Congestion Revenue Rights Settlement Rule

Revised Proposal

Department of Market Monitoring

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I. Background

The California ISO Department of Market Monitoring (DMM) has issued two previous white papers outlining options for a settlement rule to help deter the potential use of virtual bidding to increase congestion revenue rights (CRR) payments.[1] After considering the approach used by the PJM Interconnection (PJM) and ISO New England (ISO-NE), a second more "flow-based" approach was developed by DMM that was designed to provide a more targeted way of limiting CRR payments in cases when the CRR holders' virtual bids may otherwise increase their CRR payments. This second approach was incorporated in a draft proposal and discussed with the ISO's Market Surveillance Committee (MSC) and stakeholders at a September 18, 2009 MSC/stakeholder meeting.[2] Based on input from this meeting and further consideration of this issue, DMM has developed a revised proposal that incorporates several revisions and clarifications.

- The proposed rule was modified to include netting of results across all hours of each day corresponding to the participant's CRR. Specifically, for peak period CRRs, results will be netted across hours 7 to 22, while results will be netted across hours 1 to 6 and 23 to 24 for off-peak CRRs. Additional details of this modification are provided in this paper.

- The settlement rule has also been modified so that for each congested constraint that is found to be affected by the participant's convergence bids, the methodology will consider the aggregate (net) impact of this congestion on all of the participant's CRRs during each hour. Additional details of this modification are provided in this paper.

- The equations for calculating the impact of virtual bids on market flows exclude accepted virtual bids at the load aggregation point (LAP) and generation hub level, since it is unlikely that it would be feasible or profitable for an individual participant to significantly impact its CRR revenues (or payments) through virtual bidding at the LAP or generation hub level. This exclusion also creates a "safe harbor" for entities with CRRs to participate in

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[1] *Congestion Revenue Rights Settlement Rule*, Department of Market Monitoring, August 18, 2009. http://www.caiso.com/240e/240ef6614e790.pdf

Congestion Revenue Rights Settlement Rule, Draft Proposal, Department of Market Monitoring, September 14, 2009, http://www.caiso.com/2429/24291027c1fb50.pdf.

[2] *CRR Settlement Rule under Convergence Bidding*, presentation at Market Surveillance Committee Meeting, September 19, 2009, http://www.caiso.com/242c/242cd88261740.pdf.

convergence bidding without the risk of triggering this CRR settlement rule's payment adjustment.

- The mathematical details of the settlement rule have also been expanded to clarify how this rule would also be applied to "counterflow" CRRs (i.e., CRRs in the opposite direction of congestion that require the CRR holder to pay congestion costs). Given the netting provisions described above and the "safe harbor" provided for virtual bidding at a LAP or generation hub level, we believe it may not be necessary to include a cap on additional payments that may be triggered by this settlement rule for holders of "counterflow" CRRs. However, the approach can be modified to include such a cap based on further input and consideration.

- Based on a review of recent Federal Energy Regulatory Commission (FERC) decisions, the ISO legal department has expressed concern that the settlement rule cannot be applied across different business entities that may be affiliated with the same parent corporation. Thus, the settlement rule will be applied to each business entity separately. However, business entities with multiple Scheduling Coordinator (SC) IDs will have the settlement rule applied on an aggregate basis to their entire portfolio of CRRs and convergence bids. DMM will also use the basic monitoring framework incorporated in the settlement rule to monitor how convergence bidding affects the CRRs of any related business entities. If it is determined that one business entity may be engaging in convergence bidding that is contributing to price divergence in a way that benefits the CRR holdings of an entity to which it is affiliated, DMM will refer the matter to the FERC Office of Enforcement for review on a case-by-case basis. To facilitate this monitoring, entities engaged in convergence bidding and CRRs will be required to disclose other business entities doing business in the ISO markets to which they are affiliated.

Section II describes the revised proposal.

II. Proposed CRR Settlement Rule

Step 1. Calculate combined impact of participant's portfolio of virtual bids on flows of constraint for each hour

Start by considering a constraint, *k*, which was binding in the integrated forward market (IFM), the relevant real-time market, or both.[3] Also consider a participant, *i*, who owns a portfolio of time period, *p*, CRRs ($\{C\}_{p,i}$). The time period, *p*, specifies whether the CRR, $c \in \{C\}_{p,i}$, is for the peak or off-peak set of hours. The first step in determining the CRR settlement rule payment adjustment for participant, *i*, with respect to constraint, *k*, over period, *p*, is to calculate the combined impact of the participant *i*'s portfolio of accepted virtual supply and demand bids on the IFM flows of constraint, *k*, for each hour, *t*, in the time period, *p*. The total megawatt (MW)

[3] Constraints that are binding in the real-time market but not in the IFM must be considered in order to adjust payments from/to holders of CRRs who may use virtual bids to profit from the elimination of congestion on a constraint in the IFM.

flow contribution from all the accepted virtual bids of the CRR holder to the total MW flow on constraint, *k*, is calculated as follows:

$$F_{DA,k,t,i} = \sum_{j \in \{J\}_{i,t}} S_{DA,k,j,t} VB_{j,t,i}$$

Where $S_{DA,k,j,t}$ is the IFM shift factor of constraint *k* with respect to accepted virtual bids at node *j* during hour *t*, $\{J\}_{i,t}$ is the set of all nodes at which participant, *i*, has accepted virtual bids for the hour *t*, and $VB_{j,t,i}$ is the volume (MW) of accepted virtual bids by the participant at node *j*. $VB_{j,t,i}$ excludes accepted virtual bids at the LAP and generation hub level. This exclusion is provided since it is unlikely that it would be feasible or profitable for an individual participant to significantly impact its CRR revenues (or payments) through virtual bidding at the LAP or generation hub level. This exclusion also creates a "safe harbor" for entities with CRRs to participate in convergence bidding without the risk of triggering this CRR settlement rule's payment adjustment. Accepted virtual supply bids are represented as *positive* values of $VB_{j,t,i}$ while virtual demand bids are represented as *negative* values of $VB_{j,t,i}$. All the shift factors are based on the default slack (load distributed slack).

If the constraint is binding in the real-time market, but not in the IFM, then the average over the hour of the real-time shift factors for a node will be used in place of the day-ahead shift factors.

Step 2. Determine hours where participant's portfolio of virtual bids significantly impacted constraint

The next step is to compare the net impact of the participant's portfolio of accepted virtual supply and demand bids ($F_{DA,k,t,i}$) to the total flow on the constraint for each hour. A threshold percentage (*L,)* of the constraint's flow limit (*K*) is used to determine if congestion on the constraint may have been significantly impacted by the CRR holder's accepted virtual bids over hour, *t*. Specifically, the constraint's impact on the value of the participant's portfolio of CRR holdings will be considered in Step 3 below only for hours, *t*, where $F_{DA,k,t,i}$ is in the direction that would increase the value of the participant's CRR portfolio,[4] and:

[4] The general process used to determine if $F_{DA,k,t,i}$ is in the direction that would increase the value of the participant's CRR portfolio during hour, *t*, would be two steps. First, the sign of $F_{DA,k,t,i}$ would be compared to the sign of $F_{DA,k,t}$ to determine if the participant's accepted virtual supply and demand bids were in the direction to increase congestion or to decrease congestion. Next, if $\sum_{c \in \{C\}_{p,i}} Q_{c,t,i} * \Delta_{RT,k,c,t} > 0$, then the participant increased the value its CRR portfolio if the participant's accepted virtual bids were in the direction to increase congestion on *k*. If, on the other hand, $\sum_{c \in \{C\}_{p,i}} Q_{c,t,i} * \Delta_{RT,k,c,t} < 0$, then the participant increased the value of its CRR portfolio if the participant's accepted virtual bids were in the direction to decrease congestion on *k*. Therefore, if

$$\left|F_{DA,k,t,i}\right| > (K * L) + \left(K - \left|F_{DA,k,t}\right|\right)$$

Where $F_{DA,k,t}$ is the total IFM market flow on constraint, *k*, during hour, *t*.[5]

DMM suggests that *L* will initially be .10 (10 percent) for all constraints. Based on actual operating experience and off-line studies of the potential price impacts resulting from different levels of virtual bids, the threshold *L* may be adjusted for some or all constraints.

The result of Step 2 is the definition of the set $\{T\}_{k,p,i}$ as the set of hours, *t*, in time period, *p*, where the effects of the participant's accepted virtual bids on constraint, *k*, may have had a significant positive impact on the value of the participant's CRR portfolio.

Step 3. Compare constraint's impact on day-ahead value of participant's CRR portfolio to the constraint's impact on real-time value of participant's CRR portfolio

In order to determine the CRR settlement rule payment adjustment for participant, *i*, and constraint, *k*, for the time period, *p*, start by determining the constraint's contribution to the difference between the day-ahead value and real-time value of one of the participant's CRR holdings for one hour, *t*, that passed Step 2:

$$d_{k,c,t,i} = Q_{c,t,i} * \left(\Delta_{DA,k,c,t} - \Delta_{RT,k,c,t}\right)$$

Where:

$$\Delta_{DA,k,c,t} = \left(\left(-S_{DA,k,Sink_c,t}\right)\left(\lambda_{DA,k,t}\right) - \left(-S_{DA,k,Source_c,t}\right)\left(\lambda_{DA,k,t}\right)\right)$$

$$\Delta_{RT,k,c,t} = \left(\frac{\sum_{h}^{H}\left[\left(-S_{RT,k,Sink_c,t,h}\right)\left(\lambda_{RT,k,t,h}\right) - \left(-S_{RT,k,Source_c,t,h}\right)\left(\lambda_{RT,k,t,h}\right)\right]}{H}\right)$$

$Q_{c,t,i}$ is the MW quantity of CRR, *c*, owned by the participant for hour, *t*.

$\left(F_{DA,k,t,i} * F_{DA,k,t}\right)\left(\sum_{c\in\{C\}_{p,i}} Q_{c,t,i} * \Delta_{RT,k,c,t}\right) > 0$, then the participant's portfolio of accepted virtual bids were in the direction to increase the value of the participant's CRR portfolio at hour, t. Of course, if *k* is binding in the IFM but not in the appropriate real-time market, or if the direction of flow on the constraint changes between day-ahead and real-time, then the relevant equations will be adjusted to correctly determine if the participant's virtual bids were in the direction to increase the value of the CRR portfolio.

[5] The software is currently scheduled to only store the market flows on a constraint if the flows are greater than 85 percent of the constraint's thermal limit. If the IFM market flows are so low for an hour that the software does not store the market flow, the participant will not be considered as having significantly affected the flows on the constraint. Specifically:

$$if\left|F_{DA,k,t}\right| < Z * K \Rightarrow t \notin \{T\}_{k,p,i}$$

Where *Z* specifies the market flow's percentage of the constraint's limit below which the software vendor does not save the market flows.

$S_{DA,k,Sink_c,t}$ is the IFM shift factor of constraint *k* with respect to the sink node of *c*.

$\lambda_{DA,k,t}$ is the shadow price of the constraint *k* in the IFM for hour, *t*.

For PNodes within the ISO settled at the 5-minute real-time prices, *h* designates the 5-minute interval during each hour, and *H=12* intervals each hour. For CRRs involving Tie Points settled at 15-minute prices determined in the hour-ahead scheduling process (HASP), *h* designates the four 15-minute intervals during each hour.

$\Delta_{DA,k,c,t}$ is therefore the constraint *k*'s contribution to the CRR's per MW "day-ahead" value for hour, *t*, and $\Delta_{RT,k,c,t}$ is the constraint *k*'s contribution to the CRR's per MW "real-time" value for hour, *t*.

Finally, in order to determine the constraint's impact on the value of a participant's CRR portfolio for the time period, *p*, add its impact on each CRR, $c \in \{C\}_{p,i}$, for all hours $t \in \{T\}_{k,p,i}$. Specifically, the constraint's impact on the value of a participant's CRR portfolio for the time period, *p*, is:

$$\Gamma_{k,p,i} = \sum_{t \in \{T\}_{k,p,i}} \sum_{c \in \{C\}_{p,i}} d_{k,c,t,i}$$

Step 4. Apply CRR payment adjustment

If over the day, the constraint contributed to the day-ahead value of the participant's CRR portfolio's exceeding the real-time value of the participant's CRR portfolio ($\Gamma_{k,p,i} > 0$), participant *i*'s CRR payment will be adjusted by $-\Gamma_{k,p,i}$. If $\Gamma_{k,p,i} < 0$, there will not be a CRR settlement rule payment adjustment for participant, *i*, with respect to constraint, *k*, for period, *p*. A payment adjustment will be calculated for a participant for each constraint, time period, and day. Specifically, the CRR settlement rule will calculate the following daily payment adjustments for CRR holders:

$$PA_{k,p,i} = \min\left(-\Gamma_{k,p,i}, 0\right)$$

This CRR settlement rule exposes CRR holders whose virtual bids significantly affect flows over a constraint to large payments to the ISO when real-time price spikes result in the constraint's contribution to the real-time value of the participant's CRR portfolio being extremely negative. In a perfect convergence bidding market, we expect the possibility of these real-time price spikes to be incorporated into the average day-ahead prices at the relevant nodes. Therefore, CRR holders who profit by using convergence bids to reduce CRR payments paid to the ISO over the hours when there is not a real-time price spike (that would result in the constraint's day-ahead contribution to the CRR portfolio value greatly exceeding its contribution to the portfolio's real-time value for the intervals of the price spike) should be exposed to the additional CRR payments triggered by this settlement rule when a real-time price spike materializes. However, a perception of exposure to large real-time price spikes during "counter-flow" hours may deleteriously affect the market for CRRs that are expected to be "counter-flow" on average. We therefore present below the framework for an option of enforcing an hourly cap, *M*, on the CRR settlement rule's payment adjustment for hours when the constraint contributes to the participant making CRR payments to the ISO. Specifically, if such an hourly cap is deemed appropriate, the definition of $d_{k,c,t,i}$ would be adjusted in the following manner:

if $\Delta_{RT,k,c,t} < 0$

$$d_{k,c,t,i} = Q_{c,t,i} * \min\left(\Delta_{DA,k,c,t} - \Delta_{RT,k,c,t}, M\right)$$

else

$$d_{k,c,t,i} = Q_{c,t,i} * \left(\Delta_{DA,k,c,t} - \Delta_{RT,k,c,t}\right)$$

DMM's initial proposal with regards to a cap on "counter-flow" payment adjustments is that there not be any cap. If an hourly cap is deemed appropriate, we propose the cap, *M*, be set no lower than the IFM energy bid cap price (currently $500). We welcome stakeholder input on this issue, including the possibility of instituting a "counter-flow" payment adjustment cap on the total "counter-flow" payment adjustment over a time period, such as a month.