



California ISO
Shaping a Renewed Future

Settlement of Interties in Real-Time

Third Revised Straw Proposal

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Settlement of Interties in Real-Time

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1 Introduction

This third revised straw proposal presents the ISO's proposed solution to three separate but interrelated issues:

- **Real-time imbalance energy offset:** High amounts of this settlement charge had been further increased by a convergence bidding strategy consisting of virtual bids at the interties offset by virtual bids at internal nodes.
- **Convergence bidding on interties:** The high amounts of the real-time imbalance energy offset and other related market inefficiencies prompted the ISO to propose to FERC that convergence bidding on the interties be temporarily suspended. FERC approved this request effective November 28, 2011.
- **Price inconsistencies caused by intertie constraints:** The design of pricing on the interties to facilitate convergence bidding caused a relatively limited amount of pricing anomalies in which physical imports and exports cleared at levels inconsistent with their bid price.

The ISO initially established two separate stakeholder initiatives in April 2011 to address the real-time imbalance energy offset costs and intertie price inconsistency issues. The "Redesign of the Real-Time Imbalance Energy Offset" initiative,¹ sought to address issues resulting from virtual demand at internal nodes offset by virtual supply schedules at the interties that were encouraged by the difference between the Hour-Ahead Scheduling Process (HASP) price for interties and the Real-Time Dispatch (RTD) price for internal generation and load. The "Price Inconsistency Caused by Intertie Constraints,"² initiative sought to address instances where physical imports and exports may clear inconsistent with their bid price in the day-ahead market due to the design of the intertie constraints to accommodate virtual bidding at the interties. These initiatives have since been combined in the initiative that is the subject of this third revised straw proposal.

Through this current initiative, the ISO is seeking solutions to intertie pricing and settlements that will eliminate the potential for offsetting virtual bids to inflate real-time imbalance energy offset charges, and resolve the import and export pricing anomalies caused by intertie constraints.

The ISO's objective is to identify solutions that will allow the return of convergence bidding on the interties. Based on stakeholder feedback, the ISO is developing a longer-term solution with the objective of reinstating convergence bidding on the interties in fall 2013. The elements of this longer-term solution as now proposed by the ISO are as follows:

- 1) Physical imports and exports and will continue to be scheduled by HASP and virtual bids at the interties will continue to be closed out in HASP. HASP settlement for both

¹ <http://www.caiso.com/informed/Pages/StakeholderProcesses/RealTimeImbalanceEnergyOffset2011.aspx>

² <http://www.caiso.com/informed/Pages/StakeholderProcesses/PriceInconsistencyCausedIntertieConstraints.aspx>

physical imports/exports and virtual bids at the interties will be at the real-time locational marginal price (LMP) plus the plus the intertie transfer capacity (ITC) constraint shadow price component of the intertie's HASP LMP. (This will be calculated using the simple average of each of these LMP components over the applicable hour).

- 2) Subject to item 4) below, import resources will be eligible for a make-whole payment in HASP if the hourly settlement price calculated under 1), above, is less than the bid price of the import. (Alternatively, in certain hours, a make-whole payment will be paid to exports dispatched in HASP if the hourly price calculated under 1), above, is more than the bid price of the export.) The price at which virtual bids are closed-out in HASP will not be adjusted by this make-whole payment.
- 3) When calculating make-whole payments for eligible imports or exports, the ISO will net the import/export's as-bid costs against the amount received/paid due to the settlements price.
- 4) During a given hour, make-whole payments will be provided for imports or exports, but not both. The default will be that make-whole payments are provided for imports. In conditions of actual or potential over-generation, the ISO will inform market participants prior to HASP that exports are eligible for make-whole payments rather than imports.
- 5) The ISO proposes a total virtual bid position limit on the interties of 10 percent of the largest intertie. This limit would be enforced against the sum of each scheduling coordinator's submitted virtual bids across all interties scheduling points.
- 6) Undelivered HASP intertie schedules will be charged the worse of the HASP or RTD price and the current HASP schedules decline charge threshold and penalty will be eliminated. Undelivered IFM intertie schedules will be charged the worse of the IFM or RTD price.
- 7) The ISO will eliminate the "physical only" constraint in the day-ahead market that was included in the initial convergence bidding design. However, in order to comply with WECC interchange scheduling requirements, based on an intertie's ITC, the ISO will impose a limit on the number of e-tags it will accept for IFM physical market awards.
- 8) Given the intertie pricing methodology the ISO is proposing, additional measures to limit strategic bidding of offsetting physical imports and exports designed to artificially inflate bid cost recovery for physical imports or exports, beyond those covered in this proposal, are not necessary at this time.

Based on stakeholder feedback to pursue a longer term solution, the ISO proposes that intertie convergence bidding remain suspended until this longer term solution is implemented.

2 Stakeholder Engagement

Throughout the stakeholder process, the ISO engaged a stakeholder working group. Participants in the working group discussed unresolved issues outlined in the issue paper for this initiative. At the end of each session, the working group provided the ISO with resolutions reached during the working group as well as proposed next steps and tasks that were taken on

by various members of the working group. The contributions of the working group have led to the proposals outlined in this third revised straw proposal, including the proposed settlement methodology for intertie resources, resolution to the dual constraints, and settlement of undelivered HASP commitments. In addition, the FERC technical conference regarding convergence bidding on the interties has further influenced this proposal.

The schedule for the stakeholder process is shown below.

Date	Action
November 8	Post Issue Paper
November 15	Working Group Meeting
November 29	Working Group Meeting
January 25	Working Group Meeting
February 10	Post straw proposal
February 17	Stakeholder meeting on straw proposal
February 24	Stakeholder comments on straw due
March 13	Post revised straw proposal
March 20	Stakeholder meeting on revised straw proposal
March 27	Stakeholder comments on revised straw due
April 23	Post second revised straw proposal
April 30	Stakeholder meeting on second revised straw proposal
May 7	Stakeholder comments on second revised straw proposal due
May 15	Working group meeting
May 21	Comments from working group meeting due
June 6	Working group meeting
June 20	Post third revised straw proposal
June 27	Stakeholder meeting on third revised straw proposal

July 9	Stakeholder comments on third revised straw proposal due
July 26	Post draft final proposal
August 2	Stakeholder meeting on draft final proposal
August 9	Stakeholder comments on draft final proposal due
September 13	Present recommendation to ISO Board of Governors

3 Redesign of Real-Time Imbalance Energy Offset

The ISO has made several improvements to the accuracy of the ISO demand forecasts and in the consistency of procuring and dispatching resources to these forecasts in the HASP and RTD. These improvements have reduced the differences in energy prices between the HASP and RTD. This price difference between HASP and RTD, as well as the volumes of energy bought/sold in the HASP and RTD, are two components that drive the amount of the real-time imbalance energy offset charge. The price difference between HASP and RTD can arise from forecast error, operator biasing, insufficient ramping capability and the asymmetric bid floor/cap. The ISO has addressed these items through improved operational practices and the implementation of the flexible ramping constraint. These efforts, along with reducing the volumes of energy transacted between HASP and RTD by eliminating convergence bidding at the interties, have resulted in a significant reduction in real-time imbalance energy offset costs. Lowering the bid floor pending implementation of separating bid cost recovery between the real-time market and day-ahead market should further reduce real-time imbalance energy offset charges in the future.

3.1 Background

The real-time imbalance energy offset (CC 6477) is a neutrality account through which the ISO tracks the settlement dollar values for the following charge codes: real-time instructed imbalance energy (CC 6470), real-time uninstructed imbalance energy (CC 6475), real-time unaccounted for energy (CC 6474), and HASP energy, congestion and loss pre-dispatch (CC 6051), less the real-time congestion offset (CC 6774). The real-time imbalance energy offset is allocated to all scheduling coordinators (SCs) based upon a pro rata share of their measured demand (i.e., metered load and exports) excluding the demand quantity for the valid and balanced portion of self-schedules related to transmission ownership rights in real-time and net measured demand of load following metered subsystems (MSSs).³ This may result in a payment or charge to SCs depending on the whether there is a surplus or deficit.

³ Additional documentation can be found in the Settlements & Billing BPM Configuration Guide available at <https://bpm.caiso.com/bpm/bpm/version/000000000000085>

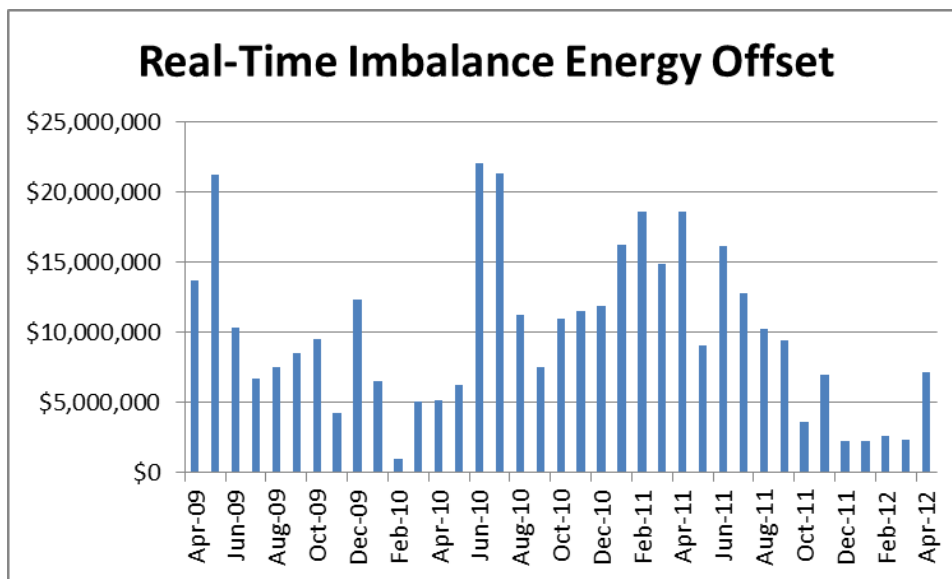
In 2009, the ISO conducted a stakeholder process to determine whether modifications to the current design of the allocation of the real-time imbalance energy offset were appropriate and necessary. At that time, no clear alternative could be identified because causal attribution to specific market activity was not clear. At the conclusion of the stakeholder process, the ISO did not change fundamentally the allocation to measured demand, but clarified that for SCs for MSS operators that have elected load following, the ISO will not assess any charges or make payments for the resulting non-zero differences recovered through the offset. The ISO, however, committed to, and has since continued to work on, operational enhancements that would assist in the convergence of the HASP and RTD prices. The ISO also committed to revisit its prior conclusion if the dollar volume in the real-time imbalance energy offset account increased substantially.⁴

As Figure 1 illustrates, from April 2009 through April 2012 the average monthly real-time imbalance energy offset has been just over \$9.51 M. The offset peaked in June/July 2010 at over \$20M and returned to levels consistent with the first half of 2010 in September 2010. From February of 2011, when convergence bidding was active, through November of 2011, the monthly real-time imbalance energy offset averaged just over \$12.04 M per month. The real-time imbalance energy offset peaked for this time period in April 2011, at which point the ISO commenced its stakeholder process to examine market design changes to address the issue. The stakeholder process resulted in the elimination of convergence bidding on the interties which was found to be exacerbating the real-time imbalance energy offset charges. In the remaining months of 2011 after April, real-time imbalance energy offset amounts generally declined. Since intertie convergence bidding has been suspended in late-November 2011, the real-time imbalance energy offset amount has averaged just less than \$3.34 M per month.

Additionally, after the commencement of the ISO's stakeholder process to address the real time imbalance energy offset charges, the volume of offsetting virtual bids dropped dramatically and HASP and RTD prices showed significantly improved convergence. However, the increased volume brought about by convergence bidding, even with improved HASP and RTD prices, still resulted in increased levels of real-time imbalance energy offset until intertie convergence bidding was suspended in late-November of 2011.

⁴ Additional information on the first Real-Time Imbalance Energy Offset (2009) stakeholder process is available at <http://www.caiso.com/2406/2406e2a640420.html>

Figure 1 – Monthly Real Time Imbalance Energy offset April 2009 through April 2012



Since July 2010, the ISO has implemented several other market rules changes that impact the offset. First, as required by the ISO tariff, in April 2010, the energy bid cap was raised from \$500/MWh to \$750/MWh and in April of 2011, it was raised to \$1,000/MWh. Because certain pricing parameters are tied to the energy bid cap, this has increased the level prices can reach in the real-time market when there are short-term imbalances in which the pricing parameters set the market clearing prices. The higher RTD prices impact the real-time imbalance energy offset charge when the ISO is constrained to procure additional energy in RTD at the higher prices. The offset is the mechanism for settling the additional imbalances for energy that are not already allocated to instructed and uninstructed deviations from resources’ day-ahead schedules. Depending on the condition, the real-time imbalance energy offset can increase or decrease. However, because the bid floor remained unchanged at negative \$30.00 combined with the lower frequency of negative prices, the relative impact of potential reductions in the offset when negative prices caused by over-generation situations occur (*e.g.*, when the HASP price is greater than RTD) is not symmetric and does not balance the effect of the real-time offset when RTD prices are higher than the HASP price.

The flexible ramping constraint, introduced in November 2011, is helping reduce the amount of real-time imbalance energy offset charges by decreasing the frequency of price spikes in RTD. Additionally, ISO proposals in the Renewable Integration and Market Product Review: Phase 1 initiative and work on the flexible ramping product should further reduce real-time imbalance energy offset charges.

Lastly, it is important to note that although these changes will reduce the amount of real-time imbalance energy offset charges, they will not eliminate them completely. Even with perfect procurement consistency between the HASP and RTD, real-time imbalance energy offset charges will exist because load is metered hourly and internal generation is metered on a 10 minute interval. This difference will create at least a small amount of real-time imbalance energy offset charges.

3.1.1 Consideration of Changes to the Allocation of Offset

The offset is currently allocated to all SCs based upon a pro rata share of their measured demand (i.e., metered load and exports) excluding the demand quantity for the valid and balanced portion of self-schedules related to transmission ownership rights in real-time and net measured demand of load following metered subsystems. In 2009, the ISO conducted a stakeholder process to determine whether modifications to the current design of the allocation of the real-time imbalance energy offset were appropriate and necessary. At that time, no clear alternative could be identified because causal attribution to specific market activity was not clear. At the conclusion of the stakeholder process, the ISO did not fundamentally change the allocation to measured demand, but clarified that for SCs for MSS Operators that have elected load following, the ISO will not assess any charges or make payments for the resulting non-zero differences recovered through the offset.

As noted in Figure 1 above, real-time imbalance energy offset charges have been decreasing since June 2011. The ISO expects that improvements and modifications put in place, and those planned as part of the current stakeholder process, will continue to reduce these uplift costs. At this time, the ISO does not propose any modifications to the cost allocation for the real time imbalance energy offset charge.

3.2 FERC Technical Conference on Convergence Bidding at the Interties

On February 2, 2012, FERC convened a technical conference to address convergence bidding on the interties. The ISO and the ISO's Department of Market Monitoring (DMM) presented information to support the need to at least temporarily suspend convergence bidding on the interties. While the real-time imbalance energy offset was used to demonstrate the magnitude of the problems the ISO identified, high real-time imbalance energy offset charges were not the primary reason the ISO suspended convergence bidding on the interties. The ISO was also concerned that intertie convergence bidding was, in certain hours, undermining and offsetting the ability of internal virtual demand bids to converge day ahead and real-time prices. At the technical conference, additional data was presented on expected vs. actual virtual bid behavior, volume of offsetting intertie virtual bids, and price convergence.⁵

3.3 The Working Group Process

The ISO continued to engage a stakeholder working group to assist in the formation of this third revised draft straw proposal. Since the release of the ISO's issue paper for this initiative, the working group has convened five times. In the initial working group meetings, the participants discussed the unresolved issues regarding the redesign of the real-time imbalance energy offset charge, including: 1) issues with the settlement of hour ahead import/exports versus settling such transactions on the same 5-minute real-time prices that internal resources are settled at; 2) issues associated with the non-performance in the real-time of intertie resources that are dispatched in the hour ahead scheduling process, and 3) potential changes to the allocation of

⁵ The ISO's presentation materials for the FERC technical conference are available at http://www.caiso.com/informed/Pages/StakeholderProcesses/IntertiePricing_Settlement.aspx

the offset. One of the primary points made by working group participants was that any solutions the ISO proposed must be compatible with reintroducing convergence bidding back on the interties. As part of the third working group session, participants focused on addressing proposals brought by Powerex and Southern California Edison (SCE). These proposals are discussed in greater detail in sections 5-8 below. The fourth and fifth working group sessions spent significant time discussing options to resolve the dual constraints and issues regarding the use of a make-whole payment based on the final settlement methodology for intertie resources.

4 The ISO Proposal

As part of the comprehensive market modifications needed to resolve issues regarding intertie pricing and settlements as well as intertie convergence bidding, the ISO is focused on developing a longer term solution to resolving the intertie pricing and settlements and intertie convergence bidding with final implementation scheduled for fall of 2013. This option bypasses any interim measures that would reinstate convergence bidding prior to fall of 2013. Therefore the ISO's proposal is as follows:

- 1) Physical imports and exports and will continue to be scheduled by HASP and virtual bids at the interties will continue to be closed out in HASP. HASP settlement for both physical imports/exports and virtual bids at the interties will be at the real-time locational marginal price (LMP) plus the plus the intertie transfer capacity (ITC) constraint shadow price component of the intertie's HASP LMP. (This will be calculated using the simple average of each of these LMP components over the applicable hour).
- 2) Subject to item 4) below, import resources will be eligible for a make-whole payment in HASP if the hourly settlement price calculated under 1), above, is less than the bid price of the import or export. (Alternatively, in certain hours, a make-whole payment will be paid to exports dispatched in HASP if the hourly price calculated under 1), above, is more than the bid price of the export.) The price at which virtual bids are closed-out in HASP will not be adjusted by this make-whole payment.
- 3) When calculating make-whole payments for eligible imports or exports, the ISO will net the import/export's as-bid costs against the amount received/paid due to the settlements price.
- 4) During a given hour, make-whole payments will be provided for imports or exports, but not both. The default will be that make-whole-payments are provided for imports. In conditions of actual or potential over-generation, the ISO will inform market participants prior to HASP that exports are eligible for make-whole payments rather than imports.
- 5) Undelivered HASP intertie schedules will be charged the worse of the HASP or RTD price and the current HASP schedules decline charge threshold and penalty will be eliminated. Undelivered IFM intertie schedules charged the worse of the IFM or RTD price.

- 6) The ISO proposes a total virtual bid position limit on the interties of 10 percent of the largest intertie. This limit would be enforced against the sum of each scheduling coordinator's submitted virtual bids across all interties scheduling points.
- 7) Undelivered HASP intertie schedules will be settled at the worse of the HASP or RTD price and the current HASP schedules decline charge threshold and penalty will be eliminated. Undelivered IFM intertie schedules will be settled at the worse of the IFM or RTD price.
- 8) The ISO will eliminate the "physical only" constraint in the day-ahead market. However, in order to comply with WECC interchange scheduling requirements, based on an intertie's ITC, the ISO will impose a limit on the number of e-tags it will accept for IFM physical market awards.
- 9) Given the intertie pricing methodology the ISO is proposing, additional measures to limit strategic bidding of offsetting physical imports and exports designed to artificially inflate bid cost recovery for physical imports or exports, beyond those covered in this proposal, are not necessary at this time.

5 Settlement of Import/Exports

The ISO has evaluated numerous options for revising the settlement of intertie resources that would both reduce real-time imbalance energy offset and allow for the reintroduction of convergence bidding on the interties. The options the ISO has considered include the mechanisms used by the NYISO and IESO Ontario, proposals made by Powerex and SCE, and making intertie resources price-takers in in real time, and combinations of various components of the LMPs from HASP and real-time.

Many of the options to resolve the real-time imbalance energy offset issues were also considered in the prior stakeholder initiatives. Through this stakeholder process, the ISO has worked with stakeholders to either a) find alternative options or b) solutions that address market inefficiency or reliability concerns of the proposed options. The sections that follow discuss the various options that have been examined that as a means to reduce the real-time imbalance energy offset charges and reinstate convergence bidding at the interties. None of these options, without putting additional safeguards in place, provide sufficient protections for reintroducing convergence bidding on the interties.

5.1 Comparison with NYISO Intertie Scheduling and Virtual Bidding

The New York ISO (NYISO) is one of the most relevant ISO/RTOs for comparison with the California ISO's approach to intertie pricing. Like the ISO, the NYISO is a large net importer of power and has a similar hour-ahead scheduling process. However, the NYISO does not allow virtual bids at the interties or at individual internal nodes.

The NYISO schedules imports and exports in an hour-ahead process that is very similar to the California ISO's HASP. The NYISO process/software tool is called "RTC." RTC runs every 15 minutes, looking forward nine 15 minute intervals in time. In addition to scheduling imports, RTC is used to commit quick start generating units. While RTC runs four times an hour, only

one of the four runs is currently used to schedule imports and exports. This run is referred to as RTC15 and initializes at the top of the hour and posts 15 minutes after the hour, with schedules for the hour beginning roughly 45 minutes after posting.

If there is no congestion on the external interfaces in the RTC evaluation, RTC will schedule imports and exports, but the price used for settlements will be the real-time price at the relevant proxy bus, computed as the time weighted average real-time price. However, imports scheduled in RTC receive a bid “production cost guarantee” that if the real-time price is lower than their offer price, they will be paid their offer price. This introduces a potential bid-or-better element into the market design that has the potential to generate uplift charges that is not ideal, but concluded to be necessary to ensure the availability of import supply. The NYISO, like the California ISO, is typically a net importer, and is particularly likely to be a net importer during high load conditions when imports may be important for reliably meeting load.

There is no price assurance for exports scheduled in RTC. If the real-time price turns out to be higher than projected in RTC and higher than the price bid by the purchaser for the export, the export buyer has to pay the real-time price for power. The rationale for the absence of any price guarantee is that the scheduling of exports does not benefit New York power consumers and hence there is no basis for them to bear any uplift costs associated with exports. Neither generators nor exporters have volunteered to bear uplift costs to make exporters whole, so there is no price assurance for export transactions.

The exception to interchange prices being determined in real-time is if the interface is constrained in RTC such that the offer price of the marginal import is lower than the internal New York price (import constrained) or the bid price of the marginal export is higher than the internal New York price (export constrained). If a proxy bus is import constrained and the clearing price in RTC is lower than the real-time price, the import supplier is paid the RTC price, i.e. a price lower than the internal NYISO price. Conversely, if a proxy bus is export constrained the clearing price in RTC is higher than the real-time price, the export buyers pays the higher RTC price. Thus, congestion does not give rise to shortfalls and uplift but contributes to surpluses in the form of real-time congestion rents.

The NYISO does not allow virtual bids on the interties, but it should also be pointed out that the NYISO does not allow nodal virtual bidding either. All virtual supply and demand bids are cleared at zonal prices.⁶ As a result, the market optimization for liquidating virtual supply and demand and determining internal zonal prices occur under the same timeframe. Since NYISO does not allow virtual bids on the interties, they do not have a timing disconnect similar to the California ISO under the current convergence bidding design.

5.2 Comparisons to the Ontario Model

Similar to the NYISO model described above, the IESO Ontario prices the interties differently if there is congestion on the interties. If there is no congestion on the interties, imports and

⁶ A simple training presentation of Virtual Trading in NYISO can be found at http://www.nyiso.com/public/services/market_training/online_resources/VirtualTrading/player.html.

exports are dispatched based on hour-ahead prices, but settle at real-time prices. In order to manage this price risk, IESO Ontario offers an “intertie offer guarantee.” The intertie offer guarantee is similar to the ISO’s bid-cost recovery. If, over the course of an hour, the price differential between the hour-ahead pre-dispatch is such that an intertie resource is unable to fully recover its bid, then intertie offer guarantee makes up the difference. It does not provide a guarantee of the expected profits from the hour-ahead pre-dispatch, but ensures that resource price risk is sufficiently mitigated.

However, if there is congestion on the interties, the IESO Ontario calculates the internal locational marginal price and the external marginal price in the hour-ahead market. The difference between the two is called the “intertie congestion price” (ICP). The ICP is similar to the congestion component of an intertie LMP in the California ISO market. IESO Ontario then settles imports and exports on congested interties at the real-time intertie locational marginal price plus the ICP.

5.3 The Powerex Proposal

Powerex provided a proposal that offered a three phased solution that Powerex asserts would ultimately lead to a timely reinstatement of convergence bidding at the interties.⁷ The proposal was discussed through the working group process. While many of the working group parties did not fully agree with all aspects of the Powerex proposal, many agreed that the proposal offered a reasonable starting point for further discussion.

The initial phase of the Powerex proposal includes five measures that Powerex asserts addresses the root causes of price divergence between the hour ahead scheduling process and real-time market, including changes to the settlement of deviation from HASP, e-tagging timelines, the price floor, the liquation of virtual bids, and the addition of a post-HASP RUC process. Phase two of Powerex’s proposal would reinstate intertie convergence bidding, ensuring all awards are consistent with bid prices and modify implementation of position limits to eliminate intertie-specific constraints on liquidity. Finally, the focus of the third phase of the Powerex proposal is promoting long term market efficiency.

The ISO has reviewed the Powerex proposal at great length and believes that several items improve the overall efficiency of the markets. Powerex’s proposal for HASP and IFM dispatches that fail to deliver in real-time is specifically addressed below in Section 7. Pursuing the refinements to the e-tagging process, as Powerex suggests, will not provide significant benefit at this time. In fact, modifying the ISO’s current e-tagging practices would reduce flexibility of many SCs, hurting overall market liquidity. Additionally, while a post-RUC process or expanding the use of Exceptional Dispatch may, in theory, ensure the ISO has sufficient resources for real-time dispatch, holding virtual bids through to the real-time market poses significant reliability and operational concerns for the ISO. The Powerex proposal would require significant changes to the current market design and business processes and the development and implementation

⁷ The Powerex proposal is available at http://www.caiso.com/Documents/PowerexProposal_ConvergenceBiddingReinstatement.pdf.

of a new RUC process that cannot be completed in the time frame of the longer-term solution the ISO is proposing.

5.4 The SCE Proposal

SCE provided a proposal as part of the working group process that would settle imports scheduled in the hour-ahead scheduling process at the real-time price and allow bid cost recovery for imports and exports based on the hour ahead scheduling process price. If the hour ahead scheduling process price is greater than zero, then bid cost recovery would be provided only for imports. If the hour-ahead scheduling process price is less than zero, then bid cost recovery would be provided only for exports. When imports are congested, SCE proposes imports receive the hour-ahead advisory price and exports would be settled at the real-time price at the relevant proxy bus, computed as the time weighted average real-time price. This is similar to the NYISO approach described further down in this paper. While not prepared to dismiss SCE's proposal, working group members had numerous questions and were unable to settle on a consensus view of the merits of the proposal. The ISO addresses the SCE proposal in Section 5.5.1 below.

5.5 Proposed Settlement Methodology for Intertie Resources

After evaluating the proposed options, the ISO is proposing that intertie resources, including imports, exports, and intertie virtual bids, settle in the real-time market based on the real-time LMP plus the HASP ITC shadow price. This approach is similar to the approach used by the IESO Ontario (discussed above). It is important that both physical imports and exports and virtual bids settle at the same price to allow market participants to utilize virtual bids to hedge the risk of not being able to deliver physical imports and exports. Additionally, settling virtual bids based on the real-time LMP should reduce the potential for real-time imbalance energy uplift. Virtual bids at the interties offset by virtual demand bids will not increase real-time imbalance energy uplift because both bids will be closed out based on the same real-time LMP. Systematic differences between the HASP SMEC and the RTD SMEC were a primary driver of the inflated real-time imbalance energy uplift when convergence bidding on the interties was in place.

The ISO proposes using the real-time LMP but including the HASP ITC shadow price because the ITC shadow price of the real-time LMP at the interties does not provide an accurate real-time price signal for congestion at an intertie. This is because congestion is resolved in the HASP when net import/export schedules are only cleared up to the intertie's capacity. Consequently, any congestion that existed on an intertie in HASP will no longer exist in RTD. Using the ITC shadow price component from HASP means the final settlement price accurately reflects the value of congestion at the time imports and exports were dispatched over the tie in HASP. For example, the ITC constraint shadow value on a line congested in HASP will be non-zero, but, if resources perform according to their HASP dispatch instructions, the ITC shadow value in the real-time LMP should be zero. However, an additional component of congestion on an intertie

is other internal system congestion, or “downstream” congestion. The congestion component of the real-time LMP most accurately reflects this internal congestion. Therefore, using the real-time LMP, plus the HASP ITC constraint shadow value allows imports and exports to be priced at the actual real-time value of the energy and internal congestion while still capturing congestion attributable to the scheduling limits on the ties.⁸ This methodology will apply in all hours regardless of whether an intertie is congested.

An example of this settlement methodology is illustrated by the following example:

Import bid price = \$40/MWh

HASP (average from RTPD 15-minute LMPs):

SMEC = \$50/MWh

Loss component of HASP LMP = -\$2/MWh

Congestion component of HASP LMP = -\$5/MWh

ITC Constraint Shadow Price = -\$3/MWh

LMP = \$43/MWh

RTD (average from RTD 5-minute LMPs):

SMEC = \$52.50/MWh

Loss Component of RTD LMP = -\$2/MWh

Congestion component of RTD LMP = -\$2/MWh

ITC Constraint Shadow Price = \$0/MWh

LMP = \$50.50/MWh

Final Settlement Price:

RTD SMEC = \$52.50/MWh

Loss Component of RTD LMP = -\$2/MWh

⁸ Settlement will occur using the simple average of the SMEC plus loss components from the five-minute interval RTD LMPs plus simple average of the congestion component from the 15-minute HASP LMPs within the relevant hour.

Congestion component of RTD LMP = $-\$2/\text{MWh}$

ITC Constraint Shadow Price = $-\$3/\text{MWh}$

Final Settlement Price = $\$45.50/\text{MWh}$

5.5.1 Make-whole Payments

Due to changing system conditions, using the average real-time LMP plus HASP ITC shadow price for settlement of HASP intertie dispatches could lead to an import dispatched in the HASP being paid at a level that is below the bid price of an import (or paying above the bid price of an export). Therefore, in order to maintain settlement consistent with bids for physical intertie resources, the ISO proposes that physical imports be eligible to receive a make-whole payment if the hourly settlement price is below the bid price of an import (alternatively, in some hours and upon prior ISO notification to the market, if the hourly settlement price is above the bid price of an export).⁹ As noted above, providing make-whole payments to imports is similar to the approach used by the NYISO. Because virtual bids will be simply closed out using the proposed settlement methodology (i.e. virtual bids do not submit a HASP bid), there is no risk of settling at a price that is inconsistent with their bid, thus virtual bids are not eligible to receive a make-whole payment.

This make-whole payment for physical resources is similar to the “bid or better” approach outlined in Section 3.4.2 of the revised straw proposal.¹⁰ The purpose of the make-whole payment is to ensure eligible intertie resources are paid at least their bid price (alternatively, exports are not charged more than their bid price), which presumably reflects the cost of procuring energy for imports (or the price a participant is willing to pay for export energy).

To avoid concerns related to make-whole payments and their interaction with overlapping imports and exports (similar to those that resulted in the ISO’s Amendment 66), the ISO will only provide make-whole payments in one direction (i.e. to either imports or exports) in a given hour.

The ISO proposes a default setting that the make-whole payment be made only to imports. This is because the ISO is typically a net importer of energy and providing suppliers certainty that they will be paid at least their bid price will be beneficial to this market. However, in periods of over-generation, it may be beneficial to switch this setting to provide the make-

⁹ For the purpose of this paper an import schedule in HASP is either increasing an import resource’s schedule in HASP or decreasing an export resource’s schedule in HASP. Alternatively, an export schedule in HASP is either increasing an export resource’s schedule in HASP or decreasing an import resource’s schedule in HASP.

¹⁰ Available at <http://www.caiso.com/Documents/RevisedStrawProposal-IntertiePricingSettlement.pdf>.

whole payment only to exports.¹¹ The ISO will inform market participants prior to HASP if there is a need to switch from the default setting for providing make-whole payments to providing make-whole payments for exports.

The amount of a resource's bid eligible for the make-whole payment will be the import or export quantity scheduled in HASP (subject to the ISO's determination and prior market notification as to whether imports or exports are eligible for make-whole payments in a particular hour). Thus, the quantity of an import eligible for make-whole payments will be the amount an import is increased in HASP relative to its IFM schedule or the amount an export is decreased in HASP relative to its IFM schedule. The quantity of an export eligible for make-whole payments will be the amount an export is increased in HASP relative to its IFM schedule or the amount an import is decreased in HASP relative to its IFM schedule.

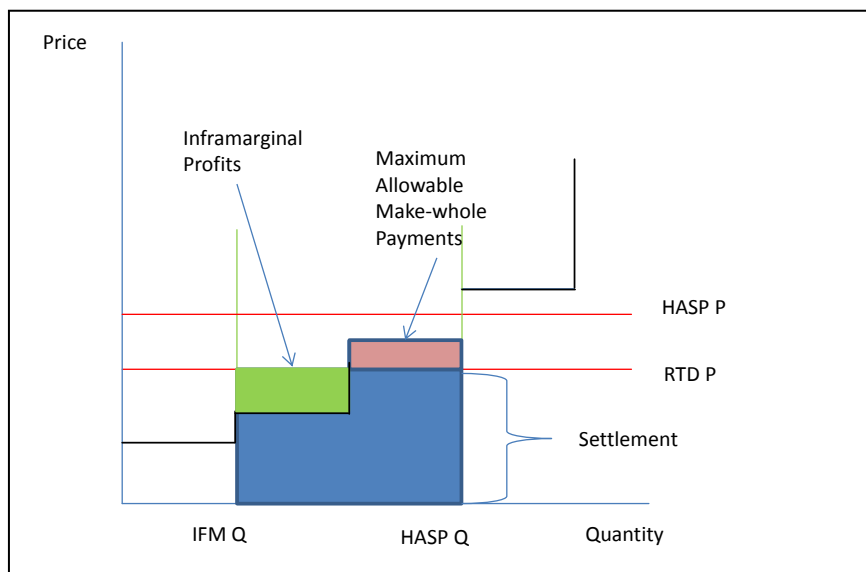
In order to compute a resource's make-whole payment, the ISO will compare the as-bid costs (i.e. weighted average bid price) to the real-time settlement. Specifically, the make-whole payment will be:

$$\text{MAX (Maximum allowable make-whole payment - inframarginal profits, 0)}$$

The comparison of inframarginal profits and a resource's maximum allowable make-whole payment is shown graphically in Figure 2. Figure 2 shows a bid curve for an import resource. This resource has an incremental HASP dispatch instruction of HASP Q minus IFM Q. This incremental dispatch contains two bid segments. While both segments are below the HASP dispatch price, one of the segments is above the final settlement price while the other is below. Because this resource has a bid accepted in HASP, but settled below its bid price, it is eligible for a make-whole payment. However, if the inframarginal profits exceed the amount of the potential make-whole payment, then the resource will not receive a make-whole payment. However, if the payment required to make a resource whole to its bid exceeds the inframarginal profits, then the resource will receive a make-whole payment that covers this difference. Undelivered HASP awards will not receive a make-whole payment.

¹¹ Providing make-whole payments to exports will become more important as the frequency of over-generation increases as more intermittent resources are added to the generation fleet. See section 7.8 of the ISO's tariff for describes ISO's existing tariff provisions for management and notification of over-generation situations.

Figure 2: An Example of Determining the Amount of a Make-Whole Payment



For example, if a physical import resource submits two 10 MW bids for \$45 and \$50 and is dispatched at a HASP advisory price of \$51, and the HASP hourly settlement price (using real-time LMP and HASP ITC constraint shadow price) is \$47, then the resource would receive an additional \$3 per MW as a make-whole payment for their bid. However, if the HASP hourly settlement price is \$49, there will not be an additional payment made to that resource.

As part of the stakeholder process, a concern was raised that providing a make-whole payment, when combined with convergence bidding, could lead to strategic bidding behavior that could lead to additional uplift potential. However, the ISO believes the potential for this strategic bidding behavior is limited and does not merit ruling out or further restrictions on the make-whole payment. This concern is illustrated in the example in Table 1 that follows.

In this example, an SC submits a virtual import bid in the IFM, which would have the effect of locking in the IFM price for a physical import later scheduled in HASP. The IFM price is \$35. However, in the HASP, the SC submits a physical import bid for \$50 for the same quantity as the original virtual bid. The physical import scheduled in HASP and the virtual bid closed out in HASP settle at the same \$30 settlement price, canceling each other out. However, because in this example, the physical import scheduled in HASP settles at a price below its bid, it would receive a make-whole payment of \$20. Therefore, the total net payment to the SC in this case is \$55 (\$35 for the virtual import scheduled in IFM and \$20 for the make-whole payment), when just the \$35 payment from the virtual bid would have served to lock-in the IFM price.

Table 1: Example of Virtual Bids and Eligibility for Make-Whole Payments

	IFM	HASP	RTD	Settlement
SMEC	\$50	\$65	\$40	\$40
Loss	-\$5	-\$5	-\$5	-\$5
Cong less ITC Constraint Shadow Price	-\$5	-\$5	\$0	\$0
ITC Constraint Shadow Price	-\$5	-\$5	\$0	-\$5
Total	\$35	\$50	\$35	\$30
			Make-Whole	\$20
			Total payment	\$55

However, for such a bidding strategy to be profitable the SC must be able to predict that the HASP price will be above the intertie settlement price and must bid in HASP above the IFM price. If the physical import does not clear in the HASP, then the SC is fully exposed for the cost of liquidating its virtual position. In addition, the resource must be eligible for a make-whole payment, which is dependent on the difference between the settlement price and the as-bid costs. Additionally, unless there are extreme differences between the HASP dispatch advisory price and the ISO’s new proposed settlement methodology, the make-whole payments should be small and occur with limited frequency.¹² Further, if the interties are competitive, a resource would not increase its bid price in search of additional make-whole payments.

Another concern related to strategic bidding to exploit make-whole payments along with the reintroduction of convergence bidding on the interties is that an SC could submit balanced physical and virtual resources to simply to capture make-whole payments. As an example, an SC could submit two bids into the IFM at an intertie: a virtual import and a physical export.¹³ Then, the SC submits a bid for a physical import in HASP. This results in market participant being fully hedged against IFM-HASP price differences but potentially earning the make-whole payments on the physical import scheduled in HASP. Therefore, the ISO proposes providing no make-whole payments when HASP awards are reducing an export, originally scheduled in the IFM, that was balanced with a virtual bid in the IFM.

The current proposal would mean that only the make-whole payment (which should be infrequent and applied only to physical resources) will contribute to the real-time imbalance

¹² As noted above, market enhancements such as the flexible ramping constraint and lower of the bid floor should improve the convergence of HASP and RTD prices

¹³ The prices could be different, but the key is that both bids must clear the IFM.

energy offset. It should be noted that because the ISO's proposed settlement methodology will settle intertie resources using the real-time LMP and only the ITC constraint shadow price from HASP, the overall contribution to the real-time imbalance energy offset caused by differences between HASP and real-time price should be reduced overall.

5.5.2 New Settlement Methodology and Uplift Assessment Study

In order to assess the magnitude of the uplift costs created by this make-whole payment, the ISO is examining actual market data using both the existing HASP settlement methodology and the proposed intertie methodology (real-time LMP plus HASP ITC). The results of this analysis will be provided to stakeholders as a supplement to this third revised straw proposal.

5.5.3 Cost Allocation of Make-Whole Payments

All costs for make-whole payments provided to eligible imports will be included in the real-time imbalance energy offset, which is allocated to measured demand. Because the ISO is proposing that exports are only eligible for make-whole payments during forecasted overgeneration situations, the ISO proposes that make-whole payments for exports should be allocated to positive supply deviations and negative load deviations consistent with the existing provisions for allocating overgeneration mitigation costs, as described in section 7.8.6 of the ISO's tariff. However, the ISO will include the costs for export make-whole payments as part of a broader review of ISO market cost allocations to be conducted later this year.

6 Position Limits

At the onset of convergence bidding, there was a position limit on convergence bids of 5 percent of an intertie's average transfer capacity per SC at each intertie. The position limits were to increase from 5 percent to 25 percent after eight months of implementation. Then they were to increase to 50 percent after 12 months from implementation. After 16 months there would be no position limits. However, as previously described, convergence bidding was suspended at the interties about nine months after it was implemented.

Given the challenges and risks that have been demonstrated with convergence bidding on the interties, the ISO believes it is prudent to impose position limits on intertie convergence bids. In the straw proposal of this stakeholder process, the ISO proposed a position limit of five percent of the largest intertie across all ties for each SC. Based on feedback from many stakeholders, this position limit was overly restrictive and would not allow sufficient virtual bids adequately to hedge physical delivery risk. Therefore, the ISO is now proposing that a total virtual intertie position limit be established at 10 percent of the largest intertie across all interties scheduling points for each scheduling coordinator.¹⁴ The use of 10 percent of the

¹⁴ Currently, the single largest intertie is the Tracy intertie at 3,829 MW.

largest intertie across all ties will allow sufficient hedging across most ties, while allowing the ISO and stakeholders to assess the effectiveness of the new convergence bidding design. This position limit would remain in place for at least six months after convergence bidding on the interties is reopened. Before lifting this limit, the ISO, in conjunction with the DMM, will examine the performance of convergence bids on the interties to determine if additional measures need be implemented to prevent gaming or if the position limits can be raised.

7 Charges for Undelivered Import/Export Schedules

In stakeholder comments, Powerex identified concerns with the treatment of undelivered IFM and HASP import/export schedules under the ISO's current market rules:

- An intertie resource that sells (or buys) energy in HASP, but fails to deliver is not subject to imbalance energy charges. Instead, failure to deliver on HASP dispatches results in a penalty equal to 50 percent of the HASP LMP for undelivered volumes beyond the first 10% over a month.¹⁵ Powerex makes the point that non-deliveries within this amount can result in significant RTD price impacts and can result in cuts to other participants import or export schedules.
- An intertie resource that sells (or buys) energy in IFM, but fails to deliver is subject to imbalance charges at the RTD price. Powerex makes the point that, for imports, being charged the RTD price may be profitable if lower than the IFM price or lower than other opportunities to sell the energy outside of the ISO. They also point out that the RTD price does not reflect all of the cost impact of undelivered imports, such as reliability impacts. Powerex points out that applying the RTD price to undelivered IFM exports can result in a net payment to a participant for an undelivered export and that the RTD price does not fully reflect the harm to other participants, such as when other import schedules have to be cut because the undelivered export was to provide a counterflow on a congested tie.

The ISO agrees these concerns have merit and proposes that undelivered HASP intertie schedules be settled at the worse of the HASP or RTD price and not be eligible for make-whole payments. This results in an effective penalty of the difference between the worst of the HASP or real-time price and the resource's HASP settlement price. In addition, although the cost allocation provisions are still being developed, the costs of the flexible ramping product currently under development are anticipated to be allocated to deviations. In conjunction with these changes, the ISO proposes to eliminate the current HASP schedules decline charge threshold and penalty.

¹⁵ See ISO Tariff, Section 11.31

Similarly, the ISO proposes that undelivered IFM intertie schedules be subject to the worse of the IFM or RTD price. Undelivered IFM schedules are also anticipated to be allocated flexible ramping product costs.

These rule changes for both undelivered IFM and HASP intertie schedules will improve the incentives to deliver intertie schedules and improve the consistency of treatment between the day-ahead market and HASP for undelivered intertie schedules.

8 Price Inconsistency Caused by Intertie Constraints

Last year, in a stakeholder initiative run in parallel to the real-time imbalance energy offset initiative, the ISO attempted to resolve price inconsistency issues that were caused by enforcing the two intertie constraints implemented with convergence bidding.¹⁶ Under the initial design, the ISO enforced two constraints at 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:

Physical imports minus physical exports \leq Line limit.

- (2) Physical and virtual imports net of physical and virtual exports must also be within established scheduling limits for that scheduling point.

(Physical imports plus virtual imports) minus (physical exports plus virtual exports) \leq Line limit.

When convergence bidding at the ties was in-effect, there were cases where physical export bids cleared the market at LMPs that were inconsistent (higher) than the submitted bid for the scheduled resource. It was also possible that an economic import was only partially dispatched, or not dispatched at all. Although this issue was recognized as a possibility in the initial design, it was expected to occur very infrequently. However, while convergence bidding at the interties was in place, this occurred more frequently than expected and market participants raised concerns regarding the negative impact this pricing inconsistency may have had on their settlement outcome.

In the straw proposal for that previous initiative, the ISO included two options that would result in consistent pricing: Option A - different settlement LMPs for physical awards and virtual awards and option B - economic curtailment. In the draft final proposal for that initiative, the ISO removed option B from consideration given potential adverse market outcomes. The potential adverse market outcomes arise because virtual export bids could clear against internal supply (at a higher price), but would be settled at the lower physical import price.

¹⁶ Additional documentation for the Price Inconsistency Cause by Interties Constraints stakeholder initiative is available at <http://www.caiso.com/2b6d/2b6dbef62e710.html>.

Stakeholders have not supported option A because it would result in different price for virtuals and physical imports/exports (although the ISO understands that its Market Surveillance Committee does not believe there is a compelling economic reason for virtual and physical imports/exports to necessarily have the same price). Several stakeholders requested that exports be provided bid cost recovery. Several stakeholders recommended no change to the current design as the impact was consistent with the frequency of this known issue during the convergence bidding design process.

In addition to the options previously considered, the ISO and stakeholders have proposed additional options. These options require two-pass pricing and scheduling solutions. These options are:

- 1) The Powerex proposal – Conduct a pricing run to establish market clearing prices, then conduct a feasibility run that would cut infeasible schedules (i.e. schedules that exceed an interties capacity). Remaining resources clear at the LMP established in the pricing run.
- 2) The SCE proposal – Conduct a pricing run to establish market clearing prices, then conduct a feasibility run that would determine if the physical market awards are feasible. If they not feasible, additional physical resources would be procured and uplift costs would be allocated to virtual bids.
- 3) Remove the physical only constraints and impose a limit on e-tags that will be accepted for IFM schedules.

Each of the options considered have benefits and drawbacks. There is no clear optimal solution. Each of the four options the ISO has considered is discussed below.

8.1 The ISO's Initial Proposal (Option A)

Prior to suspending convergence bidding at the interties, only the net virtual plus physical constraint was used in pricing. To resolve the price inconsistency problem, the Option A approach would allow the shadow prices of both constraints that are currently implemented to be factored into the settlement LMPs. This would produce two different settlement LMPs: one for cleared physical bids and one for cleared virtual bids. The virtual award would still be settled at LMP^*V , while the physical award would be settled at:

$$LMP^*P = x^*SYS - x^*PVI - x^*PI + x^*PVE + x^*PE$$

x^*PVI = import physical plus virtual constraint

x^*PI = import physical constraint

x^*PVE = export physical plus virtual constraint

x^*PE = export physical constraint

* = Optimal solution

One outcome of this option is that the virtual awards would not receive the same settlement LMP as the physical awards if the import or export physical constraint is binding. However, this

posed no adverse outcome because even before intertie virtual bidding was suspended, only one constraint was reflected in the LMP, but the two shadow prices of both of the constraints affected the bids that cleared in the market optimization. In other words, even before intertie virtual bidding was suspended, physical and virtual bids were economically cleared according to different LMPs, but priced at the same settlement LMP. Option A, therefore, produces a better outcome where the physical and virtual bids are priced in a way that is consistent with how they are cleared. This makes this option the most transparent and economically correct approach to pricing physical and virtual imports and exports if the ISO must maintain both of the constraints in their current form.

This option does not require changes to the current market optimization. However, it does require some settlement changes, OASIS reporting changes, and business practice changes. Today, there is only one pricing node for each intertie constraint (ITC) priced at LMP*V. To accommodate the two different settlement prices, the ISO will need to create an additional pricing node for the physical resources at LMP*P at each ITC. For physical bids, the pricing node priced at LMP*P must be specified, and for virtual bids, the pricing node at LMP*V must be specified. Both LMP*V and LMP*P will be published in OASIS.

Stakeholders raised a concern that this option may drive market participants to change their behavior and implement a bidding strategy of submitting physical bids rather than virtual bids with the intent to liquidate their positions in HASP assuming a more advantageous LMP for physical awards. For example, if the physical constraint is binding in the import direction, a physical export will pay a lower price than a virtual export, so a market participant may opt instead to submit a physical export bid that the market participant would sell-back in the real-time market. This strategy likely cannot generate sustainable revenue, because the increased physical exports would tend to relieve the physical constraint congestion, rendering this strategy less profitable. In addition, the ISO implemented the HASP reversal settlement rule concurrently with convergence bidding. This rule was put in place to eliminate any potential incentive for market participants to submit implicit virtual bids by reversing any positive difference between the day-ahead price and the HASP price for any MW quantity that is not e-tagged prior to HASP. Therefore, this rule to some extent alleviates the concern of using physical bids to conduct implicit virtual bidding because they are settled at different prices.

Many stakeholders commented that the potential for different prices for physical imports/exports and virtual supply/demand at the interties would limit the ability for market participants to hedge day-ahead positions to account for supply that becomes unavailable after the day-ahead market. Table 3 illustrates the hedge of a physical import. Since the virtual export price is greater than the physical import, the physical import limit is binding in this example. As long as the day-ahead price at which the virtual export clears is lower than the HASP price the market participant is able to hedge a portion of the outage that is bought back in HASP.

Table 3 – Hedge of Physical Import with Virtual Export

	MW	DA	HASP	Revenue		MW	DA	HASP	Revenue
Physical Import	100	\$ 50.00		\$ 5,000.00	Physical Import	100	\$ 50.00		\$ 5,000.00
Virtual Export	20	\$ (55.00)	\$ 60.00	\$ 100.00	Virtual Export	20	\$ (65.00)	\$ 60.00	\$ (100.00)
HASP Outage	20		\$ (60.00)	\$(1,200.00)	HASP Outage	20		\$ (60.00)	\$(1,200.00)
Actual with Hedge	80		\$ 48.75	\$ 3,900.00	Actual with Hedge	80		\$ 46.25	\$ 3,700.00
Actual w/o Hedge	80		\$ 47.50	\$ 3,800.00	Actual w/o Hedge	80		\$ 47.50	\$ 3,800.00

Some market participants have asserted that this settlement methodology is subject to gaming concerns. It has been argued that because the LMP at which virtual resources settle at will be either greater than or equal to the LMP at which physical resources settle at it is possible for a market participant to profitably submit paired physical and virtual bids in the IFM and unwind both in HASP. However, it is important to understand the circumstances the would need to occur for such strategy to be profitable.

Under the proposed Option A pricing design, prices for virtual and physical transactions will only differ in the day-ahead market if the constraint on physical transactions schedules binds at a lower price than the constraint on combined physical and virtual transaction schedules.

Option A pricing would not produce two distinct prices for physical and virtual transactions unless there were virtual export transactions that cleared in the day-ahead market on this tie and offset the virtual import transaction. Absent a sufficient quantity of such virtual export transactions, the only constraint that would bind would be the constraint on combined physical and virtual transactions and there would be a single price.

Moreover, if the virtual export bid that gives rise to the dual pricing were submitted to hedge physical import bids that might not flow in real-time, the option A pricing would accurately reflect the social cost of that hedging strategy.

8.2 The Powerex Proposal

The Powerex proposal requires the ISO to conduct both a pricing and feasibility run. The pricing run would treat physical and virtual bids comparably. The market would clear and a market clearing price for the intertie would be set. Then the ISO would assess whether or not the market awards on an intertie yields a physically feasible schedule.¹⁷ If the schedule is feasible, then no additional action would be needed. However, if the result of the pricing was not a feasible schedule, then the ISO would cut market awards until it was left with a physically

¹⁷ In this context, a physically feasible schedule is a schedule that does not exceed the physical transfer constraints on a line.

feasible schedule. The remaining intertie physical and virtual schedules would settle at the price set in the pricing run.¹⁸

A market structure such as this is subject to gaming concerns. For example, a physical importer on an intertie that is frequently congested in the day-ahead market, can costlessly raise the clearing price in the day-ahead market by submitting high priced virtual export bids that would cause higher price import offers to clear in the pricing pass, raising the price paid for the importers power. In this case, there would be no consequences to the importer because the virtual export would be cut by the ISO in the feasibility pass. Powerex proposed mitigation measures, which are discussed below, however, these measures do not fully resolve all concerns. Additionally, an SC may submit large quantity of physical import bids combined with a large, but slightly smaller, quantity of virtual export (import) awards. This will result in the SC being awarded virtual demand at inappropriately depressed IFM prices, while most of the SC physical import is eliminated in the feasibility pass. As an example of the gaming concerns of the two pass approach, consider the following example:

- There is a 10 MW tie.
- One Entity self-schedules 10 MW import.
- Additionally the same entity bids virtual demand at the price cap, as much as allowed by the intertie virtual bid position limits, for example 600 MW.
- In this example, the entity also bids in more than 600 MW of physical import at -\$30: more than their submitted virtual demand in case another entity puts virtual demand on the same intertie.
- In this example, the tie will settle at -\$30. The entity will sell its 10 MW of self-schedule at -\$30, buy 600 MW of virtual demand at -\$30, and none of its economically bid physical imports will end up clearing in the second pass. So, essentially an entity can pick a tie and end up guaranteeing itself an endless amount of virtual demand bought at the price floor, with the only limitation being the position limit.

Powerex proposed a solution to address instances where an SC had both physical and virtual bids on the same tie.

- a) Any infeasible physical awards from the first pass are eliminated in order of least economic bid price.

¹⁸ This approach was suggested by Powerex in comments to the straw proposal. Available at http://www.caiso.com/Documents/Powerex_Comments-IntertiePricing-SettlementStrawProposal.pdf

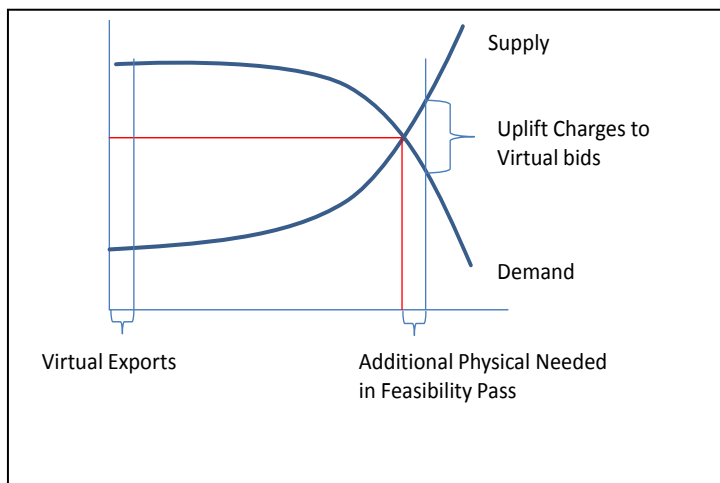
- b) Any unbalanced virtual awards are also eliminated. Unbalanced awards are the virtual counterflow awards corresponding to the quantity of physical awards that are eliminated in step (a). In selecting which virtual awards to eliminate, a two-tiered approach is utilized:
- i. First reduce any virtual exports (imports) that were providing counterflow relief to the same scheduling coordinator's physical import (export) awards cleared in the first pass that were subsequently reduced in step (a).
 - ii. Second, reduce additional virtual exports (imports) as necessary, in least economic order.

While the solution proposed by Powerex reduces the profitability of the gaming opportunities outlined above, it does not eliminate the gaming opportunity. For example, an SC that is physical importer can still raise the price on the intertie by submitting high priced virtual export bids. In this case the SC would submit virtual exports quantities at a level lower than its import bid. The ISO, as part of the feasibility pass, would cut both the virtual exports and the physical imports. However, because the physical imports are greater than the virtual exports, the residual physical imports would still settle at the higher price established as part of the pricing run. Therefore, while the solution proposed by Powerex reduces that gaming opportunities in this approach, it does not eliminate it.

8.3 The SCE Proposal

The SCE proposal, similar to the Powerex proposal, relies on a two pass approach. The first pass in the SC proposal would look identical to the Powerex proposal – both physical and virtual resources are treated equally and clear against one another, setting a market clearing price. However, the second run of the SCE proposal addresses infeasible schedules very differently. Instead of cutting infeasible schedules, the ISO, under this approach, would procure additional out-of-market physical resources such that all schedules become feasible. For example, in the pricing pass the ISO cleared 1,200 MW of physical import awards and 200 MW of virtual export awards on a 1000 MW intertie. Then, in the feasibility pass, ISO would dispatch 200 MW of additional physical exports and procure 200 MW of internal supply to be the source of these additional physical exports. This additional procurement will lead to additional uplift. See figure 3 as an example.

Figure 3: Determination of Uplift Charges using the SCE Proposal



In the absence of virtual bids, the ISO would have only cleared 1,000 MW of physical imports. Therefore, the additional uplift created by procuring the physical resources needed to make the 1,200 MW award would be allocated to all virtual bids.

The SCE proposal yields feasible results and eliminates the gaming opportunities that existed in the Powerex proposal. However, there are still several outstanding issues that would require additional development. For example, it is unclear how the ISO would resolve infeasible schedules in the event there were insufficient physical intertie bids at the tie to provide sufficient counterflow. Further, ISO would potentially have to include additional features, such as a spread bid option for intertie virtual bids that would allow virtual bidders to manage their exposure to uplift costs. Without this functionality, virtual bidders could be exposed to extremely high uplift costs without a tool to manage their risk. It is also unclear whether such procurement will have the correct impact on real-time prices. For example, procuring excess capacity in the IFM could lead to suppressed real-time prices if this additional capacity self-schedules in the real-time market. Finally, assuming all other outstanding details and questions can be resolved, this option will require significant time and effort to implement and may not be completed in time a fall 2013 implementation date.

8.4 Tagging Constraints

A third alternative, proposed by the ISO, is to eliminate the physical import and export intertie constraints, and only enforce the physical plus virtual intertie constraints. This would allow virtual bids to provide counterflow to resolve congestion in the IFM, would result in only one constraint for both physical and virtual imports/exports and result in a single LMP used for both physical and virtual imports/exports.

The past rationale for the physical import and export constraints is that they prevented physical intertie market awards from exceeding an intertie's capacity. However, based on further

consideration of the WECC reliability standards, the standards only require that total tagged interchange not exceed an intertie's capacity.¹⁹ Thus, under this alternative proposed by the ISO, physical intertie market awards could potentially exceed an intertie's capacity, but the ISO would only accept e-tags for a total net interchange up to the intertie's capacity. In the HASP, the net physical intertie market awards would then be reduced to the intertie's capacity.

In the day-ahead timeframe, e-tags in the congested direction would be approved in economic merit order. (e.g. tags for lower cost import resources would be approved first). For example, if an intertie is congested in the import direction, this would be implemented by ranking the imports in economic merit order. At the time of the day-ahead checkout, the net tagged import amount, after accounting for export counterflow, would be compared to the intertie's capacity. If the net tagged import amount exceeded the intertie's capacity, tags would be cut until the net tagged import amount was no greater than the intertie's capacity. Tags for the least economic imports would be cut first.

Some market participants have expressed concerns that allowing physically infeasible market awards and imposing a tagging limit would yield undesirable outcomes. First, parties are concerned that giving a physical resource a market award and not allowing it to tag would put the market participant at risk of violating WSPP Schedule C contracts that require market awards be tagged by 3:00 pm of the day prior to delivery. The ISO recognizes that such an approach may lead to e-tags not being accepted but observes that even under the current market design there is no assurance that a physical intertie bid will clear the IFM and consequently be allowed to tag. In addition, the ISO observes the following

- The conditions under which a physical intertie bid clears the IFM but would not be allowed to tag are the same conditions under which the a physical intertie constraint was binding but the physical plus virtual intertie constraint was not binding previous to virtual bidding on the interties being suspended (i.e. virtuals providing counterflow to physicals to meet the tie constraint). As this circumstance did not occur frequently, the ISO anticipates that circumstances in which tags would potentially be cut for day-ahead physical intertie awards will occur relatively infrequently, and when it did occur, the amount of tags that would be cut would be small.
- Not all IFM physical intertie awards are currently tagged in the day-ahead timeframe. Consequently, even if net physical intertie awards exceed an intertie's capacity, there is a likely possibility that the ISO will accept all e-tags submitted in the day-ahead timeframe.

¹⁹ WECC standard INT-006-3 requirement R1.2 <http://www.nerc.com/files/INT-006-3.pdf>.

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- E-Tags may be cut for physical market awards under the current market rules. For example, e-tags for physical imports may be cut if e-tags are not submitted for physical exports providing counterflow on an intertie with import congestion.

Nevertheless, in the case an IFM physical intertie award is not allowed to tag prior to the HASP, two circumstances could result in the HASP:

- The IFM physical intertie award clears the HASP. Subsequent to the HASP, the ISO would accept the e-tag for the market.
- The IFM physical intertie award does not clear or is reduced in the HASP. In this case, it is possible that the IFM physical intertie award would be subject to the existing HASP buy-back rule that specifies that untagged imports be bought back at the higher of the IFM or HASP price (and that untagged exports are sold back at the lower of IFM or HASP price).

Alternatively, an import could be bought-back at a higher price in the HASP (or an export could be sold-back at a lower price in HASP). However, this price would not be greater than a market participant's cost for an import (or less than a market participants cost for an export) provided the market participant bids the same price in HASP that it did in IFM (and it bid its cost in IFM). An exception is in the event the real-time settlement price for intertie transactions is different than the HASP price.

8.5 The ISO's Proposed Solution

The ISO proposes to implement the solution described immediately above -- eliminating the physical only import and export constraints, and only enforce the physical plus virtual constraints.

As noted above, other options have been presented to address the dual constraints question. However, at this time, none of these options appear to be perfect alternatives. The ISO believes that if it is to reinstate convergence bidding that continuing to settle the dual constraints as was done prior to the suspension of convergence bidding is not a viable option. Powerex has proposed a solution in which the ISO would use first run a "pricing pass" of the IFM, treating virtual and physical intertie bids equally, followed by a "feasibility pass" that reduces the quantities of physical awards to ensure feasible physical schedules. While the two-pass intertie pricing approach has several aspects that offer improvements over the existing dual constraints problem, after review by the DMM, it has been determined that this approach is subject to gaming opportunities. While the SCE approach eliminates many of the gaming concerns that exist in the Powerex approach, it will pose numerous challenges for implementation and requires significant additional consideration for how the additional resources procured to create balanced schedules would impact RUC, HASP, and real-time

markets. The ISO believes that Option A remains the economically correct approach to use if the dual constraints must be enforced. However, the ISO believes that it is possible to remove the physical only constraints and impose limitations on e-tags. The ISO understands that this solution may increase risks for some markets participants. However, the ISO believes that these risks exist today and the frequency with which e-tags are not accepted will be infrequent. Additionally, because this solution will require the fewest implementation challenges compared to the other options, the ISO believes it can put in place in a timely manner.

9 Next Steps

The ISO is will host a stakeholder meeting on June 27, 2012. Comments on this revised straw proposal are due on July 9, 2012. Stakeholders interested in participating in the attending the stakeholder meeting should notify the ISO via email to intertiepricing@caiso.com by written comments by June 25, 2012.