POWER FOR TOMORROW

The Impact of Restructuring on Linking Electricity Prices and Natural Gas Prices

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Prepared for: Power for Tomorrow

This document briefly summarizes the relationship between natural gas prices and electricity prices in both traditionally regulated and restructured states. It includes a narrative, some references to existing literature, and several charts to show the historical relationship and recent impacts. This information was gathered through a survey of the literature on the impacts of restructuring, evaluation of EIA data, and reviews of recent rates for various utilities.

Historical Review

One of the often-discussed outcomes of restructuring state electric systems is that many states that went through it have found their electricity prices more closely linked to natural gas prices. The main reason is that electricity prices in the wholesale markets are very often set by natural gas generators. When their feedstock (natural gas) prices increase, the wholesale electricity prices increase throughout the market. The reverse is also true for decreasing natural gas prices. Most customers in restructured states experience these price changes in their electricity bills, often quite rapidly and without a full understanding of why this is happening.

Conversely, in traditionally regulated states, gas price changes are only impactful to the extent of the share of natural gas fired generation in the regional electricity generation mix. Because natural gas generation only represents about one third of the generation in traditionally regulated states, changes in natural gas prices are significantly blunted on consumer electricity bills.

Evaluating the impact of restructuring states and the relationship between electricity and natural gas prices is not a simple task. A preferred approach would involve comparing price relationships in the same state before and after restructuring, but the transition period brings complexity and the long period of low gas prices since restructuring has deprived researchers of annual gas price changes to observe in electricity prices. Instead, several studies have applied advanced econometric approaches to evaluating the relationships. They are summarized here:

- Borenstein and Bushnell (2015)[1] – The following is a good summary of their theory: "Because gas generation comprises a minority share in most electricity markets, under average-cost based regulation it did not dominate rate making. Prices for deregulated generation, however, are driven by the marginal producer, which is much more commonly gas generation. Thus to a degree that was not appreciated at the time, restructuring of generation greatly increased the exposure of electricity rates to natural gas costs, even if a fairly small share of electricity was sourced from gas-fired plants."
  They tested this theory with an advanced regression analysis and found: "The influence of natural gas price on retail rates is estimated to be nearly twice as large in a state with all merchant generation than in a state with none."
- Rose et al (August 2022)[2] – The authors "test whether electricity retail prices became more sensitive to changes in natural gas prices due to restructuring." They controlled for many variables and found a "generally insignificant effect of natural gas prices on retail prices in the non-restructured states/time

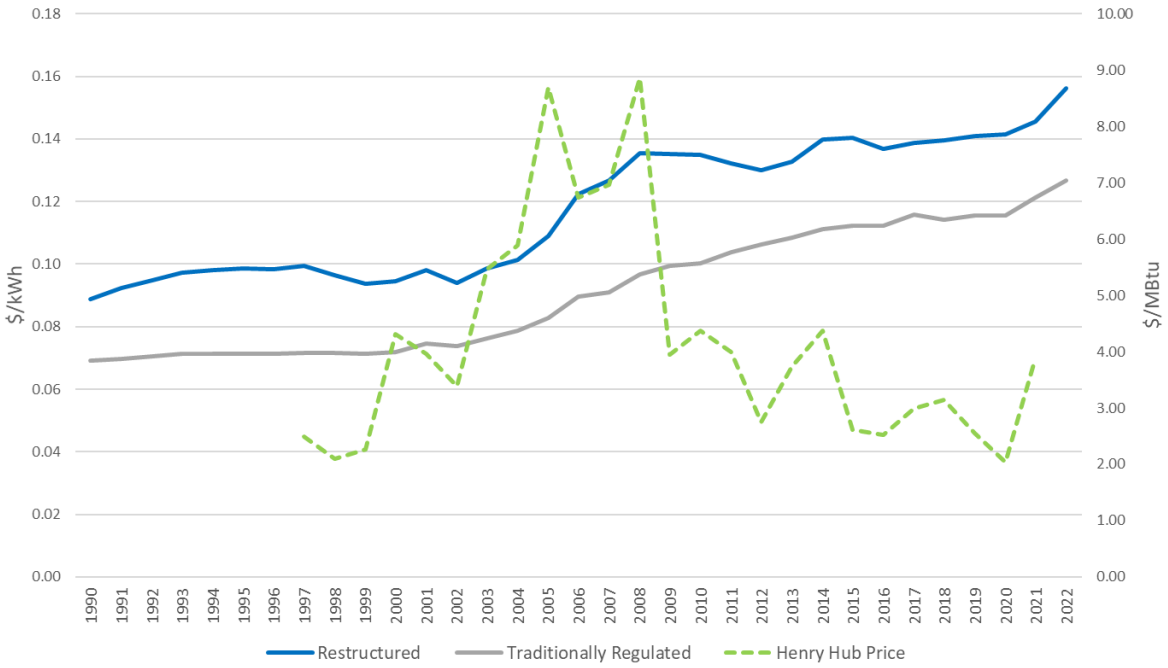
[1] Borenstein and Bushnell, "The US Electricity Industry after 20 Years of Restructuring," NBER Working Paper, 2015.
[2] Rose, et al. "Retail Electricity Market Restructuring and Retail Rates," August 2022.

periods." They conclude that "the general observation that electricity prices have moved more in tandem with natural gas prices due to restructuring is supported empirically."

- Hartley, Medlock & Jankovska (2019)[3] – The authors evaluated prices in Texas and statistically observed the role of natural gas prices in the trajectory of retail prices.

The following chart shows the past three decades of average monthly electricity costs for residential customers in restructured and traditionally regulated states, as well as the average natural gas price (Henry Hub price).

Figure 1: Energy Costs in Restructured and Traditionally Regulated States (1990-2022YTD)



Two observations stand out in the above chart:

1. The spread between the restructured states and traditionally regulated prices are nearly identical at the end of the transition for restructured states (2011/12) as it was in recent years. This suggests the lower gas prices did not bring the prices in restructured markets down to parity with those in traditionally regulated states.
2. Price bubbles are observed in the restructured prices line that follow increases in natural gas prices (2013-2016 and 2021). The most recent uptick is still underway.

Since electricity prices in restructured states have been shown to be tied to natural gas prices, yet they remained higher than in traditionally regulated states even during a long period of low natural gas prices, it is likely that the price spread would have been much larger if natural gas prices were higher. This is a theory that is currently being tested by a tight natural gas market driving prices to nearly double their average price from the past decade (2022 YTD average vs. 2011-2021 average).

<u>Implications in the Current High Gas Price Environment</u>

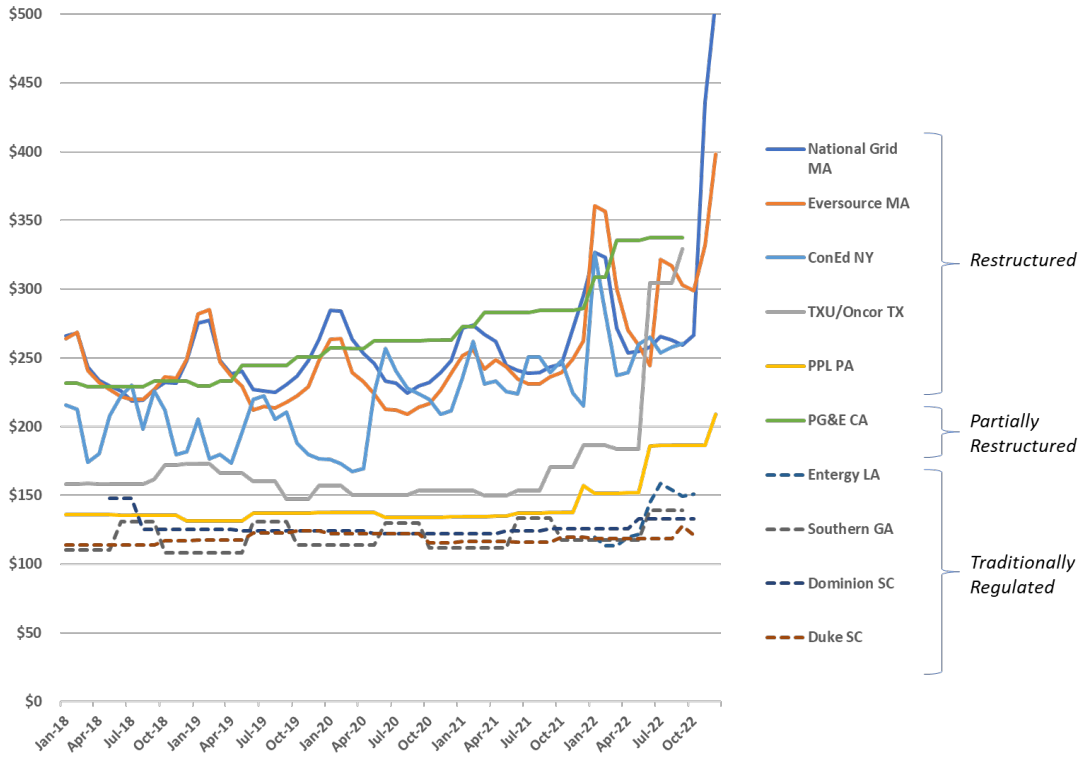
[3] Hartley, et al. "Electricity reform and retail pricing in Texas," Energy Economics, 2019.

The EIA data in the chart above only extends through June 2022. While natural gas prices have risen for well over a year, residential customers in most restructured states are just now starting to see drastic electricity price impacts. In the past year, natural gas prices more than doubled (140% increase from June 2021 to June 2022), while retail electricity prices in restructured states rose 12%. While one would not expect a 1:1 increase in prices since wholesale electricity prices are not the only driver of electricity bills, the disparity can only be temporary and electricity prices are expected to "catch up" soon.

The main reason for the brief delay or "lag" is the prevalence of supplier contracts. There is also a subset of customers on fixed price contracts that change price less frequently than variable contracts. As wholesale supply contracts inevitably roll off and fixed rate periods end, retail prices have been steadily climbing in restructured states and utilities are announcing drastic price increases for the coming months.

The following chart shows the average monthly bill for a residential customer that uses 1,000 kilowatt-hours of electricity per month in 10 different utility territories over the past five years.[4] The data was gathered through a review of posted tariffs and information gathered by state regulators. Five of the utilities are in restructured states, one (CA) is considered partially restructured, and four are in traditionally regulated states.

Figure 2 Average Monthly Bill for 1,000kwh/mo Residential Customer (nominal$)



[4] The comparison of electricity bills for a customer with a flat 1,000 kwh demand per month is common in the industry. In reality, there are differences in monthly consumption across time and geographies. This approach likely biases the results to show less of a bill disparity between restructured and non-restructured states. This is because variable prices are more common in restructured states, which can lead to a different average when paired with variability in residential demand across the year.

The chart clearly shows a drastically different response in electricity bill responses to the high commodity price environment. While bills were already significantly higher in restructured states at the beginning of the period, costs in recent and upcoming months have risen precipitously. For example, in September 2022, the average bill for customers using 1,000 kwh/month across the four traditionally regulated states was about $138, while customers using the same amount of electricity in the five restructured states saw a bill of $268 on average. Of the announced November 2022 rates for vertically integrated utilities in the chart, the highest would lead to a bill of about $151 for a customer using 1,000 kwh of electricity. Two utilities in Massachusetts announced rates for November 2022 that would lead to bills between $400 and $510 for a 1,000 kwh/month customer.

Of course, these findings are only the first phase of the overall story. As new tariffs are announced, the disparity is expected to grow. Clearly the prices in traditionally regulated states will also experience some commodity price impact over time, but the exposure is far less, as discussed earlier in this document.

Appendix

The following chart shows the share of generation in the restructured and traditionally regulated states from 2011 to 2022YTD. As expected, it grew in both by about the same amount, but the restructured states are at a higher percentage overall. This is not highly relevant to pricing since the main determinants of pricing in restructured markets are the “marginal” units, not total amount of gas generation. This chart is simply provided for your reference.

Figure 3: Natural Gas Share of Total Generation (2011-2022YTD)