

Switching to firm contracts may prevent natural gas fuel shortages at US power plants

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Between January 2012 and March 2018, there were an average of 1,000 failures each year at large North American gas power plants due to unscheduled fuel shortages and fuel conservation interruptions. This is a

problem as the power grid depends on reliable natural gas delivery from these power plants in order to function. More than a third of all U.S. electricity is generated from natural gas. New research now indicates that these fuel shortages are not due to failures of pipelines and that in certain areas of the country a change in how gas is purchased can significantly reduce generator outages.

The paper, "What Causes Natural Gas Fuel Shortages at U.S. Power Plants?" by researchers at Carnegie Mellon University and the North American Electric Reliability Corporation, was published in *Energy Policy*.

Gas shortages at generators have caused simultaneous failures of several power [plants](#). Physical failures and disruptions of the [natural gas pipeline](#) network are rare; the authors found that they account for no more than 5% of the power plant generation lost to [fuel](#) shortages over the six years examined. The vast majority of the natural gas generator outages due to fuel unavailability were due to curtailment of gas when supplies were tight. In the Midwest and Mid-Atlantic states, natural gas was available but power plants that did not purchase firm contracts were out-prioritized by commercial and industrial customers.

"While it is unsurprising that plants using the spot market or interruptible pipeline contracts for their fuel were somewhat more likely to experience fuel shortages than those with firm contracts, these contracts can still make a big difference in reliability in certain regions," says Jay Apt, a Professor and the Co-Director of Carnegie Mellon's Electricity Industry Center, who co-authored the paper. "Still, firm contracts are not a solution for areas such as New England that have few gas pipelines and further discussion on other mitigation strategies should be explored."

Natural gas is increasingly used to generate power in the U.S. and the

North American Electric Reliability Corporation (NERC) projects that the natural gas generating capacity will further expand by 12 GW over the next decade, about a 5% increase. Fuel shortages have been a problem at power plants that are used exclusively at times of peak demand, such as during extreme cold and hot weather, as well as at more heavily-used gas power plants. This indicates that fuel shortages affect the [power grid](#)'s ability to operate whether it's responding to an emergency or merely serving load during normal operation.

Previous research has focused on technical reports from reliability organizations or regional transmission organizations. For the first time, researchers for this paper used [historical data](#) collected by NERC to examine fuel shortages between 2012 and 2018 at natural gas power plants in North America to determine their cause. The researchers' primary goal was to identify how many of these fuel shortage failures were caused by physical interruptions of gas flow as opposed to operational procedures on the pipeline network, such as gas service curtailment priority. They also sought to respond to policy questions regarding whether generators could mitigate fuel shortage failures by switching to firm pipeline contracts.

Along with analyzing the NERC data from 2012—2018, the researchers developed a systematic approach to match the NERC failure data to U.S. Energy Information Administration generator characteristic data in order to evaluate how gas pipeline system characteristics have historically affected natural gas fuel shortage failures. They calculated a time series of unscheduled, unavailable capacity due to fuel shortages and time-matched the beginning times of fuel shortage power plant failure events with time windows of pipeline failures to determine if pipeline failures could have caused fuel shortage outages at power plants. They then completed a similar process of spatial matching of [power](#) plants to gas trading hubs in order to assess the historical availability of natural gas for transactions by [power plants](#).

Ultimately, the researchers observed that both plants with firm contracts and plants without firm contracts experienced fuel shortages and conservation interruptions, but that non-firm plants were overrepresented in the fuel [shortage](#) failure data. This suggests that curtailment priority on pipeline networks is the likely reason for most correlated failures. However, the data also suggests that firm contracts will not solve everything and other strategies should be explored, especially in areas such as New England where the pipeline network has historically been constrained.

More information: Gerad M. Freeman et al, What causes natural gas fuel shortages at U.S. power plants?, *Energy Policy* (2020). [DOI: 10.1016/j.enpol.2020.111805](#)

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