James Doss-Gollin, Houston, TX, February 17, 2021.

A Cascading Failure of Imagination

Predictable? Sure. Preventable? Harder.

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Tuesday, 28 September, 2021

HEPG Session on Tail Events
Remote Presentation

I'm fortunate to work with great people!

Upmanu Lall

David J. Farnham

Vijay Modi

Yash Amonkar

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Rice CEVE Colleagues

Doss-Gollin Lab @ Rice CEVE:

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Yuchen Lu

Alyssa Graham

Sophia Prieto

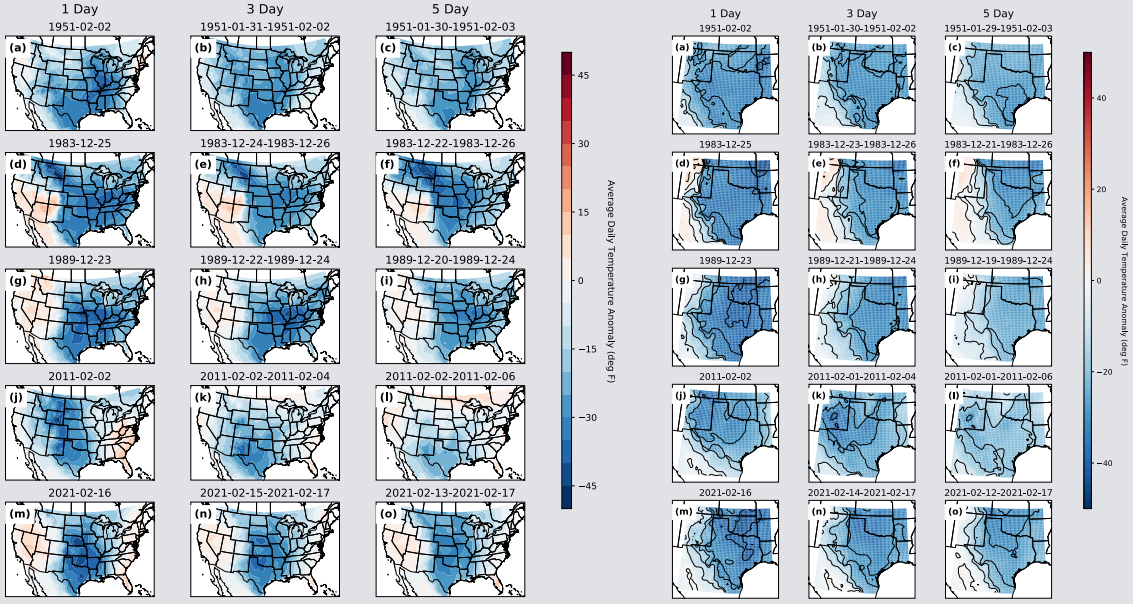
Uri swamped our best-laid (?) plans

1. SARA (ERCOT, 2020): “Based on the 2011 winter and a revised economic growth forecast…the extreme winter forecast is 67 208 MW”
2. Magness (2021): peak winter 2021 load without shed: 76 819 MW

Compare to:

1. 59 000 MW winter 2011 peak
2. 73 462 MW 2021 summer peak
3. 74 820 MW summer record (2019)

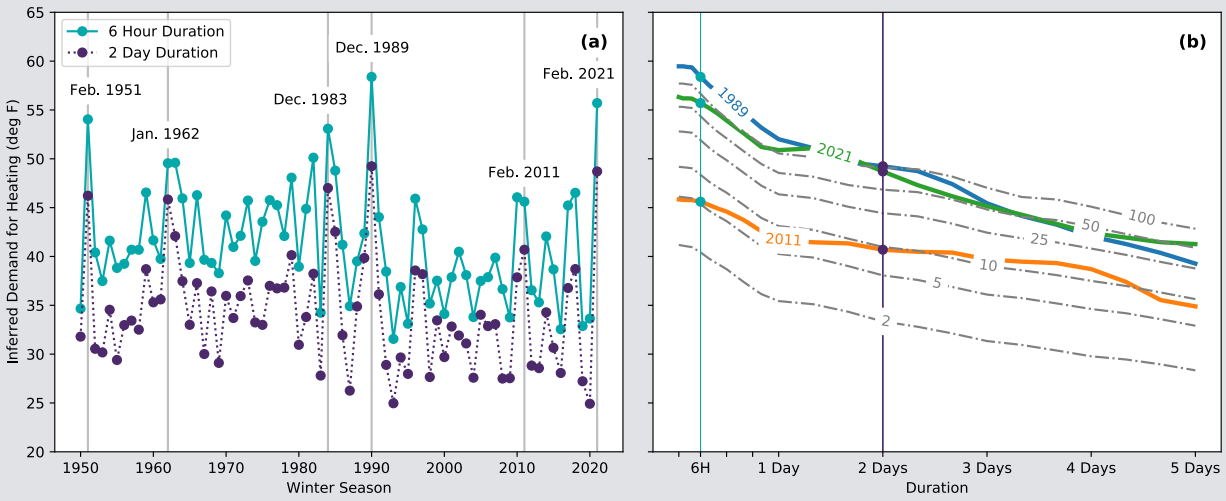
Qualitatively similar cold snaps in recent decades



Doss-Gollin et al. (2021), fig. 1 and S2

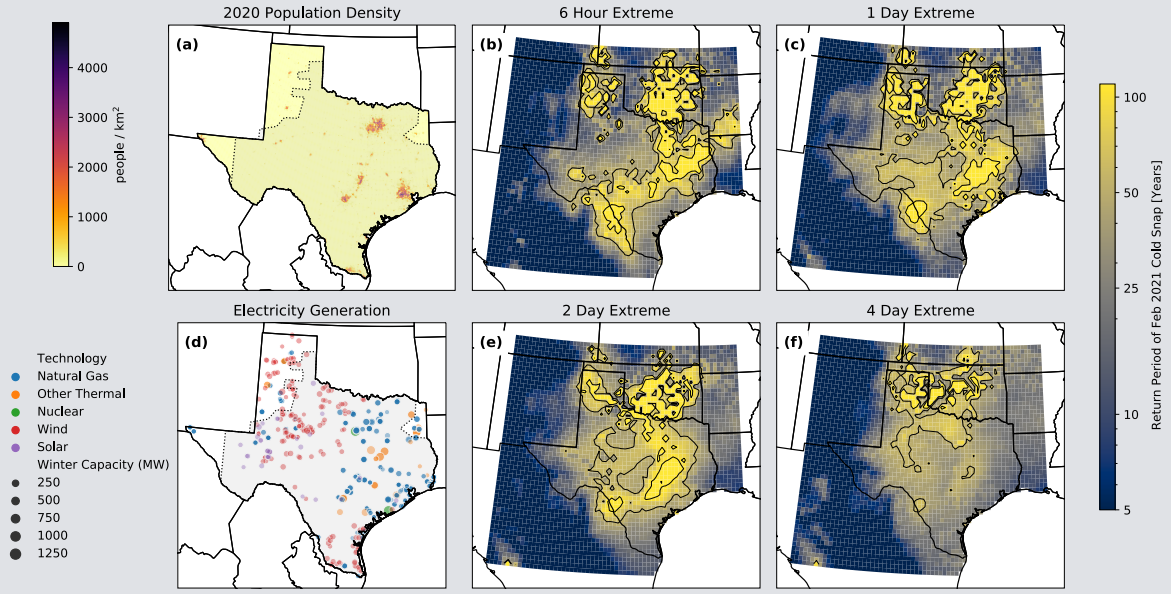
1989 weather + 2020 population would have driven higher peak demand

Gridded Temperature → Heating Degree Hours (to 65 °F) →
Integrate, weighting each pixel by 2020 Population



Doss-Gollin et al. (2021), fig. 2

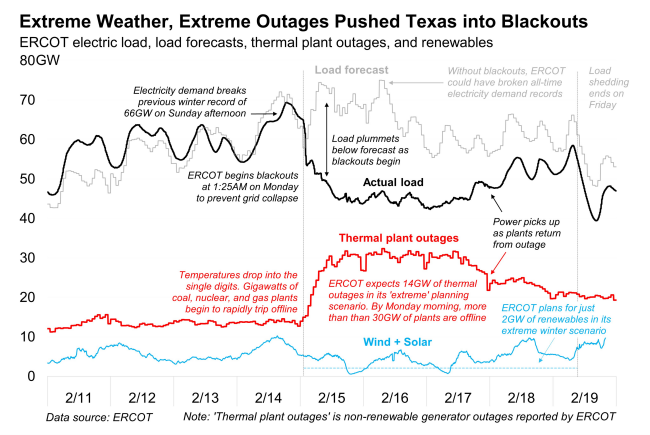
Return period $\ll$ 100 years in most of Texas



Doss-Gollin et al. (2021)

Beyond demand for heating

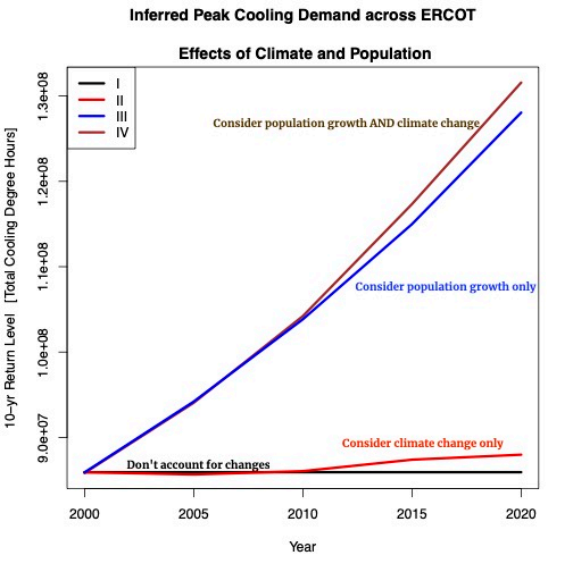
Although not extraordinary, temperatures overwhelmed Texas infrastructure



(L): Brian Bartholomew; (C,R) James Doss-Gollin

Grids will adapt or perish

1. Climate change
   - 1.1 fewer/weaker cold snaps in long term, possibly worse next 2-3 decades (Cohen et al., 2021)
   - 1.2 lots of other electricity-relevant impacts (wind, heat, drought, floods, etc.)
2. Population growth (Texas Water Development Board, 2012, says 40% 2020-2050)
3. Electrification of heating, transport, etc.



Amonkar et al, in prep.

Questions to consider

1. What should analysts & modelers (like me!) do when we identify gaps in preparedness? This vulnerability was old news (see NERC, 2013)!
2. Do the tools that guide investment in our electricity systems adequately capture weather & climate risks?
3. How can we live safely, prosperously, and equitably with $< 100\%$ reliability?

thanks!

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