NARUC Summer Policy Summit

Committee on Electricity

Reliability Implications of Recent Extreme Weather Events

11:00am-12:00pm

Moderator: Hon Matt Schuerger, Minnesota

Panelists:
Nick Wintermantel, Consultant, Astrape Consulting
Alison Silverstein, Consultant, Alison Silverstein Consulting
Ric O'Connell, Executive Director, GridLab

Capacity Accreditation

Nick Wintermantel
Astrapé Consulting LLC

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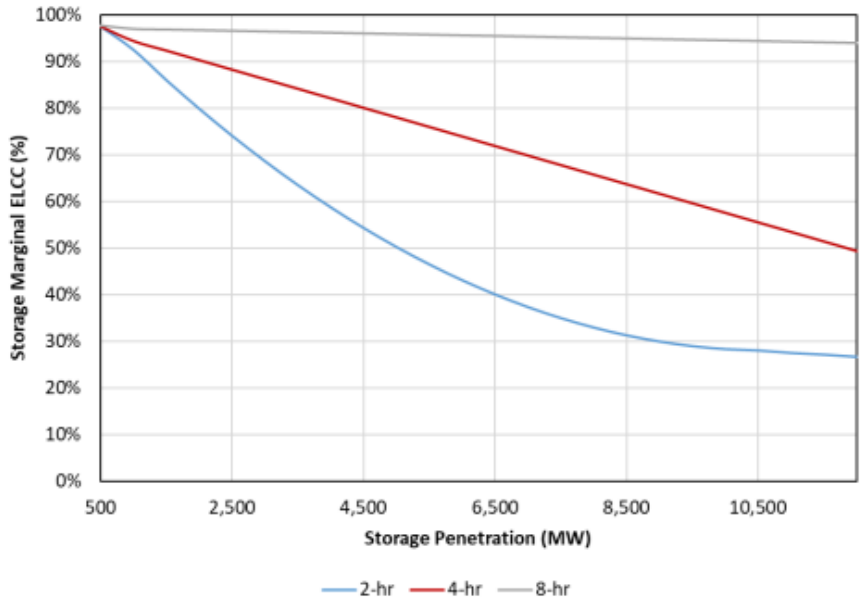
Current Capacity Accreditation

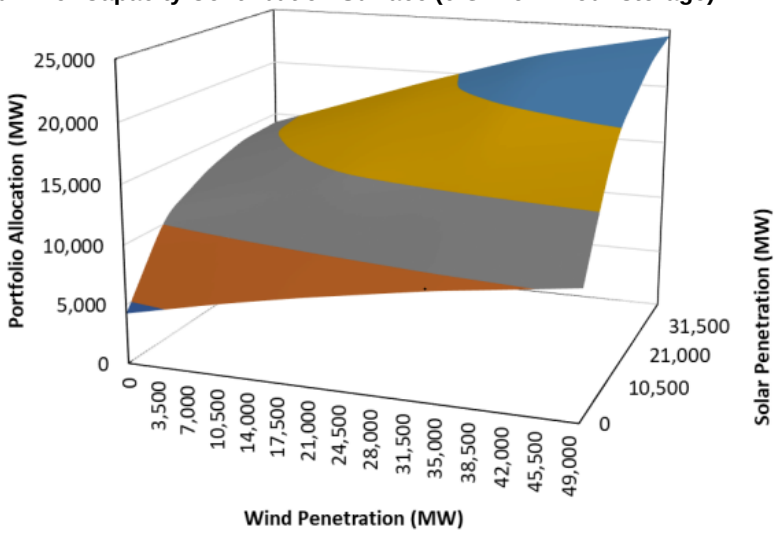
- **ELCC Analysis for intermittent and energy limited resources**
  - Solar/wind/storage average and marginal ELCCs generally decline with penetration
  - Require Surface Analysis to understand interactive effects of resources

- **Most RTOs utilize 1-EFORd accreditation for thermal resources**
  - Potential to miss additional risk components for average ELCC
    - Outage variability
    - Correlated Outages
      - Common mode failures
      - Weather dependent outages
      - Fuel availability outages
  - If no correlated outages, marginal ELCC for thermal resources approximates 1-EFORd

ERCOT: Summer Storage Marginal ELCCs by Duration (Solar 20 GW and Wind 25 GW)



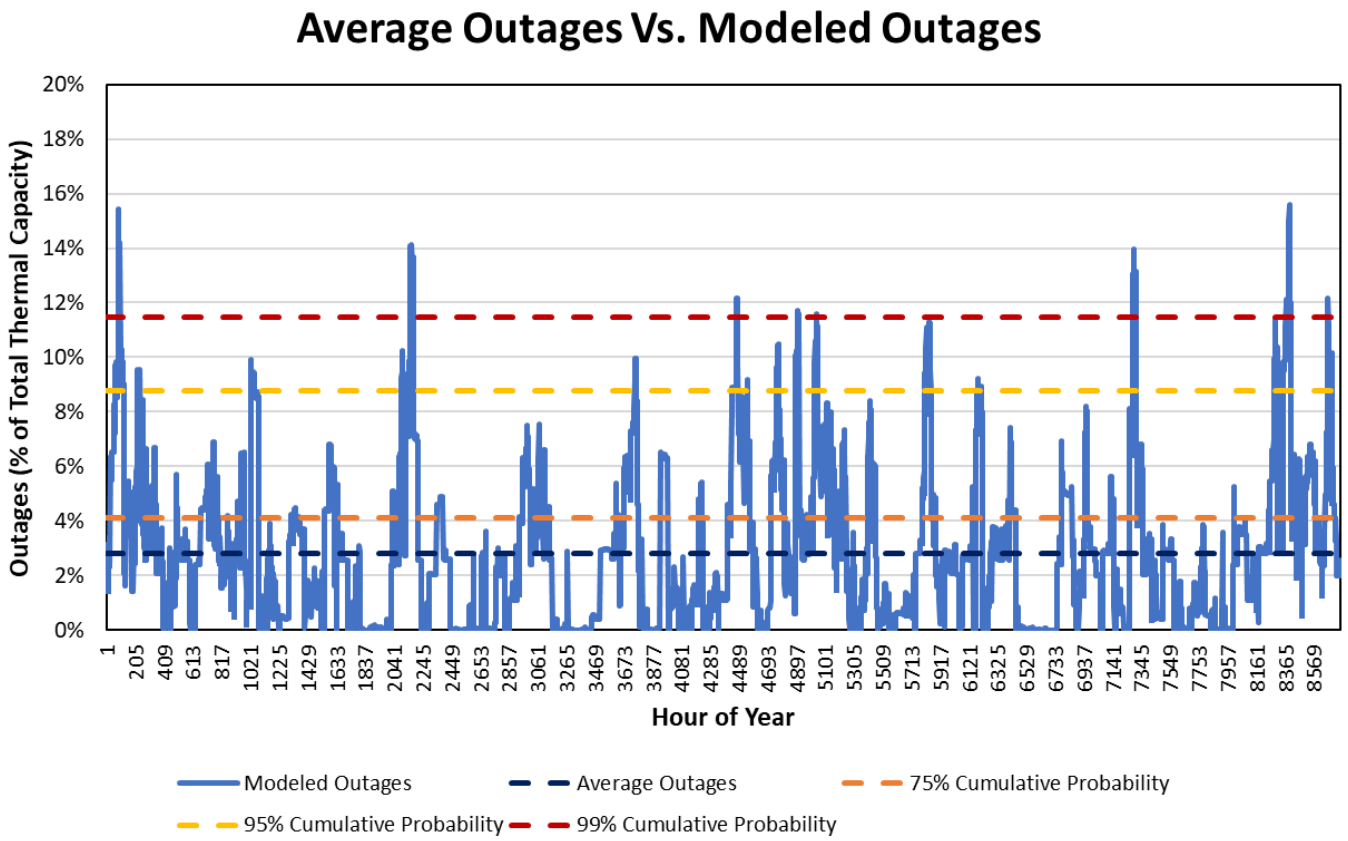
ERCOT: Summer Capacity Contribution Surface (6 GW of 2 hour storage)



2022-ERCOT-ELCC-Study-Final-Report-12-9-2022.pdf (astrape.com)

Thermal Outage Variability Example

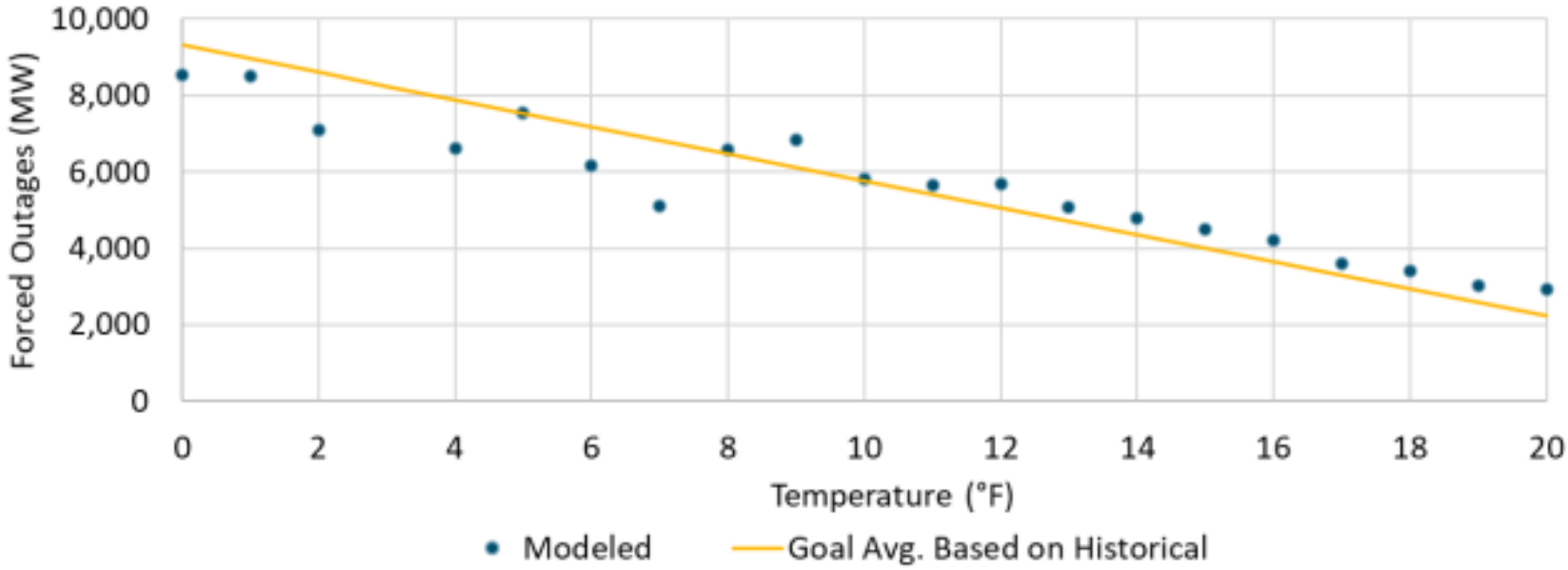
- UCAP accounting (1-EFORd) for thermal fleet in RTO/ISOs presumes only average outages need to be addressed



- Marginal thermal ELCC generally approximates 1-EFORd

Correlated Outages
Weather Dependent Outage Example

- **ERCOT Example**
  - If historical data demonstrates these outages, Astrapé recommends capturing the additional risk in resource adequacy framework
  - Robust Resource Adequacy framework captures multiple weather years
  - Monte Carlo Draws during Extreme Temperatures



- Assessment of Market Reform Options to Enhance Reliability of the ERCOT System (ethree.com)

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RTO/ISO vs. IOU IRP Context

RTO/ISO Market

Existing and new resource accreditation are both critical

- Calculating appropriate existing thermal ELCCs is important

Marginal vs Average ELCC continues to be ongoing debate

Proxy methods to capture ELCC are being considered

VS.

IOU/IRP

New Resource accreditation is critical (Solar vs. Wind vs. Storage vs. Gas)

- Use Marginal ELCCs
- Uncertainties
  - Outage rates of new storage and new gas especially in extreme temps
  - Fuel backup/winterization plans for new gas

Existing Resource Accreditation not as critical

- Doesn't drive marginal decision
- Many utilities still use ICAP accounting vs. UCAP accounting
- Potential to see utilities evolve towards a UCAP framework

Questions?

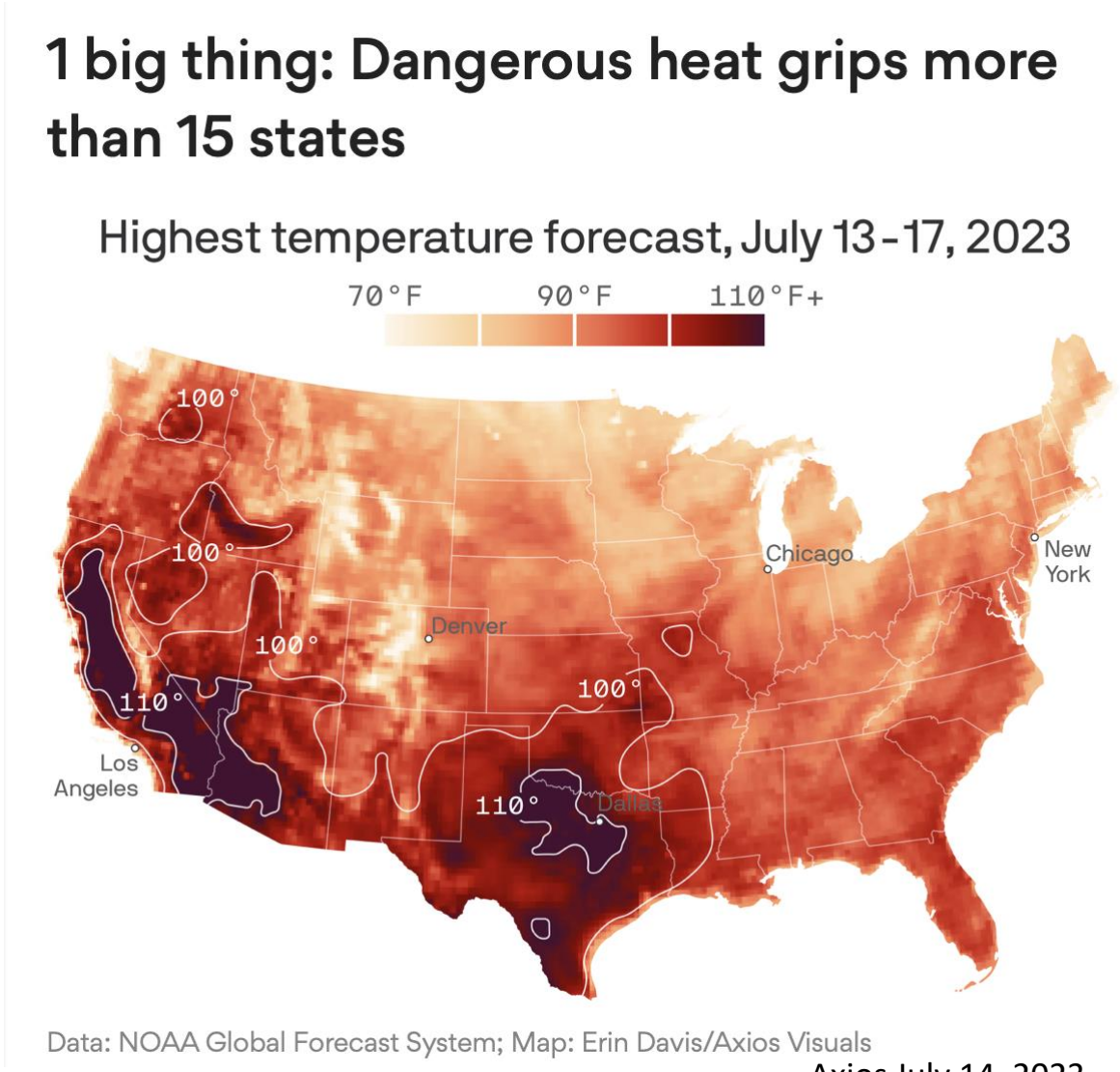
Nick Wintermantel

nwintermantel@astrape.com

Reliability Implications of Recent Extreme Weather Events

Alison Silverstein
Alison Silverstein Consulting
NARUC Committee on Electricity
July 18, 2023

Current heat wave



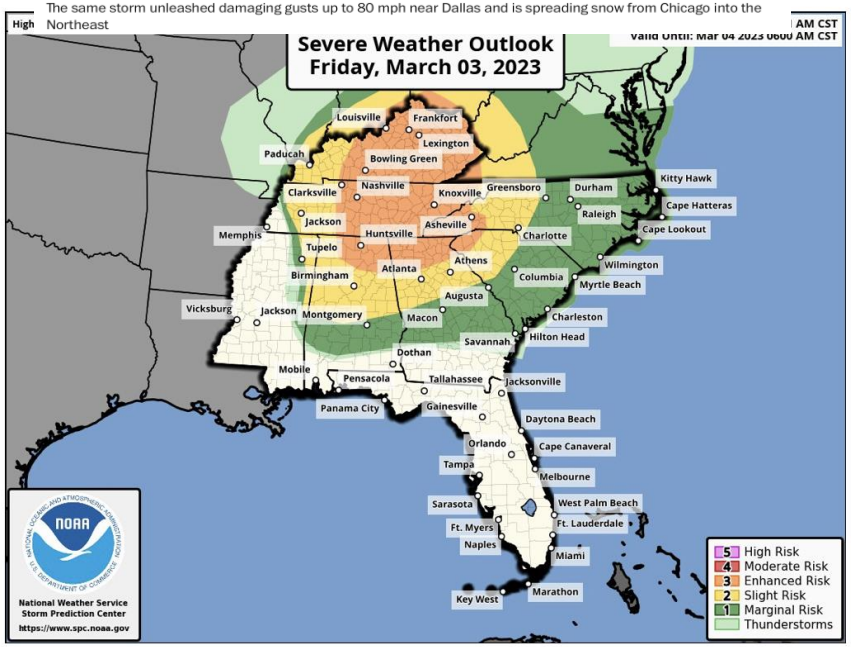
Axios July 14, 2023

- This heat dome – much higher temps than historic or normal heat levels -- affects 115 million people
- Excessive heat is the leading weather-related killer in the U.S. and world-wide
- Higher heat & humidity raises cooling peak loads at the same time that it lessens generation and transmission capabilities
- Equity
  - 1 in 4 American households experience energy insecurity
  - 30% of electric disconnects occur in summer

Washington Post

Storms, high winds cut power to 800,000 in Tennessee Valley, South

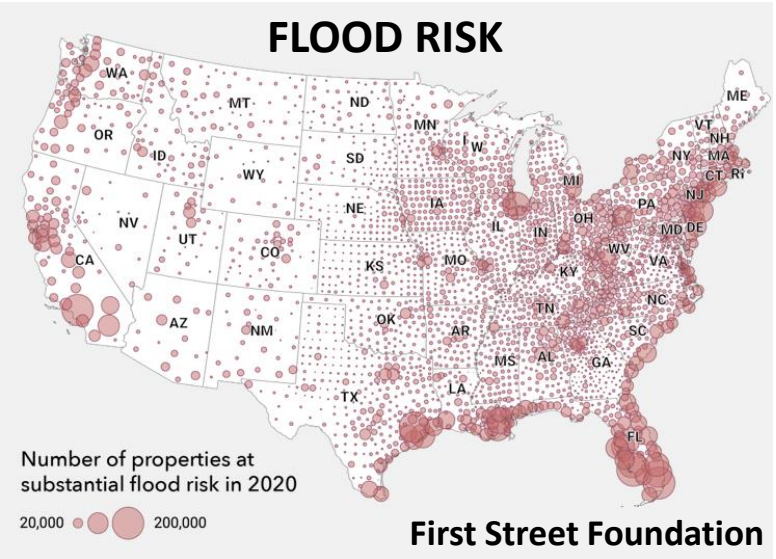
The same storm unleashed damaging gusts up to 80 mph near Dallas and is spreading snow from Chicago into the Northeast



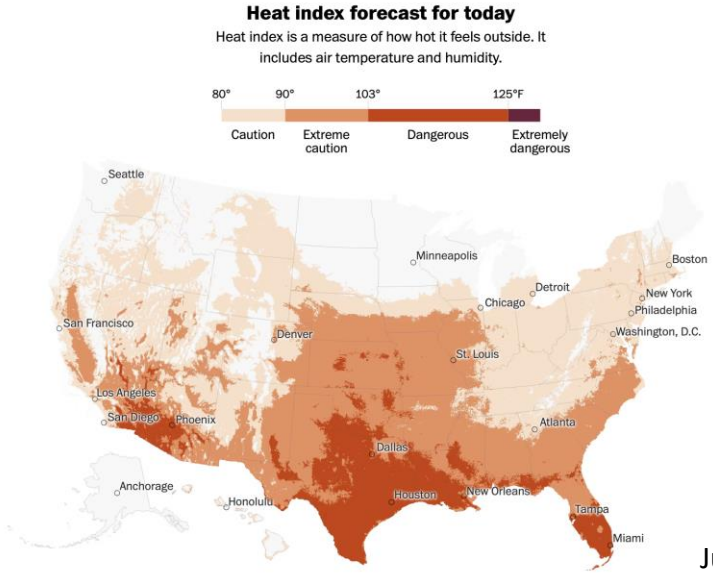
Area at risk of severe thunderstorms Friday. (National Weather Service)

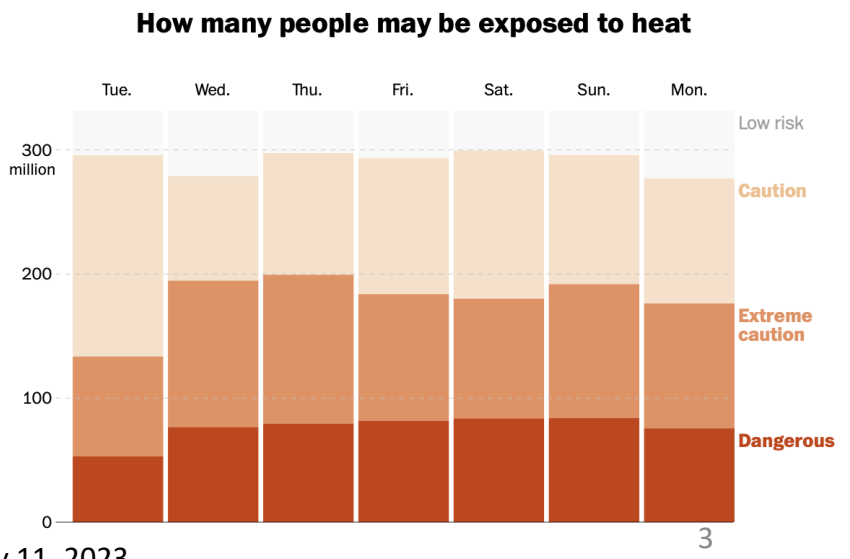
INDEPENDENT

Winter storm Elliott - live: Blizzard kills 56 and grounds 17,000 flights in war zone-like conditions



First Street Foundation

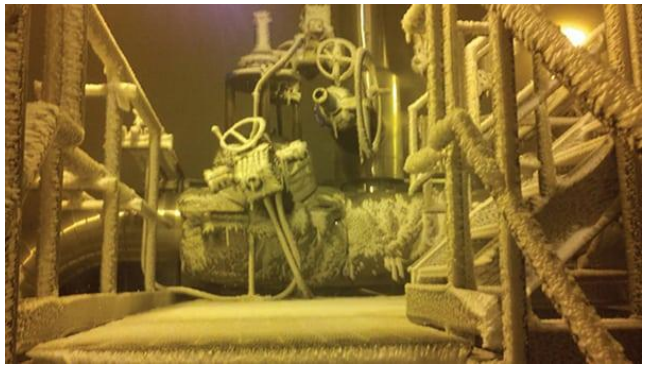




Energy & consumer risks from extreme weather events

Energy risks

- Equipment damages
- Multi-hour & multi-day local service outages from T&D damages and access delays
- Under-performance and outages from generation equipment failures & fuel supply problems
- Higher energy and capital costs and volatility
- Reputational and regulatory accountability and credibility

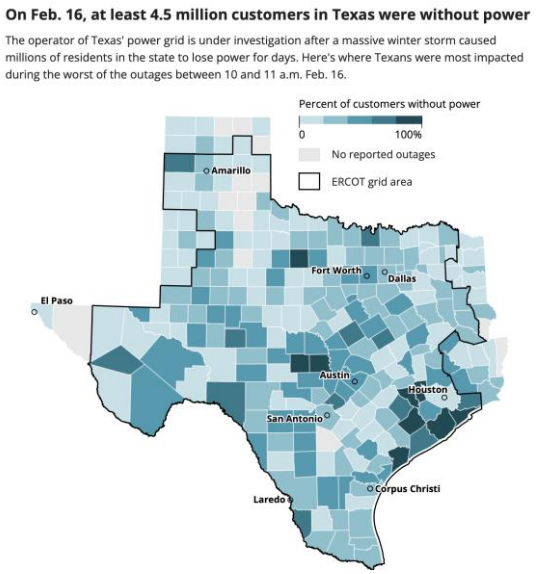


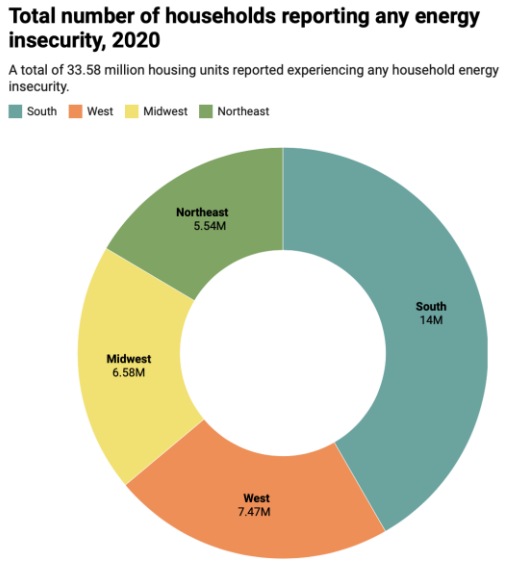


Consumer risks from extreme weather events

Consumer & community risks disproportionately harm low-income and historically disadvantaged communities and populations

- Service outages
- Property damage – direct or due to loss of electric service
- Health & mortality problems
- Household and community survivability in longer and more severe events
- Higher energy bills, higher energy insecurity and disconnection risk





America faces a power disconnection crisis amid rising heat: In 31 states, utilities can shut off electricity for nonpayment in a heat wave

Potential solutions

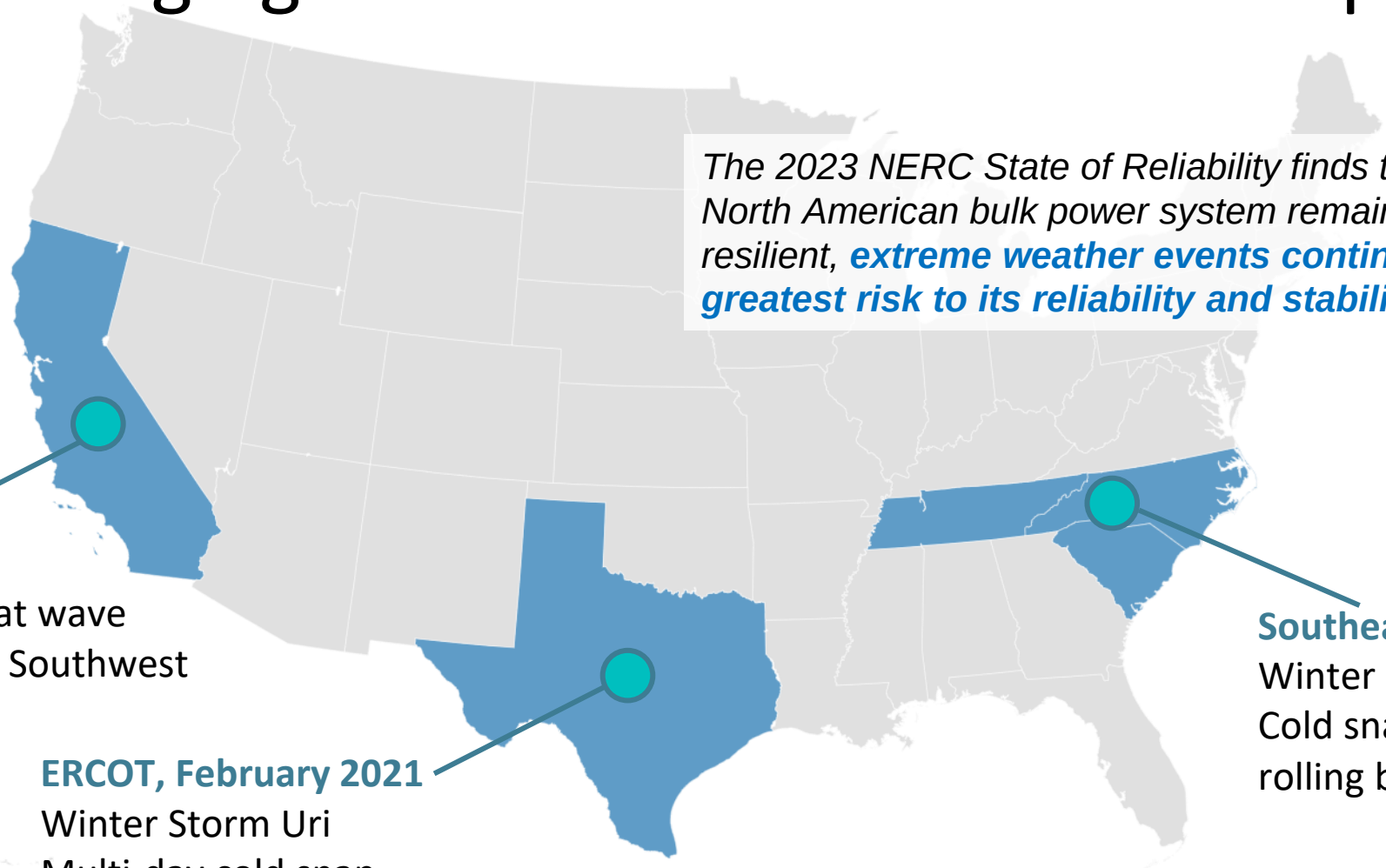
- Better planning, data and analytical methods to address extreme weather risks
  - Stop relying on historical weather and equipment performance data – conditions today and ahead have higher ferocity and frequency
  - Wider-scale weather events and grid operation necessitate regional planning, analysis and infrastructure solutions, not just state-specific measures
- Rethink resource and system assumptions
  - Assume failures will happen and plan to protect people and communities, not just the power system
  - Big systems fail in big ways. Don't just harden centralized and utility-scale assets, but plan for high-probability damage, graceful failure, and fast replacement
  - Treat energy efficiency, demand flexibility and distributed generation and storage assets as high-value, low-cost ways to address resource adequacy, offset and reduce risks of supply-side failure, and enhance community and household resilience and survivability
- Consider measures like disconnection policy, energy efficiency and urban heat island mitigation for equity

Reliability in an Extreme Weather World

Ric O'Connell

GridLAB

Recent extreme weather causing reliability shortfalls and challenging our notions of resource adequacy



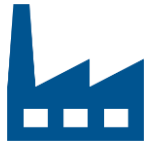
The 2023 NERC State of Reliability finds that while overall, the North American bulk power system remains highly reliable and resilient, ***extreme weather events continue to pose the greatest risk to its reliability and stability.”*** *- NERC*

CAISO, August 2020
Extreme multi-day heat wave
Heat dome across the Southwest

ERCOT, February 2021
Winter Storm Uri
Multi-day cold snap

Southeast, December 2022
Winter Storm Elliott
Cold snap leads to “first ever” rolling blackouts in some areas

Factors leading to challenging reliability conditions



Natural gas as the primary fuel source

missing weather dependent outages and gas electric coordination

Retirements and replacements

getting new resources through the interconnection queue to replace energy and capacity from retiring resources is challenging

Lack of interregional transmission and planning

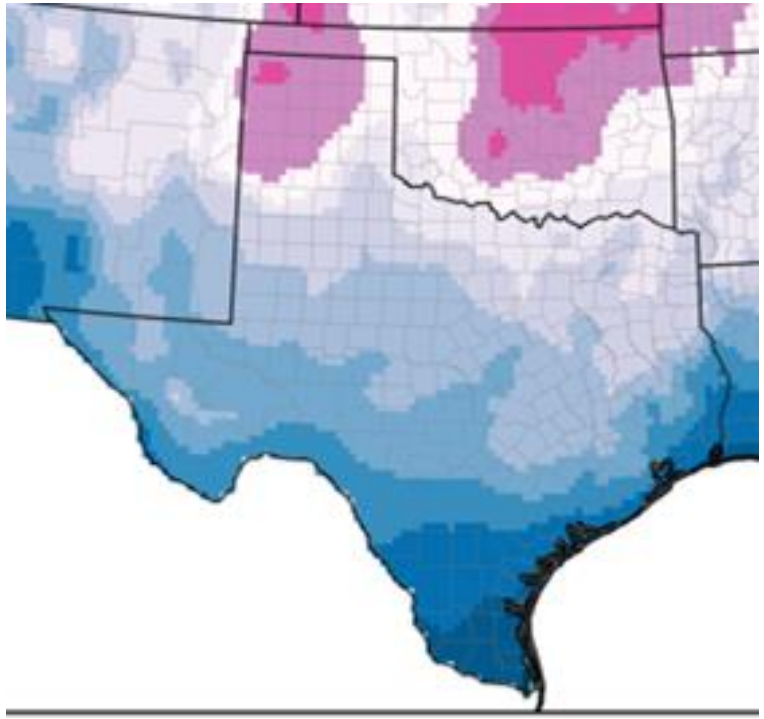
Each region is meeting its own reliability needs, missing opportunities in geographic diversity

Increasing weather dependency of the power system

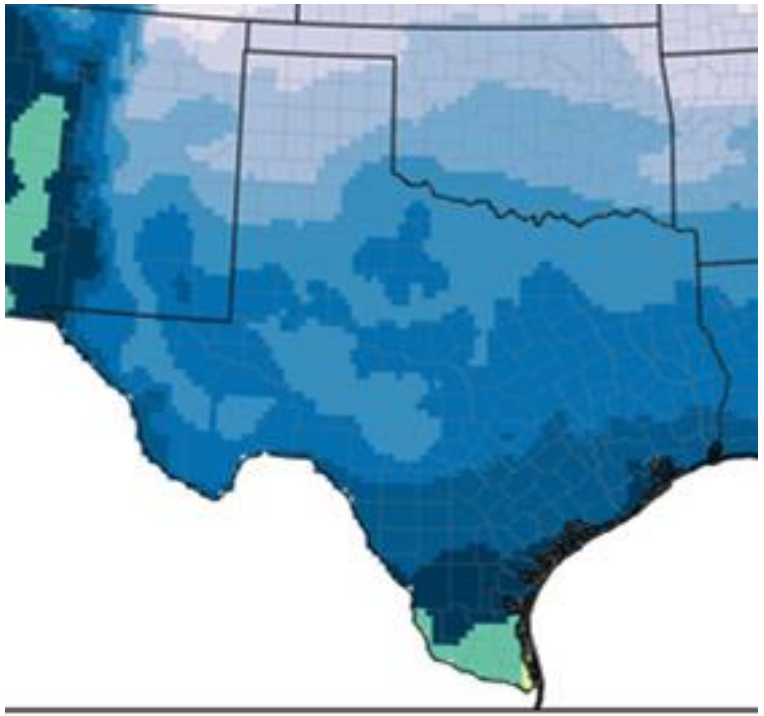
Natural gas sector, thermal outages, increased wind and solar, electrification

Winter is the new Summer

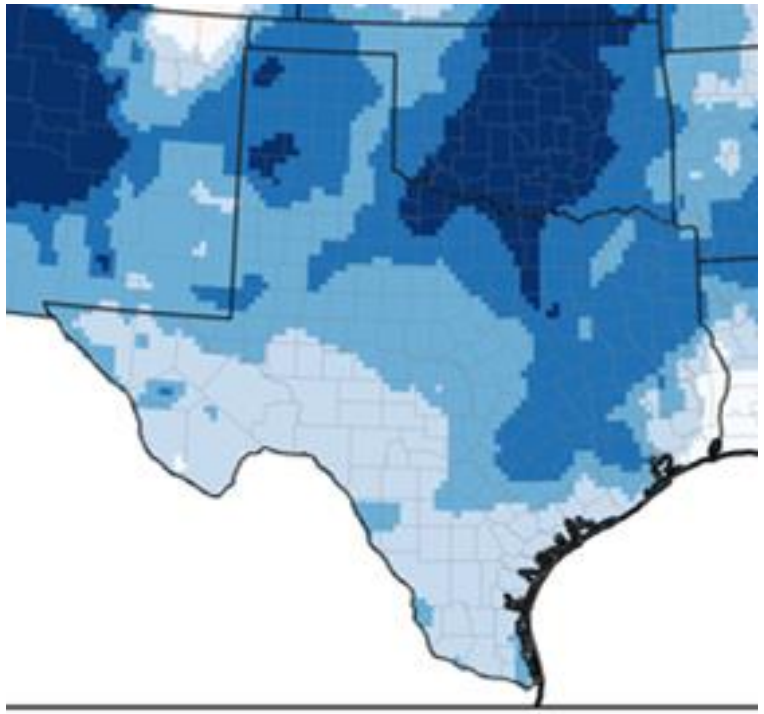
Winter Storm Uri
Feb 15, 2021



Winter Storm Elliott
Dec 23, 2022



How much colder was Uri?

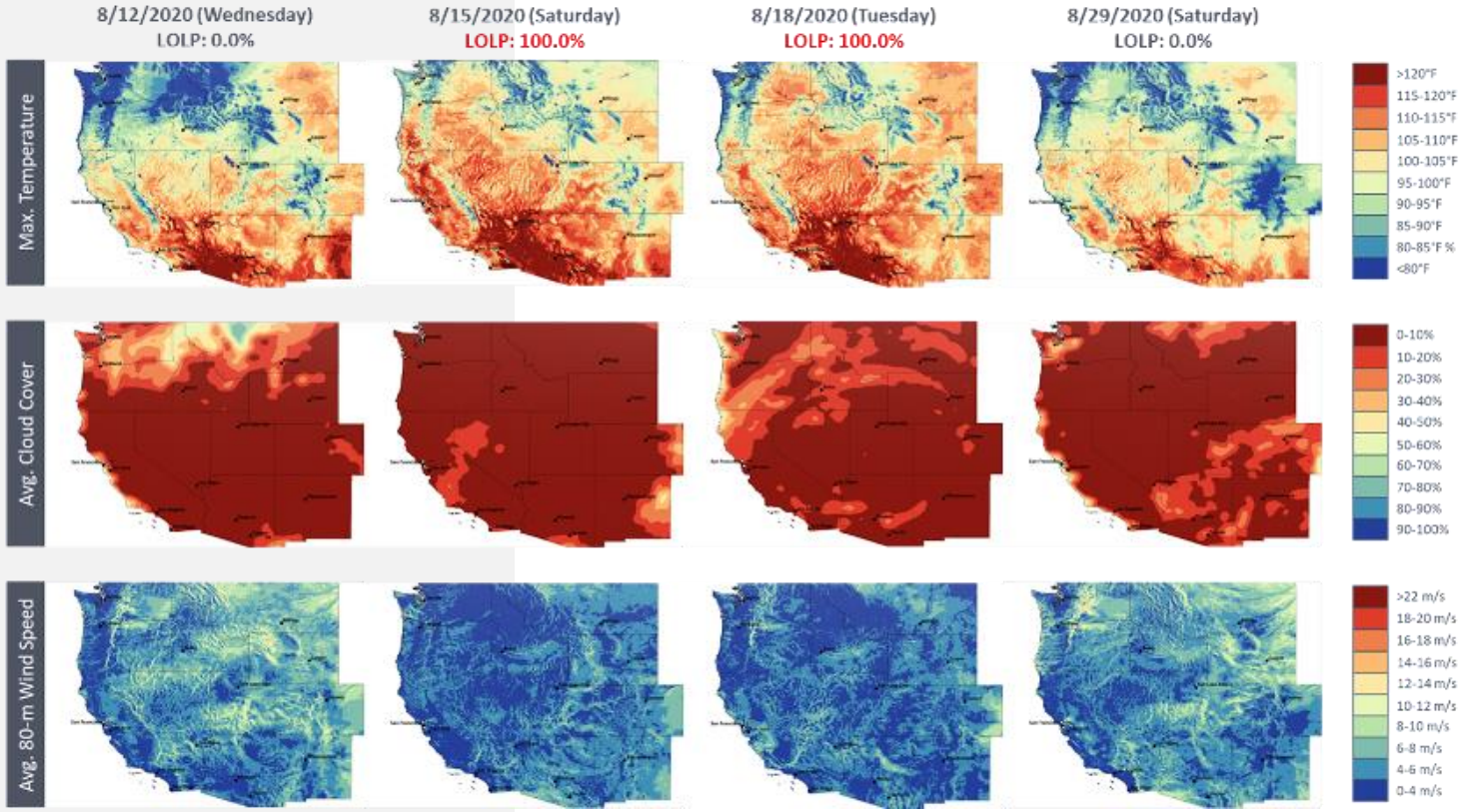


Daily minimum temperature comparison

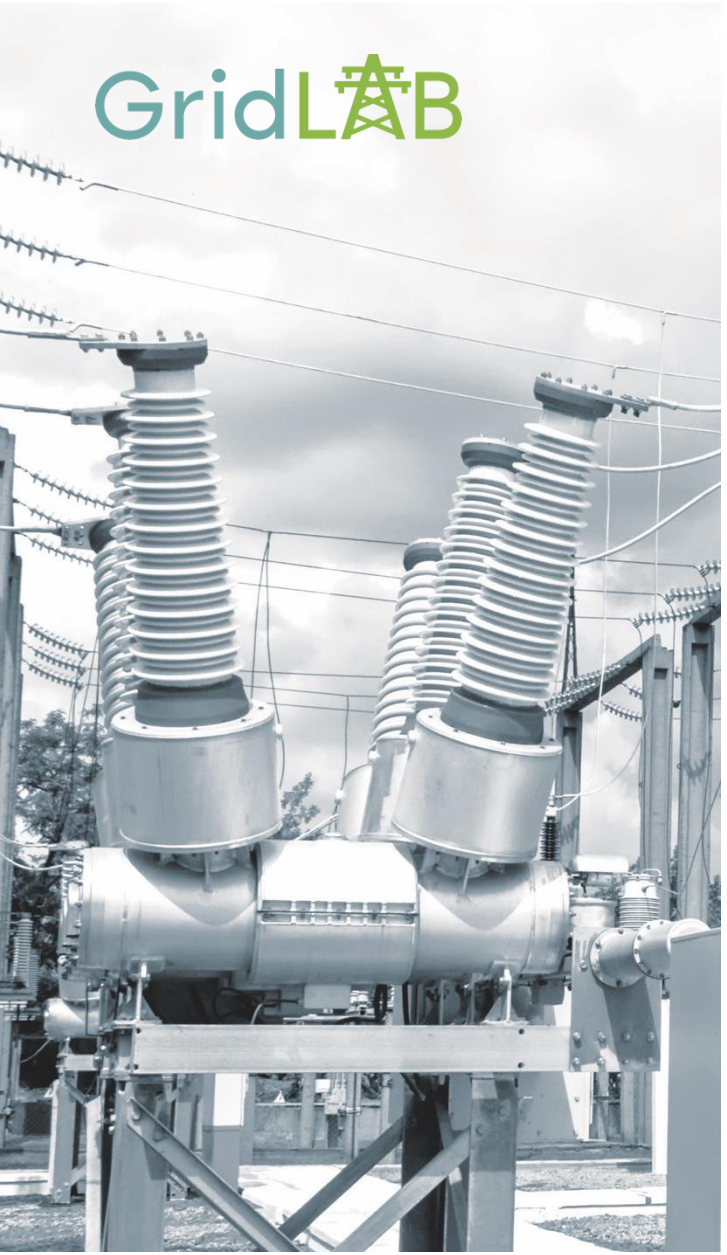
Source: EPRI, Erik Smith, Linkedin post Dec 2022

As the generation mix changes, risk moving from Summer to Winter

Summer risk still high in the West



- **Heat** = High Load, low wind
- **Drought** = low hydro, curtailed thermal due to lack of cooling water
- **Wildfire** = transmission curtailed, low solar output



Solutions

- Careful modeling and accreditation of all resources needed to quantify periods of risk
- Facilitate building resources in the near and long term through queue management, removing barriers to siting, and ensuring robust IRP portfolio development
- Be wary of doubling down on gas, instead rely on a portfolio of resources and a healthy dose of inter-regional transmission