Status Update: Evaluation of Voltage Ride Through Requirements Proposed by ERCOT

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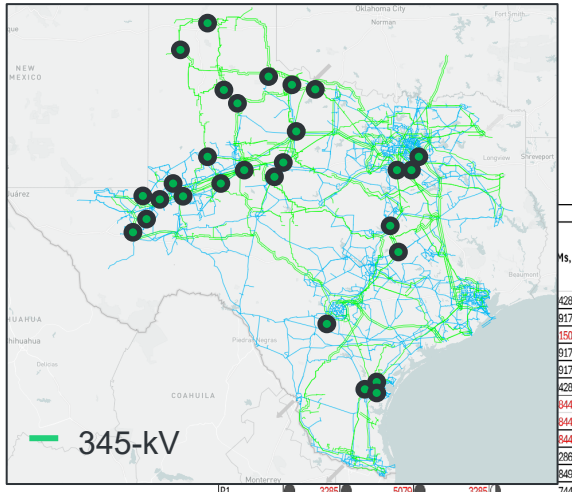
Background and Objectives

- Background
  - As presented at the October LLWG meeting, ERCOT's study results indicated that significant load reduction could occur under various fault conditions if Large Electronic Loads (LELs) are unable to ride through faults
  - ERCOT submitted NOGRR282, proposing operating requirements for LELs to ride through faults and support overall system reliability
  - Based on the scope introduced at the September LLWG, ERCOT is conducting additional study on the proposed VRT requirements and will provide status update at this meeting

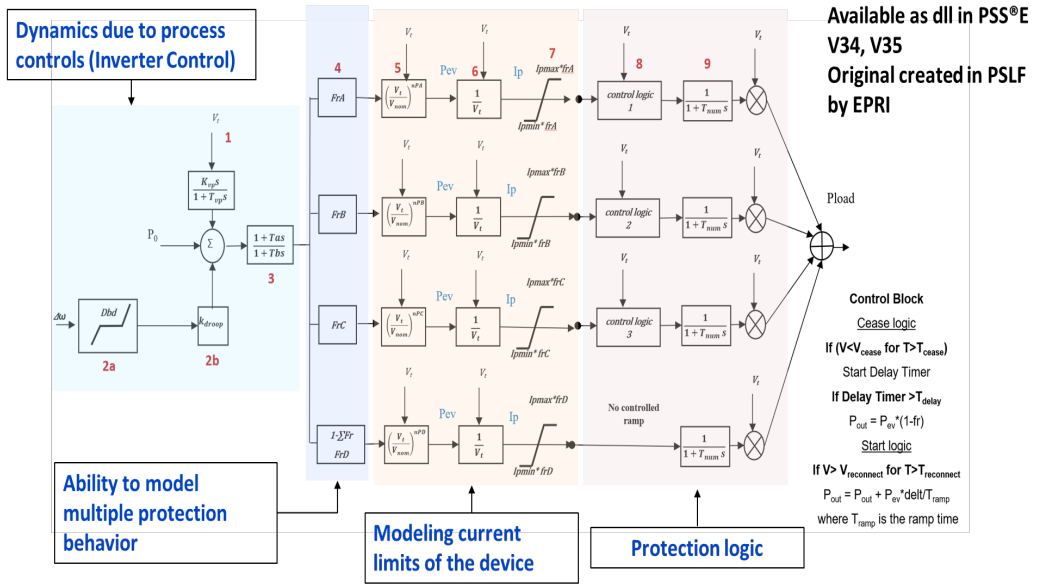


						Scenario 4 (387 E-STATCOMs, 77.4 Gvar)	Scenario 5 (Adjustment of LEL trip time delay to 70 ms)	
					428	2428	0	
					917	1917	0	
					150	2997	0	
					917	1917	0	
					917	1825	0	
					428	1561	0	
					844	2690	0	
					844	2690	0	
					844	2690	0	
					286	378	0	
					849	0	0	
P1	3285	5079	3285	744		745	0	
P1	3285	5079	3285	744		745	0	
P1	4968	4969	4968	1980		1980	0	
P1	4093	4185	2111	1917		1825	0	
P1	2294	3098	2294	924		463	0	
P1	1345	3070	1255	194		194	0	
P1	2373	2994	2373	552		116	0	
P1	1345	2864	1345	183		184	0	

- Objectives
  - Assess load reduction for LELs with VRT capability and evaluate system response by varying momentary-cessation thresholds and LEL reconnection times, in support of NOGRR282

Assumption and Methodology

- As presented at the October LLWG, the study base case and area are the same as those used to assess the transmission-upgrade effectiveness in reducing load loss
- Dynamic Model Updates for LELs within the study region
  - Replaced the LEL dynamic models with the enhanced User Defined Model (UDM)*
  - The UDM, which incorporates momentary cessation and reconnection settings with time delay during and after a fault, is considered adequate for assessing the proposed VRT requirements



Source: EPRI presentation at the July LLWG meeting

* The EV model developed by EPRI has been enhanced to include additional features based on ERCOT's feedback. This model is available as a user-defined model (UDM) in PSS/E version 34 and 35. Thanks to significant and continued support from Dr. Sreenivasachar (ksreenivasachar@iso-ne.com) in developing the UDM.

Key Questions and Scenario Studied

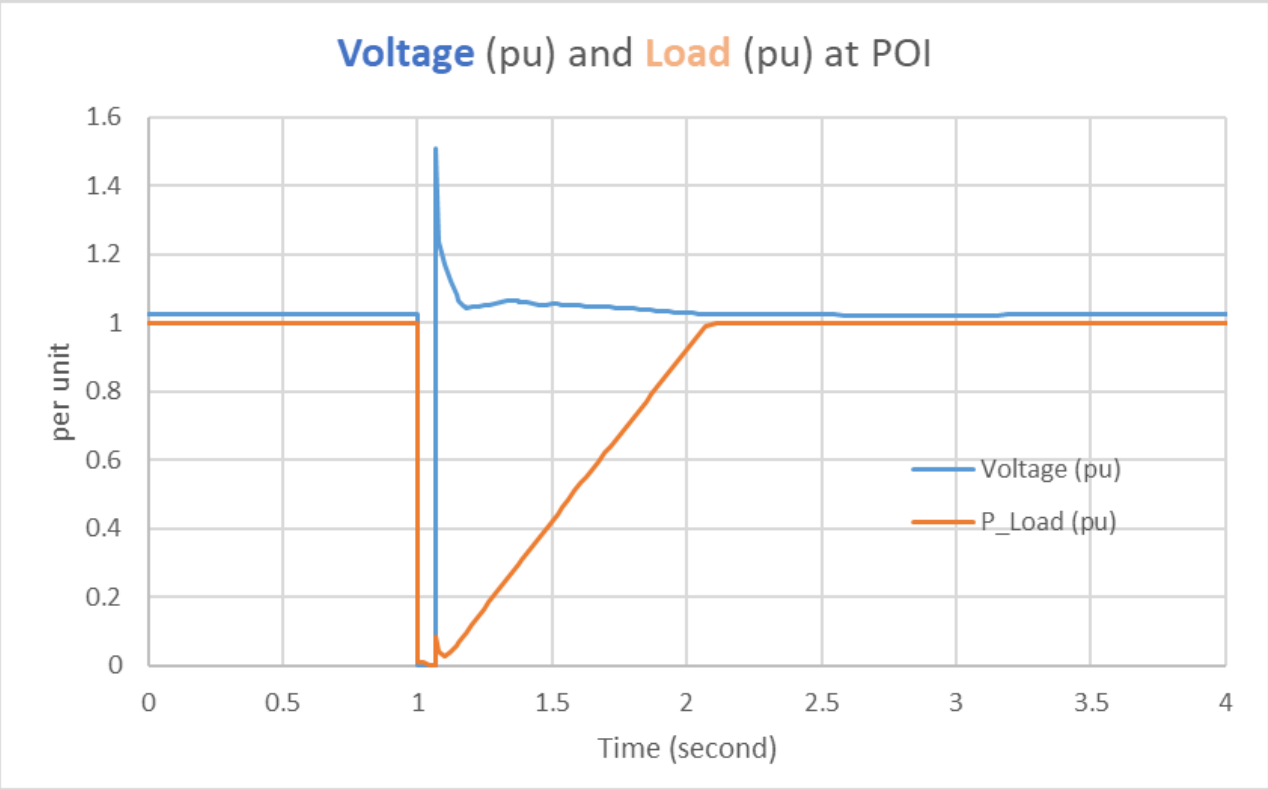
- Q1: Do any LELs trip under the proposed voltage ride-through capability?
- Q2: Should temporary current blocking (i.e., momentary cessation from 100% to 0%) be permitted during shallow voltage dips (e.g., down to 0.8 pu)?
- Q3 (Under Study): What are the appropriate reconnection times after the fault is cleared

Scenarios Considered

- **Assessment of voltage threshold sensitivity for momentary cessation (MC)**
  - Case: Study base case
    - Scenario 1: MC voltage threshold at 0.8 pu
    - Scenario 2: MC voltage threshold at 0.5 pu
    - Scenario 3: MC voltage threshold at 0.2 pu
- **Assessment of reconnection time sensitivity after fault cleared** (Under Study)
  - Case 1: Study base case
  - Case 2: Lower system inertia condition (~174 GW-s)
  - Case 3: Increased LEL condition (additional total 4 GW at selected critical locations)

Results for Question #1: LEL Equipped with Voltage Ride-Through Capability

- Do any LEL trip with the proposed voltage ride-through capability?



Example: LEL behavior with assumed VRT capability

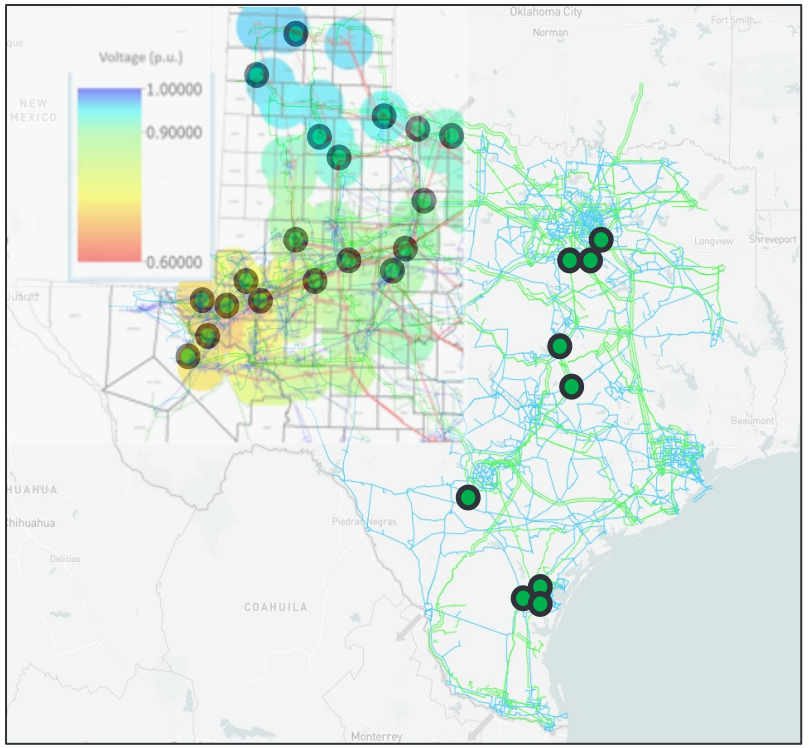
- Key critical faults were tested, including over 30 representative events identified in the transmission effectiveness study presented at the October 2025 LLWG.
- Results showed that all LELs with NOGRR282-like ride-through capability rode through the critical faults

Results for Question #2: Temporary Current Blocking

- Should temporary current blocking (i.e., momentary cessation) be allowed during shallow voltage dips?
  - Sensitivity analysis was performed for the temporary current blocking thresholds of voltage 0.8 pu, 0.5 pu, and 0.2 pu
  - It is assumed that LELs that do not go into full current blocking reduced consumption proportional to the voltage sag

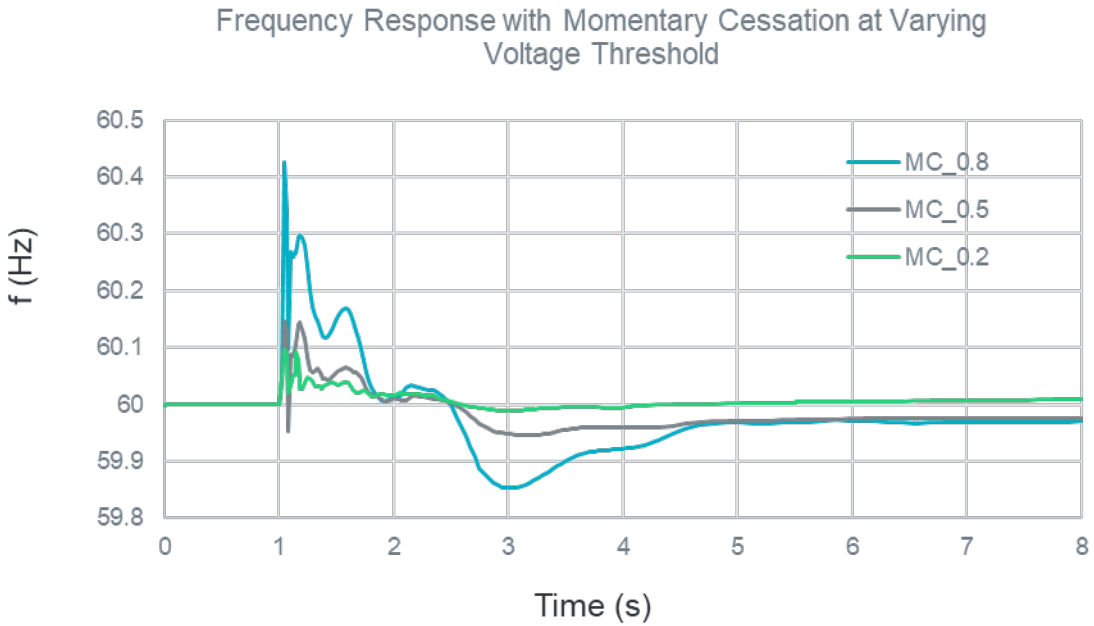
Total Load in Momentary Cessation (MC) under Certain Critical Fault			
Voltage Threshold	0.8 pu	0.5 pu	0.2 pu
LEL (MW) in MC	7,251	3,100	1,750

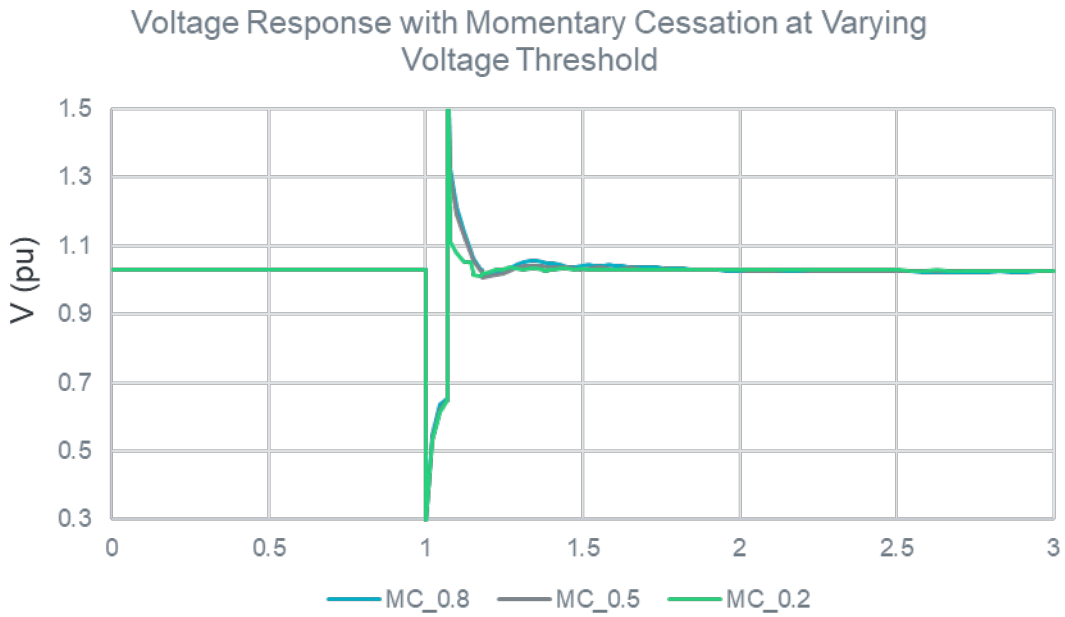
Note: A complete reduction to 0 MW was assumed immediately when voltage fell below the momentary-cessation thresholds.



- Dots are approximate, high-level future LELs locations assumed in the study
- This is a hypothetical example of wide-spread voltage dip. It is not relevant to this study or reflective of actual system conditions

Results for Question #2: Temporary Current Blocking (continued)





- Better stable response (e.g. frequency swing) were observed at the lower voltage thresholds (i.e., 0.5 and 0.2 pu)
- No significant difference in voltage response was observed
- The study results support the operating requirements proposed in NOGRR282, recommending LEL to draw current from the grid at the deeper voltage dips

Summary of MC Sensitivity Study Results			
	MC=0.8	**MC=0.5**	**MC=0.2**
Voltage	Good	Good	Good
Frequency	Worse	Good	Good

Key Findings

- ERCOT conducted a study to assess proposed VRT requirements by evaluating system response across different voltage thresholds that trigger LEL momentary cessation
- Results indicate more stable system performance under lower momentary-cessation voltage thresholds (0.5 pu and 0.2 pu)
- Findings suggest LELs should continue drawing current under deeper voltage dips, where feasible
- The study results supports the momentary-cessation voltage threshold (i.e., 0.5 pu) and the proportional load reduction relative to voltage sag, as proposed in NOGRR282

Next Steps

- ERCOT is currently conducting additional study for appropriate LEL reconnection time and will provide status update at the future LLWG meeting

Questions?

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