California Independent
System Operator Corporation

Memorandum

To: ISO Board of Governors

From: Eric Hildebrandt, Director, Market Monitoring

Date: March 17, 2010

Re: ***Market Monitoring Report***

This memorandum does not require Board action.

EXECUTIVE SUMMARY

This report provides comments and recommendations by the Department of Market Monitoring (DMM) on two items being presented to the California Independent System Operator Corporation's Board of Governors by Management at the March 25-26, 2010, meeting.

- **Non-Generator Resources in Ancillary Service Markets.** The ISO's proposal will encourage development of demand response and energy storage technologies by modifying several elements of the current ancillary service requirements. Modifying these requirements will significantly reduce barriers to participation in the spinning and non-spinning reserve markets by these non-generator resources, without reducing system reliability. The ISO's draft proposal included provisions that would allow non-generation resources to provide regulation by creating a new type of resource, known as regulation energy management. DMM and stakeholders had numerous concerns about this component of the ISO proposal. The ISO has committed to continue to examine this aspect of its proposal issue through the ancillary services market product review stakeholder process scheduled to begin in the second quarter of 2010. DMM believes that it should be possible to develop an initial framework for the provision of regulation services by non-generation resources on a timeline that does not delay development and testing of these new resources. For example, given the limited amount of these resources, pilot programs could be implemented, while the details of any new regulation or ramping products are developed as part of a more comprehensive review of ancillary service markets.

- **Market Performance Update.** This memo also provides an update on two key measures of performance of the ISO's new market design: (1) the convergence of prices between the ISO's different sequential energy markets (day-ahead, hour-ahead, and 5-minute

real-time dispatch), and (2) the frequency and magnitude of price spikes in the 5-minute real-time dispatch market. Overall market performance in terms of these two measures continues to improve over the first 11 months of the ISO's new market design. Results of this analysis, and reasons for this improvement, are included in an informational briefing scheduled for presentation by other ISO staff at the March 25-26 Board meeting. A more detailed assessment of overall market performance by DMM will be provided in our *2009 Annual Report on Market Issues and Performance*, which will be completed in early April 2010.

A more detailed discussion of each of these items is provided below.

NON-GENERATOR RESOURCES IN ANCILLARY SERVICE MARKETS

The ISO is proposing tariff modifications that would facilitate participation by non-generator resources in the ancillary services markets. The proposal is designed to open the ancillary service market to a broad range of non-generation technologies, including demand response and a variety of advanced energy storage technologies (e.g., batteries, flywheels and compressed air). With greater access to the ISO's ancillary services markets, these non-generation technologies will have a broader range of revenue opportunities, and price signals for appropriate investment in these new technologies will be improved. The ISO will benefit from the additional ancillary service resources provided, and from how these non-generation resources will help to facilitate integration of renewable energy.

Modifications to Ancillary Services Requirements

The key components of the ISO's proposal involve relaxing several elements of the current ancillary service requirements which represent significant barriers to participation in the ISO's ancillary service markets by these new technologies. These include:

- Reducing the minimum rated capacity requirement for participation in the ancillary service markets from 1 MW to 500kW; and
- Reducing the continuous energy requirement for ancillary services from two hours to 60 minutes for regulation in the day-ahead market, and 30 minutes for all other ancillary services.

These modifications will also allow demand response and energy storage technologies to participate in the spinning reserve market once the new standard for contingency reserves that has been proposed by the Western Electricity Coordinating Council is approved by the Federal Energy Regulatory Commission.[1] Thus, these modified provisions have widespread support among participants and should effectively encourage development of demand response and new storage technologies.

As noted in the ISO's memo on this proposal, the requirements being modified represent a "historical legacy" reflecting the operating characteristics of traditional supply resources, rather

[1] See *Revised Draft Final Proposal for Participation of Non-Generator Resources in California ISO Ancillary Services Markets,* February 10, 2010, p. 10.

than standards based on actual system reliability needs. Empirical analysis performed by the ISO supports the conclusion that these modifications should not detrimentally impact system reliability.[2]

To the extent that relaxation of any of these requirements or increased reliance on these new technologies for ancillary services creates operational or reliability concerns, new performance standards or testing requirements should be developed to directly address these concerns. However, given the limited amount of non-generation resources that are expected to be initially available to participate in the ISO's markets, such standards or requirements can be developed based on the ISO's initial experience with these non-generation resources. In addition, DMM notes that the provisions for random testing of supply resources in the ISO's current tariff have very rarely been implemented. Thus, any new performance standards or testing requirements that are ultimately developed should be applied equitably to both generation and non-generation resources.

Regulation Energy Management Resources

The ISO's revised draft final proposal on this issue also included provisions to establish a new category of resource: regulation energy management (REM) resources. Under the proposal, REM resources would be able to sell regulation capacity in the day-ahead ancillary service market, but the ISO will only procure up to 10 percent of the total regulation requirement from these resources. In order to treat generation and non-generation resources equally, the ISO's proposal would allow both generation and non-generation resources to be categorized as REM resources.

The ISO proposal was targeted toward including REM resources in the existing regulation market, with accommodations and restrictions, on the premise that the capacity procured from these resources and the energy provided by these resources are sufficiently comparable to those of traditional technologies. However, DMM identified numerous concerns with the REM approach incorporated in the ISO's revised draft final proposal. Several of DMM's key concerns involved the detrimental impact the proposal could have on the pricing and availability of supply in the overall market for regulation service, in which the ISO would need to continue to rely on traditional generating resources for at least 90 percent of the ISO's regulation requirements.

The ISO proposal would also exempt REM resources from settlement of real-time energy. This rule is based on the premise that, in the case of battery storage devices, the resource is merely storing energy for use when needed and is not buying or selling imbalance energy. However, the efficiency of these resources in performing this function is generally between 50 percent and 85 percent. This efficiency loss has the potential to result in uplift costs that will ultimately be allocated to demand. In addition, exempting REM resources from settlement of real-time energy would not encourage development of more efficient demand response or storage technologies relative to less efficient storage technologies.

While DMM identified modifications that could mitigate some of these concerns, DMM believes it may be more appropriate to consider creation of a separate regulation product tailored more

[2] Ibid, p. 9.

specifically for REM resources and how these resources can help facilitate integration of renewable energy. The ISO has committed to re-examining its REM proposal through the ancillary services market product review stakeholder process scheduled to begin in the second quarter of 2010. DMM believes this is a prudent approach. Developing a comprehensive approach that addresses all long run issues associated with REM resources may take significant time. However, DMM believes that it should be possible to develop an initial framework for the provision of regulation services by non-generation resources on a timeline that does not delay development and testing of these new resources. For example, given the limited amount of these resources, pilot programs could be implemented while the details of any new market products are developed.

UPDATE ON MARKET PERFORMANCE

This section provides an update on two key measures of performance of the ISO's new market design:

- The convergence of prices between the ISO's different sequential energy markets (day-ahead, hour-ahead scheduling process, and real-time dispatch); and
- The frequency and magnitude of price spikes in the 5-minute real-time dispatch market.

Overall market performance in terms of these two measures has continued to improve over the first 11 months of the ISO's new market design. Results of this analysis, and reasons for this improvement, are included in an informational briefing scheduled for presentation by ISO staff at the March Board meeting. A more detailed assessment of overall market performance by DMM will be provided in our *2009 Annual Report on Market Issues and Performance*, which will be completed in early April 2010.

Price Convergence

As shown in Figure 1, average monthly prices for the Pacific Gas and Electric (PG&E) area in the day-ahead integrated forward market and 5-minute real-time dispatch markets have tracked closely during most months since the start of the ISO's new market design. However, as highlighted in Figure 2, prices in the hour-ahead scheduling process tended to be significantly lower than in the 5-minute real-time dispatch market over the first eight months of the new market design (April to November 2009).[3] Since December 2009, average monthly prices in the hour-ahead scheduling process converged very closely to prices in the 5-minute real-time market in the PG&E area. Price patterns in the San Diego Gas and Electric (SDG&E) area have been similar to those in the PG&E area.

[3] As highlighted in DMM's Quarterly Report covering the third quarter of 2009, this price divergence has been coupled with a trend for the ISO to export relatively large quantities of additional energy in the hour-ahead scheduling process (at low prices), and then dispatch additional energy within the ISO in real-time dispatch (at significantly higher prices). This pattern of "selling low" in the hour-ahead scheduling process and "buying high" in real-time dispatch created substantial revenue imbalances that are recovered based on each participant's metered loads through real time energy imbalance energy offset charges. http://www.caiso.com/2457/2457987152ab0.pdf

Figure 1. Average Monthly Prices – PG&E LAP (Peak Hours)

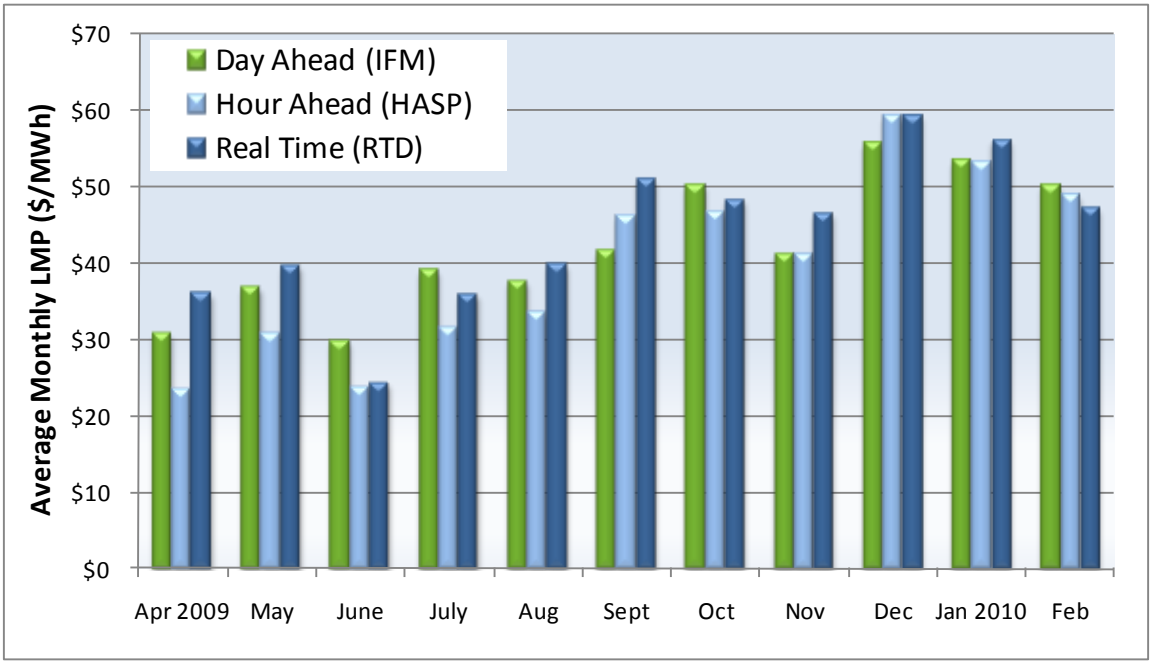
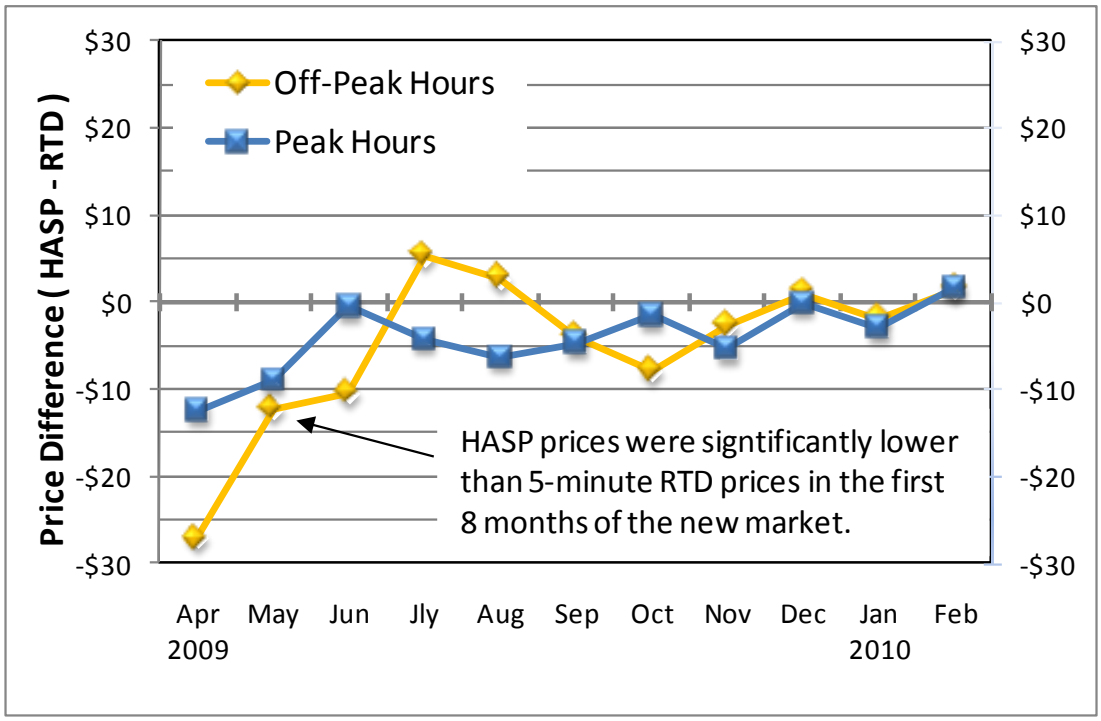


Figure 2. Convergence of HASP and RTD Prices - PG&E LAP



Meanwhile, prices in the Southern California Edison (SCE) area exhibited a similar pattern of improved price convergence through November 2009. In December 2009, price spikes in the hour-ahead and 5-minute real-time dispatch markets began occurring due to the SCE import limit constraint. This constraint represents a limit on the portion of load in the SCE service area that can be met by imports, without compromising system reliability in the event of a major generation or transmission outage. When this constraint becomes binding, it must be mitigated by reducing imports into the SCE area, while increasing generation within the ISO.[4]

Although price spikes due to the SCE import limit have occurred during a relatively small percentage of intervals, the magnitude of these price spikes drove average monthly prices in the hour-ahead and real-time dispatch markets significantly higher than day-ahead market prices, as illustrated on the next page in Figure 3. In addition, price spikes resulting from the SCE import limit were more frequent in the hour-ahead scheduling process than in the 5-minute real-time dispatch during February. During February, this drove the average hour-ahead prices during peak hours about $10/MWh higher than real-time dispatch prices and about $20 higher than real-time dispatch prices during off-peak hours.

As shown in Figure 4 on the following page, excluding the six percent of intervals in which the SCE import limit was binding in the hour-ahead or real-time markets, average peak prices in these two markets have been approximately equal in the first two months of 2010. A similar trend has occurred during off-peak hours.

The ISO has initiated processes to refine ways in which this reliability constraint is modeled by replacing the SCE import limit with a combined limit on imports to the SCE and SDG&E areas. This modification may be in place by April 2011.

[4] Historically, the SCE import limit has been binding much less frequently that it has since December. This increase in congestion appears to be due to a combination of factors. First, over 1,100 MW of the San Onofre nuclear unit has been on planned outage since late September. In addition, recent refinements in generation procedures have reduced the amount of capacity in Southern California that is committed under these procedures. Finally, under the ISO's new market, additional lower-priced imports can be dispatched in place of higher priced generation within the ISO. Under low load conditions, the combination of these factors causes this constraint to be binding much more frequently.

Figure 3. Convergence of HASP and RTD Prices – SCE LAP (Peak Hours)

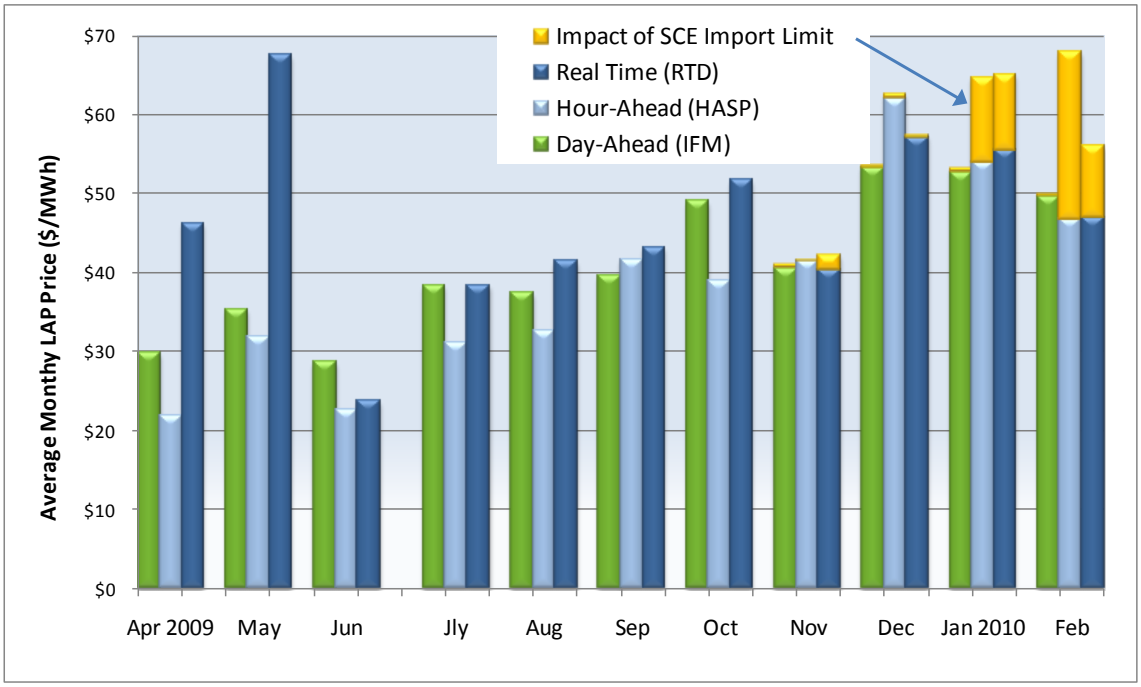
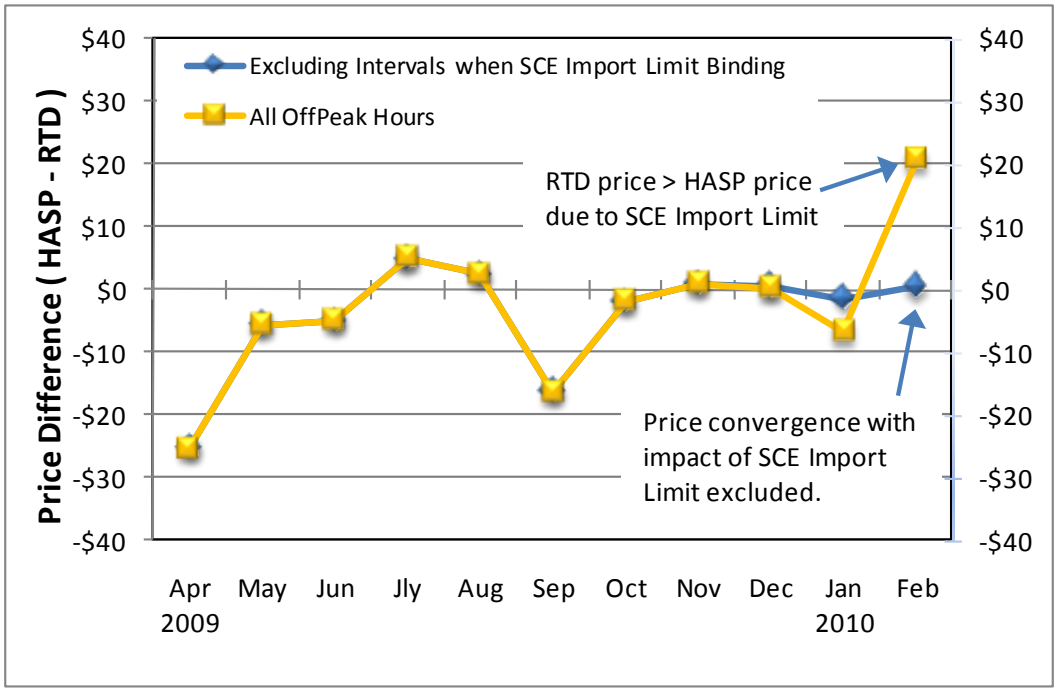


Figure 4. Convergence of HASP and RTD Prices – SCE LAP (Peak Hours)



Price Spikes

Figure 5 shows the frequency and magnitude of price spikes in the 5-minute real-time dispatch market over the first 11 months of the ISO's new market. Both the frequency and magnitude of price spikes dropped sharply over the first three months of the ISO's new market (April to June). Most of the very extreme price spikes in the early months of the ISO's new market design were due to software modeling issues, rather than underlying supply and demand conditions. After modifications were made to address these modeling and software issues, extreme price spikes (e.g., of $1,000 or more) rarely occurred.

Price spikes increased only slightly during the summer and early fall months (June through October). These months are typically when the most extreme price spikes occur, and many of the price spikes during these summer months were much more reflective of actual underlying supply and demand conditions.

As noted in the previous section, in December 2009, price spikes in the hour-ahead and real time dispatch markets began occurring due to the SCE import limit constraint. Virtually all of the prices spikes over $750 in the first two months of 2010 have been due to this constraint. As previously noted, the ISO has initiated processes replace the SCE import limit with a combined limit on imports to the SCE and SDG&E areas. This modification may be in place by April 2011, and would help reduce price spikes from the import limits into Southern California.

Figure 5. Prices Spikes in Real Time Dispatch (RTD) Market