Memorandum

To: ISO Board of Governors

From: Eric Hildebrandt, Director, Department of Market Monitoring

Date: December 11, 2013

Re: **Market Monitoring report**

This memorandum does not require Board action.

EXECUTIVE SUMMARY

This memo provides an update on market performance in 2013 by the Department of Market Monitoring (DMM). As the year draws to a close, several key trends in market performance have emerged.

- The ISO energy market continued to perform efficiently and competitively overall in 2013. Electricity market prices have been stable and extremely competitive over the course of the year. Prices are about equal to levels that DMM estimates would occur under perfectly competitive conditions in which suppliers bid at or near their marginal costs.
- Although day-ahead market prices in 2013 have been about 45 percent higher than in 2012, this was driven primarily by a steady increase in gas prices that started in 2012. Average gas prices in 2013 have been about 30 percent higher than the unusually low gas prices that occurred in 2012. This accounts for most of the increase in prices in 2013.
- Implementation of the state's cap-and-trade program for greenhouse gases also had a significant but relatively stable impact on the electric markets in 2013. DMM estimates day-ahead market prices have been about $5.60/MWh higher in 2013 due to cost of emission allowances. This is highly consistent with expected actual emission costs given the generating efficiency of gas units typically setting prices in the day-ahead market. The impact of the cap-and-trade program on electric prices has also decreased over the year as prices for emission allowances have dropped from about $14/mt$CO_2$e to just over $11/mt$CO_2$e in the fourth quarter.

Energy market performance

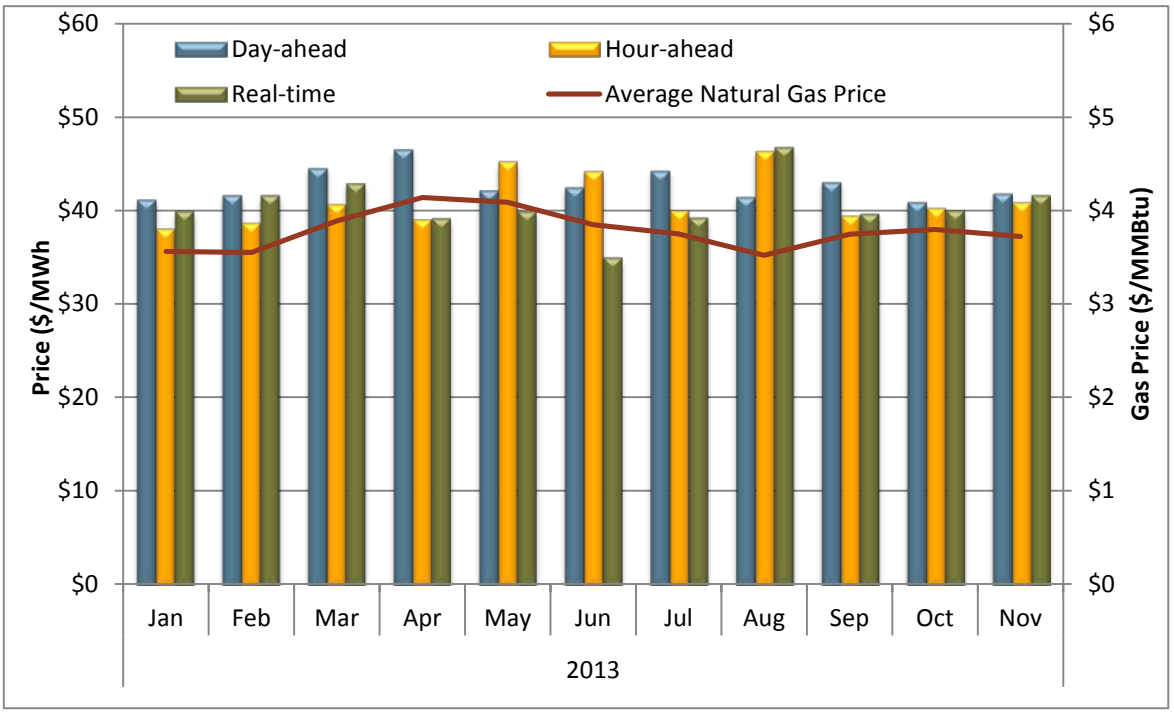
Average system energy prices in the ISO market were relatively stable over the first eleven months of 2013 (see Figure 1). Prices are about equal to levels that DMM estimates would occur under perfectly competitive conditions in which suppliers bid at or near their marginal costs. A more detailed discussion of the competiveness of prices is provided in the third section of this report.

Average system energy prices in the real-time market (excluding congestion) in almost all months have tended to be lower than average prices in the day-ahead market (see

Figure 1). This trend is largely attributable to a decrease in the incidence and magnitude of real-time price spikes, which has lowered average real-time prices. The trend was reversed in August, as higher real-time prices related to transmission outages on a few days drove average monthly real-time prices substantially higher.

Lower real-time prices have also been due in part to substantial amounts of wind and solar energy in the real-time market that was not scheduled in the day-ahead market. In some months, real-time prices were driven lower by unscheduled energy from units committed after the day-ahead market through the residual unit commitment process and exceptional dispatches.

Figure 1. Average monthly system marginal energy prices (all hours)



Through November, day-ahead market prices in 2013 have been about 45 percent higher than in 2012. This increase was driven primarily by a steady increase in gas prices that started in 2012. Average gas prices in 2013 have been about 30 percent higher than the unusually low gas prices that occurred in 2012.

Most of the remainder of the increase in prices can be attributed to compliance costs associated with the state's cap-and-trade program, which DMM estimates has also added about $5.60/MWh to day-ahead market prices (see discussion in following section of this report). Other factors causing upward pressure on electricity market prices include a decrease in hydro-electric generation and a small increase in load (about 1.5 percent at peak).

Greenhouse gas cap-and-trade program

Implementation of the state's cap-and-trade program for greenhouse gases had a significant but relatively stable and predictable impact on the electric markets in 2013.

After some volatility in the first two weeks of the year, prices for greenhouse gas emission allowances averaged about $14/mt$CO_2$e through August.[1] Prices dropped in September following results of the California Air Resources Board's fourth auction of 2013 greenhouse gas allowances in August, which cleared at the price of $12.22/mt$CO_2$e. Prices continued to soften and have averaged just over $11/mt$CO_2$e in the fourth quarter of the year.

Based on statistical analysis of changes in day-ahead market energy prices following the cap-and-trade implementation, DMM estimates that average wholesale prices are about $5.60/MWh higher in the first three quarters of 2013 due to cap-and-trade compliance costs.[2] This is very consistent with the actual expected emissions costs for gas units typically setting prices in the ISO market.

As noted in prior DMM reports, imports to the ISO from other states do not appear to have decreased in response to implementation of the cap-and-trade program. In fact, import schedules and bid-in volumes increased in the first half of 2013 compared to the first half of 2012.

At currently reported prices for 2014 emissions (about $11/mt$CO_2$e), the impact of the cap-and trade program on wholesale costs could be lower in 2014. For example, given an average emission cost of $11/mt$CO_2$e, a gas-fired unit with a heat rate of 8,000 Btu/kWh would incur an additional cost of $4.67/MWh.[3]

[1] mtCO_2e stands for metric tons of carbon dioxide equivalent, a standard emissions measurement.

[2] See *Quarterly Report on Market Issues and Performance*, Department of Market Monitoring, November 14, 2013 pages 58 to 60.

[3] $11/mt$CO_2$e x 0.0530731mt$CO_2$/MMBtu x 8,000 Btu/kWh = $4.67/MWh

Market efficiency and competiveness

DMM assesses the efficiency and competitiveness of energy markets using a variety of metrics, as summarized in our prior annual reports. Analysis by DMM indicates that the ISO energy market continued to perform efficiently and competitively overall in 2013. A detailed summary of this analysis will be included in our 2013 annual report in spring 2014.

One of the key methods used to assess market performance is to compare actual market prices to *competitive benchmark* prices which reflect prices that would be expected under extremely efficient and competitive conditions. DMM calculates this competitive benchmark by re-running the day-ahead market software after replacing actual market bids with bids that reflect each resource's actual marginal operating cost. For this analysis, DMM uses default energy bids for each unit that are developed and used in market power mitigation. These bids reflect marginal costs plus a 10 percent adder.

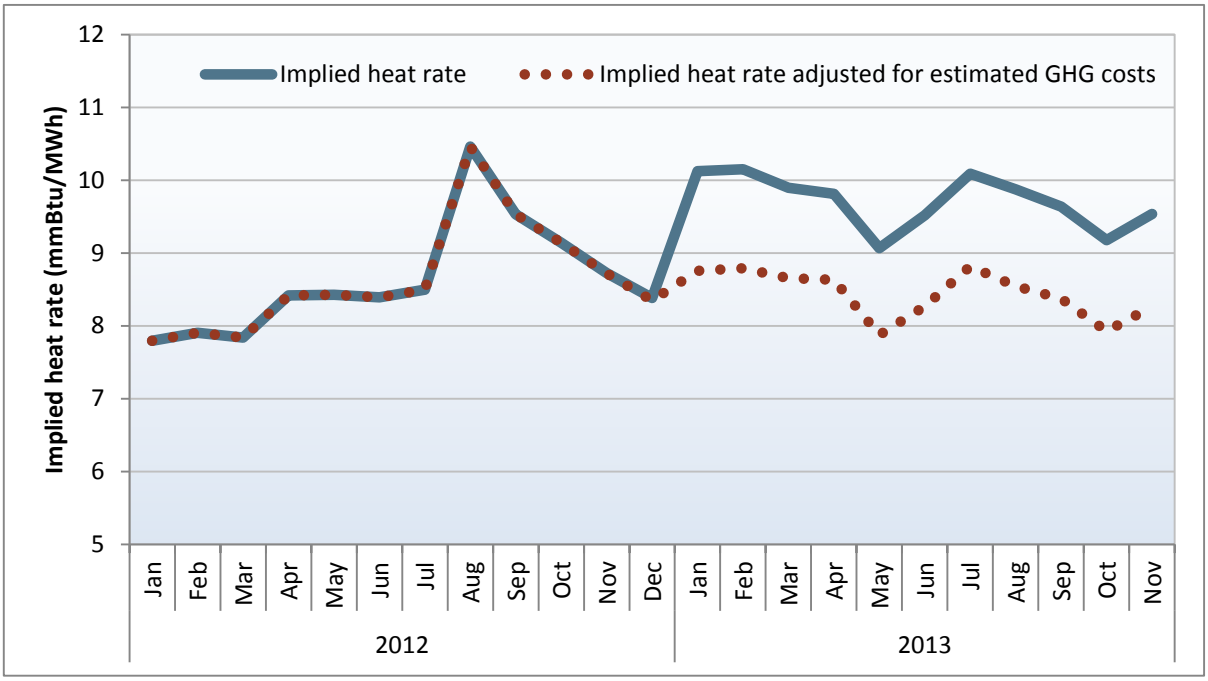
Preliminary results of this competitive benchmark analysis for 2013 indicated actual market prices were slightly below this competitive benchmark. This reflects the fact that many suppliers bid below the default energy bids used in this analysis, which include a 10 percent adder. Prices in 2012 were found to be approximately equal to this competitive benchmark, as summarized in our 2012 annual report. Thus, preliminary results indicate the ISO energy market was marketed by an even higher level of efficiency and competitiveness in 2013.

A simpler method that is commonly used to assess trends and the efficiency of electricity market prices over time is known as the *market heat rate* or *implied heat rate*. The implied heat rate is a standard measure of the maximum heat rate that would be profitable to operate given electricity prices and fuel costs, ignoring all non-fuel costs. With the introduction of the cap-and-trade program, this measure must be adjusted to account for the additional cost of greenhouse gas emissions allowances.[4]

Figure 2 shows the implied heat rate for the day-ahead energy market since January 2012 with and without this adjustment for the increase in price due to the cap-and-trade program. As shown in Figure 2, the implied heat rate before any adjustment for the price impact of the cap-and-trade program rose significantly starting in January 2013. However, after adjusting for the increase due to the cap-and-trade program, the implied heat rate during the first eleven months of 2013 (8.45 mmBtu/MWh) is slightly lower than the implied heat rate during the same months of 2012 (8.65 mmBtu/MWh).

[4] The implied heat rate is calculated by dividing the electricity price by fuel price. For instance, if the average price of electricity is $25/MWh and the price of gas is $2.50/mmBtu, this equates to an implied heat rate of 10 mmBtu/MWh. DMM calculates the implied heat rate adjusted for greenhouse gas compliance costs by first subtracting our estimate of the greenhouse gas compliance cost price impact derived above from the electricity price ($5.60/MWh). This adjusted electricity price is then divided by the gas price to calculate an implied heat rate that is comparable to this calculation prior to implementation of the cap-and-trade program starting in 2013.

Figure 2. Implied heat rates with and without greenhouse gas compliance costs



This analysis provides a further indication of a slight increase in the efficiency and competitiveness of energy prices in 2013, and that prices continue to track closely with the marginal operating costs of relatively efficient gas-fired plants that typically set prices in the ISO market.

Conclusion

The ISO energy market continued to perform very efficiently and competitively overall in 2013. Electricity market prices have been stable and extremely competitive over the course of the year. Prices are approximately equal to levels that DMM estimates would occur under perfectly competitive conditions in which suppliers bid at or near their marginal costs.

Additional analysis of 2013 market performance will provided in DMM's report fourth quarterly report and annual report, which are scheduled for release in early February and mid April 2014, respectively.