

Attachment D – Benchmarking against NYISO, PJM, and ISO-NE

As the CAISO and stakeholders consider various design elements of convergence bidding that may pose market manipulation concerns, it is useful to draw from the tools and practices developed by other ISOs to address such concerns. This section briefly describes the convergence bidding designs of other ISOs, and summarizes the monitoring tools and practices they use.

Spatial Granularity

PJM, ISO-NE and MISO have implemented a nodal convergence bidding scheme, whereas the NYISO limits virtual bidding to demand zones. Although the spatial granularity of convergence bidding in the NYISO market is less than that of the other markets, the NYISO design consists of fifteen zones (eleven internal, and four external zones) that has proven sufficient for price convergence and has provided participants with hedging opportunities.

The NYISO's zonal design of convergence bidding is most like the CAISO white paper on convergence bidding, which would propose limiting virtual bidding to LAPs at least in the first release of convergence bidding. The nodal spatial granularity of PJM, ISO-NE and MISO would be a possible enhancement of convergence bidding after the LAP-level design is proven.

Flagging of Convergence Bids

PJM, ISO-NE, and the NYISO flag convergence bids to differentiate these bids from “physical” supply and demand bids. This enables these ISOs to better monitor the effects of convergence bidding on market outcomes, and to evaluate the need for additional resources in real time to meet expected demand. Though the optimization software used by PJM and ISO-NE does not differentiate between virtual and physical bids, the virtual bids can be isolated for other analyses.

Limits of Convergence Bid Volumes/Segments

None of the ISOs limit the total quantity of convergence bid volumes or convergence bid segments as a means to mitigate any potential abuses of convergence bidding. NYISO believes that the \$200/MWh collateral requirement for convergence bids – and the potential losses associated with the volatility of price differentials – effectively limit convergence bid volumes for individual participants such that position limits are not necessary. The PJM Market Monitor has indicated that the concept of position limits for convergence bidding is under consideration.

Although none of the ISOs has implemented position limits to mitigate potential manipulative bidding practices, each has implemented some features that serve to limit the burden of large bid volumes or numbers of bid segments on the market information system and optimization routines.

- The NYISO uses a \$200/MWh collateral requirement to help prevent submission of large volumes of convergence bids/offers at extremely high/low prices that have little chance of being accepted.
- Both the ISO-NE and NYISO allow bids in whole MWh increments only.

- ISO-NE enacted a small transaction charge per convergence bid which was successful in incenting participants to submit fewer bids with more segments, thus eliminating bid “spamming” on the market optimization routines.

Treatment of Uninstructed Deviations and Forced Outages

Participants with physical generation assets may have the ability to affect real-time prices in a manner that cannot be predicted by other participants through means such as sudden forced outages and uninstructed deviations. For example, a generator may take a position in the Real Time Market and then seek to utilize its generation resources to raise or depress the real-time price in order to profit from their convergence bidding position.

Uninstructed Deviation Penalties (UDPs) could deter such gaming. The NYISO does have a UDP such that, if a participant is 3% over their schedule, they are not paid for that excess, and if a participant is 3% under their schedule, they are assessed a penalty that is tied to the price of energy reserves.¹ ISO-NE does not have an explicit UDP, but settles the deviation at the RT price. In addition, a participant’s failure to notify ISO-NE before real time results in “First Contingency” uplift charges. Like ISO-NE, PJM does not have explicit UDPs, but supply that does not generate must pay the uplift charges incurred by the re-dispatch required to cover their schedule. In addition, PJM uses *ex post* pricing to ensure that, if a generator’s deviation is greater than 10% of its DA schedule, it does not set the market clearing price.

Market Power Mitigation

PJM, ISO-NE and NYISO run their Day Ahead markets with physical and virtual supply and demand. These PJM and ISO-NE do not mitigate virtual bids, but rather use *ex post* conduct and impact tests to evaluate the extent to which a Market Participant was pivotal, and what effect that had on the market clearing outcomes. At PJM in particular, this involves careful analysis of affiliations between participants, and participants’ entire portfolios (including virtual transactions, bilateral contracts, congestion revenue rights, and generation). This monitoring requires the assembly of a great deal of information which consumes at least one third of a full-time market monitoring analyst, and requires the use of the PROBE software.

NYISO’s DA market optimization includes approximately seven passes which consider first all physical and virtual bids, then local reliability constraints, and forecasted load. Unlike PJM and ISO-NE, the NYISO DA optimization does perform supply bid mitigation. All of these market passes are conducted before dispatch decisions are made.

CRR Settlement Rule

One of the major concerns about convergence bidding is that it may be used by a market participant to manipulate Day Ahead Market prices in order to increase revenues from the market

¹ In NYISO, if a generator has no schedule, and injects energy onto the grid anyway, it is not compensated at all for that power. In addition, units providing Regulation can be subject both to the 3% penalty as well as Regulation Performance Penalties if they deviate from the requirements specific to the supply of that product.

participant's Congestion Revenue Rights (CRRs). For example, a participant owning CRRs that sink to a demand node or zone may submit virtual demand bids at this location to create or increase congestion. Although the participant may lose money on the virtual bid itself, the resulting increase in CRR revenues could make this strategy profitable.

The mitigation measures that have been adopted by other ISOs to address the potential use of virtual bidding to manipulate market prices and CRR revenues have been determined, in large part, by the spatial granularity of the convergence bidding market design. ISOs with convergence bidding at a nodal level (PJM and ISO-NE) have adopted a special rule to mitigate potential use of convergence bidding to increase CRR payments, while ISOs with zonal level convergence bidding (NYISO) have not adopted any such settlement rules.

Both PJM and ISO-NE have established a settlement rule that deters market participants from using convergence bids to increase DA congestion in order to earn additional profits from the Congestion Revenue Rights. In PJM, the rule is applied on a monthly basis by the Market Monitoring Unit. At ISO-NE, analysis of the interaction between CRRs and virtual bidding is done on a less frequent basis. The settlement rule is triggered if:

1. The participant has convergence bids accepted at one of the nodes for which it owns a CRR, or at nearby nodes, that could increase the participant's CRR payments by increasing the price difference between the two nodes defining the CRR; and
2. The difference between the DA MCPs at the source and sink nodes of the CRR is greater than the difference between the MCPs for these same nodes in the Real Time Market.

If the conditions above exist, the participant's CRR payments are then limited to be no greater than the average hourly cost of the CRR paid by the participant (e.g., in the monthly or annual auction for CRRs).

Attachment A provides a more detailed description of how this settlement rule works in a fully nodal convergence bidding design, and how this settlement rule would need to be applied to the type of convergence bidding design described under Option 2 of the CAISO white paper.

The NYISO has not adopted explicit settlement rules related to the linkage of virtual bids to CRR holdings. This is because congestion revenue rights, as well as convergence bids, are at such large geographical areas that any attempt to use convergence bids to impact congestion would be diluted across many transmission paths. It would therefore take a tremendous volume of convergence trades to create appreciable congestion between the locations for which a participant owns CRRs. The NYISO Market Monitor has found that the collateral requirement of \$200/MWh for all convergence trades and the fact that it is very difficult to impact prices in a zonal convergence bidding design sufficiently address this concern.

Ability to Limit or Suspend Trading

As previously noted, none of the ISOs have limits on the total quantity of convergence bid volumes or convergence bid segments. However, both the NYISO and ISO-NE Market Monitoring units have the authority to suspend or limit trading based on their analyses of market participant behavior. Specifically, the ISO-NE Tariff states that,

[t]he ISO, will restrict the Market Participant for a period of 6 months from submitting any virtual transactions at the same Node(s), and/or electrically similar Nodes to, the Nodes where it had submitted the virtual transactions that contributed to the unwarranted divergence between the LMPs in the Day-Ahead and Real-Time Energy Markets.²

The ISO-NE Market Monitor indicates that it has used this authority, although on a very limited basis. The NYISO Tariff provides that

[i]f the ISO determines that the conditions specified in Section 4.5.2 [should read 4.6.2] exist, the ISO may limit the hourly quantities of Virtual Bids for supply or load that may be offered in a zone by a Market Participant whose Virtual Bidding practices have been determined to contribute to an unwarranted divergence of the LBMPs between the Day-Ahead and Real-Time Markets. Any such limitation shall be set at such level that, and shall remain in place for such period as, in the best judgment of the ISO, would be sufficient to prevent any unwarranted divergence between Day-Ahead and Real-Time prices.³

The NYISO Market Monitor has indicated that it has never had to use the authority to suspend trading and considers this a “circuit breaker” provision of their Tariff.

PJM does not have Tariff authority to suspend trading.

Ability to Track Convergence Bidding Profits and Losses

The NYISO Market Monitor has the ability to track each participant’s profits and losses from virtual bidding with relatively little time lag, and indicates that this is one of the key sources of information for monitoring and investigating convergence bidding behavior. Behavior of participants with significant and systematic losses or profits may be flagged for review. Sustained losses may indicate that a participant is seeking to profit indirectly from CRRs or other contracts that may be tied to LMP prices. Conversely, significant and sustained profits may indicate that a participant is able to influence real-time prices in a way that enables them to profit from convergence bidding (such as having knowledge or ability to create unit outages, uninstructed deviations, etc.). The PJM Market Monitor appears to have the ability to determine profits and losses from convergence bidding, but it is unclear to what extent this is monitored and investigated, as the PJM Market Monitor believes that the CRR settlement rule mitigates most of the concern about potential abuses of convergence bidding.

² http://www.iso-ne.com/regulatory/tariff/sect_3/mr1_appendix_a.pdf

Market Rule 1, Appendix A, Section III.A.8.2.2. iii. (page 41 of 65 in the document at the above link, Tariff Sheet 7438)

³ http://www.nyiso.com/public/webdocs/documents/tariffs/market_services/att_h.pdf

Attachment H, Section 4.6.3 a. (page 24 of 29 in the document at the above link, Tariff Sheet 476A)

Ability to Simulate Impact of Convergence Bids on Market Prices

In order to evaluate the impact of convergence bidding on converging day-ahead and real-time prices, Market Monitors need the ability to rerun the market excluding convergence bids. Both NYISO and PJM have the ability to do this, and do so routinely. NYISO and PJM both use a software package called PROBE,⁴ and indicate that this software has been configured to replicate the actual production system with a very high level of accuracy, but requires much less computational time. The NYISO uses this ability routinely, whereas PJM's use of PROBE is more *ad hoc*. ISO-NE has an outside consultant who provides analysis based on the use of other, more simplified simulation tools.

Ability to Assess Impact of Market Behavior on Participant's Total Portfolio

In addition to rerunning the Day Ahead Market excluding convergence bids, the PROBE software used by PJM and the NYISO also has the ability to show changes in the entire settlement for each participant's total portfolio of resources and loads. This helps to identify situations in which participants may seek to utilize convergence bidding to increase profits from other elements of their portfolios. To help inform the analysis done in PROBE, PJM compiles detailed information on the affiliations of market participants.

Table 1 summarizes the key convergence bidding market design, mitigation and monitoring features in PJM, NYISO, and ISO-NE discussed above.

Table D.1: Comparison of Convergence Bidding Mitigation Features

	NYISO	PJM	ISO-NE
Spatial Granularity	Zonal (11 internal, 4 interties)	Nodal	Nodal
Flagging of Convergence Bids	Yes	Yes	Yes
Market Power Mitigation	Part of DA Market Optimization	Conduct and Impact Test, portfolio analysis	Conduct and Impact Test
Penalties for Uninstructed Deviations	Unpaid for overgen > 3%, penalty for undergen > 3%	Settled at RT price and charged uplift, not eligible to set price	Settled at RT price and charged uplift
Congestion Revenue Rights	Monitored Using Re-Runs of the DA Market	Automated Settlement Rule	Automated Settlement Rule
Bid Segments	CB in Whole MWh Only	Currently No Limits on Bids or Bid Segments	CB in Whole MWh Only
Collateral & Charges	Collateral \$200/MWh	Collateral	Small Charge per

⁴ PROBE stands for PoRtfolio Ownership Bid Evaluation, and is specialized software developed by PowerGem.

			Convergence Bid
Ability to Limit or Suspend VB	Yes – Unused “Circuit Breaker” Provision	No	Yes – Limit or Suspend Up to 6 Months
Ability to Re-Run DA Market	PROBE (Offline Software with SCUC Functionality)	PROBE (Offline Software with SCUC Functionality)	Estimates Effects of Convergence Bidding on an Annual Basis