Options for the Conceptual Design for Convergence Bidding

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Prepared for Discussion at the August 10 meeting of the Market Surveillance Committee (MSC)

1 Introduction

This paper seeks to frame the policy options surrounding key design elements for convergence bidding in the CAISO markets. Specifically, this paper posits three options related to the granularity of virtual bidding:

- The first option, for which the CAISO has previously indicated a strong preference, is to introduce convergence bidding at the LAP-level which would mirror the way that load settles energy, at least initially, within the MRTU markets.
- The second option is to impose position limits on the virtual bids that can be offered at nodal locations in the Day Ahead market, which would then be settled nodally at Real Time prices.
- The third option is for virtual demand and virtual supply bids at the nodal level, but with specific market enhancements to guard against possible gaming opportunities.

These options will be discussed at the August 10 meeting of the Market Surveillance Committee (MSC), where the MSC members, stakeholders, and CAISO staff can benefit from an open discussion on the best approach for moving forward with the changes to its market operations and software systems that are necessary to implement convergence bidding within twelve months of the startup of the MRTU markets.

In addition, the CAISO is requesting additional written comments from stakeholders on these broad policy options by August 24.

As a starting point it is worthwhile to review why the CAISO is preparing to introduce convergence bidding into the LMP-based markets. Obviously FERC has mandated virtual bidding "within twelve months of MRTU start-up,"[1] with tariff language to be filed at FERC "within 60 days of the implementation of convergence bidding."[2] Beyond these requirements, however, the CAISO recognizes several important benefits that will be brought with this mechanism that pushes Day Ahead market prices and Real Time market prices closer together:

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[1] FERC's September 21, 2006 MRTU Order (P 430-452) requires the CAISO to implement convergence bidding "within 12 months after the effective date of MRTU Release 1."

[2] FERC's April 20, 2007 MRTU Order (P 105-119) clarifies that the CAISO must file tariff language for the implementation of convergence bidding no later than 60 days prior to the one year anniversary of MRTU startup.

- **Convergence bidding enhances the general stability of the price differences between the Day Ahead and Real Time energy markets**. Thus, market participants should be more easily able to construct an index of prices that provide informational value and establish a firm degree of price certainty upon which parties can negotiate future contracts.
- **Convergence bidding minimizes incentives to underschedule in the Day Ahead market**. One of the main goals of the CAISO's market redesign is to strengthen incentives for load to schedule in advance of Real Time, and by pushing the Day Ahead and Real Time prices closer together, virtual bidding reinforces these incentives to schedule all of the expected load in the Day Ahead timeframe.
- **Convergence bidding provides a financial tool for the physical hedging of production by suppliers of energy.** With a two-settlement energy spot market, generators can commit a unit in the Day Ahead while using virtual bidding to get Real Time prices for a portion or all of the MW output.

2 Updated Timetable and Process Going Forward

This paper also consolidates some of the concepts and previous stakeholder discussions on various design elements for convergence bidding that have been posted over the past year. These documents remain available on the CAISO website (at the "Convergence Bidding" location: http://www.caiso.com/1807/1807996f7020.html).

In order to ensure full consideration of stakeholder needs, the CAISO is requesting additional written comments to be submitted by August 24 to Convergencebidding@caiso.com.

A WORD template (located at the "Convergence Bidding" location: http://www.caiso.com/1807/1807996f7020.html) will be available for downloading which focuses questions on the business needs of convergence bidding, as well as the benefits and the possible impacts upon market participants. Stakeholders are encouraged to utilize this template, although written comments in any format would be welcome and will be posted as part of the public record.

Significantly, the CAISO also is requesting written comments (on a similar timetable) regarding the prioritization of future market enhancements which are listed in the latest revision of the "Five-year Market Initiatives Roadmap" (located at: http://www.caiso.com/1822/1822931f287d0.html). This revised Roadmap also will be briefly reviewed and discussed at the August 10 MSC meeting. Stakeholders may note – and should highlight -- important relationships between some future market enhancements listed in the Roadmap and the granularity of convergence bidding. For example, the FERC requirement to increase the number of LAP zones (Section 2.2.24 of the updated Roadmap) may or may not drive the business needs or preferences of market participants on the granularity of virtual bidding. The CAISO encourages recognition of such inter-relationships, and stakeholder views will be valuable input to establish a plan for market enhancements that meet the needs of market participants in a cost effective manner.

Comments on convergence bidding that were previously submitted and posted also will be included to build a complete record of stakeholder views on the granularity of convergence bidding.

The CAISO is tentatively planning a follow-up stakeholder meeting on the design of convergence bidding for September 12. A market notice will be issued when this date is confirmed. The Appendix of this paper offers an initial list of conceptual design elements which can be expanded upon and explained in this future stakeholder meeting.

August 10	**MSC Meeting** with discussion on convergence bidding
August 24	**Stakeholder comments** due to: convergencebidding@caiso.com (Template for comments available at: http://www.caiso.com/1807/1807996f7020.html
August 24	**Stakeholder comments** on high priority future market enhancements due to: mmiller@caiso.com (Template for comments available at: http://www.caiso.com/1822/1822931f287d0.html)
September 12 (tentative)	**Stakeholder meeting** to review convergence bidding conceptual design

3 Background on other ISO Practices

Both PJM and ISO-NE 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 PJM and ISO-NE markets, the NYISO design consists of eleven load zones that has proven sufficient for price convergence and has provided participants with hedging opportunities. Within the NYISO, load, virtual supply and virtual load settle at zonal prices, while generators settle at bus prices.

A benchmarking review of other ISO practices on virtual bidding is included within the October 24, 2006 Paper prepared by the ISO's Department of Market Monitoring, which is located at: http://www.caiso.com/189b/189b787e6fbc0.pdf.

4 Proposal to Initiate Convergence Bidding at the LAPs

The CAISO has previously expressed its preference for introducing virtual demand (dec bids) and virtual supply (inc bids) at the same Load Aggregation Points at which load will be settled, for the following reasons:

a) **LAP-level virtual bids would minimize potential under-scheduling of load:** By permitting the scheduling and settlement of virtual bids only at the three Load Aggregation Points where load also settles[3], incentives for LSEs to under-schedule their expected load in the Day Ahead market would be greatly minimized. For the grid operator, strengthening incentives for load to schedule in the Day Ahead market is a primary benefit of convergence bidding, and it is consistent with the key goals of the MRTU design. As long as physical load is settled at the LAP, then limiting convergence bidding to the LAP should check potential under-scheduling as effectively as nodal virtual bidding would.

b) **LAP-level Virtual Bidding Avoids Complications of Seller's Choice Contracts:** The CAISO believes the continued existence of "Seller's Choice contracts" raises issues for a design that permits virtual bidding at the nodal level, but not for a design that limits virtual bidding to LAPs.

Seller's Choice settlement allows handoff (physical Inter-SC Trade) at generation nodes up to the level of accepted physical supply at the node. Virtual bidding at a node can influence the nodal physical supply clearing quantity (and possibly the nodal LMP). Any measures against potential gaming of nodal quantities (and prices) would require consensus of the Settlement parties, and can entail a laborious process. LAP level virtual bidding (which does not impact Seller's Choice settlement) could be introduced in the CAISO markets even while significant volumes of State Contracts exist.

Under the MRTU design, the CAISO will be instituting measures like physical Inter-SC Trades (ISTs) to ensure that parties with "Seller's choice" contracts can settle schedules that allow a hand-off point at nodes tied to the physical point, and where the handed-off MW quantity does not exceed the "feasible" generation schedule at the hand-off location.

With virtual bidding at the nodal level, an entity could theoretically choose a large amount of generation that is then offset by virtual demand bidding at that node, in effect manipulating the physical supply clearing quantity at that location to create a potentially large counterflow revenue opportunity for the seller at the expense of the buyer.

Thus the CAISO is concerned that allowing virtual bidding at a nodal level may un-do the Inter-SC Trade design established to address the incompatibility of pre-existing seller's choice contracts and an LMP market design.

While these issues are not insurmountable, the significant amount of long-term contracts that will remain in force (amounting to 9,900 MWs through 2009, declining to 5,500 MWs through 2011)[4] suggest a complicated solution would need to be devised to accommodate nodal virtual bidding. Thus, LAP only virtual bidding is preferable to more granular virtual bidding for the initial implementation of convergence bidding when considering "Seller's Choice contracts."

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[3] When MRTU begins, physical supply will bid to inject energy at a specific node; physical demand will settle its load purchases at the LAP price.

[4] See "CERS Overview and Long-Term Energy Contracts Summary" located at: http://wwwcers.water.ca.gov/pdf_files/power_contracts/mar_06_fnl_update_cers_overview_cntrct_sum.swf

c) **LAP only virtual bidding is superior to "virtual bidding at physical bid granularity."** Some have argued for alignment of virtual and physical bidding granularity, i.e., allowing LAP level virtual demand and nodal virtual supply. If virtual bidding were consistent with physical bidding – so that virtual supply could bid only nodally and virtual demand could only bid at the LAP – supply and demand would then have unequal abilities to capture the potential benefits of convergence bidding. If the Day Ahead price were higher than the Real Time price, then virtual supply bids at the node would be unable to capture the price difference except imperfectly through a portfolio of supply and demand bids.

For example, if a LSE SC bids 50 MW of uncompetitively low priced virtual supply at a node to depress the LMP at that node[5], the local supplier at that node would not be able to bid 50 MW of nodal virtual demand to counter this action.

To get the benefits of virtual bidding for supply and load, each side should have the ability to capture price differences between the Day Ahead and Real Time for the same points. Supply and demand should have equal ability to mitigate the power of each other.

Virtual bids that restrict negative signs impact the equal ability to check virtual bidding. Supply cannot make negative bids at their location whereas load could gain by their nodal bids. Similarly, load's inability to negatively bid at the LAP could be trumped by supply bids at the LAP.

Convergence bidding at the LAP for both virtual supply and virtual demand provides a check against the potential power of each side.

In addition to these disadvantages, virtual bidding at physical bid granularity fails to improve the single deficiency of LAP level virtual bidding, namely, the ability for the suppliers to hedge their physical supply against forced outages through virtual bidding; this is because such hedging is best accomplished by nodal virtual demand bids that would be disallowed under this paradigm where virtual bids mirror the physical bid granularity.

d) **Lap-level virtual bids would enhance market liquidity**: Adding liquidity to the energy markets with virtual bids is a desirable impact which should occur with LAP-level granularity. All virtual supply and demand bids and all physical demand will form a single market at each LAP.

e) **Cautious Initial Implementation of Virtual Bidding is Appropriate:** The CAISO also believes it would be highly useful to observe well-functioning performance of markets with LMP operating in California, and to be assured that no unforeseen problems or additional monitoring concerns arise after the introduction of LAP-level virtual bidding before allowing virtual bids at a more granular level. Thus, a staged approach is a reasonable and prudent course that allows flexibility to develop appropriate monitoring rules that might be advisable before adding a more granular stage of virtual bidding.

f) **LAP-level virtual bidding can be accommodated with the existing MRTU measures for market power mitigation.** An often cited potential benefit of convergence bidding is

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[5] This may payoff for the LSE SC by either increasing CRR revenues, or even potentially lower the LMPs in the load nodes in the vicinity and thus lower the LAP price albeit by a small amount.

that it may mitigate market power of suppliers --- particularly at individual supply nodes --- in the Day Ahead Market by allowing other participants to submit virtual supply bids. However, under the current MRTU local market power mitigation design, virtual bidding at individual supply nodes may actually exacerbate local market power, depending on whether virtual supply bids are considered in the local market power mitigation procedures or not. If they are considered but are also exempt from mitigation, virtual supply bids might be used to undermine the local market power mitigation procedures[6].

Alternatively, if they are excluded from the local market power mitigation procedures, their exclusion could result in inaccurate bid mitigation of physical generator bids since ultimately all bids (virtual and physical) are considered in the day-ahead energy market. Given these complexities and potential for nodal virtual bids to undermine local market power mitigation procedures, the CAISO's Department of Market Monitoring believes limiting virtual bids to LAPs, as an initial design approach, is prudent.

The CAISO believes convergence bidding at a more granular level will require more complicated market monitoring measures and market rules. The necessity for these changes is explained in the following section.

5 Proposal for Position Limits on Nodal Virtual Bids

Another approach would be to allow nodal-level convergence bidding but with limits on the amount of virtual demand and virtual supply bids that could be submitted at individual nodes. Although this concept is not practiced by other ISOs, this option might be considered as an alternative to the LAP-level approach and therefore implemented as the first stage of convergence bidding. Alternatively, this concept for position limits might be considered as the next stage to be employed after some period of time has passed when virtual bidding occurs only at the LAP-level.

An important consideration is how effectively position limits might address market monitoring measures, as well as collateral requirements for virtual bidding. Highly restrictive limits – for example, limiting each virtual bid to 10% of the maximum volume at each node -- might be viewed as a possible alternative to other market monitoring measures that are suggested (in the next section) as components that are probably needed for full nodal virtual bidding. Less restrictive limits – for example, limiting each virtual bid to 50% of the maximum volume at each node – might be viewed as a complement to additional market monitoring measures and credit requirements for virtual bidding.

5.1 How would Position Limits on Virtual Bids Work?

The general concept is to limit virtual bidding to a percentage of a firm MW amount for a PNode or APNode.

One possible application of this concept is to restrict nodal virtual bidding only to generator nodes. For nodes associated with generators, the position limits could be tied directly to the

[6] For example, under the local market power mitigation procedures, only resources that are dispatched up to relieve congestion on non-competitive transmission paths are subject to mitigation. If virtual supply bids are considered in the mitigation runs but not subject to being mitigated they may displace physical supply bids and set very high LMPs. Subjecting virtual supply bids to bid mitigation is problematic because, unlike physical resources, there is no meaningful cost-basis for these bids.

capacity of that generator. For example, if PNode X is the injection point for a generator with a PMax of 100 MWs, the position limit at PNode X would be a specific percentage of 100 MWs. If the position limits were 10%, then virtual bids would be limited to 10 MWs per Scheduling Coordinator at that node.

Another possible application of the position limit concept is to allow virtual bids on all nodes that have prices. For nodes associated with demand, a firm MW amount could be determined by two alternative ways:

- As one alternative, the CAISO might assess the average MW amount that flows over that node over a period of time. For example, if PNode Y is the sink point where power is taken off the grid, the average MW amount of the hourly schedules at that node over a year might be 200 MWs. If position limits were set at 10%, then the virtual bids at PNode Y would be limited to 20 MWs.
- A second alternative would identify the MW volume of the peak withdrawal at each node, of which a percentage would establish the position limits at each node. Using the MW amount of the peak withdrawal at a demand node would be symmetric with the use of PMax for generation nodes. As an example, if the maximum withdrawal at PNode Y over a year was 400 MWs, and position limits were set at 10%, then the virtual bids at PNode Y would be limited to 40 MWs.
- (For PNodes or APNodes that both inject and withdraw power, the largest MW value could provide the basis for the application of position limits.)

Having position limits at each node means that the virtual bids of each Scheduling Coordinator would be restricted, and that limits on virtual demand bids would be separated from virtual supply bids. Thus, virtual demand bids at Node X would be limited to 10 MWs for each Scheduling Coordinator, and virtual supply bids at Node X would be limited to 10 MWs for each Scheduling Coordinator.

It may be important to note that, in this example, just because a single market participant can only submit a 10 MW virtual bid at Node X, this doesn't mean that a participant can't find a hedge for the 100 MWs. This could be done through the bilateral (off-track market). Thus, although position limits will limit the amount that any given market participant can buy or sell through the CAISO markets at a location, any market participant should have the ability to hedge 100% of the injections or withdrawals at a location through CAISO market transactions and secondary market transactions.

The seller of these products always has the option to hedge this risk (up to its position limit) in the CAISO market, which should ensure price convergence.

6 Proposal for Unlimited Nodal Virtual Bids

Another option that the CAISO might pursue is virtual bids at the nodal level. Some stakeholders have advocated that convergence bidding should begin at the nodal level, while others suggest the CAISO should anticipate a staged transition to more granular virtual bidding -- so system requirements that are necessary for nodal virtual bids might, if possible, be incorporated in the development of the first stage of convergence bidding, even if such features are not actually implemented until later.

The CAISO proposes the following inter-related market features that should be considered as necessary components of the more granular stage for convergence bidding:

1. **A distinct market power monitoring run** (or pass) in the Day-Ahead process leading to the Integrated Forward Market (IFM) that includes an assessment of potential market power mitigation with virtual bids included. This could be accomplished by bifurcating the existing MPM-RRD run into an MPM pass with both actual bids and virtual bids (based on bid-in demand) and a RRD pass based on load forecast.
2. **Use of bid-in Demand** (which would include virtual bids) rather than forecasted Demand in this separate MPM pass. Use of bid-in Demand is mandated by FERC as a Release 2 feature.
3. **Uninstructed Deviations Penalty (UDP):** It may be particularly important to monitor and have some market rules to mitigate the potential ability of participants controlling generation assets to profit from virtual bidding by utilizing their ability to affect real-time prices in ways that would be highly unpredictable for other market participants. Examples of such mechanisms include forced outages, uninstructed deviations, and other ways of affecting the real-time LMP. Specific events that may be subject to scrutiny would be if a generation owner took a significant position through virtual bids, which was correlated with events (such as forced outages or generation deviations) that had the effect of increasing the generator's profits from these virtual bids.
4. **New "CRR Settlement Rule" that addresses the interplay between CRRs and virtual bids**:

   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 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.

   The settlement rule established at PJM and ISO-NE is meant to deter market participants from using convergence bids to increase DA congestion in order to earn additional profits from the Congestion Revenue Rights. In PJM and ISO-NE, this 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 Day Ahead Market Clearing Prices (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.[7]

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).

The NYISO has not adopted explicit settlement rules relating 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 very 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.

5. 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.[8]

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 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.[9]

6. Possibly Linking Granularity of Virtual Trading with Granularity of Physical Load Settlement

The CAISO may consider (as a general policy) the implementation of more granular virtual bidding at the same time as settlement of load goes to sub-LAPs or some other level of disaggregation.

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[7] Attachment A of the October 24, 2006 paper "Convergence Bidding: Market Monitoring and Mitigation Issues" describes how this settlement rule in a fully nodal convergence bidding design.

[8] 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)

[9] 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)

The CAISO notes that most of these features are listed in the "Market Initiatives Roadmap," and that the CAISO has established a policy for methodically ranking the overall benefits of future enhancements to the new MRTU markets based on a pre-determined set of criteria.[10] This process also assesses inter-relationships among desirable market enhancements so that complementary features might be developed at the same time.

Thus, this convergence bidding design is being developed at the same time as the CAISO is reviewing and ranking the priorities of future proposed and mandated market enhancements. The outcome of this process should produce a set of features that may be included in the systems and software development for the MRTU "Release 1A" package of enhancements, or possibly be folded into MRTU "Release 2," which would include the next major improvements to the MRTU markets following "Release 1A," or set aside for consideration of future enhancements.

The CAISO urges stakeholder input into this process for ranking future market initiatives, especially recognizing linkages to key features related to virtual bidding at the nodal level.

[10] A full explanation of the ranking criteria process is posted as part of the Board documents associated with the March 9, 2007 meeting of the ISO Board of Governors, which is located at: http://www.caiso.com/1b94/1b94ded2511d0.html

7 Appendix: Conceptual Elements of Convergence Bidding Design

This Appendix summarizes the initial development of the key design elements for convergence bidding. Most of this material has been posted previously in other documents. Section 7.6 on cost allocation for virtual bids is new and is presented here to allow stakeholders plenty of time to review these concepts and examples and offer any further suggestions.

This section on cost allocation as well as all the other sections below will be expanded upon and discussed with stakeholders in the near future.

7.1 Key Characteristics: Explicit Virtual Bids

This conceptual design should 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. If accepted in the IFM, such bids will be liquidated as price takers in the RTM.

Virtual supply that is accepted in Day Ahead will require the seller to buy that same quantity of supply back in the Real Time market. Virtual demand that is accepted in the Day Ahead will require the buyer to sell that same quantity of demand back in the Real Time market.

Virtual bidding provisions apply only to Energy Bids. No design provisions are contemplated for explicit virtual bidding for Ancillary Services or other products in the CAISO's markets.

7.2 Load Distribution Factors (LDFs)

The CAISO proposes using the same distribution factors for virtual and physical bids in the relevant market (even though real-time LDFs are likely different than day-ahead 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.

7.3 Market Power Mitigation Measures

No further measures would be necessary for the implementation of LAP-level convergence bidding beyond what will be in place upon MRTU startup.

For more granular convergence bidding:

- See the list of possible market monitoring enhancements discussed in Section 6 of this paper.
- See the discussion of possible position limits on the MW of each node in Section 5 of this paper.

7.4 Credit Requirements for Virtual Bidding

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.

At a conceptual level the CAISO proposes to adopt the approach practiced by most other ISOs for determining credit requirements. This general methodology takes into account a percentile value of the difference in Day Ahead and Real Time energy prices over a specific period of time.

Thus, for the purposes of a CAISO credit requirement, the value of virtual bids could be calculated as the product of:

A Participant's daily Virtual MWh Limit

times

B A reference price = the highest differential between the Day-ahead and Real-Time Locational Marginal Prices at the XXth percentile over the previous XX months.

times

C The number of days in the Virtual Transactions Estimated Exposure Window (for example, 2 Days).

The exact values for these parameters would be determined at a later time as part of the development of tariff language. The CAISO notes, however, that the most recent FERC ruling on the issues related to virtual bidders' credit requirements involves MISO, and therefore the values in practice at MISO offer the most appropriate starting point in the development of tariff language.

7.5 Bid Price-Quantity Pairs

For LAP-level CB:

- For each LAP, an SC could submit one 10-segment virtual bid, similar to the existing energy curve submitted for physical bids. Virtual supply bids will be submitted as a up to 10 segment monotonically increasing bid curve the same as a bid for physical supply. Virtual demand bids will be submitted as a up to 10 segment monotonically decreasing curve just like a price sensitive physical load.
- For each LAP, SC could submit either a virtual demand bid or a virtual supply bid – but not both virtual demand and virtual supply bids within the same LAP.
- Virtual bids in the Day Ahead market must have a price; Virtual positions in the Real Time market are price-takers.

7.6 Cost Allocation

In the May 31st white paper the CAISO presented an initial conceptual proposal on what CAISO settlements charges should be allocated to virtual transactions. The CAISO proposed that IFM Tier 1 Uplift costs (CT 6636) be allocated to virtual demand and RUC tier 1 Uplift Costs (CT 6636) be allocated to virtual supply and that virtual transactions be exempt from IFM and RUC

tier 2 charges (CT 6637, 6807), RTM Bid Cost Recovery (CT 6678), and all Ancillary Services costs both Tier 1 and Tier 2.

Stakeholders provided comments to the May 31st white paper that expressed concern that the CAISO should not take the simplified approach that virtual demand is the same as physical demand when related to cost allocation and that cost should be levied on virtual transactions with care to keep the market as deep and liquid as possible. Since virtual transactions provide cost benefits to the market, when considering cost allocations those cost benefits should be weighed against any costs that may result from virtual transactions.

Others stakeholders commented that virtual transactions should be treated the same as physical supply and load as much as possible and all related costs should be allocated to virtual transactions including Day-Ahead and Real-Time BCR costs and Ancillary Services Tier 2 costs.

Comments are summarized below:

- *Virtual Transactions should not be treated the same a physical demand when allocating costs and costs and cost offsets should be considered symmetrically*

- *Tier 1 IFM or RUC commitment costs should be allocated to virtual demand only if and only to the extent that virtual demand increases demand beyond the level of actual load.*

- *Convergence bids should not be exempted from Real-Time Tier 1 Bid Cost Recover charges since Virtual supply cleared in the IFM becomes demand in real-time and has an impact on the commitment of physical generating units. Convergence bids should also not be exempt from some GMC related charges and FERC fee charges.*

- *Virtual Bids should be exempt from Ancillary Services related charges and Tier 2 neutrality costs but not from Tier 1 IFM and RUC Bid Cost Recovery charges.*

The CAISO has taken into consideration stakeholder comments and has made an effort to balance stakeholder concerns by allocating a fair share of costs to virtual transactions while being mindful of the benefits of convergence bidding and encouraging participation in the market.

The following sections expand upon the CAISO's initial proposal and describe in more detail how the IFM and RUC Tier 1 charges could be allocated to virtual transactions.

7.6.1 IFM and RUC Charges for Virtual Transactions

Under MRTU all supply resources are eligible for Bid Cost Recovery (BCR) which allows Generating and Dynamic System Resources to recover their Start-Up Costs, Minimum Load Costs, and Energy and Ancillary services bid costs to the extent those costs are not covered by LMP and AS revenues from the market.

Generating Units and Resource Specific System Resources that are committed by the CAISO in the IFM, RUC, or RTM are eligible to recover Start-Up Costs and Minimum Load Costs as well as Bid Costs for Energy and Ancillary Services. Supply Resources that are self-committed are eligible to recover only Bid Costs for Energy and Ancillary Services. The funds needed to

compensate eligible resources for their Bid Cost Recovery are collected through the IFM and RUC Tier 1 and Tier 2 Uplift charges, and RTM Uplift charge, all of which are charged to demand (with exports being exempt from RUC uplift charges.)

Virtual transactions will be cleared in the Day-Ahead IFM and will have an impact on the commitment of physical generating units in the IFM and RUC processes. As a result there will be some cost impact to the market.

Virtual demand results in more unit commitment in the IFM and less unit commitment in RUC where virtual supply does has the opposite effect and results in fewer units committed in IFM and more in RUC. Since virtual transactions are not considered in the RUC process, additional units that were committed in the IFM to cover virtual demand above the physical load may have otherwise been committed in RUC. The RUC process will deduct the virtual demand and commit units in RUC based on the difference between the CAISO Load Forecast and the physical load that cleared the IFM not including virtual demand. On the other hand the quantity of virtual supply beyond physical generation that clears the Day-Ahead IFM to cover the load can not be counted in RUC and that quantity will be procured from physical generating units in the RUC process.

In an attempt to balance additional costs incurred in IFM commitment as a result of virtual transactions with costs that may be offset in RUC by virtual transactions the CAISO is proposing that market participants that engage in virtual transactions be allocated a portion of the IFM Tier 1 to virtual demand and RUC Tier 1 to virtual supply.

In the May 31st white paper the CAISO proposed that market participants be charged for BCR based on net virtual transactions. Since each market participant will be bidding either virtual demand or virtual supply in a single LAP there will be no need to net at the LAP level for each SC.

To determine the portion of the dollar amount out of the total IFM and RUC bid costs that must be recovered that should be allocated to virtual transactions, the CAISO will take a net of the total sum of the virtual demand for each of the three LAPs for all SCs and the net of the total sum of the virtual supply across all three LAPs for all SCs. Costs to each SC for IFM Tier 1 BCR will then be allocated based on the sum of the LAP level virtual demand for that SC and costs for RUC Tier 1 BCR will be allocated based on the sum of the LAP level virtual supply. Therefore if a market participant has virtual supply in one LAP and virtual Demand in another LAP they will pay a portion of both IFM Tier 1 Bid Cost Recovery and RUC Tier 1 Bid Cost Recovery.

This is a change from the original proposal where it was suggested that each market participant that participates in convergence bidding would pay either IFM or RUC Bid Cost Recovery charges but not both in the same hour. Since IFM and RUC Bid Cost Recovery is allocated to market participants on a system wide basis, in order to allocate only IFM or only RUC uplift costs to a market participant in an hour would require to net again the total virtual demand across all LAPs with the total virtual supply across LAPs. After system wide netting occurs it would be possible for market participants to net to zero between virtual demand and virtual supply across all three LAPs. This would result in no cost recovery from these market participants and costs would be shifted to other market participants that did not net out system wide which is not a desirable outcome.

7.6.1.1 IFM Tier 1 Uplift (CT 6636) Cost Allocation to Virtual Demand

Charge Type 6636 includes costs of make whole payments for start-up, minimum load and bid costs for resources committed in the IFM. Resources are committed based on bid in Demand

The allocation of IFM Bid Cost Recovery will occur in two steps. In the first step the CAISO will allocate the dollar amount of IFM BCR pro rata between the total net virtual demand in each LAP and the non convergence bid IFM BCR allocation billing determinant (i.e., the sum over all SCs of their respective IFM Demand less IFM self scheduled supply and imports). This means if the total sum of net virtual demand is 0 across all three LAPS there will be no IFM Uplift cost allocated to Virtual Demand.

Example of Step 1 of IFM Tier 1 Uplift Cost Allocation to Virtual Demand

For the purposes of this example we will make the following assumptions:

- Three Market Participants that have bid virtual transactions in three LAPs
- CAISO Forecast = 40,000 MW
- IFM Bid Costs that need to be recovered = $50,000
- Under-scheduled load = 4,000 MW

Load Scheduled Day-Ahead minus Self-Scheduled Generation = 36,000

Demand and Virtual Transactions by LAP

	PG&E	SCE	SDGE	Total
Physical Demand	20,000	16,000	4,000	40,000
Sum of Virtual Demand all SCs	200	3,000	1,300	4,500
Sum of Virtual Supply all SCs	1,800	0	300	2,100
Net Virtual Demand in LAP	0	3,000	1,000	4,000
Net Virtual Supply in LAP	1,600	0	0	1,600

Dollars will be allocated to virtual demand based on the sum of the net virtual demand over all the LAPs which is 4,000 MW. The dollar allocation to Virtual Demand will be the IFM bid costs that must be recovered ($50,000) * the Net Virtual Demand in all LAPs (4,000)/Load scheduled Day-Ahead – Self-Scheduled Generation and Imports (36,000) + Net Virtual Demand across LAPs (4000)

$50,000*(4,000/40,000) = $5,000

In this example $5000 dollars of the $50,000 total IFM bid costs that must be recovered will be allocated to virtual demand.

In the second step the CAISO will allocate IFM cost for virtual demand determined in step 1 ($5,000) to all SCs based on their LAP level Virtual Demand, i.e. based on the ratio of the sum of that SCs virtual demand in all LAPS / sum of virtual demand in all LAPs for all SCs.

Example of Step 2 of IFM Tier 1 Uplift Cost Allocation to Virtual Demand

Cost Allocation by SC

SC	Virtual Demand	Virtual Supply	IFM BCR Costs
SC1	1,000	1,800	1,111
SC2	1,600	0	1,778
SC3	1,900	300	2,111
Total	4,500	2,100	5,000

In the table above it shows that SC1 was allocated $1,111 of IFM Tier 1 BCR Costs based on $5,000 * (1,000/4,500) = $1,429

7.6.1.2 RUC Tier 1 Uplift (CT 6806) Cost Allocation to Virtual Supply

Charge Type 6806 includes costs for make whole payments for resources committed to meet the difference between bid in demand and the CAISO Forecast of Demand.

The allocation of RUC Tier 1 Uplift will occur using the same two step process as described above for the IFM Tier 1 Uplift allocation. In the first step CAISO will allocate the dollar amount RUC BCR pro-rata between the net virtual demand over all LAPs and the non-Convergence Bid IFM BCR allocation billing determinant which would be the under scheduled load over all SCs. If the net virtual demand over all LAPs is zero there will be no RUC Tier 1 Uplift allocated to virtual supply.

Example of Step 1 of RUC Tier 1 Uplift Cost Allocation to Virtual Supply

The following example will use the same assumption listed above under the IFM Tier 1 Uplift Cost allocation example.

Demand and Virtual Transactions by LAP

	PG&E	SCE	SDGE	Total
Physical Load	20,000	16,000	4,000	40,000
Sum of Virtual Demand all SCs	200	3,000	1,300	4,500
Sum of Virtual Supply all SCs	1,800	0	300	2,100
Net Virtual Demand in LAP	0	3,000	1,000	4,000
Net Virtual Supply in LAP	1,600	0	0	1,600

Dollars will be allocated to virtual supply based on the sum of the net virtual supply over all the LAPs which is 1,600 MW. The dollar allocation to Virtual Supply will be the RUC bid costs that must be recovered ($5,000) * the Net Virtual Supply in all LAPs (1600)/under scheduled load across all SCs + Net Virtual Supply across LAPs (5,600)

$5,000* (1,600/5,600) = $1,429

In the second step the CAISO will allocate the RUC cost for virtual supply determined in step 1 ($1,429) to all SCs based on their LAP level virtual supply, i.e. based on the ratio of the sum of that SCs virtual supply in all LAPS / sum of virtual supply in all LAPs for all SCs.

Example of Step 2 of RUC Tier 1 Uplift Cost Allocation to Virtual Supply

Cost Allocation by SC

SC	Virtual Demand	Virtual Supply	IFM BCR Costs	RUC BCR Costs
SC1	1,000	1,800	1,111	1,224
SC2	1,600	0	1,778	0
SC3	1,900	300	2,111	204
Total	4,500	2,100	5,000	1,429

In the chart above it shows that SC1 was allocated $1224 in RUC Tier 1 costs based on

$1,429* (1800/2100) = $1,224

7.6.1.3 IFM Bid Cost Recovery Tier 2 Charges

Charge Type 6637 includes costs for any remaining IFM uplift not covered in Tier 1.

The CAISO proposes to continue to allocate CT 6637 to Measured Physical Demand only.

7.6.1.4 Day-Ahead Residual Unit Commitment (RUC) Tier 2 Charges

Charge Type 6807 relates to costs for remaining RUC Uplift not covered in Tier 1.

The CAISO proposes that CT 6807 continue to be allocated to Physical CAISO Metered Demand only.

7.6.1.5 Real-Time BCR Uplift Charges

Charge Type 6678 includes costs for make whole payments for resources committed in the Real-Time Market.

The CAISO proposes that no costs be allocated to virtual transactions under the existing single Tier charge and continue to allocate these costs to Measured Demand only.

The CAISO has been directed by FERC in the April 20th Order, to develop a proposal for two-tiered allocation of real-time bid cost recovery that could be included in MRTU Release 2. At

that time the CAISO can explore the possibility of allocating a portion of the Tier 1 costs to virtual transactions.

7.6.2 Ancillary Services Cost Allocation

Charge Types 6090, 6196, 6596, 6696

Costs for Ancillary Services procured are charged to load based on the metered load share of the A/S obligation. The CAISO will calculate the SCs Ancillary Services obligation for each service across IFM, HASP, and Real-Time markets based on metered demand and allocate the cost for each service using the user rate.

The CAISO proposes that virtual transactions be exempt from both tier 1 and tier 2 Ancillary Services costs. As discussed in the May 31 Conceptual Proposal, A/S is purchased based on the CAISO forecast and therefore, virtual transactions will have not impact on the quantity of A/S procured.

Tier 2 A/S costs result from the revenue non-neutrality that results from the procurement of A/S using the CAISO Demand Forecast and the calculation of load obligation using actual metered demand. Although it is possible that virtual supply bids could create some cost impact in the procurement of Ancillary Services, such impact is likely to be very minor. Thus the CAISO suggests that exempting virtual supply from Tier 2 A/S costs is warranted for simplicity and justifiable because there would be no major impact upon other market participants.

7.6.3 Grid Management Charge (GMC)

The GMC is an administrative charge that is used to fund the operation and services of the CAISO.

The composition of the GMC under the MRTU markets is the focus of a separate stakeholder process. The methods in which to assess the CAISO's administrative costs to virtual bidding transactions will be addressed in 2009 within the GMC stakeholder process.

In the May 31 Conceptual Proposal the CAISO presented some ideas for consideration on how administrative costs could be applied to virtual transactions. The CAISO welcomes additional ideas and comments from stakeholders on this topic.

7.7 Other Design Elements

The timing when virtual bid settlement data will be available publicly is a critical issue for some market participants. For example, SCE strongly urges the CAISO to release virtual bidding information immediately – preferably after the close of the Day Ahead market. Bidding data should be coded, consistent with the practice for releasing other bidding data, but the code should remain constant through time so the market can track the behavior of the virtual bidding participant through time. The CAISO must investigate this issue further as part of its assessment of feasibility on all components of the convergence bidding design.