



Phase 2 Report on Aggregate Distributed Energy Resource (ADER) Pilot Project

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Technical Advisory Committee

Purpose

- Review experience and report on results associated with Phase 2 of the Aggregate Distributed Energy Resource (ADER) Pilot as required by the ADER Phase 2 Governing Document.
- Discuss proposed enhancements for a Phase 3 for the Pilot.
- Provide notice of ERCOT's intent to use discretionary authority to increase Pilot participation limits in advance of expected Phase 3 Governing Document approval.

Key Findings

Participation Growth

- As of May 2025, 3 ADERs are qualified, with a total of 15.5 MW capability for energy, 8.6 MW for Non-Spin Reserve Service (Non-Spin), and 8.8 MW for ERCOT Contingency Reserve Service (ECRS).
- Nine additional ADERs are in various stages of registration.

Ancillary Services

- Expanded ADER participation to include ECRS in Phase 2.

Telemetry Validation

- Enhancements to telemetry validation processes more proportionate to smaller resource aggregations have been implemented based on lessons learned from Phase 1.

Zonal Dispatch Analysis

- The current Load Zone Shift Factor (LZ SF) method for ADER dispatch has shown discrepancies compared to a Quasi-Nodal Shift Factor* (QN SF); depending on location, this could lead to dispatch not aligned with power flows and could exacerbate congestion in some instances.
- Observations are limited due to the modest number of participating ADERs fully participating at this time.

*Shift factor that is derived based on the electrical bus shift factor for each premise in the ADER weighted by the maximum injection capability of each premise and divided by the ADER's total maximum injection capability

Next Steps – Request for Board Approval

- ERCOT has developed a Phase 3 Governing Document, based on the recommendations in this presentation.
 - Fundamentally, many of the drivers and questions for the Pilot Project remain the same.
 - Phase 3 will allow a new participation model more akin to Non-Controllable Load Resource (NCLR) participation in the market. It will also enable third-party QSE aggregation from >100 kW premises for ADERs under the NCLR model, regardless of Load Serving Entity (LSE) affiliation, incrementally improving market access.
 - Other updates include telemetry validation clarifications, updated DOTA review processes, and expanded participation limits to 160 MW for energy and 80 MW for Non-Spin and ECRS respectively.
 - Additional clarity around when and how ERCOT will exercise discretion when participation is approaching limits (see next slide)
 - ERCOT will continue to analyze the impact of ADERs on system reliability and market efficiency, particularly focusing on shift factor discrepancies and telemetry validation improvements.
- ERCOT seeks Board approval to adopt the Phase 3 recommendations and proceed with implementing the redline edits to the Governing Document.

Increase to Participation Limits

- As noted in the previous slide, ERCOT proposed an increase to participation limits - 160 MW for energy and 80 MW for Non-Spin and ECRS respectively - upon approval of the Phase 3 Governing Document.
- ERCOT is exercising its discretion to effectively **immediately move to those limits** in advance of Phase 3 approval to accommodate growing interest and recognizing feedback from pilot participants that the current limits are impacting participation and customer engagement in the short-term.
- ERCOT has also provided the following additional wording to the Governing Document for greater clarity on its discretion regarding limits
 - “If ADER participation is approaching either the system-wide limits or QSE limits in the Governing Document, ERCOT would exercise its discretion to make incremental upward adjustments to either or both of these limits to continue to support growth in participation while managing administrative burden ahead of transitioning the pilot to ERCOT Nodal Protocols.”

Phase 2 Summary Report

Pilot Overview

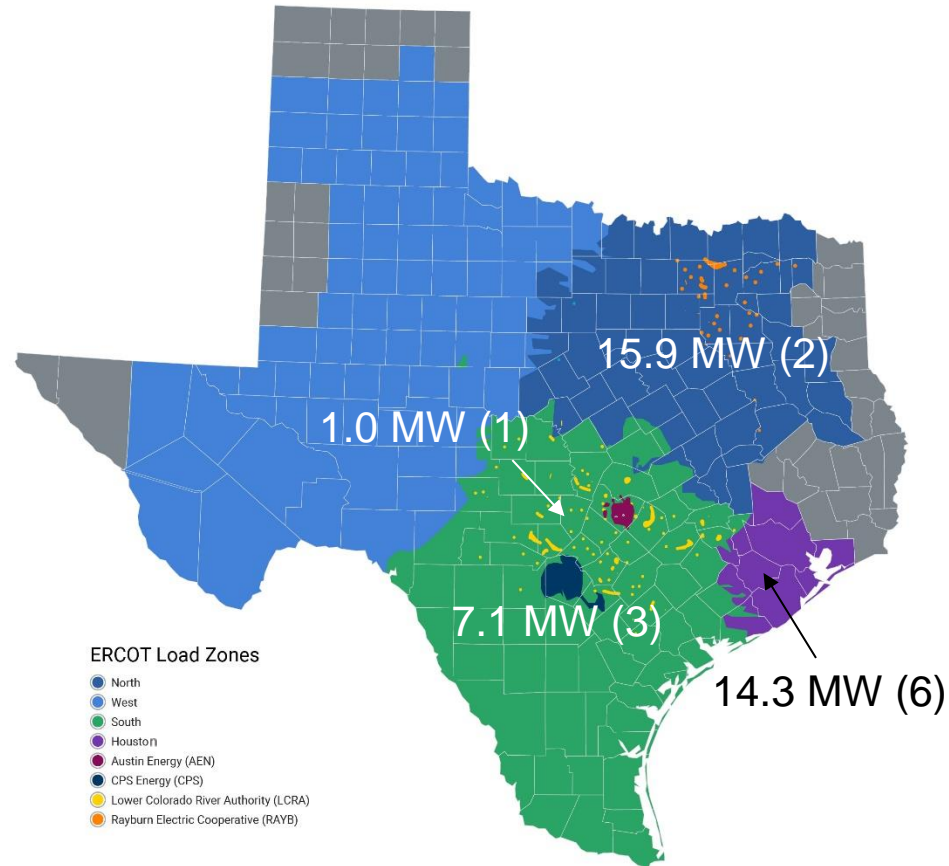
- The Aggregate Distributed Energy Resource (ADER) Pilot Project has been integrated into ERCOT's wholesale market since August 2023.
- Purpose of the pilot:
 - Test and assess operational benefits and system impacts of heterogeneous DERs aggregations which can be either net generation or net load
 - Understand ability of ADERs to provide Ancillary Services
 - Evaluate impacts to congestion associated with zonal dispatch
- Pilot has evolved in phases based on ERCOT and participant experience and from discussions at the ADER Task Force established by the Public Utility Commission of Texas (PUCT).

Pilot Evolution

- Phase 1 of the Pilot Project introduced the ability of ADERs to participate in Ancillary Services and identified areas for improvement in telemetry validation.
- Phase 2 applied lessons learned from telemetry validation processes and expanded opportunities for ADERs to provide Ancillary Services
 - ADER participation expanded to include ERCOT Contingency Reserve Service (ECRS).
 - Telemetry validation process more proportional and appropriate for small resource aggregations.

Pilot Project status as of May 2025

- 3 resources participate in the ADER program within these capabilities:
 - **15.5 MW** capability for energy
 - **8.6 MW** capability for Non-Spinning Reserve Service (Non-Spin)
 - **8.8 MW** capability for ERCOT Contingency Reserve Service (ECRS)
- ERCOT has accepted 9 additional resources' Details of the Aggregation (DOTA) forms.
 - These potential ADERs are in various stages of registration and qualification and cannot fully participate at this time.
- Total ADER capacity (qualified and potential):
 - 38.3 MW capability for energy
 - 11 MW capability for Non-Spin
 - 8.8 MW capability for ECRS

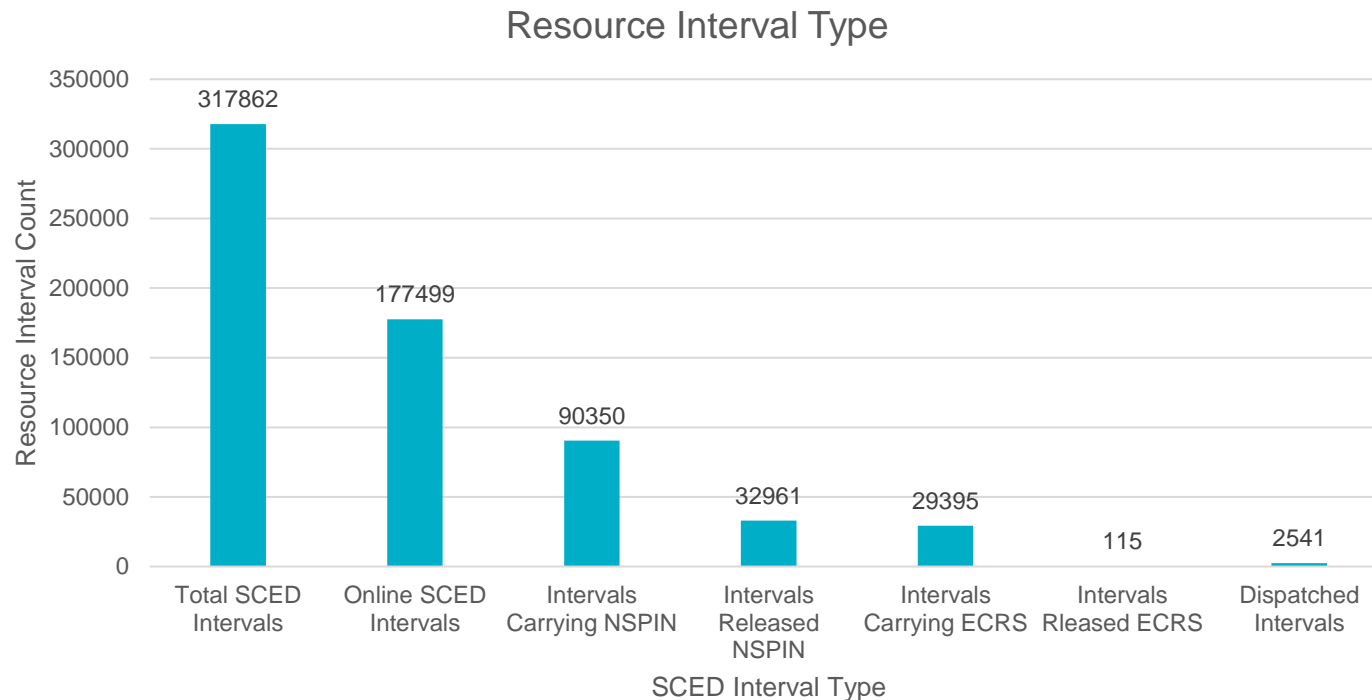


*MWs for energy and count of ADERs by Load Zone
for all 12 ADER*

Pilot Participation as of May 2025

		LZ_AEN	LZ_CPS	LZ_HOUSTON	LZ_LCRA	LZ_NORTH	LZ_RAYBN	LZ_SOUTH	LZ_WEST	ERCOT-WIDE
Energy	Limit (MW)	2.8	5.3	20.3	3.1	28.7	1.2	10.3	8.2	80.0
	Approved (MW)	0.0	0.0	14.3	1.0	15.9	0.0	7.1	0.0	38.3
	Unused (MW)	2.8	5.3	6.0	2.1	12.8	1.2	3.2	8.2	41.7
	% Full	0%	0%	71%	32%	55%	0%	69%	0%	48%
Non-Spin	Limit (MW)	1.4	2.7	10.1	1.6	14.3	0.6	5.2	4.1	40.0
	Approved (MW)	0.0	0.0	6.0	0.0	4.6	0.0	0.4	0.0	11.0
	Unused (MW)	1.4	2.7	4.1	1.6	9.7	0.6	4.8	4.1	29.0
	% Full	0%	0%	59%	0%	32%	0%	8%	0%	28%
ECRS	Limit (MW)	1.4	2.7	10.1	1.6	14.3	0.6	5.2	4.1	40.0
	Approved (MW)	0.0	0.0	4.0	0.2	4.6	0.0	0.0	0.0	8.8
	Unused (MW)	1.4	2.7	6.1	1.3	9.7	0.6	5.2	4.1	31.2
	% Full	0%	0%	39%	15%	32%	0%	0%	0%	22%

ADER Pilot Participation Statistics (09/01/2023-01/01/2025)



- Key Takeaways
 - Online SCED intervals about 55% of the time
 - Dispatched SCED intervals about 1% of the time

Phase 2 - Observations and Evaluations

1. Expanding Ancillary Service product eligibility to include ERCOT Contingency Reserve Service (ECRS)
 - 8.8 MW of ECRS has been qualified so far and there is potential for increased participation in the future.
2. Telemetry Validation Enhancements
 - ERCOT implemented amendments to the “Validation” section of the Governing Document based on flaws identified in Phase 1.
 - The validation analysis considers only intervals in which the aggregated device/premise-level data is greater than 10% of the Resource’s requested energy capability.
 - A minimum number of intervals must meet the criteria for evaluation to ensure the sample size is sufficient for the validation analysis.

Phase 2 - Observations and Evaluations cont.

3. Shift Factor Analysis

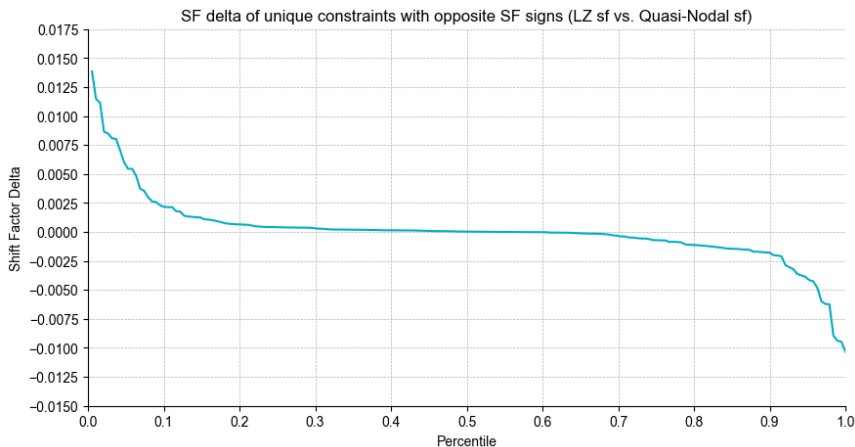
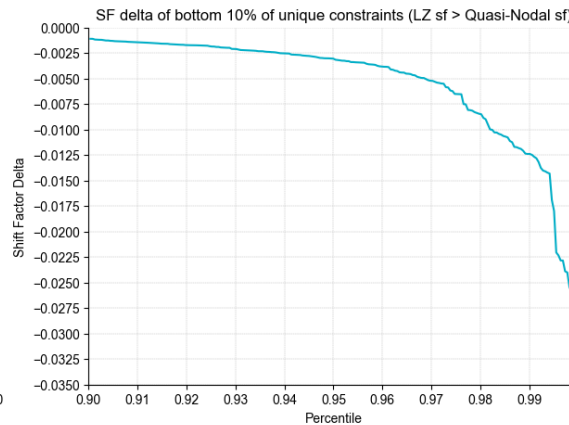
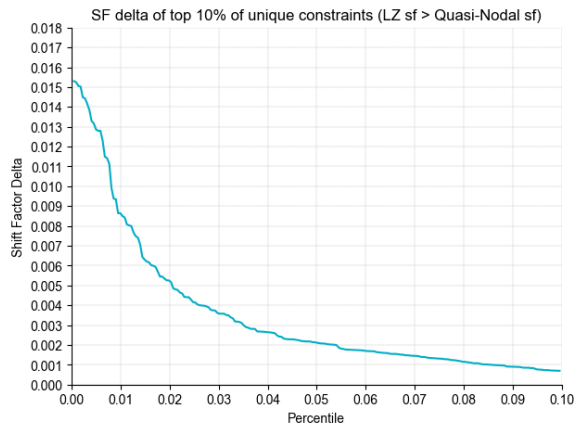
- Under the current participation model, ADERs are dispatched using Load Zone Shift Factor (LZ SF) and settled at their respective Load Zone price.
- LZ SF may not reflect true ADER impact on transmission constraints.
- An alternative method to calculate shift factors is based on the electrical bus shift factor for each premise in the ADER weighted by the maximum injection capability of each premise and divided by the ADER's total maximum injection capability, which is referred to as "Quasi-Nodal shift factor" (QN SF).
- Another concerning scenario is when the LZ SF and QN SF have different signs, as this could lead to SCED dispatching Resources in a way that would exacerbate the congestion instead of improving it.

Phase 2 - Observations and Evaluations cont.

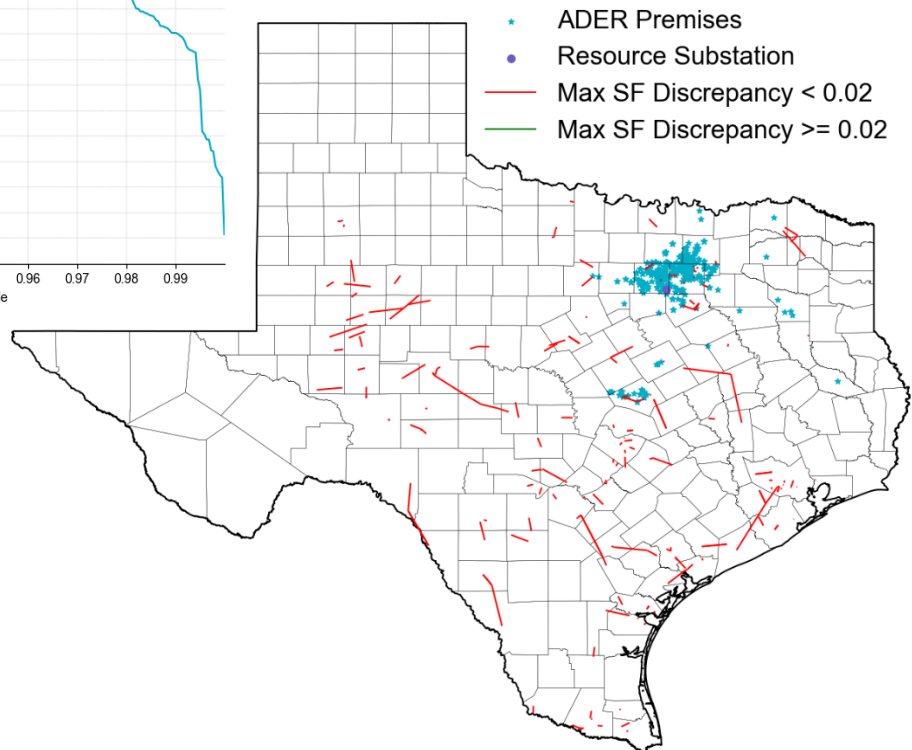
- **Timeframe:** 09/01/2023 to 01/01/2025
- **Analysis:** Examined 135,508 SCED intervals, utilizing the average shift factor for unique constraints for analysis, where unique constraint elements with a maximum absolute shift factor discrepancy was > 0.02 .
- **Findings:**
 - The absolute shift factor discrepancy between LZ SF and QN SF ranged from of 3% to 76%.
 - The absolute Shift Factor discrepancy with an opposite sign ranged from 1% to 76%
- These wide variations are attributed to differences in constraint locations, particularly their proximity to clustered premises and broader geographical distribution.

Phase 2 - Observations and Evaluations cont.

- WEBBS_ALD1 (Engie/Tesla): There were 4 unique constraint elements which have a maximum absolute sf discrepancy > 0.02 . They are all located within/near the cluster of premises.
- The largest absolute SF discrepancy was 3.2%
- The largest absolute SF discrepancy with an opposite sign was 1.3%

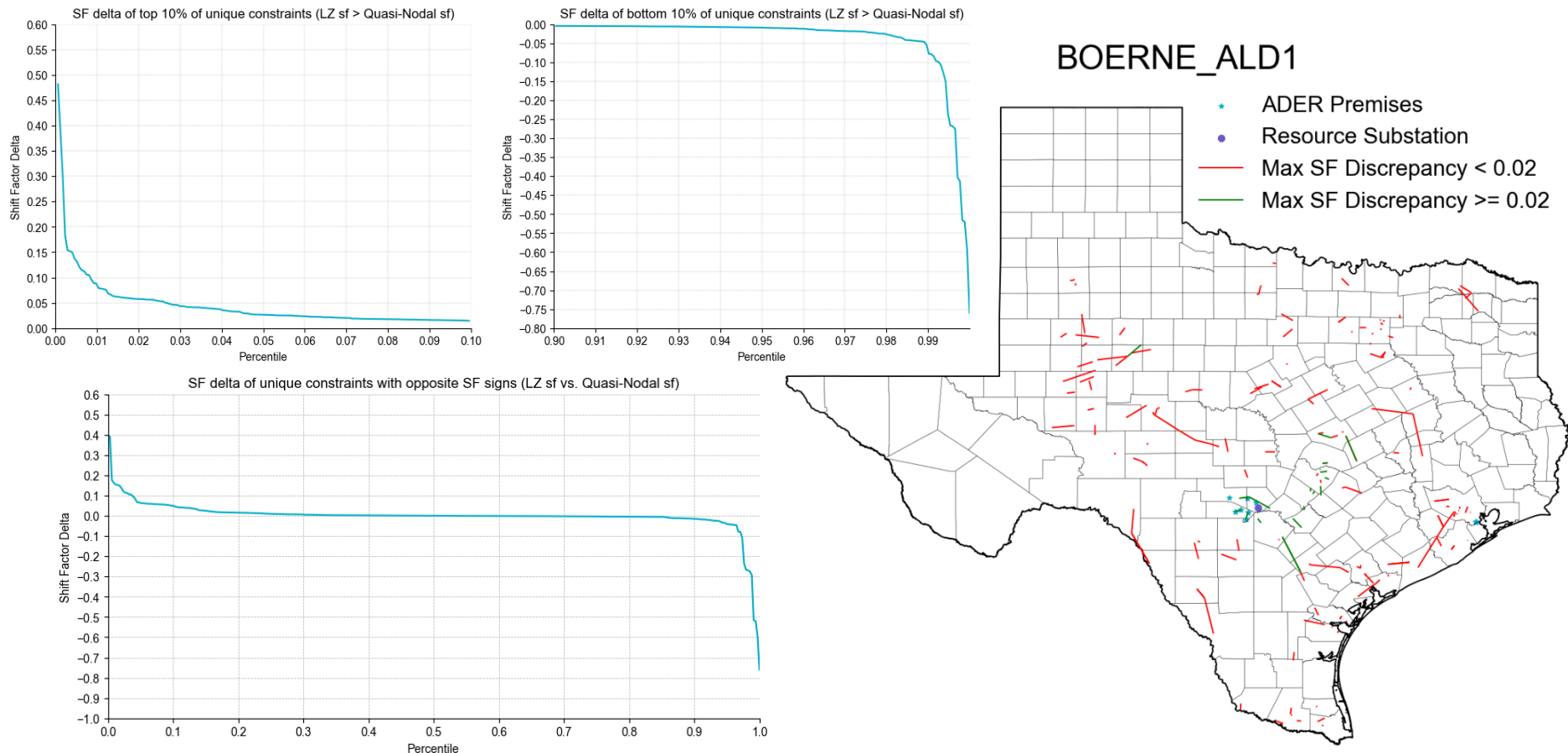


WEBBS_ALD1



Phase 2 - Observations and Evaluations cont.

- BOERNE_ALD1: There were 77 unique constraint elements with a maximum absolute SF discrepancy > 0.02 . They exhibit a larger geographical distribution.
- The largest absolute SF discrepancy was 76.0%
- The largest absolute SF discrepancy with an opposite sign was 76%



Phase 2 – Observations and Evaluations cont.

- 3 ADERs have completed the qualification and telemetry validation thus far.
- As a result, the observations around participation of ADERs in the market has been somewhat limited, in terms of the number of Resources.
- Additionally, for those Resources in the market today, their participation is likely to continue to evolve based on learning and gaining additional experience.
- This means that it may be somewhat premature at this point to draw fundamental conclusions based on the information available and therefore, several policy recommendations included for study in Phase 2 will need to remain in Phase 3 to allow additional participation, data and analysis to inform future recommended changes.
- At the same time, ERCOT does have some recommendations and commentary based on observations during Phase 2.

Phase 3 Recommendations

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- Alternative Participation Model for ADERs
 - Under the current program rules, ADERs must be SCED-dispatchable to participate in the Pilot Project. This requirement may preclude the participation of some Resource types that are able to respond to ERCOT instruction but lack the ability to smoothly ramp over a 5-minute interval.
 - Increase ADER Pilot Project participation by enabling a participation framework for Aggregated Non-Controllable Load Resources (NCLR).
 - Enable third-party QSE aggregation from >100 kW premises in NCLR model, regardless of Load Serving Entity (LSE) affiliation
- Premise-Level telemetry validation
 - Clarifications to reflect that premise-level telemetry includes the requested capability of the Resource plus all consumption behind the premises
- DOTA Form updates
- Participation Limits updates and clarity around ERCOT's use of discretion to manage and increase limits in future

A-NCLR Model

- Aggregations of devices/premises will be allowed to participate as Aggregate Non-Controllable Load Resources (A-NCLRs).
 - Aggregations will be registered and modeled like other ADERs but using NCLR categories for Resource parameters in ERCOT's Resource Integration an Ongoing Operations (RIOO) system.
 - Real-time 2-second telemetry will still be required from the QSE to ERCOT using all NCLR attributes.
 - These ADERs will be dispatched by the Ancillary Service Deployment Manager like other NCLRs. No Energy Bids or dispatch through Security-Constrained Economic Dispatch (SCED) in Real-Time.
- NCLR model will allow third-party QSEs to aggregate >100 kW premises, even if the LSE is represented by a different QSE.
 - Require an LSE Acknowledgement Form to confirm coordination between entities and to avoid cross-settlement processes.
 - ERCOT to verify QSE-LSE relationships during review.

A-NCLR Telemetry Validation

- For A-NCLR ADERs:
 - For device-level telemetry validation, ERCOT will require 5-minute interval data from each device (1-minute data will still be required for SCED dispatchable ALR-ADERs)
 - Validation Metric change: Of these intervals being evaluated, the telemetered value must be within 50% of the aggregate premise-level data averaged over each 15-minute Settlement interval when the Total Expected Registered Capacity is less or equal to 1 MW, or within 10% of the aggregate device-level data averaged over each 15-minute Settlement interval when the Total Expected Registered Capacity is greater than 1 MW.
- Deployment performance will use the meter-before/meter-after baseline methodology, like other NCLRs
 - “Baseline” capacity calculated by measuring the average of the real power consumption for five minutes before the Dispatch Instruction if the Load level of a Load Resource had not been affected by a Dispatch Instruction from ERCOT

Premise-Level Telemetry Validation

- Condition 1: Only intervals where the aggregate Premise-level 15-minute Settlement interval meter data meets one of the following will be evaluated:
 - When the aggregate Premise-level 15-minute interval Settlement meter data shows as net withdrawing, the Resource's metered withdrawals must equal or exceed 0.1 MW
 - When the aggregate Premise-level 15-minute interval Settlement meter data shows as net injecting (negative value in the meter data), the Resource's metered injections must equal or exceed -0.1 MW
- Condition 2: Of these intervals being evaluated, the telemetered NPC value minus the Resource specific assigned offset must be within 10% of the aggregate Premise-level 15-minute interval Settlement meter data
- Condition 3: During the 8-hour evaluation period, at least 50% of the intervals must meet condition 1 above.

DOTA Form Updates

- Once a DOTA form has been approved by ERCOT, any conflicts with premises participating in *subsequent* Emergency Response Service (ERS) Standard Contract Terms will be resolved through the ERS procurement processes and will not require the DOTA to be edited for those conflicts.
 - i.e., the premise would not be allowed to participate in ERS for subsequent terms
- Transmission and Distribution Service Providers (TDSP) will continue to be required to review DOTA forms for any participation conflicts with TDSP Load Management Programs.

Participation Limits Update and Utilization of ERCOT's Governing Document Discretion

- Phase 1 and 2 of the pilot limited the total registered MW capacity of all ADERs to 80 MWs for energy and 40 MWs for each of Non-Spin and ECRS.
- Under Phase 3 ERCOT is proposing to **increase** these limits to **160 MWs and 80 MWs** respectively to allow the pilot to continue to grow and evolve in Phase 3.
- Additionally, under existing Governing Document language, ERCOT staff has discretion to update system-wide pilot participation limits without needing approval of a new Governing Document.
- With our intent to increase limits under Phase 3 and recognizing feedback from pilot participants that the current limits are impacting participation and customer engagement in the short-term, ERCOT staff is increasing the limits to 160, 80, and 80 for energy, Non-Spin, and ECRS, respectively, **effective immediately**.

Communication Standard Update

- As part of the reporting requirements under subsection 5(k) of the Governing Document, a summary of certified communication standards for devices within the ADERs that are currently participating in the market is presented below:

Communication Standard	Number of Devices (Phase 1)	Number of Devices (Phase 2)	Progress (%)
IEEE 2030.5 (SEP2)	763	1213	59