



TEXAS GRID RELIABILITY: 2022 INTERRUPTION COST ANALYSIS

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Executive Summary

The Texas Solar Energy Society (TXSES) is dedicated to enhancing Texas's energy infrastructure. This report presents an analysis of the economic impact of grid service interruptions across Texas, a project led by our research department. In 2022, these interruptions cost the Texas economy an estimated \$6.97 billion. This analysis is based on data from 68 Transmission and Distribution Utilities (TDUs), utilizing refined methodologies and comprehensive data sources. The findings aim to provide actionable insights and drive necessary grid reforms.

Introduction

A reliable energy grid is vital for Texas, given its significant economic role and the essential services reliant on continuous electricity. Historically, grid interruptions have posed severe challenges, disrupting daily activities and economic operations. The objective of this report is to estimate the economic impact of grid interruptions in Texas for the year 2022. By understanding these impacts, TXSES aims to advocate for policy reforms and infrastructure improvements to enhance grid reliability.

Methodology

Our initial approach focused on utility providers, but due to the complexity and diversity of Texas's electricity providers, we shifted our focus to Transmission and Distribution Utilities (TDUs). TDUs manage a unified network of electrical wires across Texas, regulated by the Public Utility Commission of Texas (PUCT). This strategic pivot ensured our analysis covered the entire grid, utilizing data from 68 recognized TDUs.

In addition to traditional data sources, including the PUCT's Annual Service Quality Reports and the comprehensive U.S. Energy Information Administration (EIA) 861 dataset aligned with IEEE (Institute of Electrical and Electronics Engineers) standards, we employed the Interruption Cost Estimate (ICE) Calculator. Developed by Lawrence Berkeley National Laboratory (LBNL) and Resource Innovations, the ICE Calculator is a tool designed for estimating interruption costs and evaluating the benefits associated with reliability improvements in the U.S. Using the ICE Calculator allowed us to enhance the accuracy of our economic impact estimates by incorporating industry-standard interruption cost data.

Our methodology was inspired and guided by Local Solar for All's 2023 report, *The Economic Impact of Michigan's Unreliable Power Grid*, which provided a valuable framework for understanding the economic impacts of grid reliability issues. Both Texas and Michigan face significant challenges in grid reliability with

substantial economic consequences. The Michigan study's focus on comprehensive data collection and rigorous analysis served as a foundation for our approach in Texas.

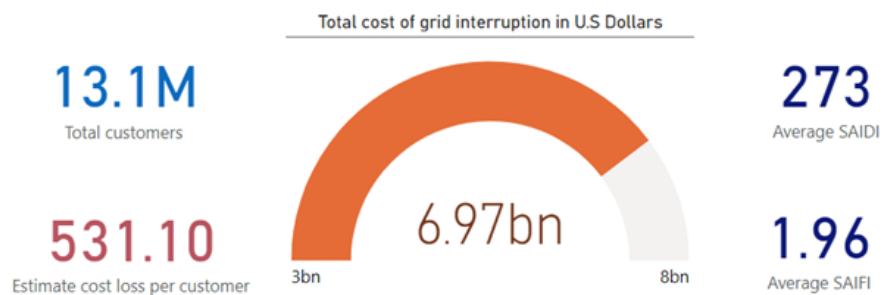
To handle missing data, we applied mean imputation and KNN imputation for missing reliability metrics such as SAIDI (System Average Interruption Duration Index) and SAIFI (System Average Interruption Frequency Index). For utilities that did not separate non-residential customers, we calculated the average percentage of non-residential customers out of the total customer base. These estimations predominantly apply to small-to-medium-sized customer bases and did not significantly alter the final statistical results of the study.

Key Findings

Our analysis revealed that grid interruptions in Texas in 2022 cost the economy \$6.97 billion. This estimate is based on data from 68 TDUs, encompassing a wide range of service areas and customer bases. The methodology employed in the Michigan study provided a strong foundation for our approach, enabling a comprehensive and reliable analysis. The replacement of missing reliability metrics and the estimation based on total customer numbers ensured that our findings are robust and actionable.

Figure 1: Main Metrics

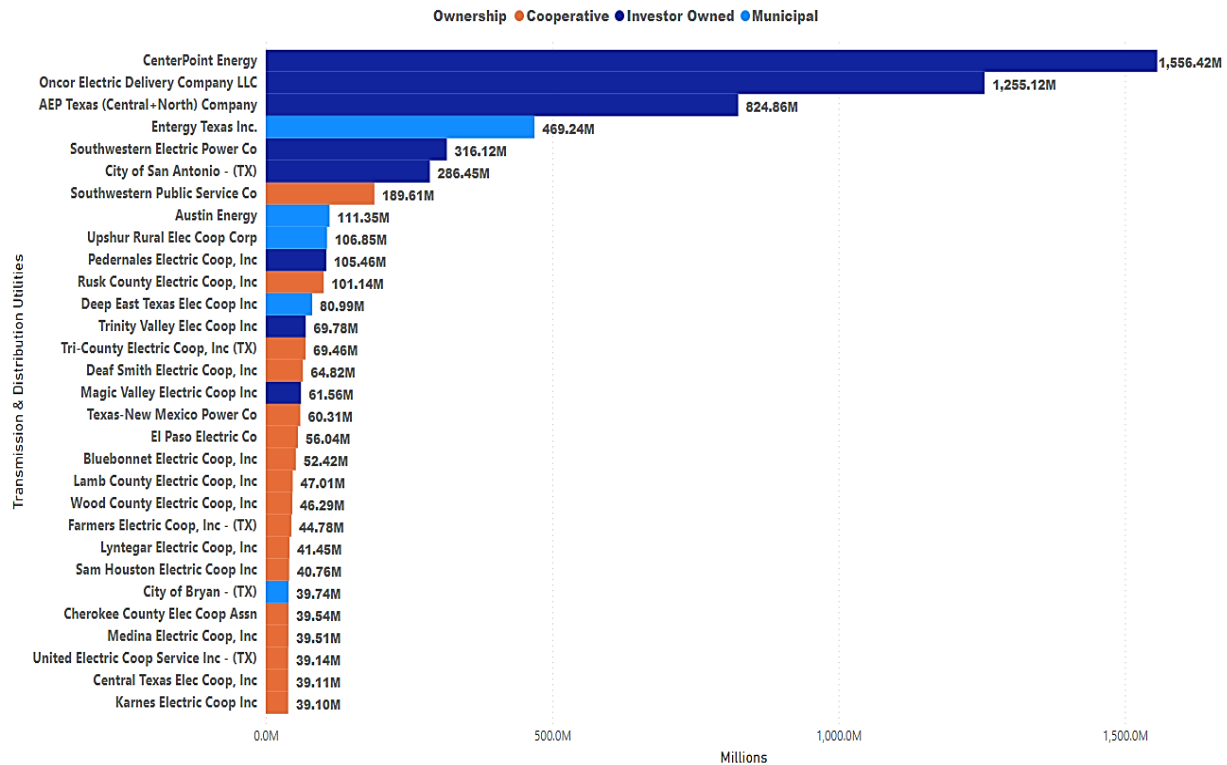
This figure summarizes key metrics related to grid interruptions in Texas:



- **Total Cost of Grid Interruption:** \$6.97 billion.
- **Total Customers Served:** 13.1 million.
- **Estimated Loss Per Customer:** \$531.10.
- **Average SAIDI:** 273 minutes.
- **Average SAIFI:** 1.96 interruptions per customer.

Figure 2: Cost of Grid Interruption by TDU in U.S. Dollars

Cost of Grid Interruption by TDU in the U.S Dollars



This figure illustrates the financial losses due to grid interruptions for each Transmission and Distribution Utility (TDU) in Texas. Investor-owned TDUs like CenterPoint Energy and Oncor Electric Delivery Company exhibited the highest financial losses.

Figure 3: TDU Losses by Ownership

This pie chart breaks down the total losses by TDU ownership:

- **Investor-Owned TDUs:** 64.6% of total losses
- **Cooperative TDUs:** 21.6% of total losses
- **Municipality TDUs:** 13.9% of total losses

TDU losses by ownership

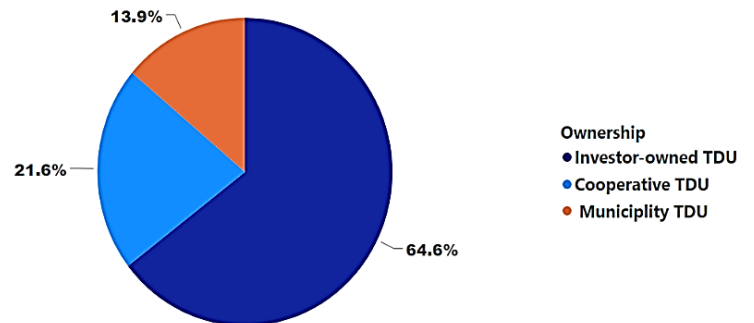


Figure 4: Customer Base Distribution by Utility Ownership

This pie chart displays the distribution of the customer base by TDU ownership:

- **Investor-Owned TDUs:** 71.48% of customers
- **Cooperative TDUs:** 17.24% of customers
- **Municipal TDUs:** 11.28% of customers

Customer Base Distribution by Utility Ownership

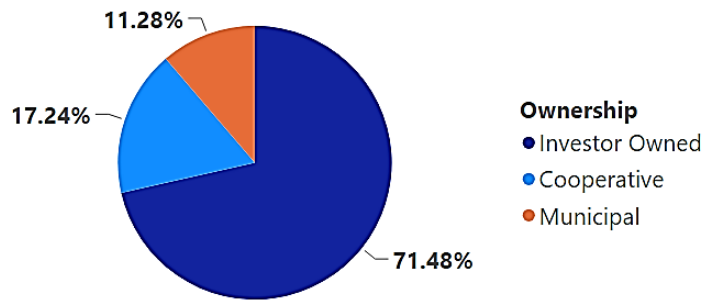
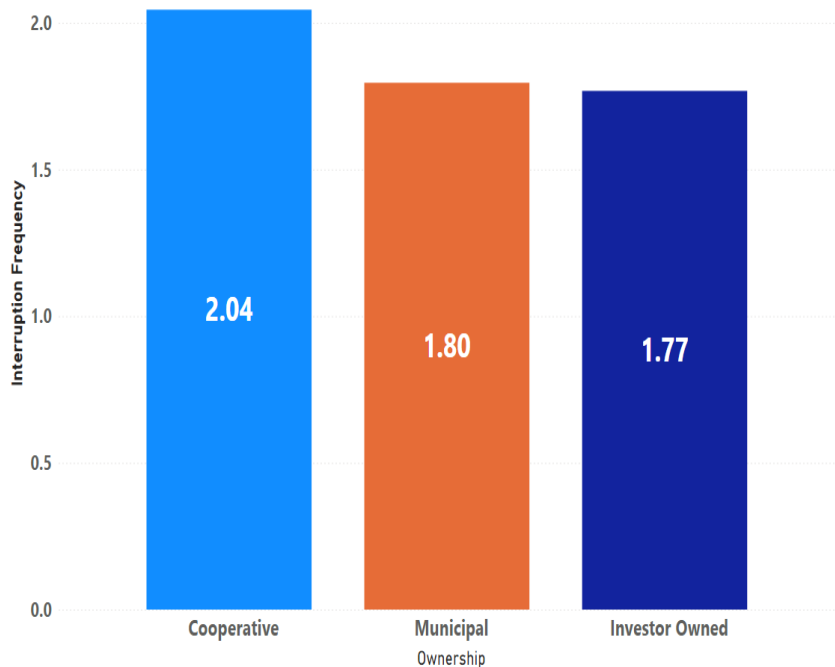


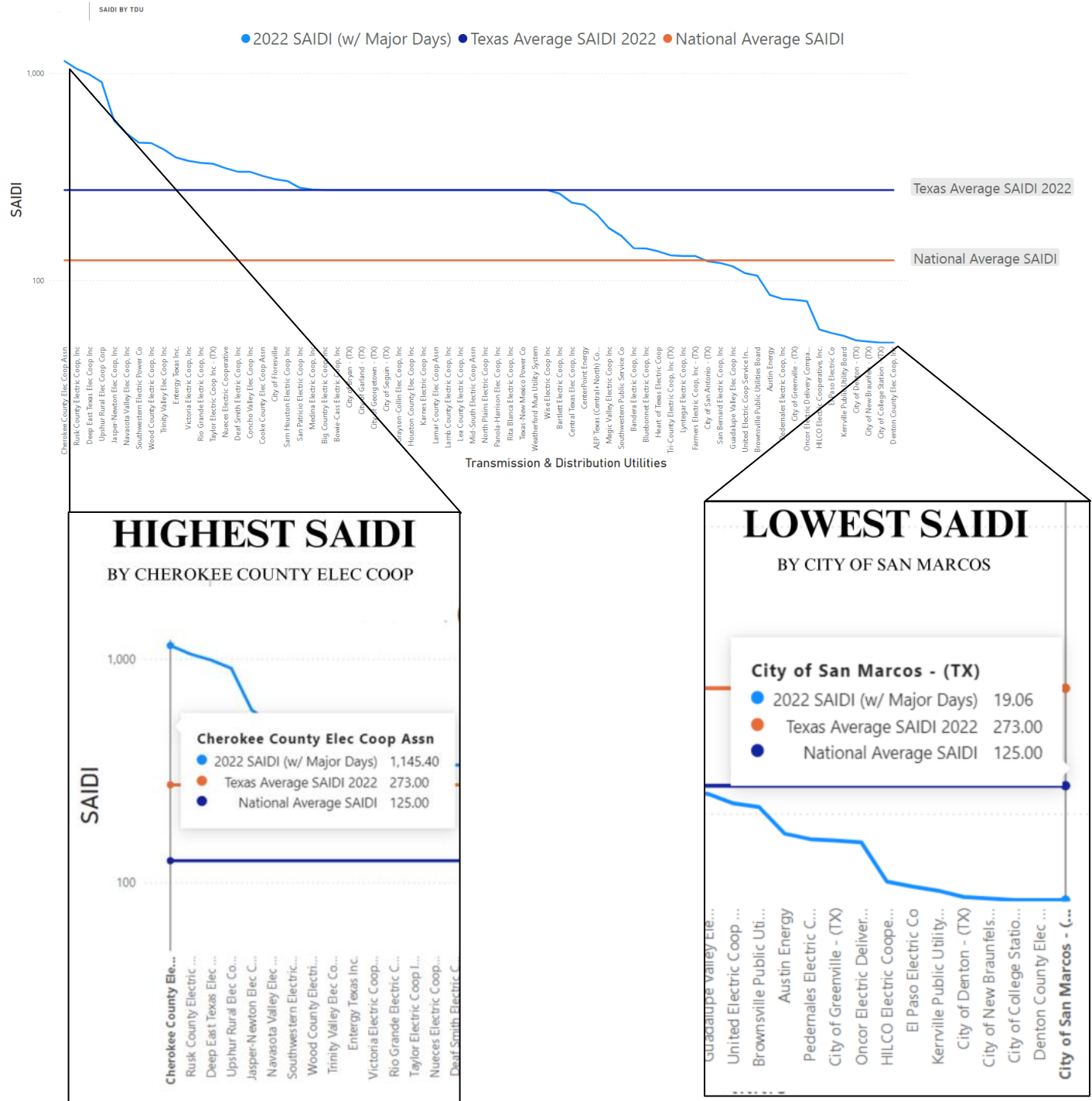
Figure 5: System Average Interruption Frequency Index (SAIFI) by Ownership

System Average Interruption Frequency Index By Ownership



This column chart illustrates the frequency of power interruptions across different TDU ownership types. Cooperative TDUs exhibit the highest average interruption frequency at 2.04 interruptions per customer, followed by municipal TDUs with an average of 1.8 interruptions. Investor-owned TDUs have the lowest interruption frequency, averaging 1.77 interruptions per customer. This comparison highlights the variability in grid reliability depending on the ownership structure of the TDUs.

Figure 6: Reliability Comparison - Texas vs. National Averages



This line graph compares the SAIDI of various TDUs in Texas against the Texas average SAIDI (273 minutes) and the national average SAIDI (125.8 minutes). Texas TDUs generally experience longer interruptions than the national average, with a wide range of SAIDI values across different TDUs.

National vs. Texas Reliability Metrics

National Averages:

- **National Average SAIDI:** 125.803 minutes
- **National Average SAIFI:** 0.861 interruptions

Texas Findings:

- **Texas Average SAIDI:** 273.002 minutes
- **Texas Average SAIFI:** 1.956 interruptions

Analysis and Interpretation

SAIDI (System Average Interruption Duration Index):

- **National Average:** 125.803 minutes
- **Texas Average:** 273.002 minutes
- Texas's SAIDI is significantly higher than the national average, indicating longer total durations of power interruptions for Texas customers.

SAIFI (System Average Interruption Frequency Index):

- **National Average:** 0.861 interruptions
- **Texas Average:** 1.956 interruptions
- Texas's SAIFI is also higher than the national average, suggesting more frequent power interruptions in Texas.

Performance Standards and Benchmarks

SAIDI Performance:

A SAIDI (System Average Interruption Duration Index) of less than 50 minutes is considered exemplary, indicating a highly reliable grid with minimal interruption duration. Conversely, a SAIDI exceeding 200 minutes reflects poor performance, highlighting significant areas for improvement in grid reliability.

SAIFI Performance:

A SAIFI (System Average Interruption Frequency Index) below 1.0 interruptions per year is generally regarded as indicative of good reliability. However, a SAIFI above 2.0 interruptions suggests a need for significant enhancements to reduce the frequency of power outages.



Texas Grid Reliability Performance

- **SAIDI:** Texas's SAIDI score of 273.002 minutes indicates poor performance compared to the national average and the standard threshold for poor performance.
- **SAIFI:** Texas's SAIFI score of 1.956 interruptions is also considered poor and significantly above the national average.

These findings suggest that the reliability of electric service in Texas is lower than the national average, with customers experiencing longer and more frequent power outages.

Recommendations

Based on the findings of this report, several policy and infrastructure improvements are recommended to enhance grid stability in Texas. These recommendations focus on improving data availability, quality, and publication to ensure better transparency and accountability.

Comprehensive and Timely Data Submission

The Public Utility Commission of Texas (PUCT) should mandate the comprehensive and timely submission of reliability metrics such as SAIDI, SAIFI, and CAIDI from all Transmission and Distribution Service Providers (TDSPs), cooperatives, and municipalities. This data should be reported both with and without the inclusion of major events to provide a clear picture of grid reliability under normal and extreme conditions.

Public Accessibility of Data

All reported data should be made available in a searchable and accessible format on a public website. This will allow customers and citizens to easily access and review the reliability metrics of their service providers. Transparency in data publication can help consumers make informed decisions and encourage service providers to maintain high standards of reliability.

Reporting on Major Events

Service providers should also be required to include detailed reports on major events. These reports should cover the cause, duration, and direct restoration costs of each major event. By understanding the impacts and costs associated with major outages, stakeholders can better prepare for and mitigate the effects of future events.

Implementation and Enforcement

To ensure compliance, PUCT should establish clear guidelines and deadlines for data submission. Regular audits and assessments should be conducted to verify the accuracy and completeness of the reported data. Penalties for non-compliance should be enforced to maintain accountability.

Future Research and Continuous Improvement

Continuous research and improvement efforts should focus on refining data collection methodologies and exploring innovative solutions to enhance grid reliability. Stakeholder engagement is crucial in this process, and collaboration among utilities, regulators, and consumers will be essential to achieving long-term improvements in Texas's energy infrastructure.

By implementing these recommendations, Texas can improve the reliability and resilience of its energy grid, reducing the economic impact of grid interruptions and ensuring a stable and dependable power supply for all Texans.

Conclusion

Interruptions to the Texas grid in 2022 resulted in an estimated economic impact of approximately \$6.97 billion. This report offers a detailed analysis of these costs, utilizing robust data sources and refined methodologies. The findings highlight the critical need for enhancing grid reliability through targeted policy reforms and infrastructure investments. TXSES is committed to championing these necessary changes and encourages active stakeholder participation in this crucial dialogue.

For further inquiries and discussions, please contact Mohammad Nassar Alkhatib at mohammed@txses.org or Patrice Parsons at pparsons@txses.org.

Appendices

Supplementary Data and Charts

- **Figure 1:** Main Metrics
- **Figure 2:** Cost of Grid Interruption by TDU in U.S. Dollars
- **Figure 3:** TDU Losses by Ownership
- **Figure 4:** Customer Base Distribution by Utility Ownership
- **Figure 5:** System Average Interruption Frequency Index (SAIFI) by Ownership
- **Figure 6:** Reliability Comparison - Texas vs. National Averages

Glossary

- **SAIDI (System Average Interruption Duration Index):** A reliability metric used by electric utilities to measure the average total duration of power outages for each customer during a given period, typically expressed in minutes per year.
- **SAIFI (System Average Interruption Frequency Index):** A reliability metric that indicates the average number of power interruptions a customer would experience during a given period, typically measured over one year.
- **CAIDI (Customer Average Interruption Duration Index):** The average time required to restore service after an outage, calculated as the total duration of outages divided by the number of outages.
- **TDU (Transmission and Distribution Utility):** An entity responsible for the transmission and distribution of electricity to end users within a specific service area, typically regulated by state utility commissions.
- **PUCT (Public Utility Commission of Texas):** The state agency that regulates the electric, telecommunication, and water utilities in Texas, ensuring that customers receive safe, reliable service at reasonable rates.

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