



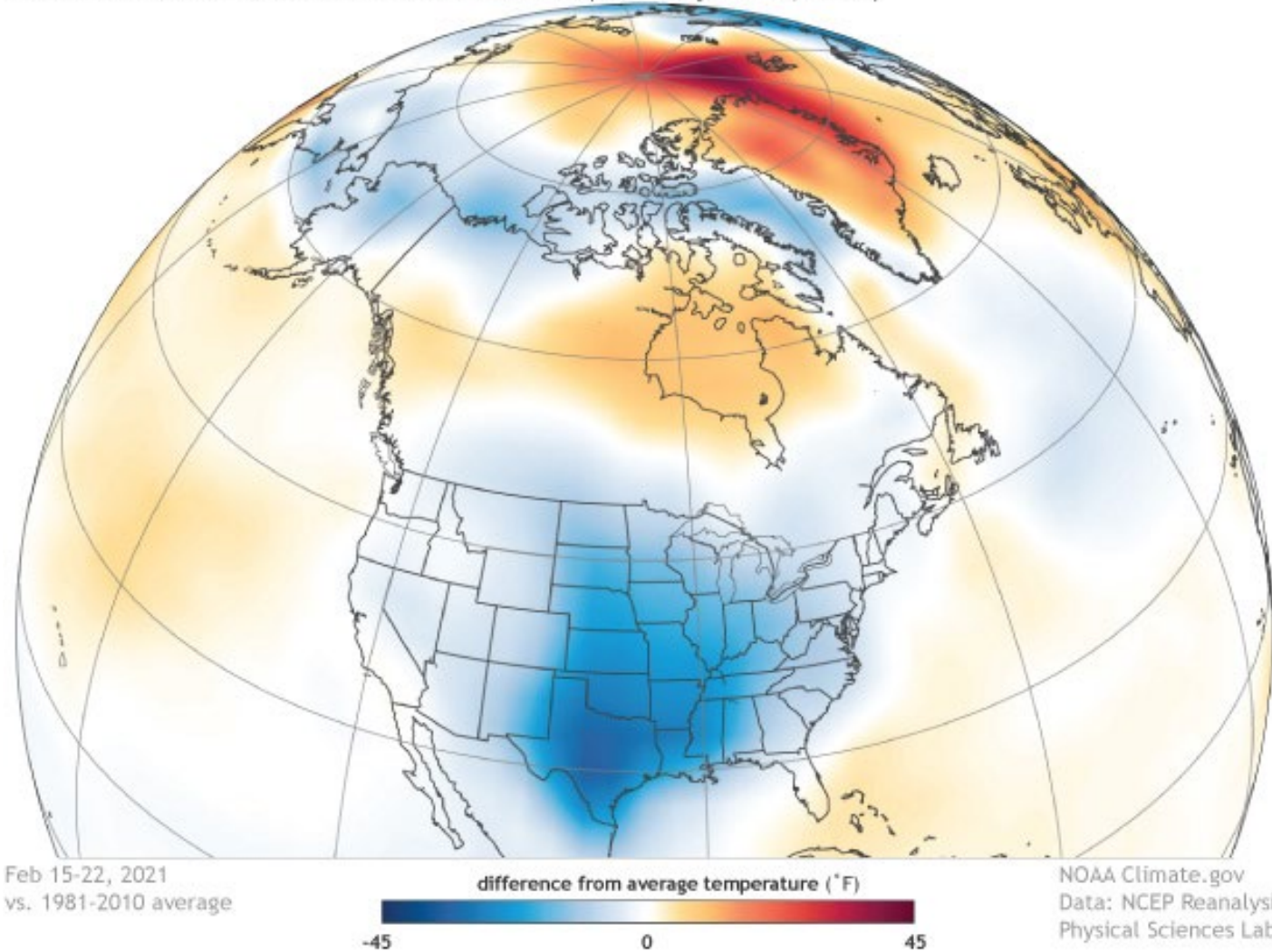
Natural gas: Building gas system resilience. Overview of the 2021 polar vortex and its implications for gas resiliency

*National Association of State Utility Consumer Advocates (“NASUCA”).
Virtual mid-year meeting, June 14, 2021.*

David E. Dismukes, Ph.D.
Center for Energy Studies
Louisiana State University

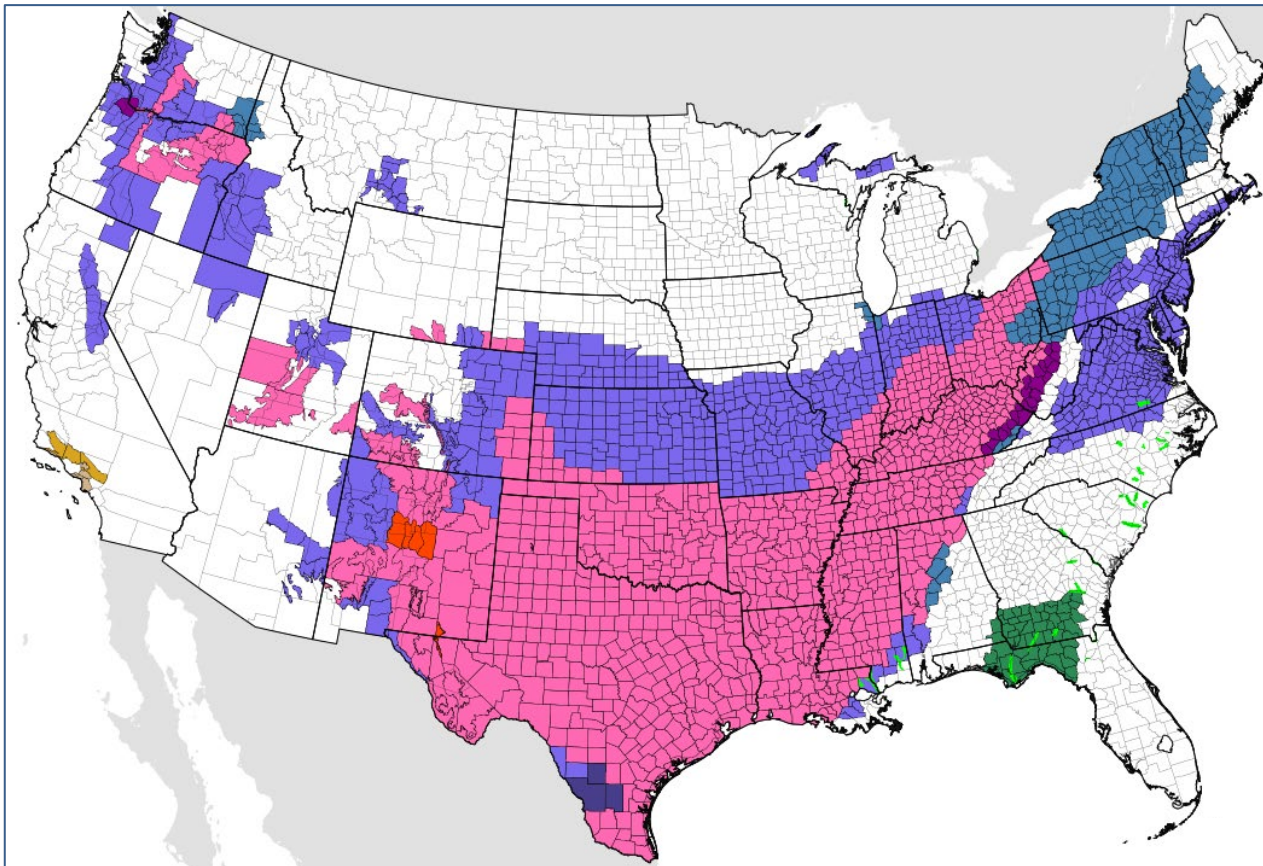
2021 Polar Vortex (Winter storm "Uri")

Extreme cold in south-central United States (February 15-22, 2021)



2021 Polar Vortex (Winter storm “Uri”): warnings.

2021 brought one of the broadest, most significant winter storms in history. Impacts were most pervasive in places not accustomed to such extreme winter temperatures.



Source: Cappucci, Matthew; Freedman, Andrew. Historic Arctic outbreak brings dangerous cold, snow and ice to central and southern U.S.

Washington Post. Feb. 14, 2021.

Available at: <https://www.washingtonpost.com/weather/2021/02/14/arctic-outbreak-south-cold-snow/>

Regional Impacts – Electrical Outages**ERCOT:**

- ERCOT set a winter demand record of 69 GW of usage on the grid.
- Significant power generation capacity (48 percent) was forced offline by the extreme weather.
- 4.4 million people in Texas were without power.
- Texas implemented rolling blackouts, which had the unintended consequences that exacerbated energy supply availability (such as natural gas systems outages).

SPP:

- Record load of over 42 GW was measured from 2/15-2/16 in SPP.
- 35 GW of generator forced outages.

Regional Impacts – Electrical Outages**MISO:**

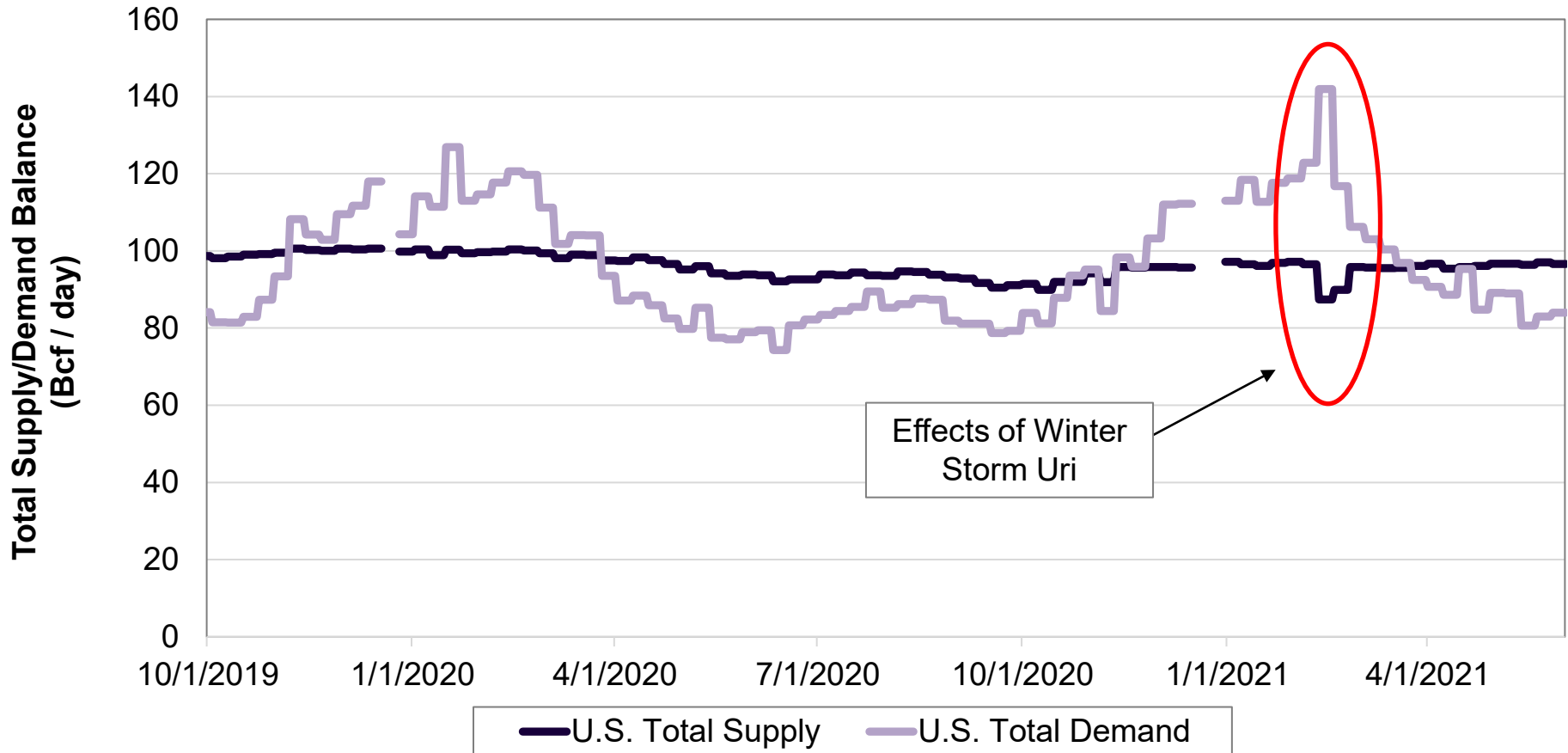
- Demand peak of MISO South = 31.6 GW
- 75,000 of Entergy's MISO south residential clients lost power.

PJM:

- While this was mostly a southwestern/midwestern/central event, PJM provided resources to compensate for losses.
- PJM export a record high of 15.7 GW of power flowing to MISO and SPP.

Natural gas impacts (demand, supply)

Monthly natural gas demand was 11.8 percent above prior winter levels. Monthly supply levels fell by over 12.9 percent.



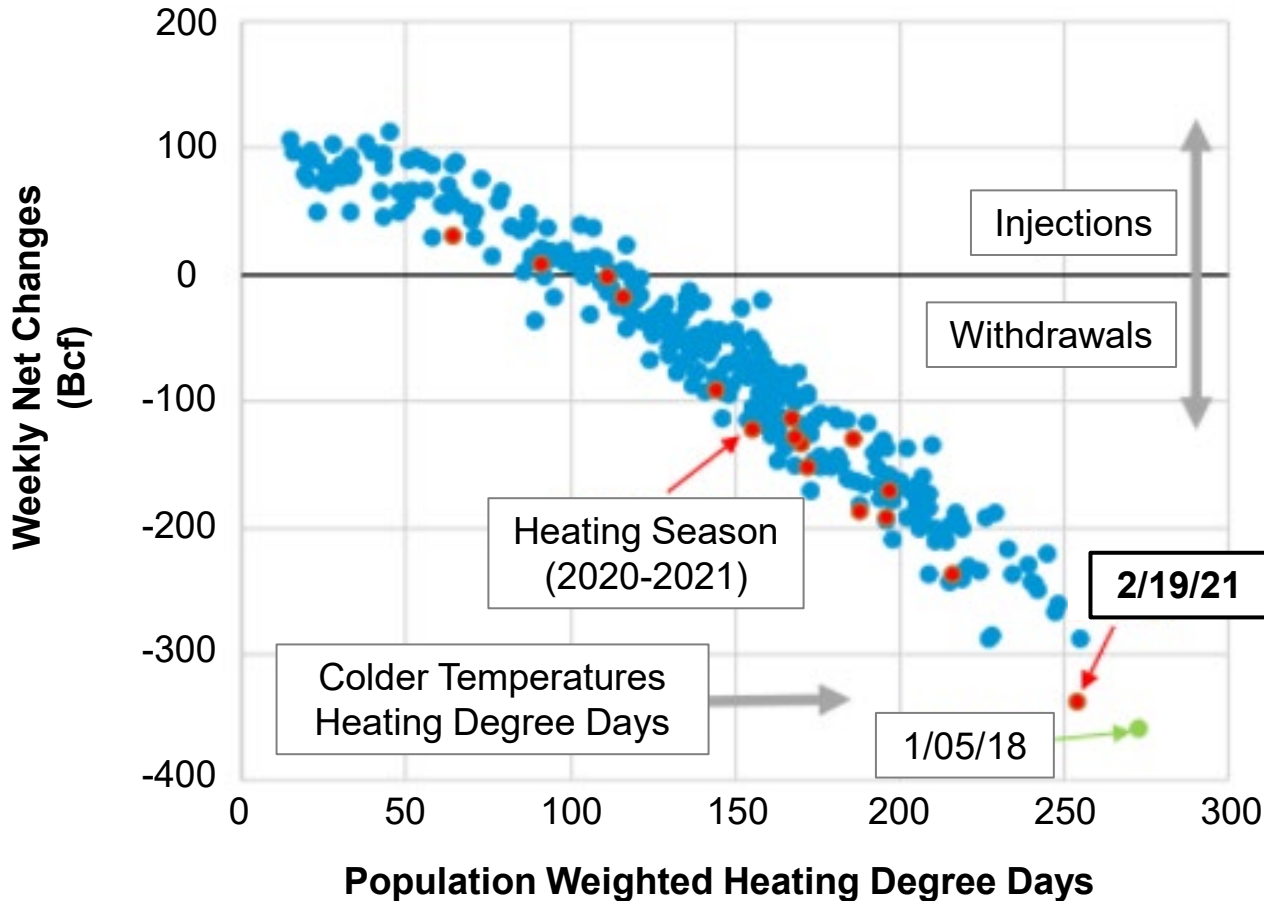
Notes: (1) The chart below presents daily averages, reported on a weekly basis by IHS Markit. (2) There are two instances of data unavailability.

Source: U.S. Energy Information Administration.

Available at: https://www.eia.gov/naturalgas/weekly/archivenew_ngwu/2021/02_25/

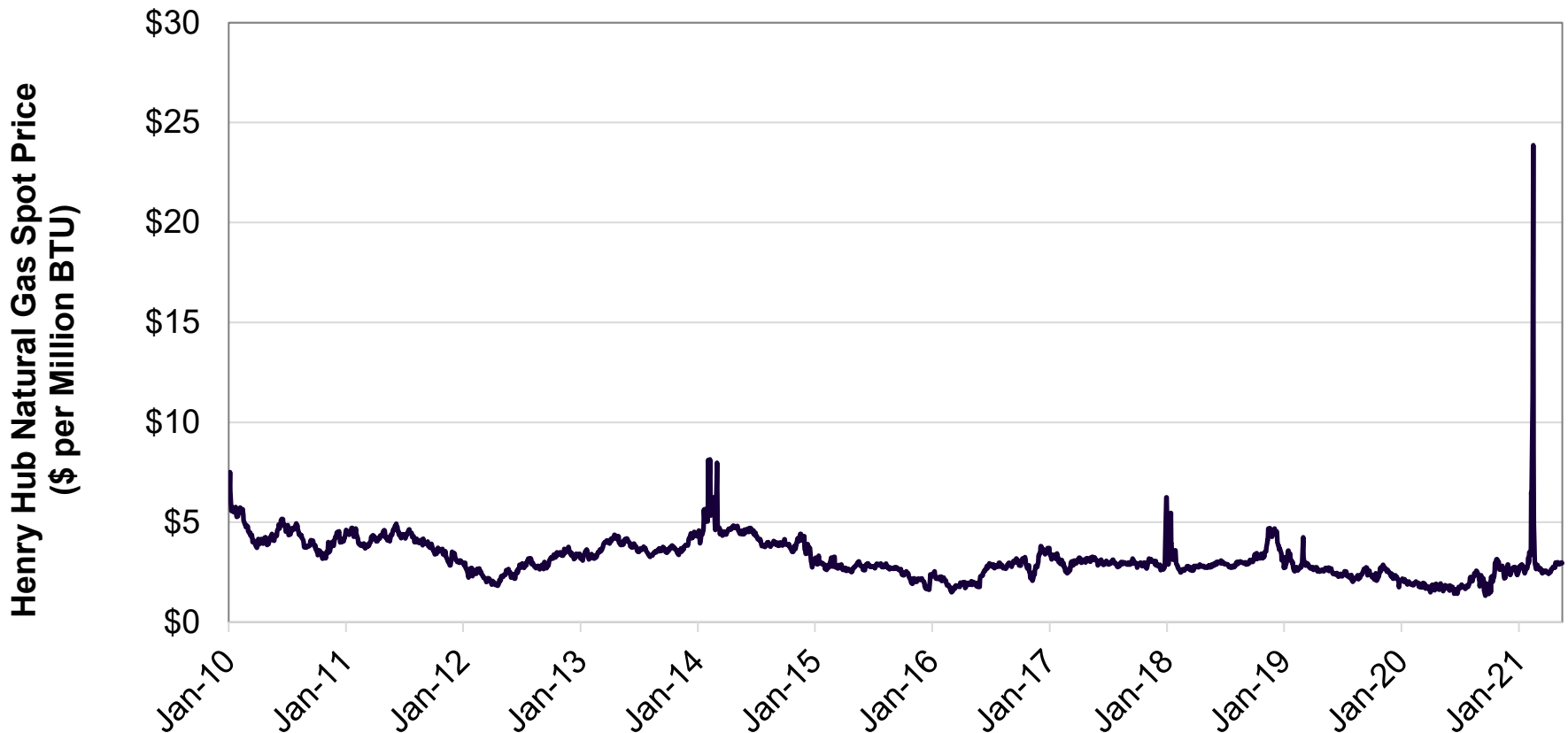
U.S. natural gas storage withdrawals

Record-breaking temperatures combined with production shortfalls led to near-record levels of natural gas withdrawals.



Henry Hub Natural Gas Spot Prices (2010–2021) (Daily)

From 2/10 – 2/17, the Henry Hub spot price rose from \$3.68/MMBtu per million to \$23.61/MMBtu, the highest nominal price going back to at least 1993.



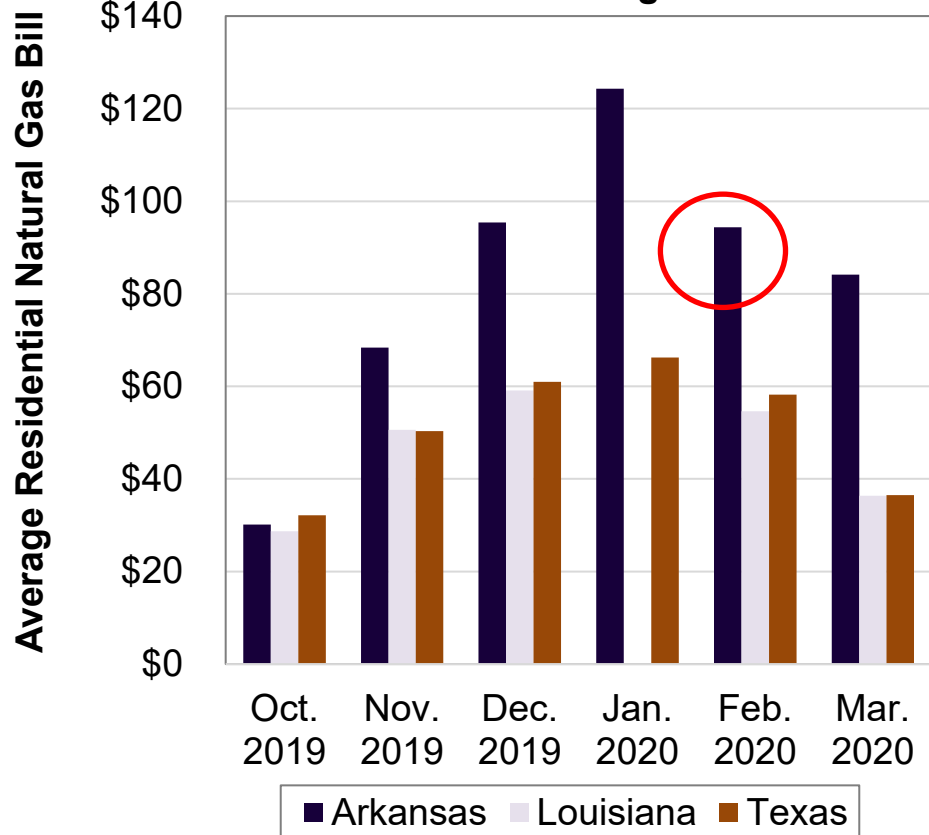
Natural Gas Prices — Overview

- Prices in some regions of the country set records amid record-low temperatures and supply disruptions.
- From 2/10 – 2/16, **prices at major Texas hubs increased dramatically**, setting all-time records (going back to 1993).
 - Katy Hub: \$4.50/MMBtu → \$352.64/MMBtu
 - Houston Ship Channel: \$4.50/MMBtu → \$400/MMBtu
- From 2/10 – 2/17, **the South Louisiana regional average price also increased significantly**, from \$3.62/MMBtu to \$15.96/MMBtu, the highest price on record.
- Midwestern prices also rose to record-setting levels.
 - At the **Chicago Citygate**, prices rose to **\$129.52/MMBtu** on 2/12
 - Highest price on record going back to 1993.

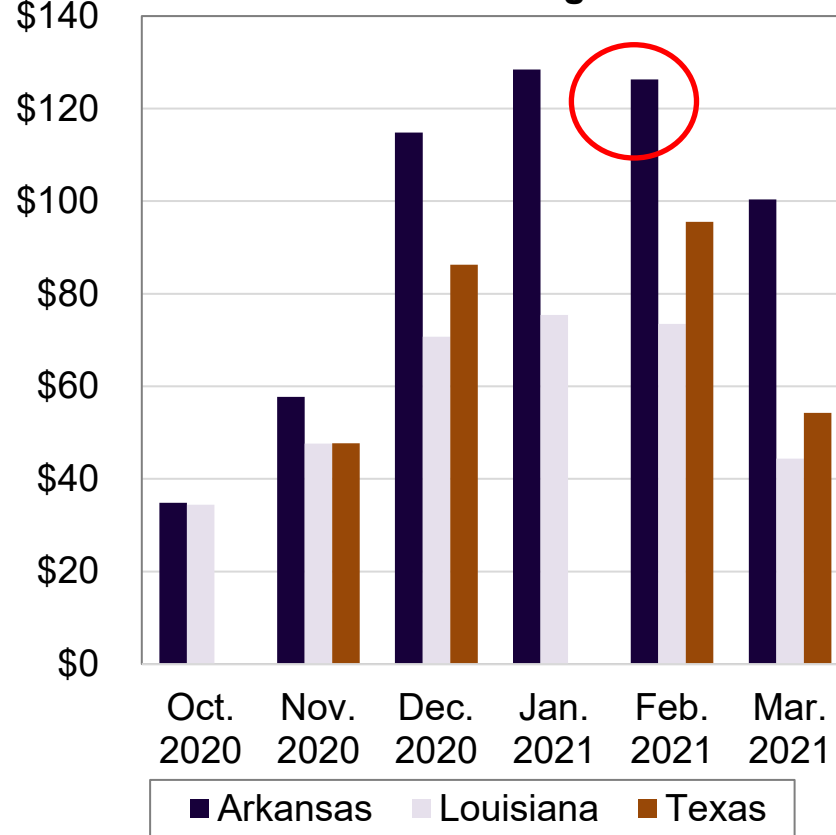
Residential natural gas bill impacts

As compared to the prior winter season, residential natural gas bills were 13% higher in Arkansas, 26% higher in Louisiana, and 40% higher in Texas during the 2020/2021 winter season.

2019-2020 Heating Season



2020-2021 Heating Season



Policy issues

Event has led to several questions that include:

- When will we learn that gas and power systems are interrelated?
- Do competitive markets facilitate or prejudice resilience?
- How do we protect ratepayers?
- Should we prioritize hardening investments and if so, how quickly?
- How to we reconcile increased resilience investment with net zero GHG goals?

Questions, comments and discussion.



David E. Dismukes

Professor and Executive Director

Center for Energy Studies

Email: dismukes@lsu.edu

Phone: 225-578-4343

URL: www.enrg.lsu.edu