



QSA Results and Large Load IROL Mitigation Plans

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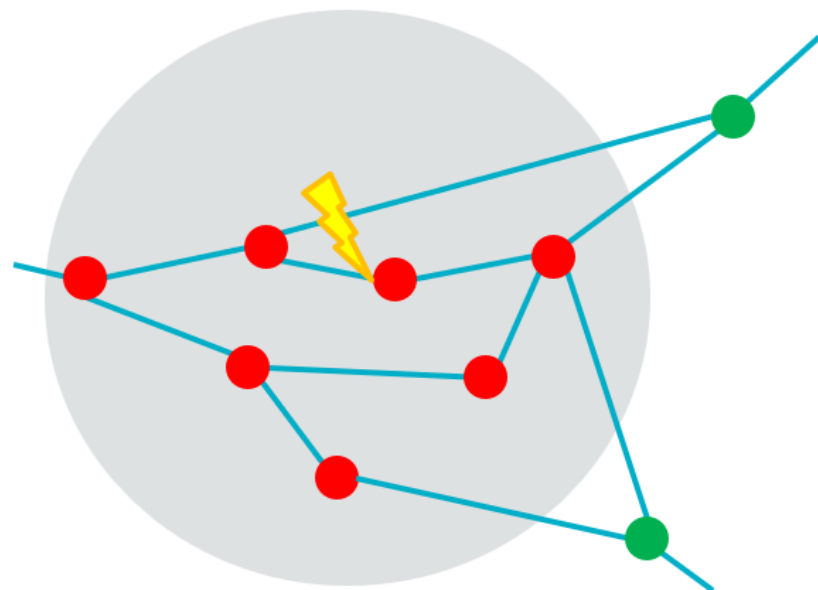
Outline:

- Reliability Concern Recap
- QSA 2026 Q4 Overview and Results
- IROL Groups for 2026 Q4
- Current Consumption Levels
- Status of Mitigation Plans and Load Share Calcs
- Next Steps

Key Takeaways

- ERCOT Operations has developed 3 Mitigation Plans for identified Large Load IROL groups based on 2026 Q4 QSA results. LL consumption has not yet reached a level in which Mitigation Plans are active.

Reliability Concern of Large Load Ride-Through



Location of the fault



Area affected by voltage dip resulting from the fault



Equipment located outside the area of voltage dip



Equipment located inside the area of voltage dip (may trip if unable to ride-through)

Reliability Concern

- System fault occurs and Large Computational Loads w/o ride-through capability trip or transfer load to backup generation
- This large amount of customer-initiated load reduction causes high system frequency and overvoltage conditions

Frequency Limit

- ERCOT identified that 3,200 MW of Load loss results in frequency overshoot to 60.4 HZ under certain system conditions.
- System frequency of 60.4 Hz leads to potential cascading outages and frequency instability

Quarterly Stability Assessment (QSA)

- ERCOT performs VRT assessment for Large Loads in each QSA
- Assessment identifies trip groups in which a single voltage disturbance may cause >3,200 MW of Load loss from LLs
- IROs and Mitigation Plans developed for identified LL trip groups

QSA / Large Load VRT Assessment Overview

Study Case

- Approved DWG 2029 HRML case with 2026 Q4 transmission and generation condition

CTGs

- 4-cycle 3P fault applied to 147 buses (345kV)
- 6-cycle 3P fault applied to 19 buses (138 kV)

Large Loads included in case

- 11 planned LLs with 2675 expected MW per LCP was studied
 - 3719 MW Approved Capacity
- Study included ~22 GW of LL

QSA Results for Large Load VRT Assessment

3.4. Large Load Voltage-Ride Through Assessment Results

As shown in Table 3.4, six groups of Large Loads were identified with a total study capacity exceeding ERCOT's 3200 MW load loss criterion.

Table 3.4: System-wide VRT Assessment Results

Group	Weather Zones	Total Study Capacity*
1	North Central, North	4944
2	Coast, North Central, South Central	4964
3	North Central, South Central	5464
4	North Central, South Central	4280
5	North Central, South Central	5540
6	Far West, North, West	4258

- “Total Study Capacity” represents the total approved capacity of Large Loads that tripped or reduced consumption in each group.
- The table above serves as a guide for developing operating constraints and mitigation plans. A single Large Load can appear in multiple groups shown in the table.

North and Central Texas IROL Groups

- ERCOT verified Approved Capacity and Load Type of affected Loads with TSPs
 - Multiple LLs had lesser Approved Capacity than used in QSA
 - ERCOT Operations modified QSA results and IROL groups based on TSP verification and feedback
- The IROL groups in North and Central Texas include most of the same LLs
- ERCOT Operations combined 5 groups into 2 IROL groups based on location and total Approved Capacity
 - *Original Group 4 now <3,200 MW, so *LLs in Group 4 only* were removed from IROL groups
- Marginal increase in total Approved Capacity of combined IROL groups
- More manageable for ERCOT Operations and TSPs to implement 2 IROLs rather than 4

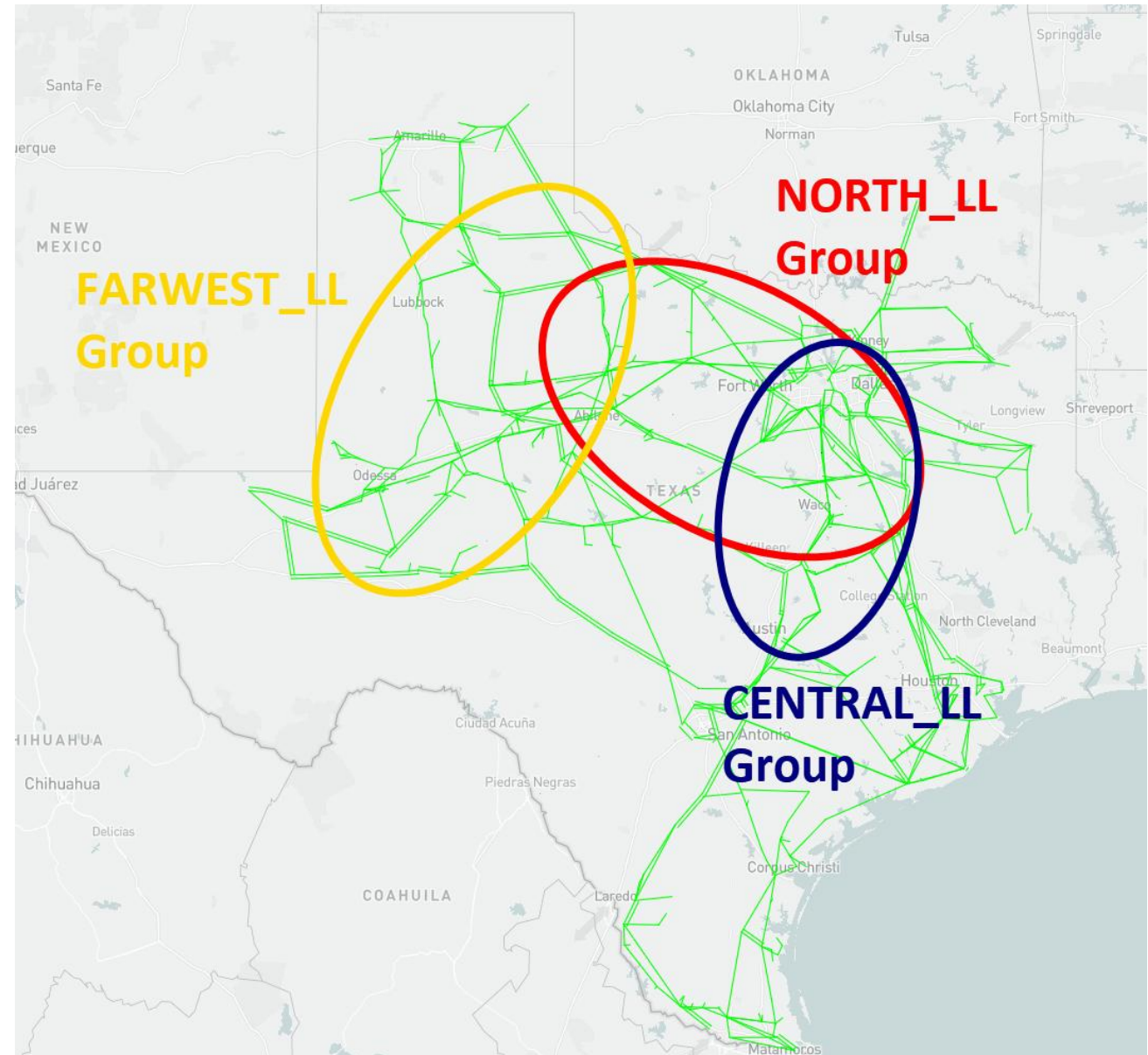
	Group 1	Group 3	Group 2	Group 4*	Group 5
QSA Approved Capacity	4,944	5,464	4,964	4,280	5,540
Adjusted Approved Capacity	4,745	5,365	4,440	3,056	5,040
	Combined Group 1: NORTH_LL		Combined Group 2: CENTRAL_LL		
Total Approved Capacity in Combined Groups	5,465		5,240		

West Texas IROL Group

- Previous QSA and draft Mitigation Plans defined two IROL groups in West TX
 - West Tx Group 3: FARWEST_LL
 - West Tx Group 4: WESTTX_LL
- The West TX Group 4: WESTTX_LL IROL is not needed based on QSA Q4 results
 - Updated models showing ride-through capability removed a couple of LCLs
 - Multiple loads had significantly less approved capacity (<75 MW) based on TSP feedback
 - Total Approved Capacity for trip group now less than 3,200 MW
- The West TX Group 3: FARWEST_LL IROL is still needed for monitoring purposes but unlikely to become active in the upcoming quarter
 - Total adjusted approved capacity is 4,198 MW
 - ~1,400 MW of this approved capacity is a single LCL that has not received approval to energize; which brings total under 3,200 MW
 - Maximum simultaneous consumption is currently ~1,000 MW
 - Some LLs in previous QSA trip groups were on the very edge of voltage sag <0.7pu
 - Did not trip in Q4 QSA assessment, but were kept in Mitigation Plans

Geographic Locations of IROL Groups

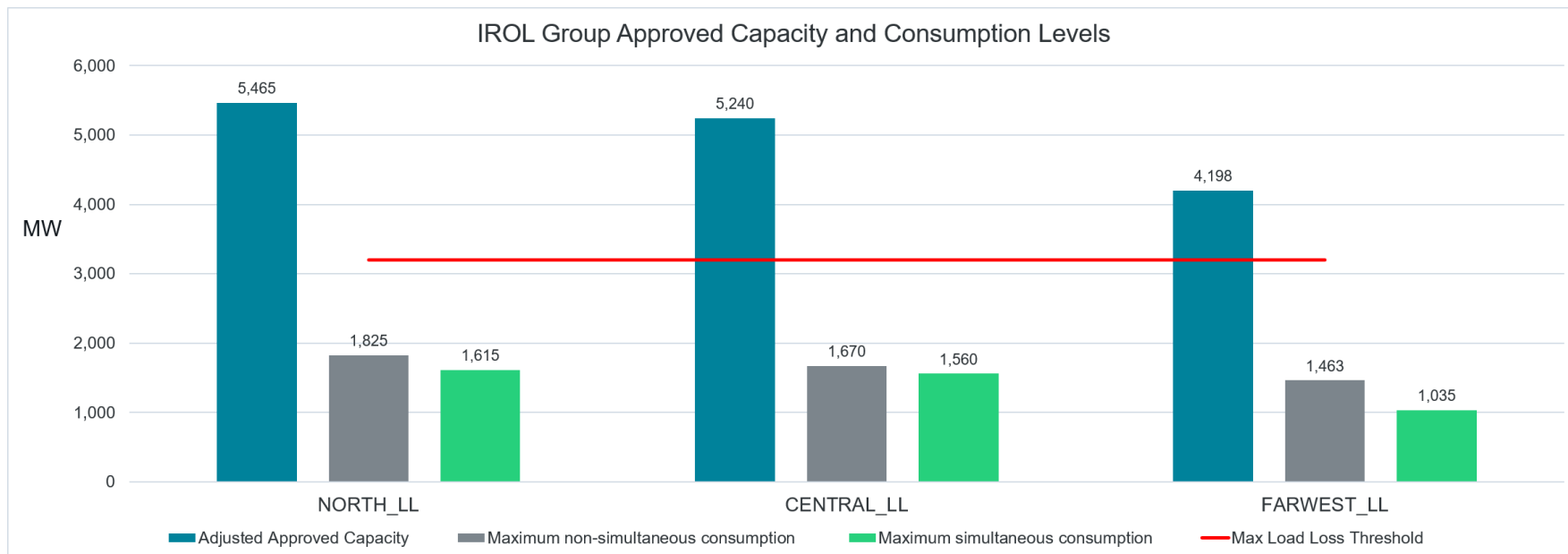
IROL Group	Total Approved Capacity (MW)
NORTH_LL	5,465
CENTRAL_LL	5,240
FARWEST_LL	4,198



Current Consumption Levels

- ERCOT is monitoring simultaneous consumption level of each IROL group in EMS

IROL Group	NORTH_LL	CENTRAL_LL	FARWEST_LL
Adjusted Approved Capacity	5,465	5,240	4,198
Maximum non-simultaneous consumption	1,825	1,670	1,463
Maximum simultaneous consumption	1,615	1,560	1,035



- Chart above has been updated from chart shown at 9/14 BOD meeting

Load Share Calculations for TSPs/QSEs

- Based on TSP feedback, load share ratios for TSPs/QSEs based on actual consumption instead of Approved Capacity
 - Several LCLs are energized with large Approved Capacity, but consuming <5 MW
 - Energized LCLs far behind ramp schedules provided in LCPs
- ERCOT determined maximum consumption for each LCL in IROL groups over last 3 months
 - Used telemetry when available; state estimated values when telemetry is suspect
 - If consumption is less than 5 MW; assumed to be construction load only and not used in load share calculations
- Mitigation Plans assign a “Not To Exceed” MW limit to each TSP/QSE based on the load share calculation
- Since these are IROLs and the 3,200 MW limit may not be exceeded, even temporarily, ERCOT will control IROLs to 85% of limit, or 2,720 MW
 - Not To Exceed Limits based on 2,720 MW

LL IROL Mitigation Plan Example

Table 1

Transmission Operator (TO) or QSE	Station Name	Station ID	Load Name	Max Consumption Last 3 months	Approved MWs
TO1	Station 1	ST1	LD_1, LD_2, LD_3	120	200
TO1	Station 2	ST2	LLD1, LLD2	240	400
TO2	Station 3	ST3	XFMR1, XFMR2	150	300
TO2	Station 4	ST4	LDLXFMR1, LDLXFMR2	40	120
TO2	Station 5	ST5	Load1, Load2, Load3, Load4	200	450
TO3	Station 6	ST6	LDXFMR3, LDXFMR4	<5	250
TO3	Station 7	ST7	XFMR3	400	800
QSE1	Station 8	ST8	LCL1, LCL2, LCL3	350	1000
		Total MW		1,500	3,520

Table 2

TO/QSE	TO1	TO2	TO3	QSE1	Total LL MW	Discounted Region Limit
Total Approved MW of Affected Loads	600	870	1,050	1,000	3,520	
Maximum Consumption (non-simultaneous)	360	390	400	350	1,500	
Percent of Total Combined Maximum Consumption	24.0%	26.0%	26.7%	23.3%	100%	
Not to Exceed MW Limit Based on Maximum Consumption	653	707	726	634		3,200*0.85 =2,720
Not to Exceed MW Limit Based on Maximum Consumption (Adjusted)	600	725	745	650		2,720

Status of Mitigation Plans

ERCOT has provided draft Mitigation Plans to TSPs and has received feedback

- Revised MPs were sent out
- Mitigation Plans sent to TSPs list all LLs in IROL groups, but cannot be shared publicly
- TSPs should notify all LLs listed in Mitigation Plans
- ERCOT meeting with affected QSEs for LLs co-located with Generation Resources

ERCOT will be providing the following telemetry to monitor IROL groups and maintain limits

- Discounted IROL limit based on ERCOT control room reliability margin (ex. 2,720 MW when set to 85%)
- Individual “Not to Exceed Limit” to each TSP/QSE
- Real-time aggregate consumption of all LLs in IROL group
- TSP/QSE individual real-time consumption of their affected loads

Mitigation Plans will be activated through ERCOT instruction

- Affected LLs may continue to ramp up until Mitigation Plan becomes active
- ERCOT will activate a MP once aggregate consumption of an IROL group reaches ~2,500 MW
- Once active, TSPs/QSEs must maintain their load at or below the “Not To Exceed” limit
- ERCOT will take action as necessary to maintain consumption of each IROL below 3,200 MW limit

Additional Work Needed

- ERCOT to meet with affected QSEs (LLs co-located with Generation Resources)
 - QSEs will not have access to full Mitigation Plans
 - May need to draft redacted MPs to provide to QSEs
 - Most individual QSEs have just one LL in MPs
- Create telemetry points and update MPs with ICCP telemetry names
- Develop Operator Procedures
- Update SOL Methodology

Questions/Comments?

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