

### Natural Gas and Electric Markets Misalignment

#### Problem / Opportunity Statement

##### Primary problem (market design issues)

Under the current wholesale electric market design, the risk/reward that Market Participants with gas generators face discourages fuel procurement at the very time generation is most needed. As need and gas costs rise, the profit margins of Market Participants with gas generators fall, often going negative. At extreme prices, there may even be corporate limitations that prevent fuel purchases altogether (authorization protocols, cashflow requirements, etc.). These market design limitations are further highlighted by generators with dual fuel capability. Generators that can maximize profits (or limit losses) will have incentive to burn limited backup fuel resources as gas procurement risk/reward falls. Often this results in backup fuel consumption well in advance of peak weather or need.

##### Significant secondary problem

The PJM Region bulk electric system relies on natural gas-fired generation to meet a large portion of its operational and reliability needs. This reliance upon natural gas is expected to continue in the short term with the retirement of coal and oil-fired power plants and the addition of renewable and intermittent resources. The change in resource mix will likely require natural gas-fired resources to be more flexible, as PJM seeks to balance generation dispatch with the fluctuating output from intermittent resources. However, the level of flexibility offered from natural gas-fired generation in the PJM Region has become more limited as natural gas pipelines in the region place more restrictions on gas transportation service. The misalignment between the natural gas and electric markets (e.g. market day for gas vs PJM markets) can also limit the amount of flexibility provided by natural gas-fired generation.

Recent events in Texas emphasize the importance of continually assessing the electric system to ensure that it is prepared for extreme events. While several factors have been identified as contributing to the severity of the Texas event, it is likely that the misalignment between the natural gas and the electric markets exacerbated the event and impeded efforts to restore the system. Extreme weather can create increased demand for both electric generation and natural gas while reducing flexibility on both. With natural gas-fired resources making up a large portion of the generation in the PJM Region, combined with the onset of renewable resources, the need for greater coordination between the electric and gas industries is paramount for the reliable operation of the electric systems.

Natural gas-fired generators in the PJM Region are facing significant challenges that present a real risk to the reliability of the bulk electric system. They face more restrictive gas pipeline operations with a greater frequency of Operational Flow Orders (OFO). In some situations, natural gas pipelines will enforce ratable provisions in a contract, requiring generators to burn the same quantity of gas in each hour throughout the gas day. Finally, natural gas pipelines are seeking to further restrict flexibility with higher imbalance penalties and greater restrictions on imbalance quantities. This will significantly hinder natural gas-fired generators' ability to operate and provide regulation and reserves during critical events.

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PJM does not account for natural gas transportation or gas procurement limitations in its economic dispatch signal, nor in its reserve calculations, potentially causing a disconnect between the capability PJM believes a natural gas-fired resource can achieve and what the resource can do in reality at certain times. This also exposes generators to natural gas pipeline tariff violations and associated consequences. Despite past coordination efforts between the industries, there remains a significant misalignment between the gas and electric markets. Natural gas is batch scheduled a few times per day with two natural gas days overlapping the electric day. There are no clear emergency protocols in extreme events that account for significant restrictions on the natural gas pipelines. Current PJM market offer parameters available to manage fuel are insufficient. The continued misalignment between the gas and electric markets puts the bulk electric system at risk of failure as the severity of extreme weather events increases and more intermittent generation is added to the system.

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