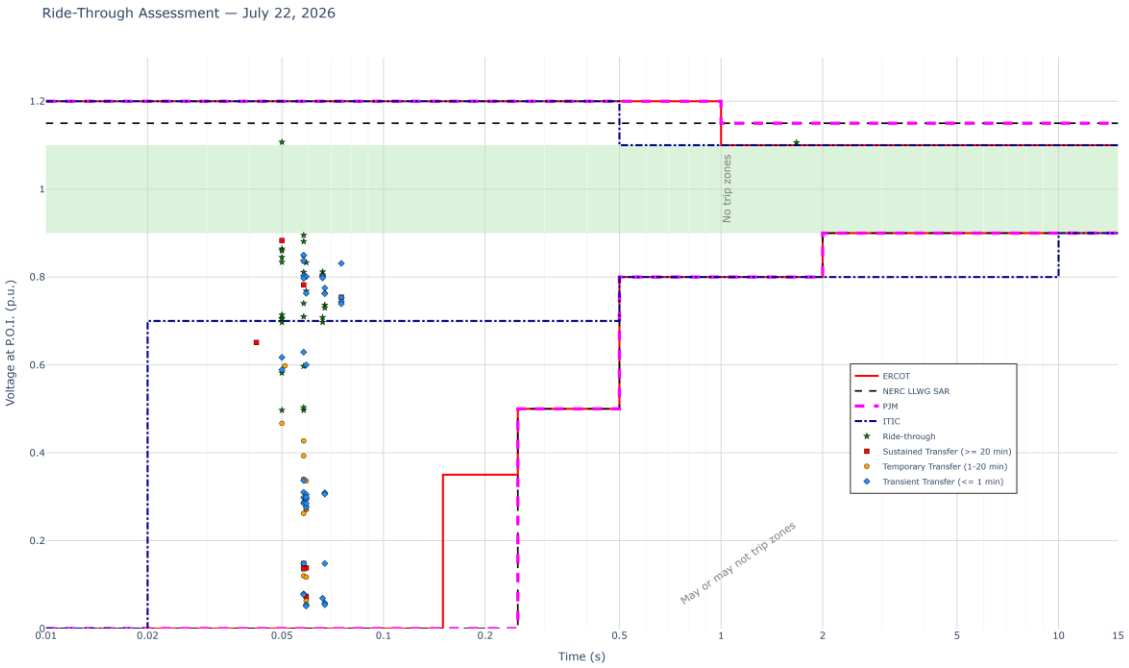
Spread of Voltage Measurements with respect to Ride-Through Performance Curves

- For July 22 load transfer event, if ride through requirements would have been in place, the event would have been avoided.
- This is evident as data points are within ERCOT, NERC LLWG SAR and PJM proposed RT curves.



General Observation on July 22, 2026

- This event had a higher impact (voltage profile, load reduction) in comparison to the previous events.
- The system load was recovered in less than 25 minutes.
- During this event there were 7 voltage sags; however, in the previous event maximum of 6 voltage sag was observed.
- This event resulted in lower voltage level (<0.4 pu) than any of the previously observed events.
- **The collaboration between DE and the customers was evident during the April 18 event. But, in this event due to a more severe voltage condition, the customers responded to the first voltage sag.**

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Ongoing Efforts

- Increase the deployment of high-fidelity monitoring equipment at appropriate locations to characterize individual data center behavior
- Perform studies to update ride-through requirements
  - Interim requirements will be released in the next FIR update at the end of this year (updated every 6 months)
  - Dynamic studies will be performed to develop tailored RT requirements.
- Modeling improvement
  - What-if analysis and benchmarking studies against data
  - Adoption of PERC models for data center modelling
  - Engagement with OEMs for EMT modeling and defining realistic RT settings
  - DEV Load Modeling Working Group was recently created
- Continued Costumer engagement

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Thank you

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