Revised

Working White Paper on Design Criteria for Convergence Bidding

Revised and Updated by
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Introduction

On June 14th 2006 the CAISO hosted a tutorial on Convergence Bidding[1] for the benefit of both CAISO Board members and interested market participants at which the concept of virtual bidding was thoroughly explored[2].

In a recent compliance filing (http://www.caiso.com/17ba/17bac4f62ab80.pdf) the CAISO undertook to present a Convergence Bidding proposal to the CAISO Board of Governors before the end of summer 2006, for the board to vote on before the end of the year. This white paper is pursuant to that commitment.

Process Clarification

This white paper continues as a Draft Work In Progress and represents the second iteration of a Convergence Bidding design proposal for the CAISO.

This draft seeks to summarize initial stakeholder comments, as well as initial input from the Market Surveillance Committee (MSC), on the different design elements that must be worked out for a complete and comprehensive Convergence Bidding design compatible with the rest of the MRTU design. In addition, this document further details both the nature of the design elements and the choices that face the CAISO, and will continue to be used to gather feedback from market participants (and the MSC) regarding the design framework. For some design elements this document states possible choices, and further public discussion will help determine how these will have to be developed further and analyzed.

The designs adopted in other ISOs and FERC precedence in that context will be used as guides to augment the possible choices for each design element. Some of the design issues have been effectively decided by FERC precedent concerning Convergence Bidding designs at the eastern ISOs. The nature of credit and collateral policies is a good example of a design element for which there is extensive guidance in the FERC record.

Among other design elements the spatial granularity of virtual bids is most significant. The choices for the CAISO to make regarding this design element are whether to allow nodal virtual bidding as PJM, ISO-NE and MISO do, only allow virtual bidding at the zonal level like the NYISO, or perhaps some hybrid.

Other significant design elements address issues related to safeguards against unintended consequences, opportunities for the exercise of market power, effects

[1] The terms Convergence Bidding and Virtual Bidding will be used interchangeably in this document. Unless otherwise specified both terms will refer to Explicit Virtual Bidding. Any intended reference to Implicit Virtual Bidding will be clearly stated.
[2] Documents from this tutorial are available at:
http://www.caiso.com/docs/2005/06/09/2005060910374912494.html

on other markets, such as the CRR market etc. The work to complete the design process will involve the following:

1. Identify all issues and concerns related to different aspects of virtual bidding and complete the initial list of the design elements stated in this first draft.
2. Identify different choices to address the requirements for each design element. The choices may be based on other ISO designs, FERC precedence, stakeholder input, and consideration of other MRTU design elements. Some choices were already stated in this first draft for some design elements, but they are not complete. If possible, narrow the choices where there exists clear consensus to do so.
3. Work out the evaluation criteria to assess the different choices for each design element. These criteria may be a subset of the Ranking Criteria being worked out in a separate but related stakeholder process, or may include criteria specific to each design element. A tentative list of criteria remains in this draft; the list will be expanded and modified as needed in subsequent iterations of this white paper.
4. Evaluate the choices formulated for each design element in (2) against the criteria agreed upon in (3) to come up with the best option for each design element.
5. The combination of the choices for various design elements will guide the recommended design. However, because of the interdependence of different design elements, the ultimate choice for each design determined in (4) may be adjusted for an overall consistent design. At this stage the Convergence Bidding design will be ready for an informational presentation to the Board.
6. Apply the full set of the Ranking Criteria (currently the subject of the Market Initiatives stakeholder meetings) to the completed design and identify costs, benefits, and risks for the Board's consideration and vote.

   Note: Williams Power Company notes in their July 28, 2006 written comments that "the CAISO appeared to refer to Convergence Bidding as just one post-Release 1 project that had to undergo a ranking process along with all other post-Release 1 projects. Such an approach does not comport with the position stated by the CAISO in the March 2, 2006 [Board] memo."

   The CAISO clarifies that (1) Since the last draft of this paper, CAISO has revised the Ranking Criteria based on stakeholder input, and provided an exemption for "mandated" issues from the first project ranking screen. (2) Regardless of whether an issue is subject to the first project ranking screen, its implementation costs, benefits, and risks must be identified for informed decision by the Board; this is consistent with the Board directive at its March 2006 meeting.

This Revised White Paper continues the effort to finalize a convergence bidding design proposal for the consideration of the Board of Governors, with the expectation (as stated in the March 2, 2006 Board memo) that convergence bidding would be implemented (with the approval of the Board) "as soon as practical after Release 1."

Elements of Convergence Bidding Design

(1) Explicit vs. Implicit

By definition the design must be based on Explicit Virtual Bidding, that is, virtual bids must be submitted with an indication (a flag) that identifies them as virtual rather than physical. By submitting a virtual bid, the participant bids to take a forward financial position that will be liquidated in real time. Submission of virtual bids will only occur in the Day-ahead Market (DAM). If accepted in IFM, such bids will be liquidated as price takers in the RTM.

Virtual supply that is accepted in DA will require the seller to buy that same quantity of supply back in the RT market. Virtual demand that is accepted in DA will require the buyer to sell that same quantity of demand back in the RT market. Virtual bidding provisions apply only to Energy Bids. No provisions are contemplated for explicit virtual bidding for Ancillary Services or other products in CAISO's markets.

Discussion

- Williams Power Company urges Explicit Virtual Bids for all market participants.
- WPTF comments that the Explicit Virtual Bids allow the ISO to understand what physical energy is expected.
- SCE comments that Explicit Virtual Bids should be flagged on submission, should only occur in the DA market and should be limited to energy only.

CAISO Recommendation

The clear consensus is for requiring virtual bids to be submitted explicitly with a flag that distinguishes them as virtual rather than physical. The CAISO clarifies that Explicit Virtual Bids would apply only to Energy Bids.

(2) Deterrence of Implicit Virtual Bidding

Implementation of Explicit Virtual Bidding reduces, but does not necessarily eliminate Implicit Virtual Bidding. The experience at the NYISO substantiates this. It shows that the incentive to engage in IVB decreases with the implementation of EVB, but does not disappear. In particular, participants appear to engage in IVB

to circumvent the onerous credit and collateral requirements that are often imposed on virtual bidding at startup. At the NYISO these credit and collateral requirements have gradually eased, as they have at other ISOs. The NYISO continues to monitor physical schedules for IVB. Similar measures by the CAISO to detect and deter IVB should be considered.

Discussion

- SCE comments that IVB should be discouraged and the CAISO should not attempt to deter IVB by providing subsidies to parties that utilize EVB. SCE further notes that the CAISO tariff already prohibits the submission of false information.

- EPIC comments that virtual trading is explicitly financial and those aspects such as physical scheduling should not be addressed in the design of virtual bidding, but should be handled by other departments at the ISO.

CAISO Recommendation

The CAISO offers the following options for resolving this design element:

- Option 1: Count on Explicit Virtual Bidding and not build a specific method to deter IVB into the fabric of the EVB design. The Department of Market Monitoring should remain alert to this issue so they can take appropriate steps when the virtual bidding design is implemented. This is what the NYISO currently does.

- Option 2: MMIP Protocols

- Option 3: High penalties for RT schedule changes with no virtual bidding tag.

(3) Spatial Granularity (Nodal vs. Zonal)

The nodal versus zonal debate has often been cast in the NY-style vs. PJM-style design of Convergence Bidding. Such a characterization risks over-simplifying the nature of the choices that the CAISO faces.

PJM allows virtual trades at every node or group of nodes for which it publishes a price. Thus the PJM nodal approach encompasses the zonal approach and, in practice, market participants in PJM seem to virtually bid at hubs at least three times more frequently than nodes.

The NYISO only allows bidding at the zonal level, but does allow generators to bid at their own specific connection node. Thus, at both the NYISO and PJM most of the virtual bidding occurs at the zonal level.

Perhaps a better way to phrase this design question is simply how deep one should push the level of spatial disaggregation at which one allows virtual trading. Even if one decides to only allow zonal virtual bidding the question remains, which zones?

The Zonal Design

The NYISO has a zonal design in which virtual trades are limited to the hubs with the exception of physical generators who can bid at their own node. In the MRTU design the equivalent would be limiting virtual trades to the three EZ Gen hubs and the LAPs, but also allowing generators to bid at their own nodes, as well as allowing those entities with sub-LAPs (e.g. MSSs) to bid at their sub-LAP level.

For convergence in pricing it is best if the zones are uniform and do not contain constrained pockets where the pattern between DA and RT prices differs. This was the experience of the NYISO (2002, 9) where the load pockets within the 138kV zone were disparate. The Market Advisor recommended a re-evaluation of the load pocket modeling as well as virtual trading at the load pocket level to improve price convergence.

Allowing virtual bidding at the pocket level would be one level of disaggregation greater than zonal. A further level of disaggregation would bring one to the nodal level. Another issue with the zonal implementation is that some of the hedging benefits that physical generators like are absent. These benefits were explained in the board presentation and material from that document is reproduced in Appendix 1.

The Nodal Design

The nodal design is fairly simple in that virtual bids are accepted at all pricing points for which the ISO posts a public price, so it includes LAPs and Hubs. Bidding at the nodal level is not limited within PJM as it is in the NYISO. The drawback of the PJM approach is that the greater level of functionality also introduces a greater risk of market manipulation. To mitigate this both PJM and the subsequent implementations in the ISO-NE and MISO have rules to prevent the gaming of CRR revenues. The CAISO is currently not aware if there are other manipulation risks posed by the zonal model. The comments of Joe Bowring indicated that this was the only one that PJM was aware of. The nodal model allows for better price convergence as price convergence occurs at the nodal level not just at the zonal level. In addition nodal bidding allows generators to physically hedge their production by scheduling DA but exposing their output either to the RT price should they so desire. It is also possible to hedge congestion using the nodal framework.

It should be noted that bidding at the nodal level inherently offers more functionality and better convergence than a zonal model. The real issue here is the magnitude of the risk introduced by the nodal design and whether or not that risk can be mitigated. A related key issue that bears scrutiny is the impact of the granularity of virtual bidding upon the seller's choice settlement features of MRTU.

Discussion

- In discussion of the NYISO model some market participants indicated that the market advisor to the NYISO had brought up potential market power concerns due to the fact that bidding at the nodal level is limited to generators only. Those participants supported nodal bidding for all participants. In contrast SCE supported the elimination of all nodal bidding to eliminate this market power problem and to prevent market participants from taking advantage of "knife-edge" (sic) solutions. According to SCE eliminating bidding at the nodal level would concentrate liquidity at the LAPs and benefit the ISO generally.

- SCE further notes that LAP-level bidding is consistent with the MRTU design and bidding philosophy in that, under MRTU, load bids at the LAP. Thus, SCE comments, "limiting VB to the LAPs allows virtual load and physical load to participate on an even footing. Moreover, the CAISO should be able to integrate 'negative virtual demand' bids (equivalent to virtual supply) by simply treating negative demand as a reduction to LAP-level load."

- SCE further emphasizes that virtual bids should not be allowed at any individual load nodes, generation nodes or interties.

- PG&E generally suggests "cautious roll-out" which "would include initially limiting convergence bidding to trading hubs or LAPs … subject to further review and relaxation of limits as the market progressed."

- Williams Power Company comments that NYISO's experience suggests that the more granular the application of virtual bidding, the more effective the price convergence is. Williams also seeks a better understanding of the implications for allowing nodal virtual bids when load is bidding on a LAP basis.

- WPTF comments that virtual bidding should be allowed at trading hubs and LAPs, and that allowing virtual bids at generating nodes would provide additional means of price convergence and hedging for generators. WPTF urged the CAISO to consider potential costs that might be incurred if virtual bidding were allowed at the generating nodes.

- EPIC comments that nodal bidding allows the market the greatest flexibility, hedging ability and price transparency, whereas a zonal approach constrains the hedging ability and flexibility and compromises the price signals sent to the market. EPIC points out that nodes provide many more points for bidding and more opportunities to resolve congestion over smaller areas. EPIC further comments that nodal bidding provides more information to the ISO on the location of congestion,

provides a better opportunity for hedging CRRs and helps to ensure price convergence at a nodal level.

CAISO Recommendation

The CAISO seeks further input and discussion from stakeholders. For the purposes of framing additional discussion, the CAISO offers the following options for spatial granularity of virtual bids:

- Option 1: Zonal virtual bidding (using EZ Gen hubs and/or LAPs)
  - Sub-option 1a: LAPs for both virtual supply and virtual demand
  - Sub-option 1b: EZ Gen hubs for both virtual supply and virtual demand
  - Sub-option 1c: EZ Gen Hubs for virtual supply and LAPs for virtual demand

- Option 2: Nodal virtual bidding

- Option 3: Nodal bidding for virtual supply and LAP bidding for virtual demand (or more generally, virtual bidding consistent with physical bidding)

- Option 4: Other (such as sub-LAPs commensurate with tiered CRR nominations or step 3 of the LAP clearing problem mitigation)

(4) LDFs

Experience in the eastern ISOs indicates that virtual load bids and virtual supply bids utilize the same designated virtual nodes. Moreover, when virtual bids are submitted to a LAP, the distribution factors used to distribute virtual bids are the same as the load distribution factors (LDFs) used to distribute physical load schedules and bids. Thus virtual load appears just like physical load on the network, and virtual supply is effectively negative virtual load.

The question to resolve in CAISO's design is how to treat LDFs in real-time where virtual bids are liquidated.

Discussion

- WPTF comments that the same LDFs in RT as those used in the DA.

- Williams Power Company comments that the CAISO should use the same DA LDFs to liquidate the virtual positions in RT as it applies to distribute the virtual position on the DA market.

- SCE expressed the view that virtual bids should be like unto physical bids in every way possible. SCE was opposed to any special treatment for virtual bids.

CAISO Recommendation

The CAISO seeks additional input into these options, or any other options proposed by stakeholders:

- Option 1: Use the same distribution factors for virtual and physical virtual bids in the relevant market (even though real-time LDFs are likely different from DA LDFs);
- Option 2: Use fixed LDFs in both DA and RT (from a distribution factors library;
- Option 3: Use DA physical distribution factors for both DA and RT virtual bids.

(5) Market Power Mitigation

In the eastern ISOs virtual bids are traditionally not subject to LMPM procedures as they are not physical resources, but they are subject to the price caps. If the CAISO were to implement a similar system then virtual bids would not be considered in the pre-IFM (i.e., CAISO's market power mitigation and local reliability determination process). Virtual supply and demand would only be considered in the DA IFM where virtual supply and demand bids are used in the same way as physical bids. Virtual supply and demand bids would then be ignored in RUC .

Concerning gaming opportunities both PJM and the ISO-NE have rules to prevent the gaming of congestion revenues using virtual bids. It would seem prudent to consider including this provision should the CAISO opt for a nodal design where this might be an issue.

The number of virtual bids and virtual bid segments allowed may be another issue that may be related to whether or not virtual bids are subject to market power mitigation. The higher the number of virtual bids or the bid segment per bid, the higher the opportunity for the so –called "Hockey stick bidding", particularly in the absence of LMPM for virtual bids.

Discussion

- PG&E endorses a strong role for the CAISO's Department of Market Monitoring in assessing the application of convergence bidding, particularly at the onset. Suggested safeguards include limits on the volume of total convergence biddings at each hub and limits on the volume that any one player could trade. PG&E also suggests tools such as monitoring:
  - Price dispersion and net position in convergence biddings of any single player;
  - Generator bidding, including under-scheduling and virtual purchases bidding, that inflates the price of a delivery point or price divergence between nodes;
  - Bids that impact holders of CRRs.

- SCE urges a detailed and effective monitoring program commensurate with the virtual bidding design. Specifically, SCE urges:
  - Tariff authority for the CAISO to suspend or revoke a participant's right to utilize virtual bids.
  - Guidance on what is and what is not acceptable virtual bidding behavior.
  - Monitoring of the impact on prices, congestion and unit commitment/RUC from specific virtual bids.
  - Monitoring of virtual bids that are highly profitable or result in high or sustained losses.
  - Explicit rules for participants who hold CRRs.
  - LAP-only bidding to address concerns that virtual bids could "distort prices, dispatch or uplift charges away from those expected in a competitive market."

- WPTF comments that virtual bids should be subject to the price caps but no other market power mitigation, which WPTF notes is the practice at other ISOs... WPTF emphasizes the CAISO should take steps to ensure that virtual bids cannot be used to take advantage of gaming opportunities.

- Williams Power Company supports the same mitigation as implemented in other ISOs, namely that virtual bids are subject to the price caps but no other market power mitigation. Williams also emphasizes the CAISO should take steps to ensure that virtual bids cannot be used to take advantage of gaming opportunities.

- EPIC commented that it was appropriate to have rules in place for virtual transactions and that the market monitor should have appropriate oversight as there are risks associated with CRR revenue manipulation as pointed out in the paper. EPIC indicated that as LMPs were not capped and it did not believe that bids should be capped either and that a trader should be able to bid any price.

CAISO Recommendation

EPIC is correct that LMPs under MRTU are not capped; however, similar to the eastern ISOs, bids will be capped under the MRTU design. The CAISO's initial recommendation is that at the very least there should be similar market oversight rules as at the eastern ISOs. This means that:

1. Virtuals should be subject to the same price caps as physicals
2. If a nodal design is chosen then a market rule concerning CRR revenue should be adopted.

The CAISO is still interested in input concerning this issue especially concerning the tie-in between market power mitigation and the choice of fully-nodal (PJM) or partially-nodal (NYISO) design. Other issues that need to be considered include:

1) Treatment for any changes needed in pre-IFM (MPM RRD)
2) How to treat virtual bids if pre-IFM is based on bid-in demand.

As a framework for additional discussion, the CAISO offers two basic options for stakeholder consideration (besides the CRR rule mentioned above):

Option 1: No mitigation for virtual bids other than bid caps

Option 2: Limit the number of virtual bids per SC and the number of bid segments per virtual bid.

(6) Pricing and Unit Commitment

Virtual bidding, to be meaningful, must be allowed to affect market clearing and price formation in the DA energy market. Therefore virtual bids will be included in the running of the IFM and will, as a result, also affect unit commitment in the IFM.

Virtual bidding will not affect the unit commitment in the RUC process as RUC concerns itself solely with ensuring that enough physical supply is committed to serve the forecast physical load. However, to the extent virtual supply bids are accepted in the IFM, the need for system-wide RUC capacity may increase, and to the extent virtual demand bids compensate for otherwise under-scheduled load in the IFM, the need for system-wide RUC capacity may decrease. Having said that, the impact of VB on local RUC capacity will depend on the other design features of VB, particularly, the geographical granularity (zonal, pocket, nodal, or other) permitted under the VB design.

Discussion

- PG&E urges the CAISO to assess whether virtual bidding's potential for increasing the use of RUC may create inappropriate cost shifts. PG&E

also comments that the virtual bidding design should include provisions that prevent dispatch of use-limited resources, which must be budgeted across a season.

- SCE urges that virtual bids be treated as closely as possible to physical bids with respect to cost allocation. Specifically, virtual and physical transactions should be included in all the processes related to LAP price averaging, incorporating the hourly costs of HASP and any RT adders/subtractors, and ex-post corrections to distribution factors made after the CAISO receives meter data. SCE also urges that certain virtual bids pay a portion of RUC costs and start-up/minimum load costs.

- Williams Power Company comments that virtual bids should be allocated IFM commitment costs only if those virtual bids increase IFM commitment beyond what would have been committed in the IFM if demand had been accurately bid into the IFM. Williams states that virtual bids could be counteracting the distorting effects of under-scheduling, and that allocating commitment costs only to physical demand creates the maximum incentive for physical demand to schedule accurately.

- WPTF agrees that uplifts necessary to facilitate transactions would be appropriately applied to virtual bids since virtual bids create an impact on the ISO's systems and processes. However, WPTF comments that uplifts that are the result of physical delivery such as no-pay allocations should not be allocated to virtual bids.

CAISO Recommendation

To further this discussion, the CAISO seeks to limit the framework for this design issue only to pricing and unit commitment. The CAISO offers two options for stakeholder consideration:

- Option 1: Maintain current restriction on the pool of units for the IFM as determined in the pre-IFM.

- Option 2: Lift restrictions on the pool of resources for the IFM.

(7) Bid Price-Quantity Pairs

Both PJM and the NYISO insist that all load bids are price capped, meaning that virtual demand cannot act as a price taker in the DAM. This is another somewhat technical issue that is worth analyzing.

Bids in the NYISO are limited to three price quantity pairs (NYISO, 2005, 7-75). The CAISO's physical design allows for ten price quantity pairs (eleven data

points). The choices for CAISO in this context are: (1) whether to allow price taker virtual bids, and if so, under what conditions, and (2) whether to restrict the number of virtual bid segments compared to actual bid segments.

A hybrid approach may also be possible if both nodal and zonal (LAPs or hub) virtual bids are considered as candidate design options under the third design element stated above (Nodal vs. Zonal). For example, it may be possible to allow price taker virtual bids only at the nodal level, but disallow price taker virtual bids (i.e., require price-quantity bids) at the zonal (LAP or hub) level.

Discussion

A participant at the stakeholder discussions pointed out that limiting the number of segments was no defense against hockey stick bidding in that, unlike physical generators that are limited to one bid per resource, there is no limit on the number of virtual bids participants can submit. Thus participants wanting to insert hockey stick type bids would simply do so via a multi-bid strategy. Physical generators have to hockey-stick bid in a single bid as they are limited to one bid submission. The eastern ISOs have not mentioned hockey stick bidding as a problem either.

As limiting the number of segments will not protect against hockey stick bidding the CAISO sees no reason to deviate from the physical design of bid submission and recommends that the virtual bid consist of the same 10 segments (11 price-quantity pairs) as the physical bids.

- EPIC comments that both PJM and ISO-NE allowed ten bid segments in their virtual bids, but that the three and four allowed in NYISO and MISO respectively was needlessly limiting.

- SCE comments that virtual bids should be subject to the same bid caps and floors applied to physical bids for generation and load. SCE suggests this implies that virtual bids cannot price-take but would have to submit valued bids within the bid cap ranges. SCE further suggests that self-schedules should have priority over virtual bids, especially if the design allows virtual bidding at the interties.

CAISO Recommendation

The CAISO offers the following options:

- Option 1: Allow only priced virtual bids (no price taker virtual bidding)

- Option 2: Allow both price taker and priced virtual bids

- Option 3: (If both zonal and nodal virtual bidding is allowed) permit only priced virtual bids for zonal virtual bidding, and only price-taker virtual bids for nodal virtual bidding.

(8) Credit and Collateral

Regarding credit and collateral issues the ISO intends to be guided by the opinions expressed by FERC concerning credit and collateral issues as they pertain to virtual bidding. The following design elements seem important.

8(A) Collateral Requirements

To engage in virtual trades participants have to post collateral as they do for other aspects of the CAISO markets (e.g. the CRR markets). FERC has previously ruled on the credit and collateral policies of the NYISO (Docket No.ER05-941-000, see Issuance of July 1st 2005) as well as separate rulings at PJM (see PJM, 104 FERC ¶ 61,309 at P 23-24 where FERC rejects a proposed four-day collateral requirement); and the Midwest ISO, (see MISO 108 FERC ¶ 61,163 at P 447-48 where FERC rejects a proposed six-day collateral requirement).

It appears that when virtual trading first began in the eastern ISOs it was common to constrain it with credit requirements. As this concern proved unfounded the ISOs have moved to more conventional credit requirements under FERC orders. The CAISO can either follow the same path that the eastern ISOs followed, namely constrain and then liberalize under FERC orders, or simply jump straight to the end point which appears to be a one or two day collateral requirement. Another compromise position would be to constrain the initial release, but document a fairly rapid liberalization at predefined dates thereafter.

Discussion

- SCE suggests that collateral for virtual bidding must be sufficient to protect the market from potential payment defaults and should be commensurate with position limits allowed for virtual bidding.

- WPTF generally supports a collateral mechanism consistent with those in place at other ISOs.

- EPIC generally requests that credit requirements be kept to a reasonable level, similar to the requirements at MISO, because many virtual marketers are small entities without vast resources. EPIC further notes that credit requirements in other ISOs have eased as virtual markets have matured, although NYISO's collateral requirements "are onerous, unnecessary and continue to suppress the virtual market in New York."

CAISO Recommendation

The CAISO offers the following options for collateral requirements:

- Option 1: Constrain virtual bidding participation based on credit posting (virtual bid quantity times proxy clearing price)
- Option 2: Revise SC credit requirements based on the introduction of virtual bidding in the CAISO markets
- Option 3: Constrain virtual bidding participation initially, and then move to a more conventional credit policy.

8(B) Proxy Clearing Price for Collateral Calculation

To calculate the collateral requirements the CAISO has to multiply the quantity virtually bid by a proposed proxy clearing price. FERC has recently required the eastern ISO to replace their initial calculation methodology, such as the NYISO's reference price which is presumed to be the 97th percentile of the highest actual price experienced in the market over a three month period, with something more realistic.

In its MISO decision FERC ordered MISO justify the 97% rule (see MISO, Docket No. ER04-691-004, p.107). The MISO subsequently moved to a 50th percentile rule.

Discussion

WPTF supports using the 50th percentile as the proxy clearing price for the collateral calculation.

CAISO Recommendation

The CAISO offers the following initial option for the computation of collateral:

- Option 1: Reference clearing price based on some percentile (97%? 50%? Other?) of the highest actual price during the previous 90 days (or a different period?)
- Other options?

(9) Cost Allocation

The issue of cost allocation can hardly be over-emphasized. This issue has recently come to the fore due to a recent FERC MISO decision (see Docket

No.ER04-691-065, " Order Requiring Refunds, And Conditionally Accepting In Part, And Rejecting In Part Tariff Sheets" Issued April 25, 2006).

> Briefly, in this case the MISO tariff assessed the Revenue Sufficiency Guarantee (RSG, similar in concept to Bid Cost Recovery for Energy and A/S bids under MRTU) to the sum of real-time load for the day, the resource uninstructed deviation quantities, and all virtual supply offers. The MISO did not implement the third part of this cost allocation (to virtual supply) and its Business Practices Manuals and tariff training materials both stated that virtual supply offers would not be included in the RSG charge calculation. Thus the MISO tariff and the BPM/training materials contradicted one another, and it appears that the MISO believed that the BPM formulation was the appropriate policy regarding uplift, and the failure to correct the tariff was an oversight of some sort.

Using the filed rate doctrine as the basis for its argument FERC ordered the MISO (paras 26-30) to recalculate the RSG charges and issue refunds where necessary. Turning to the prospective treatment of RSG allocation FERC instructed the MISO to make sure that virtual supply is allocated an appropriate share of the RSG payments (paras 48-49) as the virtual supply can cause RAC (Reliability Assessment Commitment – similar to Residual Unit Commitment under MRTU) costs.

Clearly FERC is of the opinion that RUC-type costs should be assessed to virtual supply.

9(A) Unit Commitment Costs from the IFM and RUC

There is also a fair level of complexity in the allocation of the uplift charges at both the NYISO and at PJM[3].

PJM appears to allocate uplift from the DAM solution to DAM demand (actual and virtual) and real-time uplift is allocated to any entity causing an uninstructed deviation from the DA solution (which implies that virtual demand and supply share in this cost allocation).

It should be pointed out that virtual demand increases unit commitment in the IFM and decreases commitment in RUC, whereas virtual supply (negative load) does just the opposite, it decreases unit commitment in the IFM and increases commitment in RUC. Using basic cost causation this suggests that virtual demand should pay a share of the IFM commitment costs similar to physical demand, whereas virtual supply should pay a share of the RUC commitment costs comparable to the allocation to metered load that was not scheduled in the

[3] See Technical Bulleting No. 82 at: (http://www.nyiso.com/public/documents/tech_bulletins/index.jsp?sort=name&order=descending&maxDisplay=149&=undefined

DA IFM. Such a design would conform to the principles of cost causation as well as the FERC MISO decision mentioned above.

Discussion

- PG&E urges the CAISO to assess whether virtual bidding's potential for increasing the use of RUC may create inappropriate cost shifts. PG&E also comments that the virtual bidding design should include provisions that prevent dispatch of use-limited resources, which must be budgeted across a season.

- SCE urges that virtual bids be treated as closely as possible to physical bids with respect to cost allocation. Specifically, virtual and physical transactions should be included in all the processes related to LAP price averaging, incorporating the hourly costs of HASP and any RT adders/subtractors, and ex-post corrections to distribution factors made after the CAISO receives meter data. SCE also urges that certain virtual bids pay a portion of RUC costs and start-up/minimum load costs.

- Williams Power Company comments that virtual bids should be allocated IFM commitment costs only if those virtual bids increase IFM commitment beyond what would have been committed in the IFM if demand had been accurately bid into the IFM. Williams states that virtual bids could be counteracting the distorting effects of under-scheduling, and that allocating commitment costs only to physical demand creates the maximum incentive for physical demand to schedule accurately.

- WPTF agrees that uplifts necessary to facilitate transactions would be appropriately applied to virtual bids since virtual bids create an impact on the ISO's systems and processes. However, WPTF comments that uplifts that are the result of physical delivery such as no-pay allocations should not be allocated to virtual bids.

- EPIC disagrees with the statement that "FERC is of the opinion that RUC – type costs should be assessed to virtual supply" because EPIC believes that FERC's April 25, 2006 order is unclear. EPIC further notes that RSG-type charges continue to be defined and adjusted in the eastern ISOs.

CAISO Recommendation

The CAISO offers the following options for IFM and RUC Unit Commitment cost allocation:

- Option 1: Exempt virtual bids from unit commitment cost allocations

- Option 2:

    - Include DA virtual demand bids (along with actual demand) as billing determinants for DA Unit Commitment uplift cost allocation.

    - Include DA virtual supply bids (along with under scheduled demand) as billing determinant for RUC cost allocation.

9(B) Ancillary Service Cost Allocation

In the eastern ISOs the reserve cost allocation differs between the PJM and NYISO model. PJM allocates DAM reserve costs to all demand, both actual and virtual, whereas the NYISO allocates reserves costs to actual withdrawals. Neither makes mention of regulation costs.

Although there is some choice over how AS costs are allocated the CAISO believes that the MRTU procurement methodology again gives a good indication as to how AS costs might be allocated. Under the MRTU design the procurement of Ancillary Services will be based on the CAISO forecast of CAISO demand, not on the IFM result. Thus virtual demand will not cause incremental procurement of AS and virtual supply will not create a real AS obligation.

This might suggest that AS costs should be allocated to physical loads as occurs at the NYISO. However, it should be pointed out that under MRTU A/S costs are allocated in two Tiers. Tier 1 is allocated based on Obligation net of self provision. However, there are Tier 2 (neutrality) cost allocations under MRTU which result from discrepancies between CAISO procurement and SC Obligations. Whether or not virtual bids should be allocated part of the A/S neutrality cost must be discussed.

Discussion

- SCE suggests that virtual bids can impact A/S costs, and it is appropriate to charge virtual supply tier 2 A/S costs. SCE further suggests that virtual supply should be charged RT A/S costs to the extent these costs are not captured in the tier 2 charge. SCE agrees that day-ahead tier 1 A/S costs should not be charged to virtual suppliers.

CAISO Recommendation

The CAISO offers the following options for Ancillary Service cost allocation:

- Option 1: Exempt virtual bidding from A/S cost allocation

- Option 2: Exempt virtual bidding from Tier 1 A/S cost allocation (based on User Rate), but not from A/S neutrality cost allocation (including both virtual supply and virtual demand.)

(10) Other Design Elements

SCE proposes the following design elements for consideration:

- **Information Release:** SCE proposes immediate release of virtual bidding information, preferably shortly after the close of the DA market.

- **Recovery of Development and on-going Administrative Costs:** SCE proposes an explicit per MWh transaction fee for virtual bidding to pay for implementation and on-going administration and monitoring costs.

- **Interaction with Local Market Power Mitigation:** SCE urges that any virtual bidding design not undermine MRTU's local market power mitigation, and that the virtual bidding design be reviewed after FERC approves LMPM.

- **Interaction with Resource Adequacy:** SCE urges that virtual bidding implementation not undermine the CAISO's efforts to preserve RA resources during times of supply shortages.

- **Interaction with Physical SC Trades:** SCE urges that any virtual bidding design not undermine the settlement systems or design goals that allow Inter-SC trades to facilitate the delivery and settlement of seller's choice contracts.

- **Interaction with Existing Load Settlements:** SCE urges that any virtual bidding design not undermine RT settlements or the policy objectives related to LAP-level bidding.

- **Position Limits:** SCE urges that position limits for virtual bidders be included as part of the design.

Evaluation Criteria

The evaluation criteria used to assess the proposed designs should include a number of different measures including;

1. Consistency with Previously Approved Designs: There are many advantages to implementing a previously approved design, such as the NYISO or PJM design. The main advantages are the fact that the design is tried and tested so that, in the absence of significant differences in the host system, the design

should work. Whilst the CAISO market architecture is obviously different to that in the NYISO and PJM these are still fundamentally similar systems[4]. In addition previously approved designs face much lower regulatory risk as FERC has already approved the functionality elsewhere.

2. Level of functionality: Obviously the CAISO would like to maximize the functionality of the proposed design so that market participants have more rather than less functionality.
3. Simplicity; the best designs are often clean, simple and easy to implement.
4. Market Efficiency
5. Market Power Mitigation Concerns
6. Other Criteria: [Purposefully left open to account for stakeholder input for this iteration of the white paper]

Option	Consistency	Level of Functionality	Simplicity	Market Efficiency	MPM	Other
NYISO						
PJM						
CAISO1						
CAISO2						

Stakeholder Input for Evaluation Criteria

[Purposefully left open to account for stakeholder input for this iteration of the white paper]

Final CAISO Proposed Design

[Purposefully left incomplete for this iteration of the white paper]

Conclusion

[Purposefully left incomplete for this iteration of the white paper]

Reading List

General Documents

CAISO Tutorial Documents available at:
http://www.caiso.com/docs/2005/06/09/2005060910374912494.html

[4] In some ways the CAISO architecture is closer to the NYISO design, e.g. both have DA markets for reserves and HASP and the NYISO's BME are similar, but in others it is closer to the PJM design, e.g. in PJM bid-in demand clears against bid-in supply to set the DA prices and quantities, followed by a reliability run, a structure that is very close to the MRTU design. At the NYISO the Day-Ahead market solution includes units required to support reliability.

Hogan, W.W. (2006, May 25) “Revenue Sufficiency Guarantees And Cost Allocation” Available at http://ksghome.harvard.edu/~whogan/Hogan_RSG_052506.pdf Published May 25, 2006

NYISO (2002) “State of the Market”. Available at: http://www.nyiso.com/public/documents/studies_reports/market_advisor_reports.jsp

NYISO (2005) “NYISO Market Participant User’s Guide”. Available at: http://www.nyiso.com/public/webdocs/documents/guides/mpug_mnl.pdf

NYISO Technical Bulletin No. 82 at: http://www.nyiso.com/public/documents/tech_bulletins/index.jsp?sort=name&order=descending&maxDisplay=149&=undefined

PJM Guide to Generation Offers and Schedules p.61, available at: http://www.pjm.com/etools/downloads/emkt/guide-generation-schedules-offers-v3.pdf

FERC Decisions

Midwest ISO Collateral Requirements see FERC 108 FERC ¶ 61,163 at P 447-48

Midwest ISO 97% rule see FERC Docket No. ER04-691-004, p.107

Midwest ISO Cost Allocation see Docket No.ER04-691-065, “ Order Requiring Refunds, And Conditionally Accepting In Part, And Rejecting In Part Tariff Sheets” Issued April 25, 2006

NYISO Collateral Requirements, see FERC Docket No.ER05-941-000, Issuance of July 1st 2005

PJM Collateral Requirements, see FERC 104 FERC ¶ 61,309 at P 23-24

Appendix One: Hedging By Physical Generators[5]

Protecting a Generation Offer

Marketer X is offering a generation resource that is good for 100 MW under normal circumstances. However, the unit on a particular day is having potential mechanical problems that may reduce the output of the unit by 10 MW for the next day. The situation is not critical enough that a partial de-rating of the unit is required, but the marketer is not one hundred percent confident that the unit will be able to produce 100 MW.
Marketer X bids in 100MW at $50, and a 10MW virtual demand bid (PJM dec) at $50.
Both bids clear at $60, thus Marketer X has a financially binding commitment for 100MW at $60 in the DAM, and has bought 10MW at $60 (i.e. has effectively bought back the last 10MW). This virtual will then be liquidated in real time.
There are four possible scenarios.
Unit produces 100MW in RT

1. RTM closes higher than $60, say $70, in which case Marketer X receives (100MW*$60= $6000 from DA) + (10MW*[$70-$60]=$100 from virtual) = $6100 Total
2. RTM closes lower than $60, say $50, in which case Marketer X receives (100MW*$60= $6000 from DA) + (10MW*[$50-$60]=-$100 from virtual) = $5900 Total

Unit produces 90MW in RT

3. RTM closes higher than $60, say $70, in which case Marketer X receives (100MW*$60=$6000 from DA) - (10MW*$70=$700 – due to RT under delivery) + (10MW*$70-$60=$100 due to the virtual) = $5400 Total
4. RTM closes lower than $60, say $50, in which case Marketer X receives (100MW*$60=$6000 from DA) - (10MW*$50=$500 – due to under delivery) + (10MW*$50-$60=-$100 due to the virtual) = $5400 Total

In this example Physical hedging allows the unit to contract in the DA for the RT price, rather than actually wait for the RTM. This exposes a portion of the output to the real-time price. This has the added reliability benefit of shifting the unit completely into the DAM. Without VB the unit owner would have to do this exercise physically by selling 90MW DA and then waiting for the RTM to bid in the last 10MW. By using VB to sell in the DA for the RT price the unit owner can schedule the entire unit in the DA, but pick up the RT price for the last 10MW.

Congestion Hedging

A generator (A) is offering to sell 50 MW at $15/MWh. An LSE (B) is looking to buy 50 at $20/MWh. A marketer picks up both deals and enters a bilateral transaction from point A to point B. The marketer is buying 50 MW from A at

[5] Both of these examples are taken from the board presentation, but come originally from PJM (Guide to Generation Offers and Schedules p.61). Available at: http://www.pjm.com/etools/downloads/emkt/guide-generation-schedules-offers-v3.pdf

$15/MWh and selling to B at $20/MWh and therefore, does not wish to pay more than $5/MWh in congestion charges. How does he/she cover the position? Answer: The marketer enters a 50 MW Dec bid at point B where the generator is located for $15/MWh so that this resembles a spot purchase. A 50 MW Inc offer is placed at point B for $20/MWh so that it resembles a spot sale. If LMPs from the Day-Ahead Market are $14/MWh at point A and $21/MWh at point B, the marketer is selling to the spot market at A and buying at B. As a result, the marketer knows his/her position by 16:00 on the day prior to the operating day and has time to make appropriate arrangements to respond to his/her resulting position. A summary of the charges is listed below:

Charges & Credits	Calculation	Total
Transmission Congestion Charge	50 MW * ($21-$14)	$ 350 charge
Dec Bid (Charge)	50 MW * $14	$ 700 charge
Inc Offer (Credit)	50 MW * $21	-$ 1,050 credit
Net Position		$ 0