California Independent
System Operator Corporation

September 20, 2011

The Honorable Kimberly D. Bose
Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, DC 20426

Re: California Independent System Operator Corporation
Docket No. ER11-____- 000

Tariff Amendment Eliminating Convergence Bidding at the Interties

Dear Secretary Bose:

Pursuant to Section 205 of the Federal Power Act[1] and Sections 35.11 and 35.13 of the Commission's regulations,[2] the California Independent System Operator Corporation (ISO) respectfully submits for filing an amendment to the ISO tariff to eliminate convergence bidding at the interties.[3] While convergence bidding continues to be an important enhancement to the ISO's markets, the ISO has determined that unanticipated issues with price divergence, the allocation of increased real-time imbalance energy offset costs to market participants, and inconsistency between market clearing prices and the bid prices of imported or exported resources due to intertie software constraints warrant the tariff revisions proposed in this filing.

The ISO respectfully requests that the Commission accept the tariff revisions contained in this filing effective as of November 28, 2011.

I. Executive Summary

The ISO proposes to eliminate convergence bidding (sometimes also called virtual bidding) on the interties due to inefficiencies and adverse impacts

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1 16 U.S.C. § 824d.

2 18 C.F.R. §§ 35.11 & 35.13.

3 The ISO originally submitted this filing prior to 5:00 p.m. on September 20, 2011, but due to an issue with the ISO's eTariff software system, the original submittal was not accepted in eTariff. The ISO resubmitted and served the filing after 5:00 p.m. on September 20.

on market participants that the ISO has observed over the months since convergence bidding was implemented in the ISO markets on February 1, 2011.

Convergence bidding was an important market enhancement adopted by the ISO with the expectation that it would provide numerous efficiencies to its energy markets. Primarily, it is intended to enable market participants to financially hedge their physical market positions and arbitrage differences between day-ahead and real-time prices, ultimately leading to better price convergence between these markets and more efficient dispatch of physical resources.

The ISO market structure includes the hourly settlement of interties through the hour-ahead scheduling process and the separate and distinct five-minute settlement for internal resources. This "two-settlement" market structure in the real-time was adopted to accommodate hourly transmission schedules, which prevail in all neighboring areas in the Western interconnection. The hour-ahead scheduling process accommodates intertie scheduling with neighboring regions in the western interconnection. In developing the convergence bidding policy, the ISO and stakeholders recognized that the two-settlement structure posed certain issues that could result in market inefficiencies at the interties. To mitigate for these issues, the Commission approved the ISO's proposal for position limits at the interties that are more stringent than the position limits adopted for internal locations. The position limits adopted are more stringent at the start of convergence bidding to allow for the opportunity to observe and limit any adverse impact resulting from convergence bids at the interties.

With these measures in place, the ISO had hoped to allow the market to benefit from the efficiencies of convergence bidding, but not be severely burdened by any deficiencies. However, the ISO has observed that the underlying real-time market structure requiring two settlements in the real-time is inhibiting the intended market efficiencies associated with convergence bidding at the interties and causing adverse impacts on the market through an increase in market uplifts and the distortion of market prices and incentives. In addition, the ISO has observed that the two software constraints it is required to employ to allow for convergence bidding at the interties periodically is causing market clearing prices at the interties to be inconsistent with the bid prices offered by a physical exporter or importer.

The ISO established two stakeholder initiatives to address these issues. The first stakeholder initiative was launched to examine the increase in uplift associated with an ISO account called the real-time imbalance energy offset. The real-time imbalance energy offset is a real-time neutrality account used to reconcile settlement dollar values for all real-time energy charge codes to ensure that, after all payments and charges have been calculated, there is neither a shortage nor a surplus in revenue. Surpluses or shortages are allocated to scheduling coordinators based on a pro rata share of their measured demand

(real-time metered load and exports). The ISO observed that, after the ISO launched the convergence bidding market enhancements, virtual import bids submitted by scheduling coordinators at the interties that were offset by virtual demand at points within the ISO contributed to uplift associated with the real-time imbalance energy offset, accounting at times for more than fifty percent of total offset shortages.

The ISO launched a second stakeholder initiative to examine scheduling and pricing inconsistencies at the interties. To facilitate convergence bidding at the interties, the ISO adopted the practice of enforcing differing constraints at the interties for purposes of scheduling and pricing. Differing constraints result in inconsistencies between the prices for imports and exports and the bid prices at which schedules are cleared. In the case of imports, the price inconsistencies at times result in increased bid cost recovery for energy settled at locational marginal prices (LMPs) that are lower than the bid-in price. For exports, because the ISO does not provide bid cost recovery to exports, the price discrepancies resulting from the dual constraint resulted in cleared export schedules at prices higher than the prices in which the exports were bid into the ISO market. While this was a known issue before the start of convergence bidding, these issues occurred with greater frequency than anticipated after the start of convergence bidding, raising stakeholder concerns.

Because these two issues were either created or exacerbated as a result of the implementation of convergence bidding at the interties, the ISO conducted these two stakeholder processes together from May to August 2011 to identify potential solutions to both issues. For the reasons explained below, the ISO determined that the alternatives proposed in the stakeholder process were not viable and in some cases would create further problems. The stakeholder process also confirmed that the issues created by convergence bidding at the interties are not offset by the benefits that convergence bidding was supposed to have brought to the ISO markets. In addition, the ISO's analyses showed that the costs of these inefficiencies are borne entirely by parties that do not cause and cannot control the issues.

While convergence bidding is expected to produce convergence of prices between the day-ahead and real-time, virtual bids at the interties are not accomplishing this goal. In fact, at times convergence bidding at the interties is increasing the divergence between the day-ahead and real-time prices. Historically, day-ahead LMPs have been typically lower than real-time prices. The ISO expected that convergence bidding would drive the day-ahead price closer to the real-time price by increasing the day-ahead price and/or reducing real-time prices. However, the opposite seems to be the case. Virtual supply bids at the interties in the day-ahead are driving the day-ahead prices lower, further causing the day-ahead and real-time prices to diverge. Virtual supply at the interties is profitable because the hour-ahead scheduling process price is

less than the day-ahead price. The increased spread between the day-ahead price and the real-time price is the exact opposite of the result that convergence bidding was intended to achieve.

Through the combined stakeholder process, the ISO also determined that eliminating convergence bidding at the interties can actually improve convergence of day-head and real-time prices. Consequently, the ISO proposes that the best way to address the market inefficiencies in the context of a two-settlement real-time market is to eliminate convergence bidding at the interties. As discussed further below, the elimination of convergence biding at the interties eliminates the adverse outcomes observed since the implementation of convergence bidding and does not eliminate any efficiencies gained during this time. The ISO proposes to eliminate convergence bidding at the interties until such time as the ISO can adopt a market structure that does not require the separate settlement of intertie schedules. Such a market structure might be developed in an existing ISO stakeholder process, the renewable integration market and product review phase 2 stakeholder initiative. As the scheduling timelines in the rest of the western interconnection are made to be more granular, the ISO may be able to redesign its market in a way that does not pose the problems identified under the current market structure.

II. Background

A. Convergence Bidding in the ISO Markets

On February 1, 2011, after a lengthy stakeholder process and significant market simulation and testing, the ISO implemented the convergence bidding functionality approved by the Commission for use in the ISO's LMP-based markets.[4]

Convergence bidding is an important market enhancement that is designed to enable market participants to hedge their physical market positions and manage their exposure to the differences between day-ahead and real-time

[4] *See California Independent System Operator Corp.*, 130 FERC ¶ 61,122 (2010) (order accepting convergence bidding design filing); *California Independent System Operator Corp.*, 133 FERC ¶ 61,039 (2010), *order on reh'g and compliance filing*, 134 FERC ¶ 61,070 (orders accepting revisions to the ISO tariff to implement convergence bidding). *See also* Commission Letter Order, Docket No. ER11-2720-000 (Feb. 1, 2011) (order accepting further convergence bidding tariff revisions); Commission Letter Order, Docket No. ER11-2128-003 (Apr. 13, 2011) (same); *California Independent System Operator Corp.*, 136 FERC ¶ 61,156 (2011) (same). The extensive history of the development of the convergence bidding functionality, which the ISO and stakeholders began working on in 2006, is documented in the ISO's filings in those proceedings. *See, e.g.*, ISO convergence bidding design filing, Docket No. ER10-300-000, at 5-8 (Nov. 20, 2009) (Convergence Bidding Design Filing).

prices.[5] Convergence bids – also known as virtual bids – are purely financial bids to buy or sell electricity in the day-ahead market without any obligation to provide or consume electricity.[6] If these bids are cleared in the day-ahead market, they are automatically liquidated with the opposite buy/sell positions at real-time prices.[7] Virtual bids are submitted like other bids in the day-ahead market and are explicitly recognized as not being physical. As its name indicates, one of the main purposes of convergence bidding is to improve the convergence of day-ahead and real-time prices in the ISO's markets.[8]

Like physical bids, convergence bids can be submitted both at the interties and internally within the ISO. However, the settlement rules are different for bids submitted at the interties as compared with bids for internal locations. This is because the market coordination rules applicable to balancing authority areas within the Western interconnection currently require that intertie transactions (*i.e.*, transactions between balancing authority areas) be scheduled on an hourly basis.[9] Therefore, transactions involving convergence bids at the interties must be cleared through the ISO's hour-ahead scheduling process. In contrast, the ISO's internal dispatch and market systems operate at much shorter five-minute real-time dispatch intervals.

Specifically, after the ISO clears the day-ahead market, the ISO re-optimizes imports and exports at the interties in the hour-ahead scheduling process. All changes to hourly intertie schedules for imports and exports are settled financially based on prices produced by this hour-ahead optimization process. Virtual positions at the interties are liquidated in the hour-ahead scheduling process and are settled at the relevant hour-ahead LMP in the same way as any changes in physical intertie schedules in the hour-ahead scheduling process are settled based on the relevant hour-ahead LMP. In contrast, for

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[5] Convergence bidding is also subject to a number of ISO tariff rules regarding qualification of market participants to submit convergence bids, credit requirements, and other rules that are not discussed below.

[6] The terms "convergence" and "virtual" are used interchangeably in this filing: "virtual" emphasizes the non-physical nature of the bids while "convergence" highlights one of the most significant expected benefits of this market feature – convergence of day-ahead and real-time prices.

[7] *See* ISO tariff, Section 11.3.

[8] 130 FERC ¶ 61,122, at P 35 ("Nodal convergence bidding provides benefits that have been well-documented by the Commission. We have found that convergence bidding can . . . improve day-ahead and real-time price convergence . . .").

[9] Under the current rules, intra-hour changes are scheduled between balancing authority areas in the Western Interconnection only in the event of contingencies or to address transmission overloads.

transactions involving internal convergence bids, the ISO conducts a separate market clearing process at five-minute intervals. Virtual positions on eligible pricing locations internal to the ISO are also liquidated in the hour-ahead scheduling process, but are settled at the relevant real-time LMP produced by the five-minute dispatch process.[10]

The convergence bidding design also includes initial position limits, to be gradually phased out, to reduce the total megawatts of convergence bids that a scheduling coordinator can place on behalf of a convergence bidding entity at any one internal pricing node or intertie.[11] The ISO included position limits in the convergence bidding market design believing that the introduction of a major new market design feature such as convergence bidding frequently raises the possibility of unforeseen and unintended market outcomes. The position limits were therefore intended for the early stages of convergence bidding, to ensure that no single market participant can exercise market power at an individual node and to prevent distorted market outcomes, thus protecting customers from unjust and unreasonable rates.

Position limits at internal nodes will be automatically phased out over the course of one year.[12] Position limits at the interties are to be phased out over the course of the sixteen months after convergence bidding was implemented and are more stringent than the internal position limits.[13] The longer phase-out of

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[10] *See* ISO tariff, Section 11.3. Both the hour-ahead scheduling process and the real-time dispatch are conducted in "real-time," as that term is defined in the ISO tariff.

[11] *See* ISO tariff, Section 30.7.3.6.3.

[12] Specifically, the ISO's position limits at internal nodes are:

- Ten percent of the maximum normal capability (PMax) of physical supply resources and forecasts of the maximum megawatt consumption of physical demand resources at the internal nodes for the first eight months;
- 50 percent of the PMax of physical supply resources and forecasts of the maximum megawatt consumption of physical demand resources at the internal nodes for the ninth month through the twelfth month; and
- No position limits will apply starting in the thirteenth month.

See ISO tariff, Section 30.7.3.6.3.1.

[13] Specifically, the ISO's position limits at the interties are:

- Five percent of the applicable operating transfer capability for the first eight months;
- 25 percent of the applicable operating transfer capability for the ninth month through the twelfth month;

position limits at the interties was adopted specifically in recognition that convergence bidding at the interties has the potential to present certain problems that do not apply to convergence bidding at internal nodes.[14]

The Commission approved the ISO's position limits recognizing that the ISO had worked to design a convergence bidding feature that should improve the ISO market and provide for clearer pricing and help avoid noncompetitive market behavior. The Commission also stated that the ISO was being appropriately cautious by gradually implementing the proposal and including the ability to identify problems that may develop and to allow the ISO to work to ensure that problems do not become significant.[15] The ISO has already taken certain preliminary measures to address observed issues with convergence bidding at the interties. On August 26, 2011, the ISO filed a petition for temporary waiver of the ISO tariff provisions that would require the ISO to automatically increase the intertie position limits from five percent to 25 percent on October 1, 2011. The ISO submitted this petition for temporary waiver expressly in anticipation of the filing of this tariff amendment to eliminate convergence bidding at the interties. Commission action on the ISO's petition for temporary waiver is pending.[16]

Since the implementation of convergence bidding, the ISO has enforced two constraints within its market software in the day-ahead market for each intertie scheduling point – a "physical-only" constraint and a separate "physical plus virtual" constraint.[17] These dual constraints are needed to satisfy two fundamental principles: (1) that net physical schedules at the intertie should remain within established scheduling limits, consistent with reliability standards of the North American Electric Reliability Corporation (NERC) and Western Electricity Coordinating Council (WECC); and (2) that consistent with the market structure for internal schedules, virtual and physical schedules are cleared together (*i.e.*, codetermined based on their economic bid prices) in the integrated forward market. The first principle is important not only to ensure compliance with NERC and WECC requirements, but also to provide ISO operators with a

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- 50 percent of the applicable operating transfer capability for the thirteenth through the sixteenth month; and

- No position limits will apply starting in the seventeenth month.

See ISO tariff, Section 30.7.3.6.3.2.

[14] 133 FERC ¶ 61,039, at P 125; 134 FERC ¶ 61,070, at PP 17, 19.

[15] 133 FERC ¶ 61,039 at PP 121-129.

[16] *See* FERC Docket No. ER11- 4384-000.

[17] *See* ISO tariff, Section 31.8.

high level of confidence that physical schedules for imported power will be deliverable. The second principle ensures that virtual and physical bids are both considered and treated equivalently for purposes of determining congestion prices, so that virtual transactions ultimately have the same impact as physical transactions on day-ahead market clearing prices.[18]

The physical-only constraint is designed to meet the first principle discussed above and is enforced only in the scheduling run of the integrated forward market. This constraint requires that physical imports net of physical exports must be less than or equal to the scheduling limit at the intertie scheduling point in the applicable direction (*i.e.*, either into or out of the ISO balancing authority area). The physical-only constraint is needed with or without convergence bidding and thus existed prior to the adoption of convergence bidding.

With the implementation of convergence bidding, the ISO added the physical plus virtual constraint, which is enforced at the interties in both the scheduling run and the pricing run of the integrated forward market. This constraint requires that physical plus virtual imports net of physical plus virtual exports must be less than or equal to the scheduling limit at the intertie scheduling point in the applicable direction. This constraint is used during the pricing run to establish a shared congestion price for physical plus virtual bids at each intertie, consistent with the codetermination principle set forth above. In its Convergence Bidding Design Order, the Commission approved these dual constraints for convergence bidding at the interties.[19]

B. Concerns Identified by the ISO and Stakeholders Regarding Real-time Uplift and Pricing at the Interties

In April 2011, the ISO launched two separate stakeholder initiatives to address issues raised by market participants related to the implementation of convergence bidding. The first stakeholder initiative was established to evaluate and consider measures to address increases in uplift to scheduling coordinators associated with an ISO account called the real-time imbalance energy offset account, and in particular to address increases in uplift caused by differences between the hour-ahead scheduling process prices for convergence bidding transactions at the interties and the real-time dispatch prices for internal

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[18] Convergence Bidding Design Filing at 16-18.

[20] Materials regarding this stakeholder process are available on the ISO website at http://www.caiso.com/informed/Pages/StakeholderProcesses/RealTimeImbalanceEnergyOffset2011.aspx.

convergence bidding transactions.[20] The second stakeholder initiative was established to evaluate and consider measures to address price inconsistencies caused by the enforcement of the dual constraints at the interties described above.[21] The ISO conducted the two stakeholder processes together because they both concerned issues related to convergence bidding on the interties. The tariff revisions contained in this filing were developed pursuant to the combined stakeholder process.[22]

On August 25, 2011, the ISO Governing Board authorized the ISO to submit the tariff revisions to eliminate convergence bidding at the interties.[23] In addition, the ISO's Market Surveillance Committee (MSC)[24] and Department of Market Monitoring (DMM)[25] express support for the removal of convergence bidding at the interties, though both the MSC and the DMM state that the ISO should also consider taking further measures if necessary.

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[20] Materials regarding this stakeholder process are available on the ISO website at http://www.caiso.com/informed/Pages/StakeholderProcesses/RealTimeImbalanceEnergyOffset2011.aspx.

[21] Materials regarding this stakeholder process are available on the ISO website at http://www.caiso.com/informed/Pages/StakeholderProcesses/PriceInconsistencyCausedIntertieConstraints.aspx.

[22] A list of key dates in the combined stakeholder process for this tariff amendment is provided in Attachment G to this filing.

[23] On August 18, 2011, Keith Casey, Vice President, Market & Infrastructure Development, provided a memorandum to the ISO Governing Board regarding the decision to eliminate convergence bidding on the interties. This Board memorandum is provided in Attachment F to this filing and is available on the ISO website at http://www.caiso.com/informed/Pages/BoardCommittees/Default.aspx.

[24] *See* ISO Market Surveillance Committee, Final Opinion on Intertie Convergence Bidding and the Imbalance Energy Offset, at 10-11 (Aug. 16, 2011) (MSC Opinion). The MSC Opinion is provided in Attachment D to this filing and is available on the ISO website at http://www.caiso.com/Documents/FinalOpinion_IntertieConvergenceBidding_ImbalanceEnergyOffset.pdf.

[25] *See* ISO Department of Market Monitoring, Quarterly Report on Market Issues and Performance at 34 (revised Aug. 24, 2011) (DMM Quarterly Report). This report is provided in Attachment E to this filing available on the ISO website at http://www.caiso.com/Documents/RevisedQuarterlyReportonMarketIssuesandPerformance-August2011.pdf.

1. Increases in Price Divergence and Real-Time Imbalance Energy Offset Charges Allocated to Scheduling Coordinators

In order to facilitate sufficient and reliable electric service, the ISO must balance energy supply and demand at all times. To the extent there are energy imbalances that have to be made up for in the real-time market, the ISO must procure for such differences in the real-time. The costs of the ISO's procurements in real-time are accounted and paid for pursuant to the real-time imbalance energy offset.

The real-time imbalance energy offset is an ISO account used to reconcile the settlement dollar values for all real-time energy charge codes to ensure that, after payments and charges for the real-time market have been calculated, there is neither a shortage nor a surplus in revenue.[26] This includes payments and charges for hour-ahead scheduling process energy and various types of real-time energy.[27] Any shortages or surpluses are allocated to all scheduling coordinators based on a pro rata share of their measured demand (*i.e.*, metered load and exports). Therefore, scheduling coordinators may receive a payment or a charge, depending on whether there is a surplus or a shortage in the real-time imbalance energy offset account.[28]

The ISO has experienced higher than expected real-time imbalance energy offset charges since the start of the new market in April 2009 and commenced a stakeholder process to address the issue in the fall of 2009. Through that process, the ISO identified differences between hour-ahead scheduling process prices and real-time dispatch as the main cause of the offset costs. As discussed in the attached testimony of Mark A. Rothleder, Director of Market Analysis and Development for the ISO, pricing trends since 2009 indicate a tendency for prices in the day-ahead to be lower than prices in the real-time, and for prices in the hour-ahead scheduling process to be lower than prices in the real-time market.[29] Figures 1 and 2 in Mr. Rothleder's testimony illustrate these pricing trends.

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[26] There can be no shortage or surplus because the ISO is a not-for-profit, revenue-neutral entity. For this reason, the real-time imbalance energy offset is called a type of "neutrality account."

[27] The real-time imbalance energy offset does not track the congestion costs associated with such imbalances, which are tracked and allocated separately through the real-time congestion offset.

[28] *See* ISO tariff, Section 11.5.4.2.

[29] Direct Testimony of Mark A. Rothleder on behalf of the ISO at 6-8 (Rothleder Testimony). Mr. Rothleder's testimony is provided in Attachment C to this filing.

When hour-ahead scheduling process prices were lower than real-time dispatch prices, which was frequently the case, the ISO had to incur additional costs through the real-time dispatch in order to ensure adequate and reliable service. This additional cost incurrence resulted in an increase in the real-time imbalance energy offset account and thereby resulted in more offset charges being allocated to scheduling coordinators based on their measured demand.

The price differences occurring after the start of the new market were driven by a variety of causes, including market modeling and forecasting issues, limited quantities of short-term ramping capability available to accommodate changes in imbalance conditions, and periodic increases in the energy price cap. Beginning in May 2009, the ISO undertook a number of enhancements to address these issues and improve price convergence between the hour-ahead scheduling process and real-time dispatch.[30]

In February 2011, when the ISO implemented convergence bidding, it anticipated that virtual bids would help to improve price convergence and thereby to reduce real-time imbalance energy offset charges. But contrary to the ISO's expectations, after convergence bidding went into effect, price divergence increased and therefore real-time imbalance energy offset charges also increased. As explained in Mr. Rothleder's testimony, since the implementation of convergence bidding in February 2011, offsetting of virtual supply and demand bids has contributed substantially to real-time imbalance energy offset charges.[31]

As discussed further below, an important contributing factor to the increase in the real-time imbalance energy offset since February 1, 2011 has been the fact that the ISO's two-settlement structure for its real-time market has made it consistently profitable for participants – individually and collectively – to submit virtual bids for supply at interties that are offset by virtual demand bids at locations within the ISO. As discussed in the testimony of Mr. Rothleder, systematic price divergences in the ISO markets that convergence bidding was intended to address make both virtual supply at interties and virtual demand at internal locations consistently profitable. These offsetting virtual supply and demand bids have no impact in terms of price convergence. However, virtual bids for sales at the interties are settled at the hour-ahead scheduling process price, while the internal bids for purchases are settled at the real-time dispatch price. As a result, when the virtual bids on the interties are cleared against the internal bids, and the hour-ahead scheduling process price is less than the real-time dispatch price – as it frequently is – the real-time imbalance energy offset incurs a charge that is allocated to scheduling coordinators.

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30 *See* DMM Quarterly Report at 7-16, 23.

31 *See* Rothleder Testimony at 20-22.

2. Price Inconsistencies Caused by Intertie Constraints

The ISO has also identified a separate and unrelated issue attributable to convergence bidding at the interties that arises due to the dual constraint structure used for these schedules in the day-ahead market. Specifically, the ISO has observed an increase in the frequency with which the market clearing LMP at the intertie is inconsistent with the bid price offered by a physical exporter or importer. This inconsistency is caused by congestion costs that are imposed during the pricing run as a result of virtual bids, but that are not taken into account in unit commitment during the scheduling run due to the physical-only constraint.

As noted above, during the pricing run the physical plus virtual constraint is used to ensure that physical plus virtual bids experience the same congestion price (and LMP) at the intertie. However, as discussed by Mr. Rothleder, this also means that virtual bids can impact the congestion charges that are assessed on physical bids that clear and are selected for scheduling during the scheduling run, including in periods when, under the physical-only constraint used in the scheduling run, no actual physical congestion exists.[32]

For example, under the physical plus virtual constraint, virtual export bids can produce the appearance of congestion that will result in a congestion charge being added to the amount that a physical exporter must pay, even though there is no physical congestion on the intertie. In this situation, the exporter ends up paying a higher amount than its bid price and, under existing market rules, has no means to recoup the difference. Similarly, virtual import bidding can produce a congestion charge that will increase the amount that a physical importer receives for its power above its bid price, even though there is no physical congestion on the intertie. In this situation, ISO market participants end up paying a higher price than the importer would have otherwise received.

These increased congestion costs are not reflected in the initial scheduling run used to establish the MWs that will clear for scheduling purposes because, under the physical-only constraint applicable to that run, only physical interchange bids and schedules are considered. As a result, a physical export or import bidder can have its resource committed pursuant to a bid that is inconsistent with the market clearing LMP that is ultimately established in the pricing run, when congestion costs resulting from virtual bids are established. In such circumstances, convergence bidding on the interties results in prices that are different from the awarded bids.

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[32] *Id.* at 26-30.

In the period since convergence bidding was implemented, the ISO has observed the impacts on importers and exporters discussed above. Specifically, the ISO has observed more frequent cases where physical export bids are clearing the market at LMPs that are inconsistent with (and higher than) the LMPs the exporters offered to pay due to congestion costs imposed by virtual bids. As shown in the testimony of Mr. Rothleder, for the first two months after convergence bidding was introduced, the impact to the market of this issue on the export side was approximately $225,000 per month. Since April 2011, the observed shortages to physical exports went down to approximately $13,000 per month. The ISO has also observed cases where physical import bids are clearing the market at locational marginal prices that are inconsistent with their bids, resulting in higher payments than the importer would otherwise have received. In April 2011, the ISO observed an $800,000 overpayment due to this issue. Since May 2011, the average overpayment has been approximately $24,000 per month.[33]

III. Reasons for Elimination of Convergence Bidding at the Interties

A. The Need to Address the Impact of the Current ISO Market Design and Market Participant Bidding Strategy on Price Convergence and the Real-Time Imbalance Energy Offset

As explained above, the ISO employs a two-settlement real-time market structure, under which convergence bidding transactions at the interties are paid the hour-ahead scheduling process price but internal convergence bidding transactions are paid based on the five-minute real-time dispatch price. These settlement rules are required under the ISO's current market design and cannot readily be changed. Since convergence bidding went into effect in February 2011, the ISO has observed increased price divergence, not the increased price convergence that the ISO expected and that is a primary reason for implementing convergence bidding. Lower hour-ahead scheduling process prices and higher real-time dispatch prices have meant that when virtual bids on the interties clear against internal virtual bids, the result has been an increase in the real-time imbalance energy offset and thus an increase in offset charges allocated to scheduling coordinators.

The persistent average price differential between the hour-ahead scheduling process price and the real-time dispatch price has encouraged market participants to engage in a bidding strategy that drives up the price divergence and the increase in real-time imbalance energy offset charges. As Mr. Rothleder explains, the ISO's two-settlement real-time market structure creates the incentive to submit large volumes of offsetting virtual supply and

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[33] *Id.* at 31-32.

demand bids that do not contribute to the convergence of day-ahead and real-time prices and that also significantly increase real-time imbalance energy offset charges. Mr. Rothleder discusses this bidding strategy at length and provides a numerical example that illustrates its damaging effects.[34]

The majority of the real-time imbalance energy offset since February 2011 has been due to convergence bidding, mostly due to the use of this bidding strategy. As Mr. Rothleder explains, the ISO's results show that offsetting convergence supply and demand bids has contributed an average of $7.5 million per month to real-time imbalance energy offset charges, or a total of $53 million since convergence bidding was implemented in February 2011 which represents about 52 percent of the total real-time imbalance offset costs.[35] Also, the DMM reported that, while average price convergence appears on its face to have improved since February 2011, this improvement is solely the result of averaging hourly prices over the day and the price differences between the hour-ahead scheduling process and real-time dispatch continue to make convergence bidding highly profitable.[36]

The dollar impact on the increase in real-time imbalance energy offset charges is particularly egregious because the vast majority of the impact is on one class of market participants, the scheduling coordinators based on their metered load and exports. The ISO has observed that in most or all cases it has not been the scheduling coordinators representing metered load and exports that have caused the increase in real-time imbalance energy offset charges. However, these scheduling coordinators are the parties that bear the majority of such costs. In contrast, the parties that actually impose these additional costs on these scheduling coordinators are not required to pay any of them.

As the DMM explains, while convergence bidding has added significantly to real-time imbalance energy costs, convergence bidding has had little or no benefit in terms of improving price convergence or the efficiency of day-ahead unit commitment decisions.[37] With regard to unit commitment, if scheduled demand is less than the ISO forecasted demand in the day-ahead market, the ISO's residual unit commitment process procures additional capacity to meet the forecasted demand as well as any forecasted shortfalls of minimum generation requirements. Cleared virtual supply often outweighs cleared virtual demand and, as a result, more units are committed in the residual unit commitment

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34 *Id.* at 10-16. *See also* MSC Opinion at 4-5 (describing the bidding strategy).

35 Rothleder Testimony at 20-22.

36 DMM Quarterly Report at 9, 20.

37 *Id.* at 4.

process. Accordingly, more residual unit commitment capacity is needed to replace the net virtual supply with physical supply. This situation is likely to increase the direct costs and bid cost recovery payments associated with residual unit commitment.

In addition, Mr. Rothleder explains that the offsetting virtual import and demand bids used under the bidding strategy discussed above do not promote price convergence or serve any other operational purpose. Since these bids are offsetting, they do not lead to a change in day-ahead unit commitment or improved system-wide market efficiency. Instead, the offsetting bids only contribute to increases charges assessed to scheduling coordinators pursuant to the real-time imbalance energy offset.[38]

In sum, convergence bidding at the interties, and especially the use of the bidding strategy described above and in Mr. Rothleder's testimony, have caused a number of adverse market impacts without providing the intended benefit of price convergence. Eliminating the ability to submit virtual bids at the interties as soon as practicable will immediately and effectively resolve these adverse market impacts. Based on the ISO's past observation that convergence bidding accounts for the majority of real-time imbalance energy offset costs, the ISO estimates that eliminating convergence bidding at the interties will reduce the cost of the real-time imbalance energy offset significantly. As the DMM and MSC note, while additional steps can and should be taken to achieve further reductions in real-time imbalance energy offset costs, there is no need to defer elimination of convergence bidding at the interties while these additional measures are considered or implemented.[39]

Further, elimination of convergence bidding at the interties is expected to allow internal convergence bidding to achieve increased price convergence. As discussed above and by Mr. Rothleder, convergence bidding at the interties has had the perverse effect of causing further divergence between day-ahead and real-time prices. The divergence between the hour-ahead and real-time market prices has incentivized virtual bids at the interties that indirectly arbitrage the spread between the hour-ahead scheduling process and real-time market and fail to contribute to the convergence of prices in these two markets. During periods when real-time prices tend to exceed day-ahead prices, virtual demand bids at locations within the ISO would continue to be profitable. The submission of net demand at the internal locations would increase unit commitment performed in the day-ahead market and help to moderate real-time prices.[40]

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[38] Rothleder Testimony at 14.

[39] DMM Quarterly Report at 34; MSC Opinion at 10-11.

[40] Rothleder Testimony at 34-35; DMM Quarterly Report at 19.

B. The Need to Address the Impact of the Current ISO Market Design on Price Consistency

The costs resulting from the use of dual intertie constraints have been substantial. As Mr. Rothleder explains, for the first two months after convergence bidding was introduced, the impact to the market of this issue on the export side was approximately $225,000 per month. Since April 2011, the observed shortages to physical exports went down to approximately $13,000 per month. The ISO has also observed cases where physical import bids are clearing the market at locational marginal prices that are inconsistent with their bids, resulting in higher payments than the importer would otherwise have received. In April 2011, the ISO observed an $800,000 overpayment due to this issue. Since May 2011, the average overpayment has been approximately $24,000 per month.[41]

Eliminating convergence bidding at the interties will have the immediate benefit of dispensing with the need to enforce two constraints at the interties, because there will no longer be any intertie convergence bids to which the two constraints need to be applied. As explained by Mr. Rothleder, physical schedules at the interties will no longer be subject to pricing that is inconsistent with their submitted bids. This change will remove the need to make export schedules whole when exposed to higher prices resulting from the enforcement of the physical plus virtual constraint in the pricing run. In addition, eliminating convergence bidding at the interties will eliminate payments for imports above the bid cost structure submitted by scheduling coordinators resulting from the dual constraints.[42]

IV. The ISO's Consideration of Alternative Proposals

As part of the combined stakeholder process that led to the ISO's decision to eliminate convergence bidding at the interties, the ISO reviewed with stakeholders a number of possible alternatives to eliminating convergence bidding at the interties. After weighing these possible alternative approaches, the ISO determined that none of them adequately address the problems of price divergence, increased real-time imbalance energy costs, and price inconsistency, or concluded that the proposed alternative approaches create other problems. These alternative proposals are discussed below.

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41 Rothleder Testimony at 31-32.

42 *Id.* at 34.

A. Cost Allocation of Real-Time Imbalance Energy Offset

During the 2009 stakeholder process to address issues related to the real-time imbalance energy offset, the ISO worked with stakeholders to determine whether the current design of the allocation of the real-time imbalance energy offset was appropriate. At that time, no clear alternative could be identified because it was unclear whether specific market activity was causing the issue. During the stakeholder process leading to this filing, the allocation of the offset was reviewed again, but there still was no consensus on an alternative approach. Moreover, the ISO believes that this cost allocation issue is better addressed through a longer-term comprehensive review of a larger set of cost allocation issues being addressed in the renewable integration market and product review phase 2 stakeholder initiative (discussed below).

B. Prohibit Offsetting Internal and External Virtual Bids

The ISO considered implementing a rule that would prohibit scheduling coordinators from placing offsetting internal and external virtual positions. This rule would be designed to address the impact of individual scheduling coordinators' offsetting positions on the real-time imbalance energy offset costs. However, the ISO determined that such a rule would be easily undermined by potential collusive transactions involving two or more scheduling coordinators that could effectively implement the same bidding strategy. As a result, the ISO concluded that this is not a viable option.

C. Implement a Settlement Rule that Would Neutralize the Price Arbitrage of the Hour-Ahead Scheduling Process and Real-Time Dispatch

Under this option, a new settlement rule would be invoked for each scheduling coordinator that would result in a charge or credit based upon the price difference between the hour-ahead scheduling process and real-time dispatch for the scheduling coordinator's offsetting supply and demand position at the interties and internal to the ISO. Although this initially appeared to be a targeted and effective solution to the real-time uplift issues caused by convergence bidding, stakeholders raised significant concerns that the rule could easily be subverted through bilateral arrangements outside of the ISO markets.

D. Convergence Bidding Liquidation and Settlement Timing

The ISO also considered modifications to the timing of convergence bidding liquidation and settlement. Specifically, the ISO considered keeping day-ahead awarded internal virtual supply and demand positions in the hour-ahead scheduling process, on the theory that doing so would lead to better convergence between the integrated forward market, hour-ahead scheduling process, and

real-time dispatch. However, this option poses potential reliability risks given the importance of imports to meeting ISO load. For example, in the case where there is net internal virtual supply, the ISO would be unable to secure additional physical imports in the hour-ahead scheduling process to replace the net internal virtual supply.

E. Pay As-Bid

Under this option, intertie schedules produced in the hour-ahead scheduling process would be paid their submitted bid price as opposed to a market clearing price. This approach is problematic in that it could result in significant market inefficiencies as market participants would have incentives to submit intertie bids as close as possible to what they expected the expected clearing price to be instead of their marginal costs of providing the energy. This would preclude the ISO from selecting the most efficient mix of imported and exported energy supplies to meet its operational needs.

F. Pay As-Bid or Better

Under this option, an import resource would receive either the market clearing price or its own bid, whichever was higher, and an export resource would pay either the market clearing price or its own bid, whichever was lower. In situations where the resource's bid, rather than the market clearing price, was the better price, the ISO would add an uplift payment to the market clearing price to enable that resource to receive its bid cost. This option is problematic because it creates an incentive for intertie resources to bid in a manner that increases uplift costs. This occurs because resources have an incentive to bid large quantities of offsetting import and export energy (which to a significant extent offset one another, in which case no energy is actually received by or provided to the system), so that load is being charged significant amounts for the ensuing uplift costs without receiving any concomitant benefits.

G. New York ISO Approach

Like the California ISO, the New York ISO is a large net importer of power and has a similar hour-ahead scheduling process. If there is no congestion on the interties during the hour-ahead scheduling process, the New York ISO will schedule imports and exports, and the price used for settlements will be computed as the time-weighted average real-time price. Imports receive a bid production cost guarantee such that if the real-time price is lower than their offer price, the imports will be paid their offer price. There is no price assurance for exports. If congestion exists on the interties during the hour-ahead scheduling process, different settlement rules apply to the intertie transactions. The California ISO concluded that these rules would not be appropriate to address the particular issues discussed in this filing.

V. The Ongoing ISO Stakeholder Process to Consider Modifications to the ISO Market Design

The ISO recognizes that another path for addressing the issues with price convergence, the real-time imbalance energy offset charges, and price inconsistency discussed in this filing would be to make fundamental changes to the ISO's existing market design, and specifically to modify the two settlement time frames in real-time. The ISO has begun a stakeholder process that hopefully will achieve these types of far-reaching market design changes – the renewables integration market and product review phase 2 initiative.[43] However, this process must consider a wide range of factors in determining the appropriate long-term enhancements to the design of the ISO's markets. The stakeholder process was initiated only this past spring, and the ISO does not expect it to be completed in the near future. In these circumstances, it is reasonable to eliminate convergence bidding at the interties, at least until such time as that stakeholder process (or some other stakeholder process) may lead to resolution of fundamental market design issues. At that time, the ISO may convene a new stakeholder process to determine whether convergence bidding at the interties should be reinstituted.

VI. Proposed Tariff Revisions

The ISO proposes to modify or delete the following provisions of its tariff that currently enable convergence bidding at the interties, and to make several minor clarifications of the tariff language:

- The ISO proposes to modify Section 11.2.4.1 of the tariff to remove references in that section to scheduling points. A *scheduling point* is defined in Appendix A to the tariff as a location at which the ISO controlled grid or a transmission facility owned by a transmission ownership right holder is connected, by a group of transmission paths for which a physical, non-simultaneous transmission capacity rating has been established for congestion management, to transmission facilities that are outside the ISO's operational control.

- The ISO proposes to modify Section 11.2.4.6 of the tariff to reference the defined term *transmission constraint*, which replaced the defined term *constraint* in an ISO tariff amendment previously approved by the Commission.[44]

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[43] Materials regarding this stakeholder process are available on the ISO website at http://www.caiso.com/informed/Pages/StakeholderProcesses/RenewablesIntegrationMarketProductReviewPhase2.aspx.

[44] *See California Independent System Operator Corp.*, 134 FERC ¶ 61,140, at P 14 (2011).

- The ISO proposes to delete the sentence in Section 11.3.1 of the tariff regarding charges to scheduling coordinators with virtual supply awards at an intertie. The ISO also proposes to delete the sentence in Section 11.3.2 of the tariff regarding payments to scheduling coordinators with virtual demand awards at an intertie.

- The ISO proposes to modify Sections 12.8.2 and 12.8.4, regarding settlement of virtual bids, to delete references in those sections to locational marginal prices in the hour-ahead scheduling process for virtual supply bids and virtual demand bids at the interties.

- The ISO proposes to delete language regarding interties from Section 30.7.3.6.3 of the tariff, which concerns position limits. The ISO also proposes to delete Section 30.7.3.6.3.2 of the tariff, regarding position limits at the interties, in its entirety.

- The ISO proposes to modify Section 30.8 of the tariff, regarding the prohibition on bids on out-of-service paths at scheduling points, to delete a reference to virtual bids.

- The ISO proposes to modify Section 30.9 of the tariff, regarding virtual bids, to delete provisions stating that virtual bids include energy bids submitted at pricing nodes and aggregated pricing nodes located at an intertie where virtual bidding is permitted.

- The ISO proposes to delete Section 31.8 of the tariff, regarding constraints at scheduling points for interties, in its entirety.

- The ISO proposes to delete, from the definition of the term *eligible pricing node* in Appendix A to the tariff, language stating that an eligible pricing node includes a pricing node located at an intertie where virtual bidding is permitted. The ISO also proposes to modify the definition to state that an eligible pricing node does not include scheduling points.

- The ISO proposes to delete, from the definition of the term *real-time congestion offset* in Appendix A to the tariff, references to the hour-ahead scheduling process.

VII. Effective Date

The ISO respectfully requests that the Commission accept the tariff revisions contained in this filing effective as of November 28, 2011.

VIII. Communications

The ISO requests that all correspondence, pleadings, and other communications concerning this filing be served upon the following:

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pursuant to 18 C.F.R. § 203(b)(3).

IX. Service

The ISO has served copies of this transmittal letter, and all attachments, on the California Public Utilities Commission, the California Energy Commission, and all parties with effective Scheduling Coordinator Service Agreements under the ISO tariff. In addition, the ISO is posting this transmittal letter and all attachments on the ISO website.

X. Attachments

The following documents, in addition to this transmittal letter, support the instant filing:

Attachment A	Revised ISO tariff sheets that incorporate the proposed changes described above
Attachment B	The proposed changes to the ISO tariff shown in black-line format
Attachment C	Direct Testimony of Mark A. Rothleder
Attachment D	Market Surveillance Committee Opinion

Attachment E	ISO Department of Market Monitoring Quarterly Report on Market Issues and Performance, August 24, 2011
Attachment F	Memorandum to ISO Governing Board
Attachment G	List of key dates in the combined stakeholder process for this tariff amendment

XI. Conclusion

For all the foregoing reasons, the Commission should accept the ISO's proposed revisions to its tariff to become effective on November 28, 2011. Please contact the undersigned if you have any questions concerning this matter.

Respectfully submitted,

By: /s/ Anna A. McKenna

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California Independent System Operator Corporation

Fifth Replacement FERC Electric Tariff

Convergence Bidding at the Interties Amendment

Attachment A - Clean Tariff

September 20, 2011

11.2.4.1 Calculation of the IFM Congestion Charge

For each Settlement Period of the IFM, the CAISO shall calculate the IFM Congestion Charge as the IFM MCC amount for all scheduled Demand and Virtual Supply Awards minus the IFM MCC amount for all scheduled Supply and Virtual Supply Awards. The IFM MCC amount for all scheduled Demand and Virtual Demand Awards is the sum of the products of the IFM MCC and the total of the MWh of Demand scheduled in the Day-Ahead Schedule and Virtual Supply Awards at all the applicable PNodes and Aggregated Pricing Nodes for the Settlement Period. The IFM MCC amount for all scheduled Supply and Virtual Supply Awards is the sum of the products of the IFM MCC and the total of the MWh of Supply scheduled in the Day-Ahead Schedule and the Virtual Supply Awards at all the applicable PNodes for the Settlement Period.

* * *

11.2.4.6 Adjustment of CRR Revenue

The CAISO will adjust the revenue from the CRRs of a CRR Holder that is also a Convergence Bidding Entity, and will adjust the revenue from the CRRs of a CRR Holder (regardless of whether the CRR Holder is also a Convergence Bidding Entity) where the Scheduling Coordinator representing that CRR Holder has reduced a Day-Ahead import or export Schedule in the HASP as set forth in Section 11.32, whenever the virtual bidding activity on behalf of that entity or a reduction to a Day-Ahead import or export Schedule in the HASP has had a significant impact on the value of the CRRs in the DAM as determined in accordance with the following steps.

(a) For purposes of this Section 11.2.4.6 and the definition of Flow Impact, any reduction by a Scheduling Coordinator submitting Schedules on behalf of an entity that is a CRR Holder to an import or export Schedule in the HASP will be treated as a Virtual Award. For each CRR Holder subject to this Section 11.2.4.6, for each hour, and for each Transmission Constraint binding in the IFM, HASP, or RTD, the CAISO will calculate the Flow Impact of the Virtual Awards awarded to the Scheduling Coordinator that represents the CRR Holder, excluding Virtual Awards at LAPs and generation Trading Hubs.

(b) The CAISO will determine the peak and off-peak hours of the day in which Congestion on the Transmission Constraint was significantly impacted by the Virtual Awards awarded to the Scheduling Coordinator that represents the CRR Holder. Congestion on the Transmission Constraint will be deemed to have been significantly impacted by the Virtual Awards awarded to the Scheduling Coordinator that represents the CRR Holder if the Flow Impact passes two criteria. First, the Flow Impact must be in the direction to increase the value of the CRR Holder's CRR portfolio. Second, the Flow Impact must exceed the threshold percentage of the flow limit for the Transmission Constraint. The threshold percentage is ten (10) percent of the flow limit for each Transmission Constraint.

(c) For each peak or off-peak hour that passes both criteria in Section 11.2.4.6(b), the CAISO will compare the Transmission Constraint's impact on the Day-Ahead Market value of the CRR Holder's CRR portfolio with the Transmission Constraint's impact on the HASP or Real-Time Market value of the CRR Holder's CRR portfolio, as applicable.

(d) The CAISO will adjust the peak or off-peak period revenue from the CRR Holder's CRRs in the event that, over the peak or off-peak period of a day, the Transmission Constraint's contribution to the Day-Ahead Market value of the CRR Holder's CRR portfolio exceeds the Transmission Constraint's contribution to the HASP or Real-Time Market value of the CRR Holder's CRR portfolio, as applicable. The amount of the peak period adjustment will be the amount by which the Transmission Constraint's contribution to the Day-Ahead Market value of the CRR Holder's CRR portfolio exceeds the Transmission Constraint's contribution to the HASP or Real-Time Market value of the CRR Holder's CRR portfolio for the peak-period hours that passed both criteria in Section 11.2.4.6(b), as applicable. The amount of the off-peak period adjustment will be the amount by which the Transmission Constraint's contribution to the Day-

Ahead Market value of the CRR Holder's CRR portfolio exceeds the Transmission Constraint's contribution to the HASP or Real-Time Market value of the CRR Holder's CRR portfolio for the off-peak period hours that passed both criteria in Section 11.2.4.6(b), as applicable.

All adjustments of CRR revenue calculated pursuant to this Section 11.2.4.6 will be added to the CRR Balancing Account.

* * *

11.3.1 Virtual Supply Awards

The CAISO will pay each Scheduling Coordinator with Virtual Supply Awards at an Eligible PNode or Eligible Aggregated PNode an amount equal to the Day-Ahead LMP at the Eligible PNode or Eligible Aggregated PNode multiplied by the MWhs of Virtual Supply Awards. Virtual Supply Awards subject to price correction will be settled as specified in Section 11.21. The CAISO will charge each Scheduling Coordinator with Virtual Supply Awards at an Eligible PNode or Eligible Aggregated PNode an amount equal to the simple hourly average of the Dispatch Interval Real-Time LMPs at the Eligible PNode or Eligible Aggregated PNode multiplied by the MWhs of Virtual Supply Awards.

11.3.2 Virtual Demand Awards

The CAISO will charge each Scheduling Coordinator with Virtual Demand Awards at an Eligible PNode or Eligible Aggregated PNode an amount equal to the Day-Ahead Market LMP at the Eligible PNode or Eligible Aggregated PNode multiplied by the MWhs of Virtual Demand Awards. Virtual Demand Awards subject to price correction will be settled as specified in Section 11.21. The CAISO will pay each Scheduling Coordinator with Virtual Demand Awards at an Eligible PNode or Eligible Aggregated PNode an amount equal to the simple hourly average of the Dispatch Interval Real-Time LMPs at the Eligible PNode or Eligible Aggregated PNode multiplied by the IFM MWhs of Virtual Demand Awards.

* * *

12.8.2 Virtual Bid Reference Prices

For Virtual Supply Bids, the Virtual Bid Reference Price will be the 95th percentile value of the difference between the LMP in the Real-Time Market and the LMP in the Day-Ahead Market at a given Eligible PNode or Eligible Aggregated PNode. For Virtual Demand Bids, the Virtual Bid Reference Price will be

the 95th percentile value of the difference between the LMP in the Day-Ahead Market and the LMP in the Real-Time Market at a given Eligible PNode or Eligible Aggregated PNode. Each Virtual Bid Reference Price will be calculated in $/MWh. The CAISO will calculate the Virtual Bid Reference Price for each Eligible PNode or Eligible Aggregated PNode for three-month periods (covering January-March, April-June, July-September, and October-December) of each year using the hourly actual LMPs for the same period of the previous year.

* * *

12.8.4 Adjustment of EAL After the Close of the RTM

After the Real-Time Market closes, the CAISO will recalculate the total liability of each Scheduling Coordinator with Virtual Awards based on the MW quantity that cleared in the Day-Ahead Market and the LMPs produced in the Day-Ahead Market and Real-Time Market. The total liability of a Scheduling Coordinator will equal the sum of the liability of each Virtual Bid submitted by the Scheduling Coordinator that cleared in the Day-Ahead Market. The liability of a Virtual Supply Bid will equal the product of the value of the amount of cleared MWs multiplied by the difference between the Real-Time LMP and the Day-Ahead LMP at the Eligible PNode or Eligible Aggregated PNode at which the Virtual Supply Bid was submitted. The liability of a Virtual Demand Bid will equal the product of the value of the amount of cleared MWs multiplied by the difference between the Day-Ahead LMP and the Real-Time LMP at the Eligible PNode or Eligible Aggregated PNode at which the Virtual Demand Bid was submitted. The Estimated Aggregate Liability will be adjusted accordingly and will continue to be adjusted as a result of any price correction made in accordance with Section 35.

* * *

30.7.3.6.3 Position Limits

For each Convergence Bidding Entity, the CAISO will reject all Virtual Bids submitted by its Scheduling Coordinator at any Eligible PNode or Eligible Aggregated PNode (other than a Default LAP or Trading Hub) that exceed the position limits specified in this Section 30.7.3.6.3. If the Scheduling Coordinator uses multiple SCIDs on behalf of a Convergence Bidding Entity, the position limits will apply to the sum of those Virtual Bids submitted at the Eligible PNode or Eligible Aggregated PNode (other than a Default

LAP or Trading Hub). The CAISO will perform all position limit calculations based on the highest Virtual Bid segment MW point submitted in the Virtual Bid Curve. The CAISO will not net Virtual Supply Bids and Virtual Demand Bids in performing the position limit calculations. The affected Scheduling Coordinator will be provided notice that position limits have been violated. If the Scheduling Coordinator does not resubmit Virtual Bids within the position limits, the CAISO will reject Virtual Bids for all hours at each Eligible PNode or Eligible Aggregated PNode (other than a Default LAP or Trading Hub) where the position limits are violated. Position limits only apply to Eligible PNodes or Eligible Aggregated PNodes (other than Default LAPs or Trading Hubs).

* * *

*** * ***

30.8 Bids On Out-Of-Service Paths At Scheduling Points Prohibited

Scheduling Coordinators shall not submit any Bids or ETC Self-Schedules at Scheduling Points using a transmission path for any Settlement Period for which the Operating Transfer Capability for that path is zero (0) MW. The CAISO shall reject Bids or ETC Self-Schedules submitted at Scheduling Points where the Operating Transfer Capability on the transmission path is zero (0) MW. If the Operating Transfer Capability of a transmission path at the relevant Scheduling Point is reduced to zero (0) after Day-Ahead Schedules have been issued, then, if time permits, the CAISO shall direct the responsible Scheduling Coordinators to reduce all MWh associated with the Bids on such zero-rated transmission paths to zero (0) in the HASP. As necessary to comply with Applicable Reliability Criteria, the CAISO shall reduce any non-zero (0) HASP Bids across zero-rated transmission paths to zero after the Market Close for the HASP.

30.9 Virtual Bids

Virtual Bids are Energy Bids that may be submitted only in the Day-Ahead Market, at Eligible PNodes or Eligible Aggregated PNodes,where virtual bidding is permitted, by Scheduling Coordinators representing Convergence Bidding Entities. Virtual Bids are either Virtual Supply Bids or Virtual Demand Bids. A Virtual Bid submitted in the Day-Ahead Market and cleared in the IFM represents a commitment to liquidate a Day-Ahead award in the Real-Time Market at the price determined for the applicable Eligible

PNode or Eligible Aggregated PNode as set forth in Section 11.3. For each SCID associated with a Convergence Bidding Entity, there may be only one Virtual Supply Bid and one Virtual Demand Bid per each Eligible PNode or Eligible Aggregated PNode in the Day-Ahead Market. The minimum size of a segment of a Virtual Bid is one (1) MW.

* * *

31.8 [Not Used]

Appendix A
Master Definitions Supplement

*** * ***

- Eligible PNode
A PNode, not including scheduling points, where either physical supply or demand is located and where virtual bidding is permitted.

* * *

- Real-Time Congestion Offset
For each Settlement Period of the HASP and RTM, the CAISO shall calculate the Real-Time Congestion Offset as the difference of 1) the sum of the products of the total of the Demand Imbalance Energy and Virtual Supply liquidated as demand in the RTM and the RTM MCC at the relevant Location; and 2) the sum of the products of the total of the Supply Imbalance Energy and Virtual Demand liquidated as supply in the RTM and the RTM MCC at the relevant Location; including also the sum of RTM and HASP Congestion Charges for Intertie Ancillary Services Awards, and excluding the HASP and RTM Congestion Credit for ETCs and TORs calculated as provided in Section 11.5.7.1. The Real-Time Congestion Offset is allocated as provided in Section 11.5.4.2.

* * *

California Independent System Operator Corporation

Fifth Replacement FERC Electric Tariff

Convergence Bidding at the Interties Amendment

Attachment B - Marked Tariff

September 20, 2011

11.2.4.1 Calculation of the IFM Congestion Charge

For each Settlement Period of the IFM, the CAISO shall calculate the IFM Congestion Charge as the IFM MCC amount for all scheduled Demand and Virtual Supply Awards minus the IFM MCC amount for all scheduled Supply and Virtual Supply Awards. The IFM MCC amount for all scheduled Demand and Virtual Demand Awards is the sum of the products of the IFM MCC and the total of the MWh of Demand scheduled in the Day-Ahead Schedule and Virtual Supply Awards at all the applicable PNodes~~,~~ ~~Scheduling Points~~ and Aggregated Pricing Nodes for the Settlement Period. The IFM MCC amount for all scheduled Supply and Virtual Supply Awards is the sum of the products of the IFM MCC and the total of the MWh of Supply scheduled in the Day-Ahead Schedule and the Virtual Supply Awards at all the applicable PNodes ~~and Scheduling Points~~ for the Settlement Period.

* * *

11.2.4.6 Adjustment of CRR Revenue

The CAISO will adjust the revenue from the CRRs of a CRR Holder that is also a Convergence Bidding Entity, and will adjust the revenue from the CRRs of a CRR Holder (regardless of whether the CRR Holder is also a Convergence Bidding Entity) where the Scheduling Coordinator representing that CRR Holder has reduced a Day-Ahead import or export Schedule in the HASP as set forth in Section 11.32, whenever the virtual bidding activity on behalf of that entity or a reduction to a Day-Ahead import or export Schedule in the HASP has had a significant impact on the value of the CRRs in the DAM as determined in accordance with the following steps.

(a) For purposes of this Section 11.2.4.6 and the definition of Flow Impact, any reduction by a Scheduling Coordinator submitting Schedules on behalf of an entity that is a CRR Holder to an import or export Schedule in the HASP will be treated as a Virtual Award. For each CRR Holder subject to this Section 11.2.4.6, for each hour, and for each Transmission Constraint binding in the IFM, HASP, or RTD, the CAISO will calculate the Flow Impact of the Virtual Awards awarded to the Scheduling Coordinator that represents the CRR Holder, excluding Virtual Awards at LAPs and generation Trading Hubs.

(b) The CAISO will determine the peak and off-peak hours of the day in which Congestion on the Transmission Constraint was significantly impacted by the Virtual Awards awarded to the Scheduling Coordinator that represents the CRR Holder. Congestion on the Transmission Constraint will be deemed to have been significantly impacted by the Virtual Awards awarded to the Scheduling Coordinator that represents the CRR Holder if the Flow Impact passes two criteria. First, the Flow Impact must be in the direction to increase the value of the CRR Holder's CRR portfolio. Second, the Flow Impact must exceed the threshold percentage of the flow limit for the Transmission Constraint. The threshold percentage is ten (10) percent of the flow limit for each Transmission Constraint.

(c) For each peak or off-peak hour that passes both criteria in Section 11.2.4.6(b), the CAISO will compare the Transmission Constraint's impact on the Day-Ahead Market value of the CRR Holder's CRR portfolio with the Transmission Constraint's impact on the HASP or Real-Time Market value of the CRR Holder's CRR portfolio, as applicable.

(d) The CAISO will adjust the peak or off-peak period revenue from the CRR Holder's CRRs in the event that, over the peak or off-peak period of a day, the Transmission Constraint's contribution to the Day-Ahead Market value of the CRR Holder's CRR portfolio exceeds the Transmission Constraint's contribution to the HASP or Real-Time Market value of the CRR Holder's CRR portfolio, as applicable. The amount of the peak period adjustment will be the amount by which the Transmission Constraint's contribution to the Day-Ahead Market value of the CRR Holder's CRR portfolio exceeds the Transmission Constraint's contribution to the HASP or Real-Time Market value of the CRR Holder's CRR portfolio for the peak-period hours that passed both criteria in Section 11.2.4.6(b), as applicable. The amount of the off-peak period adjustment will be the amount by which the Transmission Constraint's contribution to the Day-

Ahead Market value of the CRR Holder's CRR portfolio exceeds the Transmission Constraint's contribution to the HASP or Real-Time Market value of the CRR Holder's CRR portfolio for the off-peak period hours that passed both criteria in Section 11.2.4.6(b), as applicable.

All adjustments of CRR revenue calculated pursuant to this Section 11.2.4.6 will be added to the CRR Balancing Account.

* * *

11.3.1 Virtual Supply Awards

The CAISO will pay each Scheduling Coordinator with Virtual Supply Awards at an Eligible PNode or Eligible Aggregated PNode an amount equal to the Day-Ahead LMP at the Eligible PNode or Eligible Aggregated PNode multiplied by the MWhs of Virtual Supply Awards. Virtual Supply Awards subject to price correction will be settled as specified in Section 11.21. The CAISO will charge each Scheduling Coordinator with Virtual Supply Awards at an Eligible PNode or Eligible Aggregated PNode an amount equal to the simple hourly average of the Dispatch Interval Real-Time LMPs at the Eligible PNode or Eligible Aggregated PNode multiplied by the MWhs of Virtual Supply Awards. ~~The CAISO will charge each Scheduling Coordinator with Virtual Supply Awards at an Intertie an amount equal to the simple hourly average of the fifteen (15) minute HASP Intertie LMPs multiplied by the MWhs of Virtual Supply Awards.~~

11.3.2 Virtual Demand Awards

The CAISO will charge each Scheduling Coordinator with Virtual Demand Awards at an Eligible PNode or Eligible Aggregated PNode an amount equal to the Day-Ahead Market LMP at the Eligible PNode or Eligible Aggregated PNode multiplied by the MWhs of Virtual Demand Awards. Virtual Demand Awards subject to price correction will be settled as specified in Section 11.21. The CAISO will pay each Scheduling Coordinator with Virtual Demand Awards at an Eligible PNode or Eligible Aggregated PNode an amount equal to the simple hourly average of the Dispatch Interval Real-Time LMPs at the Eligible PNode or Eligible Aggregated PNode multiplied by the IFM MWhs of Virtual Demand Awards. ~~The CAISO will pay each Scheduling Coordinator with Virtual Demand Awards at an Intertie an amount equal~~

~~to the simple hourly average of the fifteen (15) minute HASP Intertie LMPs multiplied by the Day-Ahead MWhs of Virtual Demand Awards.~~

* * *

12.8.2 Virtual Bid Reference Prices

For Virtual Supply Bids, the Virtual Bid Reference Price will be the 95th percentile value of the difference between the LMP in the Real-Time Market ~~(or in the HASP for Virtual Supply Bids at the Interties)~~ and the LMP in the Day-Ahead Market at a given Eligible PNode or Eligible Aggregated PNode. For Virtual Demand Bids, the Virtual Bid Reference Price will be the 95th percentile value of the difference between the LMP in the Day-Ahead Market and the LMP in the Real-Time Market ~~(or in the HASP for Virtual Demand Bids at the Interties)~~ at a given Eligible PNode or Eligible Aggregated PNode. Each Virtual Bid Reference Price will be calculated in $/MWh. The CAISO will calculate the Virtual Bid Reference Price for each Eligible PNode or Eligible Aggregated PNode for three-month periods (covering January-March, April-June, July-September, and October-December) of each year using the hourly actual LMPs for the same period of the previous year.

* * *

12.8.4 Adjustment of EAL After the Close of the RTM

After the Real-Time Market closes, the CAISO will recalculate the total liability of each Scheduling Coordinator with Virtual Awards based on the MW quantity that cleared in the Day-Ahead Market and the LMPs produced in the Day-Ahead Market~~, HASP,~~ and Real-Time Market. The total liability of a Scheduling Coordinator will equal the sum of the liability of each Virtual Bid submitted by the Scheduling Coordinator that cleared in the Day-Ahead Market. The liability of a Virtual Supply Bid will equal the product of the value of the amount of cleared MWs multiplied by the difference between the Real-Time LMP~~or HASP LMP, as appropriate,~~ and the Day-Ahead LMP at the Eligible PNode or Eligible Aggregated PNode at which the Virtual Supply Bid was submitted. The liability of a Virtual Demand Bid will equal the product of the value of the amount of cleared MWs multiplied by the difference between the Day-Ahead LMP and the Real-Time LMP~~or HASP LMP, as appropriate,~~ at the Eligible PNode or Eligible Aggregated PNode at which the Virtual Demand Bid was submitted. The Estimated Aggregate Liability will be

adjusted accordingly and will continue to be adjusted as a result of any price correction made in accordance with Section 35.

* * *

30.7.3.6.3 Position Limits

For each Convergence Bidding Entity, the CAISO will reject all Virtual Bids submitted by its Scheduling Coordinator at any Eligible PNode~~,~~ or Eligible Aggregated PNode (other than a Default LAP or Trading Hub)~~, or Intertie~~ that exceed the position limits specified in this Section 30.7.3.6.3. If the Scheduling Coordinator uses multiple SCIDs on behalf of a Convergence Bidding Entity, the position limits will apply to the sum of those Virtual Bids submitted at the Eligible PNode~~,~~ or Eligible Aggregated PNode (other than a Default LAP or Trading Hub)~~, or Intertie~~. The CAISO will perform all position limit calculations based on the highest Virtual Bid segment MW point submitted in the Virtual Bid Curve. The CAISO will not net Virtual Supply Bids and Virtual Demand Bids in performing the position limit calculations. The affected Scheduling Coordinator will be provided notice that position limits have been violated. If the Scheduling Coordinator does not resubmit Virtual Bids within the position limits, the CAISO will reject Virtual Bids for all hours at each Eligible PNode~~,~~ or Eligible Aggregated PNode (other than a Default LAP or Trading Hub)~~, and Intertie~~ where the position limits are violated. Position limits only apply to Eligible PNodes~~,~~ or Eligible Aggregated PNodes (other than Default LAPs or Trading Hubs)~~, and Interties~~.

* * *

~~**30.7.3.6.3.2 Position Limits at Interties**~~

~~For an Intertie, the locational limits will be equal to a percentage of the Operating Transfer Capability of the Intertie. The percentages used to calculate the position limits of each Convergence Bidding Entity at Interties will be the following percentages of the published locational limits:~~

~~(a) Position limits of five (5) percent will apply during the time period beginning as of the effective date of this tariff provision through the last day of the eighth month following the effective date of this tariff provision.~~

~~(b) Position limits of twenty-five (25) percent will apply during the time period beginning as of the first day of the ninth month following the effective date of this tariff provision through the last day of the twelfth month following the effective date of this tariff provision.~~

~~(c) Position limits of fifty (50) percent will apply during the time period beginning on the first day of the month as of the first anniversary of the effective date of this tariff provision through the last day of the sixteenth month following the effective date of this tariff provision.~~

~~(d) Position limits will cease to apply beginning on the first day of the seventeenth month following the effective date of this tariff provision.~~

~~The CAISO will enforce the locational limits for Interties at Bid submission and at Market Close for Virtual Bids. The CAISO will utilize the 9:00 AM Operating Transfer Capability for Bids submitted after 9:00 AM until the close of the Day-Ahead Market for the next Trading Day.~~

*** * ***

30.8 Bids On Out-Of-Service Paths At Scheduling Points Prohibited

Scheduling Coordinators shall not submit any ~~Bids, including Virtual~~ Bids or ETC Self-Schedules at Scheduling Points using a transmission path for any Settlement Period for which the Operating Transfer Capability for that path is zero (0) MW. The CAISO shall reject Bids or ETC Self-Schedules submitted at Scheduling Points where the Operating Transfer Capability on the transmission path is zero (0) MW. If the Operating Transfer Capability of a transmission path at the relevant Scheduling Point is reduced to zero (0) after Day-Ahead Schedules have been issued, then, if time permits, the CAISO shall direct the responsible Scheduling Coordinators to reduce all MWh associated with the Bids on such zero-rated transmission paths to zero (0) in the HASP. As necessary to comply with Applicable Reliability Criteria, the CAISO shall reduce any non-zero (0) HASP Bids across zero-rated transmission paths to zero after the Market Close for the HASP.

30.9 Virtual Bids

Virtual Bids are Energy Bids that may be submitted only in the Day-Ahead Market, at Eligible PNodes~~, including PNodes located at an Intertie where virtual bidding is permitted,~~ or Eligible Aggregated PNodes, ~~including Aggregated PNodes located at an Intertie~~ where virtual bidding is permitted, by Scheduling Coordinators representing Convergence Bidding Entities. Virtual Bids are either Virtual Supply Bids or Virtual Demand Bids. A Virtual Bid submitted in the Day-Ahead Market and cleared in the IFM represents a commitment to liquidate a Day-Ahead award in the Real-Time Market at the price determined for the applicable Eligible PNode or Eligible Aggregated PNode as set forth in Section 11.3. For each SCID associated with a Convergence Bidding Entity, there may be only one Virtual Supply Bid and one Virtual Demand Bid per each Eligible PNode or Eligible Aggregated PNode in the Day-Ahead Market. The minimum size of a segment of a Virtual Bid is one (1) MW.

* * *

31.8 [Not Used]

~~Within the IFM optimization, the CAISO enforces two (2) constraints at each Intertie Scheduling Point so that Virtual Bids do not result in net interchange schedules violating scheduling limits unless the bidding prohibition set forth in Section 30.8 applies. The first constraint is that physical imports net of physical exports must be less than or equal to the scheduling limit at the Scheduling Point in the applicable direction. The second constraint is that physical and virtual imports net of physical and virtual exports must be less than or equal to the scheduling limit at the Scheduling Point in the applicable direction. Although both constraints are enforced in both scheduling and pricing runs, only the second constraint Shadow Price is incorporated into the pricing run LMPs.~~

Appendix A
Master Definitions Supplement

*** * ***

- Eligible PNode

A ~~PNode located at an Intertie where virtual bidding is permitted, or a~~ PNode, not including scheduling points, where either physical supply or demand is located and where virtual bidding is permitted.

* * *

- Real-Time Congestion Offset

For each Settlement Period of the HASP and RTM, the CAISO shall calculate the Real-Time Congestion Offset as the difference of 1) the sum of the products of the total of the Demand Imbalance Energy and Virtual Supply liquidated as demand in the RTM ~~or HASP,~~ and the RTM ~~or HASP~~ MCC at the relevant Location; and 2) the sum of the products of the total of the Supply Imbalance Energy and Virtual Demand liquidated as supply in the RTM ~~or HASP,~~ and the RTM ~~or HASP~~ MCC at the relevant Location; including also the sum of RTM and HASP Congestion Charges for Intertie Ancillary Services Awards, and excluding the HASP and RTM Congestion Credit for ETCs and TORs calculated as provided in Section 11.5.7.1. The Real-Time Congestion Offset is allocated as provided in Section 11.5.4.2.

* * *

California Independent System Operator Corporation

Fifth Replacement FERC Electric Tariff

Convergence Bidding at the Interties Amendment

Attachment C – Direct Testimony of Mark A. Rothleder

September 20, 2011

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

California Independent System Operator Corporation	**)**	**Docket No. ER11-____-000**

DIRECT TESTIMONY OF
MARK A. ROTHLEDER
ON BEHALF OF THE
CALIFORNIA INDEPENDENT SYSTEM
OPERATOR CORPORATION

Q. Please state your name, title, and business address.

A. My name is Mark A. Rothleder. I am Director of Market Analysis and Development for the California Independent System Operator Corporation (ISO). My business address is 250 Outcropping Way, Folsom, CA 95630.

Q. What are your duties and responsibilities at the ISO?

A. As Director of Market Analysis and Development, I play a lead role in the design and implementation of market rules and operating procedures for the ISO. Prior to this role, I was a Principal Market Developer for the ISO in the lead role in the implementation of market rules and software modifications related to the ISO's Market Redesign and Technology Upgrade (MRTU). Since joining the ISO over thirteen years ago, I have worked extensively on implementing and integrating the approved market rules for California's competitive Energy and Ancillary Services markets and the rules for Congestion Management, Real-Time Economic Dispatch,

and Real-Time Market Mitigation into the operations of the ISO Balancing Authority Area. I have also held the position of Director of Market Operations.

Q. Please describe your educational and professional background.

A. I am a registered Professional Electrical Engineer in the state of California. I hold a B.S. degree in Electrical Engineering from the California State University, Sacramento. I have taken post-graduate coursework in Power System Engineering from Santa Clara University and earned an M.S. in Information Systems from the University of Phoenix. I have co-authored technical papers on aspects of the California market design in professional journals and have frequently presented to industry forums. Prior to joining the ISO in 1997, I worked for eight years in the Electric Transmission Department of Pacific Gas & Electric Company, where my responsibilities included Operations Engineering, Transmission Planning and Substation Design.

Q. Please briefly describe your role in the ISO's decision to eliminate convergence bidding at the interties.

A. I was significantly involved in the ISO's decision that convergence bidding should be eliminated at the interties at least until issues related to the two settlement time frames for the real-time market are addressed in future market enhancements. I took a lead role, working with others at the ISO,

in evaluating the data that demonstrated the market inefficiencies of continuing convergence bidding at the interties, in addressing issues and answering stakeholder questions, and in evaluating proposed alternative solutions during the stakeholder process that led to the ISO's decision to eliminate convergence bidding at the interties, as proposed in this tariff amendment.

Q. As you testify, will you be using any specialized terms?

A. Yes. Unless otherwise indicated, capitalized terms have the meanings set forth in the Master Definitions, Appendix A of the ISO tariff.

Q. What is the purpose of your testimony?

A. In my testimony I will provide information and examples to explain why the ISO proposes to eliminate convergence bidding at the interties. First, I will address the problematic effects of the ISO's current market design on the convergence of hour-ahead and real-time prices at the interties. Next, I will discuss the less critical but still significant issue of how the use of market software constraints at the interties has caused price inconsistencies. Lastly, I will discuss why eliminating convergence bidding at the interties is justified at least until an existing comprehensive market redesign stakeholder initiative will allow the ISO to address issues related to the current design of the hour-ahead scheduling process and real-time market.

I. Effects of the Current Market Design on Price Convergence at the Interties

Q. Please briefly describe the ISO's process for settling transactions for internal resources and at the interties.

A. Under its current market design, the ISO employs a two-settlement market structure that consists of a day-ahead market and a real-time market. The real-time market includes both the hour-ahead scheduling process and the real-time dispatch. Due to the fact that intertie transactions have to be arranged approximately one hour before the operating hour, intertie transactions are arranged and settled through the hour-ahead scheduling process rather than based on the real-time prices. All other real-time energy settlement is based on the five-minute real-time dispatch prices. Specifically, the ISO settles intertie resources based on locational marginal prices established in the hour-ahead scheduling process, while energy dispatched from internal resources is settled based on five-minute real-time dispatch interval prices for energy. This results in the creation of two separate and distinct sets of financially binding prices for energy in the real-time: the hour-ahead scheduling process price and the real-time dispatch price

Q. Under the ISO's market design, when a portion of the energy is dispatched and settled based on the hour-ahead scheduling process

while the balance is dispatched and settled based on real-time dispatch, what happens if energy imbalances occur in the real-time market?

A. While both the hour-ahead scheduling process and the real-time dispatch process are attempting to balance real-time conditions, since the hour-ahead scheduling process is run one hour ahead and the real-time dispatch occurs five minutes ahead, the imbalance conditions can change. The conditions that can cause these changes are changes in load forecasts, in resource deviations, and in actual energy delivery. The result of these changing conditions is that the prices in the hour-ahead scheduling process and the real-time dispatch can differ. However, the ISO charges all load imbalances from the day-ahead based on the real-time dispatch prices. Therefore, to the extent that hour-ahead scheduling process prices and real-time dispatch prices are different, the ISO may not collect sufficient revenue from load to recover the total cost of supply in the combination of the hour-ahead scheduling process and the real-time dispatch. Such revenue imbalances are made up through a market feature called the real-time imbalance energy offset.

Q. What is the real-time imbalance energy offset?

A. It is a neutrality account that tracks the settlement dollar values for the imbalances resulting from real-time instructed imbalance energy, real-time uninstructed imbalance energy, real-time unaccounted for energy, and hour-ahead energy, and losses. The real-time imbalance energy offset does not

track the congestion costs associated with such imbalances, which are tracked and allocated separately through the real-time congestion offset. Any surpluses or shortages in the real-time imbalance energy offset are allocated to all scheduling coordinators based on a pro rata share of their metered load plus exports. Such allocations result in a payment or charge to scheduling coordinators depending on whether there is a surplus or deficit.

Q. What trends has the ISO observed in prices between its different markets?

A. As indicated in Figures 1 and 2 below, pricing trends since 2009 indicate a tendency for prices in the day-ahead to be lower than prices in the five-minute real-time dispatch, and for prices in the hour-ahead scheduling process to be lower than both day-ahead and real-time dispatch prices. Comparing price differences between markets over a day highlights the patterns in price differences that can arise during specific hours of the day. This is illustrated using Figures 3 and 4 below when comparing June 2011 or July 2011 monthly prices with the peak and off-peak price differences for those months. For example, while the average price difference between the hour-ahead scheduling process and real-time dispatch for June 2011 over a full day is low where the real-time dispatch price is greater than the hour-ahead scheduling process price by approximately $5/MW, when reviewing the off-peak results, the real-time dispatch price is approximately $13/MW higher than the hour-ahead scheduling process

price. This is because, during peak hours in June 2011, the real-time dispatch price was lower than the hour-ahead scheduling process price by approximately $3/MW.

Figure 1: Quarterly Price Comparison

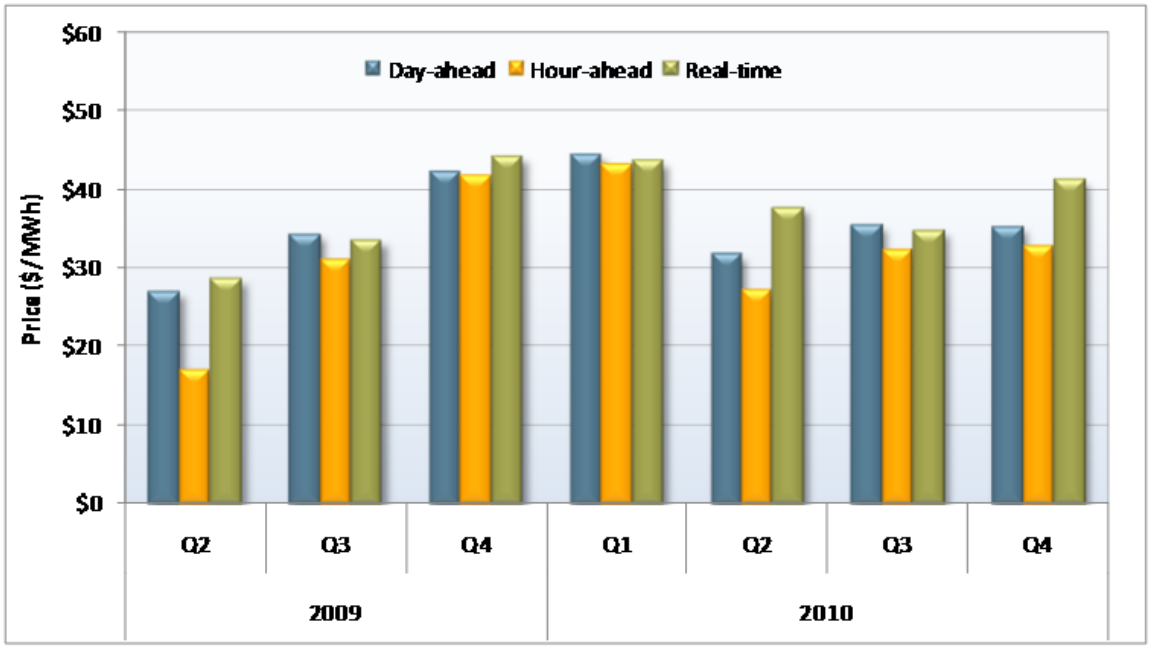


Figure 2: Monthly Price Comparison (Full Day)

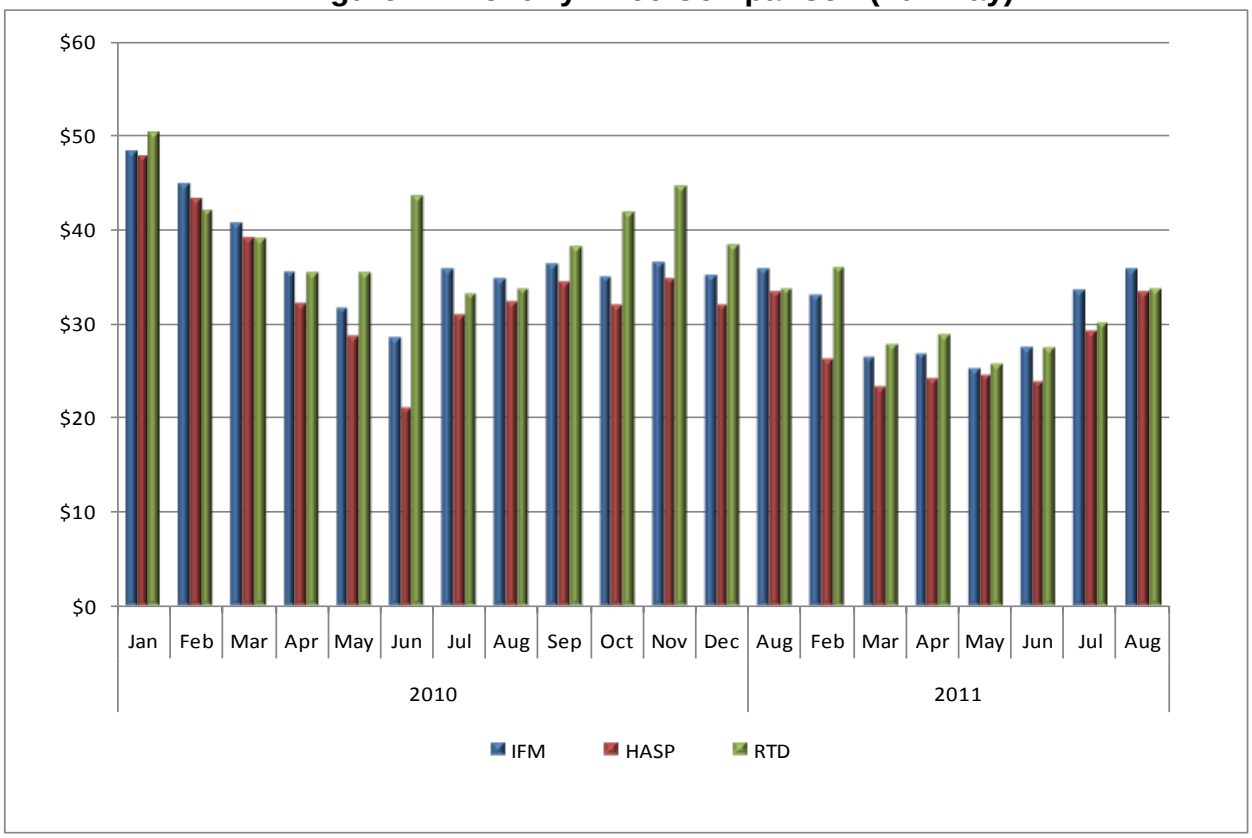


Figure 3: Monthly Comparison of Prices (Peak Hours)

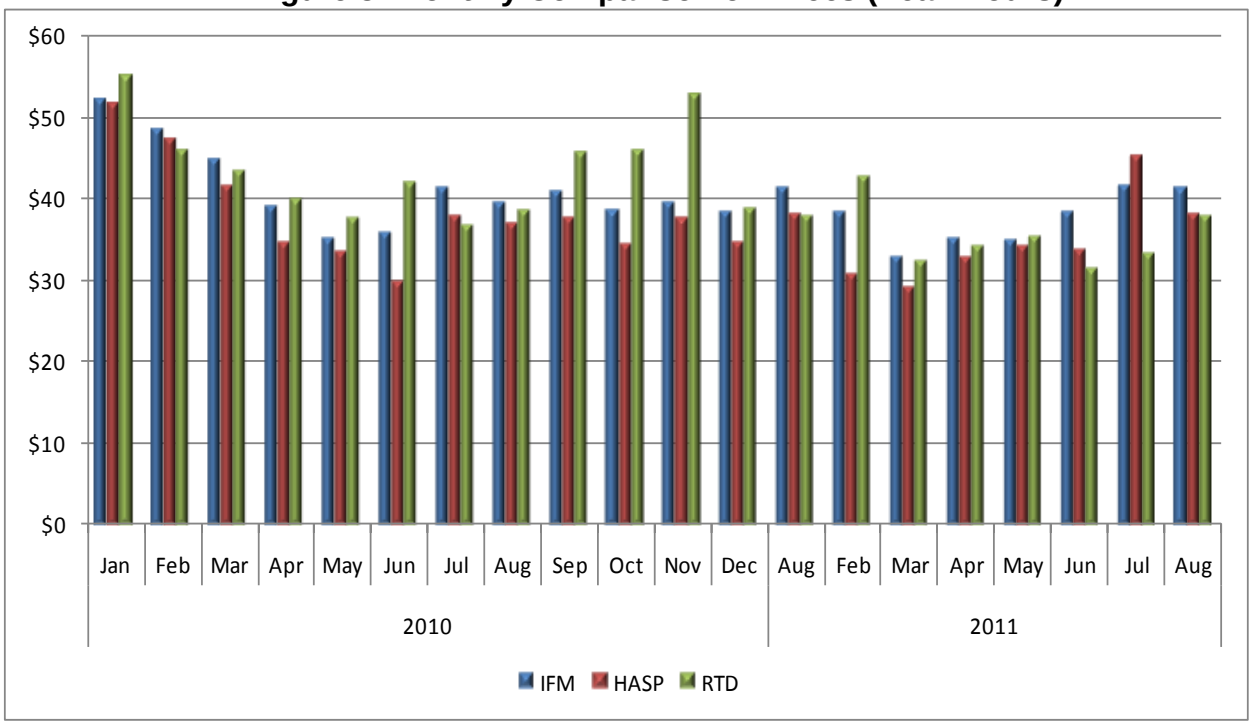
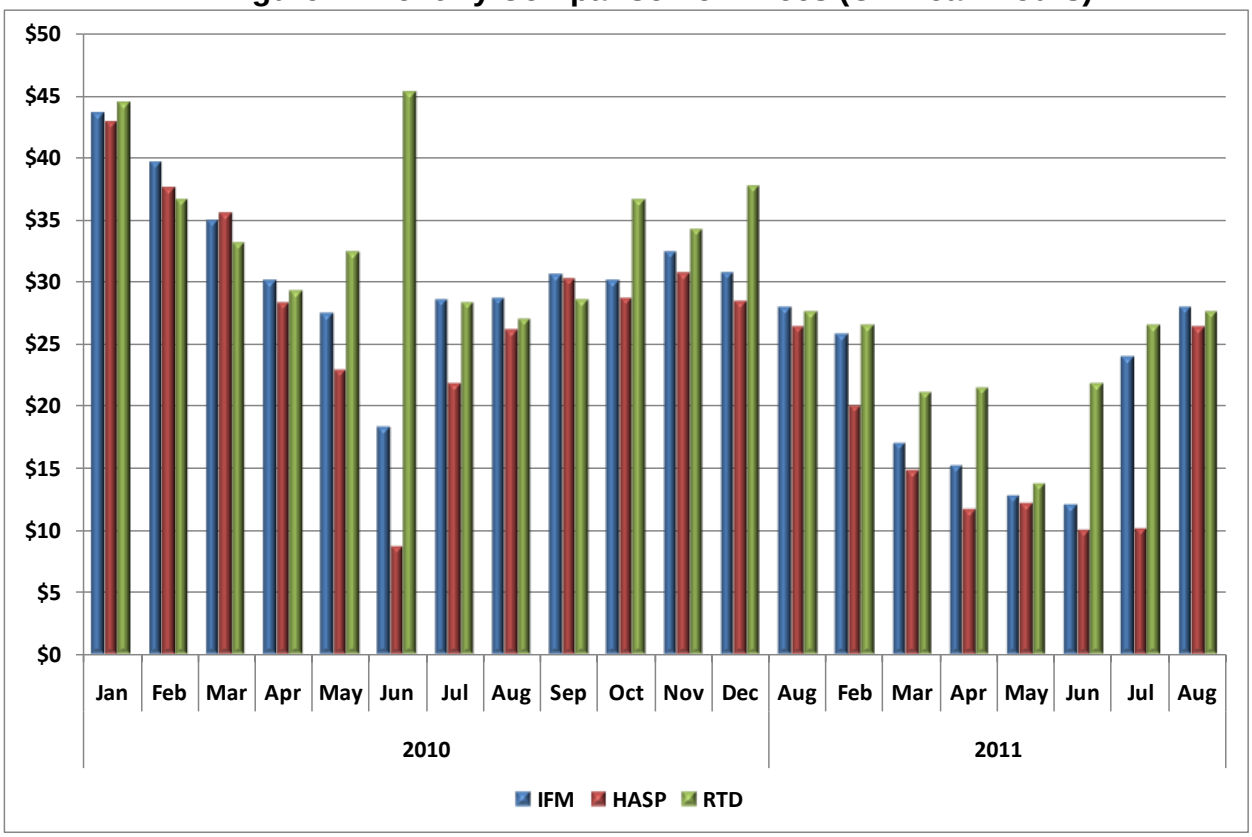


Figure 4: Monthly Comparison of Prices (Off-Peak Hours)



Q. Why have hour-ahead scheduling process prices and real-time dispatch prices differed?

A. There are numerous reasons for the trend of systematic price differences in the hour-ahead scheduling process and the real-time dispatch. First, the price differences are often driven by differences in modeled and forecasted conditions in these two markets. For instance, actual loads and uninstructed generation from different resources in real-time are often quite different from conditions that are forecasted when the hour-ahead scheduling process is performed. In some cases, supply in real-time can be significantly lower than is assumed during the hour-ahead scheduling process due to a major unit outage or a failure of scheduled imports to be delivered (or e-tagged) after the

end of the hour-ahead scheduling process. In real-time, the amount of available resources and capacity that can be ramped within a five-minute basis to accommodate such changes is relatively limited. By contrast, the hour-ahead scheduling process has intertie capacity and a 15-minute ramping time interval. As a result, even relatively minor changes in system conditions can cause the real-time dispatch price to increase significantly. Although these price spikes may last only a few five-minute intervals or hours, the overall effect is to drive average real-time dispatch prices higher than average hour-ahead prices. In addition, the difference between the currently applicable ISO bid cap of $1,000/MW and the ISO bid floor of -$30/MW results in more extreme positive price spikes when upward capability is scarce that are not offset by negative price spike events when downward ramping capability is scarce. This asymmetry will tend to bias the real-time dispatch higher even if the quantities of upward and downward ramping shortages are equal in frequency.

Q. Does the two-settlement real-time market structure you have described create any incentives for market participants with respect to convergence bidding?

A. Yes, it does. The two-settlement real-time market structure I have described creates the incentive to submit large volumes of offsetting virtual supply and demand bids that do not contribute to the convergence of day-ahead and

real-time prices and that also significantly increase real-time imbalance energy offset charges.

Q. Doesn't convergence bidding help promote convergence of prices in these different markets?

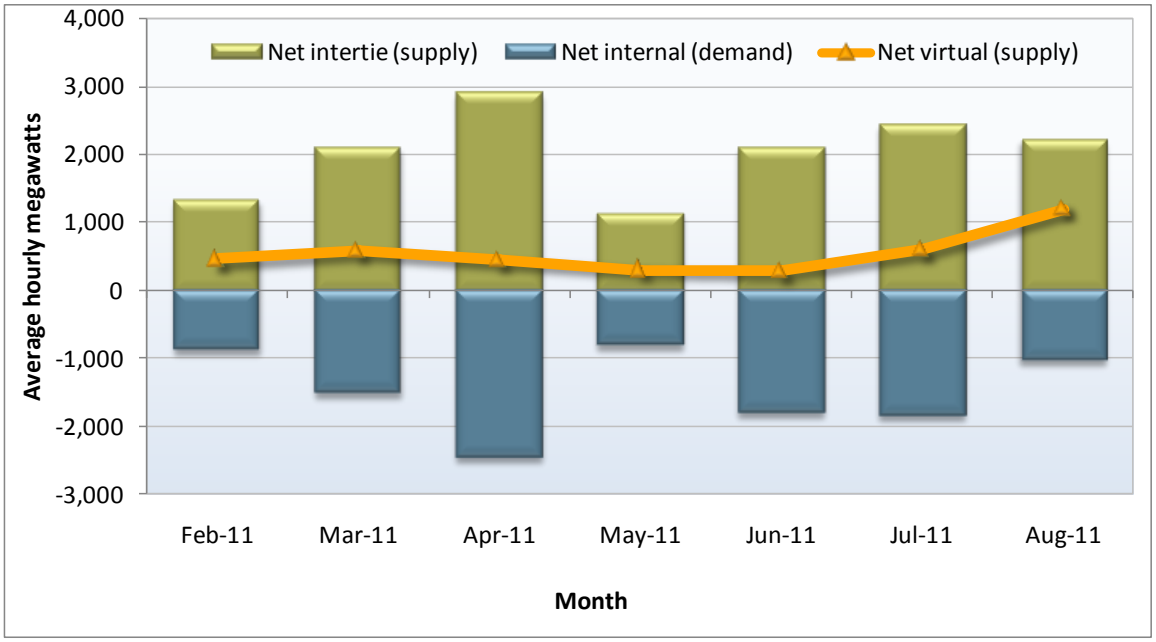
A. No, not under the ISO's market design and conditions. As I have stated, under the current market design, convergence bids at interties accepted in the day-ahead market are settled at prices from the hour-ahead scheduling process. Since hour-ahead prices tend to be lower than day-ahead prices, virtual supply bids at interties are on average profitable. In contrast, under the current market design, convergence bids at points within the ISO system accepted in the day-ahead market are settled at prices from the five-minute real-time dispatch. Since real-time dispatch prices tend to be higher than day-ahead prices, virtual demand bids at points within the ISO system are also on average profitable. Unfortunately, the net result of these two market trends is that the overall impact of convergence bidding is to significantly increase the real-time imbalance energy costs, without providing any comparable increase in market efficiency or price convergence.

Q. Can you elaborate on why this is?

A. Yes. I will illustrate this using a numerical example representative of actual market conditions that have occurred. Figure 5 below shows the

average hourly value of net virtual import/export bids accepted and the average hourly value of net virtual supply/demand accepted at points within the ISO during off-peak hours by month since convergence bidding was implemented in February 2011. As shown in Figure 5, an average of about 2,100 MW per hour of net virtual imports (*i.e.*, virtual imports minus a small amount of virtual exports) cleared during off-peak hours in the month of June. This reflects the fact that day-ahead prices tended to be higher than real-time dispatch prices during these hours, making virtual imports profitable during most hours. In theory, this 2,100 MW per hour of net virtual imports should have a significant impact in terms of helping to converge prices in these two markets. The additional 2,100 MW per hour of virtual supply (which represents about 9.6% of total average load during these hours) would tend to lower day-ahead prices. Since this 2,100 MW of virtual supply was liquidated in the hour-ahead scheduling process, this should also tend to raise hour-ahead prices. Thus, day-ahead prices and hour-ahead prices should tend to converge. In practice, however, this does not occur.

Figure 5: Net Cleared Intertie and Internal Supply and Demand



Q. Why not?

A. As shown in Figure 5, at points within the ISO, an average of about 1,800 MW per hour of net virtual demand (virtual demand less a small amount of internal virtual supply) also cleared during off-peak hours in the month of June. This reflects the fact that day-ahead prices tended to be lower than real-time dispatch prices during these hours, making virtual demand at points within the ISO profitable during most hours. Again, in theory this 1,800 MW per hour of net virtual demand should have a significant impact in terms of helping to converge day-ahead and real-time dispatch prices. However, in practice this 1,800 MW per hour of net virtual demand within the ISO is more than offset by the 2,100 MW of net virtual supply on interties in the day-ahead market. Thus, a very large portion of the accepted convergence bids have a net impact on prices in the day-ahead

market. Since all of these convergence bids are also liquidated in the hour-ahead scheduling process, these offsetting virtual supply and demand bids also have no net impact on prices in the hour-ahead scheduling process and real-time dispatch.

Q. Do these offsetting convergence bids you describe serve any beneficial purpose for the ISO or the markets?

A. No. These offsetting virtual import and demand bids do not promote price convergence or serve any other operational purpose. Since these bids are offsetting, they do not lead to a change in day-ahead unit commitment or improved system-wide market efficiency. Instead, the offsetting bids only contribute to increases in charges assessed to scheduling coordinators pursuant to the real-time imbalance energy offset.

Q. How do these convergence bids increase real-time imbalance energy offset charges?

A. I will answer this question by building on the same numerical example I outlined above. Again, assume that during an hour 2,100 MW of net virtual imports clear the day-ahead market along with 1,800 MW of net virtual demand within the ISO. Further assume that the day-ahead system energy price is $35/MW, while the hour-ahead scheduling process clears at $30/MW and the real-time dispatch price is $40/MW. Under this scenario, 1,800 MW of the 2,100 MW of virtual supply is offset by 1,800

MW of net demand within the ISO in the day-ahead market. Thus, these 1,800 MW of offsetting virtual import and demand bids have no net effect on day-ahead prices or net revenues charged and paid by the ISO in the day-ahead market. Market participants selling these 1,800 MW of virtual imports in the day-ahead market are charged $54,000 when these convergence bids are liquidated in the hour-ahead scheduling process (1,800 MW x $30/MW). Market participants buying the 1,800 MW of offsetting virtual demand in the day-ahead market are paid $72,000 when these convergence bids are liquidated at the real-time dispatch price (1,800 MW x $40/MW). These charges and payments are all included in real-time imbalance energy offset charges, which are increased by $18,000 due to these offsetting convergence bids ($54,000 in revenues received minus $72,000 in payments made by the ISO).

Q. Can the same market participant place virtual import bids and offset these with virtual demand bids within the ISO?

A. Yes. This specific bidding strategy has actually accounted for a large portion of the offsetting virtual import and demand bids that have contributed to real-time instructed energy imbalance charges. The net financial effect of this strategy for an individual market participant is that they receive the difference between prices in the hour-ahead scheduling process and real-time dispatch. For example, in the day-ahead market, payments to the market participant for a virtual import are offset by

charges for an offsetting virtual demand bid. However, the market participant then pays the hour-ahead prices for virtual import bid and receives the real-time dispatch price for the virtual demand bid when these bids are liquidated in the real-time markets. Thus, the market participant profits whenever the real-time dispatch price is higher than the price from the hour-ahead scheduling process. Financially, this offsetting bidding strategy is more consistently profitable and involves less risk of any loss for market participants than "betting" only on either convergence supply bids at interties or convergence demand bids within the ISO.

Q. Could the ISO simply prohibit this type of bidding strategy?

A. As part of a stakeholder process on this issue, the ISO considered either prohibiting this type of bidding or implementing a settlement rule designed to allocate the real-time instructed energy offset charges caused by such bids directly back to market participants profiting from these bids. However, the ISO determined that neither of these approaches would be effective for several reasons. First, offsetting virtual supply and demand bids by the same market participant only account for a portion of all offsetting bids that are contributing to the real-time instructed energy offset charges. Second, if such a prohibition or settlement rule were implemented, given the price trends discussed earlier in my testimony, it would still be profitable for individual market participants to submit either virtual imports or virtual demand within the ISO. The ISO would expect

some market participants currently placing offsetting bids to increase the volume of virtual imports, while others would increase the volume of virtual demand within the ISO. There is also the possibility that some market participants would develop bilateral arrangements that had the same effect of placing offsetting virtual supply and demand bids as a way of "betting" on the difference in hour-ahead and real-time dispatch prices. The net result would be a continuation of a large volume of offsetting virtual supply and demand bids, and high real-time instructed energy imbalance costs. The ISO's Market Surveillance Committee and Department of Market Monitoring also looked at this issue and both came to this same conclusion.

Q. Did the ISO consider any other possible solutions, besides elimination of convergence bidding on the interties, for addressing real-time imbalance energy uplift costs?

A. Yes. The ISO considered several options that involved modifying the settlement of the hour-ahead scheduling process and real-time dispatch so that these market prices in these time frames would be settled on approximately the same price. One of these options would be to adopt settlement rules for intertie transactions such as those employed in most other ISOs. In most other ISOs, intertie transactions are settled as "price-takers" based on prices resulting from the real-time dispatch of resources within the ISO during the operating hour. The New York ISO employs a

variation of this approach, under which exports scheduled on an hour-ahead basis are charged as “price-takers” based on real-time prices, while any additional import bids accepted on an hour-ahead basis are paid the higher of their bid price or the real-time dispatch price.

Other options discussed would have involved a more fundamental redesign of the hour-ahead and real-time dispatch processes. One such approach would be to combine these two processes into a single dispatch and settlement process, such as a single 15-minute real-time market. Yet another approach suggested by a member of the ISO’s Market Surveillance Committee would be to make the hour-ahead scheduling process a full hour-ahead market, in which intertie bids were cleared against bids of other market participants, rather than based on the ISO’s projection of system conditions in the real-time.

Q. Why were none of these options adopted?

A. In the first instance, all of these options would require significant additional time to consider and implement. As part of another ongoing stakeholder process, the ISO is proceeding to give further consideration to the first of these possible approaches (*i.e.*, settling all or some hour-ahead transactions at the real-time dispatch price) as an option that might be implemented by 2013. The other approaches – which would require a much more significant change in the ISO’s hour-ahead and real-time

market design – will be considered as longer-term options that might be implemented in conjunction with other changes that may be needed to accommodate the expected increase in intermittent renewable generation by 2015 and beyond.

Q. Were any other options considered?

A. Yes. Another alternative solution the ISO considered was to settle imports and exports on a "bid or better" market design. With this approach, imports would be paid either the higher of the market clearing price or their own bid price. Exports would pay the lower of the market clearing price or their own bid price. In situations where the resource's bid, rather than the market clearing price, was the better price, the ISO would add an uplift payment to the market clearing price to enable that resource to receive its bid cost. This option is problematic because it creates an incentive for intertie resources to bid in a manner that increases uplift costs. In 2005, the ISO implemented this type of "bid or better" settlement for interties for several months, but then switched to an "as-bid" settlement through Amendment 66 to the tariff then in effect due to the extraordinarily high uplift costs that were incurred due to the incentives created by the "bid or better" market design.

A final option considered in the stakeholder process was to modify the timing of convergence bidding liquidation and settlement, whereby day-

ahead awarded internal virtual supply and demand positions would remain in the hour-ahead scheduling process. However, this approach would be problematic because it poses potential reliability risks given the importance of imports to meeting ISO load.

Q. Has the ISO determined what the total impact of offsetting convergence bids has been on real-time instructed energy offset charges?

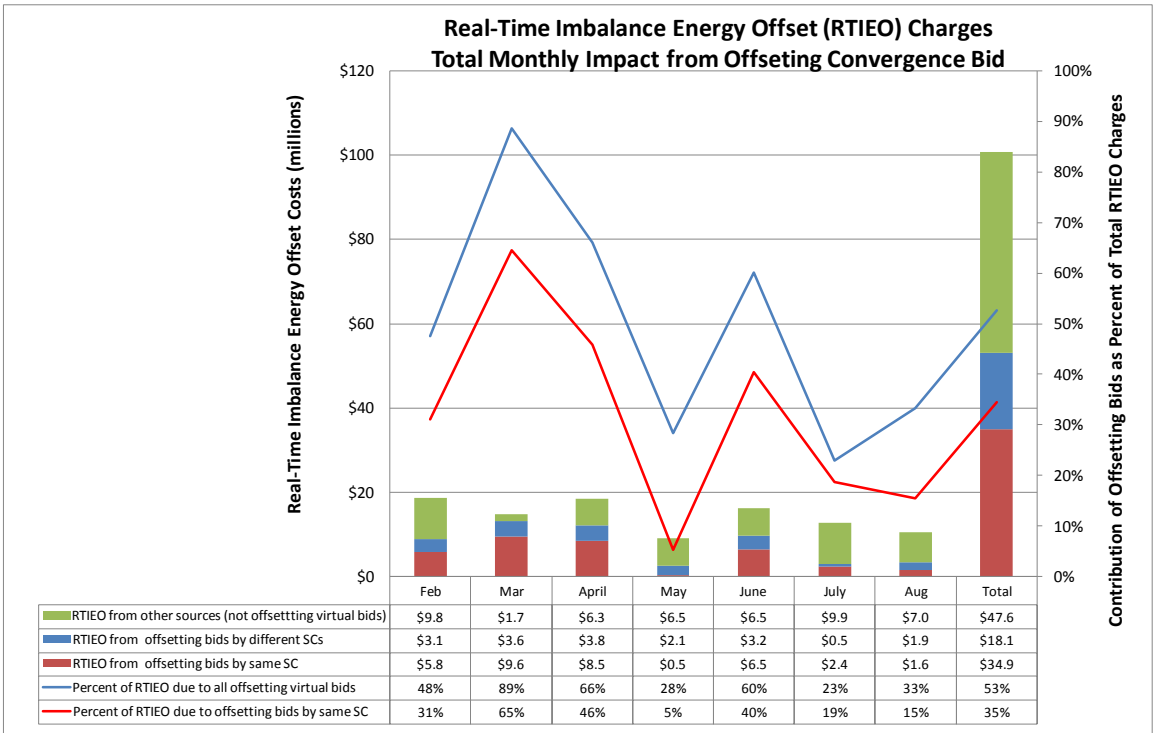
A. Yes. ISO staff under my direction has developed a method for estimating the additional costs that are incurred due to offsetting virtual supply and demand bids. The basic methodology used to calculate these costs is the same as that used in the numerical example provided earlier in my testimony with regard to Figure 5. Under this approach, we first calculate the total net virtual supply clearing at interties and the total net virtual demand clearing at points within the ISO each hour. The lower of these two values represents the amount of virtual supply and demand that is offset. For instance, if 2,100 MW of net virtual imports and 1,800 MW of net virtual demand within the ISO clear the day-ahead market during an hour, the amount of offsetting convergence supply and demand bids is 1,800 MW. Finally, the net revenue impact of liquidating these offsetting convergence supply and demand bids at the applicable hour-ahead and real-time dispatch prices is calculated, as illustrated in my previous numerical example. During some hours, when real-time dispatch prices

are lower than hour-ahead prices, these offsetting bids actually decrease the real-time imbalance energy offset charges. However, when results for all hours are summed up, the analysis shows that these offsetting bids account for a significant amount of real-time imbalance energy offset charges.

Q. What are the overall results of this analysis?

A. As shown in Figure 6 below, the results show that offsetting convergence supply and demand bids has contributed an average of $7.5 million per month to real-time imbalance energy offset charges, or a total of $53 million since convergence bidding was implemented in February 2011, which represents about 52% of the total real-time imbalance offset costs

Figure 6: Real-Time Imbalance Energy Offset Charges



	Feb	Mar	April	May	June	July	Aug	Total
RTIEO from other sources (not offsettting virtual bids)	$9.8	$1.7	$6.3	$6.5	$6.5	$9.9	$7.0	$47.6
RTIEO from offsetting bids by different SCs	$3.1	$3.6	$3.8	$2.1	$3.2	$0.5	$1.9	$18.1
RTIEO from offsetting bids by same SC	$5.8	$9.6	$8.5	$0.5	$6.5	$2.4	$1.6	$34.9
Percent of RTIEO due to all offsetting virtual bids	48%	89%	66%	28%	60%	23%	33%	53%
Percent of RTIEO due to offsetting bids by same SC	31%	65%	46%	5%	40%	19%	15%	35%

Q. Have you examined the costs associated with the offsetting convergence bids submitted by the same market participant using the bidding strategy you previously described?

A. Yes. To quantify the costs associated with that bidding strategy, we use this same methodology, but first calculate the amount of offsetting virtual supply and demand bids for each individual market participant individually based on its portfolio of convergence bids. The total volume of offsetting bids for each individual market participant is then summed up to calculate the portion of all offsetting bids associated with convergence bids placed by the same market participant. Of the $53 million, $34.9 million is a result of offsetting balanced

virtual supply and virtual demand position within the same scheduling coordination while $18.1 million is a result of offsetting balanced virtual supply and virtual demand position across scheduling coordinator portfolios. Figure 6 also shows that about 34% percent of these costs can be attributed to offsetting convergence bids placed by the same market participant. However, it should be noted that this analysis is not meant to reflect the degree by which these costs would be reduced if the bidding strategy was prohibited or mitigated by a settlement rule. As discussed previously in my testimony, if either of these options were implemented, I believe the overall volume of offsetting convergence bids by different market participants would be likely to increase as individual market participants would simply increase their convergence bidding activity at either the interties or within the ISO.

Q. Has the ISO observed any market trends since convergence bidding was implemented indicating that the factors creating this problem might increase or decrease?

A. Yes. Several noticeable market trends have emerged since the start of convergence bidding. First, the vast majority of virtual supply clearing the market consists of imports on interties, whereas the bulk of cleared virtual demand has been at internal locations. Second, the volume of virtual bids clearing the market increased steadily over the first few months until the second half of April 2011. Afterwards, volumes dropped precipitously and then began to increase steadily through June. These trends contribute to

the real-time imbalance energy offset, but have not have a significant impact on the convergence of day-ahead and real-time prices, which is the primary goal of convergence bidding.

Q. Who pays the costs of the real-time imbalance energy offset?

A. The costs are borne primarily by the load-serving entities.

Q. Why is that?

A. As I have explained, any surpluses or shortages in the real-time imbalance energy offset are allocated to scheduling coordinators based on a pro rata share of their metered CAISO demand plus exports. Load-serving entities are the only type of scheduling coordinators with metered CAISO demand, which bears the vast majority of these costs. Therefore, load-serving entities bear virtually all of the costs of real-time imbalance energy offsets. In contrast, the parties that actually impose these additional costs on the market are completely protected from any uplift costs they create.

Q. Are there any ways for load-serving entities to protect themselves from increases in the real-time imbalance energy offset?

A. No. Load-serving entities cannot protect themselves from being exposed to increases in the real-time imbalance energy offset. Since the energy crisis of 2001-2001, the major load-serving entities in ISO have consistently scheduled close to 100% of their actual physical load in the day-ahead

market. Thus, in theory, they should not be exposed to significant additional costs beyond any generation re-dispatch costs actually associated with meeting these day-ahead schedules. They cannot control the actions of any other market participants that choose to profit from convergence biding or engage in the specific convergence bidding strategy previously described my testimony.

II. Price Inconsistency Caused by Intertie Constraints

Q. Please describe the constraints the ISO employs within its market software for intertie scheduling.

A. The ISO currently enforces two constraints within its market software in the day-ahead market for each intertie scheduling point. The first constraint (the physical-only constraint) is enforced only in the scheduling run of the integrated forward market. This constraint requires that net physical schedules on each intertie (physical imports minus physical exports) must be less than or equal to the scheduling limit using the same intertie constraint in the applicable direction (*i.e.*, either into or out of the ISO balancing authority area). This first constraint is needed with or without convergence bidding and thus existed prior to the adoption of convergence bidding.

With the implementation of convergence bidding, the ISO added the second constraint (the physical plus virtual constraint), which is enforced at the

interties in both the scheduling run and the pricing run of the integrated forward market. This constraint requires that the quantity of physical plus virtual imports net of physical plus virtual exports must be less than or equal to the scheduling limit the relevant intertie constraint in the applicable direction. This constraint is used during the pricing run to establish a shared congestion price for physical and virtual bids at each intertie.

Q. Does the use of this two constraint system present any issues for the ISO?

A. Yes, this second (physical plus virtual) constraint can create pricing issue when both the physical-only constraint and the physical plus virtual constraint are binding. Because the physical plus virtual constraint is used to ensure that physical and virtual bids experience the same congestion price (and locational marginal price) at the intertie, virtual bids can impact the congestion charges that are assessed on physical bids that clear and are selected for scheduling during the scheduling run, in periods when, both the physical-only and physical plus virtual constraints are binding.

Q. Could you please explain how virtual bids can have this impact on congestion charges?

A. Yes. Virtual export bids can produce the appearance of congestion (under the physical plus virtual constraint) and result in a congestion charge being added to the amount that a physical exporter must pay, even though

there is no physical congestion on the intertie. In this situation, an exporter can end up paying a higher amount than its bid price and, under existing market rules, bid cost recovery mechanism does not apply to exports. Similarly, virtual import bidding can produce a congestion charge that increases the amount that a physical importer receives for its power above its bid price, even though there is no physical congestion on the intertie. In this situation, ISO market participants end up paying a higher price than the importer would have otherwise received.

These increased congestion costs are not reflected in the initial scheduling run used to establish the MWs that will clear for scheduling purposes because, under the physical-only constraint applicable to that run, only physical interchange bids and schedules are considered. As a result, when congestion costs resulting from virtual bids are established, a physical export or import bid can be accepted and scheduled although the bid price is inconsistent with the market clearing price that is ultimately established in the pricing run. In such circumstances, convergence bidding on the interties results in prices that are not fully compensatory to awarded bids. For instance, a $30/MW physical export bid accepted in the scheduling run could be charged $40/MW due to congestion in the import direction caused by virtual imports.

Q. Could you explain how virtual bids can have this impact on congestion charges using an example?

A. Yes. I will illustrate this impact using the following example:

Assume 100 MW of internal load that is a price taker and the following are bid inputs:

Internal Load: 100 MW price-taker

Physical Import: 300 MW priced at $0/MW and 200 MW priced at $60/MW

Physical Export: 100 MW priced at $70/MW and 200 MW priced at $22/MW

Virtual Import: 200 MW priced at $38/MW and 200 MW priced at $62/MW

Virtual Export: 250 MW priced at $60/MW and 200 MW priced at $10/MW

Import limit = 100 MW

Based on the numbers in this example, the physical-only constraint will clear at $300 MW of physical imports and 200 MW of physical exports, which ensures that the net physical schedules do not exceed the limit of 100 MW. The 100 MW of physical exports willing to pay $22/MW clears in the physical-only constraint. (Refer to Figure 7 below.)

Based on the physical plus virtual constraint, an additional 150 MW of virtual import priced at $38/MW clears against an additional 150 MW of virtual exports willing to pay up to $62 while maintaining the 100 MW

import limit. As a result, the price of the physical plus virtual constraint is $38/MW. (Refer to Figure 8 below.)

However, since the physical plus virtual price is used for settlement of all cleared physical and virtual bids, 100 MW of the physical exports that were willing to pay $22/MW are charged $38/MW. This inconsistency results in physical exports being charged $16/MW more than they were willing to pay. In addition 300 MW of physical imports are compensated at $38/MW when $22/MW would have been sufficient to compensate such resources based on the physical-only constraint.

Figure7: Example of Physical-only Constraint

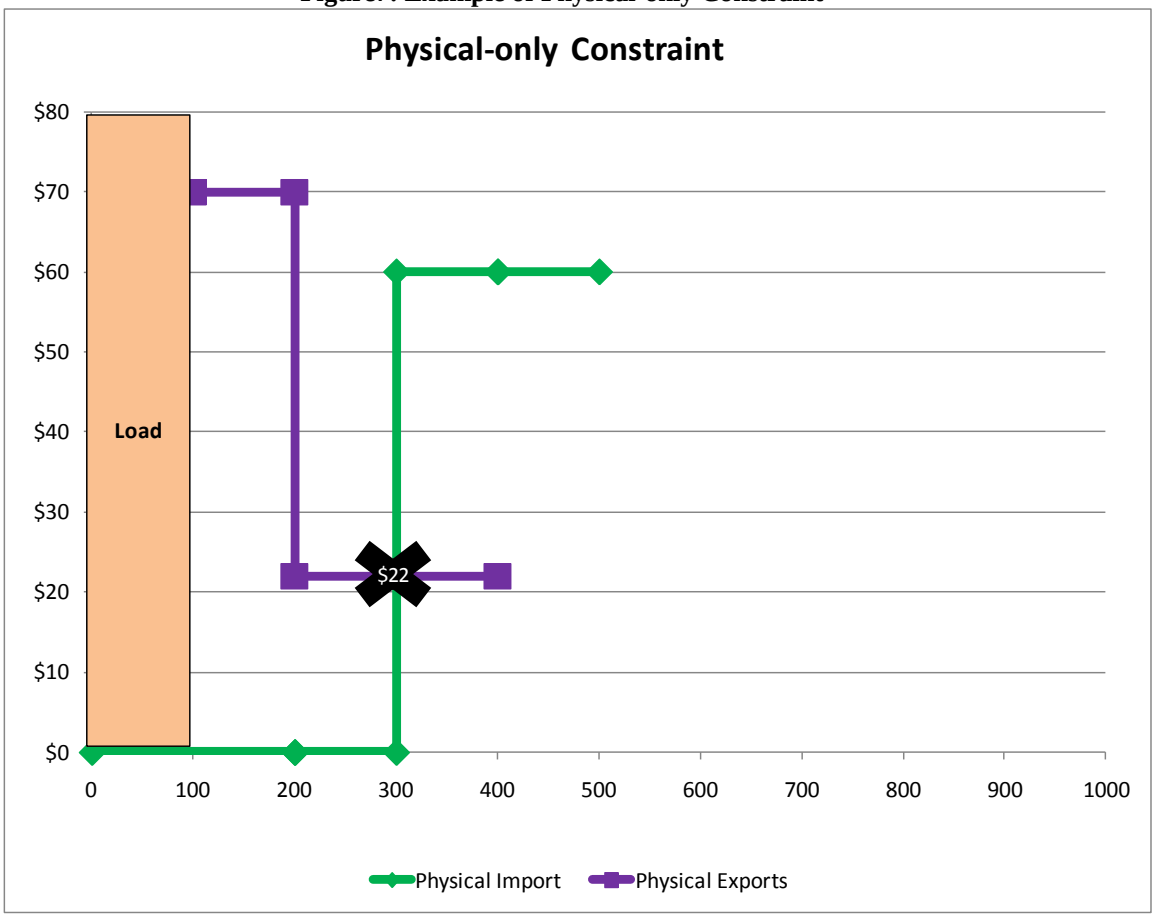
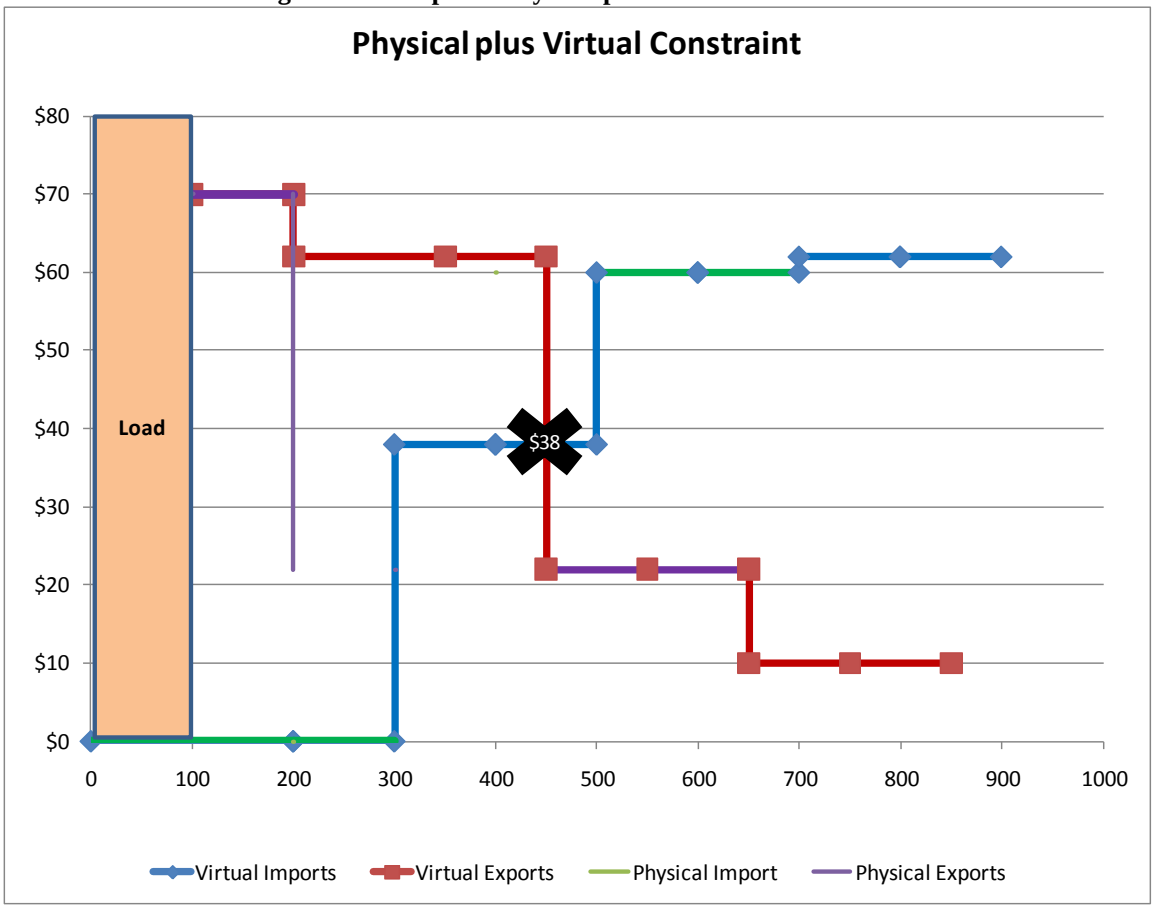


Figure 8: Example of Physical plus Virtual Constraint



Q. Was this issue identified during the convergence bidding design process?

A. Yes. However, since there were no easily implementable options to address these issues at the time, the ISO committed to monitoring the issue to determine if it was significant enough in operation to warrant a design modification.

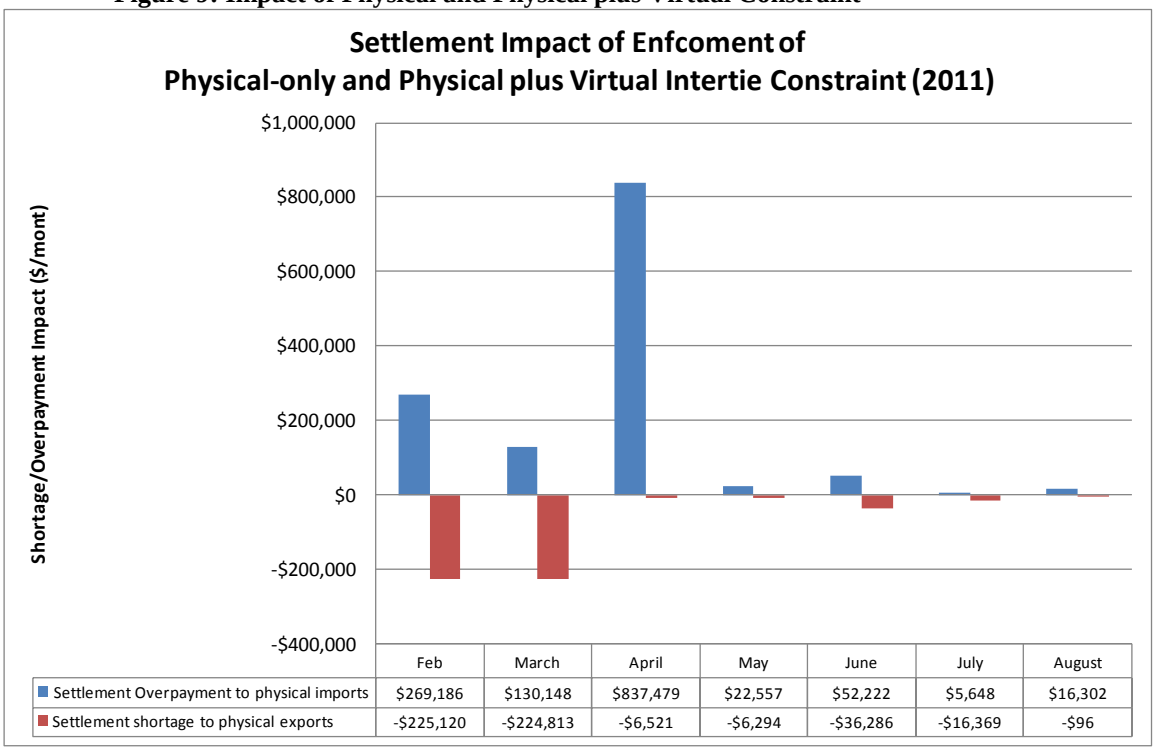
Q. Has the ISO observed this impact on congestion charges in practice?

A. It has. In the period since virtual convergence bidding was implemented, the ISO has observed the impacts on both importers and exporters discussed above. Specifically, after convergence bidding was implemented, the ISO initially observed cases where physical export bids were clearing the market at locational marginal prices that were inconsistent with (and higher than) the locational marginal prices the exporters offered to pay due to congestion costs imposed by virtual bids.

Q. What has been the dollar impact on the market due to this issue?

A. For the first two months after convergence bidding was introduced, the impact to the market of this issue on the export side was approximately $225,000 per month. Since April 2011, the observed shortages to physical exports went down to approximately $13,000 per month. The ISO has also observed cases where physical import bids are clearing the market at locational marginal prices that are inconsistent with their bids, resulting in higher payments than the importer would otherwise have received. In April 2011, the ISO observed an $800,000 overpayment due to this issue. Since May 2011, the average overpayment has been approximately $24,000 per month. (Refer to Figure 9 below.)

Figure 9: Impact of Physical and Physical plus Virtual Constraint



	Feb	March	April	May	June	July	August
Settlement Overpayment to physical imports	$269,186	$130,148	$837,479	$22,557	$52,222	$5,648	$16,302
Settlement shortage to physical exports	-$225,120	-$224,813	-$6,521	-$6,294	-$36,286	-$16,369	-$96

Q. Did the ISO consider possible solutions to these pricing issues caused by the intertie constraint approach needed to facilitate convergence bidding on the interties?

A. Yes. During the stakeholder process convened to consider these pricing issues, the ISO considered a number of alternative solutions other than eliminating convergence bidding at the interties. The ISO ultimately determined that each of those alternative solutions was problematic. The solution that the ISO considered the best alternative approach was to settle all physical intertie schedules based on both the physical-only constraint and the physical plus virtual constraint, while virtual intertie schedules would be settled based solely on the physical plus virtual constraint. This approach is consistent with the constraints that currently apply to physical and virtual bids.

If only one of the constraints were binding, the price for physical and virtual bids would be the same. However, if both constraints were binding, then the settlement price of physical and virtual bids could be different. The settlement price difference correctly reflects the fact that if the physical-only constraint is binding, virtual bids can no longer relieve the physical-only constraint and must be priced based on their impact on the physical plus virtual constraint. However, this proposed solution was not supported by a majority of stakeholders. Another alternative approach was to provide an uplift payment to physical exports that are overcharged. The concern with this approach was that it might create undesirable incentives and would not address the overpayment to imports in some cases. Furthermore paying an uplift payment would effectively create multiple prices for the same product at the same location. If paying different prices for the same product was determined to be appropriate then the first solution considered in which physical schedules are settled based on the physical-only and the physical plus virtual constraint while virtual schedules settle based on the physical plus virtual constraint is more appropriate because it avoids uplifts.

IV. Benefits of Eliminating Convergence Bidding at the Interties

Q. Will eliminating convergence bidding at the interties improve the efficiency of the ISO markets?

A. Yes. Elimination of convergence bidding at the interties will improve the ISO markets in several ways. First, the market is likely to experience

immediate relief from a reduction in the real-time imbalance energy offset uplift experienced since convergence bidding was implemented. Although the fundamental market design that requires two settlements in the real-time will still exert pressure on the real-time imbalance energy offset, the offset will undoubtedly go down without the additional revenue losses added to that account resulting from the offsetting virtual supply and demand bids that result from this settlement design that I have discussed.

Q. What other benefits will result from eliminating convergence bidding at the interties?

A. Eliminating convergence bidding at the interties will also have the immediate benefit of dispensing with the need to enforce two constraints at the interties. As a result, physical schedules at the interties will no longer be subject to pricing that is inconsistent with their submitted bids. This change will eliminate the need to make export schedules whole when exposed to higher prices resulting from the enforcement of the physical plus virtual constraint in the pricing run. In addition, this will eliminate payment for imports above the bid cost structure submitted by scheduling coordinators resulting from the dual constraint.

Q. Will there be any other benefits?

A. Yes. Elimination of convergence bidding at the interties is expected to allow internal convergence bidding to achieve increased price

convergence. As I have explained, convergence bidding at the interties has often had the perverse effect of causing further divergence between day-ahead and real-time prices. The divergence between the hour-ahead and real-time prices has made it profitable for participant to submit virtual bids at the interties that indirectly arbitrage the spread between the hour-ahead scheduling process and real-time market, but that either exacerbate or fail to reduce the divergence of prices in these two markets. During periods when real-time prices tend to exceed day-ahead prices, virtual demand bids at locations within the ISO would continue to be profitable. The submission of net demand at the internal locations would increase unit commitment performed in the day-ahead market and help to moderate real-time prices.

Q. Does the ISO anticipate that elimination of convergence bidding at the interties will be permanent?

A. Not necessarily. The ISO believes that the benefits I have described make it reasonable to eliminate convergence bidding on the interties, at least for the time being. However, an existing comprehensive market redesign stakeholder initiative will allow the ISO to address issues related to the current design of the hour-ahead scheduling process and real-time market. If that stakeholder initiative results in market redesign changes that address the issues with convergence bidding at the interties that I

have described, the ISO will consider submitting a new tariff amendment to reinstitute convergence bidding at the interties.

Q. Thank you. I have no further questions.

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

California Independent System Operator Corporation	))	Docket No. ER11-____-000

DECLARATION OF WITNESS

I, Mark A. Rothleder, declare under penalty of perjury that the statements contained in the Direct Testimony of Mark A. Rothleder on behalf of the California Independent System Operator Corporation in this proceeding are true and correct to the best of my knowledge, information, and belief.

Executed on this 20 day of September, 2011.

Mark A. Rothleder

California Independent System Operator Corporation

Fifth Replacement FERC Electric Tariff

Convergence Bidding at the Interties Amendment

Attachment D – Market Surveillance Committee Opinion

September 20, 2011

Final Opinion on Intertie Convergence Bidding and the Imbalance Energy Offset

by

James Bushnell, Member
Scott M. Harvey, Member
Steven Stoft, Member
Benjamin F. Hobbs, Chairman

Members of the Market Surveillance Committee of the California ISO

August 16, 2011

1.0 Summary

The Market Surveillance Committee (MSC) has been asked to state its opinion on the CAISO's proposed responses to the problems created by the interaction of convergence bidding and the persistent market design problems that have led to large levels of uplift payments through the Real-Time Imbalance Energy Offset charge. At the center of the CAISO's current proposal[1] is a move to suspend convergence bidding on interties until a more robust solution is found to the pricing problems experienced on the interties between the CAISO and neighboring control areas.

The California ISO final proposal was developed following discussion at the April 29 Market Surveillance Committee meeting, stakeholder teleconferences on May 4, May 25 and June 17, an in person stakeholder meeting on July 19, 2011, and multiple rounds of written stakeholder comments.

We support the CAISO's proposal to eliminate convergence bids at interties. While the ability to submit such bids is not the root cause of the high levels of Real-Time Energy Imbalance Offset charges, and we do not expect the elimination of convergence bids at the interties to by itself reduce the level of these charges to an acceptable level, there is a reasonable basis for expecting that this change will reduce those charges to some extent. Whether the reduction will be small or substantial is not clear, but the direction of the effect is unambiguous.

Because the reduction in Real-Time Energy Imbalance Offset charges resulting from this change may turn out to be small, and the charges therefore remain excessive, while moving towards implementation of this change the CAISO should continue to evaluate

[1] http://www.caiso.com/Documents/DraftFinalProposal-Real-TimeImbalanceEnergyOffset.pdf, July 29, 2011

other perhaps longer term and more far reaching changes in the pricing and scheduling of imports and exports to address the problem.

2.0 Background

Although great progress has been made in the integration and rationalization of electricity market operations across broad regions over the last decade, these advances have been largely been focused on transactions *within* the control areas of individual ISOs and RTOs. The improvement of the coordination of transactions *between* control areas has greatly lagged these internal advancements. This has been particularly true in the west, where the California ISO remains the only ISO in the Western Electricity Coordinating Council region.

One of the many sources of seams issues, as these inter-control area problems have come to be known, are the differing conventions for the timing of market closure and scheduling obligations. Most relevant to the issue at hand here is the fact that transactions between control areas throughout the western grid are currently scheduled on an hourly basis with intra-hour changes scheduled only in the event of contingencies or to address transmission overloads.[2] The CAISO, on the other hand, runs an internal dispatch and market that operates at 5 minute intervals in near "real-time.'' Although many internal resources can be dispatched on a five minute basis to sell energy into this real-time balancing market, external resources, although critical to the reliability of California's market, must for the most instead be cleared through an hour-ahead scheduling process (HASP) and then confirmed with adjacent balancing area authorities through a process known as "checkout."

Importantly, while the current market design allows for a fully integrated day-ahead market where both internal and external resources can buy and sell energy, the HASP is not a true market in the sense that the only market participant acting on behalf of California load serving entities in this process is the CAISO. Further, the prices and quantities that are determined in the HASP are used for settlements only for imports and exports. Going into the HASP, the CAISO has updated its forecasts of market conditions to reflect changes since the close of the IFM, and will seek to, essentially, buy or sell power over the interties in an attempt to minimize the cost of reliably meeting real-time load based on expected real-time conditions. In the HASP the CAISO essentially buys or sells power acting as an agent for all net consumers of power in the CAISO market. These "purchases" of imports can take the form of increased imports from neighboring regions or reduced exports from within the ISO to those regions.[3] The "internal CAISO demand" in the HASP is therefore driven completely by CAISO forecasts of real-time conditions.

[2] Consideration is being given to allowing 30 minute schedule changes for interchange transactions in the relatively near future.

[3] To take advantage of opportunities for improving operating efficiencies, the CAISO will also clear both offers to adjust export and import levels when those offers imply a gain from trade.

Conversely, internal CAISO demand in the real-time market is driven by actual conditions and supply is, mostly, limited to resources internal to the CAISO.[4] Under such conditions, the only entity able to participate in both HASP and real-time markets to buy and sell energy on behalf of internal CAISO loads is the CAISO itself. The relative level of prices in the two markets therefore depends on the CAISO's actions in these markets. The CAISO also is put in the position of a counter-party to trades in the two markets that, although intended to balance supply and demand, clear at different prices.

Inconsistencies between CAISO purchases and sales, and their respective prices give rise to unfunded costs that must be recovered through special charges. The potential for these costs arises because the CAISO settles HASP imports and exports at HASP prices, while settling internal load and generation at real-time prices. Any time the CAISO schedules net exports in the HASP and the HASP price is lower than the real-time price, the CAISO incurs costs that must be recovered from market participants through the Real-Time Imbalance Energy Offset (RTIEO) charge. Similarly, any time the CAISO schedules imports in the HASP and the HASP price is higher than the real-time price, the CAISO will also incur costs that must be recovered from market participants.[5] If the differences between the HASP prices and RTD prices at the interties were centered around zero and unpredictable, the CAISO would not incur material net Imbalance Energy Offset charges as a result of these HASP/RTD price differences, but this has not been the case.

As documented in several CAISO white papers[6] and in the State of the Market Report[7], positive Imbalance Energy Offset charges have persisted since the introduction of the new market design in the spring of 2009. On average, the CAISO has been a net-seller (i.e. exporter) in the HASP inter-change market, while the HASP price has been on average below the real-time price at which the CAISO implicitly "buys" the power in real-time to support these net exports. The problem has been exacerbated with the introduction of convergence bidding in January of this year.

[4] A relatively modest amount of energy that is imported under a protocol known as dynamic scheduling is also able to fully participate in the CAISO's real-time market.

[5] Conversely, the CAISO generates profits any time it schedules net imports and the HASP price is lower than the real-time price or schedules net exports at HASP prices that are higher than the real-time price.

[6] "Impact of Convergence Bidding on Interties, Draft Final Proposal," July 29, 2011, Figure 1 p. 7; "Impact of Convergence Bidding on Interties, Revised Straw Proposal," June 10, 2011, Figure 1 p. 7; "Redesign of the Real-time Imbalance Energy
Offset, Revised Straw Proposal and Options for an Intermediate Term Solution," May 18, 2011, Figure 1 p. 5; Issue Paper and "Price Inconsistency Caused by Intertie Constraints, Straw Proposal" April 27, 2011; "Impact of Convergence Bidding on Real-Time Imbalance Energy Offset, Issue Paper and Straw Proposal April 27, 2011, Figure 1 p 4.

[7] California ISO, Department of Market Monitoring, "2010 Market Issues & Performance Annual Report," pp. 68-70.

3. Convergence Bidding and the Imbalance Energy Offset Charge

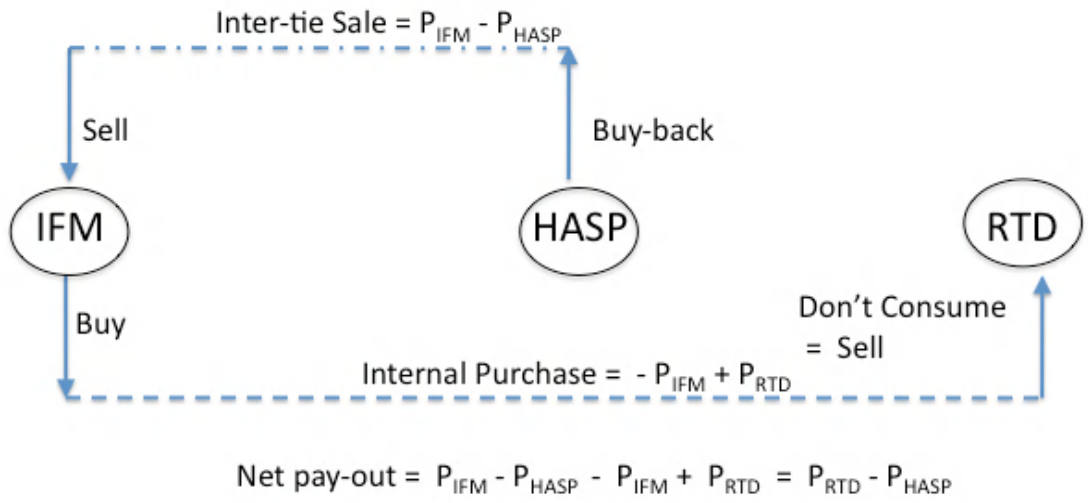
Convergence, or "virtual," bids are financial transactions that allow arbitrage between day-ahead and real-time, and are intended to allow firms to take financial positions that mimic physical ones. Internally, a convergence offer sale in the IFM is automatically balanced against a purchase in the real-time market, and a convergence bid purchase in the IFM is balanced with a sale in the real-time market. However, since physical intertie transactions are settled at the HASP price, intertie convergence bids are also settled at the HASP, rather than real-time, price. While this pricing policy provides for a consistent settlement of physical and virtual transactions on interties, it also greatly expanded the opportunities for trades that, while not risk free, can on average exploit persistent HASP-RTD price differences.

A further complication is that even internal convergence trades are in fact accounted for in the HASP. Mechanically, convergence bids impact the supply and demand balance only in the IFM. In both HASP and RTD, the market consists of adjustments to physical "supply," including intertie transactions, balanced against CAISO forecasts of actual physical demand. This means that, although internal convergence bids are settled at the RTD price, the supply to replace a "virtual" internal sale could be procured either from external supply in the HASP or from internal supply in RTD, depending on which appears lower cost in the HASP.[8]

An internal virtual purchase of 1 MW provides a position that pays the IFM price, p_{IFM}, to acquire the position in the IFM and is paid the real-time price p_{RTD} when the position is settled in real time. An intertie virtual sale provides a position that is paid the IFM price, p_{IFM}, for taking the position and pays the HASP price, p_{HASP} to settle the position. Figure 1 summarizes the flow of these two possible transactions.

[8] In comments, Powerex proposed rectifying this by waiting until RTD to clear internal convergence trades (see "Powerex Comments on Revised Straw Proposal and Intermediate Term Options, June 2, 2011.). This is equivalent to the CAISO assuming that internal virtual positions reflect actual real-time physical demand and supply when it runs HASP. The CAISO has rejected this solution as it anticipates that doing so would raise the cost of meeting load and potentially adversely impact reliability.

If CAISO did not adjust interchange or commit resources requiring long-start or ramp times in HASP, the CAISO would be limited to replacing this internal virtual supply that was scheduled to meet physical internal load in the day-ahead market with on-line and quick start generation in real-time, which could be very expensive and perhaps sometimes not even feasible. Since such outcomes would impose losses on the virtual supply bids, the potential for such outcomes would tend to reduce the level of virtual supply bids. Conversely, internal virtual demand bids would be treated as physical, driving the scheduling of additional imports in the HASP, driving up HASP prices and driving down RTD prices, making virtual demand positions less profitable. While such changes might converge HASP and RTD prices if virtual traders had perfect foresight, with traders lacking such perfect foresight such changes have the potential to introduce much more real-time price volatility, real-time reliability risks, and the potential for additional unintended consequences from interaction with other elements of the market design. The eastern ISO having such a HASP type evaluation process for scheduling imports, New York ISO, accounts for all virtual transactions as virtual in its HASP evaluation (RTC). It is important to note that convergence bidding can lead to convergence but there are no predictions about the *level* of price that would be converged upon. Such a solution could result in all markets converging at a higher price due to higher costs of system operation, such as might result from this proposed solution.



The result of combining these two virtual transactions into a "balanced" convergence bidding position is that there is no change to the net demand or supply in the day-ahead market where the virtual bids are present and offset each other, nor in HASP in which neither the virtual demand nor supply bids are present, nor in real-time in which neither the virtual demand nor supply bids are present, and therefore absent congestion, these bids have no impact on the underlying prices in any of the three markets.[9] However, at the same time, the balanced trade does not produce balanced revenues if the HASP and RTD prices are different. When the HASP price is lower than the RTD price, as it has been on average, the balanced trade produces positive revenues. These revenues are funded by the RTIEO charges.

The dual pricing constraint

An unrelated yet also vexing problem has been the reconciling the existence of convergence bids on interties with WECC standards for congestion management on interties. One of the benefits of convergence bidding is that it removes financial incentives to schedule interchange transactions day-ahead that will not flow in real-time, a practice sometimes called "implicit convergence bidding." When chronically applied during sensitive conditions, implicit convergence bidding can lead to reliability concerns as operators are expecting performance from resources whose owners do not in fact intend to perform.

In theory, convergence bids should be allowed to impact day-ahead market outcomes just like physical bids in order to promote price convergence and remove incentives for implicit convergence bidding. This concept is more controversial when convergence

[9] It might appear that these transactions are not balanced in real-time as the intertie transaction would be priced in HASP and the internal transaction priced in RTD. However recall that both the intertie and internal transactions are physically accounted for in the HASP. Thus both offsetting buy and sell positions are in effect "clearing" in the HASP market, although the internal transaction is priced at the RTD price.

bids, which are explicitly recognized as *not* reflecting physical resources, cause an interface to either become congested or uncongested in the day-ahead market. In practice, WECC rules require that interties be feasibly scheduled with respect to *physical* resources only. This means, for example, that a physically infeasible level of imports cannot be offset by virtual exports.

The CAISO has complied with this requirement by enforcing two constraints, one that determines physical interchange schedules utilizes only physical intertie bids and one that determines prices that takes account of both physical and convergence intertie bids. A problem with this solution is that the physical interchange schedules in the IFM can be inconsistent with the prices in the IFM. In particular, the submission of a virtual export transaction can cause a tie to be unconstrained for pricing purposes, yet constrained for the scheduling of physical imports. This design offers opportunities for a variety of inefficient scheduling practices. While we understand based on informal CAISO analyses that it does not appear that market participants have been taking advantage of these opportunities, this could change, and the observed price inconsistencies could reflect the use of more subtle ways of taking advantage of these limitations of the current design. Hence, it is desirable, although perhaps not urgent, to reform this element of the interchange scheduling and pricing design as well. In HASP the interchange schedules reflect only physical resources as virtual bids are not included in the market. The result is that convergence b ids impact physical dispatch differently in the two markets, further distorting the role of convergence bids in promoting the convergence of prices between the markets.

4. The CAISO Proposal

The possible responses to these problems consist of a) taking measures to eliminate the systematic differences in HASP and RTD prices, and b) mitigating or eliminating the ability to exploit these differences through convergence bids, c) modifying the settlement rules to reduce the significance of HASP- RTD price differences. The three responses are not mutually exclusive and some combination of these changes may be necessary to completely eliminate Imbalance Energy Offset charges.

The current CAISO proposal will focus on the second option. This option will also eliminate the need to manage dual constraints (virtual and physical) on interties and thereby eliminates the potential for inefficient interchange scheduling practices that exploit the inconsistencies in IFM interchange prices that the dual constraints can produce. By eliminating virtual bidding at the interties, the CAISO eliminates the ability to exploit the HASP-RTD price gap through virtual bids alone. There will still remain the ability to respond to and profit from these differences by adjusting physical transactions between day-ahead and HASP.

Other possible steps

One advantage of the CAISO proposal is that it can be implemented immediately. Other steps that would more directly address the market design and implementation flaws that

contribute to the RTIEO charges would involve changes to either the pricing algorithms, settlement calculations, the HASP or RTD optimization or some combination of these alternatives.

A theoretical "market based" solution would be to allow for a more fully participatory Hour-Ahead Market that would replace the current HASP process, which is dominated by CAISO forecasts and decisions. A fully participatory demand side to the Hour-ahead markets in which load serving entities bid to buy or sell supply incremental to their day-ahead schedules and suppliers (internal and external) could lock in changes to their day-ahead schedules could promote price-convergence and allow for a full price-formation process, both internal and external, in the hour-ahead time frame. Further, it would remove the CAISO from the role of counter-party to trades in HASP. Thus, for example sales in the hour-ahead would be balanced against purchases made at the same price. Unfortunately, an hour-ahead market will entail a major redesign whose implementation would be several years away.

Short of implementing a full hour-ahead market, other possible interim measures would be to focus on changing the settlement prices of hour-ahead intertie transactions. The root problem of the current system is that the CAISO doesn't fully know what resources it will need to meet load until real-time, while most imports have to be scheduled during an hour-ahead time frame. That means the CAISO must schedule imports, based upon hour-ahead import offer prices, and then match those adjustments to consumption based upon real-time prices. The two sides of these trades are paying different prices, and the CAISO, as the functional counter-party to both sides, faces the cost of any price differences which must then be recovered through the RTIEO uplift charge.

One solution would be to settle both interchange transactions, internal generation and load at the same real-time price – eliminating the risk of paying for the "spread." Settling interchange transactions at the real-time price, however, would create the potential for an importer (exporter) to sell (or buy) power at a price below (or above) what their bids specified they were willing to trade at. For example an importer may offer power at $50/MWh in HASP, have its offer accepted, and then face a much lower real-time price. If HASP transactions were paid the RTD price, then such an importer may be forced to sell at a "loss" for at least one interval. In some markets, such as PJM and the Midwest ISO, these parties must bear that risk, and take that risk into account in scheduling interchange. PJM and MISO market participants have the ability to change the level of interchange transactions during the hour, subject to ramp availability and some other limitations. This introduces additional uncertainty into forward commitment decisions that the CAISO would need to account for, so this would be a significant design change that would require careful evaluation.

In other markets, such as the NYISO, sellers are given a bid-price guarantee for imports that allows them to be paid the higher of the RTD price or their offer price. This is, in essence, a bid cost recovery provision. These bid-price guarantees reintroduce a divergence, albeit smaller, between hour-ahead payments and real-time prices that again make necessary an uplift fee. In addition, because scheduling limits on the interties are

not binding in RTD, such a real-time pricing system for interchange requires that binding scheduling limits in the HASP be reflected in settlement prices, so that importers are paid the higher of their offer price and the lower of the HASP and RTD price. Such changes in pricing rules could therefore provide an improvement, but would not be the "silver-bullet" that would completely eliminate the need for uplift payments such as the RTIEO and would require fairly material changes to the California ISO settlement system.

It is important to note that the ISO has been continuing to take measures to adjust its process for clearing transactions in HASP and dispatching the market in real-time to reduce costs and better converge HASP and RTD prices.[10] These efforts are independent of the convergence bidding changes outlined in the current CAISO proposal. These measures have to date not eliminated predictable differences between HASP and RTD prices. [11]

5. Discussion

We support the CAISO proposal to suspend convergence bidding on the inter-ties. While we agree that convergence bidding can provide hedging and market efficiency benefits in general, we believe that the combination of predictable price differences between the HASP and real-time, and the current design for pricing of inter-tie transactions create opportunities for profitable convergence bidding strategies that magnify real-time imbalance energy offset charges while failing to bring the HASP and RTD prices into convergence. We believe that it is not acceptable to continue to expose CAISO customers to the ongoing and potentially expanding costs that these trades impose on measured load.

It has been noted that the level of RTIEO charges attributable to a lack of convergence between HASP and RTD prices was a concern before convergence bidding was even implemented in February 2011. [12] Hence, one concern is that the implementation of convergence bidding on the interties merely changed the way in which these underlying problems have been expressed, and that with its elimination, predictable HASP/RTD differentials will continue to lead to outcomes that produce high levels of RTIEO charges.

While the incentive for market participants to schedule physical imports transactions in the day-ahead market and buy them back in HASP if the HASP price is lower than the

[10] See, for example, California ISO, Department of Market Monitoring, "Quarterly Report on Market Issues and Performance," May 24, 2011 pp. 18-19.
[11] See, for example, California ISO, Department of Market Monitoring, "Quarterly Report on Market Issues and Performance," May 24, 2011 pp. 7-9.
[12] Multiple CAISO analyses show high levels of the RTIEO since early 2010, see "Impact of Convergence Bidding on Interties, Draft Final Proposal," July 29, 2011, Figure 1 p. 7; "Impact of Convergence Bidding on Interties, Revised Straw Proposal," June 10, 2011, Figure 1 p. 7; "Redesign of the Real-time Imbalance Energy Offset, Revised Straw Proposal and Options for an Intermediate Term Solution," May 18, 2011, Figure 1 p. 5; "Impact of Convergence Bidding on Real-Time Imbalance Energy Offset, Issue Paper and Straw Proposal April 27, 2011, Figure 1 p 4. California ISO, Department of Market Monitoring, "2010 Market Issues & Performance Annual Report," pp. 68-70.

cost of that power will remain following elimination of virtual bidding at the ties, the incentives will be no greater than they are currently. Because the combination of virtual supply at the interties and virtual demand bids internal to the California ISO does not lead to price convergence between the day-ahead and HASP prices under the current rules, one form of trading does not necessarily "crowd-out" the other. We therefore believe that suspending convergence bidding on the interties has the potential to reduce RTIEO costs, and to reducing the potential for a dramatic future escalation of those costs.

That said, we are concerned that the suspension of convergence bidding will prove insufficient to eliminate the costs to load of the market flaws, as reflected in the RTIEO. The incentive of external suppliers to respond to persistent and predictable price differentials will remain and it is desirable for external suppliers to respond to high and low day-ahead and real-time prices. Further, this proceeding may very well have had a chilling effect on both implicit and explicit convergence bidding, as various solutions, some of which would make implicit convergence bidding more costly, have been considered. By taking a relatively firm stance that no further actions will be taken to address this issue short of the full market redesign, the CAISO may be removing some of the self-discipline that may have limited the level implicit convergence trades during the last few months.

If the RTIEO continues to grow or remains substantial in the absence of inter-tie convergence bids, then a potential next step could be to revise the prices at which HASP intertie transactions are settled, such as settling import and export transactions scheduled in the HASP at real-time prices rather than at HASP prices. This could involve implementing the hybrid system employed by the NYISO, or developing some variation on this approach.

Other Measures

The discussion above has concerned the impact on RTIEO of either physical or virtual imports scheduled in the day-ahead market but are not scheduled in HASP and hence settle at the HASP price. A related question is whether further measures are necessary to deter deviations between HASP and real-time interchange schedules that contribute to the magnitude of the RTIEO both directly and indirectly by increasing HASP real-time price divergence.

Such deviations can be caused, for example, by physical transactions that are scheduled in the HASP but do not flow in real-time because the market participant declines the dispatch instruction or the transaction fails check out with the other balancing authority area. As described in the CAISO Draft Final Proposal,[13] the costs of such a failure to perform is currently limited to little more than a refund of the HASP revenues that would have been earned had the transaction been delivered as scheduled. In fact, such non-performance imposes a cost on the system that is best measured by the RTD price. This is recognized for internal resources, whose cost of uninstructed deviations is at least the RTD cost of replacing the power they did not provide. We therefore believe that settling

[13] July 29, 2011 p. 10 section 4.2.2.

intertie transactions that are scheduled in HASP but do not perform in real-time because of reasons within the control of the market participant at the RTD price would both better reflect true costs and provide more symmetric treatment for internal and external resources. If, however, the transaction is curtailed because of a curtailment by the CAISO or another security coordinator, the HASP price would be the appropriate settlement price.

While some market participants recommended such a policy, the CAISO has not proposed charging the RTD price for such deviations in light of concerns expressed by other market participants relating to unintended consequences of such changes. [14] If these kinds of deviations are at all significant, the CAISO should identify the specific concerns relating to unintended consequences of such a change, evaluate and address them so that such a pricing policy can be implemented. Other ISO's, such as the New York ISO, have had such pricing rules in effect for a decade, and the implementation of efficient pricing should not be unduly delayed by the possibility of unspecified unintended consequences if the intended effect is to address a material market inefficiency.

Other proposed measures would expand the base of customers responsible for sharing the costs of the RTIEO to include imports that are reduced through market transactions in HASP. This is a different matter from an uninstructed deviation, such as a failure to perform on a HASP commitment. We therefore agree with the CAISO's position to not adopt this measure, at least as long as implicit trading remains under acceptable limits. Even if adopted, it may prove to be a weak deterrent to implicit convergence bidding as the direct costs caused by such behavior would still be distributed amongst a large base from which the implicit virtual trades would still constitute a relatively small share.

6. Conclusions

The inconsistencies between the hour-ahead market transactions with neighboring control areas and the real-time operation of the CAISO's internal market has been a persistent and troubling problem. These inconsistencies are an artifact of stubborn incompatibilities between the traditional trading regimes employed throughout the west that predate the existence of the CAISO, and the CAISO's pool-based market operations. The costs reflected in the real-time Imbalance Energy Offset are simply the latest manifestation of several long-standing incompatibilities. Improvements in the CAISO's operation of its current market design, and longer-term redesign of its HASP process, will improve the situation. However seams issues will likely persist in until there is some form of west-wide balancing market with unified settlement policies and timing.

Currently, the CAISO's HASP and real-time markets are not well integrated, and convergence bidding cannot resolve these integration problems. Convergence bidding on interties has contributed to an unacceptably high offset charge that is borne ultimately by California energy consumers. We therefore support the CAISO's proposal to suspend

[14] California ISO, "Impact of Convergence Bidding on Interties, Draft Final Proposal," July 29, 2011 p. 10 section 4.2.2

convergence bidding on interties. We suspect that further measures may in fact still be necessary if RTIEO charges continue at high levels.

California Independent System Operator Corporation

Fifth Replacement FERC Electric Tariff

Convergence Bidding at the Interties Amendment

Attachment E – ISO Department of Market Monitoring Quarterly Report on Market Issues and Performance, August 24, 2011

September 20, 2011

California ISO

Quarterly Report on Market Issues and Performance

Revised August 24, 2011

Prepared by: Department of Market Monitoring

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Executive summary

This report provides an overview of general market performance during the second quarter of 2011 (April – June) by the Department of Market Monitoring (DMM).

Energy market performance

- In the 5-minute real-time market, average prices remained above prices in the day-ahead and hour-ahead markets for off-peak hours in the second quarter, particularly in April and June. Average on-peak real-time prices were much closer to day-ahead and hour-ahead prices in April and May, but were much lower than both day-ahead and hour-ahead prices in June.

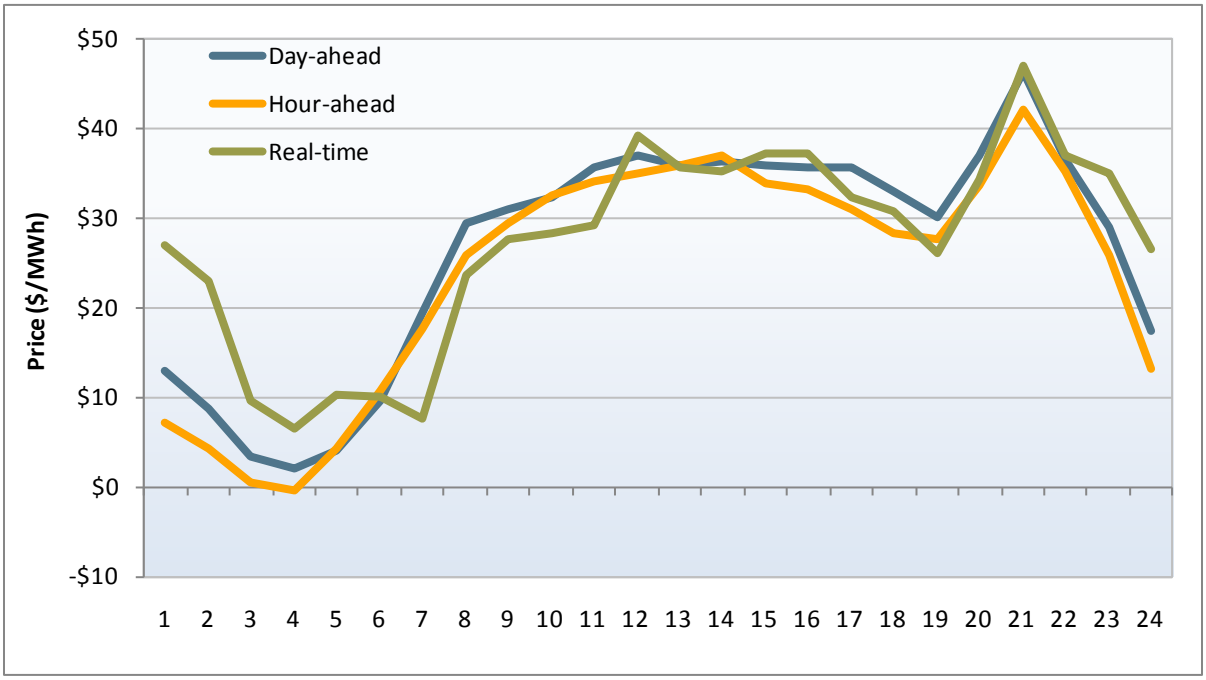
- When averaged for both peak and off-peak periods for the month, hour-ahead and real-time market price convergence improved in the second quarter, most notably in May. However, this improvement is a result of averaging price differences over the day. In some hours, real-time prices were systematically lower than hour-ahead prices and in other hours real-time prices were systematically higher than hour-ahead prices (see Figure E.1). Thus, even though overall peak and off-peak prices appear to converge for this period, systematic price divergences continued to persist in some hours.

- Higher average real-time prices for off-peak periods continued to be driven by short but extreme price spikes. Most of these high prices were attributable to minor system level shortages of upward ramping capacity during one or two consecutive 5-minute intervals. These price spikes generally do not reflect an underlying shortage of total potential capacity and may be avoided by further modeling and dispatch improvements that increase the accuracy and flexibility of real-time dispatches. The volume of price spikes were reduced in the second quarter this year compared to the second quarter last year as a result of various modeling and procedural changes made by the ISO.

- The divergence of 5-minute real-time prices from hour-ahead market prices also continues to impose unnecessary additional inefficiencies and costs on the system. This occurs when net physical and virtual imports at inter-ties settle against prices that differ from physical generation and virtual bids at internal locations. Real-time imbalance energy offset charges have totaled roughly $76 million since convergence bidding began in February 2011. DMM estimates that convergence bidding contributed to $43 million of these costs, with $19 million coming during the second quarter. In May, real-time imbalance energy offset costs associated with convergence bidding were lower than in other months. The imbalance costs in May were driven by imbalances from uninstructed and unaccounted for energy costs. The volumes of offsetting virtual bidding positions were also low in May.

- Congestion within the ISO system had minimal impact on overall prices. However, day-ahead congestion continued to occur more frequently than congestion in the real-time market, particularly on constraints relating to imports into the Southern California Edison and San Diego Gas and Electric areas. This increase in day-ahead congestion coincided with implementation of virtual bidding on February 1, 2011, and continued through the second quarter. DMM continues to evaluate the extent that this congestion was attributable to convergence bidding rather than generation and transmission outages.

Figure E.1 Hourly comparison of PG&E load aggregation point prices – Q2 2011



- Scarcity pricing of ancillary services was triggered in a dozen 15-minute real-time pre-dispatch intervals in the second quarter. As is common for this time of year, loads reached their seasonal spring lows and hydro-electric units provided energy rather than bid into the ancillary services markets. Both of these factors combined to reduce the available real-time supply of ancillary services. As a result, there was less online flexibility of supply to counteract events that occurred in real-time, such as unit de-rates and outages.

Convergence bidding

The ISO implemented functionality for convergence (or virtual) bidding in the day-ahead market for February 1, 2011. Convergence bidding is designed to allow any creditworthy entity, regardless of whether or not they own physical load or generation, to place bids to buy power and offers to sell power into the day-ahead market. As these bids are only virtual and not physical, they will liquidate in real-time and cause the physical system to re-dispatch accordingly.

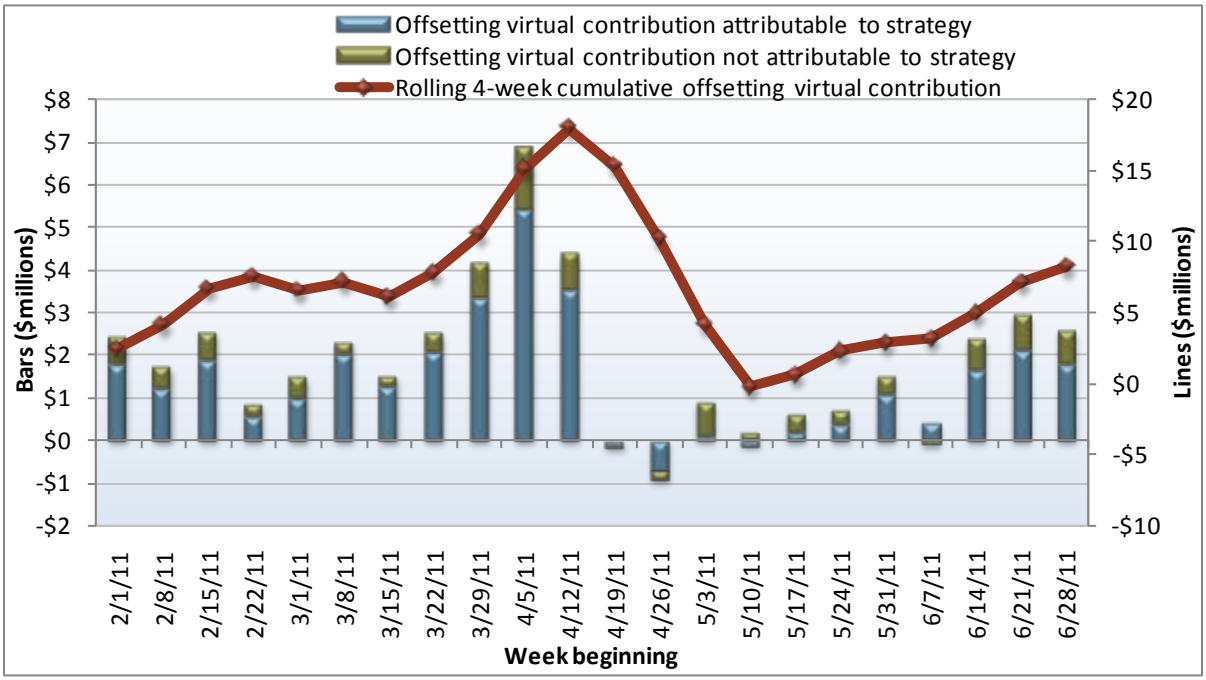
Convergence bidders profit by arbitraging the difference between day-ahead and real-time prices. In theory, as participants take advantage of opportunities to profit through convergence bids, this activity should drive real-time and day-ahead prices closer. While average price convergence appears to have improved since February 2011, this improvement is a result of averaging hourly prices over the day. In some hours, real-time prices still tend to be higher than day-ahead and hour-ahead prices, and in other hours, real-time prices are lower. These systematic price differences continue to make convergence bidding highly profitable.

Convergence bidding has been marked by two key trends over the course of the first few months.

- The vast majority of virtual supply clearing the market is imports on inter-ties, whereas the bulk of cleared virtual demand has been at internal locations. This pattern has remained constant since the start of convergence bidding in February.
- The volume of virtual bids clearing the market increased steadily over the first few months until the second half of April. Afterwards, volumes dropped precipitously and then began to increase steadily through June.

The increase in volumes of virtual bids provided little value in terms of price convergence or market efficiency because virtual demand was met with virtual supply. Specifically, individual participants bid in positions at inter-ties that offset their positions at internal nodes. The use of this strategy receded in late April and May but began to increase again in June. As a result, real-time imbalance charges associated with the offsetting strategy increased at the end of the second quarter (see Figure E.2).

Figure E.2 Contribution of offsetting virtual supply and demand to real-time imbalance charges by week[1]



Over the course of the second quarter, net revenues paid out to convergence bidding entities totaled almost $19 million – or just over the $16 million paid to convergence bidding entities in February and

[1] Figures E.2, 2.7, 2.8, 2.10, 2.11, 2.12, and 2.13 were revised on 8/24/2011. The original figures were calculated from data in the ISO's Enterprise Data Repository (EDR), which does not include price correction data. DMM developed a separate process to incorporate the price corrections made by the ISO as part of the settlement process and then updated these figures. With the exception of Figure 2.12, the changes were minimal. In Figure 2.12, convergence bidding results for the month of May changed from negative $4 million to negative $300,000. This change was the result of extreme negative prices (-$10,000/MWh) on May 27 hour ending 1 that were corrected as part of the ISO settlement process.

March. DMM's assessment of convergence bidding over the first five months is that convergence bidding has had little or no benefit in terms of helping to improve price convergence or the efficiency of day-ahead unit commitment decisions. Meanwhile, convergence bidding has added to energy imbalance offset costs that are ultimately allocated to load-serving entities.

Since 2009, DMM has indicated that the systematic difference in hour-ahead and 5-minute real-time prices has represented one of the most significant sources of inefficiency in the ISO's new market and has expressed concern that this trend is attributable to systematic differences in the inputs and models used in the different markets and may persist unless specifically addressed though enhanced modeling and operational practices. In 2010, the ISO indicated that addressing this price divergence would be a high priority and identified numerous software and modeling enhancements the ISO felt would improve price convergence. In addition to these modeling enhancements, DMM recommended that the ISO also implement improved operational procedures or guidelines for manual adjustments to the load forecast made by system operators that have a significant impact on price convergence between the hour-ahead and 5-minute real-time markets.

Numerous modeling and operational improvements have been made by the ISO. While it appears these changes have resulted in some improvements in price convergence, significant and systematic differences in hour-ahead and real-time prices persist, even after implementation of convergence bidding. This provides further evidence that more fundamental structural aspects of the current market design tend to create systematic differences in hour-ahead and real-time prices. Therefore, DMM believes it is becoming increasing apparent that more fundamental modifications to the hour-ahead and real-time market design will be needed to resolve the problems created by this price divergence.

Recommendations

- **Modeling enhancements to improve price convergence**. DMM believes that current ISO initiatives to improve price convergence between the hour-ahead and real-time markets represent important steps that will help reduce extreme price spikes due to short-term shortages of ramping capacity. Virtual bidding has not resolved the issue of real-time price convergence. Therefore, improving price convergence through modeling and operational enhancements remains a crucial approach to addressing this problem.

- **Address offsetting virtual bidding strategy**. DMM supports the ISO's proposal to suspend virtual bidding at the inter-ties. Specifically, participants taking offsetting positions of virtual supply at inter-ties and virtual demand at internal locations appear to result in higher real-time imbalance charges without contributing to price convergence or market efficiency. The strategy provides little or no increase in efficiency or reliability as these offsetting virtual supply and demand positions do not increase day-ahead unit commitment. Rather, the strategy simply allows some participants to profit from price divergence between the hour-ahead and 5-minute real-time markets. As long as participants can bid in offsetting virtual supply bids on the inter-ties and virtual demand bids on internal nodes, this strategy will likely continue to inflate real-time energy imbalance charges when price divergence occurs between the hour-ahead and real-time markets.

- **Other market design options.** One long-term solution for minimizing these offset charges is to redesign the real-time market so that all external and internal resources are scheduled and settled in the same market. However, the implementation of such a redesign is likely several years away. DMM believes that even with the removal of virtual bidding at the inter-ties, these offset charges may be significant enough to warrant further action prior to the implementation of the real-time

market redesign as part of the renewable integration initiative. Therefore, DMM recommends that the ISO continue to consider a phased approach that would start with the elimination of virtual bidding at the interties, as well as a second phase to address remaining issues with physical inter-tie schedules. In particular, DMM believes the ISO should continue to consider the merits of the NYISO's real-time method for settling inter-tie schedules.

1 Market performance

Day-ahead market

DMM continues to evaluate the competitiveness of the day-ahead integrated forward market in the first and second quarters of 2011.[2]

Real-time market

In the 5-minute real-time market, average prices remained significantly above prices in the day-ahead and hour-ahead markets for off-peak hours in the second quarter. Higher average real-time prices continued to be driven by short but extreme price spikes. Most of these high prices were attributable to minor system level shortages of upward ramping capacity during one or two consecutive 5-minute intervals. These price spikes generally do not reflect an underlying shortage of total potential capacity and may be avoided by further modeling and dispatch improvements that increase the accuracy and flexibility of real-time dispatches. Average on-peak real-time prices were much closer to day-ahead and hour-ahead prices in April and May, but were much lower than both day-ahead and hour-ahead prices in June.

Congestion

Congestion within the ISO system had minimal impact on overall prices. However, day-ahead congestion continued to occur more frequently than congestion in the real-time market, particularly on constraints relating to imports into the Southern California Edison and San Diego Gas and Electric areas. This increase in day-ahead congestion coincided with implementation of virtual bidding on February 1, 2011, and continued through the second quarter. DMM continues to evaluate the extent that this congestion was attributable to convergence bidding versus generation and transmission outages.

Ancillary services

Scarcity pricing of ancillary services was triggered regionally in a dozen 15-minute real-time pre-dispatch intervals in the second quarter. As is common, loads reached their seasonal spring lows and hydro-electric units generated rather than bid into the ancillary services market. Both of these factors combined to reduce the available real-time supply of ancillary services. As a result, there was less online flexibility of supply to counteract events that occurred in real-time, such as unit de-rates and outages.

[2] DMM has previously had the ability to rerun the ISO market software to assess the competitiveness of the day-ahead market. However, as noted in DMM Q1 2011 report, DMM was not able to conduct this analysis so far in Q1 2011 due to problems with the software system provided by the ISO to DMM for this analysis. In Q2, DMM continued to be unable to perform this analysis due to continued problems with the market software system, as well as some enhancements to the methodology for calculating the competitive market baseline being made by DMM. DMM anticipates being able to have competitiveness metrics completed for the next quarterly report.

1.1 Energy market performance

Figure 1.1 and Figure 1.2, below, show monthly average prices for on-peak periods and off-peak periods for the PG&E load aggregation point, respectively.

Figure 1.1 Average monthly on-peak prices - PG&E load aggregation point

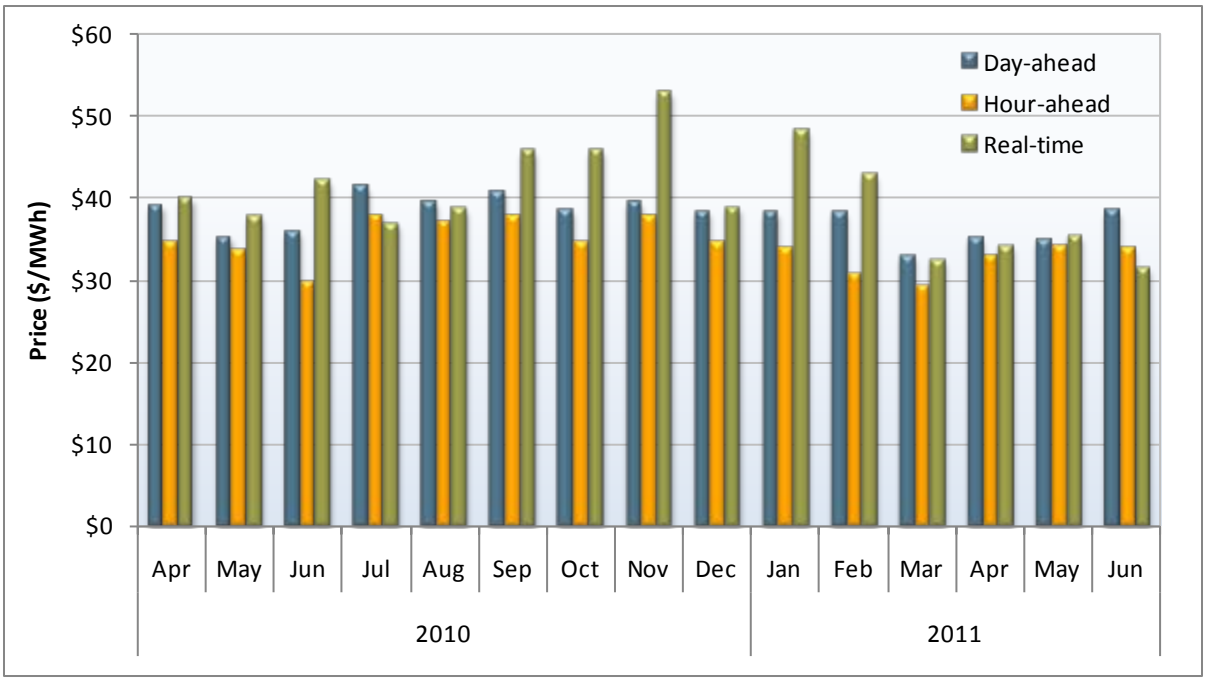
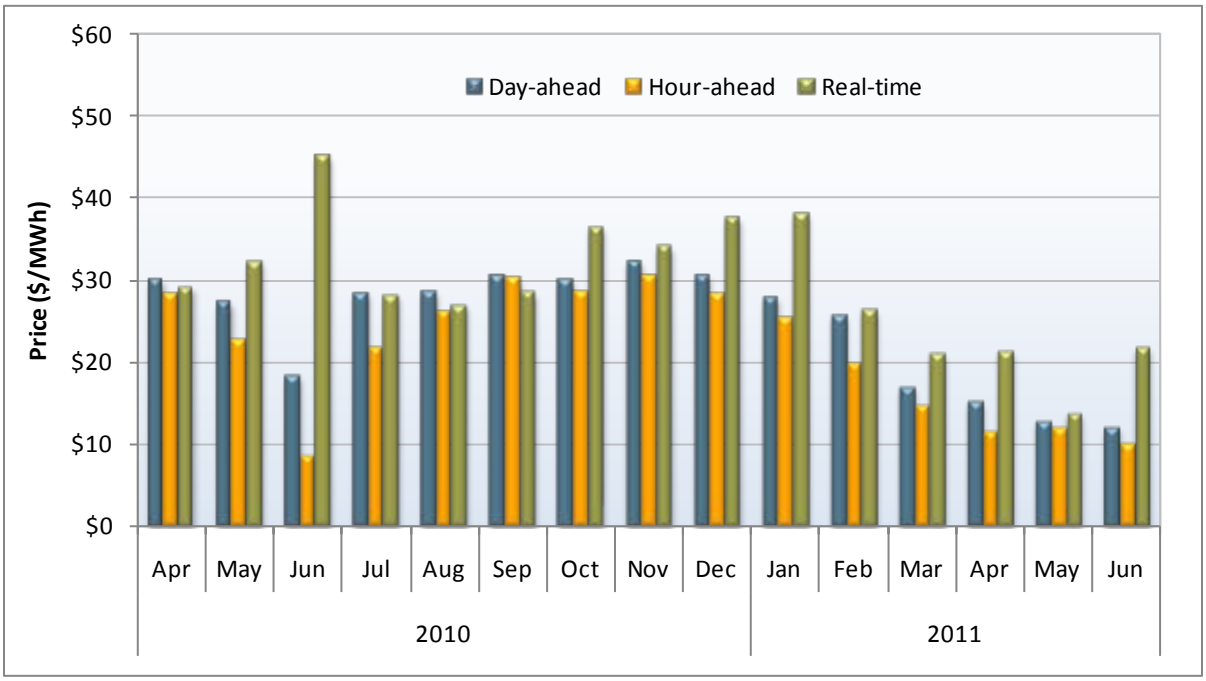


Figure 1.2 Average monthly off-peak prices - PG&E load aggregation point



- Hour-ahead market prices tended to be lower than peak and off-peak prices in the 5-minute real-time market. Hour-ahead market prices are used to settle physical imports and exports as well as virtual supply and demand bids on the inter-ties.

- During peak hours, average prices in the 5-minute real-time market were fairly close to day-ahead and hour-ahead prices in April and May. However, real-time prices were lower than both day-ahead and hour-ahead prices in June.

- During off-peak hours, prices in the 5-minute real-time market were significantly higher than day-ahead and hour-ahead prices in both April and June. Average off-peak real-time prices tracked closer to day-ahead and hour-ahead prices in May.

Figure 1.1 and Figure 1.2 suggest that hour-ahead and real-time market price convergence improved in the second quarter, most notably in May. However, this improvement is a result of averaging price differences over the day. In some hours, real-time prices were lower than hour-ahead prices and in other hours real-time prices were higher than hour-ahead prices. When averaged together, prices appear to converge, but in reality, price divergence in some hours offset price divergence in other hours.

Figure 1.3 and Figure 1.4 indicate hourly variations in price divergence:

- Figure 1.3 shows average hourly prices for the second quarter.[3] Real-time prices were higher than day-ahead and hour-ahead prices in the early morning hours (1 through 5) and late evening hours (21 through 24). In hours 7 through 11 and in hour 19, real-time prices were often much lower than both day-ahead and hour-ahead prices.

- Figure 1.4 highlights the magnitude of these differences by taking the average of the absolute difference in prices in the hour-ahead and real-time markets.[4] When taking the straight average of prices (green line), price convergence appears to have improved significantly since January. However, when the average absolute differences are taken into account, the magnitude of price differences began to increase in March, indicating that price divergence has grown. Indeed, the absolute price divergence in the second quarter of 2011 is second only to the absolute price divergence in the second quarter of 2009, at the start of the nodal market. While average differences between hour-ahead and real-time prices fell to a low of almost $1.50/MWh in May, the average absolute difference in prices was approximately $19.50/MWh for the same month.

[3] The monthly trends for April, May and June were similar and are not lost in this averaging.

[4] By taking the absolute value, the direction of the difference is eliminated and only the magnitude of the difference remains. If the magnitude decreases, price convergence would be improving. If the magnitude increases, prices convergence would be getting worse.

Figure 1.3 Hourly comparison of PG&E load aggregation point prices – Q2 2011

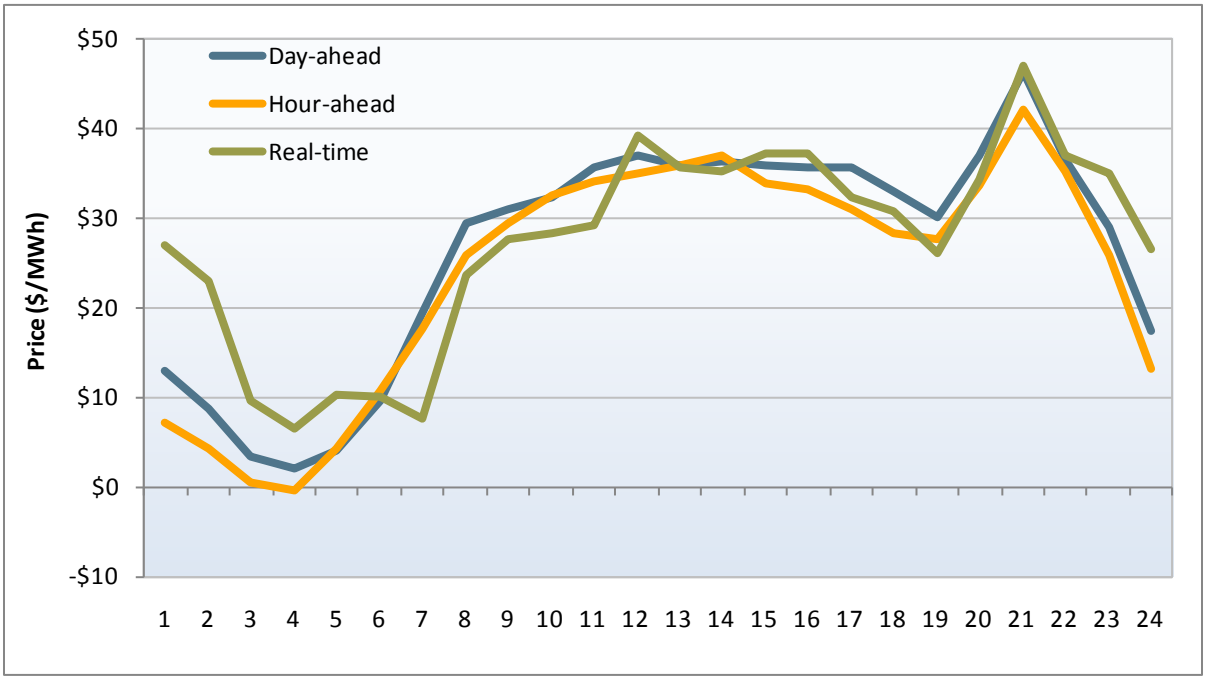
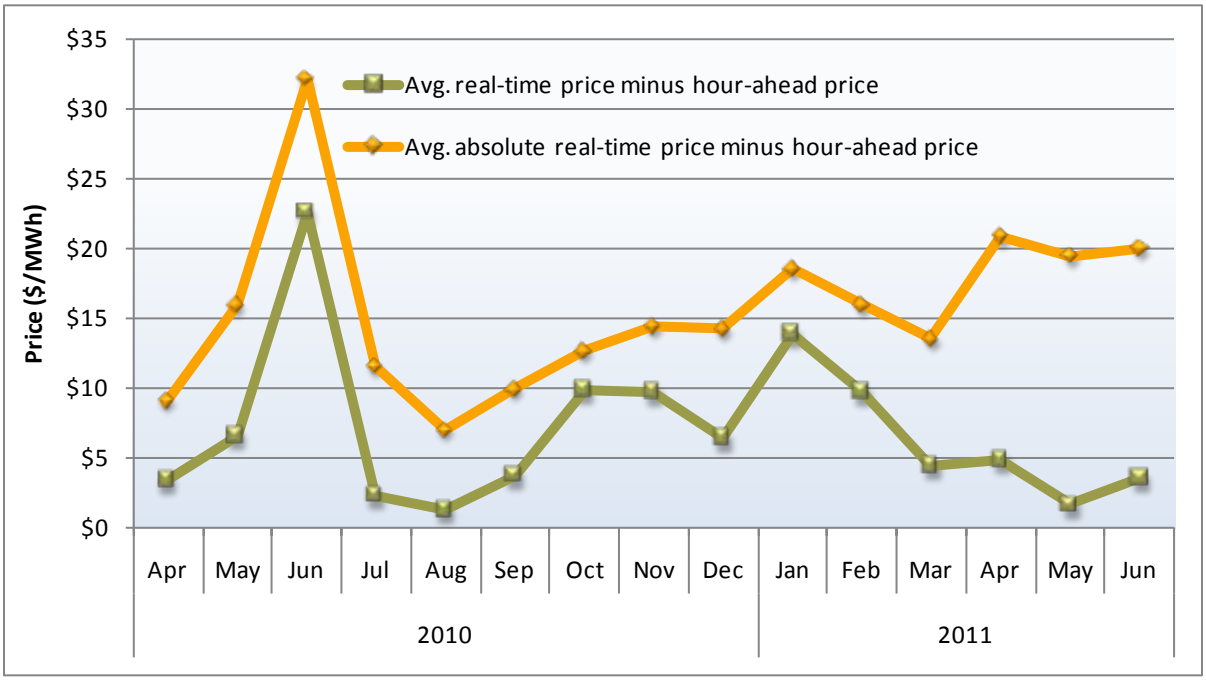


Figure 1.4 Difference in monthly hour-ahead and real-time prices when taking a simple average and absolute average of price differences (PG&E LAP, all hours)



1.2 Power balance constraint

The system-wide power balance constraint continues to contribute to both high real-time positive and negative prices. Figure 1.5 and Figure 1.6 show the frequency the power balance constraint was relaxed in the 5-minute real-time market software since the second quarter of 2010.

- Figure 1.5 shows that insufficiencies of dispatchable incremental energy caused the power balance constraint to be relaxed slightly below 1 percent of all 5-minute intervals in the second quarter of 2011. The second quarter figure is down when compared to both the first quarter of the year and the second quarter of 2010. Most notably, the number of instances fell by about 1 percent from June 2010 to June 2011. This reduction can be attributed to changes in operational procedures and software enhancements since last year, particularly those related to load adjustments.

- Figure 1.6 indicates that since February there has been a general decreasing trend in the number of power balance constraint relaxations in the 5-minute intervals because of insufficiencies of dispatchable decremental energy. The June 2011 values indicate a significant decline in the number of relaxations compared to the June 2010 values. This improvement can also be attributed to changes in operational procedures and software enhancements. Specifically, the ISO implemented in the second quarter new procedures to account for generation shut-down procedures, as well as initiated a new load forecasting tool that provides better sub-hourly load granularity.[5]

Figure 1.7 provides more detailed information on the intervals in which the power balance constraint was relaxed because of insufficient upward ramp in the second quarter of 2011. As shown in Figure 1.7:

- Power balance constraint relaxations from shortages of upward ramping capacity were dispersed over different hours of the day in the second quarter of 2011. This is a contrast to the first quarter where relaxations took place frequently during morning and evening ramp hours of 7, 8, 18 and 19. In the second quarter, the ISO changed the operational procedures related to hour-ahead load adjustments. Specifically, the ISO started new hour-ahead forecast adjustment procedures where the operators adjust hour-ahead load during ramping hours by approximately 25 percent of the load change and adjust hour-ahead load by approximately 2 percent of the forecast across peaks.[6] By procuring more capacity in the hour-ahead market, the intent of these adjustments was to address ramping deficiencies in the 5-minute real-time market.

[5] This new load forecasting tool has had significant stability issues in the third quarter leading to an inappropriate increase in price spike activity. These issues will be addressed in the next DMM quarterly report.

[6] These procedural guidelines for adjustment are for normal conditions. Operators may adjust by more or less to account for other anticipated system conditions.

Figure 1.5 Relaxation of power balance constraint due to insufficient upward ramping capacity

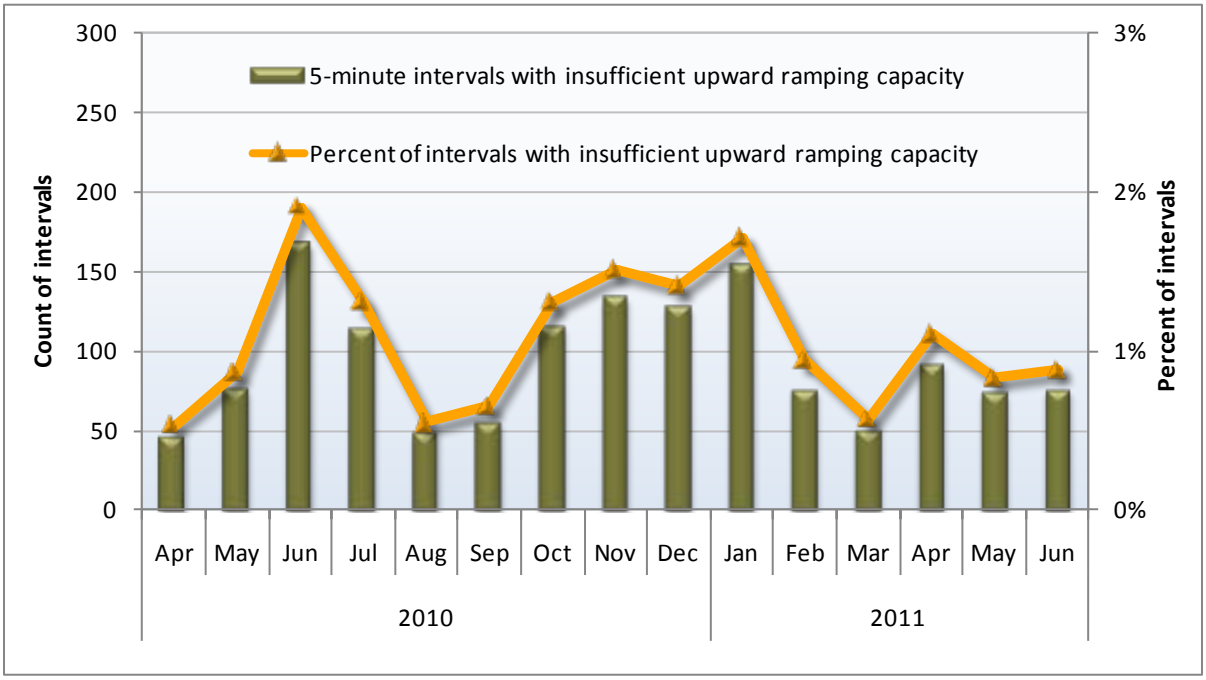


Figure 1.6 Relaxation of power balance constraint due to insufficient downward ramping capacity

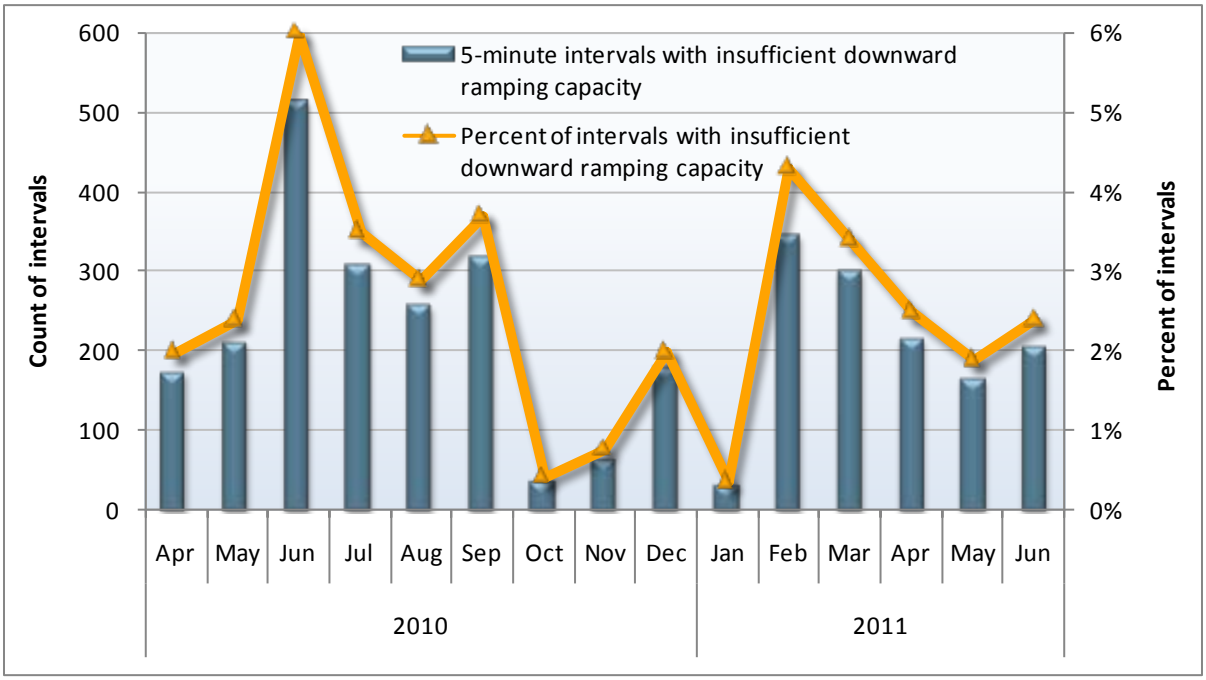
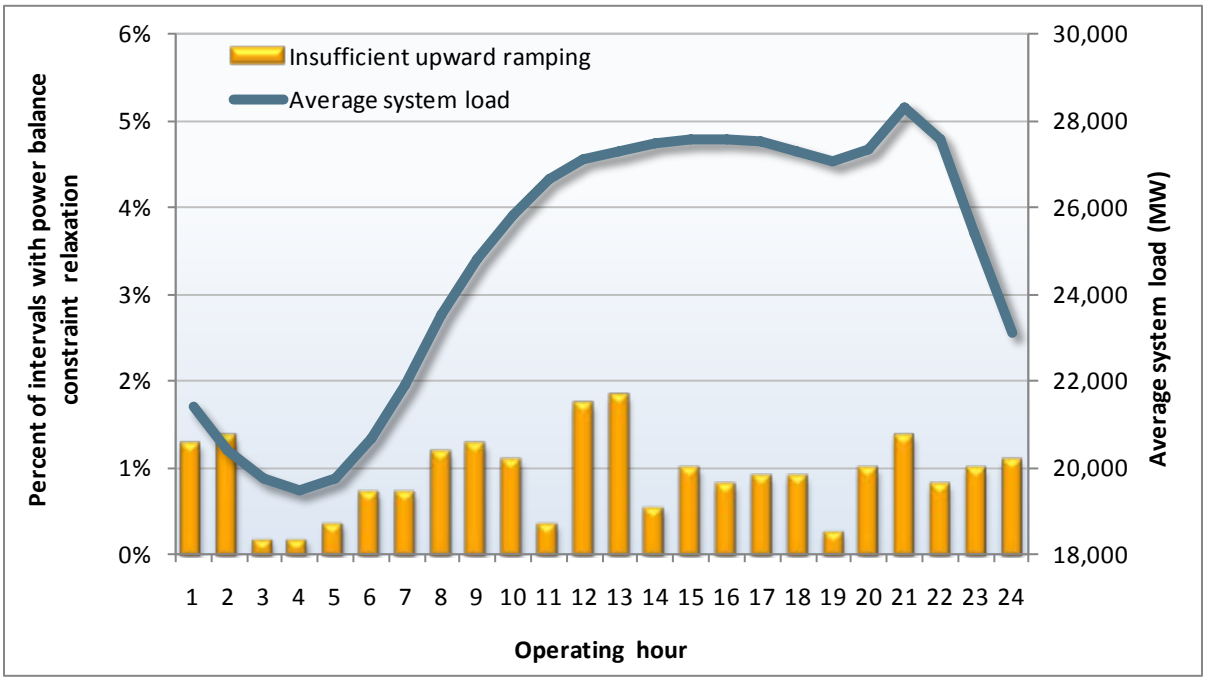


Figure 1.7 Relaxation of power balance constraint by hour (April – June 2011)



The power balance constraint was relaxed because of insufficient incremental energy less than 1 percent of intervals in the second quarter. Price spikes during these intervals continued to have a significant impact on overall average real-time prices due to the bid cap and penalty prices used in the pricing run when this relaxation occurs.

Figure 1.8 and Figure 1.9 highlight the degree to which the divergence of monthly average real-time prices during all hours was caused by extreme prices during the small percentage of intervals when power balance constraint relaxations occurred. With these intervals excluded, real-time prices were less than average day-ahead and hourly prices during the second quarter. Indeed, after correcting for these intervals, May had the largest negative spread in hour-ahead and real-time prices since the market began in April 2009.

Figure 1.8 Change in monthly prices excluding hours when power balance constraint relaxed (PG&E LAP, all hours)

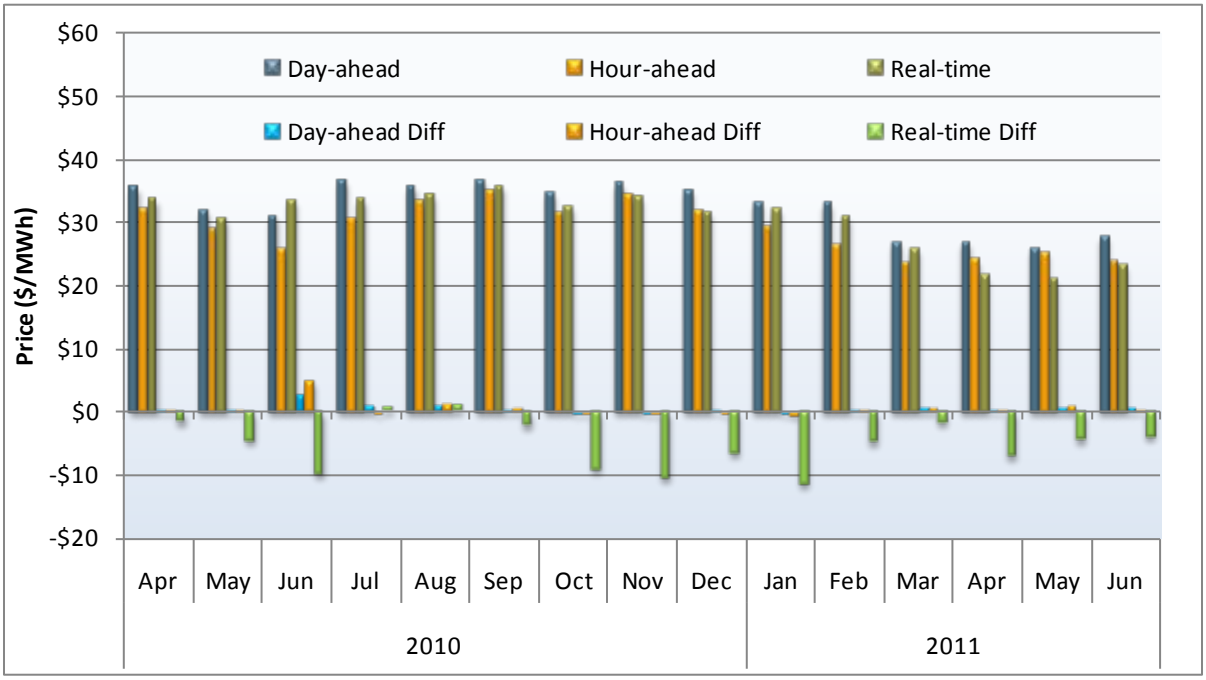
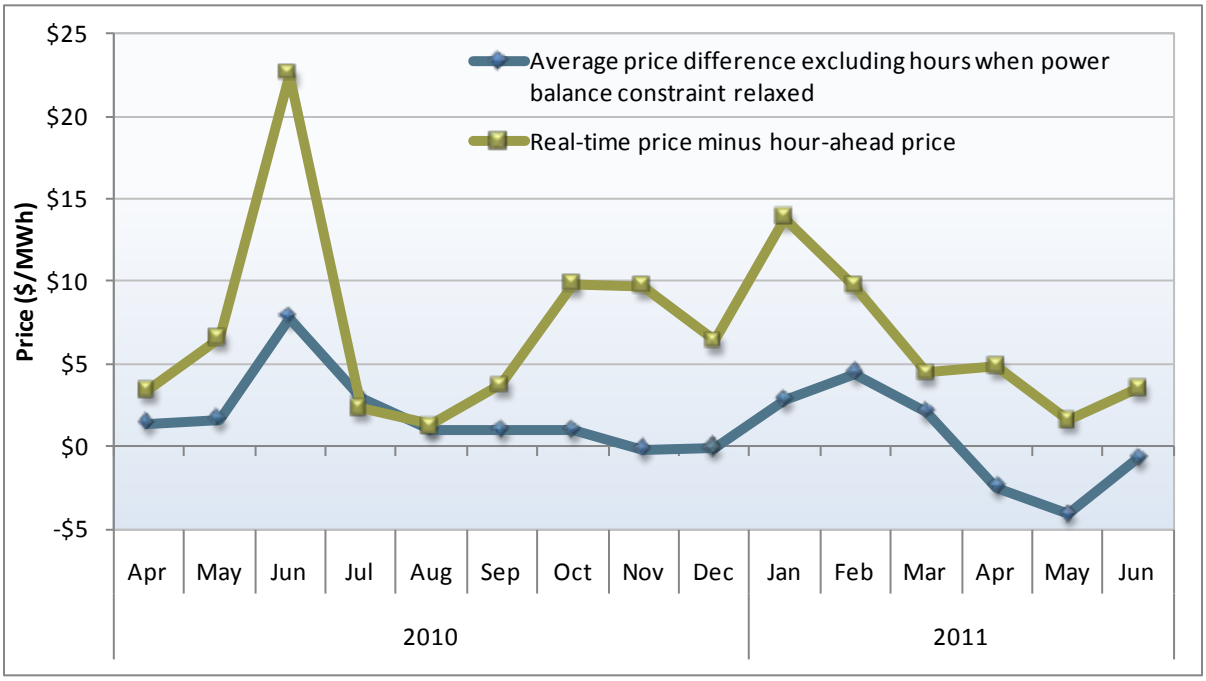


Figure 1.9 Difference in monthly hour-ahead and real-time prices excluding hours when power balance constraint relaxed (PG&E LAP, all hours)

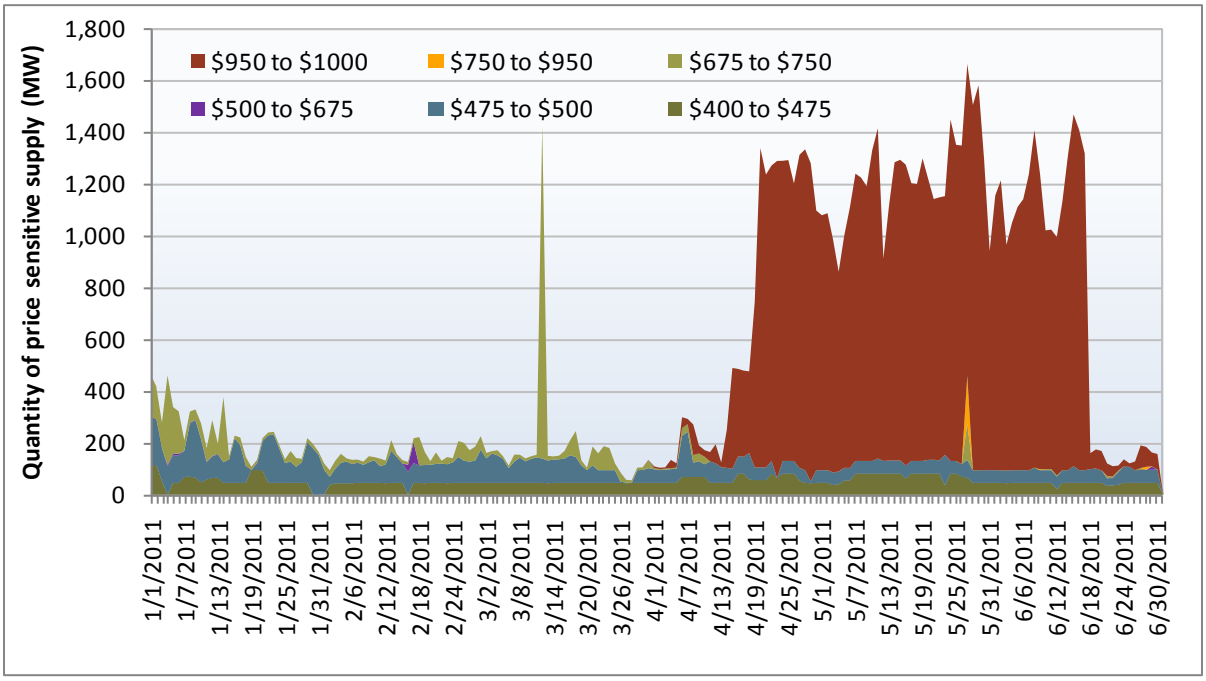


1.3 Increase in the bid cap

On April 1, the energy market bid cap was increased to $1,000/MWh from $750/MWh. Figure 1.10 shows that the volume of real-time energy bid at or near these bid caps increased dramatically in mid-April and declined sharply in mid-June. DMM attributes this increase in supply offered near the bid cap to market behavior identified in an emergency tariff filing with the Federal Energy Regulatory Commission on June 22, 2011.[7] The amount of capacity bid at or near the $1,000/MWh bid cap declined just before this filing was made.

The volume of supply bid at or near the cap was consistent with the pattern in Figure 1.10 during most hours with the exception of the last few hours of the day. In these hours, there were fewer bids at the bid cap, consistent with the strategy outlined in the ISO's June 22 filing. The strategy outlined in the filing was intended to increase bid cost recovery payments, not real-time prices.[8] As such, much of the generation bid near the cap was ramp limited and therefore unable to set price.

Figure 1.10 Real-time bids by price bin: all hours



Even though the bidding behavior around the bid cap changed dramatically from mid-April through mid-June, the frequency of price spikes did not increase relative to other periods. As summarized in Figure 1.11, the frequency of price spikes occurred in roughly 1 percent of the time in the second quarter. This was significantly less than the frequency during the second quarter of 2010 and less than the frequency of price spikes in the first quarter of 2011.

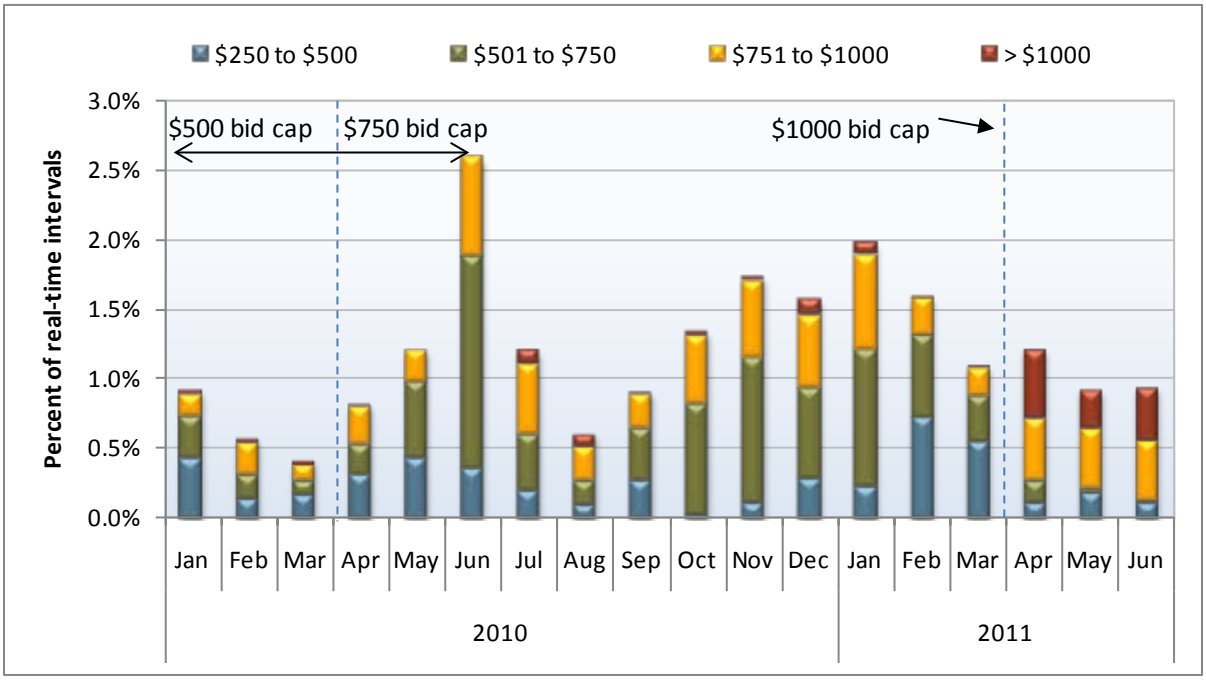
While the frequency was fairly consistent and to some extent lower than in previous periods, the magnitude of price spikes increased in the second quarter. Notably, the frequency of price spikes above

[7] See FERC Docket No. ER11-3856.

[8] Bid cost recovery payments increased as a result of the strategy. After the bid behavior changed in mid-June, bid cost recovery payments fell.

$1,000/MWh was as high as during the first quarter of the nodal market (April – June 2009). DMM attributes this change in magnitude to the increase in the bid cap to $1,000/MWh and its relationship to the power balance constraint relaxation penalty price rather than to changes in participant behavior. Indeed, in 2010, DMM observed a shift in magnitude of price spikes over $500/MWh after the bid increase to $750/MWh on April 1, 2010.

Figure 1.11 Frequency of price spikes (all LAP areas)

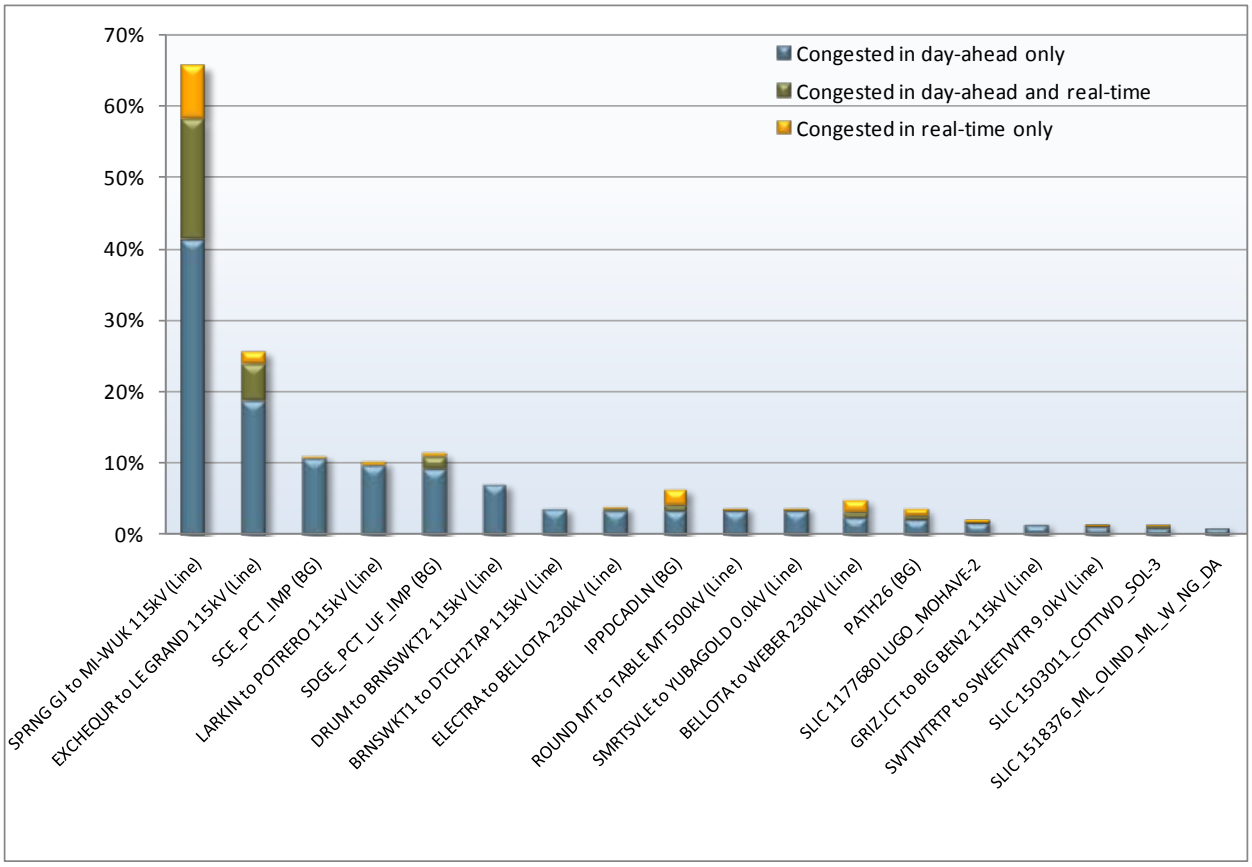


1.4 Congestion

Congestion within the ISO system had minimal impact on overall prices. However, the frequency of day-ahead congestion increased, particularly on constraints in generation pockets and those relating to imports into the Southern California Edison and San Diego Gas and Electric areas. Moreover, congestion in the day-ahead market did not usually materialize in the real-time market. This increase in day-ahead congestion coincided with implementation of virtual bidding on February 1, 2011, and has continued through the second quarter. DMM continues to evaluate the extent that this increase in congestion was attributable to convergence bidding as opposed to other factors such as generation and transmission outages.[9]

[9] DMM has limited ability to assess the impact of virtual bidding on congestion due to problems with re-running the day-ahead market software, as noted in footnote 1.

Figure 1.12 Consistency of congestion in day-ahead and real-time markets (April - June 2011)



The Spring GJ to Mi-Wuk 115 kV (line) has historically been the most frequently congested constraint during the spring and early summer months, though this constraint has only a minimal effect on PG&E congestion. This line is a radial generation tie with capacity less than that of the hydro generation tied to it. During the hydro runoff season, which occurs in the second quarter, generation becomes trapped behind the Spring Mi-Wuk flowgate. When the flowgate is congested, the hydro units can respond to prices, or, in the extreme, spill water when backed down. The nodal LMP on the generation side of the flowgate is low even when the system marginal energy component is high, resulting in a high LMP congestion component.

Similar generation pocket constraints include Exchequr to Le Grand 115 kV (line), Drum to Brnswkt2 115 kV (line), Brnswkt1 to Dtch2tap 230 kV (line), Electra to Bellota 230 kV (line), Smrtsvle to Yubagold 60 kV (line), Grizjct to Bigben2 115 kV (line) and Swtwtrtp to Sweetwtr 9 kV (line).

Outages on the Southwest Powerlink (SWPL) (North Gila-Hassayampa and Imperial Valley-Miguel) contributed to congestion into the SCE and SDG&E areas. When outages occur on SWPL, the internal San Diego percent of generation requirement increases to 30 percent from 25 percent. Limits are also placed on the South of SONGS transmission lines. Congestion in the SCE area was also increased by manual reductions (or conforming) of transmission limits for reliability reasons, and by local outages (e.g., Mira Loma-Olinda 220 kV Line).

Congestion on the Larkin to Potrero 115 kV constraint was related to a number of outages in connection with the A-X #1 115 kV cable work.

1.5 Scarcity pricing of ancillary services

Scarcity pricing of ancillary services occurs when the market optimization is unable to meet reserve requirements. Table 1.1 highlights the specific intervals with scarcity of ancillary services in the real-time pre-dispatch market, the scarce ancillary service and the MW shortfall. In total, there were a dozen intervals where scarcity pricing of ancillary services was triggered in the second quarter. Only spinning reserves and regulation up markets were short by up to 23 MW and 29 MW, respectively.

Table 1.1 Ancillary service scarcity events (April 2011 – June 2011)

Date	Time	Ancillary service	Region affected	MW Shortfall
4/29/2011	5:15	Spin	SP 26	7.1
5/15/2011	0:15	Spin	SP 26 Expanded	2.6
5/23/2011	7:00	Spin	SP 26 Expanded	22.8
5/26/2011	7:15	Spin	SP 26	9.1
6/10/2011	6:00 - 6:45	Reg Up	SP 26 Expanded	16.5
6/16/2011	6:00 - 6:30	Reg Up	SP 26 Expanded	28.9
6/16/2011	6:45	Reg Up	SP 26 Expanded	6.5

In comparison to the first three months of the year, there were fewer hydro resources offering ancillary services in the market during the second quarter. This reduction of resources can be attributed to the following factors:

- There was a large amount of snowpack this year (approximately 160 percent of historical average). As a result, hydro-electric generators produced energy rather than offering ancillary services into the market.
- Loads reached their seasonal lows. This had the effect of decreasing the amount of net committed resources in the market, reducing the available online supply of ancillary services in the market.

These two factors taken together with normal system conditions, including de-rates and forced outages of generation, caused the scarcity of ancillary services during a dozen 15-minute intervals in the quarter. All of these events were concentrated in either SP26 or SP26 expanded ancillary service sub-regions. There were no scarcity events in the CAISO or CAISO expanded regions.

The overall direct market effect of these scarcity events on ancillary service costs was just under $150,000. Indirectly, there is likely to have been unit commitment in the real-time pre-dispatch process that may not have occurred otherwise. However, no real-time generation received the 15-minute real-time pre-dispatch energy prices. Real-time generation settles against the 5-minute real-time prices, which are, at this time, not directly influenced by the scarcity pricing.

2 Convergence bidding

Convergence bidding was implemented in the day-ahead market for February 1, 2011. Net revenues for convergence bidding entities have been just over $34 million for the first five months of this new market feature (February through June). However, DMM's assessment has found little evidence that convergence bidding has helped price convergence or increased the efficiency of day-ahead unit commitment decisions. Meanwhile, convergence bidding has added to energy imbalance offset costs that are ultimately allocated to demand.

As shown in Section 1, average price convergence did appear to improve, particularly in the month of May. However, on an hourly basis, prices in real-time overshot day-ahead and hour-ahead prices in some hours and undershot in others, indicating that convergence was only achieved through averaging.

Background

Convergence bidding is designed to allow any creditworthy entity, regardless of whether or not they own physical load or generation, to place bids to buy power and offers to sell power into the day-ahead market. As these bids are only virtual and not physical, they will liquidate in real-time and cause the physical system to re-dispatch accordingly.

In theory, these participants profit by arbitraging the difference between day-ahead and real-time prices. As participants take advantage of opportunities to profit through convergence bids, this activity should drive real-time and day-ahead prices closer. The following illustrates how virtual demand and supply are designed to work.

- If prices are higher in the real-time market relative to the day-ahead market, convergence bidders should place virtual demand bids. Virtual demand will raise load in the day-ahead, which could lead to additional unit commitment. This additional unit commitment would occur because of higher prices in the day-ahead market. This additional unit commitment would be available in real-time and would have a dampening effect on real-time prices. The virtual demand would then be paid the difference between the real-time price and the day-ahead price for each virtual megawatt.

- If prices are lower in the real-time market relative to the day-ahead market, convergence bidders should place virtual supply bids. Virtual supply will displace the supply of physical generation in the day-ahead and could lead to units being committed lower on their bid curves, or potentially even displace of additional unit commitments.[10] This reduction in physical commitment would occur because of lower prices in the day-ahead market. In real-time, these virtual supply resources would not materialize and should therefore have an elevating effect on real-time prices. The virtual supply would then be paid the difference between the real-time price and the day-ahead price for each virtual megawatt.

The California market does have a unique feature that makes it different from most other ISOs and RTOs. California's market design re-optimizes imports and exports in an hour-ahead market. These

[10] This will not create a reliability issue as the residual unit commitment process occurs after the integrated forward market runs. The residual unit commitment process removes convergence bids and re-solves the market to the ISO forecasted load. If additional units are needed, the residual unit commitment process will commit these resources.

inter-tie resources settle against hour-ahead prices rather than 5-minute real-time prices. The same is true for convergence bids on the inter-ties. These bids also settle against hour-ahead prices and not 5-minute real-time prices.

As shown in Section 2.1.2, this feature of the ISO market design has led to a particular convergence bidding strategy that has been exploited when prices diverge between the hour-ahead and real-time markets. While this virtual bidding strategy has been highly profitable and has increased revenue imbalances allocated to load-serving entities, it does not appear to have provided any significant benefits in terms of helping to converge prices in the hour-ahead and 5-minute real-time markets.

2.1 Convergence bidding activity

Convergence bidding has had two distinct elements over the course of the first few months. Initially, volumes increased steadily over the first few months until the second half of April. Afterwards, volumes dropped precipitously and then began to increase steadily through June. Second, the vast majority of virtual supply positions are found on inter-ties, whereas virtual demand positions are most often on internal locations. This activity is outlined below.

2.1.1 Increase in convergence bidding volumes

Convergence bidding volumes increased steadily from the start of convergence bidding on February 1 until mid-April. In the second quarter, convergence bidding volumes were generally lower than in the first two months, though trading activity increased steadily after falling off in mid-April. Figure 2.1 and Figure 2.2 show the quantities of both virtual demand and supply offered and cleared in the market.

As shown in Figure 2.1:

- On average, roughly 60 percent of virtual supply and demand bids cleared in the first five months of convergence bidding.
- With the exception of the very first week of convergence bidding, cleared virtual supply has outweighed cleared virtual demand on average by over 580 MW.

As shown in Figure 2.2:

- Virtual supply exceeds virtual demand in every hour except the late evening ramp down hours ending 23 and 24.
- The total volume of offered and cleared virtual bids is consistent for much of the day with the exception of the early morning hours ending 3 through 7.

Figure 2.1 Weekly average offered and cleared virtual activity

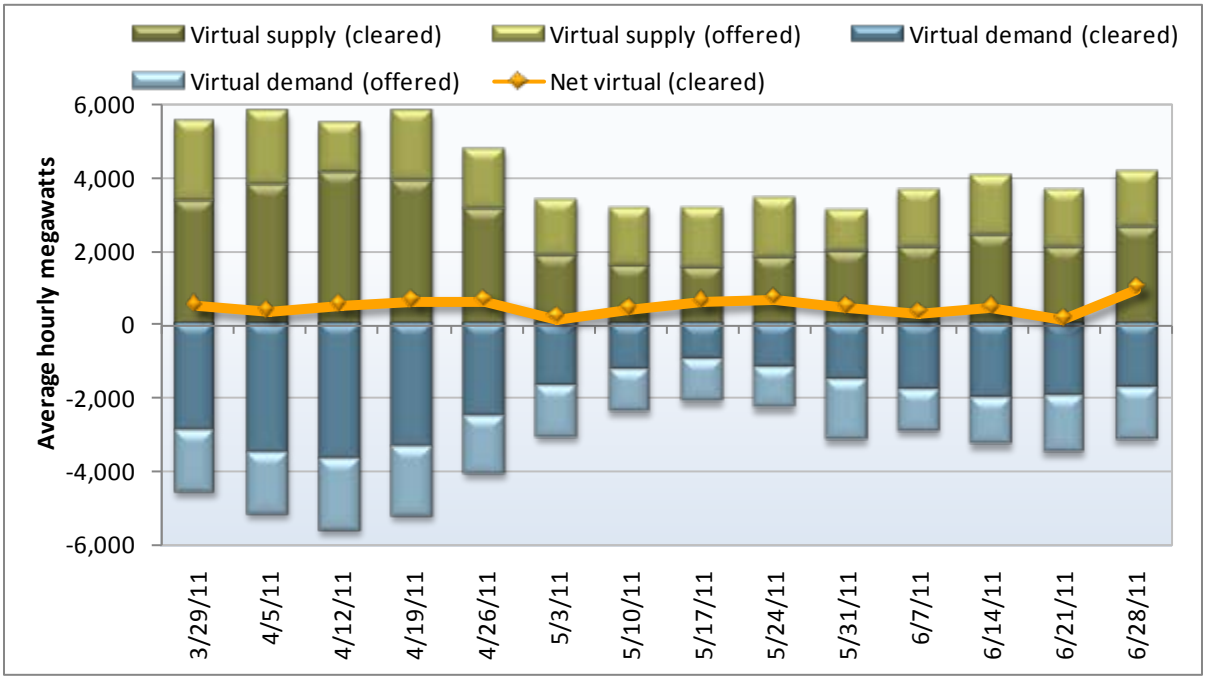
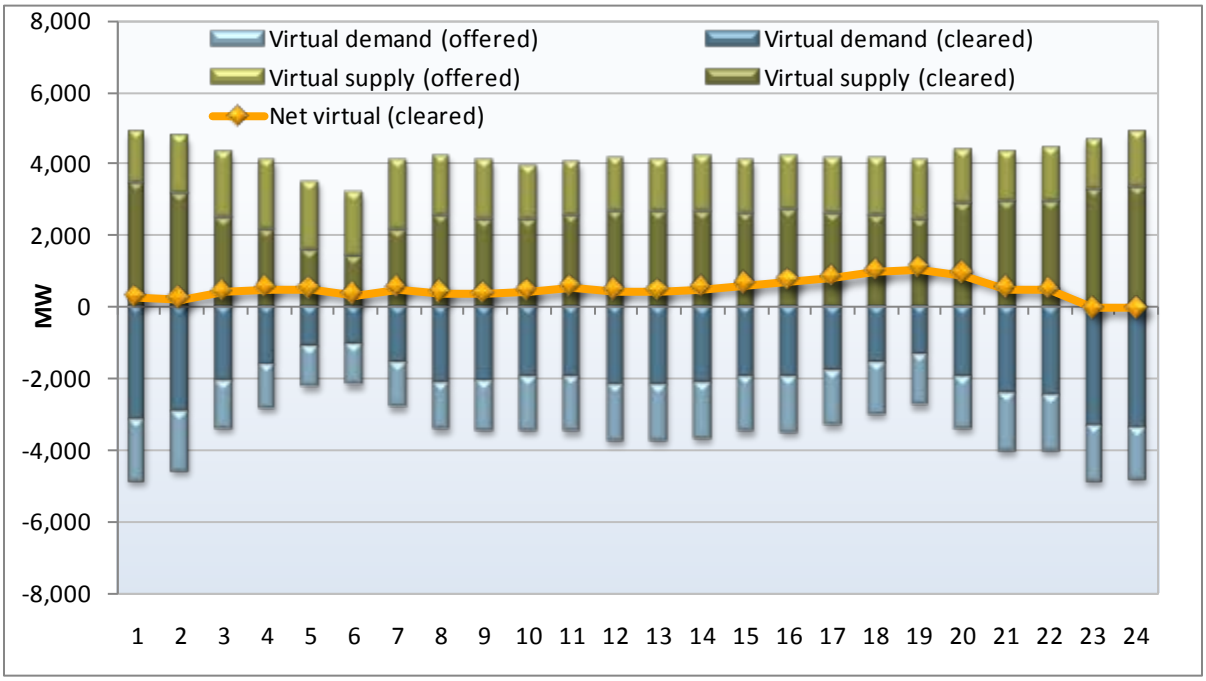


Figure 2.2 Hourly offered and cleared virtual activity (May – June 2011)



2.1.2 Virtual supply at the inter-ties and virtual demand at internal nodes

The difference between convergence bidding positions at the inter-ties and at internal nodes shows a distinctive pattern. As shown in Figure 2.3, convergence bidding on inter-ties (shown in green) is weighted towards virtual supply and convergence bidding on internal locations (shown in blue) is weighted towards virtual demand.

Numerous market participants have employed a strategy where they place virtual supply positions at the inter-ties and then place an equal and opposite virtual demand position at internal locations. Figure 2.4 shows the volume of these overlapping positions. The blue bars represent the weekly average megawatts associated with this strategy, whereas the green bars represent offsetting positions attributable to different convergence bidding entities placing offsetting positions. While there was a sharp drop off in this strategy in mid-April and into May, the volume of megawatts again began to increase at the end of May and into June.

Figure 2.3 Weekly net cleared inter-tie and internal positions

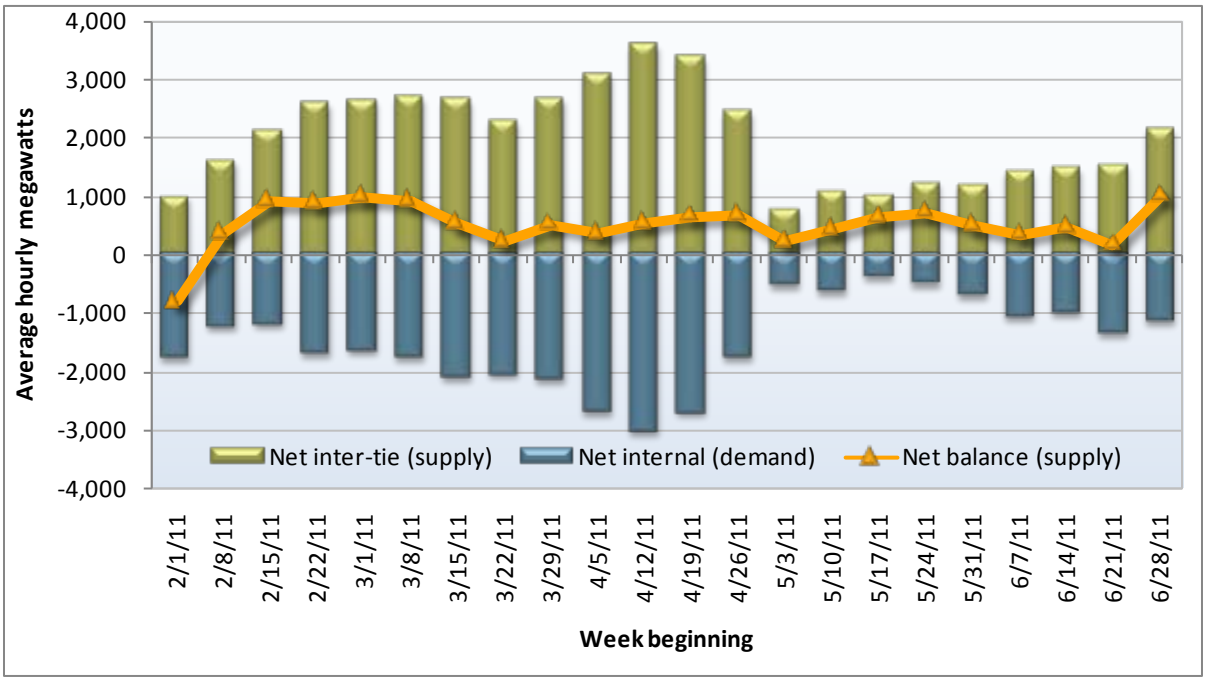
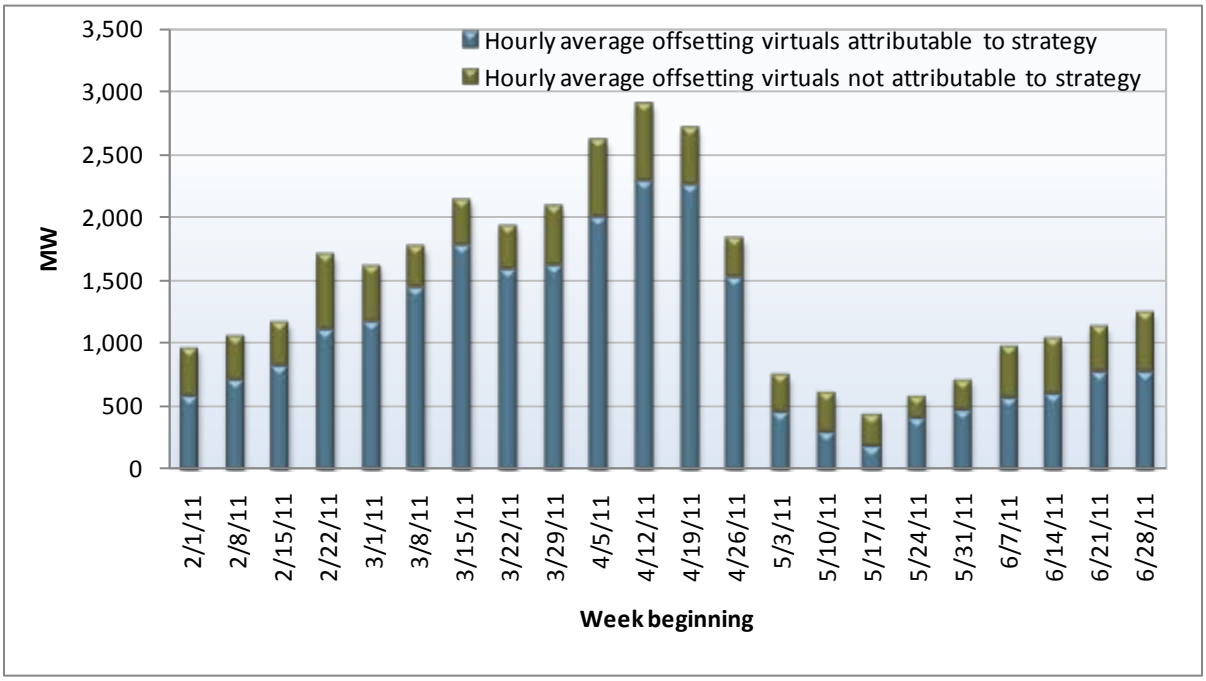


Figure 2.4 Portion of cleared virtual bids attributable to offsetting virtual bids submitted by same participant (virtual imports plus virtual internal demand)



As noted above, convergence bidding at the inter-ties settles against the hour-ahead market prices, whereas convergence bidding at internal nodes settles against the 5-minute real-time market prices. If prices in the hour-ahead market were consistent with 5-minute real-time market prices this would not create cause for concern. Yet, as shown in the next section, prices between these markets have been markedly different for much of the first five months. This has led to substantial uplifts that are outlined further in Section 2.2.3.

2.2 Convergence bidding effects on market

If convergence bidding is working as intended, day-ahead, hour-ahead and 5-minute real-time market prices should converge. Figure 2.5 shows weekly average prices at the PG&E load aggregation point.

- In February and March there appears to be signs of price convergence as real-time prices (green line) become closer to the day-ahead prices (orange line), while the hour-ahead prices (blue line) come closer to the day-ahead prices.
- Since the end of March and to the end of June, prices diverge substantially. Contributing factors for the price divergence include the frequency of power balance constraint relaxations and the increase in the bid cap from $750/MWh to $1,000/MWh, as well as generation and transmission outages.
- Since April real-time price volatility increased steadily. Unlike the first quarter, real-time prices fluctuated around day-ahead and hour-ahead prices. Averaged over the month, they may give a false sense of convergence, but as noted in Section 1, average absolute prices have diverged significantly starting in March.

Figure 2.5 Weekly average prices PG&E load aggregation point – all hours

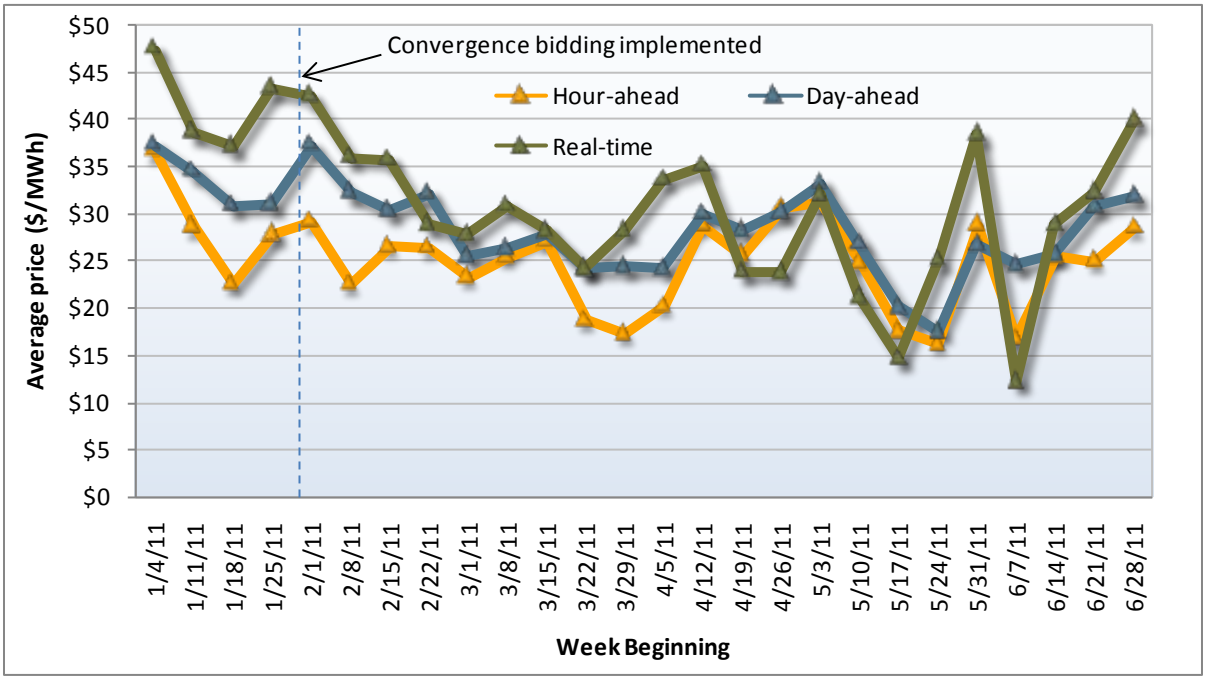


Figure 2.6 Weekly average difference between real-time and hour-ahead prices (PG&E LAP)

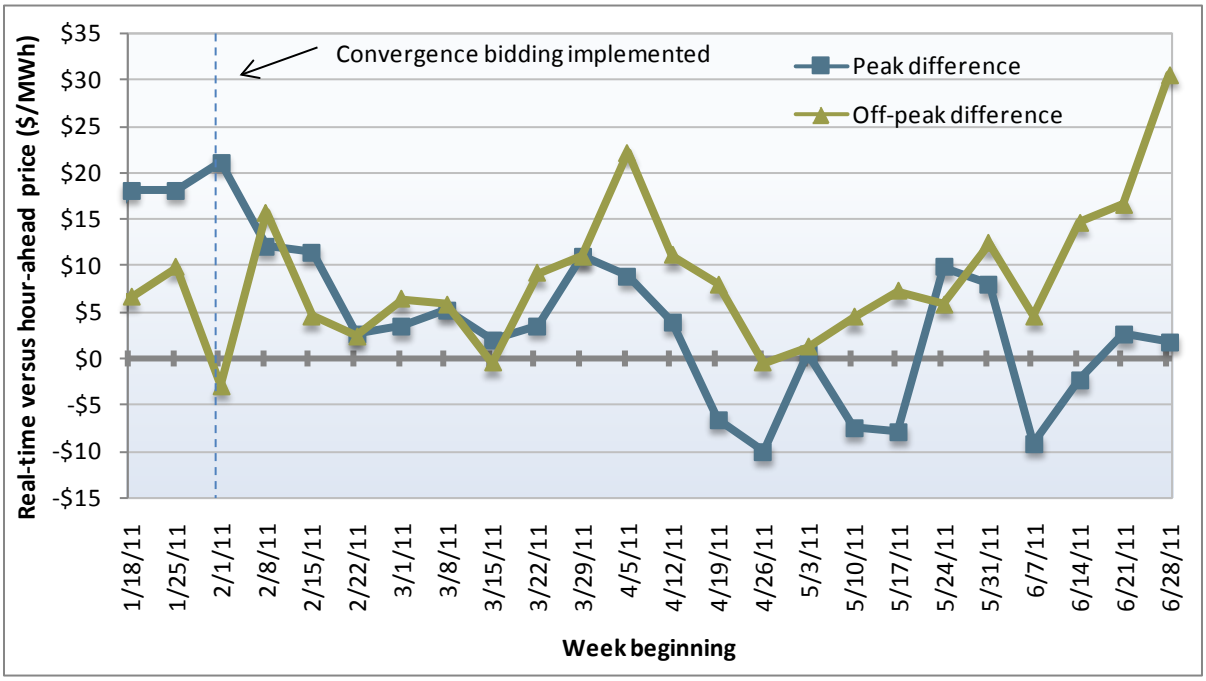
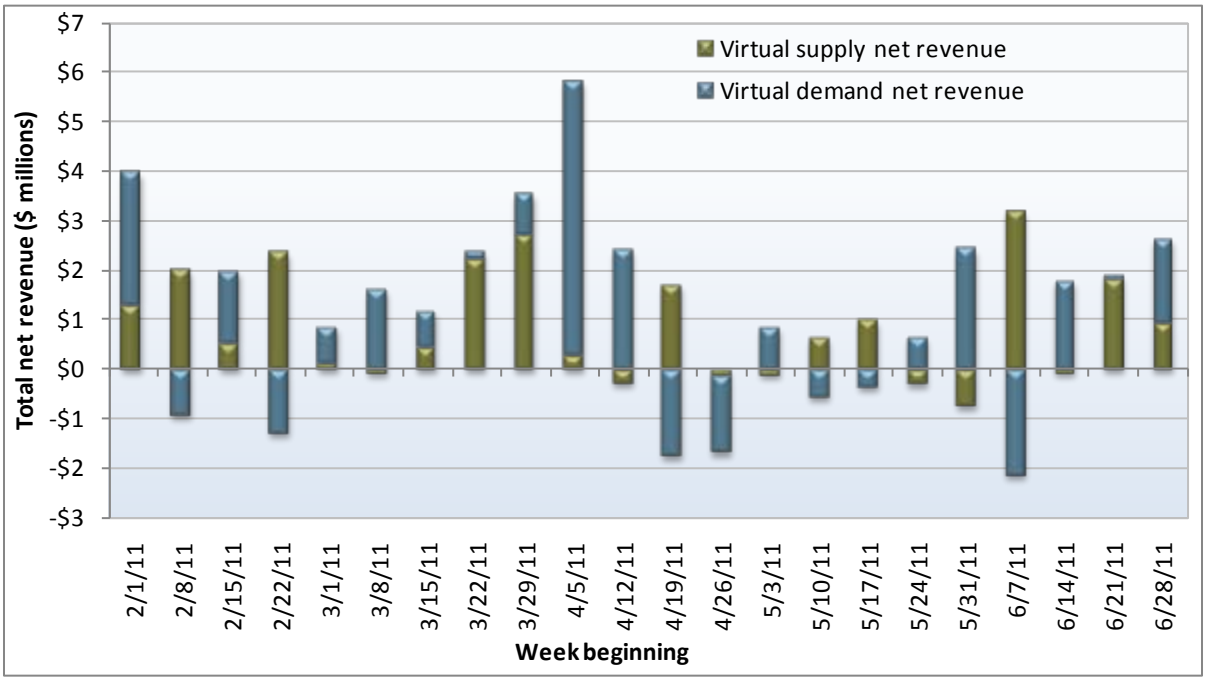


Figure 2.6 compares the difference between prices in the hour-ahead and 5-minute real-time markets for peak and off-peak periods. Figure 2.6 shows that the price difference fell in February and was near zero for much of March. Prices diverged again at the end of March and even more into June. By the end of June, peak price differences were near zero and off-peak prices exceeded real-time prices.

2.2.1 Net profits from convergence bidding

With the exception of the end of April and May, the total net profits paid to convergence bidding entities have been positive. Over the course of the second quarter, net revenues paid out to convergence bidding entities totaled almost $19 million, just over the $16 million paid to convergence bidding entities in February and March. Figure 2.7 shows weekly convergence bidding net revenues for both virtual demand and virtual supply positions. Frequently, both virtual supply and virtual demand positions have led to positive net revenues. This is because inter-tie bids and internal bids settle against hour-ahead and 5-minute real-time market prices, respectively. Moreover, these prices most often move in different directions relative to day-ahead prices.

Figure 2.7 Total weekly convergence bidding net revenues

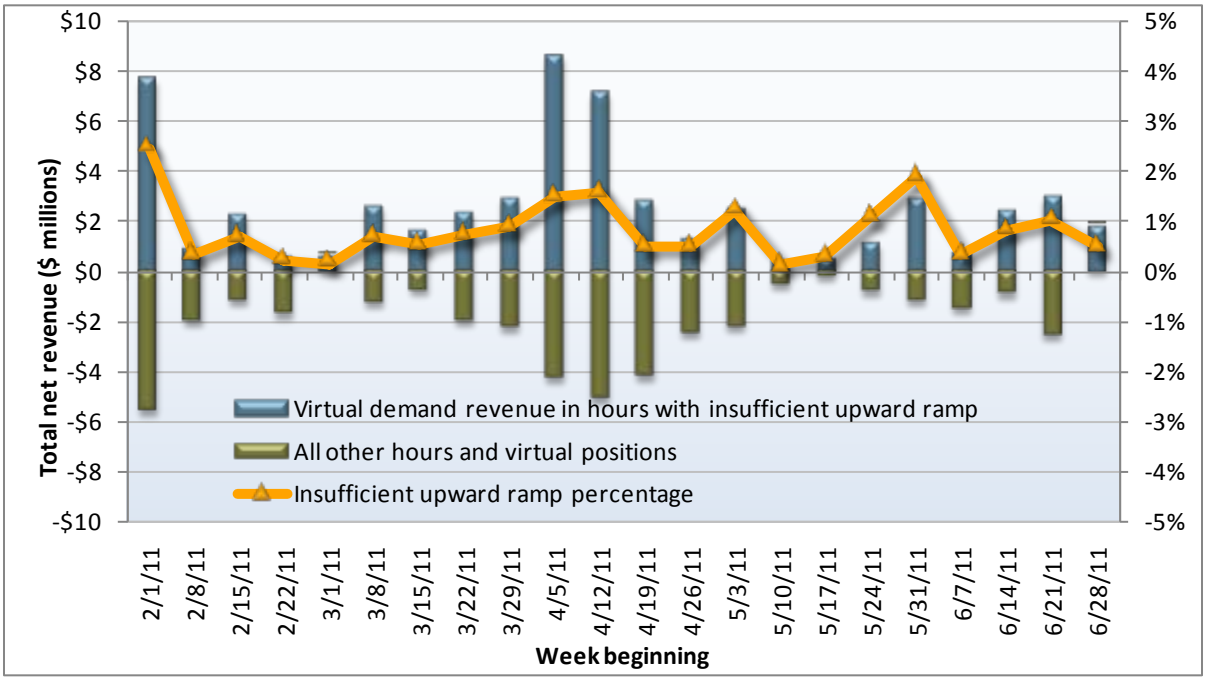


Net revenues on internal nodes

Approximately 80 percent of virtual demand bids clear at internal locations. Virtual demand bids at internal nodes are profitable when real-time prices spike in the 5-minute real-time market. Intervals when the system power balance constraint relaxes account for almost all of the positive revenues for internal virtual demand positions, as shown in Figure 2.8. As noted in Section 1, when the power balance constraint is relaxed, the system marginal energy component of the price is set to the bid cap, which was $750/MWh in the first two months of convergence bidding and increased to $1,000/MWh on April 1. Net revenues received from these brief but extreme price spikes are typically high enough to

outweigh losses when the day-ahead price exceeds the real-time market price. In fact, having a single 5-minute interval price spike can yield enough aggregate income to compensate losses in the remaining intervals of the hour.

Figure 2.8 Convergence bidding revenues at internal nodes



These price spikes are typically associated with brief shortages of ramping capacity. Convergence bidding can potentially add additional capacity, but that capacity may not be enough to address the ramping limitations. Moreover, in the event of over generation, real-time prices can be negative, but they never go below the bid floor of -$30/MWh. This diminishes the risk of market participants losing substantial money by bidding virtual demand as well as reduces the potential benefits to virtual supply bids at internal nodes.

2.2.2 Changes in unit commitment

In the day-ahead market, if scheduled demand is less than the ISO forecasted demand, the residual unit commitment process procures additional capacity to meet the forecasted demand as well as any forecasted shortfalls of minimum generation requirements.

Cleared virtual supply often outweighs cleared virtual demand and, as a result, more units are committed in the residual unit commitment process. Accordingly, more residual unit commitment capacity is needed to replace the net virtual supply with physical supply. This situation is likely to increase the direct costs and bid cost recovery payments associated with residual unit commitment.

In the second quarter of 2011, total direct residual unit commitment costs totaled $250,000 compared to a 2010 total of $83,000. Since convergence bidding started in February, direct residual unit commitment costs have totaled around $385,000. Bid cost recovery payments for the residual unit

commitment capacity amounted to over $900,000 in the second quarter compared to $1.4 million in all of 2010.[11]

2.2.3 Costs associated with continued price divergence and convergence bidding

Divergence in prices can pose unnecessary additional inefficiencies and costs on the system. When net imports decrease in the hour-ahead market, but real-time imbalance energy increases, the decrease in net imports may be inefficient.[12] Moreover, if net virtual supply on the inter-ties outweighs net virtual demand on internal nodes, and real-time imbalance energy increases, this may also be inefficient.

Such reductions are inefficient if hour-ahead prices are systematically lower than real-time prices, so that the ISO is selling both physical and virtual supply in the hour-ahead at a low price and then dispatching additional energy in real-time at a higher price. Conversely, if both physical supply and virtual demand are purchased in the hour-ahead market at high prices and then additional energy is dispatched in real-time at lower prices, this can also create imbalances. These situations can create substantial uplifts that must be recovered from load-serving entities through the real-time imbalance energy offset charge.[13]

Physical net imports in the hour-ahead market relative to day-ahead market

Historically, hour-ahead market prices have been lower than both day-ahead and real-time market prices. However, over the course of the last few months, hour-ahead prices have become more in line with real-time prices and closer to day-ahead prices (as shown in Section 1). This has coincided with the change in operational load adjustment patterns whereby loads are adjusted upward systematically in the hour-ahead market to compensate for modeling discrepancies.[14] Correspondingly, there has been a shift in the hour-ahead market from reducing net imports, to increasing net imports on average.[15]

Figure 2.9 shows hourly average differences of scheduled physical hour-ahead market imports and exports from the scheduled day-ahead imports and exports. Continuing the trend started in March, the average change in physical imports has outweighed the average change in physical exports in the hour-ahead market. As a result, net physical imports increased in the hour-ahead market by an average of just over 200 MW in the second quarter. For the same period, net virtual supply has outweighed net virtual demand by roughly 580 MW since convergence bidding started in February.

[11] In the first half of 2011, net bid cost recovery payments associated with all energy, ancillary services and residual unit commitment markets were significantly higher relative to the same period in 2010. After the ISO's emergency tariff filing in June, the payments began to decrease.

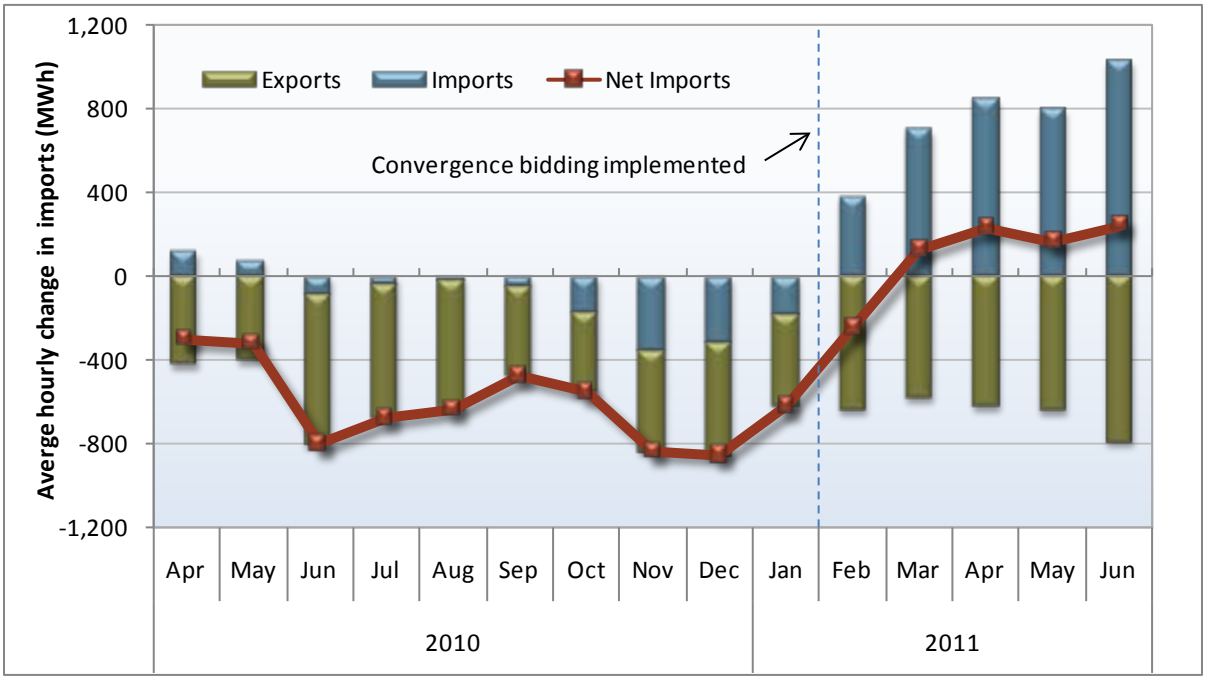
[12] The inter-tie prices are relative to prices in neighboring systems. If prices outside of the ISO system are higher, it makes economic sense for net imports to decrease in the hour-ahead scheduling process. This can be accomplished by either reducing imports or increasing exports.

[13] More information about the Real-Time Imbalance Energy Offset charge can be found on the ISO website at http://www.caiso.com/2406/2406e2a640420.html.

[14] See Section 1.2 for more detail on the load adjustment procedures.

[15] At this time, DMM has not been able to determine the extent that the load adjustments have led to increased net imports relative to the actions of convergence bidding.

Figure 2.9 Change in net imports in hour-ahead relative to final day-ahead schedules



Costs of differences in physical net imports in the hour-ahead relative to real-time market

Real-time energy imbalances can occur when physical net imports decrease at hour-ahead prices that are lower than real-time prices when the real-time dispatch energy increases. Imbalances can also increase when physical net imports increase at hour-ahead prices that are higher than real-time prices when the real-time dispatch energy decreases. In both cases the ISO procures energy in the higher cost market and sells off energy in the lower cost market.[16] The effects of these movements are outlined below.

A. Costs of decreases in physical net imports in the hour-ahead relative to real-time market

When physical net imports decrease in the hour-ahead and real-time imbalance energy increases, the decreased imports in the hour-ahead are likely to have increased the need to dispatch imbalance energy in real-time.[17] This scenario occurred in almost 59 percent of the hours in the second quarter.

The blue bars in Figure 2.10 show DMM's estimate of the average hourly decrease in hour-ahead net imports that were subsequently re-procured by the real-time dispatch by month. The lines in Figure 2.10 compare the corresponding weighted average prices at which this decrease in net imports was

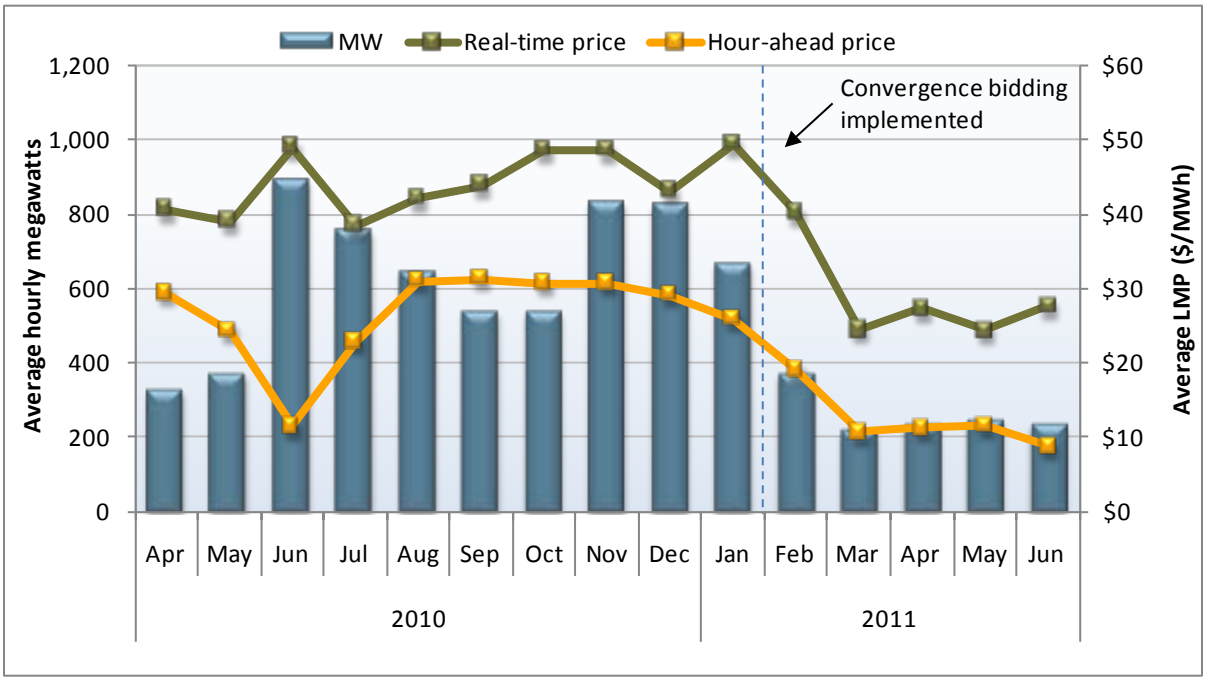
[16] When physical net imports in the hour-ahead market and real-time dispatch energy move in the same direction, no real-time imbalance is attributable to changes in physical net imports.

[17] In some cases, reductions in net import may be necessary in the hour-ahead market to manage congestion or reduce supply because of energy not scheduled in the day-ahead market, such as renewable generation or unscheduled start-up or minimum load energy from thermal units. The hour-ahead software should take this energy into account and seek to optimize prices between imports and exports adjusted in the hour-ahead and subsequent dispatches and prices in the 5-minute real-time market.

settled in the hour-ahead market and the weighted average prices for additional energy procured in the real-time market during each month.[18] Together, the hourly decrease in hour-ahead net imports and the difference in hour-ahead and real-time prices produce the estimated imbalance energy costs. The total costs are determined by the quantity that is reduced in the hour-ahead market and then re-procured in the 5-minute real-time market, combined with the difference in prices in these two markets.

As shown in Figure 2.10, there has been a slight decrease in the price divergence between hour-ahead and 5-minute real-time market prices in the second quarter of 2011 compared to the second quarter of 2010. The average price difference in the second quarter of 2011 was around $16/MWh with a diminished average quantity of about 238 MW compared to $21/MWh and 528 MW in the second quarter of 2010.

Figure 2.10 Monthly average quantity and prices of net import reductions in the hour-ahead market and resulting increase in real-time energy dispatched



[18] DMM estimates the hourly decrease in hour-ahead net imports that were subsequently re-procured by the real-time dispatch by month based on the difference between the decrease in net imports each hour with the amount of energy dispatched in the 5-minute market during that hour. For instance, if the net imports were decreased by 500 MW in the hour-ahead, and 700 MW of net incremental energy was dispatched in the 5-minute market that hour, the entire 500 MW decrease of net imports in hour-ahead was re-procured in the 5-minute market. If net imports were decreased by 500 MW in the hour-ahead, but only 200 MW of net incremental energy was dispatched in the 5-minute market that hour, then only 200 MW of the decrease of net imports in hour-ahead was counted as being re-procured in the 5-minute market.

B. Cost of increases in physical net imports in the hour-ahead relative to real-time market

When physical net imports increase in the hour-ahead and real-time imbalance energy decreases, the increased imports in the hour-ahead may have increased the need to dispatch decremental imbalance energy in real-time. This scenario occurred in over 17 percent of the hours in the second quarter.

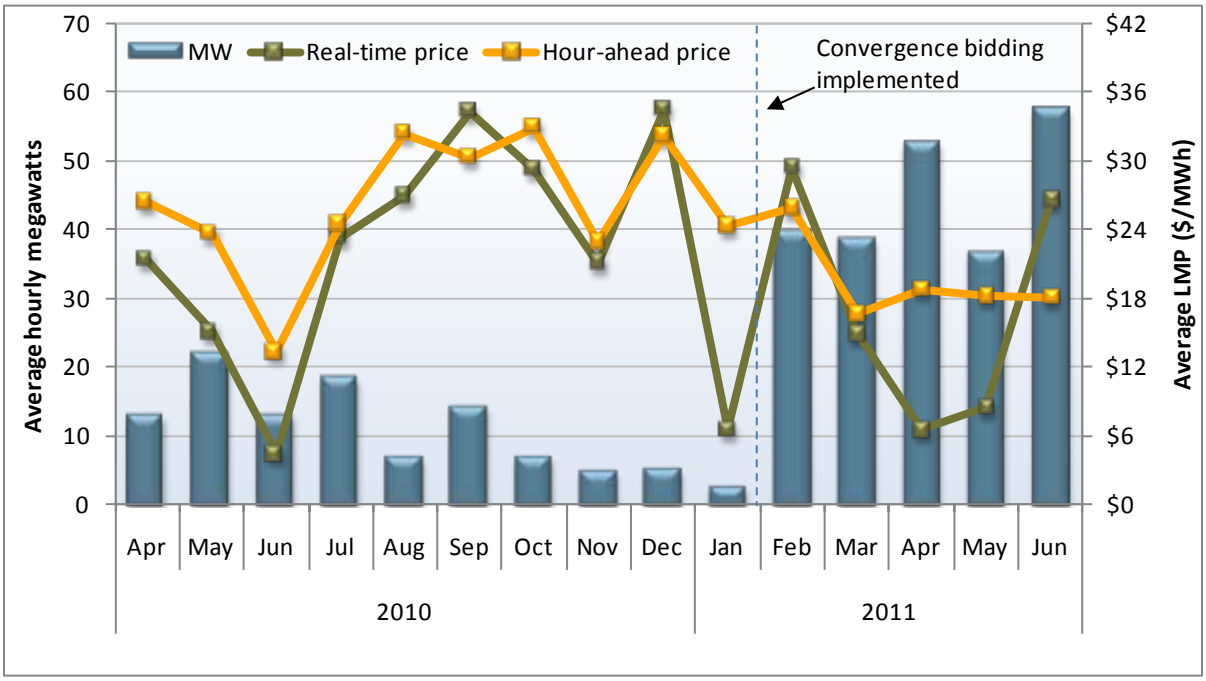
The blue bars in Figure 2.11 show DMM's estimate of the average hourly increase in hour-ahead net imports that were subsequently re-sold by the real-time dispatch by month. The lines in Figure 2.11 compare the corresponding weighted average prices at which this increase in net imports was settled in the hour-ahead market and the weighted average prices for additional energy sold in the real-time market during each month.[19] Together, the hourly increase in hour-ahead net imports and the difference in hour-ahead and real-time prices produce the estimated imbalance energy costs. The total costs are ultimately determined by the quantity that is increased in the hour-ahead market and then sold in the 5-minute real-time market, combined with the difference in prices in these two markets.

The average hourly volume of dispatch energy sold has more than quadrupled since the launch of convergence bidding in February this year, from an average of roughly 11 MW for the year prior to convergence bidding to 45 MW after. Average prices in the hour-ahead market were higher than the real-time market during most of the months. This also contributes to the imbalance cost as energy that is purchased in the hour-ahead market at higher prices is sold off in the real-time market at lower prices. Historically these volumes have been low and the relative price differences fairly tight and the effect on overall imbalance changes have been low. However, as shown in Figure 2.11, the average hour-ahead and real-time prices diverged in April and May 2011, with the hour-ahead price exceeding the real-time price by about $11/MWh, at volumes higher than the historical average.

Overall, this has been and remains a relatively small contributor to the real-time energy imbalance costs. However, as the hour-ahead market takes in more net imports and as the hour-ahead price exceeds the real-time price, this situation can also increase real-time imbalance energy costs.

[19] DMM estimates the hourly increase in hour-ahead net imports that were subsequently sold by the real-time dispatch by month based on the difference between the increase in net imports each hour with the amount of energy dispatched down in the 5-minute market during that hour. For instance, if the net imports were increased by 500 MW in the hour-ahead, and 700 MW of net decremental energy was dispatched in the 5-minute market that hour, the entire 500 MW increase of net imports in hour-ahead was offset in the 5-minute market. If net imports were increased by 500 MW in the hour-ahead, but only 200 MW of net decremental energy was dispatched in the 5-minute market that hour, then only 200 MW of the increase of net imports in hour-ahead was counted as being offset in the 5-minute market.

Figure 2.11 Monthly average quantity and prices of net import increases in the hour-ahead market and resulting decrease in real-time energy dispatched



Real-time energy imbalance costs

Figure 2.12 shows the estimated costs of additional imbalance energy because of changes in net imports in the hour-ahead that is offset by imbalance energy in real-time at a different price.[20] With the introduction of convergence bidding in February 2011, these costs changed substantially and have been replaced by a virtual bidding imbalance cost. This virtual bidding imbalance cost is related to liquidating virtual positions on the inter-ties at different prices from internal virtual positions in the 5-minute real-time market.

The total convergence bidding imbalance cost during the first five months (February – June) was around $43 million. In the month of May, convergence bidding provided a small net credit to real-time energy imbalance costs of about $300,000. This is different from the overall trend and can be attributed to a difference of about $6 million between the hour-ahead payments made to the ISO for net virtual supply on the inter-ties and real-time payments made by the ISO on the net internal virtual demand. Because the hour-ahead and real-time prices were close during the month (a difference of about $3/MWh in energy prices on average), the additional payments from convergence bidding to the ISO can be attributed to a net higher volume of virtual supply on the ties in comparison to the internal virtual demand. On average, there were nearly twice as many virtual supply megawatts on inter-ties than internal virtual demand megawatts.

[20] DMM estimates these costs based on the following: 1) the decrease in hour-ahead net imports that were subsequently re-procured in real-time; 2) the increase in hour-ahead imports that were subsequently sold in real-time; and 3) the difference in hour-ahead versus real-time prices during the corresponding hour. This cost estimate is only one element of the real-time imbalance energy offset charge and, therefore, will differ from the total value of the charge for various reasons. Further detail on the different elements contained within the charge can be found in the following report: http://www.caiso.com/2416/2416e7a84a9b0.pdf.

Overall, there were almost $10 million in imbalance costs during the month of May. More than half of this value can be attributed to two factors:

- Imbalance cost attributed to the uninstructed imbalance energy (UIE);[21]
- Imbalance cost because of unaccounted for energy (UFE) dispatches in the real-time market.[22]

With May as an exception, the remaining months show substantial real-time imbalance charges because of convergence bidding activity. The ISO has initiated a stakeholder process to address issues related to convergence bidding and the real-time energy imbalance offset charge.[23] DMM supports this ISO stakeholder initiative and will provide any further comments as part of the stakeholder process.

Figure 2.12 Estimated imbalance costs due to changes in physical and virtual hour-ahead net imports at different prices than physical and virtual dispatch in the 5-minute market[24]

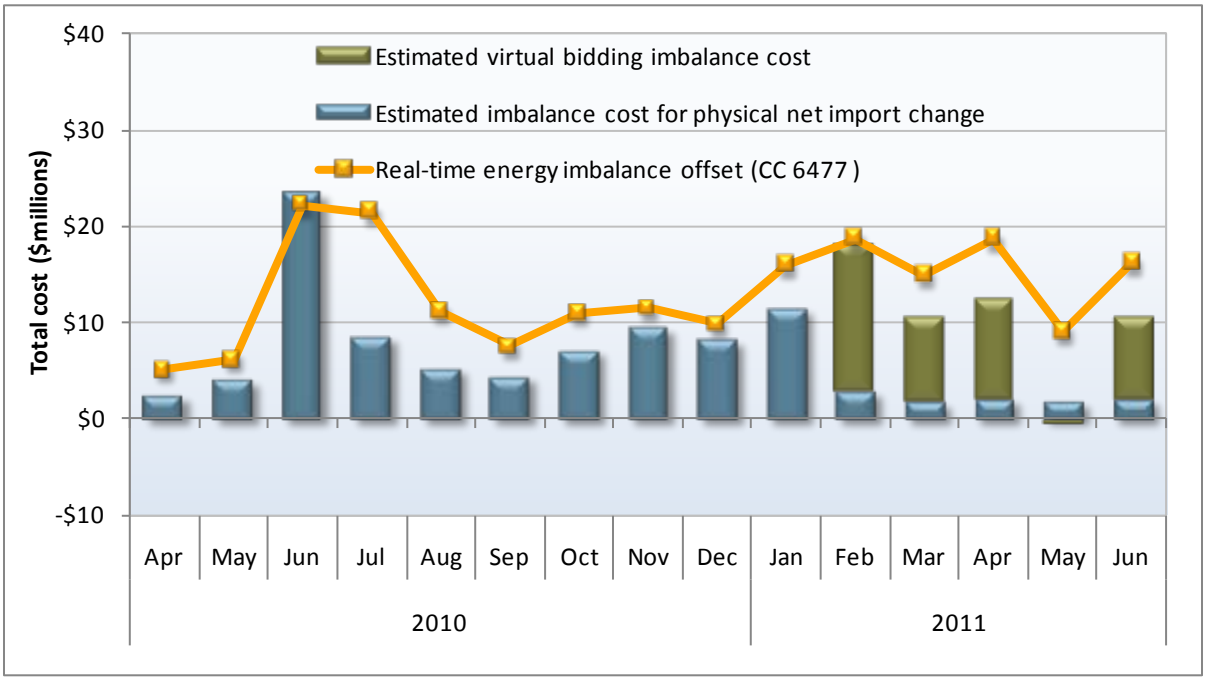


Figure 2.13 shows the breakdown of the estimated real-time imbalance cost associated with offsetting virtual supply on inter-ties and virtual demand at internal locations. The vast majority of the real-time

[21] Uninstructed imbalance energy includes generation that is self-committed or dispatched outside of the ISO market mechanism.

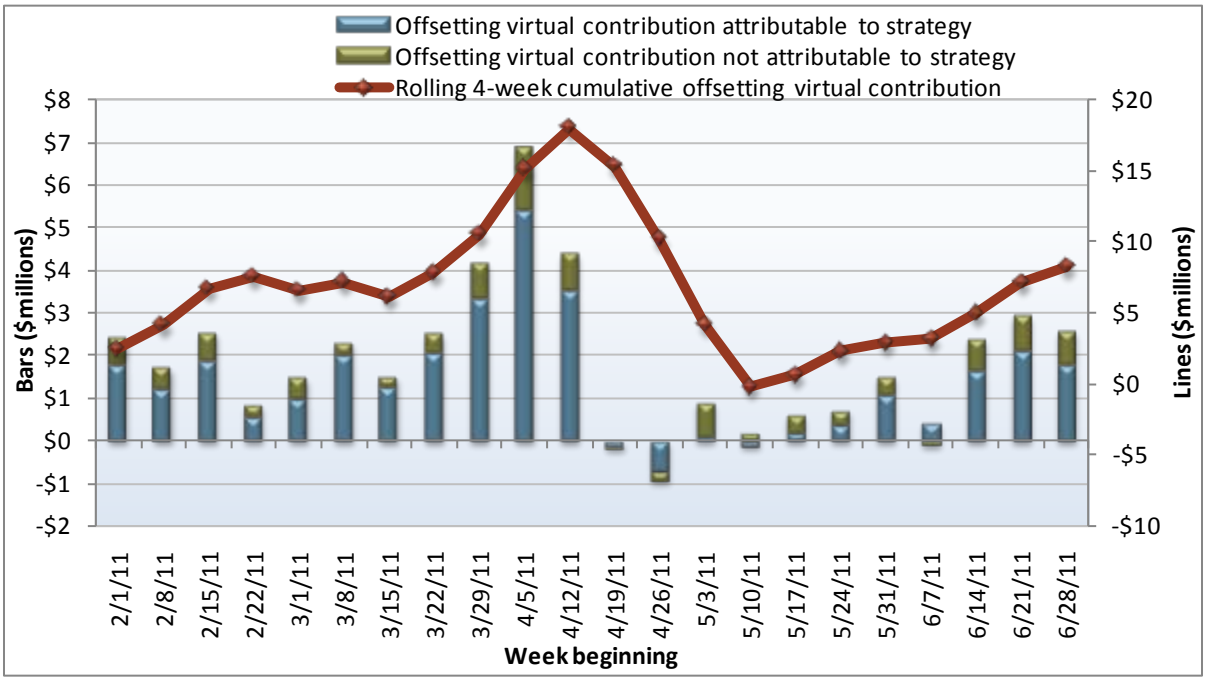
[22] Unaccounted for energy is attributable to meter measurement errors, power flow modeling errors, energy theft, statistical load profile errors, and distribution loss deviations.

[23] See the following for more information: http://www.caiso.com/informed/Pages/StakeholderProcesses/RealTimeImbalanceEnergyOffset2011.aspx.

[24] This figure was revised on 8/24/2011. The original figure was calculated from data in the ISO's Enterprise Data Repository (EDR), which does not include price correction data. DMM developed a separate process to incorporate the price corrections made by the ISO as part of the settlement process and then updated these figures. Convergence bidding results for the month of May changed from negative $4 million to negative $300,000. This change was the result of extreme negative prices (-$10,000/MWh) on May 27 hour ending 1 that were corrected as part of the ISO settlement process.

imbalance created by convergence bidding is associated with offsetting virtual positions. Over the course of the first five months of convergence bidding, this has resulted in roughly $42 million in real-time imbalance charges, approximately $11 million of which were after the shift in mid-April. Real-time energy imbalance charges associated with participants offsetting their own positions accounted for $31 million over the first five months, representing about 75 percent of the total offsetting positions.

Figure 2.13 Contribution of offsetting virtual supply and demand to real-time imbalance charges by week



2.2.4 Congestion revenue right settlement rule

The congestion revenue right (CRR) settlement rule was implemented to help deter the potential use of virtual bidding to increase payments for congestion revenue rights. The rule limits revenues from CRRs that have been increased by the strategic use of convergence bids.[25] This rule is to recapture, where warranted, the increase in CRR revenues to CRR holders that are attributable to that participant or affiliate's convergence bidding strategy. A four step approach is used to determine if the settlement rule will be applied:[26]

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

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

[25] This rule is very similar to the rules in other RTOs and ISOs used to limit the effects of virtual bidding on financial transmission rights (FTRs).

[26] *External Business Requirements Specification, Convergence Bidding*, December 01 2009, http://www.caiso.com/2478/24788f756dfc0.pdf.

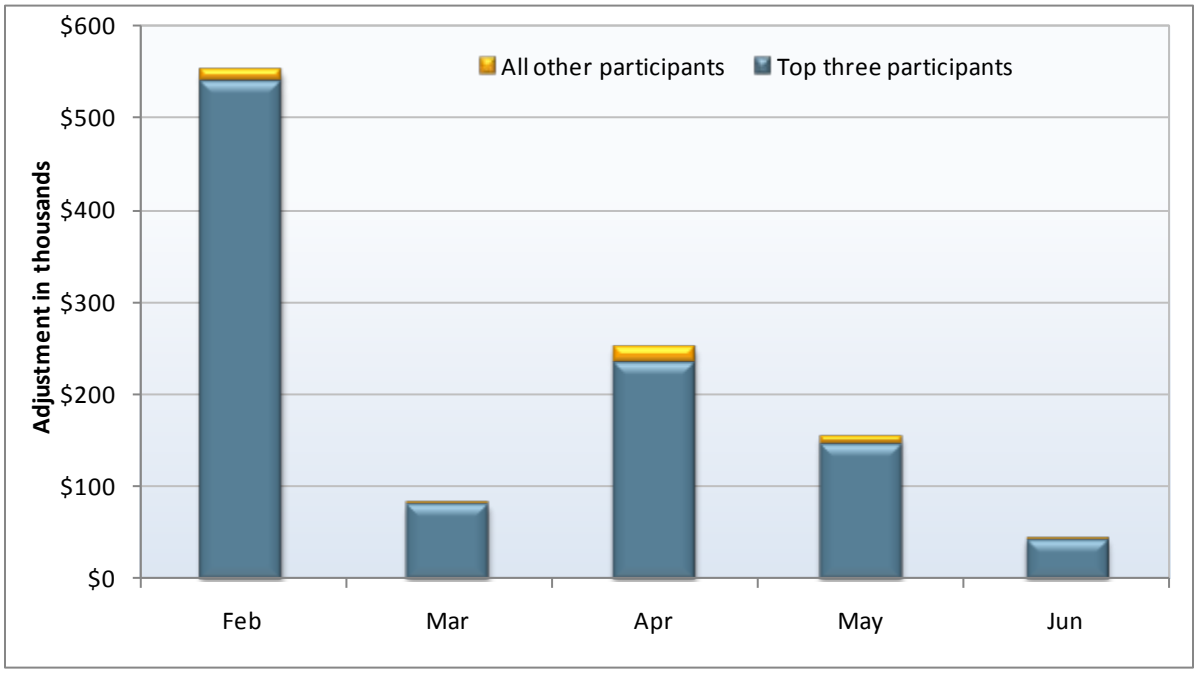
3. Compare constraint's impact on day-ahead value of participant's CRR portfolio to the constraint's impact on real-time value of participant's CRR portfolio; and

4. Apply CRR payment adjustment (netted by constraint, period — peak and off-peak, and day).

From February through June, DMM estimates the total sum of revenue attributed to the settlement rule to be roughly $1 million. June was the month with the least amount of adjustment at less than $50,000. These payments were removed from the congestion revenues paid to the specific congestion revenue rights holders that impacted the congestion. In total, these revenues represented less than 1 percent of all revenues to congestion revenue rights for the period.

Figure 2.14 shows the monthly combination of peak and off-peak periods. This figure highlights that almost all of the revenues associated with the settlement rule were concentrated on three market participants. The top three highest ranking market participants were similar over the period but their ranking varied month by month.

Figure 2.14 Congestion revenue right settlement rule: peak and off-peak periods



2.3 Recommendations

DMM is supportive of the ISO's proposal to eliminate virtual bidding at the inter-ties as a short-term option for reducing real-time energy imbalance costs. Convergence bidding has not resolved the issue of real-time price convergence and has contributed to high real-time energy imbalance costs. Until price convergence can be reached through more effective modeling or structural changes between these two markets, convergence bidders can continue to take advantage of these differences between the hour-ahead and real-time markets. As long as these systematic price differences continue, participants can bid in offsetting virtual supply bids on the inter-ties and virtual demand bids on internal nodes. This strategy will continue to impose unnecessary costs to the market while providing little or no market or reliability benefits.

California Independent System Operator Corporation

Fifth Replacement FERC Electric Tariff

Convergence Bidding at the Interties Amendment

Attachment F – Memorandum to ISO Governing Board

September 20, 2011

California Independent
System Operator Corporation

Memorandum

To: ISO Board of Governors

From: Keith Casey, Vice President, Market & Infrastructure Development

Date: August 18, 2011

Re: **Decision on Eliminating Convergence Bidding on the Interties**

This memorandum requires Board action.

EXECUTIVE SUMMARY

The California Independent System Operator Corporation proposes to eliminate convergence bidding on the interties. The ISO implemented convergence bidding on February 1, 2011, which includes the ability to submit financial bids on the intertie scheduling points in the ISO market. Convergence bidding is an important market enhancement. It enables market participants to hedge their physical market positions and arbitrage differences between day-ahead and real-time prices. This ultimately leads to better price convergence between these markets and more efficient dispatch of physical resources. However, the ISO has observed that, due to current real-time market structure issues, convergence bidding on the interties is not driving the intended market efficiencies.

Convergence bidding involves placing purely financial bids, sometimes called virtual bids, at particular pricing nodes in the day-ahead market. If cleared in the day-ahead market, virtual supply and virtual demand bids settle first at day-ahead prices. They then automatically liquidate with the opposite sell or buy position at the applicable *hour ahead scheduling process* price for interties or *real-time dispatch* prices for internal nodes. The hour ahead scheduling process is where all intertie bids submitted in real-time are cleared and priced. This process runs prior to the 5-minute real-time dispatch for internal resources. Interties require a separate scheduling process in real-time because their schedules need to be finalized and cleared with adjacent balancing areas well in advance of the applicable operating hour. The real-time dispatch is the five minute real-time market in which the ISO establishes binding dispatch instructions and prices for internal resources.

Shortly after convergence bidding was implemented, market participants raised two concerns regarding its market impacts on the interties. First, market participants raised a concern over the increased cost of balancing the real-time market and arriving at revenue neutrality, referred to as the *real-time imbalance energy offset*. The concern is that differences in the hour ahead scheduling process and real-time dispatch prices incent virtual bidding strategies that do not serve to converge day-ahead and real-time prices but contribute to the real-time imbalance energy offset costs allocated to measured demand. Second, market participants

raised concerns over occasional inconsistencies between the market clearing price and the bid price of resources scheduled to import or export at the interties resulting from the enforcement of different physical and virtual intertie constraints in the day-ahead market.

Management has determined that these issues are symptomatic of a fundamental current market design shortcoming which requires settlement of intertie transactions in the hour ahead scheduling process while internal supply and demand are settled later in the real-time dispatch. Stakeholders and the ISO have not been able to identify an alternative near term option that effectively addresses the identified issues without creating new market efficiency issues or reliability concerns. Additionally, the ISO has commenced the renewable integration market and product review phase 2 stakeholder initiative to evaluate potential enhancements to the real-time market. Enhancements being considered include a single settlement timeframe for interties and internal supply and demand that would resolve the structural issues currently afflicting convergence bidding on the interties.

If the settlement timeframes of the real-time market are resolved so that there is a common clearing price for intertie schedules and internal resources, convergence bidding at the interties could be reinstated. In the meantime, Management believes it is inappropriate to continue to allow virtual bids that exacerbate current market design issues without improving market efficiency. This is particularly true in light of the fact that the costs created by this these issues are borne entirely by parties that do not cause and cannot control the issues. Therefore, Management proposes to remove from its current market design the ability for parties to submit virtual bids at the interties. The elimination of this market feature will eliminate the root cause of the two identified issues.

Management proposes the following motion:

> ***Moved, that the ISO Board of Governors approves the proposed tariff change regarding removing interties as eligible convergence bidding nodes, as described in the memorandum dated August 18, 2011; and***
>
> ***Moved, that the ISO Board of Governors authorizes Management to make all necessary and appropriate filings with the Federal Energy Regulatory Commission to implement the proposed tariff change.***

DISCUSSION AND ANALYSIS

Each of the two problems created by convergence bidding on the interties (market uplifts and occasional market prices that are not fully compensatory with awarded bids) is explained more fully below, along with the various options that have been considered to address them.

Convergence bidding on the interties has significantly increased market uplifts

Convergence bidding on the interties increases market uplifts through increasing the real-time imbalance energy offset. The real-time imbalance energy offset is a neutrality account used to reconcile the settlement dollar values for all real-time energy charge codes to ensure that, after all payments and charges have been calculated, there is neither a shortage nor surplus in revenue. Any offset surpluses or shortages are allocated to scheduling coordinators based on a pro rata share of their measured demand (real-time metered load and exports). Therefore, scheduling coordinators may receive a payment or a charge, depending on whether there is a surplus or deficit in the offset account. The ISO has experienced higher than expected real-time imbalance energy offset charges since the start of the new market in April 2009 and commenced a stakeholder process to address the issue in the fall of 2009. Through that process, the ISO identified price differences between the hour ahead scheduling process and real-time dispatch as the main driver of the offset costs. The price difference was often driven by market modeling and forecasting issues and the limited quantities of short-term ramping capability available to accommodate changes in imbalance conditions. Beginning in May 2009, the ISO undertook a number of enhancements to address these issues and improve hour ahead scheduling process and real-time dispatch price convergence. However, when convergence bidding was implemented in February 2011, the real-time imbalance energy offset costs increased significantly.

With the introduction of virtual bids, virtual positions at the interties are settled at the relevant hour ahead scheduling process LMP in the same way as any changes in physical intertie schedules in the hour ahead scheduling process are settled. However, virtual positions on eligible internal pricing locations are settled based on the relevant real-time dispatch LMP. As a result, when virtual bids on the interties clear against internal bids, and there is a significant difference between the respective settlement prices (hour ahead scheduling process and real-time dispatch), there is a corresponding increase in the real-time energy offset.

Additionally, the persistent average price differential between the hour ahead scheduling process and real-time dispatch has encouraged a strategy using internal virtual demand bids and external virtual or physical supply bids. This bidding strategy seeks to arbitrage the price differential, but when the bidding strategy is successful, there is an increase in the real-time imbalance energy offset costs. Market participants can combine an internal virtual demand bid and an intertie physical or virtual supply bid at the same price and quantity, which in essence allows the market participant to arbitrage the lower hour ahead scheduling process price relative to the real-time dispatch price. Since the bidding strategy requires a balanced intertie and internal position to be successful, the strategy does not lead to a change in day-ahead unit commitment or improved system wide market efficiency.

Convergence bidding on the interties can produce prices that are not fully compensatory to awarded bids

Under the current convergence bidding design, the ISO enforces two constraints at intertie scheduling points: (1) net physical schedules across each scheduling point, ignoring the accepted virtual schedules to ensure that the physical schedules are within the established scheduling limit for that scheduling point; and (2) physical and virtual imports net of physical and virtual exports must also be within established scheduling limits for that scheduling point. Since convergence bidding was implemented, the ISO has observed cases where physical export bids are clearing the market at LMPs that are inconsistent (higher) than the submitted bid for the scheduled resource. Market participants adversely impacted by such settlement outcomes have raised concerns over this issue.

This issue was identified during the convergence bidding design process. However, since there were no easily implementable options to address it at the time, the ISO committed to monitoring the issue to determine if it was significant enough in operation to warrant a design modification. In addition, physical import bids are clearing at LMPs that are also inconsistent with their bids resulting in higher payments than would have otherwise been received. The impact to the market on the export side has been approximately $250,000 per month. However, stakeholders who have raised concerns about this issue do not believe the impact reaches a threshold that supports eliminating convergence bidding on the interties. They would prefer that uplift payments be provided to make them whole with respect to their bid costs. However, since removing convergence bidding at the interties is necessary to address the real-time imbalance energy offset concerns, the price inconsistency issue is also resolved.

POTENTIAL SOLUTIONS REVIEWED WITH STAKEHOLDERS

The ISO reviewed several proposed alternatives to eliminating convergence bidding on the interties with stakeholders to address the issues related to the increased real-time imbalance energy offset uplift costs and the price inconsistency on the interties. The proposed alternatives analyzed in the stakeholder process, and the reasons for not implementing them, are described below.

Proposed alternatives for addressing real-time imbalance energy offset uplift costs

Cost allocation of real-time imbalance energy offset

During the 2009 stakeholder process to address issues related to the real-time imbalance energy offset, the ISO worked with stakeholders to determine whether the current design of the allocation of the real-time imbalance energy offset was appropriate. At that time, no clear alternative could be identified because causal attribution to specific market activity was not clear. During the current stakeholder initiative, the allocation of the offset was reviewed again, but there still was no consensus on an alternative approach. Moreover, Management believes that this cost allocation issue is better addressed through a longer-term comprehensive review of a larger set of cost allocation issues being addressed in the renewable integration market and product review phase 2 stakeholder initiative.

Prohibit balanced internal and external virtual bids

Management considered implementing a rule that would prohibit scheduling coordinators from placing balanced internal and external virtual positions. This rule would be designed to address the impact of individual scheduling coordinators' balanced positions on the real-time imbalance energy offset costs. However, it was determined through the stakeholder process that the rule would be easily undermined by potential collusive transactions involving two or more scheduling coordinators that could effectively implement the same bidding strategy. As a result, the ISO concluded that this is not a viable option.

Implement a settlement rule that would neutralize the price arbitrage of the hour ahead scheduling process and real-time dispatch

Under this option, a new settlement rule would be invoked for each scheduling coordinator that would result in a charge or credit based upon the price difference between hour ahead scheduling process and real-time dispatch for the scheduling coordinator's balanced supply and demand position at the interties and internal to the ISO. Although this initially appeared to be a targeted and effective solution to the real-time uplift issues caused by convergence bidding, stakeholders raised significant concerns that the rule could be easily subverted through bilateral arrangements outside of the ISO markets.

Convergence bidding liquidation and settlement timing

Management also considered modifications to the timing of convergence bidding liquidation and settlement. Specifically, Management considered keeping day-ahead awarded internal virtual supply and demand positions in the hour ahead scheduling process, on the theory that doing so would lead to better convergence between the IFM, hour ahead scheduling process and real-time dispatch. However, this option poses potential reliability risks given the importance of imports to meeting ISO load. For example, in the case where there is net internal virtual supply, the ISO would not be able to secure additional physical imports in the hour ahead scheduling process to replace the net internal virtual supply.

Alternatives considered addressing intertie price inconsistency

Management evaluated three alternatives to address the issue where LMPs are not consistent with intertie bids. The alternatives were designed to address the hour ahead scheduling process settlement for intertie transactions and included: (1) pay as-bid; (2) pay as-bid or better; and (3) the New York ISO approach to settlement of interties. As explained below, significant problems were identified with each of the three proposed options.

Pay as-bid

Under this option, intertie schedules produced in the hour ahead scheduling process would be paid their submitted bid price as opposed to a market clearing price. This approach is problematic in that it could result in significant market inefficiencies as market participants would have incentives to submit intertie bids as close as possible to what they expected the expected clearing price to be instead of their marginal costs of providing the energy. This would preclude the ISO from selecting the most efficient mix of imported and exported energy supplies to meet its operational needs.

Pay as-bid or better

Under this option, an import resource would receive either the market clearing price or its own bid, whichever was higher, and an export resource would pay either the market clearing price or its own bid, whichever was lower. In situations where the resource's bid, rather than the market clearing price, was the better price, the ISO would add an uplift payment to the market clearing price to enable that resource to receive its bid cost. This option is problematic because it creates an incentive for intertie resources to bid in a manner that increases uplift costs. This occurs because resources have an incentive to bid large quantities of offsetting import and export energy (which to a significant extent offset one another, in which case no energy is actually received by or provided to the system), so that load is being charged significant amounts for the ensuing uplift costs without receiving any concomitant benefits.

New York ISO approach

Like the California ISO, the New York ISO is a large net importer of power and has a similar hour ahead scheduling process. If there is no congestion on the interties during hour ahead scheduling process, the New York ISO will schedule imports and exports, and the price used for settlements will be computed as the time weighted average real-time price. Imports receive a bid production cost guarantee such that if the real-time price is lower than their offer price, the imports will be paid their offer price. There is no price assurance for exports. If there is congestion on the interties during hour ahead scheduling process, different settlement rules apply to the inter-tie transactions. Though the New York ISO does not allow virtual bids on their interties, Management considered whether the settlement rules that govern their hour ahead scheduling process would help address the price inconsistency issue the ISO periodically experiences. Management concluded that these rules would not help, as they still could lead to pricing inadequacies for exports.

POSITIONS OF THE PARTIES

The parties involved in the stakeholder process have been unable to reach resolution on a near term solution to the settlement timing issues in the hour ahead scheduling process and real-time dispatch. A summary of stakeholder comments and positions is provided as Attachment A. The varied positions of stakeholders have been a key driver in narrowing the proposal to remove convergence bidding on the interties under the current market design. In the ongoing renewable integration market and review phase 2 initiative, the ISO is working with stakeholders to review the changes necessary to the real-time market in order to meet renewable integration requirements. The changes necessary to address the market inefficiency issues currently with convergence bidding, such as eliminating hour ahead scheduling process, are more appropriately addressed within the context of this larger, more comprehensive initiative.

During the stakeholder process, several stakeholders highlighted an additional concern that deviations from physical hour ahead scheduling process import and export schedules were another large driver of the real-time imbalance energy offset, and that removing convergence bidding at the interties could result in an increase in implicit virtual bidding. Implicit virtual bidding is the use of physical import and export bids with no intention to physically deliver the power if the bid is awarded. Other stakeholders highlighted that additional measures to

address implicit virtual bidding may have negative unintended consequences that could result in reduced liquidity at the interties. As such, Management has concluded that no additional measures are needed at this time to mitigate against potential implicit virtual bidding. Furthermore, the treatment of schedule deviations is more appropriately addressed through the renewable integration market and product review phase 2 stakeholder initiative currently underway.

The Market Surveillance Committee and Department of Market Monitoring support the removal of convergence bidding at the interties; however, they state that further measures may still be necessary if the real-time imbalance energy offset charges continue at high levels. The Market Surveillance Committee notes that currently, the ISO's hour ahead scheduling process and real-time dispatch markets are not well integrated, and convergence bidding cannot resolve these integration problems. As a result, convergence bidding on interties has contributed to an unacceptably high real-time imbalance energy offset charge that is borne ultimately by California energy consumers. The final opinion of the Market Surveillance Committee is provided as Attachment B. The Department of Market Monitoring believes the short-term option of eliminating convergence bidding on the interties will help reduce high real-time imbalance energy offset charges without any decrease in overall market efficiency. A comprehensive re-design of the hour ahead scheduling process and real-time dispatch real-time markets that would more fully address this issue is expected to take several years. Therefore, the Department of Market Monitoring states that the ISO should consider additional modifications for settlement of physical inter-tie schedules that may be implemented on a relatively short time frame. The Department of Market Monitoring Report is included with the informational reports in the August board materials.

MANAGEMENT RECOMMENDATION

Management requests Board approval of its proposal to remove interties as eligible nodes for convergence bidding as described in this memorandum. The benefits of continuing convergence bidding on interties under the current real-time market design do not outweigh the market inefficiencies outlined in this memo.

Attachment A

Stakeholder Process: Convergence Bidding on the Interties

Summary of Submitted Comments

Stakeholders submitted two rounds of written comments to the ISO on the following dates:

Real Time Imbalance Energy Offset (2011)
- Round One, 05/11/11
- Round Two, 06/01/11
- Round Three, 06/24/11
- Round Four, 08/05/11

Price Inconsistency Caused by Intertie Constraints
- Round One, 05/11/11
- Round Two, 06/01/11

Stakeholder comments are posted at:

Real Time Imbalance Energy Offset (2011)
http://www.caiso.com/informed/Pages/StakeholderProcesses/RealTimeImbalanceEnergyOffset2011.aspx

Price Inconsistency Caused by Intertie Constraints
http://www.caiso.com/informed/Pages/StakeholderProcesses/PriceInconsistencyCausedIntertieConstraints.aspx

Other stakeholder efforts include:

Real Time Imbalance Energy Offset (2011)
- Stakeholder conference call to review issue paper and straw proposal, 05/04/11
- Stakeholder conference call to review revised straw proposal, 05/25/11
- Stakeholder conference call to review revised straw proposal, 06/17/11
- Stakeholder meeting to discuss benefits of convergence bidding on interties, 07/19/11

Price Inconsistency Caused by Intertie Constraints
- Stakeholder conference call to review issue paper and straw proposal, 05/04/11
- Stakeholder conference call to review draft final proposal, 05/25/11

Stakeholder	Remove CB on Interties	Comment	Management Response
Brookfield Energy	Does not support	Eliminating convergence bidding on the interties does not resolve root causes of the real-time imbalance energy offset. More moderate steps can be taken to attempt to address this problem before moving to such an extreme position as eliminating convergence bidding on the interties completely. Most of the dollar volume of the real-time imbalance energy offset uplift is driven by price spikes in real-time dispatch that will be addressed by the flexi-ramp constraint. Convergence bidding on the interties provides valuable benefits to the market and a legitimate hedging tool for market participants.	The ISO has acknowledged that eliminating convergence bidding on the interties will not fully resolve the real-time imbalance energy offset; however, while the proposal will not address the price differences between hour-ahead scheduling process and real-time dispatch, the proposal will decrease the quantity of MW that can impact the offset. The ISO is proposing to eliminate convergence bidding on the interties as a result of the market design issues identified through the stakeholder processes. Since the current market design has two settlement periods in real-time (hour-ahead scheduling process for interties and real-time dispatch for internal load/generation) and virtual bids are removed from the market optimization in HASP, the benefits of price convergence through virtual bids is reduced.
Citigroup	Does not support	Encourage the ISO to further review the other contributing factors to the real-time imbalance energy offset charge prior to taking drastic measures in removing convergence bidding. We do feel that a more conclusive stakeholder process that attempted to collectively dive into the various options to reduce the offset, would have benefitted the overall market.	The current real-time market design prevents the benefits of price convergence from being fully utilized. Enhancements to the real-time market are needed to efficiently integrate renewables at the 33% renewable portfolio standard. To address operational and market challenges due to the expanding renewable generation fleet and new technologies, the ISO has commenced a comprehensive initiative, RIMPR Phase 2, to identify market design enhancements to meet these challenges. The RIMPR Phase 2 includes enhancements to the real-time market and the ISO believes that it is appropriate to address other contributing factors to the real time imbalance energy offset through this initiative.
CPUC	Supports	Because of structural defects that result in systematic price differences between the hour-ahead scheduling process price for interties and the real-time dispatch price for internal generation and load, the CPUC staff supports the ISO's proposal to eliminate convergence bidding at the interties. Enhancements such as the flexible ramping constraint and increasing the negative bid floor appear to have potential to reduce the price differences. Nevertheless, the price differences have been persistent and other ISO	The ISO believes that the RIMPR Phase 2 initiative is the appropriate venue to address other contributing factors to the real-time imbalance energy offset. The ISO will continue to monitor for implicit virtual bidding and will take additional steps to address the issue if warranted.

Stakeholder	Remove CB on Interties	Comment	Management Response
		efforts to date to address implicit virtual bidding and bring price convergence between hour-ahead scheduling process and real-time dispatch prices have not succeeded. The CPUC staff therefore generally supports the ISO's proposal, except that it continues to urge the ISO to adopt rules to deter implicit virtual bidding within this stakeholder initiative.	
DC Energy	Does not support	Strongly opposes the ISO's proposal to suspend convergence bidding at the interties. As noted in earlier comments, DC Energy believes that intertie convergence bidding is an essential part of the ISO market – providing a number of benefits to participants (ability to bid out-of-state renewable energy in the integrated forward market, hedging of physical and congestion revenue rights positions, etc.) as well as the market as a whole (liquidity, market power mitigation, price formation, etc.). In addition to providing these benefits, as WPTF noted in its presentation, intertie convergence bidding is currently providing over $300 million in annual savings to load. This is several times greater than the total increase to the real time imbalance energy offset charge from convergence bidding estimated by the ISO.	The ISO is proposing to eliminate convergence bidding on the interties as a result of the market design issues identified through the stakeholder processes. Since the current market design has two settlement periods in real-time (hour ahead scheduling process for interties and real-time dispatch for internal load/generation) and virtual bids are removed from the market optimization in hour-ahead scheduling process, the benefits of price convergence through virtual bids is reduced. The objective of convergence bidding is not the reduction in day-ahead market prices, but rather the convergence of day-ahead and real-time price through changes in the day-ahead unit commitment that result from virtual bids. The ability for out-of-state renewable energy to participate in the day-ahead market is not impacted by the decision to remove convergence bidding from the interties. Several stakeholders stated that virtual supply allows renewable resources to take a day-ahead position, but wait to secure transmission closer to actual delivery based upon a more updated and accurate forecast. However, the financially equivalent strategy can be employed by submitting a day-ahead physical import and securing transmission prior to the hour-ahead scheduling process and making the appropriate supply adjustments in the hour-ahead scheduling process.
Financial Marketers	Does not support	The Financial Marketers object to the draft final proposal to not allow interties to be eligible nodes for convergence bidding under the current market design. The Financial	The ISO originally planned to bring this matter to the Board for decision in July. Since the impact to the real-time imbalance energy offset moderated in May and June, the ISO and stakeholders took additional time to find intermediate alternatives to address the

Stakeholder	Remove CB on Interties	Comment	Management Response
		Marketers suggest that the ISO revisit the second straw proposal, in which the ISO recognized that operational improvements to address the hour-ahead scheduling process and real-time dispatch price differential resulted in a significant reduction in real-time imbalance energy offset costs. As stated above, the second straw proposal concludes that it would be "prudent to take additional time to develop a more comprehensive intermediate term solution instead of moving ahead with the proposed short-term settlement rule." Instead of taking this prudent step, the draft final proposal would serve to eliminate the nascent market for convergence bidding at the interties.	issues. However, no proposal to address the structural issues with having two settlement optimizations for real-time prices (hour-ahead scheduling process for interties and real-time dispatch for internal load/generation) were identified which would have led to virtual bidding driving convergence between day-ahead prices and real-time prices.
J.P. Morgan	Does not support	J.P. Morgan does not support the ISO's proposal. Elimination of convergence bidding at the interties will result in market inefficiencies and will obviate much of the benefit of convergence bidding as proposed and implemented by the ISO and approved by FERC. As presented by WPTF at the recent stakeholder meeting, convergence bidding at the ties offers quantifiable benefits to the market as a whole by increasing supply in the day-ahead market. The ISO has not supported the need to take such action. The ISO has not demonstrated that the current rules have had any deleterious impact on reliability. Furthermore, the ISO itself has acknowledged that real-time imbalance energy offset charges have declined over the last month and have remained at a more moderate level. Most recently, the ISO has presented information that reveals that the offset charge remains low and that, at times, convergence bidding has resulted in lower real-time imbalance energy offset charges	The ISO is proposing to eliminate convergence bidding on the interties as a result of the market design issues identified through the stakeholder processes. Since the current market design has two settlement periods in real-time (hour-ahead scheduling process for interties and real-time dispatch for internal load/generation) and virtual bids are removed from the market optimization in hour-ahead scheduling process, the benefits of price convergence through virtual bids is reduced. The objective of convergence bidding is not the reduction in day-ahead market prices, but rather the convergence of day-ahead and real-time price through changes in the day-ahead unit commitment that result from virtual bids.
NCPA	Supports	NCPA supports the ISO's draft final proposal to remove interties as eligible convergence bidding nodes under the current market design.	
NRG Energy	Does not support		The ISO is proposing to eliminate convergence bidding on the

Stakeholder	Remove CB on Interties	Comment	Management Response
		While NRG, among other parties, was skeptical of the ISO's initial proposal to "claw back" revenues associated with balanced internal/intertie virtual positions, NRG is discouraged and perplexed by the ISO's unilateral decision to eliminate that proposal from consideration. NRG is especially perplexed by the ISO's removal of the claw back proposal from consideration because it seemed to completely address the chief concern by the ISO associated with offset costs while still allowing convergence bidding at the interties. Hoping that the ISO will reconsider this "nuclear option", but expecting that it will not, NRG urges the ISO to "fast-track" modifications to its market design in Phase 2 of the Renewable Integration and Market Product Review to eliminate discrimination between suppliers internal and external to the ISO and to restore convergence bidding on the interties.	interties as a result of the market design issues identified through the stakeholder processes. Since the current market design has two settlement periods in real-time (hour-ahead scheduling process for interties and real-time dispatch for internal load/generation) and virtual bids are removed from the market optimization in hour-ahead scheduling process, the benefits of price convergence through virtual bids is reduced. The objective of convergence bidding is not the reduction in day-ahead market prices, but rather the convergence of day-ahead and real-time price through changes in the day-ahead unit commitment that result from virtual bids. The focus of RIMPR Phase 2 is to redesign the real-time market and the ISO believes that it is appropriate to address other contributing factors to the real-time imbalance energy offset through the changes necessary to meet future renewable generation penetration.
PG&E	Supports	PG&E fully supports the ISO's proposal to seek Board approval in August to remove convergence bidding from the interties. We agree with the ISO's assessment that the benefits of continuing to allow convergence bidding at the interties do not outweigh the ongoing market risks. However, PG&E also believes further efforts to address non-convergence bidding real-time imbalance energy offset issues should continue through a stand-alone initiative, rather than being tabled until implementation of the Renewable Integration Phase 2 roadmap in 2014. The real-time imbalance energy offset remains unacceptably high, and to the extent that action can be taken to reduce the magnitude of this uplift, it should be pursued on an expedited basis.	The ISO is continuing to develop and implement enhancements to its operational practices and systems to converge HASP and RTD prices which should further reduce the real-time imbalance energy offset. Furthermore, the ISO will continue to closely monitor the level of real-time imbalance energy costs and take additional actions if warranted. The real-time market structural issues are being addressed in the RIMPR Phase 2 initiative.
Powerex	Supports	Under the current market design, intertie convergence bids do not substantially lead to improved efficiency in the commitment or dispatch of physical resources, which Powerex submits is their primary objective. Rather than	The ISO agrees and will address the real-time market structural issues in the RIMPR Phase 2initiative.

Stakeholder	Remove CB on Interties	Comment	Management Response
		adopting a patchwork fix, Powerex believes resources are better directed at identifying and remedying the root underlying causes of the persistent price divergences in the ISO market. An important stakeholder discussion on implicit virtual bidding specifically – and on non-performing physical awards generally – was underway, but it appears to have been prematurely terminated by the ISO, largely as a result of nebulous and speculative comments of some of the stakeholders. Powerex believes that a prudent course of action is for the ISO to seek approval from its board of directors to suspend convergence bidding on interties. However, the issue of whether to adopt additional measures to discourage implicit virtual bidding need not – and should not – be decided at the same time.	
Six Cities	Supports	Fully supports the ISO's determination in the final proposal to remove interties as eligible convergence bidding nodes. In addition, however, the ISO should continue to monitor carefully the levels of Real-Time Imbalance Energy Offset costs and act promptly to mitigate such costs if they return to the high levels experienced in several previous months.	The ISO is committed to continuing to monitor the real-time imbalance energy offset costs and implement operational and system enhancements to converge HASP and RTD prices to keep the offset costs at acceptable levels. If the offset costs rise to unacceptable levels, the ISO will consider additional intermediate term solutions to address the issues.
SWP	Supports	Removing convergence bidding at interties should eliminate the impact of convergence bidding at interties and could resolve part of the real-time imbalance Energy Offset issue and the price inconsistency caused by intertie constraints issue. Although the ISO expects to fully address the offset issue within the Renewable Integration Market and Product Review Phase 2 Stakeholder process, SWP considers an intermediate term solution for the offset issue is also necessary.	The ISO is committed to continuing to monitor the real-time imbalance energy offset costs and implement operational and system enhancements to converge HASP and RTD prices to keep the offset costs at acceptable levels. If the offset costs rise to unacceptable levels, the ISO will consider additional intermediate term solutions to address the issues.
SCE	Supports	SCE supports suspension of virtual bidding at the interties. While such a measure is unfortunate, we have found no other workable solution, and further, no other stakeholder has offered a workable alternative. At its core we have a	The ISO is proposing to eliminate convergence bidding on the interties as a result of the market design issues identified through the stakeholder processes. Since the current market design has two settlement periods in real-time (HASP for interties and RTD for internal load/generation) and virtual bids are removed from the

Stakeholder	Remove CB on Interties	Comment	Management Response
		structural market design issue, and thus a solution requires a structural change. Moreover, arguments by some stakeholders that somehow virtual bids produce a net-benefit to Load - even considering the $80 million uplift - are both unjustified and irrelevant. Convergence bids are intended to *converge* prices. Arguments that instead convergence bids systematically depress prices over a long-term horizon are, in effect, arguments that the current implementation is dysfunctional and contravenes its intended purpose.	market optimization in HASP, the benefits of price convergence through virtual bids is reduced. The objective of convergence bidding is not the reduction in day-ahead market prices, but rather the convergence of day-ahead and real-time price through changes in the day-ahead unit commitment that result from virtual bids.
SDG&E	Supports	SDG&E supports the ISO's proposal to suspend convergence bidding at interties under the current market design. Specifically, such a suspension should remain until convergence bids for interties are settled in the same real-time market as internal nodes (i.e. no hour-ahead scheduling process settlement for convergence bids). SDG&E believes a separate initiative should be started now to redesign the hour-ahead scheduling process market that eliminates the driver of offset costs, deters the physical substitute for SC Balanced Virtual bids or fairly allocates uplift costs until such redesign is implemented, and is consistent with the policy objectives of RIMPR Phase 2.	The ISO is committed to continuing to monitor the real-time imbalance energy offset costs and implement operational and system enhancements to converge HASP and RTD prices to keep the offset costs at acceptable levels. If the offset costs rise to unacceptable levels, the ISO will consider additional intermediate term solutions to address the issues.
WPTF	Does not support	WPTF continues to strongly believe that suspending convergence bidding at the ties is mis-directed and would be counterproductive to the ISO market. • The ISO should focus foremost on a sustainable market design that conforms settlements for internal and external resources; • The real-time imbalance energy offset charge is primarily driven by factors other than convergence bidding; • The actions of the ISO to reduce the offset have been productive but the charge is still very sensitive to ISO operator actions and other factors unrelated to convergence bidding; • Convergence bidding has reduced costs to LSEs well in	The ISO is proposing to eliminate convergence bidding on the interties as a result of the market design issues identified through the stakeholder processes. Since the current market design has two settlement periods in real-time (HASP for interties and RTD for internal load/generation) and virtual bids are removed from the market optimization in HASP, the benefits of price convergence through virtual bids is reduced. The objective of convergence bidding is not the reduction in day-ahead market prices, but rather the convergence of day-ahead and real-time prices through changes in the day-ahead unit commitment that result from virtual bids. The ISO acknowledges that several market participants who originally highlighted concerns with price inconsistencies arising

Stakeholder	Remove CB on Interties	Comment	Management Response
		excess of any real-time imbalance energy offset cost impacts stemming from convergence bidding; • Convergence bidding is a useful market feature, and convergence bidding at the ties provides hedge capabilities that cannot be replaced by an internal node-only convergence bidding policy; • Parties are willing to further consider settlement rules and other means to manage the impact of intertie convergence bidding on the real-time imbalance energy offset; • WPTF members are willing to manage the risks of the dual constraint issue for convergence bidding, and thus this should not be a driver for suspending convergence bidding.	from enforcement of the dual constraint of the interties are willing to manage the risks associated with this market issue over the alternative of removing convergence bidding at the interties.

Attachment B

Final Opinion on Intertie Convergence Bidding and the Imbalance Energy Offset

by

James Bushnell, Member
Scott M. Harvey, Member
Steven Stoft, Member
Benjamin F. Hobbs, Chairman

Members of the Market Surveillance Committee of the California ISO

August 16, 2011

1.0 Summary

The Market Surveillance Committee (MSC) has been asked to state its opinion on the CAISO's proposed responses to the problems created by the interaction of convergence bidding and the persistent market design problems that have led to large levels of uplift payments through the Real-Time Imbalance Energy Offset charge. At the center of the CAISO's current proposal[1] is a move to suspend convergence bidding on interties until a more robust solution is found to the pricing problems experienced on the interties between the CAISO and neighboring control areas.

The California ISO final proposal was developed following discussion at the April 29 Market Surveillance Committee meeting, stakeholder teleconferences on May 4, May 25 and June 17, an in person stakeholder meeting on July 19, 2011, and multiple rounds of written stakeholder comments.

We support the CAISO's proposal to eliminate convergence bids at interties. While the ability to submit such bids is not the root cause of the high levels of Real-Time Energy Imbalance Offset charges, and we do not expect the elimination of convergence bids at the interties to by itself reduce the level of these charges to an acceptable level, there is a reasonable basis for expecting that this change will reduce those charges to some extent. Whether the reduction will be small or substantial is not clear, but the direction of the effect is unambiguous.

Because the reduction in Real-Time Energy Imbalance Offset charges resulting from this change may turn out to be small, and the charges therefore remain excessive, while moving towards implementation of this change the CAISO should continue to evaluate

[1] http://www.caiso.com/Documents/DraftFinalProposal-Real-TimeImbalanceEnergyOffset.pdf, July 29, 2011

other perhaps longer term and more far reaching changes in the pricing and scheduling of imports and exports to address the problem.

2.0 Background

Although great progress has been made in the integration and rationalization of electricity market operations across broad regions over the last decade, these advances have been largely been focused on transactions *within* the control areas of individual ISOs and RTOs. The improvement of the coordination of transactions *between* control areas has greatly lagged these internal advancements. This has been particularly true in the west, where the California ISO remains the only ISO in the Western Electricity Coordinating Council region.

One of the many sources of seams issues, as these inter-control area problems have come to be known, are the differing conventions for the timing of market closure and scheduling obligations. Most relevant to the issue at hand here is the fact that transactions between control areas throughout the western grid are currently scheduled on an hourly basis with intra-hour changes scheduled only in the event of contingencies or to address transmission overloads.[2] The CAISO, on the other hand, runs an internal dispatch and market that operates at 5 minute intervals in near "real-time.'' Although many internal resources can be dispatched on a five minute basis to sell energy into this real-time balancing market, external resources, although critical to the reliability of California's market, must for the most instead be cleared through an hour-ahead scheduling process (HASP) and then confirmed with adjacent balancing area authorities through a process known as "checkout."

Importantly, while the current market design allows for a fully integrated day-ahead market where both internal and external resources can buy and sell energy, the HASP is not a true market in the sense that the only market participant acting on behalf of California load serving entities in this process is the CAISO. Further, the prices and quantities that are determined in the HASP are used for settlements only for imports and exports. Going into the HASP, the CAISO has updated its forecasts of market conditions to reflect changes since the close of the IFM, and will seek to, essentially, buy or sell power over the interties in an attempt to minimize the cost of reliably meeting real-time load based on expected real-time conditions. In the HASP the CAISO essentially buys or sells power acting as an agent for all net consumers of power in the CAISO market. These "purchases" of imports can take the form of increased imports from neighboring regions or reduced exports from within the ISO to those regions.[3] The "internal CAISO demand" in the HASP is therefore driven completely by CAISO forecasts of real-time conditions.

[2] Consideration is being given to allowing 30 minute schedule changes for interchange transactions in the relatively near future.

[3] To take advantage of opportunities for improving operating efficiencies, the CAISO will also clear both offers to adjust export and import levels when those offers imply a gain from trade.

Conversely, internal CAISO demand in the real-time market is driven by actual conditions and supply is, mostly, limited to resources internal to the CAISO.[4] Under such conditions, the only entity able to participate in both HASP and real-time markets to buy and sell energy on behalf of internal CAISO loads is the CAISO itself. The relative level of prices in the two markets therefore depends on the CAISO's actions in these markets. The CAISO also is put in the position of a counter-party to trades in the two markets that, although intended to balance supply and demand, clear at different prices.

Inconsistencies between CAISO purchases and sales, and their respective prices give rise to unfunded costs that must be recovered through special charges. The potential for these costs arises because the CAISO settles HASP imports and exports at HASP prices, while settling internal load and generation at real-time prices. Any time the CAISO schedules net exports in the HASP and the HASP price is lower than the real-time price, the CAISO incurs costs that must be recovered from market participants through the Real-Time Imbalance Energy Offset (RTIEO) charge. Similarly, any time the CAISO schedules imports in the HASP and the HASP price is higher than the real-time price, the CAISO will also incur costs that must be recovered from market participants.[5] If the differences between the HASP prices and RTD prices at the interties were centered around zero and unpredictable, the CAISO would not incur material net Imbalance Energy Offset charges as a result of these HASP/RTD price differences, but this has not been the case.

As documented in several CAISO white papers[6] and in the State of the Market Report[7], positive Imbalance Energy Offset charges have persisted since the introduction of the new market design in the spring of 2009. On average, the CAISO has been a net-seller (i.e. exporter) in the HASP inter-change market, while the HASP price has been on average below the real-time price at which the CAISO implicitly "buys" the power in real-time to support these net exports. The problem has been exacerbated with the introduction of convergence bidding in January of this year.

[4] A relatively modest amount of energy that is imported under a protocol known as dynamic scheduling is also able to fully participate in the CAISO's real-time market.

[5] Conversely, the CAISO generates profits any time it schedules net imports and the HASP price is lower than the real-time price or schedules net exports at HASP prices that are higher than the real-time price.

[6] "Impact of Convergence Bidding on Interties, Draft Final Proposal," July 29, 2011, Figure 1 p. 7; "Impact of Convergence Bidding on Interties, Revised Straw Proposal," June 10, 2011, Figure 1 p. 7; "Redesign of the Real-time Imbalance Energy
Offset, Revised Straw Proposal and Options for an Intermediate Term Solution," May 18, 2011, Figure 1 p. 5; Issue Paper and "Price Inconsistency Caused by Intertie Constraints, Straw Proposal" April 27, 2011; "Impact of Convergence Bidding on Real-Time Imbalance Energy Offset, Issue Paper and Straw Proposal April 27, 2011, Figure 1 p 4.

[7] California ISO, Department of Market Monitoring, "2010 Market Issues & Performance Annual Report," pp. 68-70.

3. Convergence Bidding and the Imbalance Energy Offset Charge

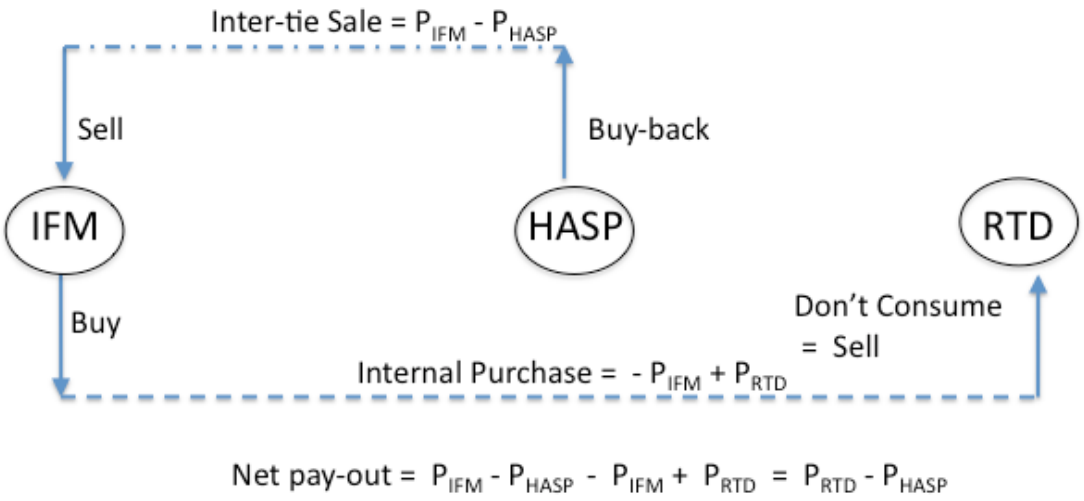
Convergence, or "virtual," bids are financial transactions that allow arbitrage between day-ahead and real-time, and are intended to allow firms to take financial positions that mimic physical ones. Internally, a convergence offer sale in the IFM is automatically balanced against a purchase in the real-time market, and a convergence bid purchase in the IFM is balanced with a sale in the real-time market. However, since physical intertie transactions are settled at the HASP price, intertie convergence bids are also settled at the HASP, rather than real-time, price. While this pricing policy provides for a consistent settlement of physical and virtual transactions on interties, it also greatly expanded the opportunities for trades that, while not risk free, can on average exploit persistent HASP-RTD price differences.

A further complication is that even internal convergence trades are in fact accounted for in the HASP. Mechanically, convergence bids impact the supply and demand balance only in the IFM. In both HASP and RTD, the market consists of adjustments to physical "supply," including intertie transactions, balanced against CAISO forecasts of actual physical demand. This means that, although internal convergence bids are settled at the RTD price, the supply to replace a "virtual" internal sale could be procured either from external supply in the HASP or from internal supply in RTD, depending on which appears lower cost in the HASP.[8]

An internal virtual purchase of 1 MW provides a position that pays the IFM price, p_{IFM}, to acquire the position in the IFM and is paid the real-time price p_{RTD} when the position is settled in real time. An intertie virtual sale provides a position that is paid the IFM price, p_{IFM}, for taking the position and pays the HASP price, p_{HASP} to settle the position. Figure 1 summarizes the flow of these two possible transactions.

[8] In comments, Powerex proposed rectifying this by waiting until RTD to clear internal convergence trades (see "Powerex Comments on Revised Straw Proposal and Intermediate Term Options, June 2, 2011.). This is equivalent to the CAISO assuming that internal virtual positions reflect actual real-time physical demand and supply when it runs HASP. The CAISO has rejected this solution as it anticipates that doing so would raise the cost of meeting load and potentially adversely impact reliability.

If CAISO did not adjust interchange or commit resources requiring long-start or ramp times in HASP, the CAISO would be limited to replacing this internal virtual supply that was scheduled to meet physical internal load in the day-ahead market with on-line and quick start generation in real-time, which could be very expensive and perhaps sometimes not even feasible. Since such outcomes would impose losses on the virtual supply bids, the potential for such outcomes would tend to reduce the level of virtual supply bids. Conversely, internal virtual demand bids would be treated as physical, driving the scheduling of additional imports in the HASP, driving up HASP prices and driving down RTD prices, making virtual demand positions less profitable. While such changes might converge HASP and RTD prices if virtual traders had perfect foresight, with traders lacking such perfect foresight such changes have the potential to introduce much more real-time price volatility, real-time reliability risks, and the potential for additional unintended consequences from interaction with other elements of the market design. The eastern ISO having such a HASP type evaluation process for scheduling imports, New York ISO, accounts for all virtual transactions as virtual in its HASP evaluation (RTC). It is important to note that convergence bidding can lead to convergence but there are no predictions about the *level* of price that would be converged upon. Such a solution could result in all markets converging at a higher price due to higher costs of system operation, such as might result from this proposed solution.



The result of combining these two virtual transactions into a "balanced" convergence bidding position is that there is no change to the net demand or supply in the day-ahead market where the virtual bids are present and offset each other, nor in HASP in which neither the virtual demand nor supply bids are present, nor in real-time in which neither the virtual demand nor supply bids are present, and therefore absent congestion, these bids have no impact on the underlying prices in any of the three markets.[9] However, at the same time, the balanced trade does not produce balanced revenues if the HASP and RTD prices are different. When the HASP price is lower than the RTD price, as it has been on average, the balanced trade produces positive revenues. These revenues are funded by the RTIEO charges.

The dual pricing constraint

An unrelated yet also vexing problem has been the reconciling the existence of convergence bids on interties with WECC standards for congestion management on interties. One of the benefits of convergence bidding is that it removes financial incentives to schedule interchange transactions day-ahead that will not flow in real-time, a practice sometimes called "implicit convergence bidding." When chronically applied during sensitive conditions, implicit convergence bidding can lead to reliability concerns as operators are expecting performance from resources whose owners do not in fact intend to perform.

In theory, convergence bids should be allowed to impact day-ahead market outcomes just like physical bids in order to promote price convergence and remove incentives for implicit convergence bidding. This concept is more controversial when convergence

[9] It might appear that these transactions are not balanced in real-time as the intertie transaction would be priced in HASP and the internal transaction priced in RTD. However recall that both the intertie and internal transactions are physically accounted for in the HASP. Thus both offsetting buy and sell positions are in effect "clearing" in the HASP market, although the internal transaction is priced at the RTD price.

bids, which are explicitly recognized as *not* reflecting physical resources, cause an interface to either become congested or uncongested in the day-ahead market. In practice, WECC rules require that interties be feasibly scheduled with respect to *physical* resources only. This means, for example, that a physically infeasible level of imports cannot be offset by virtual exports.

The CAISO has complied with this requirement by enforcing two constraints, one that determines physical interchange schedules utilizes only physical intertie bids and one that determines prices that takes account of both physical and convergence intertie bids. A problem with this solution is that the physical interchange schedules in the IFM can be inconsistent with the prices in the IFM. In particular, the submission of a virtual export transaction can cause a tie to be unconstrained for pricing purposes, yet constrained for the scheduling of physical imports. This design offers opportunities for a variety of inefficient scheduling practices. While we understand based on informal CAISO analyses that it does not appear that market participants have been taking advantage of these opportunities, this could change, and the observed price inconsistencies could reflect the use of more subtle ways of taking advantage of these limitations of the current design. Hence, it is desirable, although perhaps not urgent, to reform this element of the interchange scheduling and pricing design as well. In HASP the interchange schedules reflect only physical resources as virtual bids are not included in the market. The result is that convergence b ids impact physical dispatch differently in the two markets, further distorting the role of convergence bids in promoting the convergence of prices between the markets.

4. The CAISO Proposal

The possible responses to these problems consist of a) taking measures to eliminate the systematic differences in HASP and RTD prices, and b) mitigating or eliminating the ability to exploit these differences through convergence bids, c) modifying the settlement rules to reduce the significance of HASP- RTD price differences. The three responses are not mutually exclusive and some combination of these changes may be necessary to completely eliminate Imbalance Energy Offset charges.

The current CAISO proposal will focus on the second option. This option will also eliminate the need to manage dual constraints (virtual and physical) on interties and thereby eliminates the potential for inefficient interchange scheduling practices that exploit the inconsistencies in IFM interchange prices that the dual constraints can produce. By eliminating virtual bidding at the interties, the CAISO eliminates the ability to exploit the HASP-RTD price gap through virtual bids alone. There will still remain the ability to respond to and profit from these differences by adjusting physical transactions between day-ahead and HASP.

Other possible steps

One advantage of the CAISO proposal is that it can be implemented immediately. Other steps that would more directly address the market design and implementation flaws that

contribute to the RTIEO charges would involve changes to either the pricing algorithms, settlement calculations, the HASP or RTD optimization or some combination of these alternatives.

A theoretical "market based" solution would be to allow for a more fully participatory Hour-Ahead Market that would replace the current HASP process, which is dominated by CAISO forecasts and decisions. A fully participatory demand side to the Hour-ahead markets in which load serving entities bid to buy or sell supply incremental to their day-ahead schedules and suppliers (internal and external) could lock in changes to their day-ahead schedules could promote price-convergence and allow for a full price-formation process, both internal and external, in the hour-ahead time frame. Further, it would remove the CAISO from the role of counter-party to trades in HASP. Thus, for example sales in the hour-ahead would be balanced against purchases made at the same price. Unfortunately, an hour-ahead market will entail a major redesign whose implementation would be several years away.

Short of implementing a full hour-ahead market, other possible interim measures would be to focus on changing the settlement prices of hour-ahead intertie transactions. The root problem of the current system is that the CAISO doesn't fully know what resources it will need to meet load until real-time, while most imports have to be scheduled during an hour-ahead time frame. That means the CAISO must schedule imports, based upon hour-ahead import offer prices, and then match those adjustments to consumption based upon real-time prices. The two sides of these trades are paying different prices, and the CAISO, as the functional counter-party to both sides, faces the cost of any price differences which must then be recovered through the RTIEO uplift charge.

One solution would be to settle both interchange transactions, internal generation and load at the same real-time price – eliminating the risk of paying for the "spread." Settling interchange transactions at the real-time price, however, would create the potential for an importer (exporter) to sell (or buy) power at a price below (or above) what their bids specified they were willing to trade at. For example an importer may offer power at $50/MWh in HASP, have its offer accepted, and then face a much lower real-time price. If HASP transactions were paid the RTD price, then such an importer may be forced to sell at a "loss" for at least one interval. In some markets, such as PJM and the Midwest ISO, these parties must bear that risk, and take that risk into account in scheduling interchange. PJM and MISO market participants have the ability to change the level of interchange transactions during the hour, subject to ramp availability and some other limitations. This introduces additional uncertainty into forward commitment decisions that the CAISO would need to account for, so this would be a significant design change that would require careful evaluation.

In other markets, such as the NYISO, sellers are given a bid-price guarantee for imports that allows them to be paid the higher of the RTD price or their offer price. This is, in essence, a bid cost recovery provision. These bid-price guarantees reintroduce a divergence, albeit smaller, between hour-ahead payments and real-time prices that again make necessary an uplift fee. In addition, because scheduling limits on the interties are

not binding in RTD, such a real-time pricing system for interchange requires that binding scheduling limits in the HASP be reflected in settlement prices, so that importers are paid the higher of their offer price and the lower of the HASP and RTD price. Such changes in pricing rules could therefore provide an improvement, but would not be the "silver-bullet" that would completely eliminate the need for uplift payments such as the RTIEO and would require fairly material changes to the California ISO settlement system.

It is important to note that the ISO has been continuing to take measures to adjust its process for clearing transactions in HASP and dispatching the market in real-time to reduce costs and better converge HASP and RTD prices.[10] These efforts are independent of the convergence bidding changes outlined in the current CAISO proposal. These measures have to date not eliminated predictable differences between HASP and RTD prices. [11]

5. Discussion

We support the CAISO proposal to suspend convergence bidding on the inter-ties. While we agree that convergence bidding can provide hedging and market efficiency benefits in general, we believe that the combination of predictable price differences between the HASP and real-time, and the current design for pricing of inter-tie transactions create opportunities for profitable convergence bidding strategies that magnify real-time imbalance energy offset charges while failing to bring the HASP and RTD prices into convergence. We believe that it is not acceptable to continue to expose CAISO customers to the ongoing and potentially expanding costs that these trades impose on measured load.

It has been noted that the level of RTIEO charges attributable to a lack of convergence between HASP and RTD prices was a concern before convergence bidding was even implemented in February 2011. [12] Hence, one concern is that the implementation of convergence bidding on the interties merely changed the way in which these underlying problems have been expressed, and that with its elimination, predictable HASP/RTD differentials will continue to lead to outcomes that produce high levels of RTIEO charges.

While the incentive for market participants to schedule physical imports transactions in the day-ahead market and buy them back in HASP if the HASP price is lower than the

[10] See, for example, California ISO, Department of Market Monitoring, "Quarterly Report on Market Issues and Performance," May 24, 2011 pp. 18-19.
[11] See, for example, California ISO, Department of Market Monitoring, "Quarterly Report on Market Issues and Performance," May 24, 2011 pp. 7-9.
[12] Multiple CAISO analyses show high levels of the RTIEO since early 2010, see "Impact of Convergence Bidding on Interties, Draft Final Proposal," July 29, 2011, Figure 1 p. 7; "Impact of Convergence Bidding on Interties, Revised Straw Proposal," June 10, 2011, Figure 1 p. 7; "Redesign of the Real-time Imbalance Energy Offset, Revised Straw Proposal and Options for an Intermediate Term Solution," May 18, 2011, Figure 1 p. 5; "Impact of Convergence Bidding on Real-Time Imbalance Energy Offset, Issue Paper and Straw Proposal April 27, 2011, Figure 1 p 4. California ISO, Department of Market Monitoring, "2010 Market Issues & Performance Annual Report," pp. 68-70.

cost of that power will remain following elimination of virtual bidding at the ties, the incentives will be no greater than they are currently. Because the combination of virtual supply at the interties and virtual demand bids internal to the California ISO does not lead to price convergence between the day-ahead and HASP prices under the current rules, one form of trading does not necessarily "crowd-out" the other. We therefore believe that suspending convergence bidding on the interties has the potential to reduce RTIEO costs, and to reducing the potential for a dramatic future escalation of those costs.

That said, we are concerned that the suspension of convergence bidding will prove insufficient to eliminate the costs to load of the market flaws, as reflected in the RTIEO. The incentive of external suppliers to respond to persistent and predictable price differentials will remain and it is desirable for external suppliers to respond to high and low day-ahead and real-time prices. Further, this proceeding may very well have had a chilling effect on both implicit and explicit convergence bidding, as various solutions, some of which would make implicit convergence bidding more costly, have been considered. By taking a relatively firm stance that no further actions will be taken to address this issue short of the full market redesign, the CAISO may be removing some of the self-discipline that may have limited the level implicit convergence trades during the last few months.

If the RTIEO continues to grow or remains substantial in the absence of inter-tie convergence bids, then a potential next step could be to revise the prices at which HASP intertie transactions are settled, such as settling import and export transactions scheduled in the HASP at real-time prices rather than at HASP prices. This could involve implementing the hybrid system employed by the NYISO, or developing some variation on this approach.

Other Measures

The discussion above has concerned the impact on RTIEO of either physical or virtual imports scheduled in the day-ahead market but are not scheduled in HASP and hence settle at the HASP price. A related question is whether further measures are necessary to deter deviations between HASP and real-time interchange schedules that contribute to the magnitude of the RTIEO both directly and indirectly by increasing HASP real-time price divergence.

Such deviations can be caused, for example, by physical transactions that are scheduled in the HASP but do not flow in real-time because the market participant declines the dispatch instruction or the transaction fails check out with the other balancing authority area. As described in the CAISO Draft Final Proposal,[13] the costs of such a failure to perform is currently limited to little more than a refund of the HASP revenues that would have been earned had the transaction been delivered as scheduled. In fact, such non-performance imposes a cost on the system that is best measured by the RTD price. This is recognized for internal resources, whose cost of uninstructed deviations is at least the RTD cost of replacing the power they did not provide. We therefore believe that settling

[13] July 29, 2011 p. 10 section 4.2.2.

intertie transactions that are scheduled in HASP but do not perform in real-time because of reasons within the control of the market participant at the RTD price would both better reflect true costs and provide more symmetric treatment for internal and external resources. If, however, the transaction is curtailed because of a curtailment by the CAISO or another security coordinator, the HASP price would be the appropriate settlement price.

While some market participants recommended such a policy, the CAISO has not proposed charging the RTD price for such deviations in light of concerns expressed by other market participants relating to unintended consequences of such changes. [14] If these kinds of deviations are at all significant, the CAISO should identify the specific concerns relating to unintended consequences of such a change, evaluate and address them so that such a pricing policy can be implemented. Other ISO's, such as the New York ISO, have had such pricing rules in effect for a decade, and the implementation of efficient pricing should not be unduly delayed by the possibility of unspecified unintended consequences if the intended effect is to address a material market inefficiency.

Other proposed measures would expand the base of customers responsible for sharing the costs of the RTIEO to include imports that are reduced through market transactions in HASP. This is a different matter from an uninstructed deviation, such as a failure to perform on a HASP commitment. We therefore agree with the CAISO's position to not adopt this measure, at least as long as implicit trading remains under acceptable limits. Even if adopted, it may prove to be a weak deterrent to implicit convergence bidding as the direct costs caused by such behavior would still be distributed amongst a large base from which the implicit virtual trades would still constitute a relatively small share.

6. Conclusions

The inconsistencies between the hour-ahead market transactions with neighboring control areas and the real-time operation of the CAISO's internal market has been a persistent and troubling problem. These inconsistencies are an artifact of stubborn incompatibilities between the traditional trading regimes employed throughout the west that predate the existence of the CAISO, and the CAISO's pool-based market operations. The costs reflected in the real-time Imbalance Energy Offset are simply the latest manifestation of several long-standing incompatibilities. Improvements in the CAISO's operation of its current market design, and longer-term redesign of its HASP process, will improve the situation. However seams issues will likely persist in until there is some form of west-wide balancing market with unified settlement policies and timing.

Currently, the CAISO's HASP and real-time markets are not well integrated, and convergence bidding cannot resolve these integration problems. Convergence bidding on interties has contributed to an unacceptably high offset charge that is borne ultimately by California energy consumers. We therefore support the CAISO's proposal to suspend

[14] California ISO, "Impact of Convergence Bidding on Interties, Draft Final Proposal," July 29, 2011 p. 10 section 4.2.2

convergence bidding on interties. We suspect that further measures may in fact still be necessary if RTIEO charges continue at high levels.

ATTACHMENT G

List of Key Dates in Stakeholder Process for Tariff Amendment to Eliminate Convergence Bidding at the Interties

Date	Event/Due Date
April 27, 2011	ISO issues papers entitled "Price Inconsistency Caused by Intertie Constraints Issue Paper & Straw Proposal" and "Impact of Convergence Bidding on Real-Time Imbalance Energy Offset Issue Paper & Straw Proposal"
May 4, 2011	ISO hosts stakeholder conference call that includes ISO presentation entitled "Market Design Changes to Address Issues since Implementation of Convergence Bidding" and discussion of papers issued on April 27
May 11, 2011	Due date for written stakeholder comments on papers issued on April 27
May 18, 2011	ISO issues paper entitled "Price Inconsistency Caused by Intertie Constraints Draft Final Proposal"
May 25, 2011	ISO hosts stakeholder conference call that includes ISO presentation entitled "Market Design Changes to Address Issues Since Implementation of Convergence Bidding" and discussion of paper issued on May 18
June 1, 2011	Due date for written stakeholder comments on paper issued on May 18
June 10, 2011	ISO issues paper entitled "Impact of Convergence Bidding on Interties Revised Straw Proposal"
June 17, 2011	ISO hosts stakeholder conference call that includes ISO presentation entitled "Impact of Convergence Bidding on Interties" and discussion of paper issued on June 10
June 24, 2011	Due date for written stakeholder comments on paper issued on June 10
July 19, 2011	ISO hosts stakeholder meeting that includes ISO presentation entitled "Impact of Convergence Bidding on Interties" and discussion of paper issued on June 10
July 29, 2011	ISO issues paper entitled "Impact of Convergence Bidding on Interties Draft Final Proposal"
August 5, 2011	Due date for written stakeholder comments on paper issued on July 29
August 16, 2011	ISO Market Surveillance Committee issues opinion entitled "Final Opinion on Intertie Convergence Bidding and the Imbalance Energy Offset"
August 18, 2011	Keith Casey, Vice President, Market & Infrastructure Development for the ISO provides memorandum to ISO Governing Board entitled "Decision on Eliminating Convergence Bidding on the Interties"

Date	Event/Due Date
August 19, 2011	ISO issues draft tariff language to eliminate convergence bidding at the interties
August 25, 2011	ISO Governing Board authorizes submittal of tariff amendment to remove interties as eligible convergence bidding nodes
August 26, 2011	Due date for written stakeholder comments on draft tariff language issued on August 19
August 30, 2011	ISO hosts stakeholder conference call that includes discussion on draft tariff language issued on August 19; ISO issues revised draft tariff language to eliminate convergence bidding at the interties; ISO issues paper entitled “Convergence Bidding at the Interties Amendment Answer to Stakeholder Comments”