

Evaluation of Public Service of Oklahoma's Physical and Financial Natural Gas Hedging and Price Risk Management

Enterprise Risk Consulting, LLC

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Hedging Evaluation

- Hedging needs can be broken down into the two components of load:
 - Baseload
 - Swing
- **Baseload** exposures are best hedged with monthly index purchases, and especially fixed-price forward purchases to reduce baseload cost volatility via “financial storage”.
- **Swing gas** exposures can best be hedged by standard physical natural gas storage agreements.
 - Swing gas load entails substantial volumetric and price uncertainty.
 - The adverse financial effects of the demand for swing gas can be hedged by adding insurance in the form of purchasing real optionality for the supply portfolio in the form of physical gas storage.
- **Real options** are physical assets and exposures that have similar attributes to traded options. They involve flexibility, not an obligation. An example for a gas consumer is the ability to delay or to accelerate supply purchases to best economically serve demand.
- These hedges need to be sized to levels of historical risk exposure; the risks from Uri are a one-off occurrence that should not be the primary driver of the size of hedges.

Summary of Findings & Conclusions

- Recommended risk mitigation alternatives include the following:
 - Fixed-price physical monthly and seasonal forward purchases
 - First of the month index physical purchases
 - Physical natural gas storage
- The hedging alternatives are applicable because:
 - a) they are generally commonly available to PSO,
 - b) PSO already has experience and comfort with using some of these alternatives such as indexed and fixed-price forward purchases, and
 - c) physical natural gas storage is a common approach used by natural gas consumers to manage seasonal and intra-month swing demand.
- Note that Oklahoma has a higher dependence on natural gas storage than the national average and that the use of gas storage is growing in the state.
- Storage is especially important to add flexibility to PSO's natural gas supply portfolio given the continuing expansion of renewable electric generation resources in the Southwest Power Pool.

Hedging Alternatives

Physical / Assets	Market Instruments: Physical	Market Instruments: Financial
Rate adjustments / pass-through	X Day-ahead purchases	X Futures – Index (e.g., Henry Hub)
Cash reserves (self insurance)	X Daily options (calls, collars)	X Futures – Basis (e.g., Panhandle)
Natural gas reserves	X Monthly index purchases	✓ Options on futures (calls, collars)
Physical natural gas storage	✓ Monthly / seasonal fixed-price forwards	✓ Swaps - monthly
Effective gas storage via pipeline flexibility	✓	Swaps – daily
		Swaps - basis
		Swing options

*Except for the management of physical storage

**If available, not prohibitively priced, and PSO has the resources for valuation and exercise decision support

Hedging Plan Considerations

- Choices of natural gas hedging alternatives, including the amounts and timeframes for hedging, will depend on the perceived benefit-to-cost tradeoff PSO faces in the current market environment.
- Hedging natural gas as a consumer can be thought of as purchasing price and volume risk insurance. As with all insurance decisions, some insurance is useful, but too much insurance can be counterproductive because the cost can be out of proportion with the benefits.
- The hedging plan should be flexible to allow for adjustments to the level of the monthly hedge depending on market conditions. Summers are much more predictable than winter and shoulder months.
- The hedging plan should allow for flexibility in the level of the hedges in longer term transactions to take advantage of value opportunities, and during delivery months to adapt to consumption forecasts and variable load factors.

Hedging Plan Components

■ Seasonal Forward Purchases

- Forward physical hedges are designed to reduce longer-term price volatility, and in *backwardated* markets would provide an opportunity to purchase gas in the future at lower prices than current or recent historical prices.
- **Backwardation** is a relationship between prices for future delivery months where forward prices are lower than nearby prices.

■ Monthly Index Purchases

- PSO can add hedges via monthly index purchases to reduce shorter-term price volatility.
- These hedge additions to annual and seasonal purchases are subject to market conditions and to seasonal consumption variability. Summers are typically much more predictable and have higher consumption. The winter months of December and January are the most predictable of the winter season.

■ Storage

- Storage is subject to market conditions. Sometimes a storage contract is not available because of high demand.
- The purchase of longer-term hedges can make up for the reduction of storage supply. For example, a storage plan that assumes a total stored volume of 1 Bcf may only result in a contract to purchase one half Bcf of gas, or none. This reduction of storage supply may be mitigated by a longer-term hedge or an increase in the monthly index volume. Flexibility in hedges lowers the volatility and cost risk during the winter season.

Enterprise Risk Consulting, LLC's Consulting Team

- **Larry G. Lawrence**, Founder (2002) and President of ERC, has over 35 years experience in energy risk management and trading. His experience includes financial and physical trading in energy and equity markets, risk management and trading consulting, and derivatives portfolio management. Mr. Lawrence has extensive experience in trading and risk management implementation for energy companies including numerous public power entities. His experience includes trading and hedge strategy development; tactical trading assistance; implementing hedging programs; developing and implementing hedge optimization models, asset valuation models, risk models, and performance measurement models; implementing credit risk management programs; the development of trading and risk management policies, procedures, and control structures; the review and assessment of risk management programs; value at risk implementation and assessment; trading and risk information system selection and implementation, utility resource planning; transaction structuring; and real option valuation and modeling.
- **Neil F. McAndrews**, Senior Principal -- has over 30 years of experience in the energy industry. He was a founder and later Chief Operating Officer of one of the first integrated risk management programs for an electric utility in the US. Later he assisted in establishing enterprise-wide energy risk management and power trading programs at utilities in several NERC regions, working with both executive staff and boards of directors. He has extensive energy risk management experience with some of the largest wholesale power transactions in Texas and in PJM over the last fifteen years. He is the author of numerous technical papers and economic and financing studies related to the subject of risk management in power markets.