NYISO Capacity Pricing Issue: The Use of Day Ahead Natural Gas in Valuing Real Time Power

This analysis is being presented by Shell Energy North America (US), L.P. to assist NYISO and market participants in the evaluation of energy market and ancillary service market revenue offsets used in the demand curve development process. It has been developed only for that purpose and relies on a combination Shell Energy's own data and data being provided with the permission of Platts.

Issue: In determining the revenue offset used to price NYISO capacity, NERA uses daily gas prices to estimate profits generated from the real time power market (refer to page 43 of the demand study). By doing so, NERA implicitly assumes either that:

1. *Real time* power is generated using *day ahead* natural gas as the fuel supply.
2. *Real time* natural gas and *day ahead* natural gas are priced the same.

Hypothesis: Real time natural gas sells at a premium relative to day ahead natural gas. If this is the case, then NERA's estimate of the energy and ancillary service market revenue offset is overstated since fuel costs to generate real time power are understated.

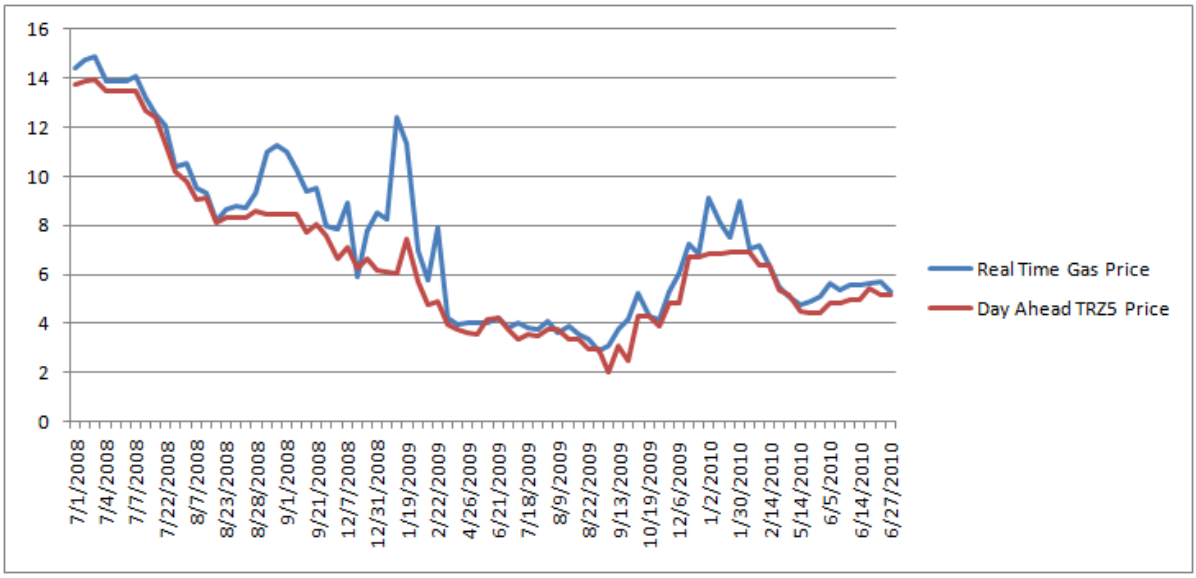
Methodology: We check our hypothesis by:

1. Confirming that prices for natural gas procurements for real time power generation schedules are higher than prices for gas that is procures for day ahead schedules; and
2. Demonstrating that NERA's Revenue Model would show reduced profitability for Rest-of-State generators based on the higher real time natural gas prices.

For step one above, we calculate the historical spread between the real time and day ahead Transco Zone 5 natural gas prices from July 1, 2008 to July 11, 2010. Since this spread can be volatile from day to day, our goal was to hone in on the *expected* spread.

Our first step was to gather and cleanse the historical price quotes for natural gas purchased at Transco Zone 5 for day ahead and real time power market operations. We selected Transco Zone 5 since we had data for real time power market purchases for a generator that we operate in that Zone. We did not have enough data for Transco Zone 6 (area of NYISO ROS generators), but believe Zone 5 purchases served as a good proxy. If anything, values for real time purchases in Transco Zone 5 would probably be understated relative to Zone 6 since Zone 6 is downstream.

From our internal systems, we were able to obtain the two years of historical price quotes. The historical day ahead quotes were available for every trading day. However, the real time quotes needed to be determined from actual Transco Zone 5 spot deals that were done by Shell Energy. Therefore, real time quotes were sporadic – sometimes we had no quotes for a given day and other times we had multiple quotes. To account for this, we averaged all real time quotes within a day and only calculated the real time – day ahead spread where we had a real time quote. The graph below illustrates the cleansed real time and day ahead gas prices for Transco Zone 5:



After we cleansed the data and calculated the sample spreads, we performed statistical analysis on the distribution of these spreads. We wanted to determine the *expected* real time – day ahead spread and the 95th percentile confidence interval of the *expected* spread. For this statistical analysis, we assumed that the historical spreads are lognormally distributed, which can be roughly shown from the sample data. Therefore, we applied a log transformation to the sample spreads and calculated the mean and standard deviation of the "log spreads". We assume the log spreads are normally distributed. So we can calculate the 95th percentile confidence of expected log spreads using the calculation $\bar{x} \pm s / \sqrt{n}$ where $\bar{x}$ is the mean of sample log spreads, s is the standard deviation of sample log spreads, and n is the sample count. We then applied a transformation to convert log spreads back to regular spreads (ie $e^{\ln(\text{spread})}$ = spread), which gives us the expected real time – day ahead spread and 95th percentile confidence interval of the expected spread. We use the resulting expected spread to determine how much of a premium to add to the day ahead quotes to determine the real time quotes.

Finally, we adjusted the NERA model to reflect real time fuel costs for real time power generation. To do so, we added the expected spread to Transco fuel cost in the "RT Prof" column and recalculated the model.

Summary of Findings:

Our results show that **the expected real time – day ahead spread is $0.65 and a sample mean of spreads ($\bar{x}$) should fall between $0.51 and $0.80** with 95% confidence. However, at any point in time the spread could be substantially different than the expected spread. Over our two year horizon, the sample spreads ranged from -$0.35 (December 9, 2008) to $6.32 (January 5, 2009). Moreover, the sample mean, $\bar{x}$, could fall outside our confidence interval. In fact, our sample spreads averaged $0.83 because of one extreme outlier, the $6.32 spread on January 5, 2009[1].

There are several reasons that real time prices are generally higher than day ahead prices. First, transportation constraints limit the supply of gas in a specific market. If transportation capacity is fully utilized for scheduled volumes, then no more gas can enter the market and only the excess gas will be sold back into the real time market. Even if there is transportation capacity, the gas available

for flow into the real time market could have a higher marginal cost. It is generally coming from storage, which is more expensive because of opportunity[2] and withdrawal costs. In addition, cheaper sources for gas are typically scheduled already, which leaves more expensive sources as the only alternative for the real time market.

. The expected spread of $0.65 tells us that real time natural gas should sell at a $0.65 premium to day ahead natural gas within Transco Zone 5 *on average*. Therefore, we adjusted the real time fuel costs by adding $0.65. As a result, the NERA Revenue Model demo shows profits from power sales decline ~21%. This suggests that the Energy and Ancillary Services Net Revenues in the demand study could be overstated, because of the assumption that day ahead gas prices are the best proxy for fuel costs associated with real time power generation.

(1) Our data contained 85 sample spreads and all quotes above are in $ / mmbtu.

(2) Companies typically store natural gas to sell it at a higher price in the future. In order to incent companies to withdraw from storage and supply the real time market, a premium above market must be paid to compensate them for the lost opportunity to sell at a potentially higher price in the future.