# Memorandum

**To:** ISO Board of Governors

**From:** Eric Hildebrandt, Director, Market Monitoring

**Date:** July 9**,** 2015

**Re:** **Market Monitoring report**

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***This memorandum does not require Board action.***

## EXECUTIVE SUMMARY

This memo provides comments by the Department of Market Monitoring (DMM) on two items:

- **Management proposal for settlement of variable energy resources.** DMM supports Management's proposal to modify rules for settlement of energy from variable energy resources submitting economic bids into the real-time market. The proposed modifications improve incentives for variable energy resources to provide economic bids to decrease their output in the real-time market during periods of very low prices or excess supply. The ISO's proposal accomplishes this goal while maintaining bid cost recovery mitigation measures as required to maintain proper incentives for variable energy resources to attempt to follow forecast and ISO dispatch.

- **Mid-year summary of market performance**. The ISO market has continued to perform efficiently and competitively in the first half of 2015. Average monthly system energy prices in the day-ahead and real-time markets have tracked very closely in 2015, and have trended downward as a result of a continuation of the drop in natural gas prices that began in 2014. Performance of the energy imbalance market has improved over the course of 2015. During most intervals, prices in the EIM have continued to be highly competitive and have been set by bids closely reflective of the marginal operating cost of the highest cost resource dispatched to balance loads and generation. The price discovery provisions approved under the Commission's December 1, 2014 order have effectively mitigated prices during a relatively small portion of intervals when energy or flexible ramping constraints have had to be relaxed for the market software to balance modeled supply and demand.

## MANAGEMENT PROPOSAL ON VARIABLE ENERGY RESOURCES

As described in Management's memo, variable energy resources that submit economic bids into the real-time energy market differ from conventional generating units because their energy output may be driven by either a dispatch instruction from the ISO or an uncontrolled change in their intermittent energy source (e.g. wind or solar). Despite this difference, the ISO market's energy settlement in some aspects currently treats the energy from variable energy resources as if the output is always controllable. This can provide a significant disincentive for variable energy resources to submit bids to decrease their output in the real-time market when needed.

Management proposes to address this issue by modifying settlement rules as follows. First, the settlement process will differentiate when the output from variable resources with bids dispatched in the real-time market is driven by an intermittent energy source change versus an economic dispatch. Second, when variations in output are driven by an intermittent energy source change, the settlement of residual imbalance energy from these variations will be modified so that this energy is settled based on the locational marginal price rather than the resource's bid price. Finally, current settlement mitigation measures will no longer be applied to residual imbalance energy resulting from variations in the energy source of variable energy resources.

However, when residual imbalance energy is driven by an economic dispatch, under Management's proposal this energy will continue to be settled based on the resource's bid that drove the dispatch, consistent with a conventional generator's settlement. DMM believes continuing to apply settlement mitigation measures to real-time residual energy that would get settled based on a resource's bid price plays an important role in creating incentives for resources to attempt to follow dispatch instructions. If these settlement mitigation measures are not applied to residual imbalance energy that settles on the resource's bid price, a variable energy resource would often have incentives to withhold producing renewable energy that the resource could produce, and that the ISO would want the resource to produce. Therefore, we support Management's proposal to continue to apply bid cost recovery mitigation measures to residual imbalance energy that settles on the resource's bid price. [1]

The ISO's proposal to not apply bid cost recovery mitigation measures to residual imbalance energy settling on the resource's locational marginal price is an appropriate settlement change that should encourage economic participation by variable energy resources. However, by continuing to apply the bid cost recovery mitigation measures to energy that the resource could buy back at a price set by the resource, the ISO creates the right incentives for variable energy resources to follow their real-time

[1] *Bid cost recovery and variable energy resource settlement*, Draft Final Proposal, May 20, 2015, http://www.caiso.com/Documents/DraftFinalProposal_BidCostRecovery_VariableEnergyResourceSettlements.pdf

dispatch and to not willingly withhold producing renewable energy that the ISO asks it to produce.

## MARKET PERFORMANCE

The ISO market has continued to perform efficiently and competitively in the first half of 2015. As shown in Figure 1, average monthly system energy prices in the day-ahead and real-time markets have tracked very closely in 2015.[2] Average prices in the 15-minute market over the month of June were driven higher than average day-ahead prices by several hours of extremely high 15-minute prices ranging from $400 to $1,000/MWh on June 8. The downward trend in prices in 2015 reflects a continuation of the drop in natural gas prices that began in 2014.

From late March to through June, congestion on Path 15 in the south-to-north direction frequently caused prices to be higher in the PG&E area and lower in the SCE and SDG&E areas (see Figure 2). This congestion was caused by a combination of several factors. The available transmission capacity on Path 15 was reduced from about 3,300 MW to about 2,000 MW due to planned transmission maintenance. In addition, relatively low loads and a significant increase in solar generation in Southern California resulted an abundance of lower cost generation south of Path 15.

During this period, the frequency of negative prices in the SCE and SDG&E areas increased notably in the real-time market, particularly during peak-hours. Figure 3 shows that the frequency of negative prices at load aggregation points (LAPs) increased to about 8.5 percent of 15-minute intervals in May, the highest frequency since implementation of the 15-minute market in 2014, before falling to 1.5 percent of intervals in June. Most of these negative prices resulted from dispatch of negative bids priced from $0 to -$30/MWh, which is well above the current bid floor of -$150/MWh.

Figure 4 shows that the negative LAP prices occurred in the 15-minute market during about 8 percent of all intervals during weekdays in hours ending 9 through 15 from April to June. This pattern reflects the growing amount of solar energy in Southern California during these hours.

As noted above, during these months loads were relatively low and the amount of transmission on Path 15 was reduced due to planned maintenance. The combination of these factors – along with the recent increase in solar output – contributed to the increase in negative prices during these months. The frequency of negative real-time prices in Southern California dropped substantially starting in June as loads increased and transmission maintenance on Path 15 was completed.

[2] System energy prices exclude the differences in locational margin prices (LMPs) at different points within the ISO system due to congestion.

**Figure 1. Average monthly system energy prices (January – June 2015)**

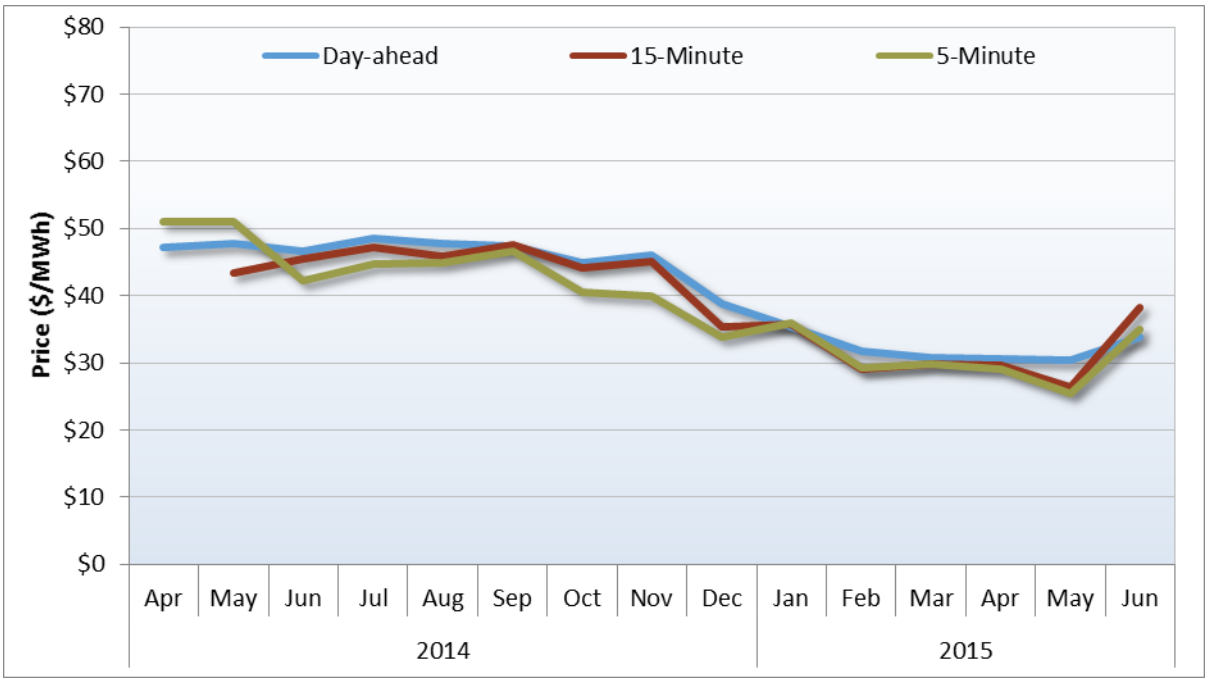



**Figure 2. Average hourly LMPs (April – May 2015)**

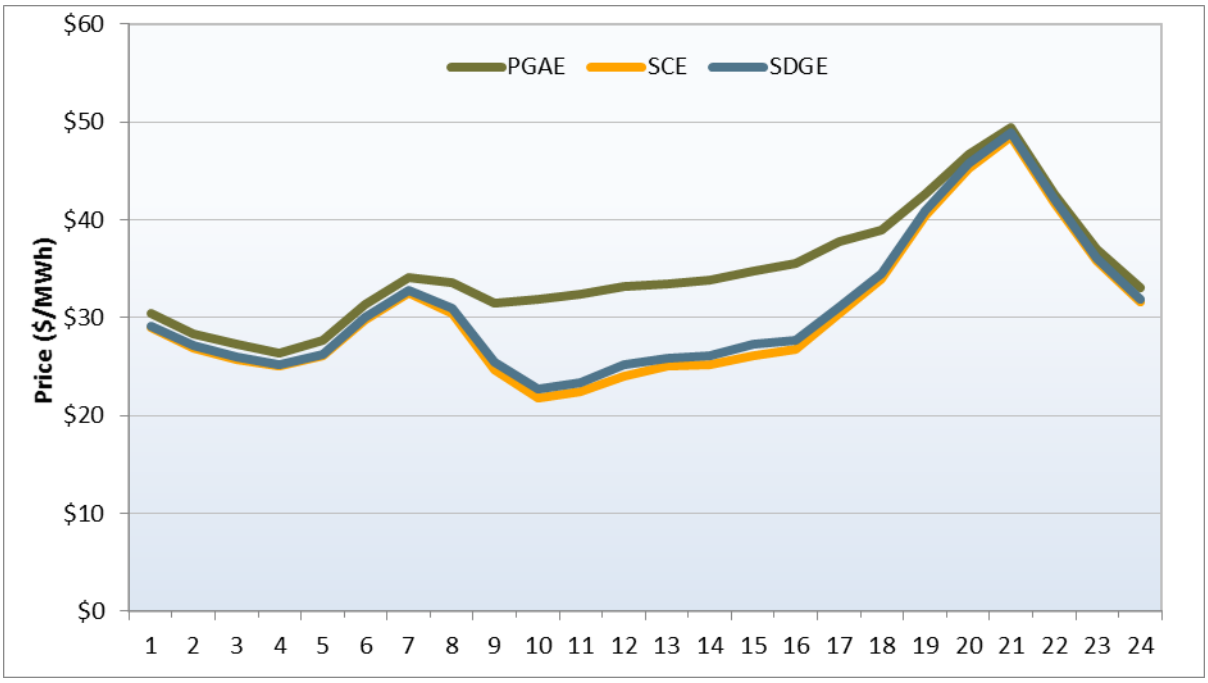


**Figure 3. Monthly frequency of negative LAP prices in 15-minute market**

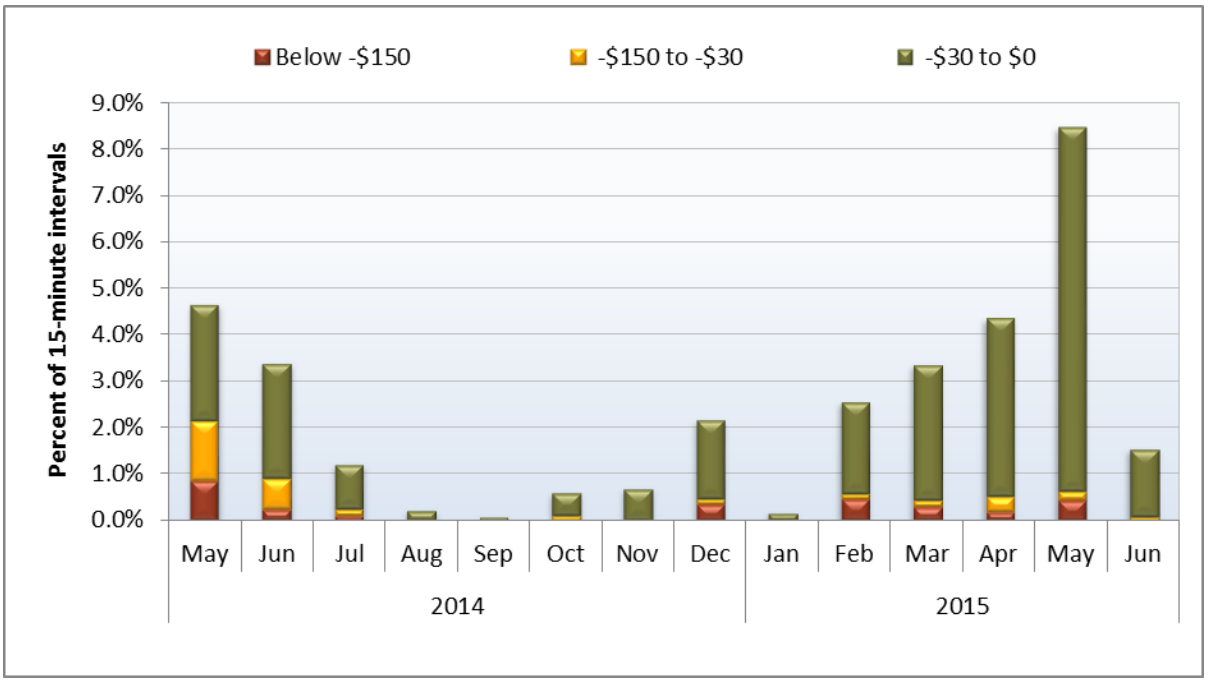
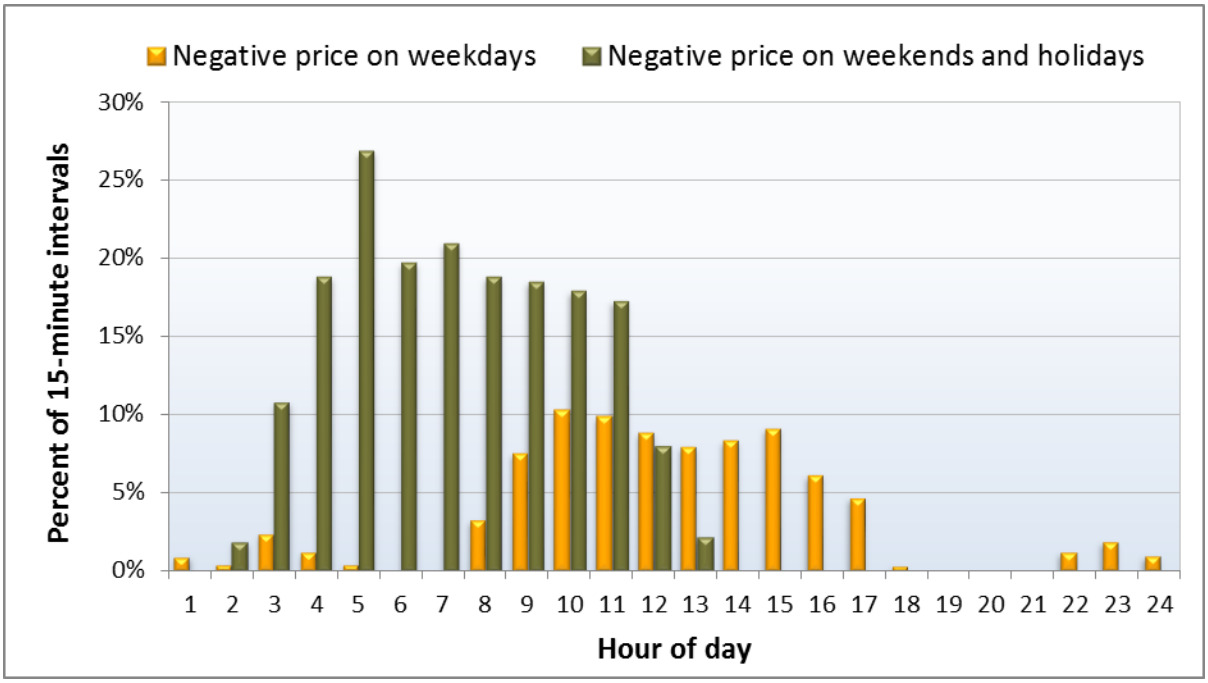



**Figure 4. Frequency of negative LAP prices in 15-minute market (April – June 2015)**



### *Energy Imbalance Market*

Performance of the energy imbalance market has improved over the course of 2015. During most intervals, prices in the EIM have continued to be highly competitive and have been set by bids closely reflective of the marginal operating cost of the highest cost resource dispatched to balance loads and generation. However, during a relatively small portion of intervals, energy or flexible ramping constraints have still had to be relaxed for the market software to balance modeled supply and demand.

Figures 5 and 6 show average monthly prices in the 15-minute market *with* and *without* the special price discovery mechanism being applied to mitigate prices during intervals when the energy imbalance constraint needed to be relaxed in PacifiCorp East and PacifiCorp West, respectively. These figures also include monthly average bilateral market prices that were used to determine balancing energy charges prior to EIM implementation in PacifiCorp East and PacifiCorp West.

As shown in these figures, the price discovery provisions approved under the Commission's December 1, 2014 order have effectively mitigated the impact of constraint relaxation on energy imbalance market prices. In the PacifiCorp East area, prices in the 15-minute market that would have resulted without these special price discovery provisions have dropped substantially over the first six months of the energy imbalance market and were about equal to bilateral prices in May. In the PacifiCorp East area, 15-minute prices that would have resulted without price discovery provisions have tracked closely with bilateral prices since February

**Figure 5. Monthly average 15-minute prices (PacifiCorp East)**

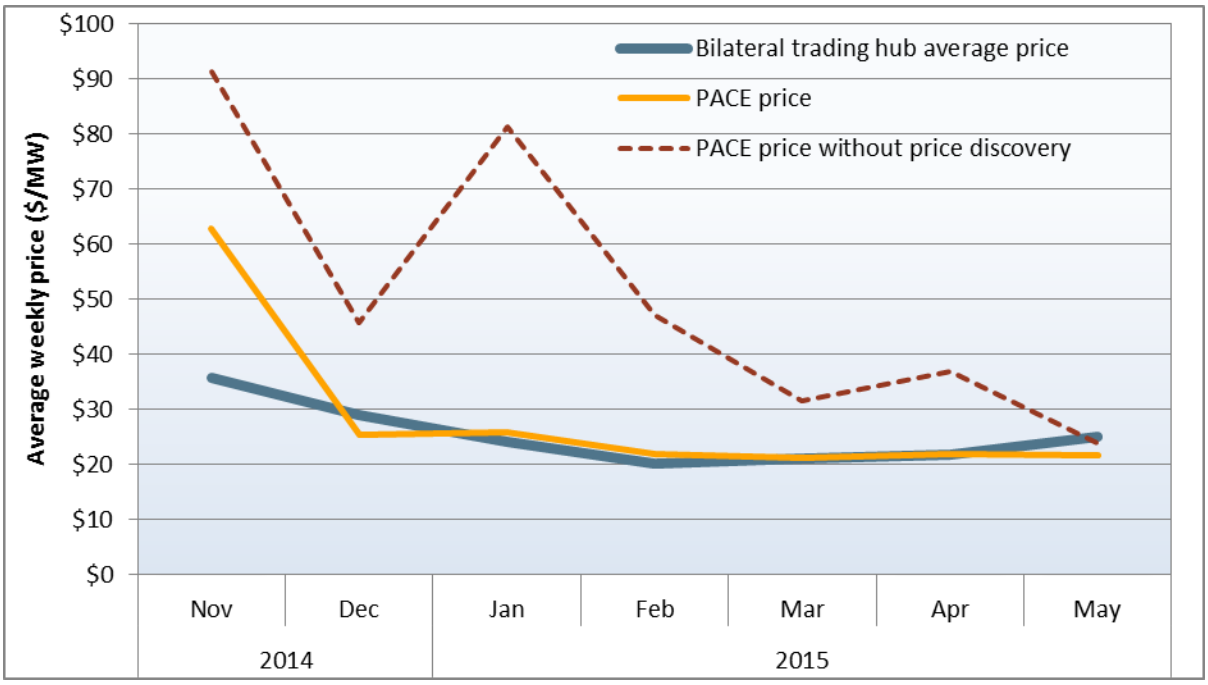



**Figure 6. Monthly average 15-minute prices (PacifiCorp West)**