MISO is improving how it models the transportation and pricing of natural gas, which will produce better forecasts of the region's long-term transmission needs

Overview

With the MISO region becoming increasingly reliant on natural gas for generating electricity, it is crucial that MISO can accurately model how the area's gas-fired power plants could be impacted by fluctuating gas prices, pipeline issues and other factors. That's why MISO engineers have designed and implemented some high-tech enhancements to a sophisticated computer software program that MISO uses to model how gas is priced and transported to power plants across the MISO region.

PROMOD is a powerful tool…

The commercial software system that MISO enhanced, which is called PROMOD, is widely used in the energy industry to model how electricity and gas systems can be affected by commodity prices, transmission congestion, power-plant outages, renewable-energy policies and a host of other variables.

In its "off-the-shelf" form, PROMOD estimates how gas prices differ across the country by starting with the market price that is set at the industry benchmark Henry Hub delivery point in Louisiana, and then incorporating pre-determined "price adders" as gas it flows through pipelines to one of 24 different market locations. PROMOD tacks on additional price adders when gas flows from these market points to one of 33 state-wide gas pools. The price adders are calculated once a year by ABB, the multi-national company that owns PROMOD, using their own set of assumptions and inputs.

> ### MISO's modeling provides a more accurate representation of the natural gas system
>
> - *Granularity* – all-in burner tip gas prices are specified for each individual plant
> - *Accuracy* – burner tip prices are able to reflect differences in fuel contracting practices (IT/FT, Pipeline/LDC)
> - *Flexibility* – allows for variation in locational gas prices based on assumptions made in MTEP futures

…that MISO made even better

While PROMOD is a powerful tool, the off-the-shelf version did have its limitations. For example, the pre-determined price adders for gas did not change regardless of whether MISO modeled scenarios consisting of high or low gas demand, or high or low pipeline utilization—all of which would likely cause prices to vary in the real world. Similarly, the gas-price adders in the basic version did not adjust to different growth rates in electricity demand. Additionally, the basic software assumed that all gas-fired generating units in a given state would pay the same price for gas at all times, even though combined-cycle units and combustion turbines frequently pay substantially different prices for fuel due to their different operating characteristics, supply options and contracting practices, among other things.

> - The enhancements that MISO made to its PROMOD system addressed these and other issues. For example, the enhanced model estimates how gas prices could change across several hundred gas pipeline zones, as opposed to the far smaller number of pricing points in the off-the-shelf version of the software.

> - Moreover, the enhancements allow MISO to vary the amount of the locational gas-price adders according to the assumptions in the MISO Transmission Expansion Plan (MTEP), an annual, region-wide transmission-planning document that MISO develops with extensive input from its stakeholders.

> - For example, MTEP18, which is currently under development, contains a proposed "Future" called "Limited Fleet Change" in which increased industrial production along the Gulf Coast would result in higher gas prices in that region compared to the rest of MISO. The

enhancements that MISO made to its PROMOD system would reflect those higher prices, whereas the off-the-shelf version of the software may have not.

➢ The enhancements also allow MISO to more accurately model how gas is priced as it is transported from hundreds of pipeline zones to individual gas-fired generating units in the region. The price adders that the enhanced model uses, which are dubbed "burner tip adders," are developed through a review of public data on plant-level gas prices listed in the EIA-923 Power Plant Operations report.

➢ These burner tip price adders are the only piece in the new transportation system that will not change by MTEP Future scenario, under the assumption these gas price relationships in the final leg of delivery will not change drastically over time.

More granularity, accuracy and flexibility

This enhanced transportation system increases granularity, accuracy, and flexibility in the model. Granularity is improved by specifying plant-specific gas burner tip adders. Accuracy is improved because these burner tip adders are able to reflect differences in fuel contracting practices such as firm vs interruptible transportation, as well as gas system connection factors such as whether a plant is directly connected to an interstate pipeline or if it is served by a Local Distribution Company. Flexibility is improved because the system allows for variation in locational gas prices depending on assumptions made in the MTEP Future.

Benchmark results show
marked improvements in accuracy

As the charts show, MISO-generated gas prices (in blue) more accurately reflect actual cost data (black) over the past four years compared to PROMOD prices (red).

Additional benchmarking work was done utilizing the PROMOD 2013 Market Benchmark model. This model was developed in an attempt to accurately reflect actual market data from 2013. Applying MISO's enhanced gas transportation system to this model resulted in a slight increase in overall burner tip gas prices (an average of a 1-3% increase compared to the original model). The updated transportation system caused LMPs, capacity factors, and dispatch amounts that more closely resembled actual market data compared to the original benchmark model.

Example Plant - MISO North

Example Plant - MISO Central

Example Plant - MISO South