Memorandum

To: ISO Board of Governors

From: Eric Hildebrandt, Director, Market Monitoring

Date: June 21**,** 2016

Re: Market Monitoring update

This memorandum does not require Board action.

EXECUTIVE SUMMARY

This memo provides comments by the Department of Market Monitoring (DMM) on modifications to the congestion revenue right (CRR) settlement rule being presented to the Board. The CRR settlement rule was developed by DMM to deter potential manipulation of CRRs through virtual bidding. Management proposes two modifications. First, Management proposes to narrow the criteria used to determine when changes in day-ahead import and export schedules made in the real-time market are treated as virtual bids when applying the settlement rule. This should increase incentives for market participants to submit economic bids in the real-time market on the interties. DMM supports this modification because it includes new provisions to deter potential manipulation based on changes in the bid price of imports and exports between the day-ahead and real-time markets. Second, Management proposes to remove exemptions for virtual bids placed at load aggregation points and trading hubs from the settlement rule. This change was recommended by DMM to close a gap in the current rule.

This memo also provides an update on performance of the western energy imbalance market (EIM). With the addition of NV Energy to the EIM in December 2015, about 1,100 MW of transfer capacity was added between NV Energy and the ISO, while another 600 MW of capacity was added between NV Energy and PacifiCorp East. This additional capacity has the effect of creating significant transfer capacity between the ISO and all EIM areas. This transmission has reduced the need to decrement renewable generation within the ISO during mid-day hours and allowed low cost energy to flow from PacifiCorp East to the ISO in the overnight hours. This additional transmission capacity has also decreased congestion between all EIM balancing areas to very low levels, greatly reduced the incidence of constraint relaxations, and equalized prices across the ISO and EIM footprint during most hours.

CONGESTION REVENUE RIGHT SETTLEMENT RULE

The CRR settlement rule is an automated settlement feature developed by DMM that protects against participants using their virtual bids to impact congestion on a constraint in a way that inflates their CRR payments.

To be subject to the rule, a participant's total portfolio of virtual bids must impact power flows over a constraint by at least 10 percent of the total capacity of the constraint. This is referred to as the *constraint impact test*. In addition, the participant's virtual bids must increase or decrease congestion in a manner that increases the total profits (or reduced losses) of the participant's CRR portfolio. Changes in day-ahead import and export schedules made in the real-time market are also treated as virtual bids in the constraint impact test.

If the constraint impact test indicates an entity's virtual bids did significantly impact the flow on a constraint in the day-ahead market, the financial impact of congestion on the constraint on the entity's total CRR portfolio revenues is then calculated. The impact of virtual bids on CRR revenues is calculated by comparing the entity's CRR revenues from the constraint to a counterfactual based on the congestion price for that constraint in the real-time market. If the entity's virtual bids are determined to have increased its CRR revenues, then the entity must pay back this increase.[1]

DMM supports Management's proposal to modify the constraint impact test in the following two ways.

Changes in import and export schedules

First, Management proposes to modify which imports or exports are considered virtual bids when performing the constraint impact test. Currently all reductions in imports or exports are treated as virtual bids in the constraint impact test. The ISO proposes to exclude certain import or export reductions based on their real-time bids. Imports bidding at or below the day-ahead locational marginal price, and exports bidding at or above the day-ahead locational marginal price, will be excluded from the constraint impact test.

DMM supports the proposal to use the day-ahead locational marginal price to limit which imports and exports the settlement rule treats as virtual bids. Scheduling coordinators likely intend to deliver day-ahead import schedules whose real-time bids are below the day-ahead locational marginal price. This is not the case for scheduling coordinators that re-bid a day-ahead import schedule at an offer price that makes the schedule unlikely to clear in real-time. Day-ahead import schedules that are bought back in real-time due to a higher bid price should therefore continue to be treated as virtual bids in the settlement rule.

[1]The increase in CRR payments is further netted over on-peak and off-peak hours. The entity will only be subject to a settlement charge if the net effect on CRR payments across all hours in the period is positive.

Virtual bids at load aggregation points and trading hubs

Currently virtual bids placed at load aggregation points or trading hubs are excluded from the constraint impact test. Based on a recommendation by DMM, the ISO proposes to remove this exemption so that all virtual schedules will be included in the constraint impact test.

FERC has confirmed that the CRR settlement rule is a reasonable mechanism for mitigating virtual bids intended to increase the value of CRRs. [2] An entity that has a large quantity of virtual schedules clearing at a node or group of nodes can manipulate the day-ahead congestion of a constraint in ways that benefit the entity's CRR portfolio. The CRR settlement rule is needed to deter and mitigate this type of potentially manipulative activity in the ISO's market.

Prior to the implementation of virtual bidding, neither DMM nor the ISO had the technical data and experience to accurately assess how virtual bids at load aggregation points and trading hubs could impact day-ahead congestion prices on individual constraints. When the ISO filed its original virtual bidding and CRR settlement rule proposal at FERC, it seemed reasonable to expect that it would be difficult for virtual bids at liquid nodes to be utilized to manipulate the day-ahead market prices at those nodes. However, additional information on shift factors and experience with virtual bidding have led DMM to conclude this assumption was incorrect.

Virtual schedules at load aggregation points and trading hubs can be used to impact – or manipulate -- the day-ahead congestion price of a constraint in exactly the same way as virtual schedules at an individual load or generation node. If an entity's total portfolio of cleared virtual schedules at all nodes in the system have a sufficiently large flow impact on a constraint, that entity's portfolio of virtual schedules can change the constraint's day-ahead congestion price. The impact that an injection at a node can have on a constraint is the relevant indicator of whether or not a virtual injection of a particular size at that node can significantly affect the constraint's congestion price. The liquidity of virtual bids at a particular node is irrelevant.

Arguments made by stakeholders in favor of maintaining the load aggregation point and trading hub exemption fail to consider the innovative safeguards built into the settlement rule's original design. These safeguards already protect an entity from being affected by the

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[2] See FERC "Order Accepting Tariff Revisions, Directing Compliance Filing and Granting Waiver Request," in Docket No. ER10-1559, P 154, available at: http://www.caiso.com/Documents/October15_2010Orderdirectingcompliancefilingandgrantingwaiverrequestindocketno_ER10-1559_convergencebidding_.pdf

Rule unless their virtual bidding portfolio significantly impacted a constraint in a way that increased the entity's CRR profits.

In particular, an entity can only be affected by the rule if the flow impact on a constraint from its portfolio of virtual bids exceeds 10 percent of the constraint's limit. In general, an entity's net virtual position at load aggregation points or trading hubs would have to be very large in order for its flow impact on a constraint to exceed 10% of the constraint's limit. However, if the entity's net flow impact from all of its virtual schedules on a constraint does exceed this threshold, then the entity's virtual schedules are almost certainly having a significant impact on the constraint's day-ahead congestion price.

In its comments on the draft final proposal, WPTF presents an example that illustrates how this 10 percent flow impact threshold protects an entity with virtual bids at load aggregation points and trading hubs from being subjected to the rule unless the entity's virtual bidding portfolio actually has a significant impact on the constraint in question.[3] WPTF's example shows an entity with a large virtual supply position at one trading hub and a large virtual demand position at a different trading hub.

WPTF then argues that because one of those positions exceeds a constraint's 10 percent flow impact threshold, the entity would be unfairly subjected to the CRR settlement rule. However, WPTF does not consider an important protective feature built into the settlement rule's original design. The constraint impact test evaluates the combined flow impact from an entity's entire portfolio of virtual schedules, not simply the flow impact from one node at a time. Because the combined flow impact of the entity's virtual positions is less than 10 percent of the constraint's limit, the entity bidding at the trading hubs in WPTF's example would be correctly protected from being subjected to the settlement rule.

PG&E argues that virtual supply intended to represent physical generation not being scheduled in the day-ahead market should be exempt from the CRR settlement rule. Their argument illustrates how the current exemption at load aggregation points and trading hubs may actually be creating inefficient market participation. Virtual supply intended to represent a specific physical generator that only participates in the real-time market should schedule at that physical generator's specific node. Bidding the virtual supply at a load aggregation point or trading hub instead of at the generator's specific node would distort the day-ahead market away from the optimal solution. To the extent that such virtual supply bids are being placed at load aggregation points or trading hubs in order to take advantage of the exemption, the exemption is creating a market inefficiency. This represents another reason the exemption for load aggregation points and trading hubs should be eliminated.

[3] See "Western Power Trading Forum Comments on CRR Clawback 5/16/16 Modification Proposal," available at: http://www.caiso.com/Documents/WPTFComments_CongestionRevenueRightsClawbackRuleModification_DraftFinalProposal.pdf

EIM MARKET PERFORMANCE

The addition of NV Energy to the western EIM in December 2015 has significantly changed the energy imbalance market dynamics. NV Energy added significant transfer capacity with the ISO (about 1,100 MW) and with PacifiCorp East (about 600 MW). Prior to NV Energy joining the EIM, the ISO had no ability to directly transfer power with PacifiCorp East and limited 5-minute transfer capability with PacifiCorp West. As a result, transfer congestion was common between the EIM balancing areas. With the addition of NV Energy, congestion has rarely occurred between the ISO and NV Energy.

Table 1 shows the net EIM imports and exports for each balancing area in the 15-minute market for the first quarter. Figure 1 shows total net transfers between each EIM area for December 2015 through March 2016, including changes to 15-minutes schedules made in the 5-minute market.

As shown in Table 1, NV Energy has tended to have net imports more frequently and in greater volumes than any other area. While the ISO has frequently been a net importer (60 percent), the ISO also exports large volumes during other intervals. PacifiCorp East is the largest and most frequent exporter, while PacifiCorp West exports about two-thirds of the time and imports about one-third of the time.

Table 2 shows the average transfers and frequency of congestion between balancing areas in the first quarter of 2016 for the 15-minute market. As shown in Table 2, congestion between EIM areas was very low during the first quarter:

- Transfers into NV Energy were congested during two percent of intervals and transfers out of NV Energy were also congested during two percent of intervals.
- Transfers between PacifiCorp East and the ISO were congested during only two percent of intervals and there was no congestion for transfers between PacifiCorp East and NV Energy.
- Transfers from PacifiCorp West to the ISO were congested during 19 percent of intervals, and transfers from the ISO to PacifiCorp West were congested during only about two percent of intervals. Prior to the addition of NV Energy, transfers were congested during about 13 percent of the time from PacifiCorp West into the ISO and about 8 percent of the time from the ISO into PacifiCorp West.

Because congestion was very limited between the EIM areas, the EIM prices were often uniform across the balancing areas in the first quarter. Average 15-minute EIM prices in the first quarter were $20/MWh in NV Energy, $19/MWh in PacifiCorp East, and $18/MWh in PacifiCorp West. Pacific Gas and Electric prices averaged $23/MWh and Southern California Edison prices averaged $22/MWh for the same period. The primary difference between prices inside and outside of California were driven by greenhouse gas costs.

Table 1. Net EIM transfers in 15-minute market by balancing area (Q1 2016)

EIM participant	Net importer frequency	Net importer flows	Net exporter frequency	Net exporter flows
ISO	60%	-229	40%	316
NV Energy	80%	-258	20%	97
PacifiCorp East	24%	-184	76%	264
PacificCorp West	32%	-136	68%	126

Table 2. EIM transfers and congestion (Q1 2016)

	Percent of intervals	Average transfer (MW)
NV Energy		
Congested from ISO	2%	770
Non-congested from ISO	48%	265
Non-congested to ISO	44%	-163
Congested to ISO	2%	-298
PacifiCorp East		
Congested from NVE and ISO	0%	470
Congested from ISO only	2%	375
Congested from NVE only	0%	49
Non-congested from NVE	14%	184
Non-congested to NVE	80%	-240
PacifiCorp West		
Congested from ISO	2%	225
Non-congested from ISO	19%	117
Non-congested to ISO	55%	-137
Congested to ISO	19%	-151

Figure 3. Final net EIM transfers between balancing areas (December 2015 – March 2016)