April 24, 2006

The Honorable Magalie Roman Salas
Secretary
Federal Energy Regulatory Commission
888 First Street N.E.
Washington, DC 20426

Re: California Independent System Operator Corporation, ER02-1656

Dear Secretary Salas:

The California Independent System Operator Corporation ("ISO") hereby respectfully submits for filing an original and fourteen copies of a report on the performance of the Automated Mitigation Procedures ("AMP") covering the last quarter of 2004 through the first quarter of 2006, *i.e.,* October 1, 2004 through March 31, 2006. This report is being submitted in accordance with the directive in the Federal Energy Regulatory Commission's ("Commission") July 17, 2002 Order, *California Independent System Operator Corporation,* 100 FERC ¶ 61, 060 (2002) (the "Order"). Please return one file-stamped copy of the report to the ISO in the enclosed, self-addressed return envelope. The report will also be posted on the ISO's website at http://www.caiso.com.

The Order pursuant to which the AMP reports have been submitted does not contain an end date for the ISO's reporting obligation. The ISO notes that the current report reflects six quarters of AMP activity, *i.e.,* Quarter 4 of 2004 through Quarter 1 of 2006. The ISO was delayed in preparing and submitting AMP reports on a quarterly basis following implementation of the ISO's current Real Time Market software, RTMA. However, during this period, timely communication of market activity and analysis from ISO Market Monitoring Staff to the Commission's OMOI Staff has increased considerably. This increased communication has been in the form of monthly conference calls, weekly emails, individual phone calls, and the more timely submission of market data to OMOI Staff as a result of ISO Tariff Amendment No. 71. The increased communication between ISO Staff and Commission Staff has resulted in more timely and thorough reporting of market events, including relevant AMP activity. Given the improved communication between ISO Staff and Commission Staff and the extremely infrequent occurrence of AMP mitigation (only three hours of mitigation over a three-and-one-half year period), the ISO respectfully requests that the Commission reconsider the requirement for the ISO to submit quarterly AMP reports and either (1) notify the ISO that it is no longer obligated to provide these reports to the Commission or (2) provide an expiration date for the reporting requirement .

Thank you for your assistance in this matter.

Respectfully submitted,

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Report on Performance of the Automated Mitigation Procedure
Covering Quarters 2004 Q4 through 2006 Q1
California ISO – April 17, 2006

As directed by the Federal Energy Regulatory Commission ("Commission") in its July 17, 2002 Order,[1] the ISO has prepared this Report on the Performance of the Automated Mitigation Procedure (AMP), covering the six quarters between October 1, 2004, and March 31, 2006. AMP, proposed by the ISO in its May 1, 2002 Market Redesign 2002 filing, was approved by the Commission with modifications in the July 17 Order. This report provides observations and analysis of trends pertaining to the effectiveness of AMP mitigation for the subject period. Quarterly submission of this report was delayed after implementation of the CAISO's new market software, RTMA, on October 1, 2004. This report includes six quarters of market operation, which brings the submission of AMP reports current.

Description of AMP

AMP is an automated procedure designed as part of the ISO's real-time market dispatch software. It was intended to limit the ability of suppliers of energy in the real-time market to exercise market power by offering energy at prices well in excess of production costs. In short, AMP is a three-step algorithm that runs approximately 53 minutes prior to each hour of operation of the real-time market:

1. **Price Screen:** AMP predicts prices for each 15-minute interval of the operating hour based upon submitted bids and predicted imbalance.[2] If any predicted interval price in any ISO congestion zone exceeds $91.87/MWh, AMP applies the Conduct Test.
2. **Conduct Test:** AMP compares each resource's bid to its *Reference Level,* a benchmark generally based upon the resource's rolling average of bids from the previous 90 days. In the event that a bid exceeds its reference level by the lower of $100 or twice the reference level, the resource is said to have failed the Conduct Test.
3. **Impact Test:** AMP substitutes reference levels for all resources that have failed the Conduct Test. AMP then re-calculates the predicted prices based upon this reconstructed supply curve. If the average predicted price over the four 15-minute intervals is $50 above or twice the original predicted price, whichever is lower, the Impact Test is said to have been failed.

In the event that the Impact Test is failed, all resources whose bids failed the Conduct Test are mitigated. That is, their reference levels replace submitted bids for purposes of actual real-time dispatch and pricing.

Review of Previous Reports

The previous AMP Performance Reports examined the effectiveness of the AMP Price Screen and Conduct Test, as the Impact Test had never been failed prior to October 1, 2004. In general, those reports noted that the price screen had little predictive value as a test, as predicted prices varied

[1] *California Independent System Operator Corporation*, 100 FERC ¶ 61,060 (2002) (July 17 Order).

[2] AMP actually runs for four 15-minute predicted intervals in each hour, rather than for the 12 actual 5-minute market intervals each hour. This was a design tradeoff that could provide similar predictive value in a computer processing timeframe that was feasible for hourly operation.

widely from actual real-time prices. Those reports also found that the Conduct Test had some predictive ability to anticipate prices well above costs, although prices during those periods tended to be low and the $250/MWh price cap generally rendered AMP mitigation ineffective. Finally, those reports also noted that, for a small subset of resources that frequently set prices, reference levels increased over time which may have been the result of strategic higher (priced) bidding specifically targeted to influence a unit's reference level.

With the deployment of the Real-Time Market Application (RTMA) on October 1, 2004, the beginning of the subject period of the instant Report, AMP was incorporated into the market software and the results of the Price Screen are now available only in "save cases" from the market software runs and are not published to an accessible database. As a result, this report does not analyze the effectiveness of the Price Screen; however, it does review Conduct and Impact Test failures as well as trends in reference levels.

Test Failures

AMP Conduct Test failures are correlated with high electricity prices, because the test is only applied whenever a predicted interval MCP exceeds $91.87/MWh. The failures also appear to be correlated with rapid changes in natural gas prices. Generators tend to increase their bids immediately when facing suddenly higher natural gas costs. However, reference levels are adjusted for gas price changes on a monthly basis, using a monthly gas index. Frequent Conduct Test failures may be due in part to the lag between the change in daily spot natural gas prices (as reflected in supplier's bids from day to day) and monthly adjustments to the reference levels to reflect the changes in natural gas prices. In fact, the Conduct Test was failed in nearly all hours on some days following the hurricanes in August and September 2005, and again during a nationwide cold snap in December 2005. The following chart shows Conduct and Impact Test failures, in addition to the monthly gas index and ranges of gas prices for that month.

Table 1. Conduct and Impact Test Failures vs. Natural Gas Normalization Index and Prices: Oct-04 through Mar-06[3]

Month	Conduct Test Failures	Impact Test Failures	Gas Index	Gas Price Low	Gas Price High
Oct-04	81	0	$ 4.85	$ 4.06	$ 7.50
Nov-04	51	0	$ 7.39	$ 4.57	$ 7.35
Dec-04	22	0	$ 6.48	$ 5.61	$ 7.10
2004 Q4	154	0			
Jan-05	36	0	$ 6.05	$ 5.24	$ 6.04
Feb-05	22	0	$ 5.85	$ 5.52	$ 6.24
Mar-05	81	0	$ 5.75	$ 6.08	$ 6.97
2005 Q1	139	0			
Apr-05	48	0	$ 6.84	$ 6.18	$ 7.15
May-05	15	0	$ 6.71	$ 5.45	$ 6.23
Jun-05	4	0	$ 5.75	$ 5.48	$ 6.89
2005 Q2	67	0			
Jul-05	11	0	$ 6.44	$ 5.96	$ 7.30
Aug-05	38	0	$ 6.37	$ 7.00	$ 10.07
Sep-05	195	0	$ 8.52	$ 8.80	$ 11.47
2005 Q3	244	0			
Oct-05	328	0	$ 10.33	$ 9.42	$ 11.79
Nov-05	173	0	$ 11.34	$ 6.07	$ 10.35
Dec-05	371	0	$ 9.55	$ 7.56	$ 13.92
2005 Q4	872	0			
Jan-06	97	2	$ 9.57	$ 6.70	$ 8.26
Feb-06	38	0	$ 7.16	$ 5.85	$ 7.68
Mar-06	52	0	$ 6.68	$ 5.49	$ 6.30
2006 Q1	187	2			

Note that from October 1, 2004, through the end of 2005, the Impact Test was never failed and consequently AMP never mitigated on a system-wide basis. Previous Quarterly AMP Reports confirm that AMP had not mitigated prior to October 1, 2004. There were, however, two mitigation events in January of 2006, as indicated in the "Impact Test Failures" column of Table 1. These events occurred on January 2, hour-ending 19, and January 24, hour-ending 18. Both of these instances resulted in bid mitigation for multiple resources that violated the Conduct Test. These events are discussed in more detail in the last section of this report. As AMP had only mitigated bids on two occasions in more than three years of operation, suppliers had little incentive (as a result of the AMP in place for system market power mitigation) to increase bid prices for real-time energy in attempt to influence their reference levels, which would have decreased their probability of failing the Conduct Test and would increase their mitigated bid price if they were mitigated. Moreover, there is a potential cost to bidding higher in that units that bid higher would be less competitive in the Real Time Market and would potentially forego revenue. Reference level movement may occur due to other issues, such as changes in production costs or delivery contracts, other business practice reasons, or as a result of potential incentives provided by the CAISO's local market power mitigation (LMPM).

Under the CAISO's current LMPM, a resource that is dispatched out-of-sequence (OOS) for incremental real-time energy and has a bid price in excess of the lesser of $50 above the zonal

[3] Gas prices shown are Southern CA Border Average prices.

market clearing price or twice the zonal MCP is subject to LMPM and is mitigated to its reference price. The OOS dispatch is paid the higher of the unit's reference price or the dispatch interval ex post price. OOS dispatches, and activation of LMPM, are more frequent than instances where mitigation occurs as a result of (system) AMP. The CAISO also has a different LMPM provision for decremental energy bids where if the CAISO needs to dispatch internal generator down to manage real-time intra-zonal congestion, the dispatch and OOS settlement will be based on the unit's decremental reference level.

Reference Level Trends

Reference levels generally are rolling averages of bids accepted in the ISO real-time market during competitive periods (implemented as in-sequence dispatches) over the previous 90 days, and adjusted using a natural gas price index that is updated approximately at the beginning of each month, for each of ten evenly-spaced megawatt intervals for each resource's production curve. Reference levels are calculated separately by Potomac Economics, a consultant contracted by the ISO, for peak and off-peak hours for each resource every day. In the event that no such bids are accepted and dispatched as incremental real-time energy over the prior 90-days, reference levels are determined through alternative methods such as production costs, average real-time prices, or costs based upon consultation with Potomac Economics. A detailed description of the alternatives and the priority (sequence) that they are utilized are described in the ISO Tariff.[4]

Reference levels are intended to simulate competitive bids. This notion assumes that some resources may be able to exercise market power at certain moments, but not likely in all hours, so the 90-day volume-weighted average should approximate competitive bidding. Because reference levels are generally based upon submitted bids, they may or may not actually reflect production costs. In previous Reports, the ISO has identified certain resources that have systematically increased reference levels well above production costs. Those resources appear to have done so by capitalizing on hours where they were more likely to be dispatched by bidding measurably in excess of estimated incremental costs.

To determine whether reference levels track competitive bidding behavior, it is useful to examine the difference between reference levels and production costs, as measured by an estimated marginal cost based on daily spot gas prices and incremental heat rates on file with the CAISO. A simple reference level "markup," defined as the difference in dollars between a resource's reference level and estimated production cost, provides a reasonable metric to indicate potential effects of bidding strategies intended to increase reference levels.[5] A disproportionately high value of this metric for a specific resource would indicate the resource is able to be dispatched at bid

[4] CAISO FERC Electric Tariff, Appendix A, section 3.1.1.1.

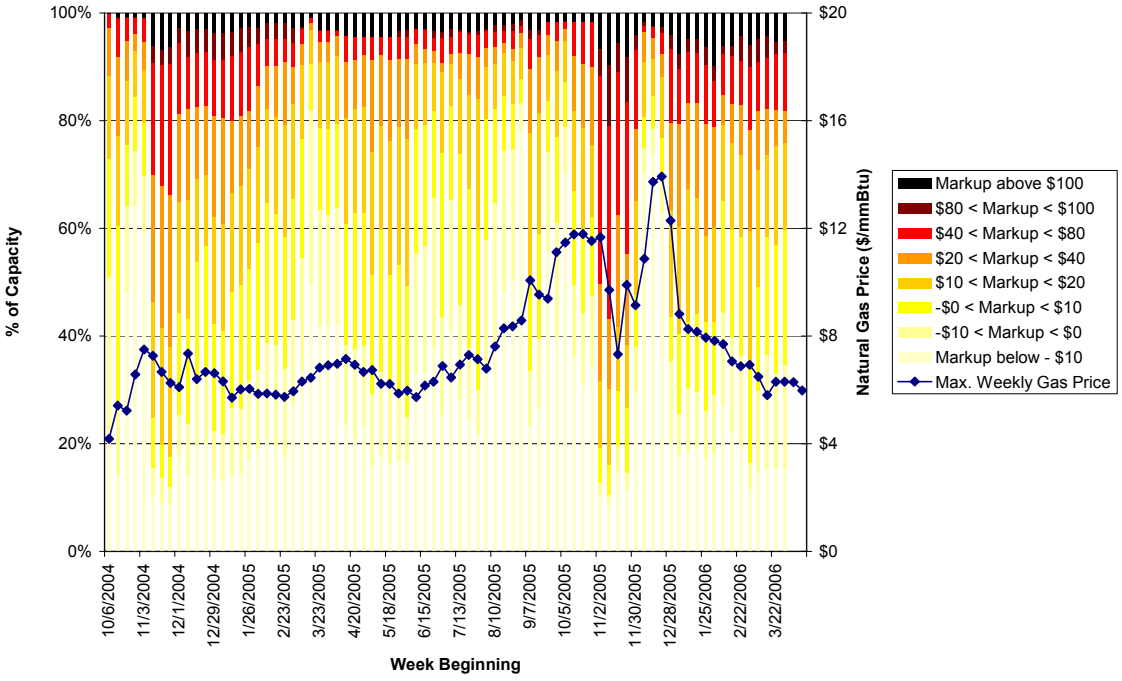
[5] The "markup" metric, as described above, is not directly adjusted for changes in natural gas prices since both components are adjusted individually prior to calculation of the markup metric and the metric, as measured, reveals the actual difference between reference price and estimated cost that suppliers face. For natural gas-fired resources, production costs move naturally with natural gas costs, and reference levels are already adjusted for natural gas price fluctuations. There tends to be some discrepancy in the adjustments because reference levels are adjusted using a gas price index that is adjusted once at the beginning of each month, which represent forward contract costs of delivery, while production costs are based on daily spot gas prices.

prices significantly above its marginal cost in enough intervals to ensure that the reference level markup is also significantly high. In cases where the reference markup is not disproportionately high, the reference level is likely a useful proxy for competitive bids.

Due to the rolling-average property of reference levels, reference level markup is most pronounced after a brief run-up in natural gas prices, followed by a quick retreat. As gas prices increase, suppliers increase their offer prices to account for the increase in input cost. Since reference prices are adjusted for gas once at the beginning of each month (not daily), suppliers tend to offer high bids following a cost increase due to higher gas prices, and the resulting bid prices are incorporated into the reference level for the next 90 days. If costs then quickly fall, the reference level "markup" will be high for some time thereafter.

Similarly, reference level markups are generally low after a rapid decrease in prices, followed by an increase. In this case, the briefly low costs are incorporated into the reference level even after production costs increase again. The following chart shows average reference price-to-cost markups for natural gas-fueled units in the CAISO control area (averaged across all thermal units for the peak hour).[6]

Figure 1. Peak Hour Reference Level Capacity by Reference Level "Markup" Bin: Weekly, Oct-04 through Mar-06



If suppliers were bidding to strategically increase their reference levels, this would be evident in Figure 1 in one of two ways: 1) a significant portion of the capacity represented shows a high

[6] The "Markup" is the difference between a unit's reference level curve and production cost curve given the daily regional gas price.

markup across the time period (indicating the strategy had been employed prior to the study period or that certain units had always bid above the estimated production costs) or 2) the amount of capacity with high markups shows an increasing trend across the study period. Neither of these patterns appear in Figure 1. Figure 1 shows that, in general, reference curves for thermal units tend to represent an average markup of less than $20 / MWh with about 20% of reference curve capacity having a markup of over $20.[7] Furthermore, there is no discernable upward trend in the average markup level. Figure 1 does however highlight an interesting circumstance that is in part a product of the 90-day moving average used in calculating the reference prices and the lag in adjusting reference prices for changes in natural gas prices. This circumstance occurs when the there are sudden and significant changes in the price of natural gas. In this case (see September - October in Figure 1 for example) natural gas prices increased rapidly following hurricane Katrina and then retreated in November. During October, gas prices were high and suppliers increased their bid prices to reflect the increase in input costs. As these higher-priced bids were dispatched they also became incorporated in the 90-day rolling average that comprises the reference price, thereby indirectly increasing reference levels. The cost component of the reference markup reflects daily gas prices, so as gas prices increase within the month so does the cost component, and since the reference price component is only adjusted for changes in monthly gas prices, the daily cost component is increasing faster than the reference price during periods where gas prices are increasing, which results in lower markups.

This process reverses when natural gas prices decline quickly, as was the case in the early part of November, as depicted in Figure 1. In this circumstance, production costs decline with daily spot gas prices. The corresponding decline in reference prices follows more slowly, thus increasing the reference markup metric. In cases such that gas prices increased significantly and then subsequently declined, such as in November 2005, the effect of lags in the reference price (due to lagged gas price adjustment) were particularly apparent where reference markups over $40/MWh represented 80 percent of all real-time bid volume for the few weeks following the rapid decline in gas prices from $11.87 to $7.32/mmBtu within a two-week period. The point of exploring how the reference markup is impacted by the methodology used to calculate the reference price is to illustrate that during periods where natural gas prices are volatile, the reference price can be a less accurate measure of what a reasonable bid price should be – though the rather substantial conduct threshold of the lesser of $100 or 200 percent above their reference levels mitigates the concern that such resources might be inappropriately mitigated because of abrupt changes in daily gas prices.

Bids rapidly increased again during the sharp increase in gas prices in December 2005, due to a nationwide cold snap while much U.S. production capacity had not yet returned to service following the hurricanes. Meanwhile, the lower prices bid during the November gas price crash were incorporated into December reference levels. This resulted in 80 percent of maximum markups below $20/MWh during the middle two weeks of December.

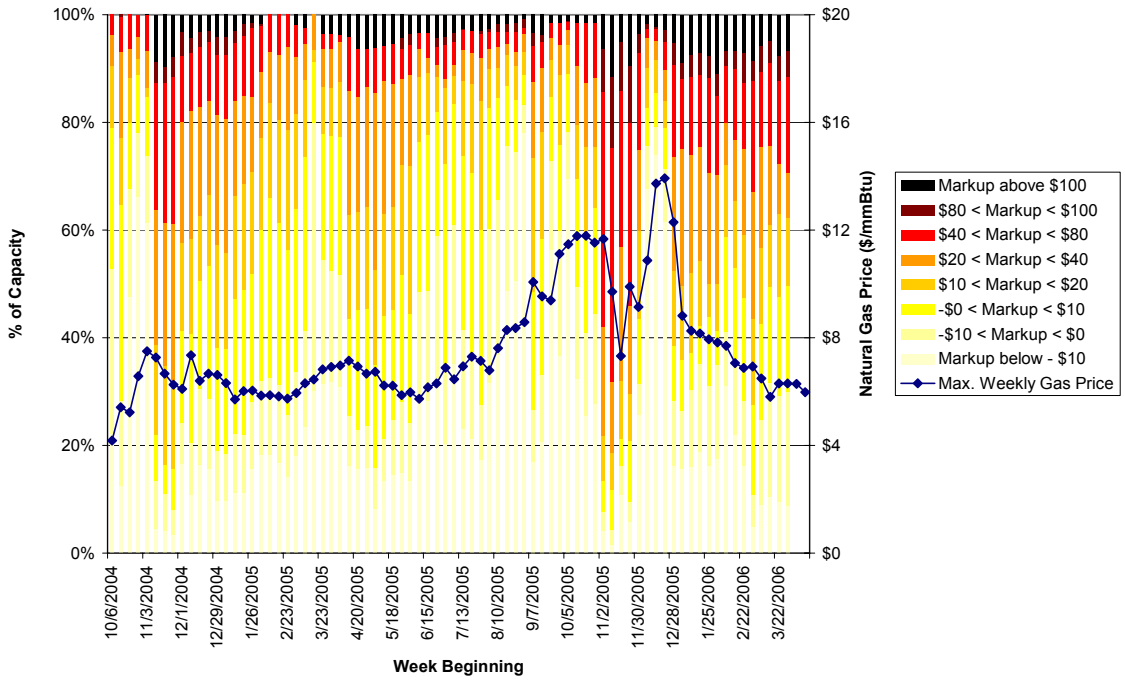
The proportion of reference levels that consistently bid at least $80/MWh above cost is small, increasing above 20 percent of supply for only a few weeks in November 2005. This indicates that

[7] Figure 1 reflects markups calculated using all reference curves, regardless of the source of the reference value (i.e. bid-based, consultative, MCP-based, or cost-based reference values).

most suppliers' reference levels are fairly similar to cost, and that reference levels have generally served as a useful proxy for competitive bidding during the subject period.

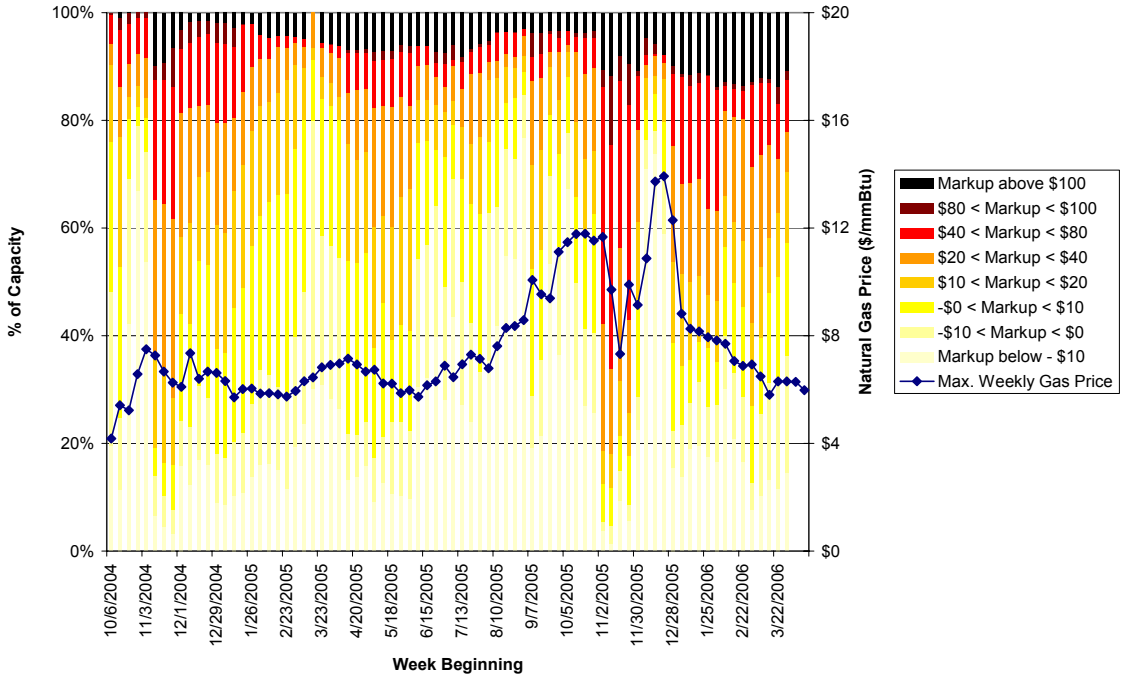
The phenomenon is similar and more pronounced when including only bid-based reference levels (i.e., excluding consultative-based and MCP-based reference levels). The chart below shows average reference markups (by markup bin) for gas-fueled capacity with bid-based reference levels during peak hours.

Figure 2. Peak Hour Bid-Based Reference Level Capacity by Reference Level "Markup" Bin: Weekly, Oct-04 through Mar-06



The trends are also similar for off-peak reference levels, although the high-markup regions tend to include an additional 5 percent of capacity across all periods. This is likely due to the fact that a relatively small pool of resources can be responsive to the rapid imbalance swings during off-peak shoulder hours, such as hours ending 6:00, 23:00, and 24:00. As a result, those resources that are responsive appear to have some pricing power (i.e., ability to have relatively high bids dispatched). The following chart shows off-peak bid-based reference level capacity by bid "markup" bin.

Figure 3. Off-Peak Hour Bid-Based Reference Level Capacity by Reference Level "Markup" Bin: Weekly, Oct-04 through Mar-06

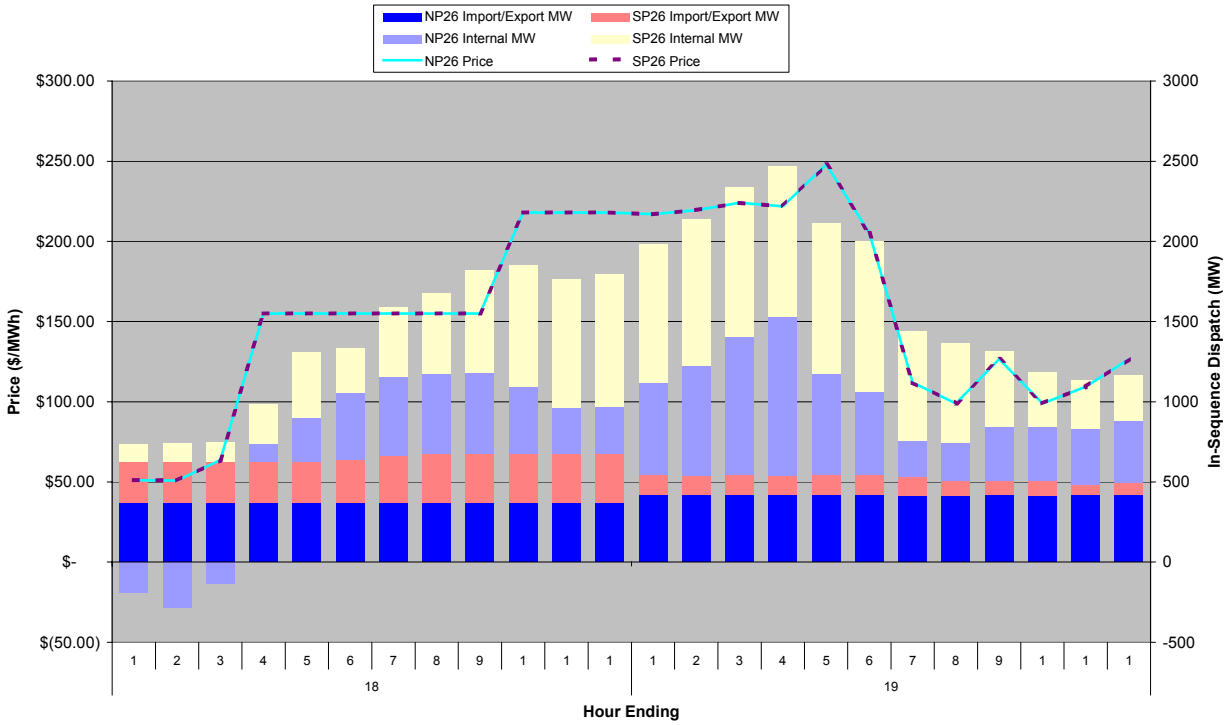


Mitigation Events in 2006

January 2, 2006

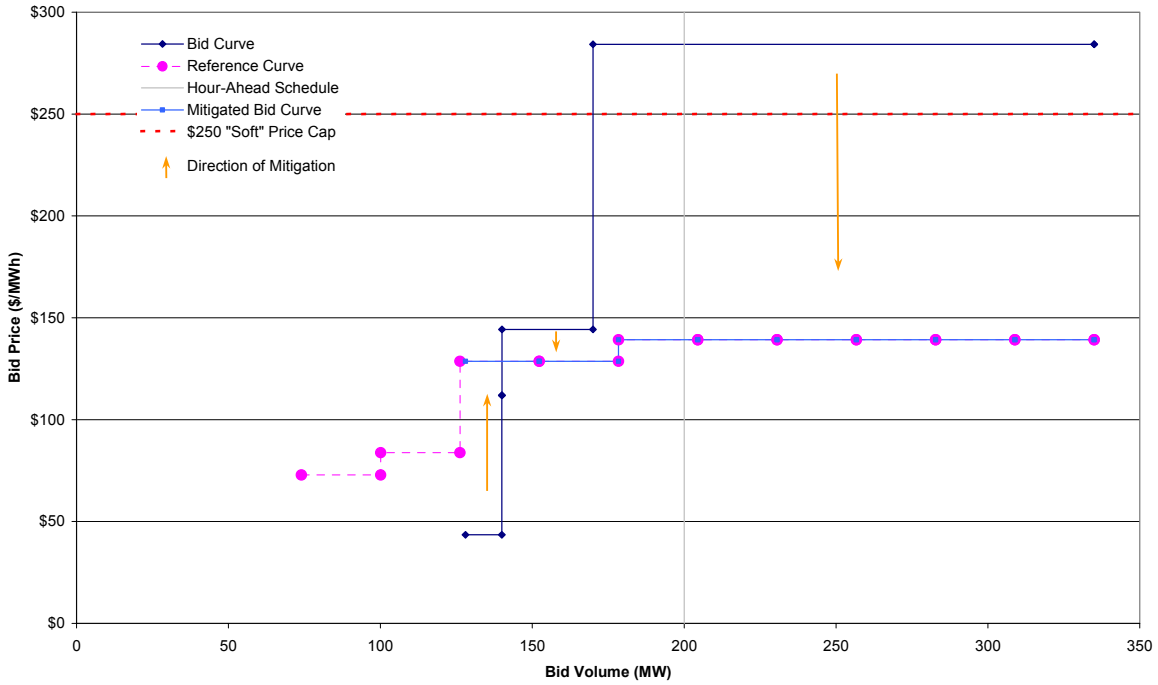
On January 2, HE 19:00, the AMP was triggered and resulted in bid mitigation. For this hour, a price was predicted in excess of the Price Test threshold of $91.87/MWh, triggering the application of the Conduct Test. The software identified 13 resources that failed the Conduct Test by bidding in excess of the lesser of $100 or 200 percent above their reference levels. The failure of the Conduct Test triggered the application of the Impact Test. The predicted price using mitigated bids was in excess of the lesser of $50 or 200% over the average MCP from the unmitigated run. This failure of the Impact Test resulted in bid mitigation where the entire bid curve of each resource that failed the Conduct Test was replaced with its reference curve for RTMA dispatch and pricing. Figure 4 shows the observed real-time market outcomes for hours-ending 18 and 19 on January 2. Note that for hour ending 19:00, during which mitigation occurred, actual market clearing prices ranged between $99 and $248.05/MWh.

Figure 4. RTMA Dispatch and Prices, January 2, 2006, HE 18-19



Of the 13 units that were mitigated, six received incremental dispatch instructions during the hour. Of these, all were dispatched into operating regions for which bid segment prices were in excess of Conduct Test thresholds. Some of these units submitted bids above the "soft" price cap, meaning that their original bids would not have been eligible to set the market-clearing price. However, these bids were mitigated to levels below the price cap, so the mitigated bids were in fact eligible to set the market-clearing price in the case that any of them were marginal. The following chart shows an example of bid and reference curves for a unit that was mitigated.

Figure 5. Sample Bid Curve that was Mitigated to its Reference Curve, 1/2/06, HE 19



Aside from properly serving the intended function of mitigating economic withholding, the there are two interesting AMP outcomes illustrated in Figure 5. First, as mentioned above, bid prices in excess of the "soft" bid price cap that were not eligible to set the MCP were mitigated down to prices below the "soft" bid price cap where they could set the MCP if dispatched. While appropriately mitigating economic withholding, in a circumstance where the mitigated bid was priced closer to the price cap and set the MCP in one or more intervals, it is possible that the cost of the market impact resulting from this high priced mitigated bid could outweigh the cost savings of not paying the one supplier "as-bid" for energy provided from unmitigated bid segments priced above the "soft" bid cap.

The second interesting AMP outcome illustrated in Figure 5 is that the lower-priced bid segments are actually mitigated upward. This is a result of the AMP rule in which the entire bid curve is replaced by the reference level curve for the purpose of dispatch when the resource is mitigated. This may also have a market impact in cases where these lower-priced bid segments that are mitigated upward actually set the MCP. This AMP outcome is discussed in more detail at the end of this report.

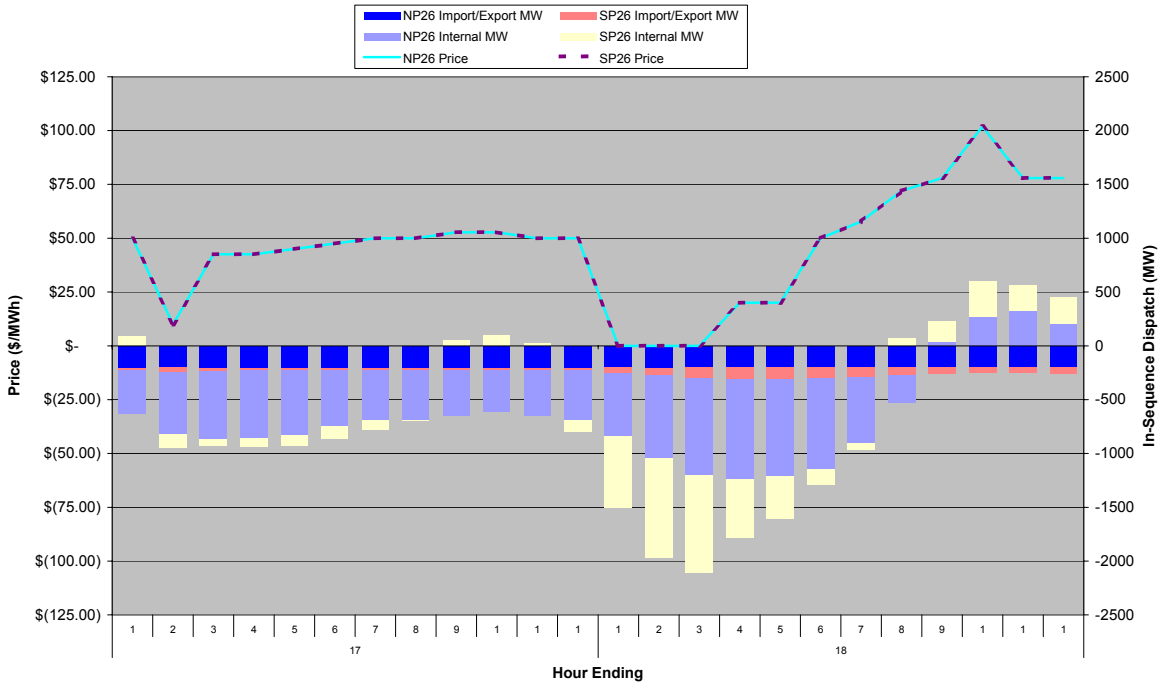
One mitigated resource did not in fact submit bids in this hour, so RTMA used its proxy bid, based on its incremental heat rate as registered with the CAISO. Because this proxy bid featured prices well in excess of the unit's reference level (due largely to high a incremental heat rate), the proxy bid was mitigated to its reference level. Thus, this resource was dispatched at prices below its

estimated cost in at least one interval (interval 11). In other intervals, the resource was dispatched based on its reference level, but the market price was in fact above its proxy bid price.

January 24, 2006

On January 24, hour ending 18:00, interval MCPs in excess of $91.87 were predicted. Resources failed the Conduct Test, and the Impact Test subsequently failed, resulting in bid mitigation. In this hour, sixteen units failed the Conduct Test and were mitigated. This hour is somewhat different from the mitigation event on January 2 for the following reason: dispatch in real time was in the decremental direction system-wide for intervals 1 through 8. The maximum incremental dispatch in intervals 9 through 12 was 601 MW, which is not unusually large. The following chart shows the RTMA in-sequence interval dispatch and prices for January 24, hours ending 17:00 and 18:00.

Figure 6. RTMA Dispatch and Prices, January 24, 2006, HE 17-18

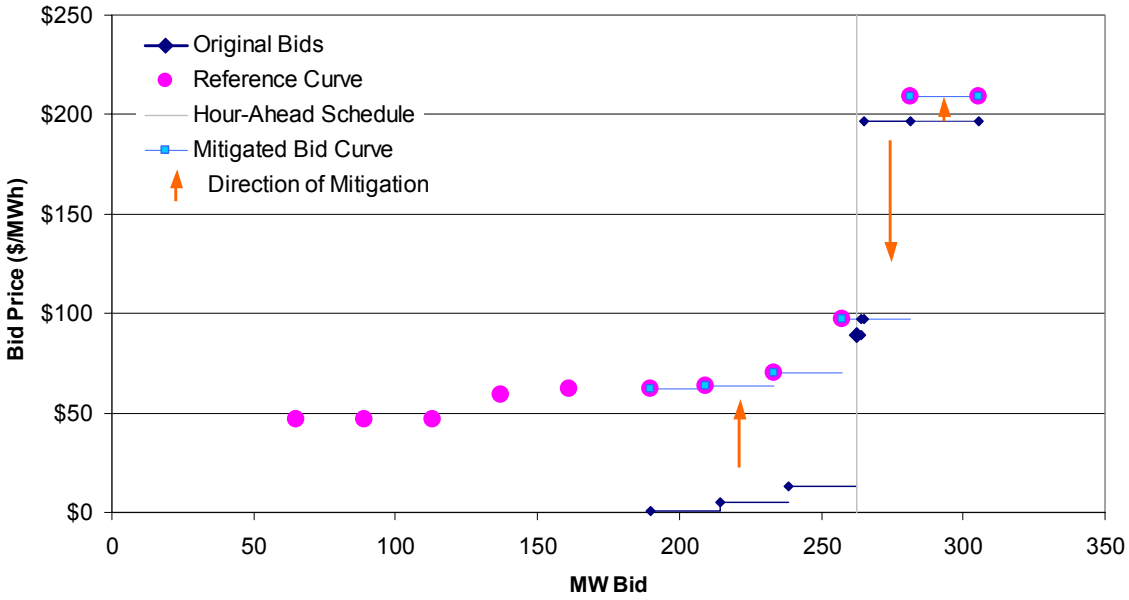


Because actual real-time dispatch was overwhelmingly decremental, the resources whose bids were mitigated that also received dispatches were dispatched only in the decremental direction. In the later intervals where the CAISO was dispatching in the incremental direction, those mitigated resources were un-dispatched and returned toward their hour-ahead schedules at their maximum ramp rates.

Overall, relatively few units whose bids were mitigated were in fact dispatched. Of the sixteen units whose bids were mitigated, only four actually received real-time dispatch instructions, and all were in the decremental direction.

The ISO Tariff states that bids that failed the Conduct Test "would be kept mitigated at their default bid levels." Of the bids that were mitigated, some had actually bid portions of their curves at prices below their reference levels, and thus were mitigated upward to their reference levels in those cases. The following chart shows an example of mitigation for a unit that had bid below its reference curve in some bid ranges and above its reference curve in others.

Figure 7. Mitigation of One Resource's Bid Curve by AMP, 1/24/06, HE 18[8]



In this case, most of the resource's bid curve was mitigated in the upward direction. The small curve range in which the bid was mitigated downward was the range in which the resource failed the Conduct Test. Because this range was above the resource's hour-ahead schedule and the unit was dispatched in the decremental direction, the unit was not actually dispatched into the downward-mitigated range. However, the unit was decrementally dispatched into an upward-mitigated range. This situation appears to be the case with other mitigated and dispatched units in this hour as well.

[8] In order to demonstrate the issue while protecting confidential data for market participants, affine transformations of actual bid and reference curves are shown.