Texas cold snap highlights need for improved power systems

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With extreme weather events rising in frequency, the need for a prepared modern energy grid grows.

The greatest demand for electricity in Texas is traditionally during the hottest days of the year, when air conditioners turn on full blast to beat the heat. But in February 2021, an unusually long spell of cold weather took the region by surprise. It resulted in high demand for electricity, more than 4.5 million Texans losing power, 210 deaths and direct economic costs estimated at $15–$27 billion.

Texas's event made news for its terrible societal and economic impact. Researchers from the U.S. Department of Energy's (DOE) Argonne National Laboratory studied it from another angle: how Texas and other parts of the country can improve power system planning and electricity market operations.

Their article, "Extreme weather and electricity markets: Key lessons from the February 2021 Texas crisis," was published in the Jan. 6, 2022 issue of *Joule*.

"Usually, we don't think about electricity because it's always there," said Audun Botterud, a principal energy systems engineer at Argonne who co-authored the article with lead author Todd Levin and W. Neal Mann, Jonghwan Kwon and Zhi Zhou. "The Texas event really illustrated how critical the electric power system is to society and how dependent we are on it. It also illustrated how bad things can get if we lose power for extended time."

Climate projections show that extreme weather events will happen more often with every uptick in global warming. The Texas event was the first cold weather event in the U.S. to deliver the kind of punch usually felt after a major hurricane. More research can help the power industry enhance their long-term plans and also operate reliably in the short-term in the face of such changes.

This is especially true as a greater share of power comes from renewable

energy sources like wind and solar, which depend heavily on weather.

"There are a lot of connections between the electricity sector, other energy sources such as natural gas and its associated infrastructure," said Levin, also a principal energy systems engineer. "Weather has always been a factor in power system planning but we have to rethink our procedures as the climate changes and our technologies become more sensitive to weather."

Plans made based on historical weather patterns don't reflect the changing climate and the impact on tomorrow's energy sources.

"It's easy to look back in hindsight and say we could have avoided what happened in Texas," said Levin. "But looking forward, how can we strengthen power systems to withstand extreme weather events? It's not necessarily realistic or even ideal to build a system that never has power outages. The cost of creating it might outweigh the benefit. We have to do more research and analysis to understand the trade-offs."

According to the authors, power system plans need to use new information from state-of-the-art climate projection models. Systems may find, after review, that it's worth the cost to weatherize equipment. Electricity markets may need to rethink designs so power is available when people need it most, tomorrow and five years from now.

Additionally, to reduce the likelihood and impact of system-wide emergencies, transmission lines that connect regions could improve national or regional coordination. Policy, regulatory frameworks and improved forecasting can help, too.

"As we face a future where renewable energy becomes more prominent, the effect of weather becomes more important in power systems planning," said Botterud. "The event in Texas makes us examine how we

can better manage power systems in the future."

More information: Todd Levin et al, Extreme weather and electricity markets: Key lessons from the February 2021 Texas crisis, *Joule* (2022). DOI: 10.1016/j.joule.2021.12.015

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