

# Self-Schedules Bid Cost Recovery Allocation and Lower Bid Floor Draft Final Proposal

Comments by Department of Market Monitoring  
August 23, 2016

## Summary

The ISO proposal to lower the energy bid floor from  $-\$150/\text{MWh}$  to  $-\$300/\text{MWh}$ s is based on two key premises: (1) that the need to curtail self-schedules due to lack of decremental bids is a significant and growing problem; and (2) that lowering the bid floor to  $-\$300/\text{MW}$  will incent more economic participation by generators in the real-time market, and reduce instances of real-time self-scheduling. The proposal also specifically states that lowering the bid floor to  $-\$300/\text{MWh}$  would allow many variable energy resources (VERs) to reflect opportunity costs of curtailment in economic bids.

DMM does not believe that the ISO's *Draft Final Proposal* supports the key premises underlying the proposal to lower the bid floor at this time. On the contrary, analysis by DMM and comments by key stakeholders suggest that neither of these premises appear valid at this time. DMM also notes that lowering the bid floor may have several detrimental or inequitable market impacts in a variety of ways which have been highlighted in prior stakeholder processes.

Consequently, while DMM is generally supportive of efforts to increase real-time economic participation by generators, it does not appear at this time that lowering the bid floor is warranted or that it would have the intended effect. DMM believes that at this time the potential for detrimental or inequitable market impacts of a lower bid floor continue to outweigh potential gains from a lower bid floor. In the event conditions begin to change in the future, it seems the option of lowering the bid floor could be implemented with limited lead time.

DMM believes the ISO could more effectively increase the flexibility of the ISO's fleet of resources by focusing its limited resources in other areas. These areas include further enhancements to the Flexible Ramping Product design, better aligning resource adequacy requirements with actual reliability needs, energy imbalance market expansion, and regional integration.

## I. Rationale for decreasing bid floor

The following sections discuss the various rationale provided in the ISO's Draft Final Proposal for lowering the bid floor to -\$300/MWh.

### **Basing the bid floor on marginal cost (or opportunity cost)**

DMM believes the key frame of reference for setting the appropriate level of the bid floor is the actual marginal cost (or opportunity cost) of reducing generation. The current -\$150/MWh cap was set at a level that was determined by the ISO to be "below the opportunity costs for providing energy for the majority of the renewable energy fleet."<sup>1</sup>

DMM believes that bid data summarized in DMM's 2015 Annual Report, as well as stakeholder comments and the current value of renewable energy tax credits, provide strong evidence that the true marginal cost (or opportunity cost) of most or all resources is higher than the current -\$150/MWh bid floor. Figure 1 shows the ranges of bids submitted to the market by resource type in 2015.

Almost all natural gas-fired generation bid at prices from \$0 to \$50/MWh, which is consistent with the prevailing natural gas and greenhouse gas prices, resource heat rates and emissions factors. An extremely small portion of natural gas generation was bid in at negative prices above -\$25/MWh, while virtually no gas generation was bid in below -\$25/MWh. Analysis by the ISO and DMM performed in 2015 also found that economic bids were being submitted for most gas-fired generation, with the ISO concluding that the gas-fired fleet was not a significant source of potential additional source of economic bids in the real-time market.

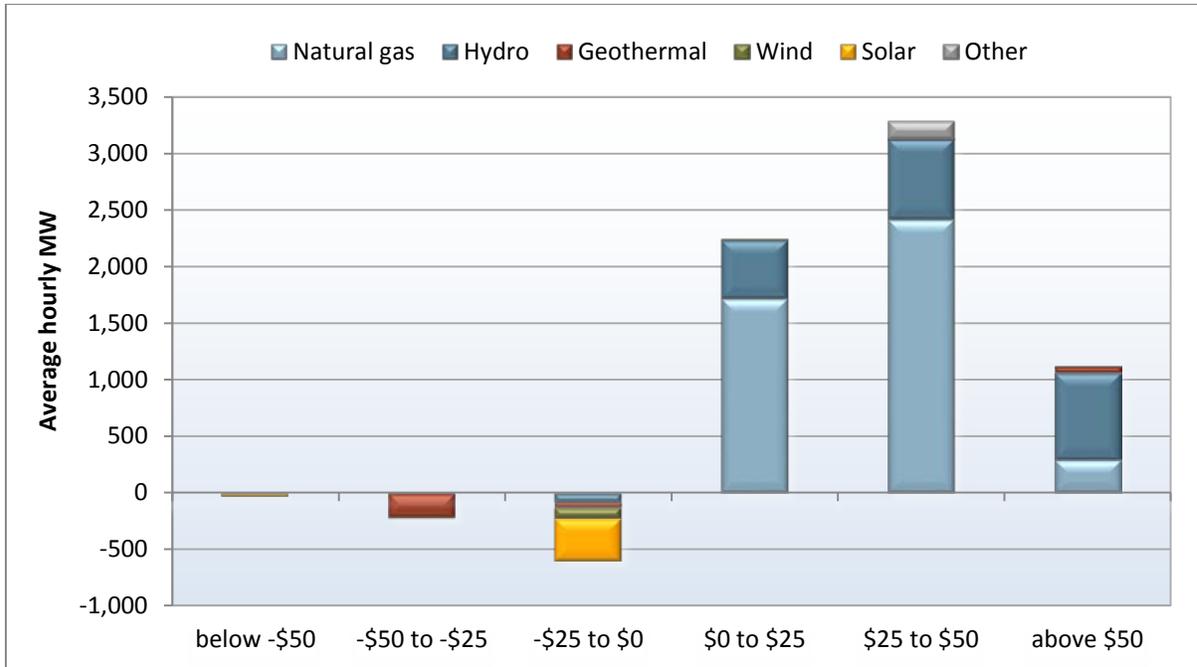
Bids for hydro-electric generation varied from negative prices, which accounted for about 5 percent of total hydro capacity bid into the market, to prices above \$50/MWh. Based on analysis by the ISO and DMM performed in 2015, the ISO also concluded that hydro resources were not a significant potential additional source of economic bids in the real-time market.

Almost all negative bids submitted were for renewable resources, and these bids were generally between -\$50/MWh and -\$10/MWh, or the range of tax credits and renewable energy credits (RECs) that these resources receive for each megawatt-hour of output. When output from these resources is decreased due to real-time market dispatch, these tax credits and RECs represent the opportunity cost of this lost production.

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<sup>1</sup> *Lowering the Energy Bid Floor and Changing the Bid Cost Recovery Methodology with Additional Performance Based Refinements*, ISO transmittal letter, September 25, 2013, pp. 3-4, [http://www.caiso.com/Documents/Sep25\\_2013\\_TariffAmendment-BidCostRecoveryMitigationMeasuresER13-2452-000.pdf](http://www.caiso.com/Documents/Sep25_2013_TariffAmendment-BidCostRecoveryMitigationMeasuresER13-2452-000.pdf)

**Figure 1. Real-time economic bids by bid range and resource type (2015)**



Thus, DMM believes that the data in Figure 1 provides no indication that the current -\$150/MWh is limiting the amount of bids submitted in the real-time market. This conclusion is further supported by the comments of the state’s major load-serving entities – which are parties to most of the PPAs for VERs.

The current value of the federal renewable tax credit is \$23/MWh.<sup>2</sup> Public data on compliance REC prices are not readily available or presented in the ISO proposal, and specific terms of Power Purchase Agreement are non-public. However, as noted below, many stakeholder comments from the *Stepped Constraint Parameters Issue Paper* indicate that total curtailment costs for VERs do not exceed the current bid floor of -\$150/MWh.

<sup>2</sup> Applies to wind and solar, among other technologies, at \$0.023/KWh. Solar is not mentioned on the page linked here but is shown on the IRS tax credit form at the link provided on that page: <http://energy.gov/savings/renewable-electricity-production-tax-credit-ptc>.

## **Will lowering the bid floor increase the supply of bids?**

Another key indication that lowering the bid floor to -\$300/MWh is unnecessary and unlikely to have the intended effect are the comments submitted by stakeholders submitted in response to the *Stepped Constraints Parameters Issue Paper*. Comments by the state's major load-serving entities – which are parties to most of the PPAs which are said to be driving the opportunity costs for VERs – are particularly noteworthy given that these entities are in a position to assess the impact of lowering the bid floor on renewables. PG&E explicitly states that they believe the current bid floor of -\$150/MWh provides “ample incentives” for VERs to curtail.<sup>3</sup> SCE does not support lowering the bid floor until the CAISO can demonstrate that the current bid floor is not sufficiently low, and that many of their renewable contracts do allow a number of economic curtailments.<sup>4</sup>

Although the ISO's *Draft Final Proposal* contends that “comments generally supported lowering the bid floor,”<sup>5</sup> comments of numerous other stakeholders suggest a willingness to consider a lower bid floor, but also request further analysis to justify the need to lower the bid floor. Few comments appear to reflect unconditional support for a lower bid floor.

Given the stakeholder comments on this issue, it is not apparent that lowering the bid floor below the current level of -\$150/MWh would achieve a significant change in the real-time economic participation of VERs. This notion is further supported by the request for analysis to support the need for a lower bid floor by many other stakeholders. The request for additional analysis to support a lower bid floor emphasizes the point that those who may be affected by such a change do not see this as a needed change that would affect market participation.

## **Curtailement of self-schedules**

In response to stakeholder comments on the ISO initial proposal to lower the bid floor to -\$300/MWh, the ISO's *Draft Final Proposal* includes some data analysis in support of the proposal to lower the bid floor. The ISO's analysis is meant to highlight the frequency of over-supply conditions during which there were insufficient economic bids to resolve over supply.

DMM continues to review the ISO's analysis, but at this time questions the degree to which it accurately reflects the frequency, magnitude and trend of self-schedule

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<sup>3</sup> *Comments of Pacific Gas and Electric Company: Stepped Constraint Parameters Issue Paper*, May 27, 2016. <http://www.caiso.com/Documents/PGEComments-SteppedConstraintParameters-IssuePaper.pdf>

<sup>4</sup> *Southern California Edison Stakeholder Comments: Stepped Constraint Parameters Issue Paper*, May 26, 2016. <http://www.caiso.com/Documents/SCEComments-SteppedConstraintParameters-IssuePaper.pdf>

<sup>5</sup> *Draft Final Proposal*, p.4.

curtailments that could be reduced by more bids from VERs. DMM's own analysis summarized in these comments and in prior DMM reports suggest a different overall trend – namely, that bidding by VERs is increasing, and curtailments of self-schedules are very low and have decreased over the last year.

The ISO's analysis presents monthly totals of the number of 5-minute intervals in which the system power balance constraint was relaxed for excess supply, as well as the number of intervals in which real-time self-schedules were curtailed. The first of these metrics addresses instances of over-supply at the system level over the last 13 months (see Figure 1 in *Draft Final Proposal*).

Analysis by DMM indicates that while the frequency of negative prices set by economic bids is increasing, the frequency of intervals in which there were insufficient bids to balance oversupply in the real-time market has dropped and is extremely low. DMM has concluded that the extremely low frequency of prices roughly at or below the - \$150/MWh bid floor has been partly the result of an increase in bidding flexibility of renewable resources as well as increased transfer capability in the real-time market through the energy imbalance market (EIM).

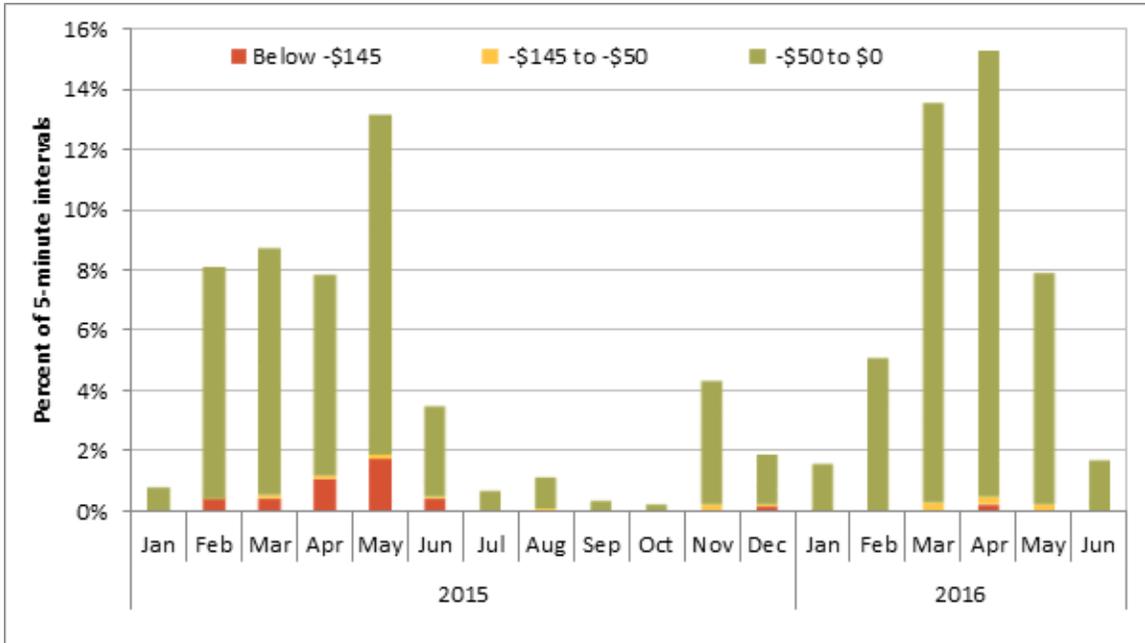
As shown in Figure 2, despite a significant increase in hydro and renewable energy, the frequency of prices roughly at or below the -\$150/MWh bid floor dropped to about 0.1 percent of 5-minute intervals in the second quarter of 2016 compared to about 1 percent during the same quarter in 2015. This represents a significant decrease in the 5-minute intervals when the supply of negatively priced real-time bids to decrease generation was fully dispatched and some resources needed to be curtailed.

Figure 3 shows the frequency of negative prices in the 5-minute market during the second quarter of 2016 by hour. This figure highlights that the extremely low number of intervals of prices roughly at or below -\$150/MWh occurred during hours ending 10 and 11. These represent hours when solar output is increasing and net load is dropping sharply.

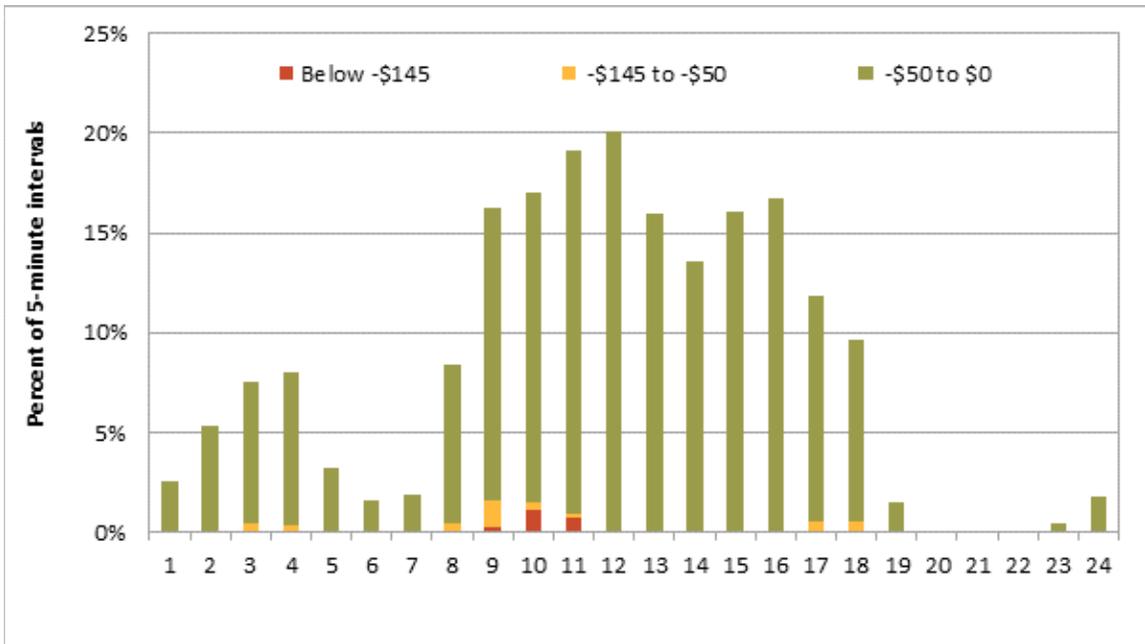
DMM notes that this is one of the key situations that the flexible ramping product being implemented in fall 2016 is designed to address. Once implemented, the flexible ramping product should increase the amount of dispatchable gas-fired generation that can be reduced in the 5-minute market during these hours.

DMM's analysis indicates that since the 15-minute market was implemented in May 2014, there have been no oversupply power balance constraint violations in either the 15-minute market or the day-ahead market. This reflects the fact that when the supply of bids to reduce generation have been exhausted, this has resulted from a very temporary and short term set of conditions in the 5-minute market.

**Figure 2. Frequency of negative 5-minute prices by month (ISO LAP areas)**



**Figure 3. Frequency of negative 5-minute prices by hour (April – June 2016)**



The second metric in the Draft Final Proposal appears to show the percentage of intervals in which any resource in the ISO was decremented below its self-schedule over the last 13 months (see Figure 2 in *Draft Final Proposal*). As noted in the *Draft Final Proposal*, these data include intervals in which self-schedules may have been curtailed for overall system conditions as well as localized constraints.

This metric shows that at least one resource in the ISO system was dispatched below its self-schedule in the real-time market during about 1 to 4 percent of all 5-minute intervals over the 12-month period ending in March 2016, and that this increased dramatically to over 11 percent of intervals in April 2016. The *Draft Final Proposal* suggests that this increase represents a harbinger of future trends as more solar is added to the system.

DMM understands that this metric includes all resources in the ISO system. DMM suspects that a very large portion of the units and intervals driving this metric are relatively small curtailments of hydro resources or other resources in very localized “generation pockets”. In these localized situations it is likely that self-scheduled solar and other renewable energy resources are not causing or exacerbating the need for these curtailments. DMM suggests that more analysis of this data and this issue may be beneficial.

Meanwhile DMM’s analysis of VERS indicates that non-economic curtailments of solar and wind energy are extremely low and have dropped to *de minimus* levels in 2016. Table 1 shows the percentage of all solar and wind generation that has been reduced based on economic bids as well as through uneconomic reductions (i.e. curtailment of self-schedules). This table expands analysis presented in DMM’s 2015 Annual Report through the first half of 2016.

As shown in Table 1, despite the increase in hydro and solar output, virtually no non-economic curtailment of renewables has occurred in 2016. During the first half of 2016, although total solar and wind increased by over 30 percent, the portion of these resources’ output that was non-economically curtailed dropped from about 0.06 percent to only 0.02 percent of total wind and solar output over this period. Again, DMM has concluded that this trend has been the result of an increase in bidding flexibility of renewable resources as well as increased transfer capability in the real-time market through the energy imbalance market (EIM).

**Table 1. Volume of reductions in solar and wind generation  
due to real-time market dispatches and curtailments**

Year	Month	Solar			Wind		
		Economic downward dispatch	Non-economic curtailment	Total reduction	Economic downward dispatch	Non-economic curtailment	Total reduction
2015	Jan	1.1%	-	1.1%	.1%	-	.1%
	Feb	1.5%	-	1.5%	.3%	-	.3%
	Mar	2.0%	.1%	2.1%	.3%	.1%	.3%
	Apr	2.0%	.1%	2.1%	.4%	.1%	.5%
	May	3.2%	.2%	3.4%	.2%	.1%	.3%
	Jun	.8%	-	.8%	.1%	.1%	.2%
	Jul	.4%	-	.5%	.2%	-	.2%
	Aug	.6%	.1%	.6%	.1%	-	.1%
	Sept	.3%	-	.3%	.1%	-	.1%
	Oct	.4%	-	.4%	-	-	-
	Nov	1.2%	-	1.3%	.2%	-	.2%
	Dec	1.1%	.1%	1.2%	.1%	.1%	.1%
2016	Jan	1.0%	-	1.0%	.1%	-	.1%
	Feb	1.4%	-	1.4%	.2%	-	.2%
	Mar	3.4%	.1%	3.5%	.3%	.1%	.4%
	Apr	2.5%	-	2.6%	.5%	-	.5%
	May	1.4%	-	1.4%	.4%	-	.4%
	Jun	.9%	-	.9%	.1%	-	.1%
	Jul	.1%	-	.1%	.1%	-	.1%

### **Bid floors in other ISOs**

As further support for the lower bid floor, the ISO notes that nearly all other ISO/RTOs have a bid floor that is more negative than the proposed  $-\$300/\text{MWh}$ . Without further support for this comparison (e.g., similarities in markets), it is not clear that this alone should motivate the CAISO to lower its bid floor. For example, other ISO's may have additional protections or place less weight on the potential detrimental effects of the lower bid floor. In addition, differences in market software and settlement rules may make the impacts of a lower bid floor have less potential detrimental effects.

### **The bid floor as a form of administratively set prices**

As noted in the ISO's *Draft Final Proposal*, when power balance constraint needs to be relaxed and self-schedules must be curtailed, prices are set based on the power balance relaxation price – which is in turn based on the bid floor. The ISO proposal contends that “this does not provide accurate price signals because the power balance constraint is an administratively determined price,” and that “in contrast, economic bids reflect the marginal cost of supply.”<sup>6</sup>

DMM questions how this logic supports lowering the bid floor for  $-\$150/\text{MWh}$  to  $-\$300/\text{MWh}$ , unless (1) there are additional resources with actual marginal costs between  $-\$150/\text{MWh}$  and  $-\$300/\text{MWh}$ , and (2) these resources will offer this additional decremental capacity into the real-time market if the bid floor is lowered to  $-\$300/\text{MWh}$ . Otherwise, DMM suggests that lowering the bid floor simply replaces an administratively set price of  $-\$150/\text{MWh}$  with an administratively set price of  $-\$300/\text{MWh}$ .

DMM believes that the discussion in these comments suggests that under current market conditions, lowering the bid floor – and the administrative price when curtailments occur – will result in less accurate prices, rather than more accurate prices in terms of the true marginal cost of supply.

### **Power balance excesses due to “spurious” events**

Numerous participants have expressed concern that many of the prices below the bid floor represent “spurious [negative] price spikes” caused by ramping constraints or other informational or software issues that may not reflect actual system conditions. The ISO's *Draft Final Proposal* responds to these concerns by indicating that the flexible ramping constraint products will be implemented prior to the point at which the bid floor would be lowered.<sup>7</sup>

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<sup>6</sup> *Draft Final Proposal*, p.3.

<sup>7</sup> *Draft Final Proposal*, p.18.

DMM shares the concern that many of the very small number of intervals in which the power balance constraint needs to be relaxed due to excess supply represent “spurious price spikes” caused by ramping constraints or other informational or software issues that may not reflect actual system conditions. DMM agrees that implementation of the flexible ramping product should decrease such “spurious [negative] price spikes” by increasing the amount of dispatchable gas-fired generation that can be reduced in the 5-minute market.

However, DMM believes that – given the very low frequency and downward trend of prices below the -\$150/MWh bid floor – it is preferable to implement the flexible ramping product and observe market performance and trends before lowering the bid floor. In the event conditions begin to change in the future, it seems the option of lowering the bid floor is a relatively simple market design change that could be implemented with limited lead time.

### **Demand curve for flexible ramping product**

The ISO states that lowering the bid floor to -\$300/MWh will enable the demand curve cap under the Flexible Ramping Product design to be symmetric for upward and downward ramp. The ISO further states that without such a change in the bid floor, downward ramp would be valued less than upward ramp. DMM believes this logic is inconsistent with the design of the Flexible Ramping Product demand curve. The Flexible Ramping Product demand curves in either direction are a function of the shortage or excess power balance penalty parameters, and the ancillary service penalty parameters bound the demand curve prices.

For example, consider a 30 percent probability of a forecast error being beyond an amount of Flexible Ramping Product capacity. For upward capacity the demand curve price would be  $0.30 * \$1,000 = \$300$ . For downward capacity the demand curve price would be  $0.30 * \$300 = \$90$ . The upward demand price would be truncated by the spinning reserve penalty parameter of \$250.<sup>8</sup> The downward demand price is not truncated and remains \$90 because it is below the ancillary service penalty price. As the bid cap and bid floor would continue to be asymmetric under the proposed -\$300/MWh bid floor, the Flexible Ramping Product demand curve prices should continue to be asymmetric.

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<sup>8</sup>Actual truncation is to \$247 to avoid border cases.

## II. Potential detrimental market impacts

The potential benefits from lowering the bid floor to  $-\$300/\text{MWh}$  must be weighted carefully against the resulting potential for unintended market outcomes and/or gaming. In the comments below, we highlight three such potential market outcomes. The potential issues presented here have been previously discussed in the context of other initiatives. However, lowering the bid floor increases the ability to create some of these market outcomes while increasing the economic incentives of others. The following sections discuss the ways in which lowering the bid floor may have detrimental impacts on market efficiency and equity.

### Potential for excessive bid cost recovery

The ISO's *Bidding Rules Enhancements Initiative Revised Straw Proposal* discusses two potential market outcomes which create the potential for excessive bid cost recovery that could be exacerbated by lowering the bid floor:<sup>9</sup>

- Changing bids after a commitment decision during an intertemporal constraint, and
- Changing bids after a commitment decision without intertemporal constraint.

For each of these possible outcomes, the *Bidding Rules Enhancements Revised Straw Proposal* provides clear explanations and examples of these potential issues.

This first situation involves a resource that changes bids during an intertemporal constraint. The intertemporal constraint creates a downward market power situation for the resource during which it can effectively buy-back a portion of a day-ahead schedule at a real-time bid price through bid cost recovery (BCR) payments. Lowering the bid floor exacerbates the existing potential to inflate these payments.

As an example, consider an MSG resource with two configurations and a day-ahead schedule in the upper configuration. Assume that the upper configuration has a minimum down time of 8 hours, and that in real-time the resource initially submits high bids on the upper configuration such that the resource is transitioned to the lower configuration. If the resource then lowers real-time bids on the upper configuration, BCR can be inflated for the buy-back of the day-ahead schedule in the upper configuration.

This occurs as the resource is locked into the lower configuration during the minimum down time of the upper configuration, yet the revised low bids on the upper configuration make it appear uneconomic to buy-back the day-ahead schedule from the

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<sup>9</sup> *Bidding Rules Enhancements – Revised Straw Proposal*, Section 7.1: “Proposals for energy bidding flexibility”. December 3, 2015.

[http://www.aiso.com/Documents/RevisedStrawProposal\\_BiddingRulesEnhancements.pdf](http://www.aiso.com/Documents/RevisedStrawProposal_BiddingRulesEnhancements.pdf)

upper configuration. The revenue shortfall on which BCR is calculated in this situation is the difference between the real-time price and the energy bid in the upper configuration. Thus, the magnitude by which BCR could be inflated in this situation increases with a lower bid floor.

A second issue discussed in the *Bidding Rules Enhancements Revised Straw Proposal* is the ability of a resource to inflate BCR from commitment costs when real-time bids are changed after a real-time unit commitment. In this scenario, a resource can submit higher bids in the nearest hour, or first hour of the STUC process, while submitting very low bids for the next three hours. Bids can then be raised hourly for the first hour of each STUC period, but always keeping bids in the following three hours very low.

This has the potential effect of keeping the resource committed due to the very low bids in future hours, but holding the resource at minimum load due to recognition of the higher energy bid in the shorter horizon. This allows accumulation of minimum load BCR up to the minimum load bid cap. This outcome is not dependent on any intertemporal constraint, and the ability to submit lower energy bids through a lower bid floor would further facilitate the ability to create such outcomes. The potential gains from this scenario are further exacerbated by other recent market changes such as those implemented in response to the Aliso Canyon gas storage situation which allow submission of commitment cost bids up to about 200 percent of actual costs.<sup>10</sup>

### **Decremental market power**

Beyond the issues discussed above and in the *Bidding Rules Enhancements Initiative Revised Straw Proposal*, DMM notes that with a lower bid floor, generators in a position of downward or decremental market power may have greater incentive to exercise that market power with extreme low real-time bids.

This type of market power and the incentive to exploit it may arise when a generation resource located in a non-competitive “generation pocket” bids strategically to gain from modeling inconsistencies between the day-ahead and real-time markets. The resource may bid competitively or self-schedule in the day-ahead, then submit extreme low bids corresponding with the day-ahead scheduled quantities in real-time. In the event that a constraint limit becomes more binding in real-time such that the resource is needed to mitigate congestion by decreasing output, the resource is placed in a position of downward market power. The resource then has potential to set the LMP at which it is buying back its day-ahead schedule with an extreme low bid.

The potential gains and incentives associated with a bidding strategy designed to exploit downward market power would be greater with a lower bid floor. DMM has commented on the potential for such behavior as part of earlier stakeholder processes

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<sup>10</sup> Resources in the SoCal gas region can submit commitment cost bids up to a cap which is calculated based on 175 percent of the gas index plus the additional 125 percent allowed for all resources .

which contemplated lowering the bid floor to the current level of -\$150/MWh<sup>11</sup>. In its comments on the Renewable Integration Product and Market Review, Fourth Revised Draft Straw Proposal, DMM expressed concern that such behaviors may occur, and although such behaviors had not yet been observed, they may be more likely to occur as the incentives grow with a lower bid floor:

*Finally, DMM has previously expressed concerns regarding the potential for more negative prices and bid floors to provide incentive to engage in uncompetitive strategies. One such strategy would be for units within uncompetitive “generation pockets” to exploit modeling inaccuracies or inconsistencies between the day-ahead and real-time markets by scheduling energy in the day-ahead market, and then submitting extremely low negatively priced bids for this energy in the real-time market. Under this scenario, the supplier is able to sell energy in the day-ahead market, and then also get paid to not provide this energy in real-time. While such strategies have not been observed to date, we do note that the more negative the bid price floor and resulting market prices can go, the more incentive there will be to pursue such practices. In the event such behavior is observed as the bid floor is lowered, the ISO may need to develop rules to mitigate market bids or prices under this scenario.*

Since the time of these comments and the lowering of the bid floor to -\$150/MWh, DMM has observed some instances of this type of bidding behavior. Further, such instances are among the only observed bids submitted by generators near the current bid floor. These outcomes highlight this risk associated with further lowering the bid floor and may again suggest the need for the ISO to consider developing mitigation rules for downward market power. Such a consideration may be particularly important if the ISO does ultimately lower bid floor beyond the current level.

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<sup>11</sup> *Comments on Renewable Integration Product and Market Review: Fourth Revised Draft Straw Proposal*, Department of Market Monitoring, November 17, 2011.  
[http://www.caiso.com/Documents/DMM\\_Comments\\_RenewableIntegrationMarket-ProductReviewPhase1DraftFinalProposal.pdf](http://www.caiso.com/Documents/DMM_Comments_RenewableIntegrationMarket-ProductReviewPhase1DraftFinalProposal.pdf)