OVERHEAD RESILIENCY STUDY

AUSTIN ENERGY

COMPONENT B
EXECUTIVE SUMMARY

July 15, 2025

Disclaimer

1898 & Co.® is a part of Burns & McDonnell that performs or provides business, technology, and consulting services. 1898 & Co. does not provide legal, accounting, or tax advice. The reader is responsible for obtaining independent advice concerning these matters. That advice should be considered by reader, as it may affect the content, opinions, advice, or guidance given by 1898 & Co. Further, 1898 & Co. has no obligation and has made no undertaking to update these materials after the date hereof, notwithstanding that such information may become outdated or inaccurate. These materials serve only as the focus for consideration or discussion; they are incomplete without the accompanying oral commentary or explanation and may not be relied on as a stand-alone document.

The information, analysis, and opinions contained in this material are based on publicly available sources, secondary market research, and financial or operational information, or otherwise information provided by or through 1898 & Co. clients whom have represented to 1898 & Co. they have received appropriate permissions to provide to 1898 & Co., and as directed by such clients, that 1898 & Co. is to rely on such client-provided information as current, accurate, and complete. 1898 & Co. has not conducted complete or exhaustive research, or independently verified any such information utilized herein, and makes no representation or warranty, express or implied, that such information is current, accurate, or complete. Projected data and conclusions contained herein are based (unless sourced otherwise) on the information described above and are the opinions of 1898 & Co. which should not be construed as definitive forecasts and are not guaranteed. Current and future conditions may vary greatly from those utilized or assumed by 1898 & Co.

1898 & Co. has no control over weather; cost and availability of labor, material, and equipment; labor productivity; energy or commodity pricing; demand or usage; population demographics; market conditions; changes in technology, and other economic or political factors affecting such estimates, analyses, and recommendations. To the fullest extent permitted by law, 1898 & Co. shall have no liability whatsoever to any reader or any other third party, and any third party hereby waives and releases any rights and claims it may have at any time against 1898 & Co. and any Burns & McDonnell affiliated company, with regard to this material, including but not limited to the accuracy or completeness thereof.

Any entity in possession of, or that reads or otherwise utilizes information herein is assumed to have executed or otherwise be responsible and obligated to comply with the contents of any Confidentiality Agreement and shall hold and protect its contents, information, forecasts, and opinions contained herein in confidence and not share with others without prior written authorization.

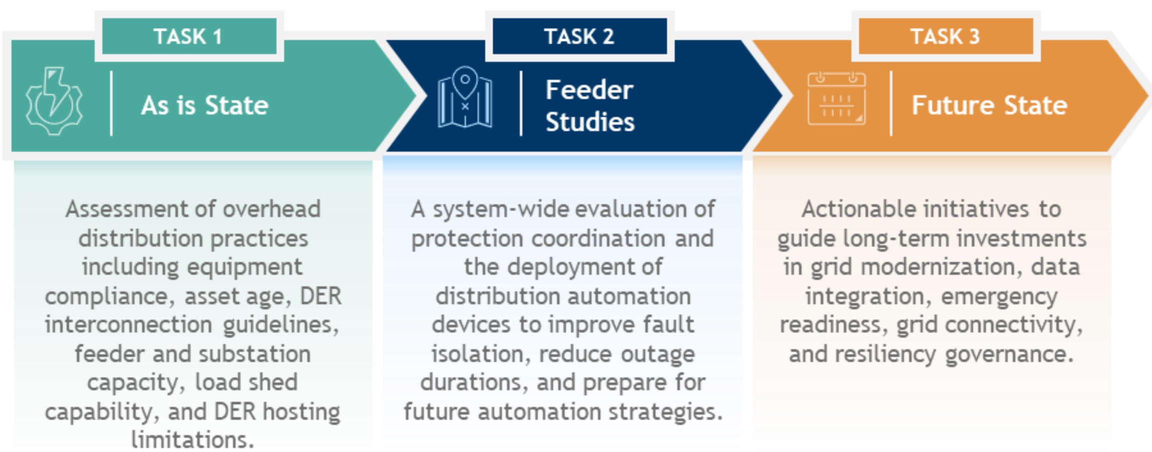
Executive Summary

Effective system resiliency is critical to managing and maintaining overhead distribution infrastructure, which plays a pivotal role in delivering electricity to homes, businesses, and industries. Ensuring the reliable and uninterrupted supply of electricity to customers requires a robust approach that balances long-term system strength with responsive emergency capabilities.

Over the past decade, Austin has faced several severe weather events—including Winter Storm Uri (2021), Winter Storm Mara (2023), and the Austin Microburst (2025)—highlighting the growing need for grid hardening and resiliency. In response, Austin Energy proactively sought federal funding to assess and strengthen its overhead distribution system, with the goal of improving its ability to withstand and recover from major events.

This resiliency study provides Austin Energy and the community it serves with insight into the current state of the overhead distribution system and identifies strategic recommendations for shaping its future state. This study was structured around three core tasks:

Figure ES-1: Study Workflow



Resiliency, in this context, refers to Austin Energy's ability to withstand, adapt to, and recover from major disruptions while maintaining reliable service.

Key Takeaways

This study provides Austin Energy with a detailed understanding of its current overhead distribution system, highlighting strengths, identifying areas for improvement, and defining a strategic path forward. While many system components are well-aligned with internal standards and perform reliably, the distribution grid must continue evolving to meet growing demands for flexibility, resiliency, and customer service.

Key takeaways from this study include:

- **Strong Foundation, Clear Modernization Priorities:** Austin Energy's overhead system demonstrates high compliance with internal standards and robust baseline performance. However, aging infrastructure—particularly legacy poles and transformers—points to the need for proactive lifecycle planning and condition-based replacement.
- **Load Shed Readiness Can Be Expanded Through Targeted Automation:** Austin Energy meets its current Electric Reliability Council of Texas ("ERCOT") load shed obligations, but broader automation—such as integrating mainline reclosers into remote-control operations and retrofitting high-load air-break switches—would enhance flexibility and reduce customer impacts during emergencies.
- **Feeder Protection Improvements Unlock Restoration Capability:** A system-wide analysis of protection coordination shows that deploying mainline reclosers and lateral reclosers can significantly reduce protection zones and enable faster, more targeted restoration. These improvements lay the groundwork for the future deployment of coordinated automation strategies like Fault Location, Isolation, and Service Restoration ("FLISR") and support the evolution toward a more adaptive grid.
- **Resiliency Transformation Will Require Enterprise-Wide Alignment:** Through the development of 24 future state initiatives grouped into five themes, Austin Energy can define a path for building a more modern, agile, and resilient distribution system. The initiatives span infrastructure, operations, automation, data systems, and governance—underscoring the need for cross-functional alignment and sustained investment.
- **Phased Implementation Offers Low-Risk, High-Impact Progress:** Near-term tactical initiatives—such as deploying additional mainline reclosers on high-priority feeders, replacing targeted fuses with lateral reclosers, expanding remote control capabilities to existing field devices, and prioritizing vegetation management along historically outage-prone circuits—can deliver immediate resilience benefits. These efforts should be paired with long-term governance and funding structures to enable a coordinated and sustained resiliency transformation.

Together, these findings position Austin Energy to move forward with confidence by balancing quick wins with strategic modernization, and delivering a stronger, smarter, and more resilient electric grid for the future.

Task 1: As-Is State

The As-Is State assessment provides an evaluation of Austin Energy's existing overhead distribution system, with emphasis on infrastructure performance, operational efficiency, and system resilience.

The analysis examines alignment with internal design standards, the age of critical assets, and quantifies system constraints such as load shedding capability and distributed energy resource (“DER”) hosting capacity. These insights are intended to inform future planning and investment decisions.

Design Standards Compliance and Asset Age Evaluation

Austin Energy designs and operates its overhead distribution system based on established internal design standards and practices. This section includes a three-part assessment of current practices. First, it assesses whether existing overhead equipment aligns with Austin Energy’s design standards using available system data. Second, it analyzes the age of key overhead distribution assets—such as poles, primary conductors, and service transformers—to inform infrastructure risks and replacement needs. Third, it reviews Austin Energy’s guidelines for connecting DERs, such as solar panels and battery storage, and compares them to peer utility practices and national standards.

Together, these evaluations provide insights into standards adherence, infrastructure lifecycle risk, and DER readiness.

Equipment Compliance with Internal Standards

1898 & Co. evaluated the alignment of Austin Energy’s overhead distribution system with the utility’s standard equipment specifications. The analysis focused on primary-side overhead equipment and assessed compliance based on equipment type, size, and rating.

Key Findings

- **High Equipment Compliance with Internal Standards:** Most primary-side overhead equipment, including conductors, transformers, fuses, and reclosers, are compliant with Austin Energy’s internal standards. However, a small subset of devices, particularly legacy switches and non-standard capacitor banks represent the majority of observed deviations and may warrant targeted replacements.

Asset Age

The age distribution of key overhead distribution assets—poles, primary conductors, and service transformers—were evaluated using installation year data. The analysis highlights concentrations of older equipment and identifies areas where age-related risk may warrant increased monitoring or future replacement.

Key Findings

- **Equipment Age Suggests Future Lifecycle Risks:** Installation data shows that many poles and service transformers have been in service for more than 40 years. While age is not a direct indicator of asset health, it serves as a useful proxy for prioritizing inspections, tracking performance, and guiding long-term asset replacement strategies. Continued monitoring of asset age—alongside performance and inspection data—will support proactive risk assessment, maintenance prioritization, and resilience-focused investment planning.

DER Interconnection Guidelines Assessment

This section assesses Austin Energy's DER interconnection practices[1,2], with comparisons to peer utilities and industry trends. While the classification and application processes are well-documented, several improvement areas were identified.

Key Findings

- **DER Standards Are Well-Documented but Require Technical Additions:** Austin Energy's DER interconnection classification and application processes are clearly documented and effectively implemented. However, the utility's technical guidance lacks detail on smart inverter settings, voltage and frequency ride-through behavior, and self-limiting export functionality. These capabilities are increasingly standard among peer utilities and should be incorporated into future guideline updates.
- **Screening and Study Framework Would Benefit from Greater Structure and Automation:** Austin Energy's current two-step interconnection review process provides initial oversight but lacks the technical depth and formalization seen in some peer utility practices. Introducing a more granular, criteria-based screening framework—with defined thresholds for hosting capacity, generation-to-load ratios, and short circuit ratios—would improve consistency. Enhancing the scope of system impact studies to include advanced methods (e.g., time series analysis, Rapid Voltage Change ("RVC") assessments), and implementing automated data workflows for DER modeling and system configuration, would reduce manual effort and accelerate the review process.

System Capacity Analysis

Austin Energy's distribution system capacity was analyzed to identify substations and/or circuits approaching capacity or voltage limitations, quantify system-wide constraints, and guide future investment decisions.

Key Findings

- **Substation Planning Insight:** 14 out of 80 substations are categorized as nearing capacity thresholds. Targeted upgrades at these locations would reduce thermal and voltage risk.
- **Data Integration and Model Refinement Opportunities:** There are opportunities for continued improvements in data integration and load modeling accuracy. Actions like better advanced meter integration and device-level verification will strengthen the planning process.

[1] "Distributed System Interconnection Guide for Customer-Owned Power Production Facilities less than 10 MW," (Revision 13, 2023).
[2] "Austin Energy Design Criteria," (2023).

Load Shed Analysis

Load shed capabilities are essential to system resilience against severe weather and emergency events. The effectiveness of feeder-level sectionalizing for critical load isolation and overall system readiness to meet ERCOT requirements were quantified for several scenarios, depending on the aggressivity desired. Austin Energy is responsible for shedding a portion of the system-wide load shed request from ERCOT, which is currently 3.43% in winter and 3.52% in summer.

Key Findings

- **Current Operations Use Full-Circuit Load Shedding:** Present load shed operations are conducted via Supervisory Control and Data Acquisition ("SCADA")-controlled circuit breakers that do not impact critical loads and are not configured for under-frequency load shedding ("UFLS").
- **Partial Circuit Load Shedding Could Expand Capability:** Incorporating mainline reclosers and retrofitting targeted air-break switches for remote operation would enable partial circuit load shedding and could increase overall load shed capability by up to 32%.

DER Hosting Capacity Analysis

Austin Energy feeders were analyzed for DER accommodation, such as solar PV and battery storage, considering thermal loading limits, voltage limits, and reverse power flow concerns on select feeders. Hosting capacity limits were determined for peak and minimum loading scenarios, first at the feeder level, then at the substation level to assess transformer limitations.

Key Findings

- **Hosting Constraints on Many Circuits:** Hosting capacity analysis identified 171 circuits, or 40% of the circuit population, with less than 1.0 MW of available generation headroom.
- **Impacts on Interconnection Review:** Circuits with limited capacity may require detailed engineering impact studies for even small DERs, potentially increasing workload for planning engineers and contributing to longer DER interconnection processing timelines.
- **Planning and Process Implications:** These constraints highlight the potential value of proactive hosting capacity upgrades and informed DER siting strategies.
- **Recommended Methodological Enhancements:** To improve future hosting capacity analyses and align with evolving industry practices, the following methodological enhancements are recommended:
    - Use forecasted peak and minimum loads to assess DER impacts more accurately.
    - Raise the DER penetration threshold from 20% to 60% of transformer peak to align with utility practices.
    - Tighten voltage deviation limits from 5% to 2%, consistent with IEEE 1547[3] and other industry standards.

[3] "1547-2018 – IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces," (Source, 2018).

As-Is State Recommendations

Based on the findings from the As-Is State assessment, the following recommendations are proposed to address identified limitations and support future system planning, operational improvements, and grid resilience initiatives:

1. **Prioritize Replacement of Legacy, High-Risk, or Non-Standard Infrastructure:** Conduct condition-based assessments and initiate phased replacement programs for poles, conductors, and transformers that show signs of aging, underperformance, elevated failure risk, or non-compliance with current standards—particularly those found in lower-performing feeders.
2. **Modernize DER Interconnection Standards:** Update Austin Energy's DER guidelines to include smart inverter settings, voltage and frequency ride-through behavior, self-limiting export functionality, and enhanced technical screening processes. Align practices with IEEE 1547-2018 and leading peer utility standards.
3. **Monitor High-Need Substations for Capacity Planning:** Track and evaluate the 14 substations identified as nearing thermal or voltage thresholds. These locations should be prioritized for modeling refinement and potential upgrades.
4. **Improve Data Integration Across Systems:** Establish consistent asset identifiers and strengthen data-sharing processes across Advanced Metering Infrastructure ("AMI"), Geographic Information System ("GIS"), SCADA, and system planning models. This will streamline future analyses and reduce manual data reconciliation efforts.
5. **Expand Load Shed Flexibility Through Automation:** Austin Energy can currently meet its obligatory portion of an ERCOT emergency load reduction request[4][5] via SCADA-controlled full-circuit interruptions. Partial circuit interruption could be enabled by retrofitting select air-break switches and including mainline reclosers in Advanced Distribution Management System ("ADMS")-controlled load shed rotation operations, which would increase load shed capability by up to 32%, reducing customer impact, and giving Austin Energy the ability to respond to larger or more complex ERCOT events.
6. **Refine Hosting Capacity Methodology:** Incorporate forecasted load profiles, raise transformer DER penetration thresholds to 60%, and tighten voltage deviation limits to 2%. Consider proactive hosting capacity infrastructure upgrades and refined DER siting support to alleviate future bottlenecks.

---

[4] Load available to shed depends on the season and time-of-day.
[5] Austin Energy's obligatory portion of an ERCOT load shed request is currently 3.43% in winter and 3.52% in summer.

Task 2: Feeder Studies

Proper coordination of protection devices is essential for a resilient distribution system. This task focused on the deployment of distribution automation devices, specifically electronic mainline reclosers and lateral reclosers, that improve fault response capabilities.

At the time of this study, Austin Energy's system contained 55 pod-forming mainline reclosers (0.13 per feeder). The recommended additions would increase this to approximately 640 mainline reclosers (1.3 per feeder). Additionally, the study recommends replacing 1,041 fuses with lateral reclosers to enhance protection on downstream segments.

Feeder Studies Recommendations

Based on the system-wide, detailed analysis of protection coordination and device deployment, the following recommendations are proposed to enhance fault isolation, improve outage restoration, and support future automation strategies across Austin Energy's overhead distribution system:

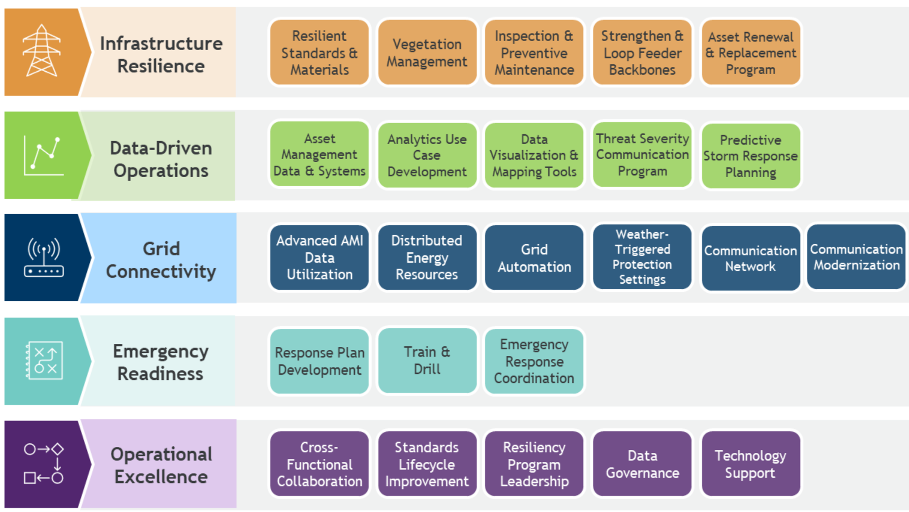
- **Expand Deployment of Mainline Reclosers** to segment feeders into smaller protection zones. This allows faults to be isolated to smaller areas, minimizing outage impact and improving service restoration. Mainline reclosers also lay the foundation for coordinated automation strategies such as Fault Location, Isolation, and Service Restoration ("FLISR").
- **Utilize Feeder Ties** within protection zones to enable partial restoration by transferring load to adjacent feeders with available capacity. These transfers can be performed manually (via air-break or disconnect switches) or automatically through electronic mainline reclosers coordinated in a method commonly known as a FLISR.
- **Evaluate and Increase the Capacity of Inter-Pod Ties** to support broader FLISR functionality. Where feeder ties do not exist, consider adding them to improve system flexibility and restoration options.
- **Expand Deployment of Lateral Reclosers** to improve lateral protection, reduce sustained outages from momentary faults, and decrease dependence on fuse-only coordination. Prioritize areas with high vegetation exposure, long feeder runs, or limited access.
- **Leverage Lateral Reclosers and Fast-Curve Lateral Protection Schemes** to reduce truck rolls, improve restoration times, and enhance reliability. Where coordination margins allow, apply fast-curve settings on lateral protection devices to enable fuse-saving behavior without compromising upstream coordination.
- **Replace Miscoordinated Fuses with Lateral Reclosers** and adopt a revised lateral fusing philosophy. Use the largest downstream fuse rating that maintains proper coordination with upstream lateral reclosers to optimize timing margins and reduce unnecessary fuse operations.
- **Standardize Breaker Relay Settings** where feasible to streamline recloser deployment and improve coordination. While variations may be necessary due to feeder loading, breaker reach, or substation transformer protection, standardization helps streamline protection coordination and simplify recloser deployment.

Task 3: Future State

The proposed framework for defining the future state of Austin Energy's distribution system involved a thorough examination of existing infrastructure, technologies, and operational processes. This comprehensive assessment identifies areas needing improvement and informs the development of a forward-looking vision.

Through a gap analysis and leveraging knowledge and work with other utilities, 24 discrete initiatives have been identified that could improve Austin Energy's resiliency and performance in responding to events.

Figure ES-2: Five Themes of Resiliency Initiatives



Future State Takeaways

Austin Energy's future state initiatives reveal three key takeaways: foundational strengths, the need for enterprise-wide modernization, and the identification of near-term priorities. The utility demonstrates strengths in areas such as infrastructure robustness and incident response, providing a solid foundation for future resiliency efforts. However, achieving industry-leading resilience will require sustained focus and cross-functional alignment, particularly when adopting new tools and systems, expanding automation and control capabilities, and streamlining operations. Several tactical, high-impact initiatives can be tackled immediately, while simultaneously preparing leadership and the broader organization for a comprehensive resiliency program.

Future State Recommendations

1898 & Co. recommends a phased approach for Austin Energy—a low-risk, parallel pathway that combines near-term wins with long-term program development. Initially, priority initiatives in separate areas, each with distributed ownership, will deliver immediate, localized improvements and valuable lessons learned. This phased approach will help inform the development of a comprehensive, long-term resiliency program. Simultaneously, Austin Energy should establish executive sponsorship, appoint a dedicated resiliency lead, implement resiliency program governance, and conduct readiness assessments to build a robust program structure and funding plan. This parallel approach—near-term action coupled with long-term planning—will enable a more coordinated, sustainable, and effective resiliency transformation.

1898andco.com