

Analysis of Extreme Temperatures and Peak Power Demand across Texas

Electric Reliability Council of Texas

- The Electric Reliability Council of Texas (ERCOT) manages the electric grid across most of Texas¹.
- It covers 90% of the state electric load and 75% of the land area.
- The Texas Interconnection can only import a fraction of the demand from other interconnections.

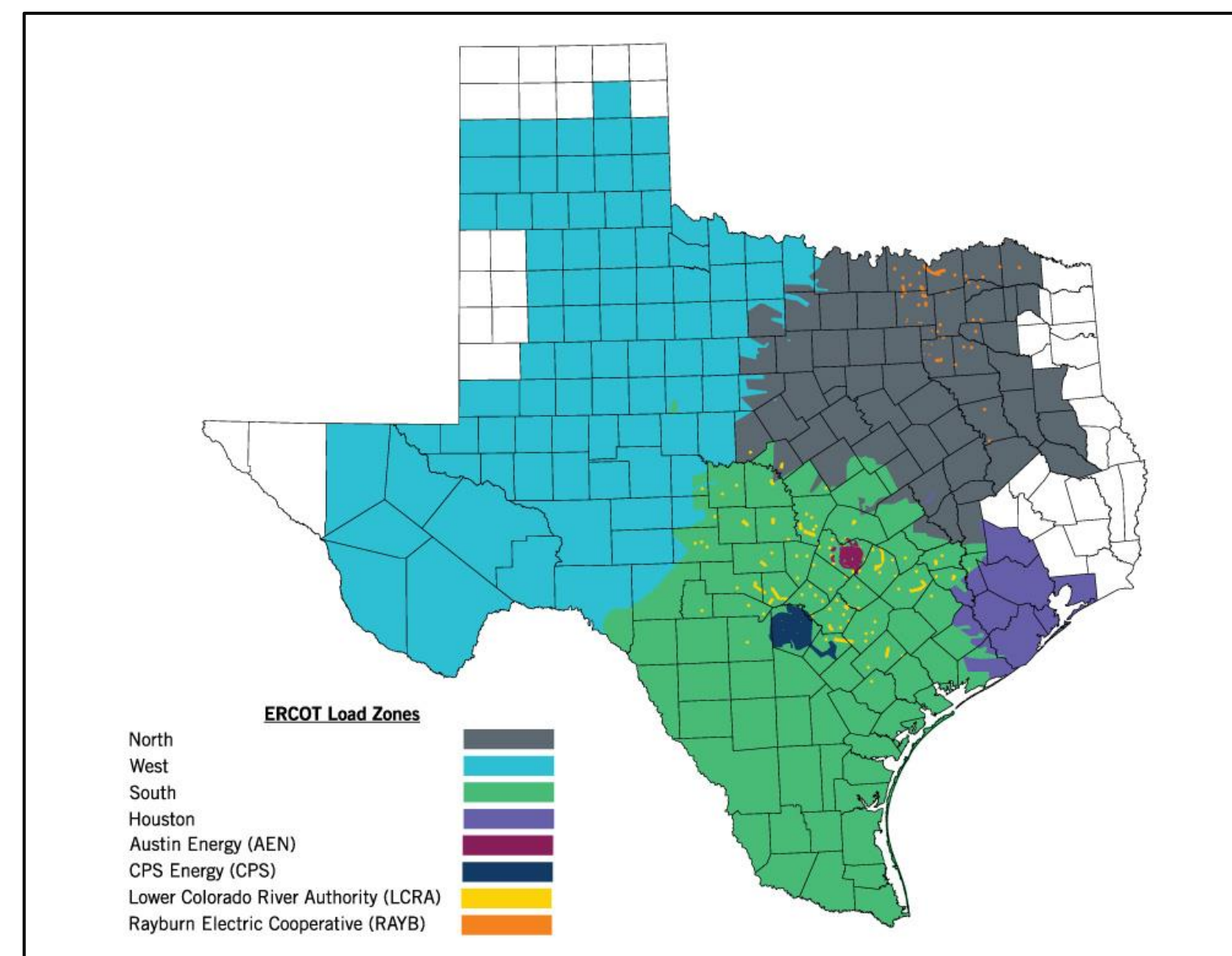


Figure 1. ERCOT Load Zone Map¹.

Trends in Peak Inferred Power Demand

- The degree day approach is used to analyze trends (using non-parametric trend test) in the peak inferred power demand aggregated across Texas. The Annual Maximum is the peak metric of interest.
- The Annual Maximum Inferred Demand is analyzed using a block maximum approach (Using block size of 72 hours).
- The 10-yr return levels on the Annual Maximum time series are computed using a Generalized Extreme Value (GEV) Distribution.

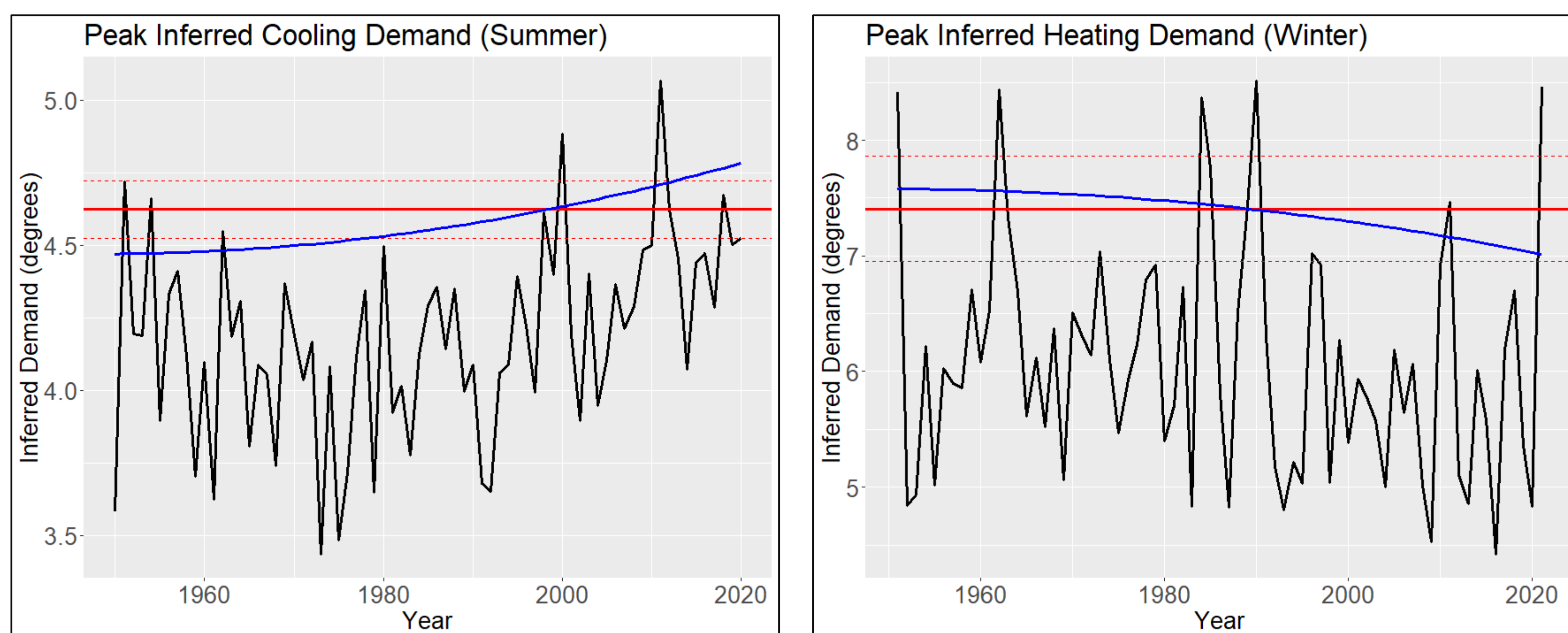


Figure 2. Annual Maximum per-capita inferred demand (black line) for cooling (left) and heating (right). The 10-yr return periods are computed using a stationary (red) and non-stationary (blue) distribution.

Winter Storms and Summer Heatwaves

- Extreme temperatures play confounding roles of increasing residential demand along with greater health hazards and supply constriction².
- During February 2021, Texas was hit hard with freezing temperatures leading to cascading failures and millions of Texans without heat and electricity for days.
- The risk of overheating in residential buildings in Dallas and Houston is high³.
- Prolonged grid failures represent significant health hazards.
- This duality complicates power system operations.

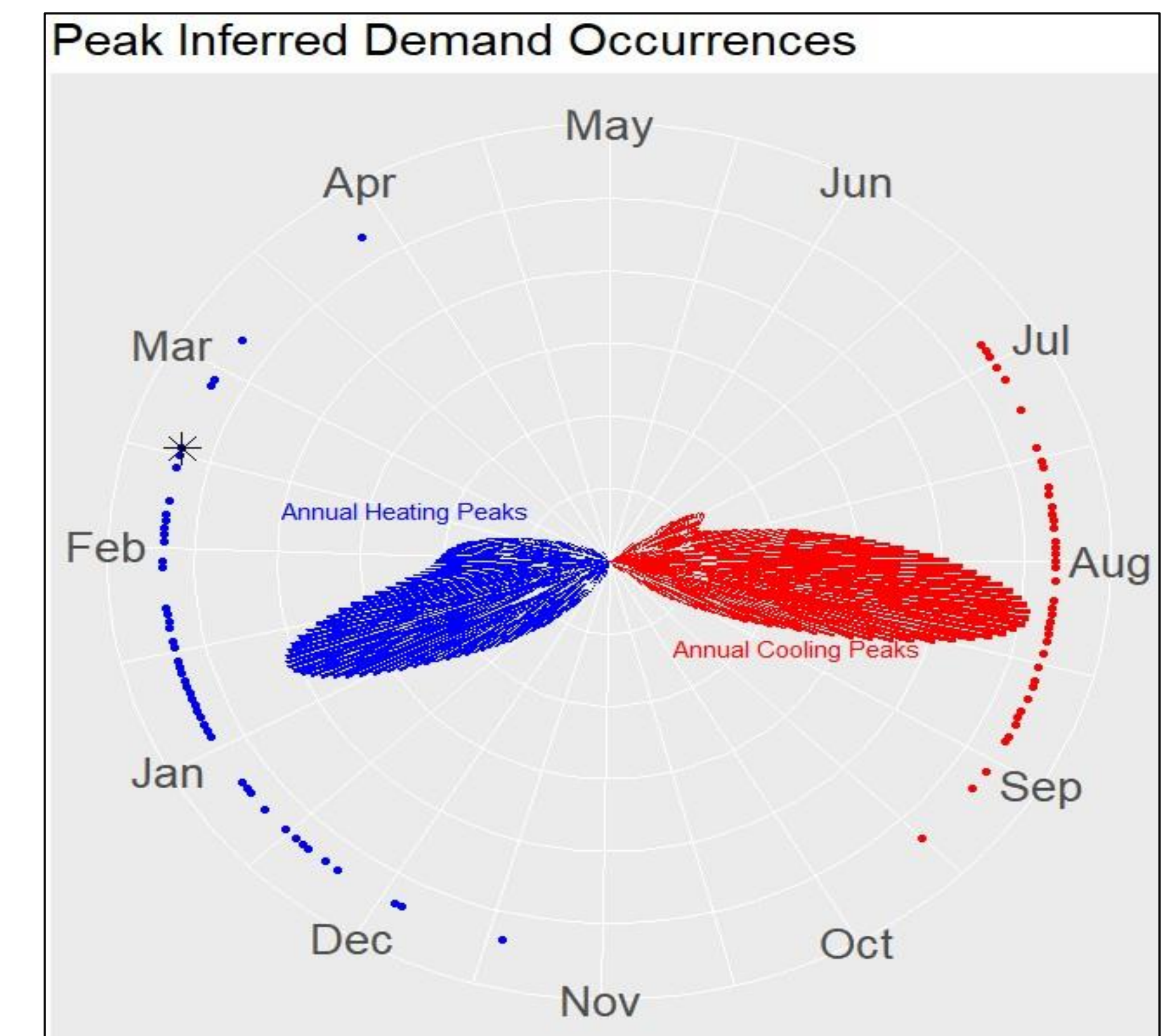


Figure 3. Day-of-year occurrence of all summer (cooling) and winter (heating) extreme demand proxies from 1950-2020. The asterisk denotes Winter Storm Uri.

Conclusion

- Overall, summer cooling peak demands have shown increasing trends whereas winter heating peak demands have remained the same.
- The cities of the future must plan for these extreme temperatures and their associated stresses to their electric grid.

References

- 1 – "About ERCOT." Electric Reliability Council of Texas. <http://www.ercot.com/about>. Accessed 10 July 2021.
- 2 – Stone Jr, Brian, et al. "Climate change and infrastructure risk: Indoor heat exposure during a concurrent heat wave and blackout event in Phoenix, Arizona." *Urban Climate* 36 (2021): 100787.
- 3 – Sailor, David J., et al. "The growing threat of heat disasters." *Environmental Research Letters* 14.5 (2019): 054006.