California Independent
System Operator Corporation

MRTU Market Power Mitigation:
Options for Bid Caps for Start-Up and Minimum Load Costs

Supplemental Report

Department of Market Monitoring

May 16, 2007

I. Introduction

This paper supplements a whitepaper issued on February 9, 2007 (February 9 whitepaper) by the Department of Market Monitoring (DMM), which provided a preliminary discussion of a range of potential options for capping start-up and minimum load bids under the bid-based option provided under the CAISO's MRTU market design, and presented results of DMM's preliminary quantitative assessment of these various options.[1]

This supplemental whitepaper provides additional information on options for capping start-up and minimum load bids, including:

- A review of rules and experience with bid-based options for start-up and minimum load at other ISOs.
- More specific and detailed analysis of how gas prices may be determined for purposes of calculating start-up and minimum load caps under any of the options presented in the February 9 whitepaper.
- A summary of comments received on DMM's February 9 whitepaper and initial responsive comments to this input.

[1] *MRTU Market Power Mitigation: Options for Bid Caps for Start-Up and Minimum Load Costs*, Department of Market Monitoring, February 9, 2007 (*http://www.caiso.com/1b87/1b87a5451d380.pdf*)

II. Review of Other ISO Market Rules

The section presents a review of market power mitigation provisions relating to start-up and minimum load (or no load) costs at four other ISOs:

- PJM Interconnection (PJM)
- New York ISO (NYISO)
- ISO New England (ISE-NE)
- Midwest ISO (MISO)

PJM Interconnection

The CAISO's local market power mitigation (LMPM) provisions incorporated in the CAISO MRTU market design is based largely on the LMPM provisions of PJM. The key feature of this PJM-style LMPM is that mitigation is triggered on a unit-by-unit basis only when a unit is constrained on or required to operate at a higher level due to a transmission constraint that is deemed to be non-competitive.

Like the CAISO MRTU market design, PJM provides generation owners with between a "cost based" or "price-based" option for the start-up and no load components of a unit's offer,[2] and prevents a generation owner from switching to a different option for a minimum 6-month period.[3] If a generator selects the price-based option, they must submit the same price-based start-up and minimum load bid during the entire 6-month period, and may not submit lower bids.

However, contrary to the CAISO's initial understanding of PJM's LMPM procedures, start-up and no load bids for units under the price-based option are mitigated to cost-based levels whenever a unit is constrained on or required to operate at a higher level due to a transmission constraint that is deemed to be non-competitive. As described in PJM's manual for *Scheduling Operations*[4]:

> If transmission limits are identified during the ahead scheduling process or during real time operations, the appropriate generators (those for which the owner fails the Three-Pivotal Supplier Test …) are offered capped.
>
> Units are offer capped at the lesser of their cost-based or price-based schedules, including start-up and no-load components [emphasis added].

The specific approach employed by PJM could not be implemented under the CAISO's current market design, since the CAISO identified units dispatched due to non-competitive constraints

[2] PJM's bid schedule includes a component no load costs, which is the approximate equivalent of the CAISO's minimum load bid component. The key difference is that CAISO's minimum load bid component also covers energy up to the unit's minimum operating limit. Under the PJM bid schedule, a separate bid is provided for energy from the no load point (MW) up to the unit's minimum operating limit.

[3] See *PJM Manual 11: Scheduling Operations*, p. 20, http://www.pjm.com/contributions/pjm-manuals/pdf/m11.pdf.

[4] See *PJM Manual 11: Scheduling Operations*, p. 23.

based on a comparison of results from two pre-market runs of market (i.e. the Competitive Constraints (CC) and All Constraints (AC) model runs), rather than the Three-Pivotal Supplier Test employed by PJM. In addition, it is unlikely that software modifications could be made to incorporate mitigation of price-based start-up and minimum load cost bids directly into the MRTU LMPM procedures, in the same manner that energy bids are automatically mitigated under MRTU.

In PJM, cost-based start-up and no load bids are submitted directly by participants each day – rather than being automatically calculated as in the CAISO's MRTU market software. However, cost-based start-up and no load submitted by participants are subject to audit by PJM, and are required to be calculated pursuant to guidelines specified by PJM.[5]

Other ISOs

The other three major ISOs (NYISO, ISO-NE and MISO) all have similar "New York-style" forms of local market power mitigation, under which start-up and minimum load (or no load) bids are subject to mitigation based on results of two sequential tests: a *conduct test* and an *impact test*. The conduct test is first applied to determine if bids exceed *reference levels,* which are designed to reflect each units marginal operating costs, by pre-specified levels.[6] Market bids exceeding these thresholds are deemed to have failed the conduct test. An impact test is then performed to calculate the impact that bids failing the conduct test have on market prices (relative to market prices that would result with these bids mitigated to their reference levels). If the projected impact on market prices exceeds certain pre-specified thresholds, bids failing the initial conduct test are then mitigated to their reference levels during the actual market clearing process.

Under this New York-style form of market power mitigation, units are classified as being located in either transmission *constrained* or *unconstrained areas,* based on historical or expected patterns of congestion. Units within constrained areas are subject to stricter thresholds for conduct and impact tests than units within non-constrained areas.

In the context of this New York style market power mitigation, the thresholds used in the impact test for energy bids are based on the impact that bids failing the conduct test have on the market clearing price for energy – or LMPs. However, start-up and minimum loads bids are not reflected in LMPs, a different approach is needed for determining the impacts of high start-up and minimum load bids. Under the New York style approach, the impact test for start-up and minimum loads bids are based on the degree to which a unit's bid cost recovery guarantee resulting from its market bids (for start-up, minimum load and energy) exceeds the cost recovery guarantee that would result if each of these bid components were mitigated to the unit's reference levels.

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[5] See *PJM Manual 11: Scheduling Operations***,** p. 23, and *PJM Manual M-15 (Cost Development Guidelines*).

[6] In each ISO, generation owners may select from a variety of options for determining bid reference levels, which are very similar to the options for calculating Default Energy bids (DEBs) provided under the CAISO's MRTU market design (e.g, in addition to a cost-based option, each ISO provides a negotiated option and at least one option based on a unit's accepted market bids or LMPs during the previous 90 days).

Table 1 summarizes the specific thresholds used in these various ISOs to perform conduct and impact tests for start-up and minimum load bids.

As shown in Table 1, the impact thresholds in two of the ISOs with the New York-style market power mitigation (NYISO and MISO) limit total start-up and minimum load payments for units in nonconstrained areas to a 200% increase in the revenue sufficiency guarantee, calculated using cost-based start-up of minimum load costs. Thus, this impact threshold (200% increase) should equate to a cap of about 300% of each unit's actual start-up and minimum load costs. Meanwhile, NE-ISO limits these payments to a 100% increase in the revenue sufficiency guarantee, calculated using cost-based start-up of minimum load costs. This threshold (100% increase relative to actual costs) should equate to a cap of about 200% of each unit's actual start-up and minimum load costs --- the same level incorporated in Option 2 of DMM's February 9 whitepaper.

Impact thresholds for start-up and minimum load payments are the same within unconstrained and constrained areas in two ISOs: NE-ISO (~200% of costs) and MISO (~300% of costs). However, the impact threshold in NYISO is significantly lower in constrained areas (a 50% increase relative to cost-based revenue payment guarantees, or about 150% of costs).

For purposes of comparison with the CAISO LMPM provisions, DMM believes the most appropriate benchmarks are the thresholds for constrained areas, since units within the CAISO system that may be committed, despite having relatively high bid-based start-up and minimum load costs, are most likely to be located within constrained areas. Based on results shown in Table 1, the impact thresholds in these other ISOs for constrained areas equate to caps of about 150%, 200% and 300% of actual start-up and minimum load costs.

Table 1. Conduct and Impact Test Thresholds for Start-up and Minimum Load Bids in Other ISOs

	NYISO	NE-ISO	MISO
Start-up			
Conduct Test			
Unconstrained Areas	200%	200%	200%
Constrained Areas	50%	25%	50%
Impact Test			
Unconstrained Areas	Increase of 200% in participant's total guarantee payments	Increase of 100% in participant's total guarantee payments	Increase of 200% in guarantee payment for any unit
Constrained Areas	Increase of 50% in guarantee payments for generator's units in constrained area	Same as above	Same as above
Minimum/No Load			
Conduct Test			
Unconstrained Areas	Lower of (a) 300% or (b) $100/MWh	200%	Lower of (a) 300% or (b) $100/MWh
Constrained Areas	Lower of (a) 300%, (b) $100/MWh or (c) the following equation: $\frac{2\% * \text{Avg LMP} * 8760}{\text{\# Constrained Hours}}$ Where: Avg. LMP = Average LMP over previous 12 months Constrained Hours = # hours with congestion on any path leading into constrained area.	25%	$\frac{\text{Net Annual Fixed Cost}}{\text{\# Constrained Hours}}$ Where: Net Annual Fixed Cost = Annual cost on new peaker minus net energy revenues minus credits for any resource Constrained Hours = # hours with congestion on any path leading into constrained area, but not more than 2000 hours.
Impact Test			
Unconstrained Areas	Increase of 200% in unit's total guarantee payment for any unit	Increase of 100% in total guarantee payment for any unit	Increase of 200% in guarantee payment for any unit
Constrained Areas	Increase of 50% in guarantee payments for units in constrained area	Same as above	Same as above

Note: Percentages and $/MW figures for a conduct test represent thresholds above reference levels that constitute failure of a conduct test.

III. Gas Costs

As noted in DMM's February 9, 2007 whitepaper, while all of the options for setting start-up and minimum load bid caps examined by DMM are designed to allow most or all generators to bid significantly in excess of actual start-up and minimum load costs, each these options requires some assessment of the projected start-up and minimum load costs of gas fired units, taking into account the potential future price of gas over the six month period for which the cap may be in effect. Thus, at the time that any caps are set, some method is needed for projecting gas prices over a forward-looking six month period.[7]

This section described a specific methodology that could be used to determine gas prices and to be used in any of the options for setting start-up and minimum load bid caps. The methodology is then applied to actual gas price data over the last four years in order to assess the degree and frequency to which this methodology could underestimate spikes in the daily gas spot market. Finally, the section provides a discussion of how results of this analysis could be used to adjust the basic methodology proposed for calculating gas prices to ensure that resulting bid caps allow bids to meet or exceed actual start-up and minimum load costs.

Proposed Methodology

The basic methodology for determining gas prices used in calculating start-up and minimum load bid caps incorporated in DMM's February 9 whitepaper is to base gas prices on the highest price for monthly futures contracts for the over the six month period for which the cap would be in effect. In practice, the gas price to be used in this calculation would be re-calculated once a month – based on gas futures prices over a forward-looking six month period – and resource-specific or market-wide start-up and minimum load bid caps would be recalculated each month using the updated gas price. Any Scheduling Coordinator submitting a bid-based start-up or minimum load bid at any point in time would be subject to the most recent cap calculated by the CAISO.

For example, initial caps for SCs electing the bid-based option starting in February 2008 would be based on the maximum of gas futures prices for the months of February through July 2008. In practice, the CAISO may calculate the gas cost for each six month period week or so in advance of the start of the first month of the six month period, based on gas futures prices for this six month period as reflected in published market prices at the time this calculation is performed. Thus, initial caps for SCs electing the bid-based option starting in February 2008 would be based on the maximum of gas futures prices for the months of February through July 2008 at the time that bid caps for this six month period are calculated in January 2008 (e.g. about the third week or so of January).

In order to avoid significant impacts due to very short term (day-to-day) fluctuations in gas futures prices, this calculation could be performed based on the average of gas futures prices over a period of days (e.g. over the first three weeks of the month prior to the start of each six

[7] In addition, DMM has noted that some mechanism may be necessary to periodically recalculate or reset caps in the event that gas prices increase dramatically over levels initially used in setting caps.

month period). For example, under this approach, caps for SCs electing the bid-based option starting in each month (*m*) would be based on the following equation:

$$NYMEX_m = \text{Max} \ (\ AVG\_NYMEX_m, \ldots, AVG\_NYMEX_{m+6})$$

Where

AVG_NYMEX_m = the average closing price of the NYMEX gas futures contract for month *m* during first 21 days of the month prior (*m-1*) to the first month (*m*) of the six month period for which the maximum monthly contract price is being calculated (*m, m+1 …, m+6*).

For example, in order to calculate bid caps applicable for units starting under the bid-based option in February 2008, the average price of the six monthly NYMEX futures contracts for the months February through June 2008 would be calculated using the daily closing prices for these six contracts during the first 21 days of January 2008. The maximum of these six averages would be used as the gas price in setting start-up and minimum bid caps applicable for any unit starting under the bid-based option in February 2008. This calculation would be updated each month, with the resulting bid caps being applicable to any unit starting under the bid-based option in subsequent months.

Analysis of Historical Data

The methodology for calculating a gas price described above was applied to actual gas price data over the last five years in order to assess the degree and frequency to which this methodology could underestimate spikes in the daily gas spot market, as described below:

- First, for each month from January 2002 through October 2006, a series of six forward looking NYMEX gas contract prices was generated using the equation described in the previous section (see description of AVG_NYMEX_m)
- Second, for each month from January 2002 through October 2006, the maximum of these six forward looking NYMEX gas contract prices was calculated as described above (see equation for $NYMEX_m$)
- Third, the maximum daily spot market gas prices over each of these same six month periods were constructed. For Northern California, the PG&E City Gate prices were used, while Southern California Border prices were used for Southern California.
- The maximum price spot market gas price for each of these delivery points over this six month period was then compared to the maximum price of monthly NYMEX futures at the start of the six month period (calculated as described above). For example, the maximum of the six monthly NYMEX futures contracts for January to June 2002 ($NYMEX_{Jan2002}$) was compared to the maximum daily spot market gas price actually occurring during this six month period. The result of this comparison indicate the degree to which – at any point

during the six month period -- spot market prices exceeded the gas price that would be used in determining the gas price to be used for in setting start-up and minimum load bid caps for each forward looking six month period.

The specific equation used in this analysis to calculate the percentage by which maximum spot market prices exceeded the proposed method for calculating gas prices for each forward looking six month period can be described as:

$$HIST\_PCT_m = \frac{\text{Max } (MaxSpot_m\ MaxSpot_{m+1}, \ldots MaxSpot_{m+6}) - NYMEX_m}{NYMEX_m}$$

Where:

$HIST\_PCT_m$ = The percentage by which the highest daily spot market gas price during the six month period (*m* to *m+6*) exceeded the highest NYMEX monthly futures contract price for the same six month period (*m* to *m+6*).

$MaxSpot_m$ = The maximum daily spot market price during month *m.*

$NYMEX_m$ = The maximum of NYMEX contract prices for the six month period from *m* to *m+6*), calculated as describe in the previous section.

In addition, similar analysis is performed based on a comparison of *average* spot market prices to the proposed method for calculating gas prices for each forward looking six month period. The result of this analysis provided an indication of how well the proposed methodology projects overall gas prices. Separate analyzes were performed using daily spot market prices for each of the three delivery points in California for which indices are published (Southern California Border, Malin and PG&E City Gate).

Figure 1 shows the distribution of daily spot market gas prices as a percentage of the NYMEX futures price index that would be used to calculate start-up and minimum load bids over the period from January 2002 to March 2007.[8] Other results of this analysis are summarized in Figures 2 and Tables 2 and 3.

[8] A total of 9,889 observations were generated for the 1,905 days in this period, since up to six monthly NYMEX gas price indices were compared to each daily spot market gas price during this 63 month period. For example, daily spot market gas prices for each day in June were compared to the six NYMEX indices for the months January through June, since a unit under the bid-based option in June could have initially selected (or modified) its start-up or minimum load bid during any of these six months. Thus, spot market gas prices for the 30 days in June would result in 180 observations (30 x 6 = 180).

As shown in Figure 1, daily spot gas prices would have rarely exceeded the gas price index used in setting start-up and minimum load costs by more than about 150%. More specifically, based on the analysis of historical data over this 63 month period shown in Figure 1:

- About 70% of the time, spot market prices would be lower than the gas price index used in setting start-up and minimum load bids.
- About 98.5% of the time, spot market prices would be within 150% of the gas price index used in setting start-up and minimum load bids.
- About 99.67% of the time, spot market prices would be within 200% of the gas price index used in setting start-up and minimum load bids.

As shown in Figure 2 and Table 2, the maximum degree to which daily spot market prices during any six month period exceeded the gas price that would have been calculated at the start of the six month period using the proposed methodology is just under 300%. However, as shown in Figure 2, this would have occurred during only a few days in late February and early March 2003, when spot market gas prices at the SoCal Border reached as high as $11/MMBtu. At this time, units establishing start-up and minimum load bids under the bid-based option during the previous six months would have been subject to bid caps based on gas futures price indices ranging from about $3.70 to $4.80/MMBtu.

Meanwhile, as shown in the bottom summary rows of Tables 2 and 3, average spot market prices over this entire period at the Southern California border and Malin equaled about 78% to 83% of the six month forward looking gas price that would have resulted from the proposed methodology.

These results suggest that the proposed methodology would provide a very good indicator of average spot market gas prices, and could be a reasonable method of determining gas prices on a forward looking six month basis under the type of approach for setting minimum load and bids caps described under Option 2 of the February 9, 2007 whitepaper. Specifically, Option 2 suggested setting bid caps at about 200% of each unit's start-up and minimum load costs, calculated using a projection of gas prices over the next six months. As shown by this analysis, experience over the last five years shows that even if significant price spikes occurred in the daily spot market for gas, actual start-up and minimum load costs given these spot market prices would have exceed the caps for start-up and minimum loads that would have been set under Option 2 for only a handful of days during the last five years.

Figure 1. Ratio of Daily Spot Gas Price (High – SoCal Border) versus Six Month NYMEX Gas Price Futures Index January 2002 to March 2007

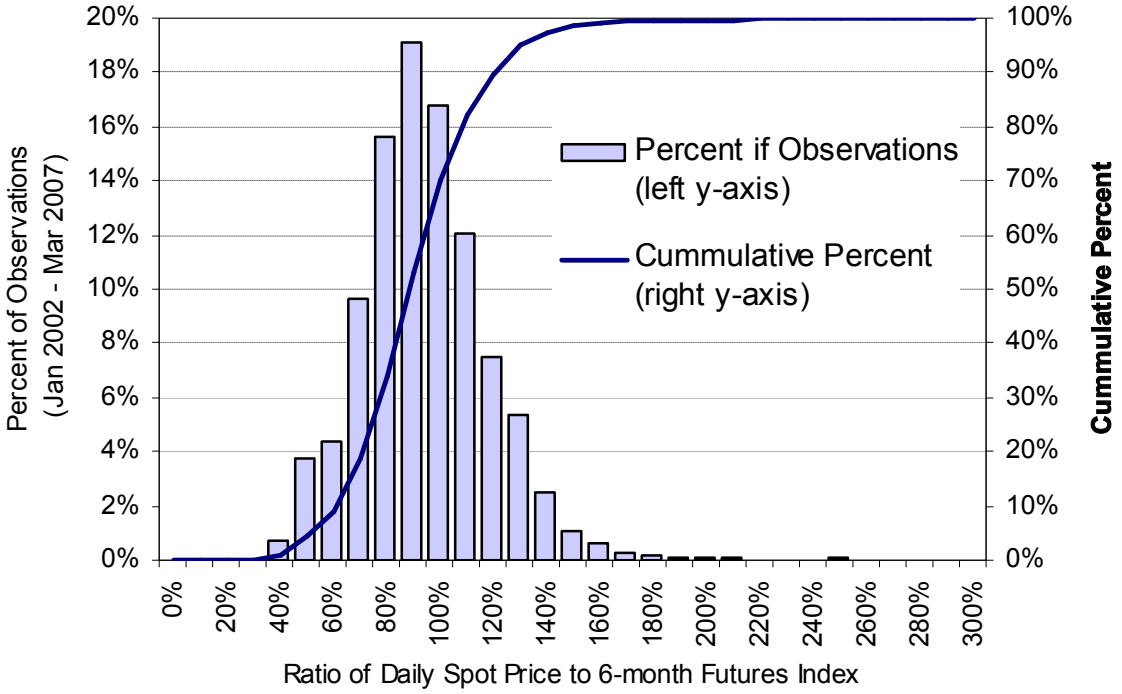

Figure 2. Price Spikes in Spot Market for Gas February – March 2003

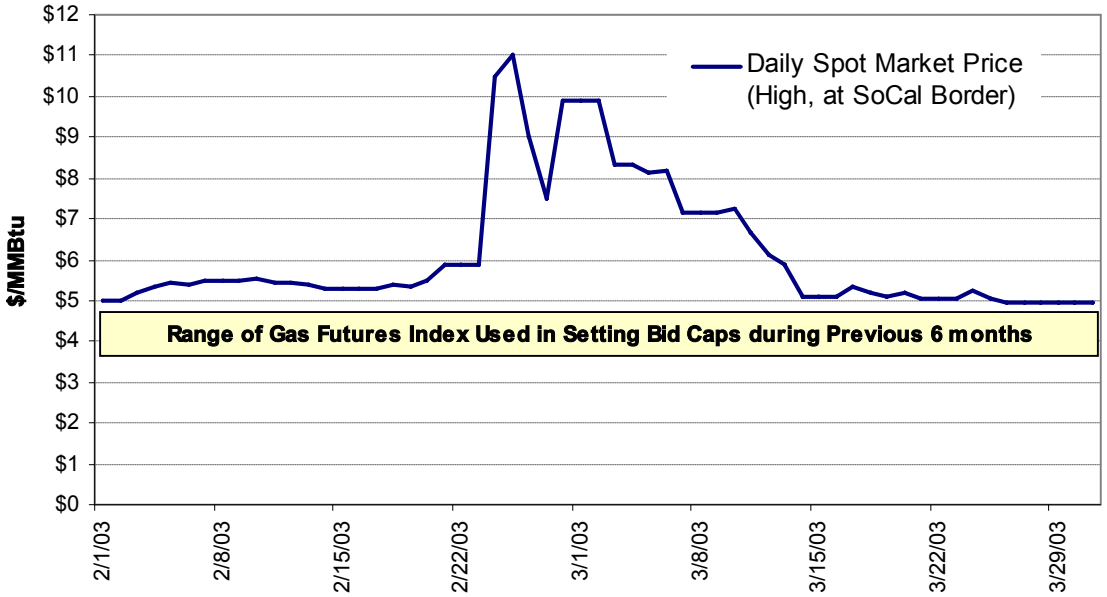

Table 2. Comparison of Maximum NYMEX Futures Price with Maximum and Average Daily Spot Market Price (at SoCal Border)

6-month Period Beginning	Maximum NYMEX Price	Maximum Spot Price*	Difference $/MMBtu	Difference Ratio	Average Daily Spot Price	Difference $/MMBtu	Difference Ratio
2002.01	$2.83	$3.68	$0.85	130%	$2.19	-$0.65	77%
2002.02	$2.50	$3.68	$1.18	147%	$2.24	-$0.26	90%
2002.03	$2.54	$3.68	$1.14	145%	$3.03	$0.49	119%
2002.04	$3.07	$3.68	$0.61	120%	$3.15	$0.08	102%
2002.05	$3.47	$4.42	$0.95	127%	$3.00	-$0.47	86%
2002.06	$4.04	$4.42	$0.38	109%	$3.03	-$1.02	75%
2002.07	$3.88	$4.91	$1.03	127%	$2.97	-$0.90	77%
2002.08	$3.78	$5.40	$1.62	143%	$2.82	-$0.97	74%
2002.09	$3.73	$11.00	$7.27	295%	$3.24	-$0.49	87%
2002.10	$4.15	$11.00	$6.85	265%	$3.69	-$0.47	89%
2002.11	$4.34	$11.00	$6.66	253%	$3.87	-$0.47	89%
2002.12	$4.10	$11.00	$6.90	268%	$4.47	$0.36	109%
2003.01	$4.79	$11.00	$6.21	230%	$4.80	$0.01	100%
2003.02	$5.28	$11.00	$5.72	208%	$5.88	$0.60	111%
2003.03	$5.93	$9.90	$3.97	167%	$5.97	$0.04	101%
2003.04	$6.05	$6.10	$0.05	101%	$4.97	-$1.08	82%
2003.05	$5.42	$6.10	$0.68	113%	$5.36	-$0.06	99%
2003.06	$6.05	$6.10	$0.05	101%	$5.28	-$0.77	87%
2003.07	$6.45	$6.50	$0.05	101%	$4.92	-$1.54	76%
2003.08	$5.75	$6.80	$1.05	118%	$4.89	-$0.86	85%
2003.09	$5.59	$6.80	$1.21	122%	$4.50	-$1.09	80%
2003.10	$5.39	$6.80	$1.41	126%	$4.53	-$0.86	84%
2003.11	$5.64	$6.80	$1.16	121%	$4.40	-$1.24	78%
2003.12	$5.03	$6.80	$1.77	135%	$5.60	$0.57	111%
2004.01	$6.54	$6.80	$0.26	104%	$5.60	-$0.94	86%
2004.02	$6.58	$6.38	-$0.20	97%	$5.03	-$1.56	76%
2004.03	$5.41	$6.38	$0.97	118%	$5.00	-$0.41	92%
2004.04	$5.71	$6.38	$0.67	112%	$5.41	-$0.30	95%
2004.05	$5.92	$7.68	$1.76	130%	$5.91	-$0.01	100%
2004.06	$6.58	$7.70	$1.12	117%	$5.70	-$0.88	87%

* Maximum spot price represents maximum daily spot market price (Daily High) over six month period starting from date in first column of table.

(Table continued on next page)

Table 2. Comparison on Maximum NYMEX Futures Price with Maximum Daily Spot Market Price (at SoCal Border) Over Six Month Periods

(Continued from previous page)

6-month Period Beginning	Maximum NYMEX Price	Maximum Daily Spot Price	Difference		Average Daily Spot Price	Difference	
			$/MMBtu	Ratio		$/MMBtu	Ratio
2004.07	$6.84	$7.70	$0.86	113%	$5.68	-$1.16	83%
2004.08	$6.85	$7.70	$0.85	112%	$5.31	-$1.53	78%
2004.09	$6.91	$7.70	$0.79	111%	$4.68	-$2.23	68%
2004.10	$6.69	$7.70	$1.01	115%	$5.52	-$1.17	82%
2004.11	$8.55	$7.70	-$0.85	90%	$5.91	-$2.64	69%
2004.12	$8.37	$7.25	-$1.12	87%	$6.30	-$2.07	75%
2005.01	$7.10	$7.25	$0.15	102%	$5.73	-$1.37	81%
2005.02	$6.18	$7.36	$1.18	119%	$5.73	-$0.44	93%
2005.03	$6.40	$10.15	$3.75	159%	$6.51	$0.11	102%
2005.04	$7.25	$11.70	$4.45	161%	$6.65	-$0.59	92%
2005.05	$7.58	$11.90	$4.32	157%	$5.83	-$1.75	77%
2005.06	$7.28	$11.90	$4.62	164%	$6.13	-$1.15	84%
2005.07	$8.31	$14.28	$5.97	172%	$6.68	-$1.63	80%
2005.08	$9.07	$14.28	$5.21	157%	$8.09	-$0.98	89%
2005.09	$10.09	$14.28	$4.19	141%	$9.66	-$0.43	96%
2005.10	$12.79	$14.28	$1.49	112%	$10.77	-$2.01	84%
2005.11	$14.34	$14.28	-$0.06	100%	$7.61	-$6.74	53%
2005.12	$12.35	$14.28	$1.93	116%	$11.19	-$1.17	91%
2006.01	$14.20	$8.45	-$5.75	60%	$7.67	-$6.53	54%
2006.02	$9.50	$7.86	-$1.64	83%	$6.73	-$2.77	71%
2006.03	$8.32	$7.95	-$0.37	96%	$5.95	-$2.37	72%
2006.04	$7.63	$7.95	$0.32	104%	$5.98	-$1.65	78%
2006.05	$8.31	$7.95	-$0.36	96%	$5.29	-$3.03	64%
2006.06	$9.19	$7.95	-$1.24	86%	$5.75	-$3.45	62%
2006.07	$9.89	$7.95	-$1.94	80%	$5.93	-$3.97	60%
2006.08	$10.14	$7.95	-$2.19	78%	$6.70	-$3.44	66%
2006.09	$11.20	$7.51	-$3.69	67%	$4.60	-$6.60	41%
2006.10	$9.42	$7.51	-$1.91	80%	$5.48	-$3.94	58%
Average	$6.85	$8.29	$1.44	130%	$5.44	-$1.41	83%

* Maximum spot price represents maximum daily spot market price (Daily High) over six month period starting from date in first column of table.

Table 3. Comparison on Maximum NYMEX Futures Price with Maximum and Average Daily Spot Market Price (at Malin)

6-month Period Beginning	Maximum NYMEX Futures	Maximum Daily Spot	Difference		Average Daily Spot	Difference	
			$/MMBtu	%		$/MMBtu	%
2002.01	$2.83	$3.57	$0.74	126%	$2.14	-$0.70	75%
2002.02	$2.50	$3.57	$1.07	143%	$2.17	-$0.32	87%
2002.03	$2.54	$3.57	$1.03	141%	$3.02	$0.48	119%
2002.04	$3.07	$3.59	$0.52	117%	$3.05	-$0.02	99%
2002.05	$3.47	$4.31	$0.84	124%	$2.86	-$0.61	82%
2002.06	$4.04	$4.31	$0.27	107%	$2.38	-$1.66	59%
2002.07	$3.88	$4.81	$0.93	124%	$2.17	-$1.71	56%
2002.08	$3.78	$8.05	$4.27	213%	$2.66	-$1.12	70%
2002.09	$3.73	$10.50	$6.77	281%	$3.18	-$0.55	85%
2002.10	$4.15	$10.50	$6.35	253%	$3.65	-$0.50	88%
2002.11	$4.34	$10.50	$6.16	242%	$3.78	-$0.56	87%
2002.12	$4.10	$10.50	$6.40	256%	$4.34	$0.24	106%
2003.01	$4.79	$10.50	$5.71	219%	$4.71	-$0.08	98%
2003.02	$5.28	$10.50	$5.22	199%	$5.85	$0.57	111%
2003.03	$5.93	$9.04	$3.11	152%	$5.79	-$0.14	98%
2003.04	$6.05	$5.75	-$0.30	95%	$4.80	-$1.25	79%
2003.05	$5.42	$5.75	$0.33	106%	$5.13	-$0.29	95%
2003.06	$6.05	$5.75	-$0.30	95%	$5.00	-$1.05	83%
2003.07	$6.45	$6.25	-$0.20	97%	$4.54	-$1.92	70%
2003.08	$5.75	$6.74	$0.99	117%	$4.65	-$1.10	81%
2003.09	$5.59	$6.74	$1.15	121%	$4.39	-$1.20	79%
2003.10	$5.39	$6.74	$1.35	125%	$4.36	-$1.03	81%
2003.11	$5.64	$6.74	$1.10	119%	$4.33	-$1.31	77%
2003.12	$5.03	$6.74	$1.71	134%	$5.40	$0.37	107%
2004.01	$6.54	$6.74	$0.20	103%	$5.54	-$1.00	85%
2004.02	$6.58	$6.00	-$0.58	91%	$4.92	-$1.66	75%
2004.03	$5.41	$6.00	$0.59	111%	$4.90	-$0.51	91%
2004.04	$5.71	$6.00	$0.29	105%	$5.26	-$0.45	92%
2004.05	$5.92	$7.70	$1.78	130%	$5.63	-$0.30	95%
2004.06	$6.58	$7.70	$1.12	117%	$5.44	-$1.14	83%

* Maximum spot price represents maximum daily spot market price (Daily High) over six month period starting from date in first column of table.

(Table continued on next page)

Table 3. Comparison on Maximum NYMEX Futures Price with Maximum and Average Daily Spot Market Price (at Malin)

(Continued from previous page)

6-month Period Beginning	Maximum NYMEX Futures	Maximum Daily Spot	Difference		Average Daily Spot	Difference	
			$/MMBtu	Ratio		$/MMBtu	Ratio
2004.07	$6.84	$7.70	$0.86	113%	$5.51	-$1.33	81%
2004.08	$6.85	$7.70	$0.85	112%	$5.16	-$1.69	75%
2004.09	$6.91	$7.70	$0.79	111%	$4.56	-$2.35	66%
2004.10	$6.69	$7.70	$1.01	115%	$5.44	-$1.25	81%
2004.11	$8.55	$7.19	-$1.36	84%	$5.74	-$2.81	67%
2004.12	$8.37	$7.16	-$1.21	86%	$6.12	-$2.25	73%
2005.01	$7.10	$7.16	$0.06	101%	$5.69	-$1.41	80%
2005.02	$6.18	$7.16	$0.98	116%	$5.66	-$0.52	92%
2005.03	$6.40	$9.91	$3.51	155%	$6.46	$0.06	101%
2005.04	$7.25	$11.70	$4.45	161%	$6.60	-$0.64	91%
2005.05	$7.58	$11.99	$4.41	158%	$5.77	-$1.81	76%
2005.06	$7.28	$11.99	$4.71	165%	$6.06	-$1.21	83%
2005.07	$8.31	$14.00	$5.69	168%	$6.50	-$1.81	78%
2005.08	$9.07	$14.00	$4.93	154%	$8.06	-$1.01	89%
2005.09	$10.09	$14.00	$3.91	139%	$9.73	-$0.37	96%
2005.10	$12.79	$14.00	$1.21	110%	$10.78	-$2.00	84%
2005.11	$14.34	$14.00	-$0.34	98%	$8.14	-$6.20	57%
2005.12	$12.35	$14.00	$1.65	113%	$11.30	-$1.06	91%
2006.01	$14.20	$8.75	-$5.45	62%	$7.74	-$6.45	55%
2006.02	$9.50	$7.70	-$1.80	81%	$6.65	-$2.85	70%
2006.03	$8.32	$7.57	-$0.75	91%	$5.95	-$2.37	72%
2006.04	$7.63	$7.57	-$0.06	99%	$5.95	-$1.68	78%
2006.05	$8.31	$7.57	-$0.74	91%	$5.27	-$3.05	63%
2006.06	$9.19	$7.57	-$1.62	82%	$5.58	-$3.62	61%
2006.07	$9.89	$7.57	-$2.32	77%	$5.73	-$4.16	58%
2006.08	$10.14	$7.57	-$2.57	75%	$6.53	-$3.61	64%
2006.09	$11.20	$7.51	-$3.69	67%	$4.58	-$6.62	41%
2006.10	$9.42	$7.51	-$1.91	80%	$5.47	-$3.95	58%
Average	$6.85	$8.12	$1.27	119%	$5.32	-$1.53	78%

* Maximum spot price represents maximum daily spot market price (Daily High) over six month period starting from date in first column of table.

IV. Stakeholder Comments

Comments on DMM's February 9 whitepaper were received from two stakeholders: Williams and WPTF.[9]

1. Both Williams and WPTF object to the fact that the CAISO is considering bid caps for start-up and minimum load bids after initially proposing a package of market power mitigation measures which did not include such caps. Williams notes that the CAISO initially concluded that the inability to change start-up and minimum load bids for six months was a sufficient deterrent for market power. Similarly, WPTF states that the CAISO has previously characterized the previously proposed market power mitigation measures as a "package whose individual components should not be adjusted" and that "implementation constraints prohibit consideration of any further changes." (p.2)

   DMM acknowledges that the CAISO's initial MRTU filing included a variety of market power mitigation measures that were intended to be viewed as a package of measures, and that, within this context, the CAISO initially concluded that the inability to change start-up and minimum load bids for six months was a sufficient deterrent for market power. However, as described in this paper, further review of market power mitigation measure in place within the PJM system – which serves as the model for the CAISO's conceptual filing – actually includes cost-based mitigation of start-up and minimum load bids whenever a unit is dispatched to relieve an uncompetitive system constraint.

   Although the specific approach for mitigating start-up and minimum load bids incorporated in the PJM market rules would not be feasible at this point due to implementation issues, DMM believes the options outlined in the previous whitepaper could be implemented with minimal effort, since each of these options could be implemented by imposing a constraint on start-up and minimum load bid values entered into the Master File for each resource no more than once every six month period.

2. Both Williams and WPTF believe the CAISO should present some evidence of market power in bidding of start-up or minimum load bids prior to seeking any additional mitigation measures. (Willliams, p.1 ; WPTF, p. 3)

   DMM believes the purpose of mitigation is to prevent the exercise of excessive market before it occurs. Thus, DMM does not agree with the fundamental premise that evidence of the exercise of market power through excessively high start-up and minimum load bids is necessary prior to development of measures to mitigate the potential for such market power. In addition, DMM notes that all other major ISOs do have some mitigation measures in place to mitigate the exercise of market power through excessively high start-up and minimum load bids.

[9] Comments are posted on CAISO website at http://www.caiso.com/1b98/1b98b6c33d8f0.pdf (Williams) and http://www.caiso.com/1b98/1b98b55235570.pdf (WPTF).

3. WPTF states that the Resource Adequacy (RA) process provides the opportunity for the ISO to declare which units are required for reliability, and that the ISO should not rely on any units for reliability that have not already been identified and contracted under RA rules (p.2). WPTF further states that the RA bilateral contracting process provides an avenue for buyers to specify treatment of start-up and minimum load costs. Similarly, Williams states that the scenario the CAISO appears to be most concerned about is if a unit when only once unit can resolve a reliability issue and can thus exercise market power by submitting unreasonably high start-up and minimum load bids. Under this scenario, Williams notes that the unit should be identified as needed for reliability and should be forward contracted.

DMM agrees with Williams that the most likely scenario is that excessively high start-up and minimum load bids might be used to exercise market power on a locational basis within a constrained area, and that capacity would typically be under RA contracts. However, DMM notes that RA contracting requirements only create an obligation for a unit to offer available capacity in the CAISO's markets, and include no cost or bid mitigation provisions pertaining to start-up and minimum loads. Thus, one option could be to establish the type of start-up or minimum load bid caps outlined in the February 9 whitepaper (e.g. several time the cost of a typical unit) for units under RA and/or LRAR contracts, and have a much higher "damage control" cap for other units.

4. Williams suggests that it may be appropriate to have some "damage control" bid cap on start-up and minimum load bids, but contends that the options outlined in the whitepaper suggest the CAISO "is seeking yet another layer of supply-side mitigation without any assurances that the effects of this layer of mitigation will themselves be mitigated through another balancing means for cost recovery." (p.1) Williams finds none of the proposed caps acceptable, but notes that the least unacceptable cap would be one that provides the most headroom over a six month term to allow for gas price fluctuation., such as "taking some multiple of the highest cost resource within a technology." Similarly, WPTF states that all of the options outlined in the February 9 whitepaper mitigate the "bid-based" approach with cost-based mechanisms, effectively defeating the design of the bid-based mechanism. WTPF believes if cap for start-up and minimum load bids is implemented, it should be viewed as a "damage control" cap, and should be set at a very high level, such as 5 to 10 times the average energy price. (p.3)

DMM notes that Option A for minimum load bids considered in the February 9 whitepaper does seem to represent the type of damage control cap suggested by Williams and WPTF. For start-up bids, however, WPTF's suggestion of setting a damage for cap at " 5 to 10 times the average energy price" does not seem applicable since start-up costs are not determined on a MWh basis. Thus, some alterative basis would be needed to develop an analogous "damage control" cap for start-ups.

DMM believes that start-up and minimum load bids caps that would result under Options B and C for bid-based start-ups and Options A, B and C for minimum load bids considered in the February 9 whitepaper would allow bids that significantly exceed actual costs for most units, and are comparable to the level of mitigation imposed in other ISOs. As shown in Tables 4 and 6 of the February 9 whitepaper, caps under these options would equal about 200% of actual start-up and minimum load costs for typical units under each of these options. DMM believes this is consistent with the intent of the bid-based option — which DMM believes is to provide some flexibility for generators to submit bids which exceed costs that

might be calculated under the cost-based option to some degree, but which still reflect a units actual start-up and minimum load costs.

Meanwhile, as shown in Table 1 of this report, market rules in other major ISO's generally limit start-up and minimum load to about this same range. Specifically, while mitigation thresholds in these other ISOs may be higher than 200% of costs for unconstrainted areas, mitigation thresholds within constrained areas are generally lower than these levels. This is particularly the case under PJM market rules, which do not limit start-up and minimum load bids when a unit is not needed due to an uncompetitive transmission constraint, but automatically mitigate a unit's start-up and minimum load bids to cost-based levels whenever a unit is dispatched due to an uncompetitive transmission constraint.

5. Williams and WPTF both express concern that under all of the proposed options, caps would be set based on the projected gas price over a six month period, so that suppliers would face the risk that spikes in daily spot market gas prices could create the risk that suppliers' actual start-up and minimum load costs could exceed the bid caps at some point over the six month period over which the suppliers' bid would remain capped.

The analysis of gas prices presented in this paper was designed to assess the actual risk of this scenario based on gas futures and spot market price data for the last five years. As shown in Figure 2 and Tables 2 and 3, under the risk of this scenario appears very low under any option that allows bids up to 200% of a unit's actual start-up and minimum load costs. However, DMM notes that the analysis of gas prices presented in this paper does suggest that the second option for capping start-up and minimum load bids (unit-specific caps set at 200% of projected start-up and minimum load costs) would involve less risk than options which caps would be set based on the upper range of start-up and minimum load costs for units within categories (e.g. start-up bid Option 1 or 3, or minimum load bid Option 3).

V. Preliminary DMM Recommendation

Based on the results of the additional analysis in this paper, DMM favors the basic approach outlined in Option 2 described in the February 9 whitepaper for both start-up and minimum load bids. Under the specific description of this approach included in the February 9 whitepaper, bids would be capped at 200% of each unit's projected start-up and minimum load costs, calculated using the index of forward looking gas price index described in this whitepaper.

A key advantage of this approach is that the necessary start-up and other operating data for all gas-fired units should already be collected under MRTU and entered into the CAISO's Master File. In effect, this approach utilizes the same data used under the cost-based option, but substitutes a different gas price (derived from a simple formula that be easily calculated by the CAISO and all participants). Unlike some of the other approaches, this option does not require further definition of unit types, categories, prototypical units, or other values to be used in the calculation.

DMM has also verified that this approach may be relatively easy to implement by the CAISO through controls on the values that may be entered by participants in the Master File, which allow the CAISO to verify and approve data before it is accepted in the Master File. The CAISO believes this is approach could be implemented relatively easily by calculating – on a monthly basis – the maximum start-up or minimum load bid that may be entered by any unit by combining the monthly gas index described in this report with the start-up and minimum load operating characteristics of each unit in the Master File. An internal CAISO process would then be put in place to check any start-up or minimum load bid submitted by a participant against this value prior to acceptance of the value in the Master File. In practice, since start-up and minimum load bids under the bid-based option may only be modified once every six months, the CAISO expects that the volume of bids submitted each month will be very limited.

Three variations of this basic approach are described below:

- **200% of Projected Cost based on Maximum Gas Futures Prices**. This approach is the same as Option 2 described in the February 9 whitepaper for both start-up and minimum load bids. As demonstrated by the analysis in this paper, the 200% range above costs provided under this approach appears to be sufficiently high so as to essentially eliminate the risk that any short term gas price spike could cause a unit's actual start-up or minimum load cost to exceed this level.[10]
- **200% of Projected Cost based on Maximum Gas Futures Prices with Additional Cost Recovery Mechanism.** Under this approach, bid caps would be calculated for each unit in the same manner as described above. However, if (a) a unit owner submitted a start-up or minimum load bid that was capped at this level, and (b) spot market gas prices ever increased to the point where the unit's actual start-up or minimum load cost exceeded this cap, then the owner could receive an additional payment covering the difference between the capped bid and the actual start-up or minimum load cost. Under this option, the unit's actual start-up or minimum load cost would be calculated using the same spot market gas index used in calculating start-up or minimum load costs under the cost-based option.

[10] Moreover, it must be remembered that start-up and minimum load bids are only utilized as part of the bid cost recovery, so that even if actual start-up or minimum load costs exceed maximum allowable bid levels, a unit may still recover these costs through energy and ancillary market payments.

- **300% of Projected Cost based on Maximum Gas Futures Prices**. A final variation of this option would be to increase the cap above 200%. Under this approach, the review of impact thresholds in other ISOs and analysis of gas prices presented in this paper suggest that maximum range of 300% may be appropriate. The 300% level corresponds to the maximum impact threshold in effect in another ISO (MISO), as well as the maximum spike in gas prices that has occurred over the last five years (relative to the NYMEX futures prices in the preceding six months).

DMM is planning on holding a stakeholder call and providing the opportunity for further comment from stakeholders on these potential refinements.