September 16, 2003

The Honorable Magalie Roman Salas
Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, D.C. 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 for the five months ended July 31, 2003, as directed by Commission's July 17, 2002 Order, 100 FERC ¶ 61,060 (2002). Please return one file-stamped copy to the messenger.

This report also will be posted on the ISO's web site (http://www.caiso.com).

Thank you for your assistance in this matter.

Respectfully submitted,

Anthony J. Ivancovich
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California Independent System Operator Corporation
151 Blue Ravine Road
Folsom, CA 95630
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REPORT ON THE PERFORMANCE OF THE AUTOMATED MITIGATION PROCEDURE
FEBRUARY 1 THROUGH JULY 31, 2003
California ISO – August 10, 2003

Executive Summary

As directed by the Federal Energy Regulatory Commission ("Commission") in its July 17, 2002 Order[1], the ISO has prepared this second Quarterly Report on the Performance of the Automated Mitigation Procedure (AMP). AMP, proposed by the ISO in its May 1, 2002 Market Redesign 2002 filing ("May 1 MD02 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 period covering February 1, 2003, through June 30, 2003. Future reports will cover calendar quarters; the next report will cover July through September 2003.

As described in the first Quarterly AMP Report, certain units continue to fail the AMP Conduct Test. Many of these units have non-strategic reasons, such as environmental constraints, for consistently bidding prices sufficiently high to fail the Conduct Test. Others failed because their reference levels were extraordinarily low, potentially not reflecting true operating costs. A subset of units that consistently set high Market Clearing Prices ("MCPs") also failed the Conduct Test, occasionally in hours in which they actually set the price.

The many spikes in the price of incremental balancing energy that occurred during the subject period indicate that AMP, to some extent, has limited price-setting bids to ranges in which they would not fail the AMP Conduct Test. That is, some bidders apparently treat the AMP thresholds as unit-specific bid caps and consistently bid below them, in the same way that bidders often bid just under the price cap of $91.87 per megawatt hour (MWh) in the period ending October 30, 2002. Meanwhile, because no unit has failed the AMP Impact Test, AMP has not mitigated any unit's actual bid.

Price spikes in the real-time market for incremental balancing energy occurred relatively frequently from February through April 2003, due to operational issues pertaining to peak-hour blocks of forward energy, and relatively infrequently from May through July 2003. However, the relatively few price spikes since May were prolonged and costly. AMP has not yet mitigated any price spikes, primarily due to the conduct and impact thresholds and the "price screen" that were specified by the Commission in the July 17 Order. Presumably to prevent the mitigation of any prices at or below the previous soft cap of $91.87/MWh, the Commission directed that the ISO apply AMP only if the predicted real-time energy price exceeds $91.87/MWh. Due to imperfections in the price prediction algorithm, and the chaotic nature of the movement of market prices, this "price screen" often prevents AMP from being applied in hours in which spikes occur. The prediction algorithm also occasionally predicts prices in excess of $91.87/MWh in hours in which the actual prices are below that level.

In hours in which AMP was applied, spikes have not been affected by mitigation, usually because the price-setting units have bid within their respective permitted conduct and impact thresholds, which are higher than those requested by the ISO in its Filing of May 1, 2002. Hence, these units

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

do not fail the Conduct Test in such hours. Less often, price-setters (i.e., units whose bids set the market clearing price) fail the Conduct Test but other units also bid high, such that the price-setting units pass the Impact Test, since they would not unilaterally have raised the price beyond the permitted threshold. Occasionally, units exempt from AMP, such as hydroelectric resources or load aggregations, set the market-clearing price (MCP). In such cases, those bids would not have failed the Impact Test had they been subject to AMP.

In most hours in which incremental real time energy was dispatched, units' AMP reference levels have been above their marginal operating costs, but the spreads between the reference levels and marginal costs for units that set market-clearing prices in most cases have not been excessive. Price-setting units' reference levels were within $18/MWh of those units' marginal operating costs for approximately 80 percent of all dispatched megawatt-hours in April and July. This is roughly equivalent to a spread of $10/MWh between reference levels and estimated marginal operating cost when normalizing to the price of natural gas in October 2002, when AMP was first implemented.

However, during periods of price spikes, such spreads have increased considerably. Among the price setting units whose reference level to cost spreads represent the top decile of dispatched volume, the peak-hour spreads averaged approximately $61/MWh ($40/MWh normalized) in April and $41/MWh ($27/MWh normalized) in July, without adjusting for changes in the price of natural gas. Off-peak spreads have been similar.

Certain units have been able to increase their reference levels systematically, either by bidding high prices themselves, or by operating only when prices are high in the real-time market. Units that operate only when prices are high increase the average price of their energy sales. This has the effect of increasing the units' reference levels, which are calculated based on 90-day rolling average prices when those data exist.

I. Conduct Test

Conduct Test failures. Whenever the predicted MCP exceeds $91.87/MWh, certain units will necessarily fail the Conduct Test. Most such units are thermal units that supply the real-time market infrequently and have reference levels well below average, within the range of $0/MWh to $20/MWh. Another such unit until recently exclusively bid $750/MWh by order of a California environmental regulatory agency. As a result, the unit has a reference level of $250/MWh, equal to the price cap currently in place, and the maximum possible reference level by software design. Finally, units that are exempt from AMP, such as hydroelectric resources and curtailable demand, regularly bid high prices without risk of being mitigated.

Dispatched thermal units, including price-setters, often fail the Conduct Test during the latter parts of the costliest price spikes. These spikes generally last two hours or longer, so the conditions that cause the predicted MCP to exceed $91.87/MWh persist into the screened hours, as discussed in the next section. The following table shows the number of hours each week between February 1 and July 31, 2003, in which the incremental MCP spiked to at least $100/MWh, at least one unit

failed the Conduct Test, or both a price spike occurred and a unit failed the Conduct Test in the same hour.

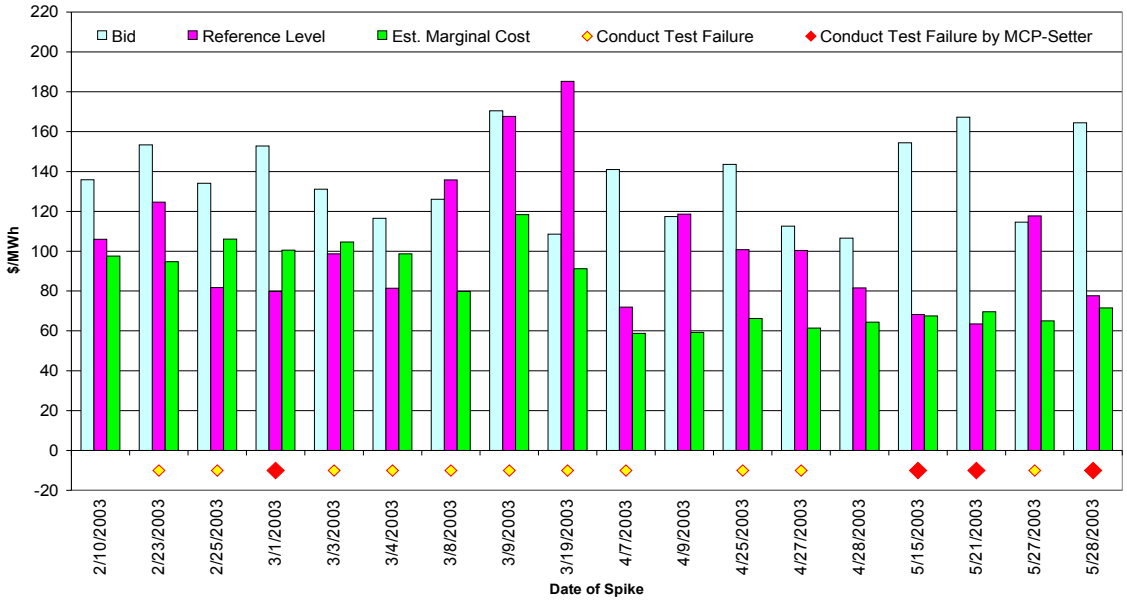
Table 1. Count of Hours with Price Spikes, Conduct Test Failures, or Both

Week Beginning	No. of Hours with Price Spikes	No. of Hours with Conduct Test Failures	No. of Hours with Both
2/1/2003	2	0	0
2/9/2003	2	1	0
2/16/2003	0	1	0
2/23/2003	27	51	15
3/2/2003	34	82	29
3/9/2003	9	18	3
3/16/2003	9	23	1
3/23/2003	7	4	0
3/30/2003	5	4	1
4/6/2003	11	8	1
4/13/2003	8	2	0
4/20/2003	6	11	1
4/27/2003	12	14	2
5/4/2003	7	16	2
5/11/2003	17	31	3
5/18/2003	7	52	6
5/25/2003	10	29	7
6/1/2003	3	0	0
6/8/2003	2	1	0
6/15/2003	1	4	0
6/22/2003	0	1	0
6/29/2003	2	0	0

While extended spikes usually result in some units failing the Conduct Test, the units that fail the Conduct Test are only occasionally those that set the MCP or otherwise bid high prices. Of the 18 price spikes between February 1 and June 30, 2003, for which instructed incremental energy costs exceeded $250,000, at least one unit failed the Conduct Test at some point during 15 of them, and the price-setting unit failed the Conduct Test at some point during four such spikes. The following chart compares MCPs with reference levels and marginal costs of the price-setting bid during those 18 price spikes, and indicates whether that or other unit(s) failed the Conduct Test at some point during each of the price spikes.[2]

[2] A Conduct Test Failure by an MCP Setter indicates that a single unit that set the price in at least one interval during the spike also failed the Conduct Test for at least one hour during the period in which it set the price. It does not indicate, for example, that a spike in which several units set prices in different intervals all failed the Conduct Test in those respective hours.

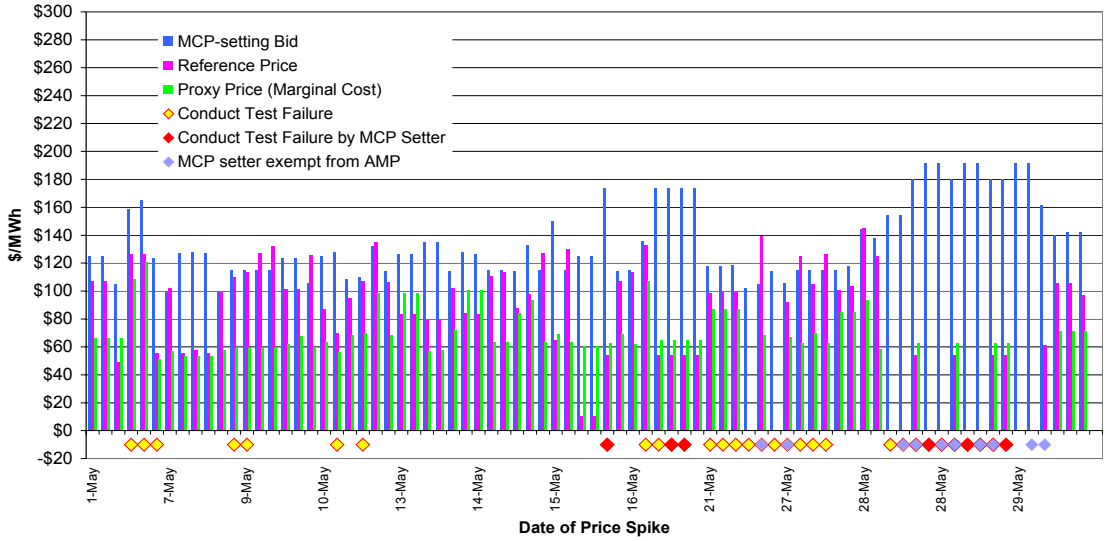
Figure 1. Costly Price Spikes: MCP vs. Price-Setter's Reference Level and Marginal Cost, And Failures of the Conduct Test



The duration of most other spikes was too brief for AMP to have been applied. That is, either the spike that caused the predicted price to exceed $91.87/MWh ended before AMP was applied in the following hour; or it did not persist through the seventh minute after the hour (53 minutes prior to the following hour), the time that the price prediction software is executed. This problem is discussed in detail in the next section.

The following chart shows ten-minute interval INC prices in May that exceeded $100/MWh, and the corresponding reference levels and estimated marginal operating costs of the price-setters in those intervals. It also indicates whether the price-setter and/or other units failed the Conduct Test in that hour; and whether the MCP was set by a unit exempt from AMP, such as a hydroelectric or load resource.

Figure 2. Interval Prices above $100/MWh in May-03: MCP vs. Price-Setter's Reference Level and Marginal Cost, Failures of the Conduct Test, and AMP-exempt Price Setters



Price Screen. A key problem that the ISO identified in implementing AMP as directed in the July 17 Order is the difficulty of predicting the imbalance energy price ahead of real time operations.[3] Consequently, AMP often is not applied to the market during price spikes. While the ISO has improved the price prediction algorithm, the inherently chaotic behavior of market prices can never be perfectly predicted.[4]

The "price screen" prediction software is executed 53 minutes before the hour of operation, immediately after the bid data for the next hour become available through the market software systems.[5] Meanwhile, most price spikes occur as the result of the skipping of real-time non-contingency energy bids from spinning and non-spinning reserves in non-contingency periods.[6] Since spikes occur quite suddenly, and small variations in load can suddenly cause or terminate spikes, the spikes cannot reliably be predicted by the dispatch algorithm in advance. As a result, AMP has not been applied in many hours in which price spikes occurred. An example of this situation is shown in the following chart, which depicts the predicted and actual incremental energy

[3] *See Report on the Performance of the Automated Mitigation Procedure, October 30, 2002 through January 31, 2003*, submitted the Commission on June 12, 2003, at 11-12.

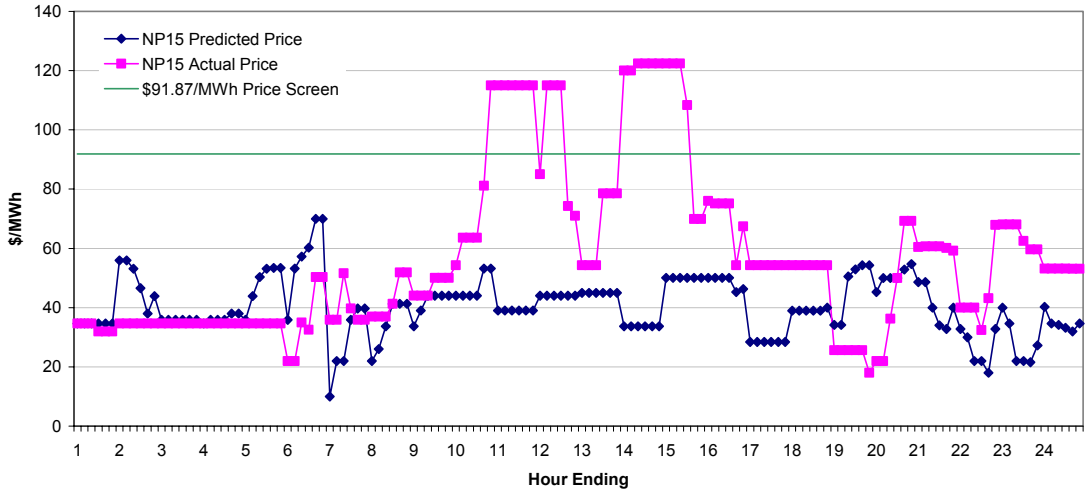
[4] If the ISO, or, more importantly, a market participant, were able to predict a price change with certainty, the participant could exploit that predicted price change for profit. The behavior exploiting the price change itself would change the evolution of prices. Thus, an ostensibly certain prediction would necessarily be incorrect.

[5] The deadline for submitting bids to the ISO's real-time Imbalance Energy market is 60 minutes prior to the operating hour.

[6] ISO Operating Procedure M-430, *Splitting Operating Reserve Energy from Imbalance Energy*: "Under no circumstances shall 'contingency only' O[perating] R[eserves] be used as I[mbalance] E[nergy] to satisfy routine system requirements." Since the ISO's Imbalance Energy stack consists of Supplemental Energy bids and Energy bids associated with Ancillary Services capacity, the ISO skips Energy bids associated with Ancillary Services when operating reserve margins are low to prevent further depleting those reserves. This allows the reserves to be held for contingencies.

prices in the NP15 congestion zone on April 9, 2003. In this case, import curtailments due to unscheduled flow necessitated unexpected reliance on in-state resources. This reduced the ratio of energy to operating reserves, so the ISO skipped real-time non-contingency energy bids from reserves, increasing the MCP above the predicted level.

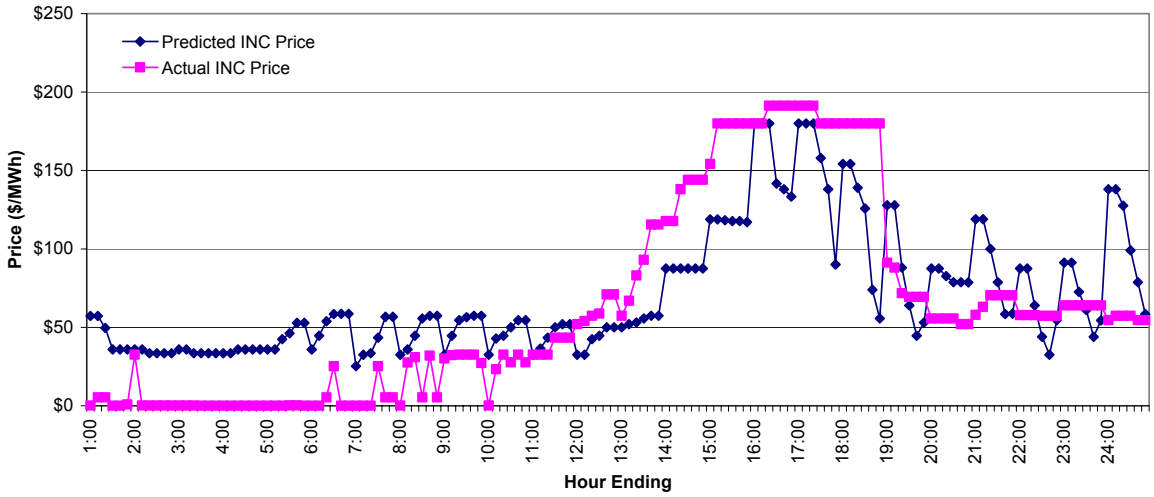
Figure 3. Predicted vs. Actual BEEP Incremental Energy Prices in NP15 on April 9, 2003



The exception to this rule is the case of prolonged price spikes, in which AMP will be applied and units will fail the Conduct Test during the latter portion of the spike. When a spike begins prior to the execution of the price prediction software (53 minutes before an hour of operation), it likely, but not necessarily, will result in the prediction exceeding $91.87/MWh for that hour. However, price setters usually, although not always, are able to avoid failing the Conduct Test by bidding below the Conduct Test threshold of the lesser of $100/MWh greater than or twice the reference level.

During these instances, units that consistently fail the Conduct Test will do so only if the spike persists into the hour of operation. For example, on May 28, 2003, the BEEP market-clearing price averaged $170/MWh between the hours ending (HE) 13 through 18 (specifically, from 12:40 to 6:00 p.m.). AMP was not applied in HE 13 or 14. However, at 1:07 p.m., the software ran for HE 15 (2:00 to 3:00 p.m.). The predicted price exceeded $91.87/MWh, and AMP was applied to HE 15, as well as the hours that followed. The following chart shows the predicted and actual prices in SP15 on the afternoon of May 28, 2003.

Figure 4. Predicted vs. Actual BEEP Incremental Energy Prices in SP15 on May 28, 2003



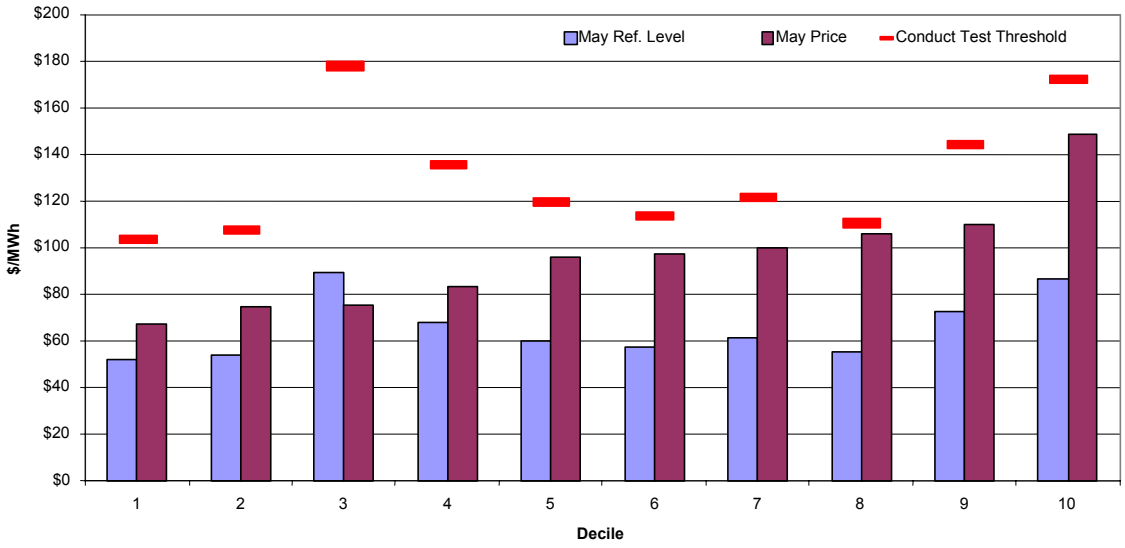
It is difficult to assess with certainty the effectiveness of AMP, because so many variables influence reference levels and bidding behavior. For example, the effect of changing fuel prices on reference levels appears similar to the effect of strategic bidding intended to increase reference levels over time, particularly when both things may be happening concurrently.[7]

II. Conduct Test Thresholds as Indirect Bid Caps

While AMP has not been used to mitigate any bid, the Conduct Test thresholds have served as indirect bid caps on many of the units subject to AMP. That is, suppliers tend to bid within their individual Conduct Test thresholds. The following chart shows deciles of prices for all incremental megawatt-hours sold in the ISO real-time market in peak hours in May, a month with a high frequency of price spikes, compared to the volume-weighted averages of reference levels for the setters of the MCPs at which those megawatt-hours were sold, and the corresponding volume-weighted averages of Conduct Test thresholds. In particular, 50 percent of the MCPs of all dispatched megawatt-hours in peak hours in May (the 5th, 6th, 7th, 8th, and 10th price deciles) were within $25/MWh of the price-setters' Conduct Test thresholds.

[7] The ISO has made every effort to normalize its indices to control for changes in fuel prices whenever practical to do so, and have noted potential situations in which indices must be interpreted carefully when it is impractical to normalize them. Normalized charts are identified as such.

Figure 5. Deciles of Prices for All Incremental Dispatches in Peak Hours in May-03 And Corresponding Reference Levels and Conduct Test Thresholds (Not Normalized for Changes in Gas Prices)



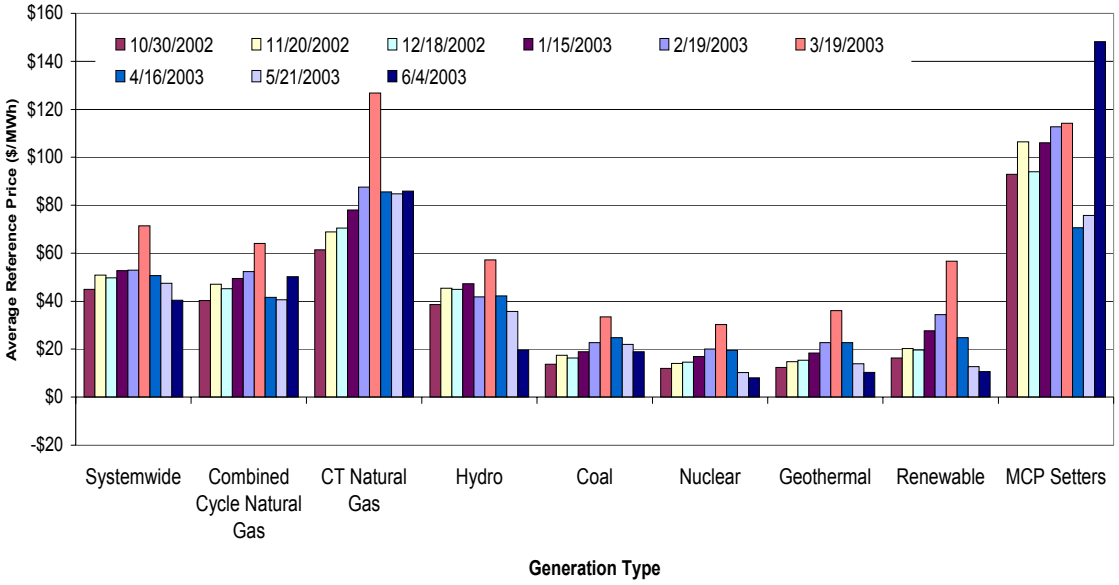
III. Reference Level Trends

Reference Level Drift. Due to the concern that bidders have some incentive to increase their reference levels by systematically increasing their bid levels, particularly when prices are high, the ISO monitors trends in reference levels. Reference levels are based primarily on 90-day rolling averages of accepted bids, adjusted within the average to account for changes in the cost of natural gas. Hence, reference levels serve as indicators of overall bidding trends. Units whose energy is completely forward-scheduled or units that do not have any accepted bids during the previous 90 days have reference levels equal to 90-day volume-weighted rolling averages of real-time market prices in all intervals those units are generating to meet forward schedules. The procedure virtually ensures units that do not generally participate in the real-time market have reference levels that reflect those of marginal units, with the exceptions of units that have applied for and received consultative reference levels. Because marginal (price-setting) units are almost always gas-fired thermal resources, reference levels for *all* generation types which are determined using market clearing prices appear to reflect the fluctuation in gas prices. That is, nuclear and renewable resources' reference levels exhibit the March peak that gas-fired units have established for the entire market.

Overall, reference levels have tended to fluctuate with the price of natural gas, following the spike in gas prices in late February to early March. When controlling for the gas price, average reference levels have been relatively flat since October. The normalized average reference level of a portfolio of units that have set the market-clearing price in at least 15 intervals since April 1 (the "MCP Setters") declined through mid-May, but rebounded sharply by June, following a five-hour price spike on May 28.

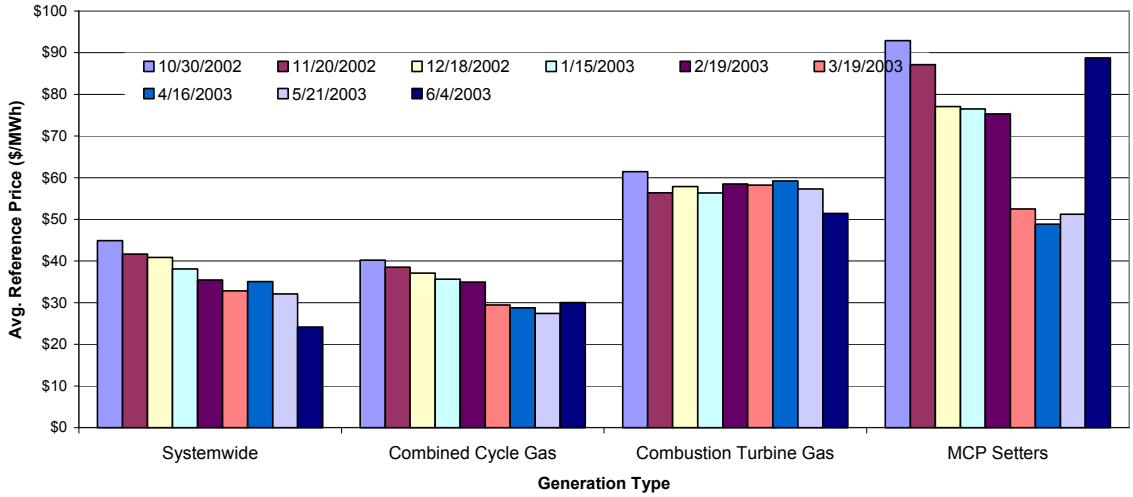
The following chart shows capacity-weighted average absolute peak-hour reference levels by type of generation each month between October 2002 and June 2003.

Figure 6. Nominal Average Peak-Hour Reference Levels by Generation Type



When adjusted to discount the change in the price of natural gas, most generation groups appear to have peak-hour reference levels that have been relatively constant or declining since October 2002. However, the May 28 imbalance energy price and volume spike was sufficient to raise the reference levels of the price-setting units even when adjusted for gas prices. The following chart shows system wide and gas-fired units' average reference levels, normalized for the price of natural gas.

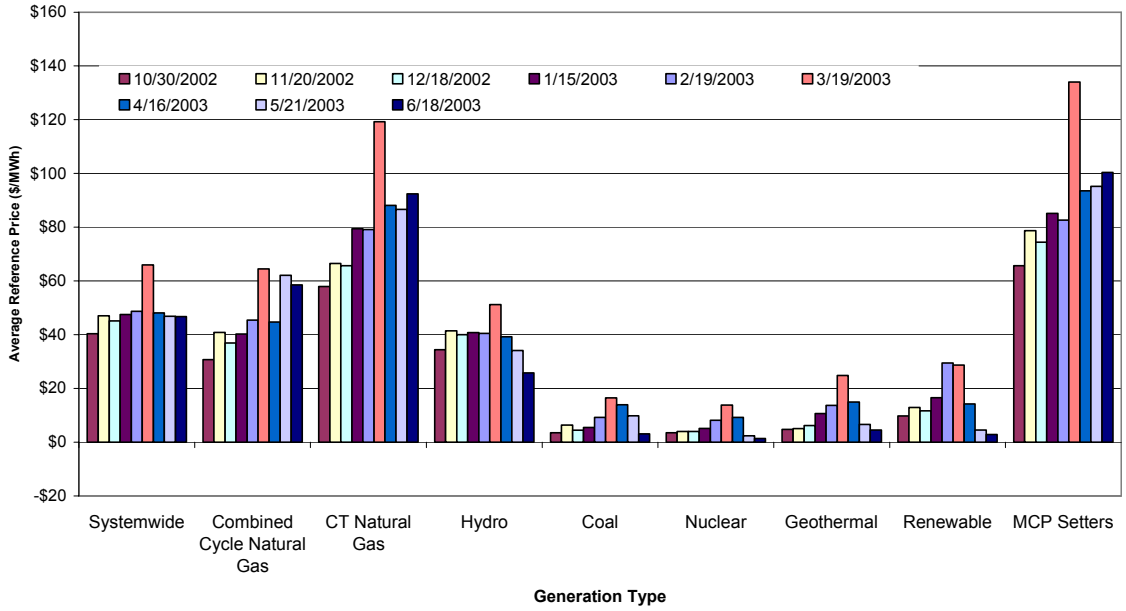
Figure 7. Average Peak-Hour Reference Levels for Gas-Fired Generation Types, Normalized to the Oct-02 Gas Price



Non-normalized average reference levels for off-peak hours also spiked in March, following the increase in natural gas prices. However, the portfolio of off-peak price-setters' reference levels continued to trend upward in the range of $90/MWh to $100/MWh after retreating from spike-period levels. This was due to frequently recurring price spikes in hours ending (HE) 22 and 23 (between 9:00 and 11:00 p.m.) from March through early May caused by real-time supply constraints.[8] The following chart shows average off-peak-hour reference levels for all generation types, not normalized for the price of natural gas.

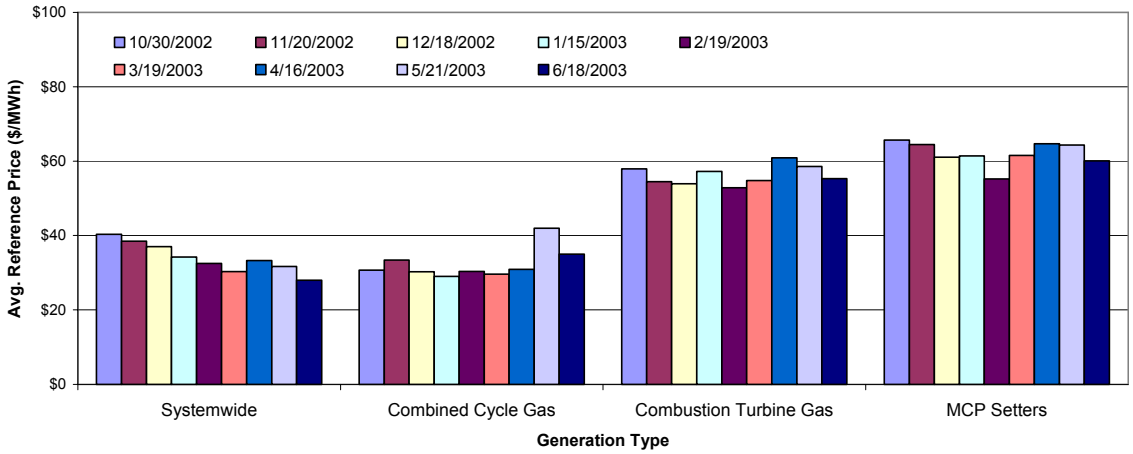
[8] A description of these spikes can be found in the ISO Market Analysis Reports for March and April 2003, available at http://www.caiso.com/docs/2000/07/27/2000072710233117407.html .

Figure 8. Average non-normalized Off-Peak-Hour Reference Levels by Generation Type



The aforementioned HE 22-23 price spikes caused the off-peak price-setters' portfolio average reference level, adjusted to the October 2002 gas price, to crest in April at $64.34/MWh, and to remain nearly at that level through the first half of May. The HE 23 spikes largely dissipated by late May, due to the shift in load from the winter pattern, with a daily peak in the evening, to the summer pattern, with a daily peak in mid-afternoon. This increase in the price-setters' reference level was a considerable increase from its low in February of $55.21/MWh. The following chart shows gas-normalized off-peak average reference levels.

Figure 9. Average Off-Peak Reference Levels for Gas-Fired Generation Types, Normalized to the Oct-02 Gas Price



When normalized to October 2002 natural gas prices, reference levels for the most part decreased between $10/MWh and $20/MWh between November 2002 and April 2003, and then remained relatively constant or increased by small amounts, generally less than $10/MWh, between April and July 2003. The gas-normalized reference levels of the price setters associated with prices realized during times of the greatest imbalance energy volume have decreased by $15/MWh or more on a normalized basis since November 2002. The following charts show total bid volume awarded dispatch instructions in November 2002, and January, April, and July 2003, grouped by decile in the order of the price-setting unit's reference level during peak and off-peak hours, respectively. All prices have been normalized to October 2002 gas prices.

Figure 10a. Peak-Hour Gas-Normalized Reference Level Deciles of Incremental Dispatch Instructions, Nov-02 through Jul-03

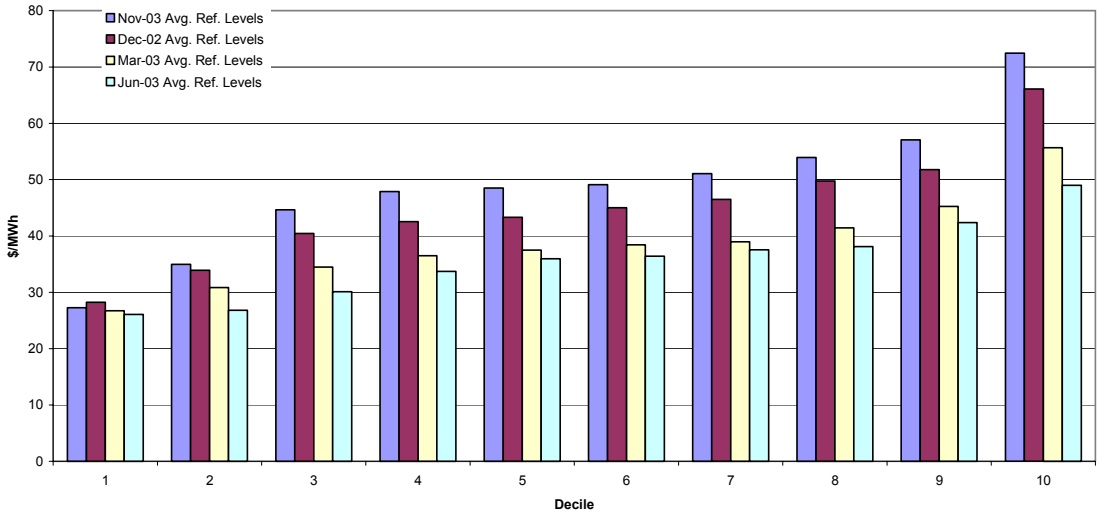
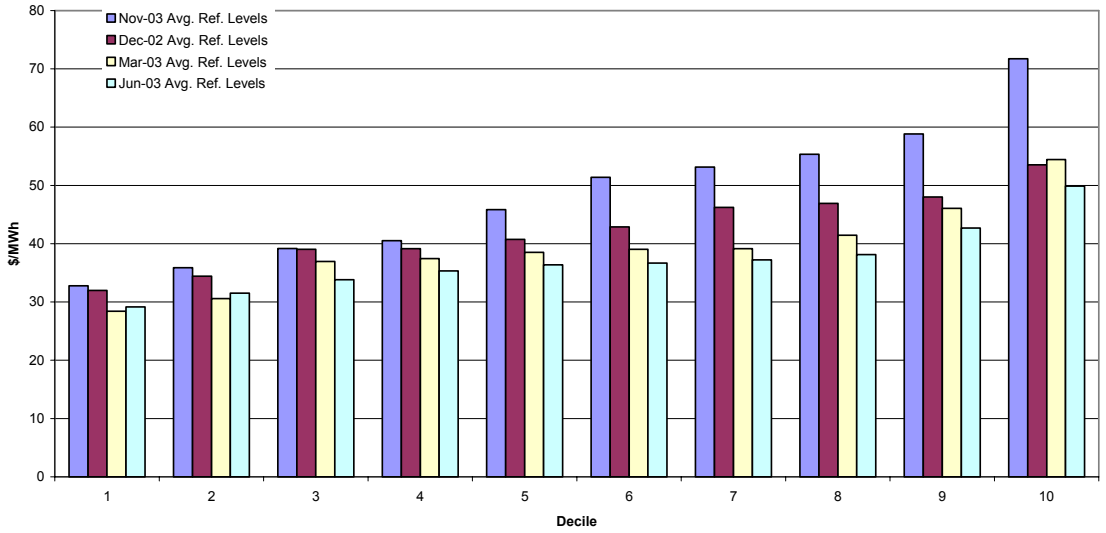


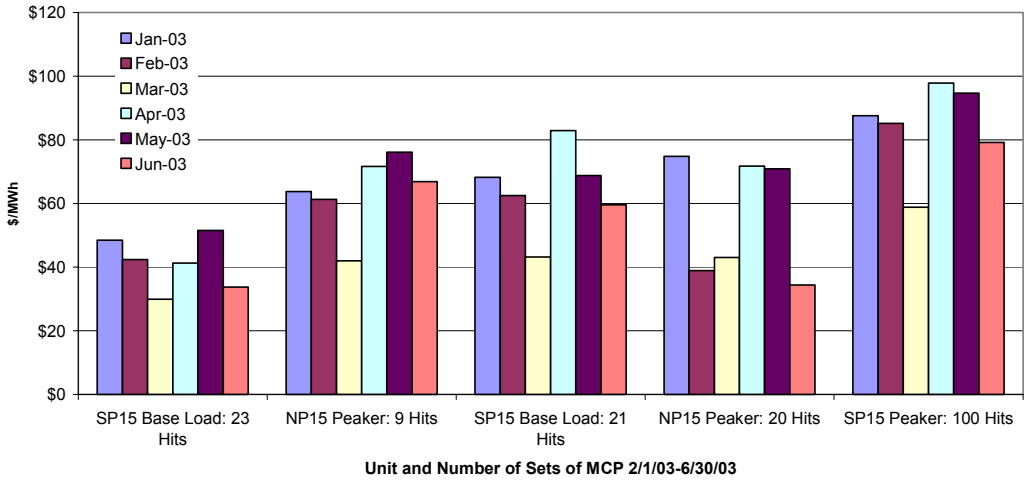
Figure 10b. Off-Peak Reference Level Deciles of Incremental Dispatch Instructions Nov-02 through Jul-03



The overall decrease in reference levels corresponding to price-setters for all dispatched volume may be due in part to seasonal variations. Generators typically are out of service on seasonal maintenance and real-time prices are often high in the October-November period. Meanwhile, reference levels are lowest in April, during which California had strong hydroelectric production, dampening prices. However, the $91.87/MWh price cap that was in effect until October 29, 2002 likely offset this seasonal effect. . The price cap limited suppliers' bids, and would therefore be incorporated into the bids used to calculate the November 2002 reference levels.

Although average normalized reference levels have been fairly stable, certain units in particular have had the ability to raise their reference levels. Units whose bids were within five percent of the MCP when the MCP was at least $100/MWh, for example, were able to significantly increase their reference levels in certain periods. Every time a unit's bid is accepted in the neighborhood of the MCP, its reference level is affected. Between February and April, standard "6 by 16" peak-period power contract products terminated delivery between HE 22-23 (around 10:00 p.m.), while the decrease in load in the same hour was much smaller and less abrupt. This created a need for rapid incremental imbalance energy in HE 23, and enabled several units to have high bids accepted in the neighborhood of the MCP, and thus raise their reference levels in that period. As these spikes became less frequent beginning in mid-May, some such units' reference levels began to decline. The following chart shows gas-adjusted off-peak reference levels of five units that bid within five percent of the MCP between January and June 2003, deflated to October 2002 gas prices, and the number of "hits," or bids within five percent of the MCP, when the MCP was at least $100/MWh between February 1 and June 30, 2003.

Figure 11. Off-Peak Average Reference Levels for Units with Multiple Bids Accepted near MCPs above $100/MWh



Certain suppliers clearly have the ability to increase their reference levels during system conditions that result in high market clearing prices. Because AMP was intended to provide price mitigation during uncompetitive market conditions, the ability of suppliers to increase their reference levels in those same periods may be cause for concern. When units have the ability repeatedly to sell at high prices during tight supply periods without failing either the Conduct Test or the Impact Test, bids accepted during these conditions that are then used to calculate reference levels may not serve as reliable indicators of marginal cost for all units.

Reference Levels and Marginal Cost. The ISO also monitors trends in differences between reference levels and the marginal costs of corresponding awarded bids. In July 2003, approximately 90 percent of the volume of energy sold into the ISO real-time market in peak hours was produced in intervals in which price setters' peak-hour reference levels were within $10/MWh of their estimated marginal production costs, when normalized to October 2002 gas costs (approximately $16/MWh on a nominal basis in July 2003). As a benchmark, marginal production costs averaged $35.31/MWh on a normalized basis ($56.91 nominally). The remaining 10 percent of energy sold into the ISO markets had costs averaging approximately $20/MWh above marginal production costs when normalized to October 2002 gas costs (approximately $32/MWh nominally). In April 2003, the top decile of energy sold approached $40/MWh above marginal costs, due to the aforementioned price spikes associated with the end of peak-hour contract deliveries, which affected both peak and off-peak periods.[9] The following charts compare deciles of the difference between peak-hour reference levels for price-setting units and corresponding marginal production costs of energy sold into the real-time market, for peak and off-peak periods, in November 2002 and January, April, and July 2003.

[9] As noted previously, this series of spikes dissipated in mid-May. It thus had some impact on the June indices.

Figure 12a. Peak Deciles of Spreads between Price-Setters' Reference Levels and Marginal Costs for Incremental Dispatch Instructions, Nov-02 through Jul-03

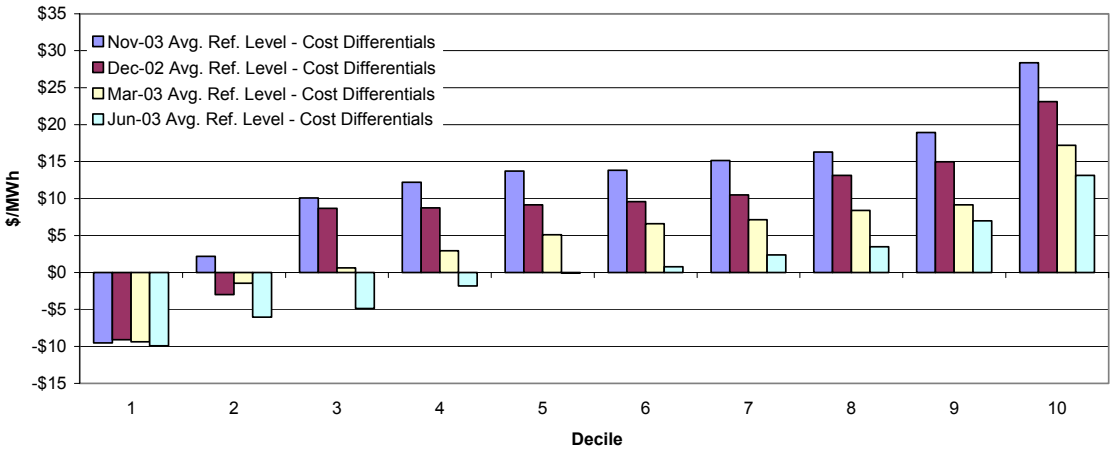
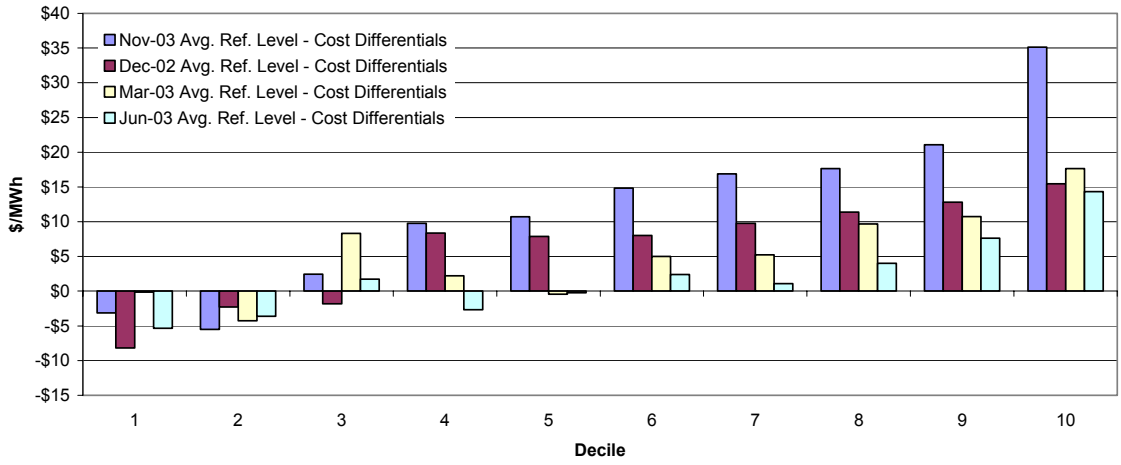


Figure 12b. Off-Peak Deciles of Spreads between Price-Setters' Reference Levels and Marginal Costs for Incremental Dispatch Instructions, Nov-02 through Jul-03



Conclusion

To date, AMP has had relatively little effect on prices in the real-time Imbalance Energy market, with the exception that some bidders appear to treat their individual AMP thresholds as upper limits on bid prices. This presumably had the effect of limiting market-clearing prices overall. However, the combination of the wide conduct and impact thresholds and the $91.87/MWh price screen directed in the Commission's July 17 Order have resulted in no bid mitigation since AMP was implemented. In a few isolated hours, bidders that set the price did fail the Conduct Test, but other units bid sufficiently high that the price setters did not fail the Impact Test. Moreover, units that bid near the market-clearing price during periods of high prices raised their own reference levels as high prices persisted in March through May 2003, but the subsequent low prices in June decreased those reference levels.