Targeted demand response reduces price volatility of electric grid

March 23 2022, by Rachel Rose

Credit: CC0 Public Domain

Demand response, a measure taken to reduce the energy load in response to supply constraints within the Texas electric grid, has been a topic of recent conversation after the wake of Winter Storm Uri just one year

ago. Demand response can enhance the reliability of the grid through renewable energy penetration and also significantly reduce price volatility, or fluctuation, in the wholesale electricity market.

To reduce the energy load across the entirety of the state's grid, traditional demand response studies focus on reducing the energy load in high population centers such as Houston and Dallas. However, Le Xie, professor in the Department of Electrical and Computer Engineering at Texas A&M University, and his team found that focusing on a few strategic locations across the state outside those high-population areas is much more cost-effective and can have a greater impact on the price volatility of the grid. A machine learning algorithm is utilized to strategically select these demand response locations based on a synthetic Texas grid model.

This research was published in the February issue of the journal *iScience*.

"Suppose today's electricity demand results in high prices and yesterday's electricity demand resulted in low prices," said postdoctoral researcher Ki-Yeob Lee, who designed the algorithm used in the paper. "Can we move today's electricity demand closer to yesterday's electricity demand so that this change can result in low prices? If this is not successful, can we move today's electricity demand closer to the day before yesterday's electricity demand? Based on this simple idea, our machine-learning algorithm searches for the day where electricity results in low prices and the amount of demand response is minimal."

Although previous studies have demonstrated the benefits of demand response in mitigating price volatility, there is limited work considering the choice of locations for maximal impact.

"We're taking a technology-agnostic approach," Xie said. "We're showing the current market design and the consequences of this design.

By pointing these things out, we can hopefully reduce the price volatility of the grid, which we believe would be best for society."

In addition to Xie and Lee, contributors to the research include Xinbo Geng, Sivaranjani Seetharaman and Srinivas Shakkottai from the electrical and computer engineering department at Texas A&M; Bainan Xia from Breakthrough Energy; and Hao Ming from Southeast University in China, who received his doctorate from Texas A&M.

Provided by Texas A&M University