

Comments on Congestion Revenue Rights Enhancements September 30 Meeting

Department of Market Monitoring
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Summary

The Department of Market Monitoring (DMM) appreciates the opportunity to comment on the *Congestion Revenue Rights Enhancements September 30th Meeting*.¹ In these comments, we focus mainly on providing further details and examples of the approach based on constraint specific reserve prices that was presented by DMM and discussed with stakeholders at the September 30 meeting. As described in the first section of these comments, DMM views this approach as one of several viable approaches that can address flaws in the existing auction design, while also addressing the concerns about the willing seller approach that have been identified in this initiative.

Background

DMM continues to support development of a congestion revenue rights (CRR) auction design based on willing sellers as a top priority for the current CRR enhancements initiative. However, after years of discussion and despite significant support from load serving entities, the ISO has not undertaken any analysis that would be needed to address stakeholder questions about this approach and move forward with consideration of this option. Therefore, DMM has also begun suggesting other options that could improve the CRR auction while addressing specific concerns about the willing seller approach raised by the ISO and some stakeholders.

In recent stakeholder comments, DMM has outlined two options for addressing the main concerns with the willing seller approach that have been expressed by the ISO and some stakeholders in this initiative:

- **Willing seller auction with backstop mechanism.** This approach would address concerns expressed by the ISO and some stakeholders about the willing seller approach by providing opportunities for entities to obtain CRRs to hedge energy transactions if they do not receive them in the allocation or auction.² This backstop approach would be made available to a targeted set of entities hedging physical transactions in the ISO's energy markets, as suggested by the Bay Area Municipal Transmission Group (BAMx).
- **Constraint specific reserve prices.** DMM has suggested this approach as an effective alternative to the ISO's proposal for placing uniform reserve bid or clearing price limits directly on CRRs (source-to-

¹ *Congestion Revenue Rights Enhancements Phase 2*, California ISO, September 30, 2026: <https://stakeholdercenter.caiso.com/StakeholderInitiatives/Congestion-revenue-rights-enhancements>

² *Comments on Congestion Revenue Rights Enhancements Stakeholder Meeting Session #9*, Department of Market Monitoring, May 6, 2026, pp 3-5: <https://www.caiso.com/documents/dmm-comments-on-congestion-revenue-rights-enhancements-stakeholder-meeting-session-9-may-06-2026.pdf>

sink pairs).³ This approach has also been suggested by members of the ISO's Market Surveillance Committee (MSC). This approach could also be made available to the set of entities hedging physical transactions in the ISO's energy markets in addition to a willing seller auction, as suggested by BAMx.

In addition, the Bay Area Municipal Transmission Group has outlined potential ways the ISO could seek to provide liquidity using the current CRR auction in a targeted manner, aimed at parties that actually use the transmission system and can utilize CRR as hedges.⁴

DMM believes all three of these options merit more detailed development and consideration by the ISO and stakeholders. DMM does not believe the ISO should expend additional resources developing and analyzing the uniform minimum bid/price approach.

In prior comments, DMM has also outlined two other measures that could be taken in addition to any of the three options for changing the auction.⁵ These include:

- **Improving the CRR allocation process.** This involves modifying the CRR allocation process and increasing CRRs allocated to load serving entities, so that these entities do not need to rely on the auction to hedge their energy procurement.
- **Increasing market information prior to auction.** The ISO could create a voluntary mechanism to collect and disseminate information to all participants prior to the auction about CRRs that parties have indicated they are interested in buying or selling. This approach would address concerns about liquidity by helping offers to buy and sell CRRs to coalesce on a more limited set of specific CRR source-to-sink pairs.

DMM believes that that these two measures deserve further discussion and consideration as additional measures that could be taken, rather than as a substitute for any of the three options for changing the auction listed above.

In the remainder of these comments, DMM focuses on providing further details and examples of the approach based on constraint specific reserve prices that was presented by DMM and discussed with stakeholders at the September 30 meeting. The comments are designed to specifically address questions and concerns about this approach made at the September 30 meeting.

³ *Comments on Congestion Revenue Rights Enhancements Phase 1 Draft Final Proposal*, Department of Market Monitoring, July 2, 2026, pp 3-5: <https://www.caiso.com/documents/dmm-comments-on-congestion-revenue-rights-enhancements-phase-1-draft-final-proposal-on-auction-efficiency-and-revenue-adequacy-jul-02-2026.pdf>

Adding reserve prices to the CRR auction, Department of Market Monitoring, Congestion Revenue Rights Working Group, September 30, 2026: <https://stakeholdercenter.caiso.com/InitiativeDocuments/Presentation-Department-of-Market-Monitoring-Congestion-Revenue-Rights-Enhancements-Sep-30-2026.pdf>

⁴ *Usage-Based Limitations for Auction CRRs*, Bay Area Municipal Transmission Group (BAMx), September 30, 2026: <https://stakeholdercenter.caiso.com/InitiativeDocuments/Presentation-Flynn-Resources-Consultants-Congestion-Revenue-Rights-Enhancements-Sep-30-2026.pdf>

⁵ Memo to ISO Board of Governors and Western Energy Markets Governing Body, re: congestion revenue rights enhancements, July 8, 2026: <https://www.caiso.com/documents/department-of-market-monitoring-update-congestion-revenue-rights-enhancements-jul-2026.pdf>

Constraint specific reserve prices

Examples of adding constraint specific reserve prices

Below are simple examples meant to illustrate how adding reserve prices to an SFT CRR auction could be modeled. Excel files are posted to the initiative comments webpage with the examples (Excel's solver needs to be enabled to run the files).

For the first example, consider a simple two-node, one-constraint network. This is modeled by setting the constraint limit to zero and adding a relaxation variable that acts to release contracts up to the constraint limit if the reserve price is met.

$$\max_{MW, R1} \sum MW_i * P_i + R1 * rp^{K1}$$

Subject to:

$$\sum_i SF_i^{K1} * MW_i - R1 \leq 0$$

MW_i : cleared CRR bids for bidder i

P_i : bid price for MW_i

$R1$: cleared relaxation variable for constraint $K1$

rp^{K1} : reserve price for constraint $K1$

Figure 1 shows the example of this one-constraint model from the September meeting where there is both trade between CRR bidders and sales from the ISO relaxation variable. Note the change in sign convention from the meeting where the reserve price is now added to the objective function and it being a cost to the objective function is accounted for in the sign of the reserve price (as the Excel file calculates bid surplus with a sum product). As shown in the September 30 stakeholder meeting, this model illustrates that constraint specific reserve prices can allow auction participants to buy from the ISO if the reserve price is met, and still trade with each other even if their bids would not meet the reserve price if implemented as a bid floor/cap.

The relaxation variable $R1$ has a reserve price of $-\$2.50$ meaning it will only release contracts if someone is willing to bid at least $\$2.50$. That is, if clearing the participant bid increases (or at least does not decrease) the bid surplus net of the cost of the $\$2.50$ reserve price cost to the bid surplus. Bid 1 is willing to pay $\$3.00$ so clears contracts up to the limit of 30 MW. Bid 1 bids to buy up to 100 MW which is more than the 30 MW limit. Bid 2 is willing to sell contracts for $\$2.75$ which is less than Bid 1's willingness to pay, so an additional 70 MW of contracts is traded between Bid 1 and Bid 2. The shadow price on the constraint is $\$2.75$ which sets the price for the contracts traded.

Figure 1. Two-node, one-constraint example 1

	Bid 1	Bid 2	R1						
Cleared MW	100.00	70.00	30.00		\$32.50	Bid Surplus			
Bid Price	\$3.00	-\$2.75	-\$2.50						
Bid max MW	100	100	30						
Bid min MW	0	0	0						
					Flow	Limit		SV	
	1.00	-1.00	-1	K1	0.00	<=	0	\$2.75	
Auction Prices	\$2.75	-\$2.75	-\$2.75						

Now consider that a transmission line is really two constraints (i.e., one constraint for each of the two possible directions of flow on the line). Adding constraint K1C, which is the constraint on flows in the opposite direction of constraint K1, would mean also adding a relaxation variable and reserve price for constraint K1C as its limit is also set to 0. Just like all flows from CRRs on K1 are by definition counterflows on K1C, the model needs to account for the R1 counterflows on K1 being flows on K1C (and vice versa).

The formulation for this two-constraint model is:

$$\max_{MW, R1, R1C} \sum MW_i * P_i + R1 * rp^{K1} + R1C * rp^{K1C}$$

Subject to:

$$\sum_i SF_i^{K1} * MW_i - R1 + R1C \leq 0$$

$$\sum_i SF_i^{K1C} * MW_i + R1 - R1C \leq 0$$

Figure 2 and 3 below provide two examples of this two-node two-constraint model.⁶ In these examples, the expected shadow price on constraint K1 is \$3 and the reserve prices are set with 5 percent premiums on this expected shadow price. This implies a reserve price in the flow direction (R1) of \$3.15 and a reserve price in the counterflow direction (R1C) of \$2.85.

- Example 1 in Figure 2 shows that, again, auction participants can trade with each other or with the ISO through the relaxation variables. Bid 1 clears 8 MW. Bid 2 provides 3 MW because it is willing to sell at \$2.80 which is less than Bid 1's willingness to pay of \$3.20. R1, the ISO relaxation variable, provides the additional 5 MW as \$3.20 is greater than the reserve price. The price is set at \$3.20 for all contracts.
- Example 2 in Figure 3 shows an example of only a bid clearing counter to the direction of prevailing flow. This is meant to highlight that setting reserve prices based on expected value means lowering the reserve price when the default \$0 reserve price is above the expected value. Here, Bid 2 is

⁶ An Excel model for this example is also posted to the initiative comments.

willing to pay -\$2.80 for 3 MW which is greater than the -\$2.85 reserve price of the relaxation variable R1C (which enters the bid surplus as +\$2.85). The ISO sells 3 MW to Bid 2 for a price of -\$2.85.

Figure 2. Two-node, two-constraint example 1

	Bid 1	Bid 2	R1	R1C						
Cleared MW	8.00	3.00	5.00	0.00						
Bid Price	\$3.20	-\$2.80	-\$3.15	\$2.85						\$1.45 Bid Surplus
Bid max MW	10	3	5	5						
Bid min MW	0	0	0	0						
						Flow	Limit			SV
	1.00	-1.00	-1	1	K1	0.00	<=	0		\$3.20
	-1.00	1.00	1	-1	K1C	0.00	<=	0		\$0.00
Auction Prices	\$3.20	-\$3.20	-\$3.20	\$3.20						
E(MCC)	\$3.00	-\$3.00								

Figure 3. Two-node, two-constraint example 2

	Bid 1	Bid 2	R1	R1C						
Cleared MW	0.00	3.00	0.00	3.00						
Bid Price	\$1.00	-\$2.80	-\$3.15	\$2.85						\$0.15 Bid Surplus
Bid max MW	10	3	5	5						
Bid min MW	0	0	0	0						
						Flow	Limit			SV
	1.00	-1.00	-1	1	K1	0.00	<=	0		\$2.85
	-1.00	1.00	1	-1	K1C	0.00	<=	0		\$0.00
Auction Prices	\$2.85	-\$2.85	-\$2.85	\$2.85						
E(MCC)	\$3.00	-\$3.00								

Examples of calculating average shadow prices

To address some of the questions raised in the September 30 stakeholder meeting, below are some examples of how the reserve prices can be derived from a time series of hourly congestion data. Because no premiums or adjustments are applied to congestion data in these examples, the resulting reserve prices equal the value of having a CRR that flowed over the constraints over the period in the data. Note that the examples assume the same shift factors in the auction as in the data.

First, consider the case shown in Figure 4, where there are three lines in series modeled over 4 hours. When there is congestion, one of the three constraints binds with a shadow price of \$1 per MWh. Constraint A binds for the first two hours. Constraint B binds in the third hour, and constraint C binds in the last hour. Summing up the shadow prices over the 4 hours on the constraints individually results in a \$2 reserve price for constraint A, and \$1 reserve prices for both constraints B and C. Summing over all the three constraints results in \$4 (or \$1 per MWh when dividing by 4 hours), which is what a CRR would be paid over the period. A reserve price of \$4 could be put on any one of the three constraints, or \$4

split into reserve prices over the three constraints as it is in the data, and the cost to the objective function would still equal the value of the CRR coming from the data.

Figure 4 Three lines in series, 4 hours

In Series Lines		Hourly Shadow Prices				Total	\$/MWh
Constr	SF	1	2	3	4		
A	1.00	\$1.00	\$1.00			\$2.00	\$0.50
B	1.00			\$1.00		\$1.00	\$0.25
C	1.00				\$1.00	\$1.00	\$0.25
MCC		\$1.00	\$1.00	\$1.00	\$1.00	\$4.00	\$1.00

Now consider the case shown in Figure 5 where there are three lines in parallel. When there is congestion, one of the three constraints binds with a shadow price of \$1 per MWh. Summing up the shadow prices over the 4 hours on the constraints individually results in a \$2 reserve value for constraint A and \$1 each for constraints B and C. Summing over all the constraints results in a total of \$4 (or \$1 per MWh). Applying the equal shift factors of 0.33, this results in an MCC of \$1.33 (or \$0.33 per MWh), which is equal to what CRR would be paid over the period. A reserve price of \$4 could be put on any one of the constraints, or \$4 split into reserve prices over the three constraints as it is in the data, and the cost to the objective function would still equal the value of the CRR coming from using the data as is.

Figure 5 Three parallel lines, 4 hours

Parallel Lines		Hourly Shadow Prices				Total	\$/MWh
Constr	SF	1	2	3	4		
A	0.33	\$1.00	\$1.00			\$2.00	\$0.50
B	0.33			\$1.00		\$1.00	\$0.25
C	0.33				\$1.00	\$1.00	\$0.25
		Total of constraints				\$4.00	\$1.00
MCC		\$0.33	\$0.33	\$0.33	\$0.33	\$1.33	\$0.33

Intervening to provide liquidity in a targeted and limited way

BAMx proposal

The Bay Area Municipal Transmission Group (BAMx) outlined potential ways the ISO could seek to provide liquidity in the CRR market in a targeted manner, aimed at parties that use the transmission system and can utilize CRR as hedges. This is consistent with the principle that if the ISO is going to intervene in markets, the intervention should be targeted and limited to achieving the purpose of the intervention.

Under the BAMx proposal, there are several ways the ISO could provide liquidity in addition to a willing seller auction to this targeted group:

- Running the current simultaneous feasibility test (SFT) auction design for the target group before a Willing Seller market.
- Providing source-to-sink path-based contracts, with reserve prices on these contracts, before or after a Willing Seller market to the target group.
- Running an SFT auction design for the target group with constraint specific reserve prices.

The ISO could also consider running an SFT auction with constraint specific reserve prices that is not targeted at entities that actually use the transmission system. Because this would not be targeted and limited, and because it would still have many of the problems caused by an SFT-based auction, this option may require additional measures such as the deficit offsets or other measures to mitigate opportunistic behavior.