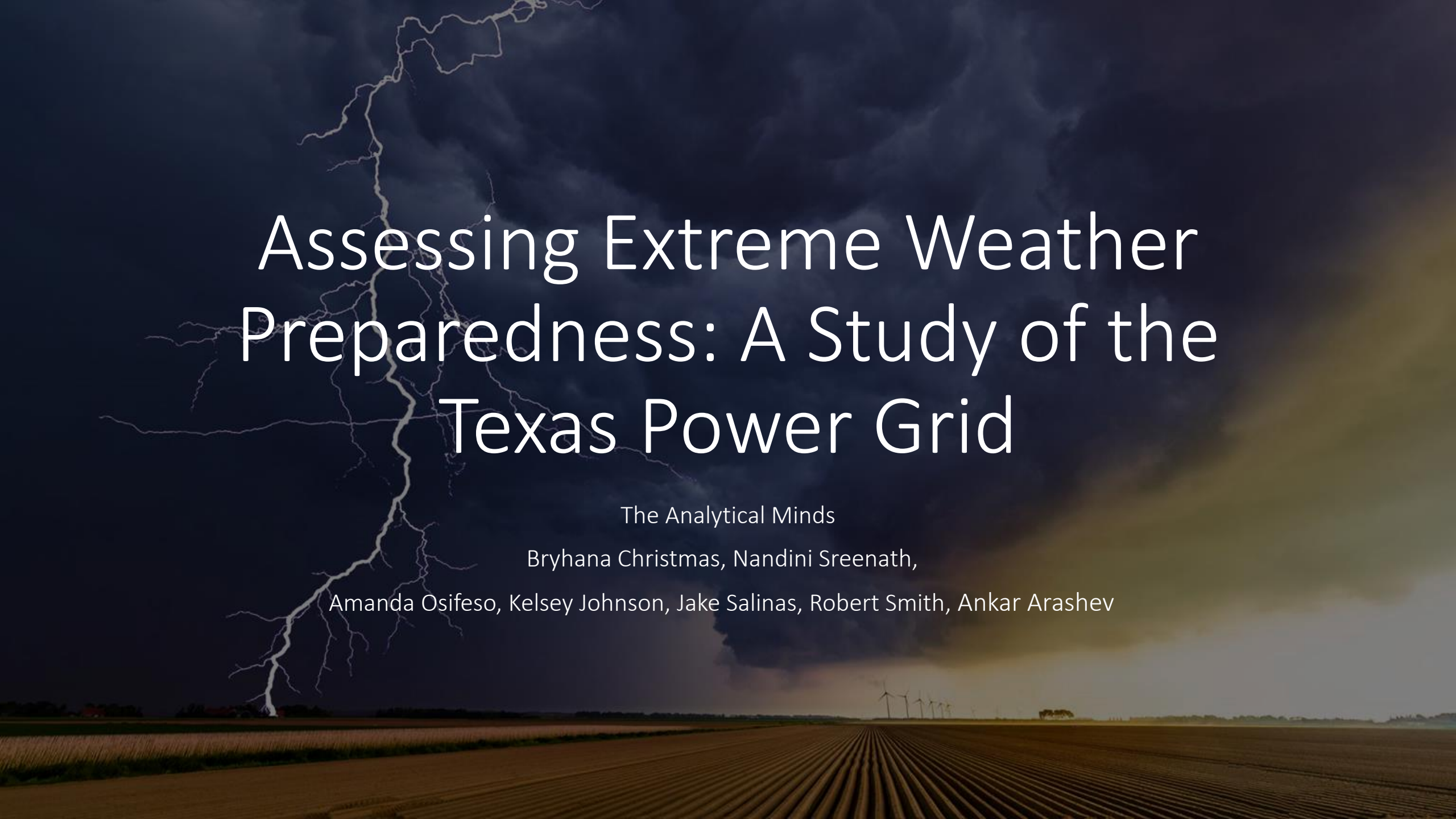


Assessing Extreme Weather Preparedness: A Study of the Texas Power Grid

The Analytical Minds

Bryhana Christmas, Nandini Sreenath,

Amanda Osifeso, Kelsey Johnson, Jake Salinas, Robert Smith, Ankar Arashev

AGENDA

- Background
- Project Objective
- Data Exploration
- Potential Weaknesses
- Conclusion

Origins of the Texas Power Grid

1935: The Federal Energy Regulatory Commission (FERC) was created

1941: The Texas Interconnected System formed when **all** utility companies in Texas agreed to **not** send any power out of the state

1970: the **Electric Reliability Council of Texas** formed (ERCOT)

Texas has a deregulated market

- ERCOT is at the root of this market as a **nonprofit corporation**

About **75%** of the state's electric load

Operates and manages the flow of electric power to more than **26 million** Texans

What Fuels Texas?

- Texas generates approximately **11%** of the total energy in the U.S.
- Texas leads the nation in wind energy production, accounting for **30%** of total production in the U.S.

Project Objective

Objective

Assess the energy readiness of the Texas power grid for extreme weather

Why?

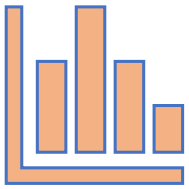
Weather data is a rich resource for analysts affect great positive change

Have promises to winterize energy sources been implemented?

How?

Conduct an analysis of existing energy infrastructure to address vulnerabilities and propose recommendations

Data Exploration

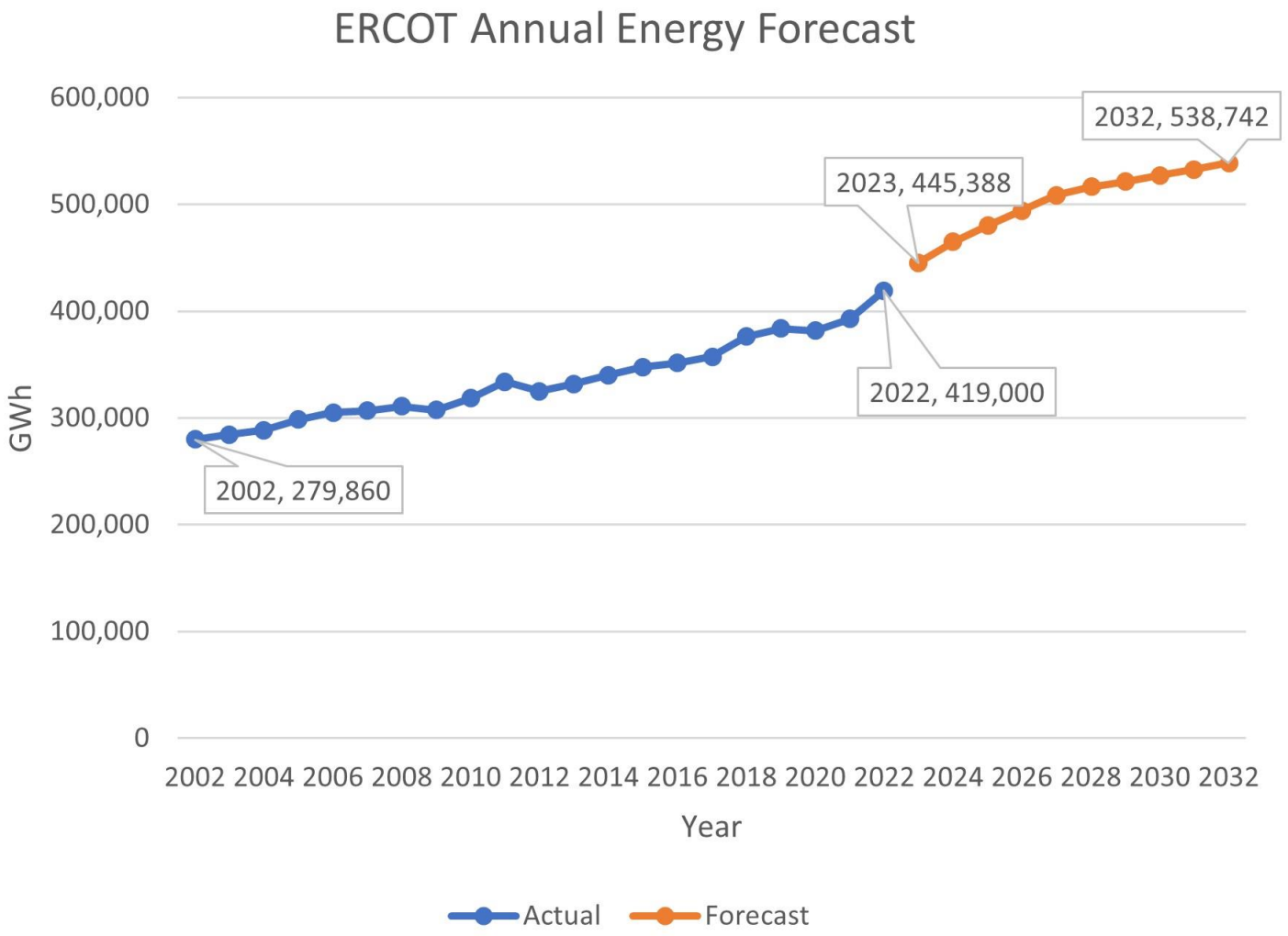


ERCOT's Annual Energy Forecast

Gradual increase in demand every year (2002-2022)

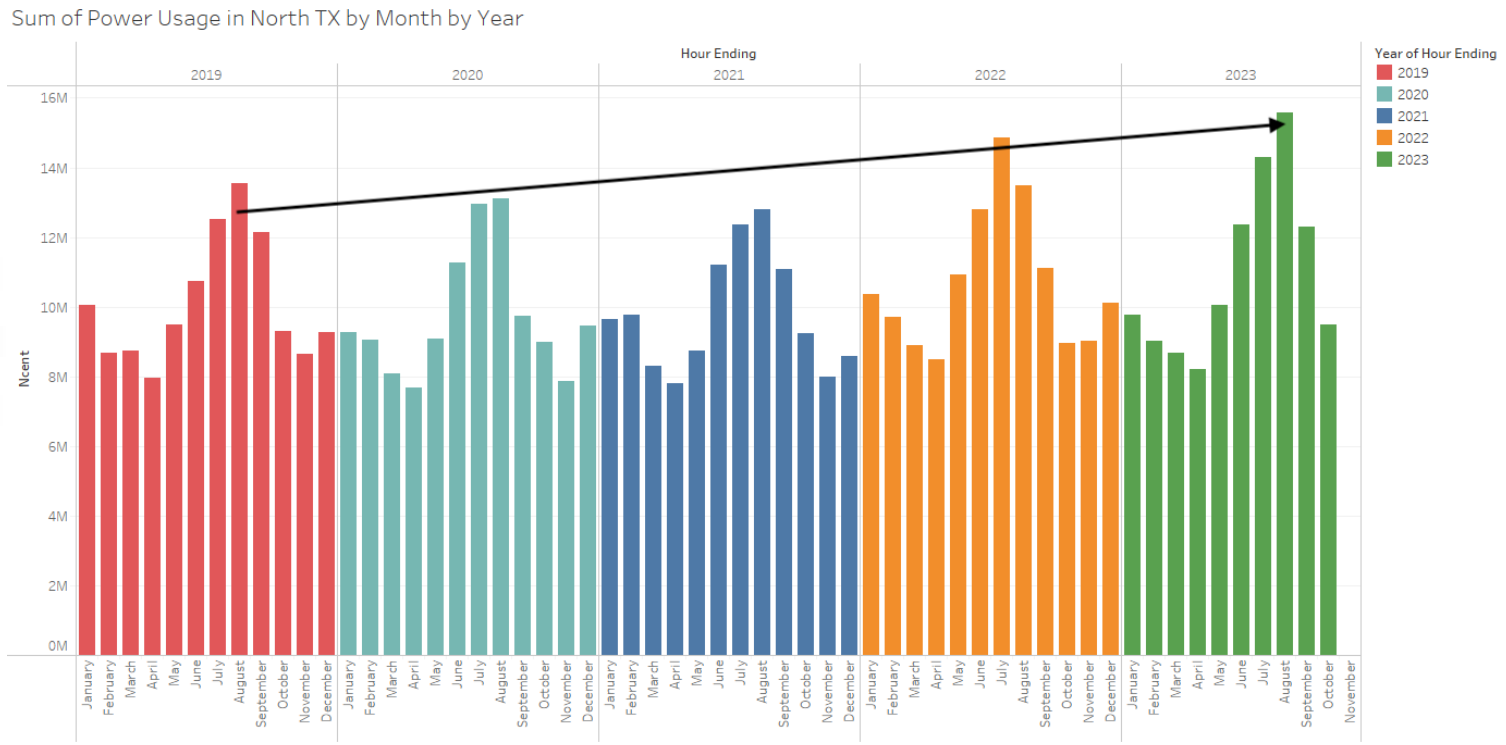
Major contributors to the increase in demand:

- Increase in extreme weather conditions
- Technological advances
- Population growth



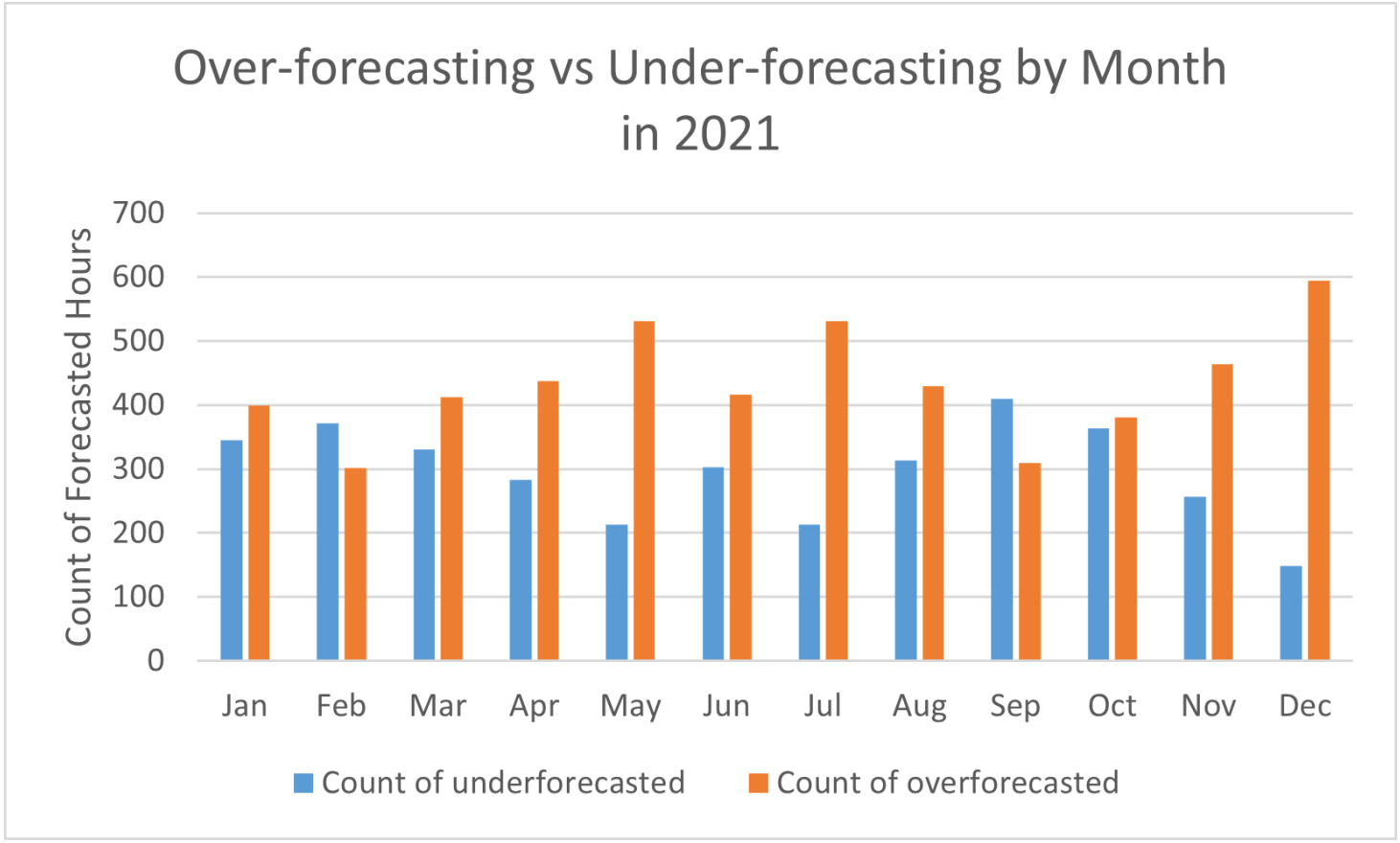
Overall Seasonality (2019-2023)

- Consistent seasonal trends over the past 5 years
- Highest Demanding Months:
  - August
  - July
- Lowest demanding month:
  - April
- Winter has a significantly lower demand compared to summer



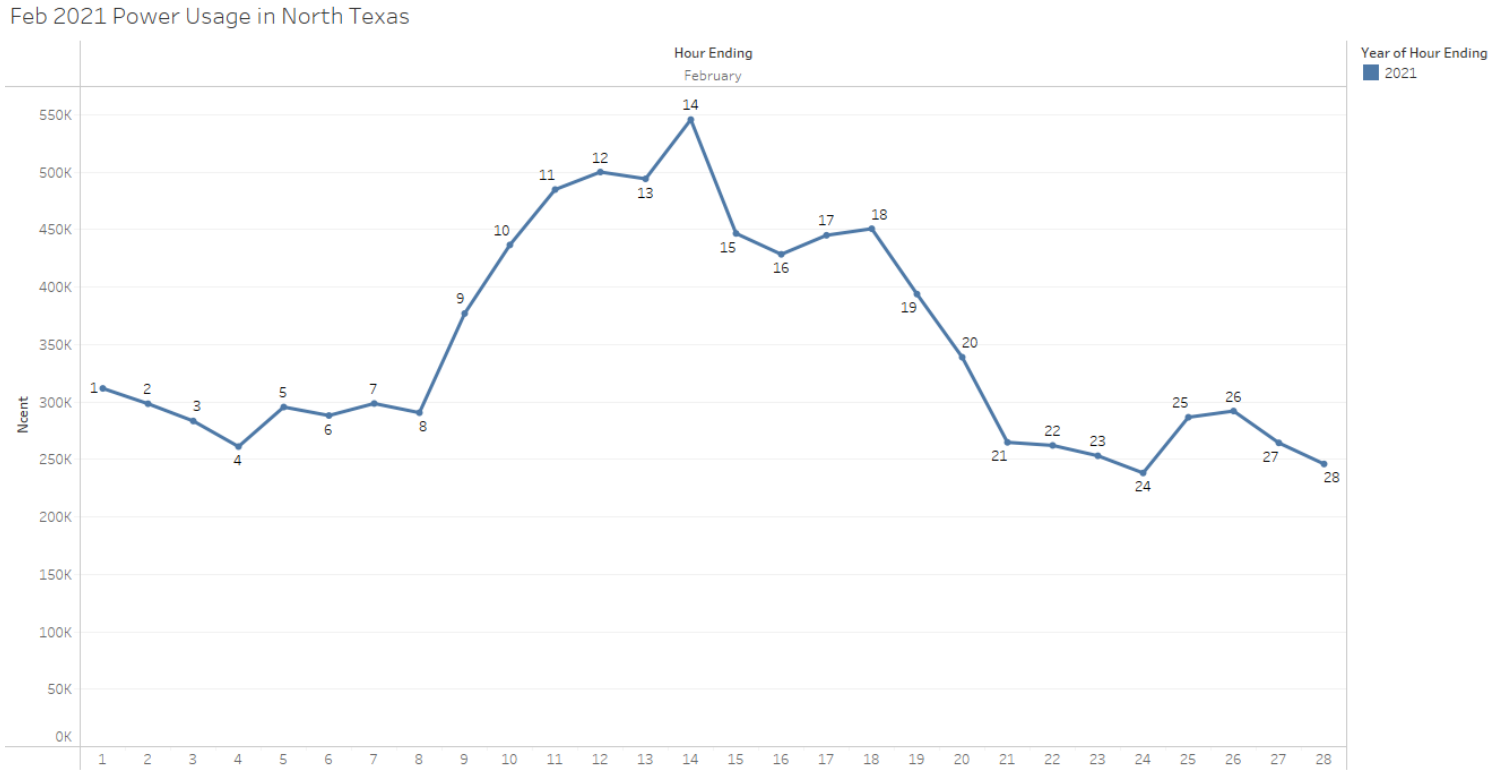
Under Vs. Over-Forecasts 2021

- Overall view of 2021
- Over-forecasted during summer and holidays
- Highest over-forecasted month
  - December
- Under-forecast during September
- For February, the rate of under-forecasted hours is higher



2021 Winter Storm

- Background
  - Major grid failure due to extraordinary ice storm "Uri"
  - Occurred during February 10th-27th
  - 246 fatalities, $195 B in property damage, 4 M households lost power
- Analysis
  - Significant surge in energy consumption
    - Valentines Day
  - Average energy consumption in February ranged between 250k-300k MW
  - Energy usage doubled from the typical average during the ice storm



Where It All Went Wrong

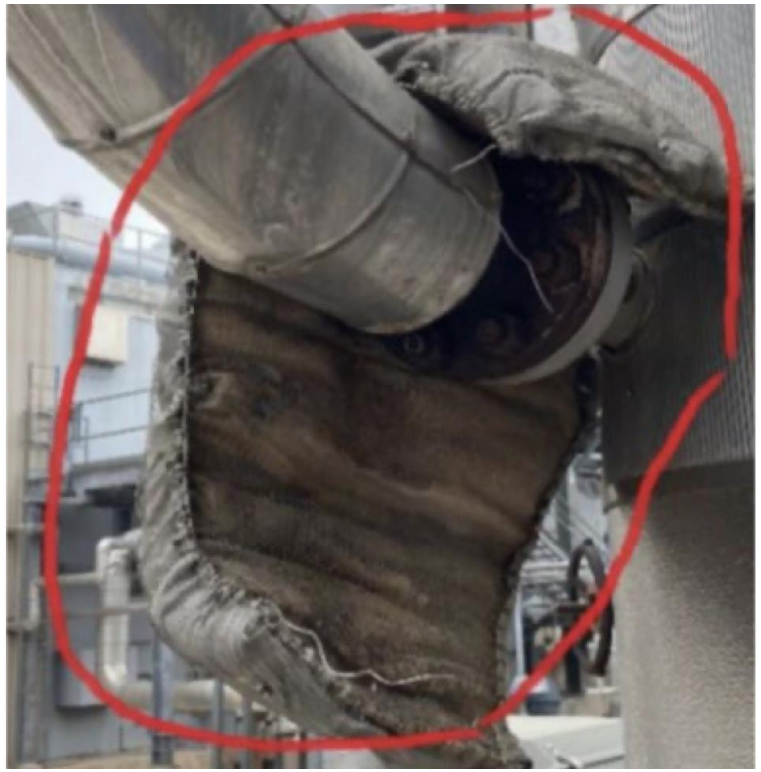
- Failed to winterize machinery
- Lost 40% of power supply from Feb 10th - Feb 27th
- Have promises to winterize energy sources been implemented? **Answer: NO**
- Despite advanced tools for accurate weather forecasting, there were large discrepancies in execution
- Consider alternative tracking methods for machinery maintenance and upkeep

Mechanical Failures During the Winter

- While Texas has a diverse range of energy sources, a significant portion of them failed during winter storm Uri.
- Windmills – Require built-in heaters to keep lubricants from freezing.
- Natural gas – Pressurization of gas generates moisture that froze without insulation
- Nuclear plant – Water cooling tubes were not insulated outside resulting in them freezing

ERCOT's Implemented Improvements

- Heat Tracing Applied to Water Lines (prior to applying insulation and cladding)
- Incomplete Insulation Blanket "Clamshell" Instrument Enclosure
- Temporary Wind Break Structures



Recommendations

01

Continuous improvement in grid infrastructure

02

Enhanced monitoring and early warning systems via ERCOT's data

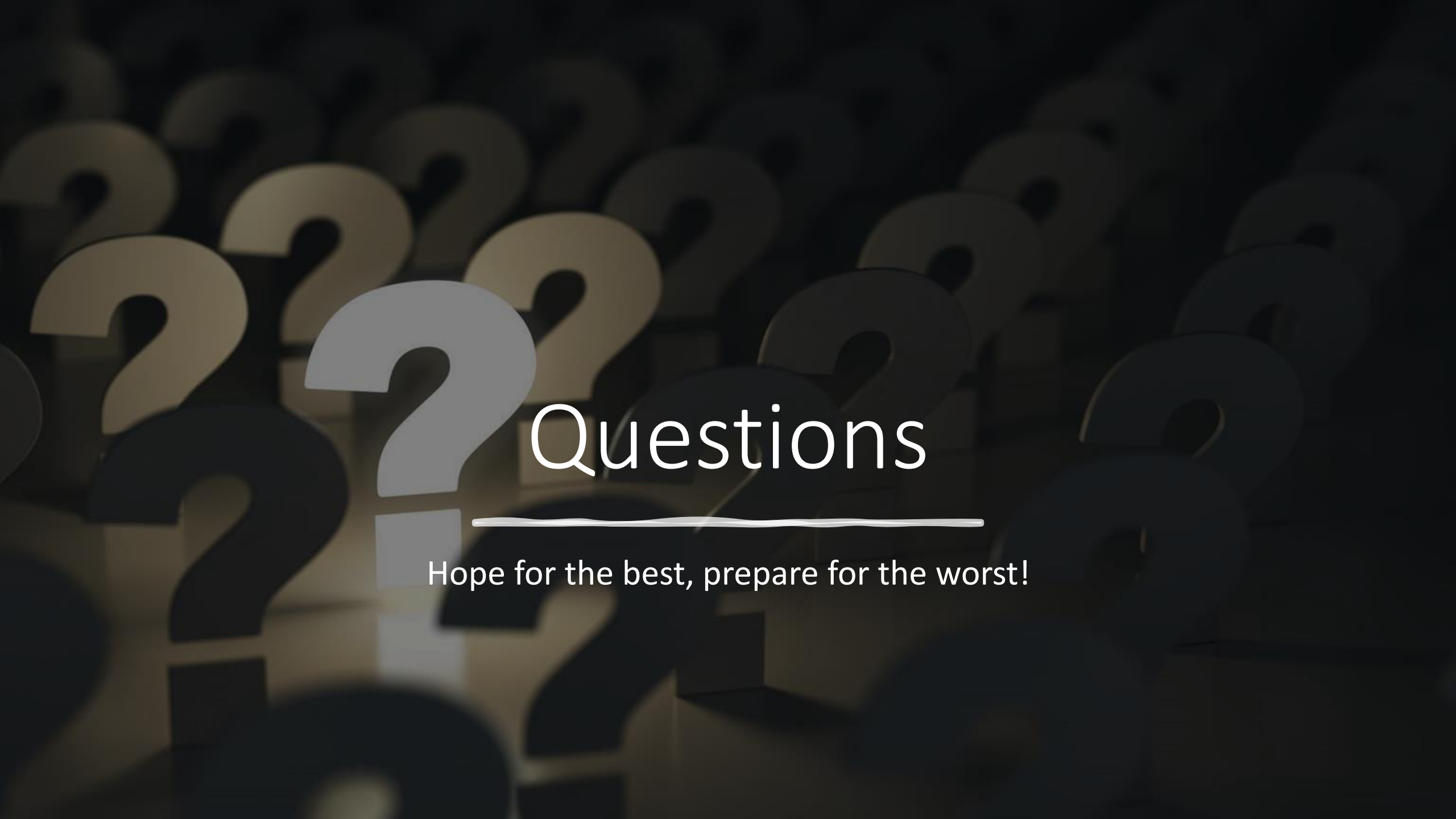
03

Enlist a data professional to convey critical points to ERCOT's board of directors

04

Data serves as the compass guiding us through uncertainty

“Know Thy Data”-Dr. Cavazos



Questions

Hope for the best, prepare for the worst!

References

- Published by Statista Research Department, & 25, J. (2023, January 25). *U.S. electricity consumption by leading state*. Statista. https://www.statista.com/statistics/560913/us-retail-electricity-consumption-by-major-state/#:~:text=Texas%20is%20the%20leading%20electricity,more%20than%20240%20terawatt%20hours.
- Cohn, Julie A. “Connecting Past and Future: A History of Texas’ Isolated Power Grid.” Baker Institute, December 1, 2022. https://www.bakerinstitute.org/research/connecting-past-and-future-history-texas-isolated-power-grid.
- Nelson, Jennifer. “How the Texas Power Grid Works and Why It Failed.” Investopedia, June 7, 2023. https://www.investopedia.com/texas-power-grid-5207850#:~:text=7-,How%20Will%20Texas%20Solve%20Its%20Grid%20Problem%3F,more%20reliable%20supply%20of%20energy.
- Golding, Garrett. 2023. “Texas Electrical Grid Remains Vulnerable to Extreme Weather Events.” Www.dallasfed.org. January 24, 2023. https://www.dallasfed.org/research/economics/2023/0117.
- Electric Reliability Council of Texas.n.d. Www.ercot.com. https://www.ercot.com/.
- *Grid information*. Electric Reliability Council of Texas. (n.d.). https://www.ercot.com/gridinfo

References

- Rickerson, Woody, and David Kezell. *ERCOT Special Board of Directors Meeting - Item 3: Weatherization and Inspection Update*. 2022. Photograph. *ERCOT*, January 17, 2022. https://www.ercot.com/files/docs/2022/01/17/3_Weatherization_and_Inspection_Update.pdf
- *South Texas project unit 1 tripped at 0537 on Feb 15, 2021*. Atomic Insights. https://atomicinsights.com/south-texas-project-unit-1-tripped-at-0537-on-feb-15-2021/
- *Winter storm Uri 2021*. https://comptroller.texas.gov/economy/fiscal-notes/2021/oct/winter-storm-impact.php#:~:text=Although%20Winter%20Storm%20Uri's%20devastation,damage%20and%20forgone%20economic%20opportunities. (n.d.).
- Igini, Martina. "4 Environmental Issues in Texas in 2023." *Earth.Org*, 1 July 2023, earth.org/texas-climate-change/
- Foxhall, Emily. "Texas Gets $60 Million in Federal Funds to Strengthen Power Grid against Extreme Weather." *The Texas Tribune*, The Texas Tribune, 6 July 2023, www.texastribune.org/2023/07/06/texas-electricity-grid-federal-grant-extreme-weather/.