



**California ISO**  
Shaping a Renewed Future

## **Settlement of Interties in Real-Time**

### **Second Revised Straw Proposal**

**April 23, 2012**

**Settlement of Interties in Real-Time**

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## 1 Introduction

This second 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,<sup>1</sup> 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,"<sup>2</sup> 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 second revised straw proposal.

Through this current initiative, the ISO is seeking solutions to intertie pricing and settlement 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. In the ISO's revised straw proposal in this initiative, the ISO proposed two options, option one and option two:

- Option one included a short-term solution that could be put in place while the more robust longer-term solution was being developed.
- Option two was to not implement a short-term solution and rather focus on the longer-term solution so it could be implemented sooner.

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

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

Based on stakeholder feedback, the ISO intends to adopt option two and begin developing the 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. Both physical imports/exports and virtual bids at the interties will settle at the RTD system marginal energy cost (SMEC) plus the RTD loss component of the intertie's locational marginal price (LMP) plus the HASP congestion component of the intertie's LMP. (This will be calculated using the simple average of each of these LMP components over the applicable hour).
- 2) Subject to item 3) below, a make-whole payment will be paid to imports dispatched in HASP if the hourly 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) 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, and upon prior notification to market participants, ISO operators will have the authority to temporarily switch the make-whole payments to exports.
- 4) 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.
- 5) Undelivered HASP schedules will be settled at the RTD price and the current HASP schedules decline charge threshold and penalty will be eliminated.
- 6) When the dual intertie constraints bind in the day-ahead market, the ISO will use different settlement LMPs for physical awards and virtual awards (Option A). This rule would potentially be modified if the ISO determines it is permissible to not enforce the day-ahead physical only intertie constraint.
- 7) 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 are not necessary at this time.

There was very little support for the interim proposal for intertie convergence bidding proposed by the ISO under option one. Therefore, consistent with option two, the ISO proposes that intertie convergence bidding remain suspended until this longer term solution is implemented.

## **2 Stakeholder Engagement**

At the onset of the stakeholder process, the ISO engaged a stakeholder working group to assist in the formation of the initial straw proposal. Participants in the working group discussed unresolved issues outlined in the issue paper for this initiative. At the end of each session, the

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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 second revised straw proposal. 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	Proposed Working group meeting
May 21	Comments from working group meeting due
May 23	Post draft final proposal
May 30	Stakeholder meeting on draft final proposal
June 7	Stakeholder comments on draft final proposal due

### 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).<sup>3</sup> This may result in a payment or charge to SCs depending on the whether there is a surplus or deficit.

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

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

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.<sup>4</sup>

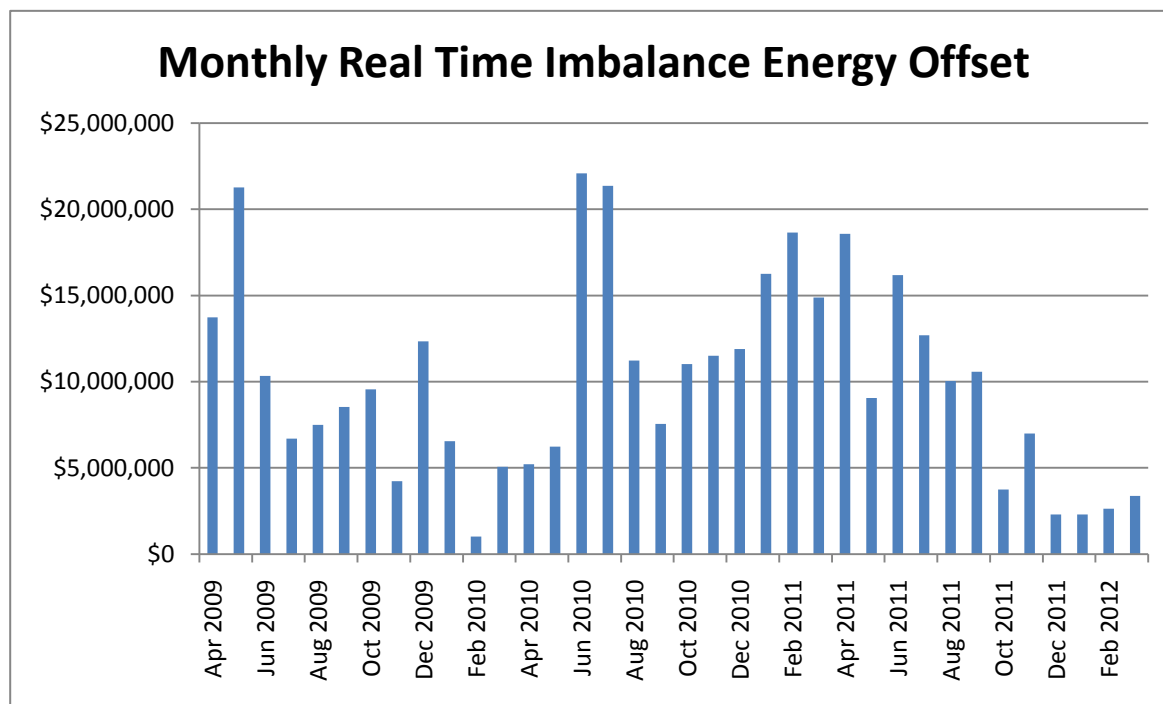
As Figure 1 illustrates, from April 2009 through March 2012 the average monthly real-time imbalance energy offset has been just over \$10.08 M. The offset peaked in June/July 2010 at over \$20M and returned to levels consistent with the first half of 2010 in September 2010. Since February of 2011, when convergence bidding was active, through November of 2011, the monthly real-time imbalance energy offset averaged just over \$12.14 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 \$2.65 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.

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<sup>4</sup> 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 March 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 recently introduced flexi-ramp constraint is currently 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 flexi-ramp 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 significantly 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.<sup>5</sup>

### **3.3 The Working Group Process**

The ISO engaged a stakeholder working group to assist in the formation of an initial straw proposal to address real-time imbalance energy offset issues that are the subject of this paper. The participants in the working group 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

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<sup>5</sup> The ISO's presentation materials for the FERC technical conference are available at [http://www.caiso.com/informed/Pages/StakeholderProcesses/IntertiePricing\\_Settlement.aspx](http://www.caiso.com/informed/Pages/StakeholderProcesses/IntertiePricing_Settlement.aspx)

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 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. Since the release of the ISO's issue paper for this initiative, the working group has convened three times. As noted in the schedule above, the ISO will engage the working group again prior to issuing a draft final proposal in this matter.

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 below.

### **3.3.1 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.<sup>6</sup> Prior to the meeting, Powerex previewed their proposal with several other members of the working group. While many of these 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.

Powerex's proposal for HASP dispatches that fail to deliver in real-time is specifically addressed below in Section 4.2.1. Pursuing refinements to the e-tagging, 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. Lowering the bid floor should reduce the real-time imbalance energy offset, and, as noted above in Section 3.1, the ISO is lowering the bid floor as part of Renewable Integration and Market Product Review: Phase 1 initiative. The ISO has reviewed the Powerex proposal at great length and believes that several items improve the overall efficiency of the markets. 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 of a new RUC process that cannot be completed even the

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<sup>6</sup> The Powerex proposal is available at [http://www.caiso.com/Documents/PowerexProposal\\_ConvergenceBiddingReinstatement.pdf](http://www.caiso.com/Documents/PowerexProposal_ConvergenceBiddingReinstatement.pdf).

time frame of the longer-term solution the ISO is proposing. The ISO addresses other aspects of the Powerex proposal in Section 4 below.

### **3.3.2 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 4 below.

### **3.4 Settlement of Import/Exports based upon RTD**

In addition to the suggestion made by Powerex and SCE, the ISO has examined numerous other options to reduce real-time imbalance energy offset charges. Many of the options to resolve the real-time imbalance energy offset issues were also considered in the prior stakeholder initiatives. However, each of the options outlined had potential market inefficiencies or reliability concerns. The ISO does not wish to reexamine the options, but believes it is appropriate for the stakeholder process to attempt to either a) find alternative options or b) solutions that address market inefficiency or reliability concerns of the proposed options. The proposals in 3.4.1 and 3.4.2 provide various options for reducing the real-time imbalance energy offset charges, they do not, without putting additional safeguards in place, provide sufficient protections for reintroducing convergence bidding on the interties. Additionally, some of these options may have other undesirable side-effects. As described in greater detail in Section 4, the ISO is proposing to settle imports and exports dispatched in HASP and close-out intertie virtual bids at the RTD system marginal energy cost (SMEC) plus RTD loss component of the LMP plus the HASP congestion component of the LMP. This approach is similar to the approach used by the IESO Ontario (discussed below).

#### **3.4.1 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.<sup>7</sup> 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.

### **3.4.2 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 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

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<sup>7</sup> 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](http://www.nyiso.com/public/services/market_training/online_resources/VirtualTrading/player.html).

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.

### **3.4.3 Implementaion Considerations**

The NYISO intertie settlement option was reviewed in the Real-Time Imbalance Energy Offset stakeholder process. Given the timeframe allowed and the added complexity that would have been needed to make the process complete for the interim solution the ISO concluded that the NYISO settlement option was not appropriate for the interim solution. Since the ISO, through this initiative, is proposing a longer term solution which would provide additional time to consider the modifications that would be necessary to make the NYISO or IESO Ontario processes applicable to the ISO, there is now more time and merit in examining these options as part of the stakeholder process.

Some stakeholders suggested that providing bid cost recovery for HASP exports would have less liquidity impact on intertie transactions than the bid or better option. The ISO considers the merits of providing bid cost recovery or make whole payments for HASP import and exports in Section 4.2 below.

## **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 previously proposed two options to resolve the issues of intertie pricing and convergence bidding at the interties. Based on stakeholder comments to the revised straw proposal and the ISO's assessment of the trade-offs between the two options, the ISO is proposing to implement "option two." Option two focuses on 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. Both physical imports/exports and virtual bids at the interties will settle at the RTD system marginal energy cost (SMEC) plus the RTD loss component of the intertie's locational marginal price (LMP)

plus the HASP congestion component of the intertie's LMP. (This will be calculated using the simple average of each of these LMP components over the applicable hour).

- 2) Subject to item 3) below, a make-whole payment will be paid to imports dispatched in HASP if the hourly price calculated in 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) 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, and upon prior notification to market participants ISO operators will have the authority to temporarily switch the make-whole payments to exports.
- 4) 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.
- 5) Undelivered HASP schedules will be settled at the RTD price and the current HASP schedules decline charge threshold and penalty will be eliminated.
- 6) When the dual intertie constraints bind in the day-ahead market, the ISO will use different settlement LMPs for physical awards and virtual awards (Option A). This rule would potentially be modified if the ISO determines it is permissible to not enforce the day-ahead physical only intertie constraint.
- 7) 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 are not necessary at this time.

The following sections provide greater details on each of the specific items of the ISO's proposal.

#### **4.1 Settlement Methodology for Intertie Resources**

In the revised straw proposal, the ISO suggested using an intertie pricing mechanism similar to the one employed by the NYISO. However, after evaluating other options and given recent stakeholder feedback, the ISO is now proposing a settlement mechanism based on the IESO Ontario model. The ISO proposes that imports, exports, and intertie virtual bids settle in the real-time market at the real-time SMEC plus the loss component of the intertie RTD LMP plus the congestion component of the HASP LMP.

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 RTD SMEC should reduce the potential for real-time imbalance energy uplift to be inflated by virtual bids at the

interties offset by virtual demand bids because both bids will be closed out based on the same SMEC. Systematic differences between the HASP SMEC and the RTD SMEC are what previously led to inflated real-time imbalance energy uplift.

One reason for using the RTD SMEC and loss components but the HASP congestion component is that the congestion component of the real-time LMP at the interties would not provide an accurate real-time price signal at that 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 congestion component of the HASP LMP reflects the appropriate value of congestion at the time imports and exports were dispatched in HASP. In addition, using the real-time SMEC and loss component allows imports and exports to be priced at the actual real-time value of the energy.<sup>8</sup> 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

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 = \$0/MWh

LMP = \$50.50/MWh

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<sup>8</sup> 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.

Final Settlement Price:

RTD SMEC = \$52.50/MWh

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

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

Final Settlement Price = \$45.50/MWh

#### 4.2 Make Whole Payments

Due to changing system conditions, using the average real-time SMEC and line losses could lead to a resource dispatched in the HASP ultimately paying or being paid at a level that is below the bid price of an import or above the bid price of an export. Therefore, in order to maintain bid constancy for physical resources, the ISO proposes physical imports (alternatively, in some hours exports) receive a make whole payment if the hourly settlement price is below the bid price of an import or above the bid price of an export. Because virtual bids are simply closed out (i.e. virtual bids do not submit a HASP bid) using the proposed settlement methodology, there is no risk of settling at a price that is inconsistent with their bid, thus virtual bid will not 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. For example, if a physical import resource submits a bid for \$50 and is dispatched at a HASP advisory price of \$60, and the hourly settlement price (using SMEC, real-time line losses, and HASP congestion) is \$45, then the resource would receive an additional \$5 per MW as a make whole payment for their bid. However, if the average hourly settlement price is \$55, there will not be an additional payment made to that resource.

Additionally, the purpose of the make whole-payment is to ensure imports 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). The cost of any make-whole payments will be included in the real-time imbalance energy offset, which is allocated to metered demand. It should be noted because the ISO’s proposed settlement methodology will settle intertie resources using the RTD SMEC and losses and only the HASP congestion component, the overall contribution to the real-time imbalance energy offset should be reduced overall. The current proposal would mean that only the HASP congestion component and the make-whole payment (which should be infrequent and applied only to physical resources) will contribute to the real-time imbalance energy offset. Therefore, while this settlement solution does not eliminate uplift created by the difference between the HASP and real-time, it should result in a net reduction of uplift when compared with the current settlement.



The ISO proposes a default setting of proposing that the make whole payment be made available only to imports. This is based on the fact the ISO is typically a net importer of energy. However, in periods of over-generation, it may be beneficial to switch this setting to provide the make whole payment only to exports.<sup>9</sup> The ISO operators will inform market participants prior to HASP if there is a need to switch from the default setting for providing make-whole payments providing make-whole payments for exports. Additionally, the ISO will only provide make-whole payments in one direction in a given hour to prevent potential gaming opportunities. Finally, the ISO is still analyzing whether this approach is operationally feasible for both the ISO and market participants and other options may have to be considered.

### **4.3 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.<sup>10</sup> The use of 10 percent of the 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 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.

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<sup>9</sup> 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.

<sup>10</sup> Currently, the single largest intertie is the Tracy intertie at 3,829 MW.

#### 4.4 Negative Deviations to HASP Imports/Exports

In stakeholder comments in the real-time imbalance energy offset initiative, Powerex identified a concern with the treatment of HASP deviations. An intertie resource that sells energy in HASP, but fails to deliver is not subject to imbalance charges at the RTD price. Instead, failure to deliver on HASP commitments results only in (a) non-payment of the HASP price (up to 10% of the participant’s total HASP respective supply and demand volume per month); or (b) a penalty equal to 50 percent of the HASP LMP for volumes beyond the first 10%.<sup>11</sup> As a non-performing HASP sale results in the ISO purchasing that energy from internal resources in the RTD, this revised straw proposal proposes as part of the long-term solution, that failure to deliver on HASP awards should be charged the RTD LMP, independent of the magnitude, frequency or reason for such failure. Intertie resources scheduled in the day-ahead market already pay the real-time price for energy that is not delivered in real-time. This rule change improves the consistency of treatment between the day-ahead market and HASP for intertie resources.

The ISO has reviewed the penalties imposed for failure to deliver on HASP schedules. Table 3 shows that these penalties have been insignificant for 2011. This data shows that very few undelivered imports or exports exceed the 10% margin.

**Table 3: Monthly Penalties for Failure to Deliver on HASP Commitments**

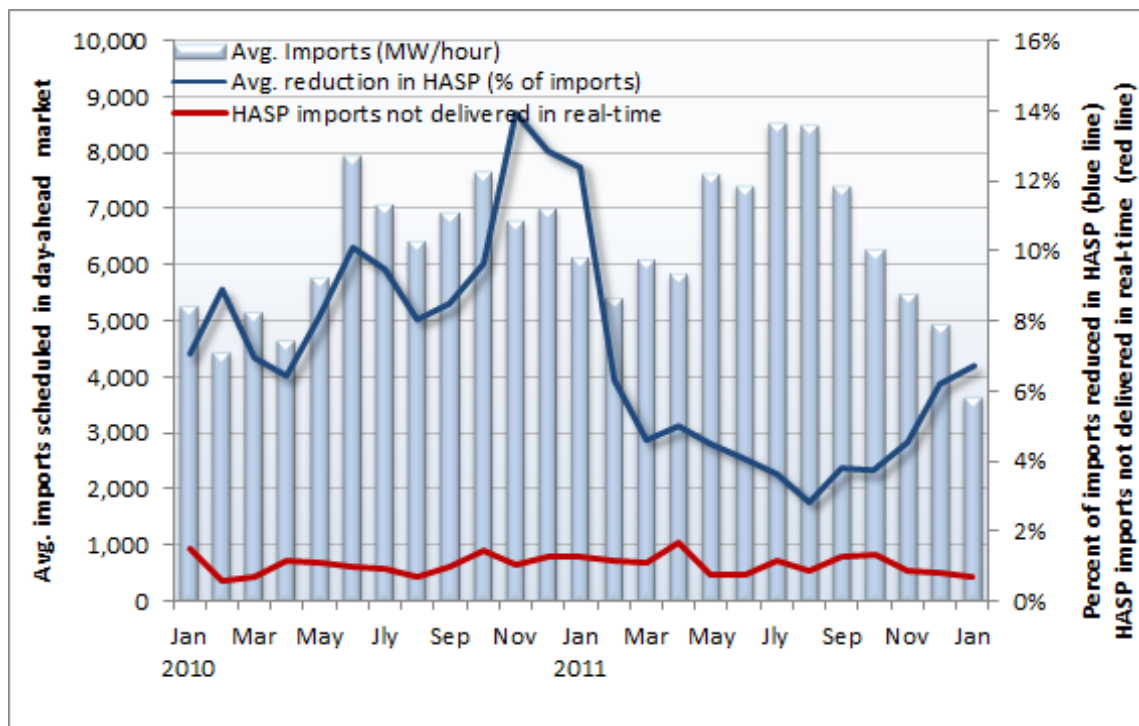
Month	Penalties
1/1/2011	\$25,861.87
2/1/2011	\$60,375.89
3/1/2011	\$16,872.14
4/1/2011	\$24,562.05
5/1/2011	\$13,721.57
6/1/2011	\$12,284.98
7/1/2011	\$94,221.41
8/1/2011	\$75,741.50
9/1/2011	\$32,545.35
10/1/2011	\$17,995.75

<sup>11</sup> See ISO Tariff, Section 11.31

11/1/2011	\$8,478.53
12/1/2011	\$4,295.47
<b>Grand Total</b>	<b>\$386,956.51</b>

Though very few scheduling coordinators are triggering the penalty criteria (85 percent of the penalties have been assessed to six scheduling coordinators), it is still important to note that small declines of HASP dispatches can lead to significant effects on the real-time prices. As such, these deviations may significantly increase the real-time imbalance energy offset charges. Therefore, the ISO proposes to require all resources that fail to deliver on HASP commitments to buy back their deviations at the real-time price. The ISO believes this will create the proper incentives for resources dispatched in HASP to perform in such a way that will reduce divergence of HASP and real-time prices. The Powerex proposal, described above, suggests that the deviations be settled at the worse of the HASP or real-time price to create a stronger incentive to deliver. However, the ISO believes that settling deviations at the real-time price is more aligned with cost-causation principles. This creates a penalty only if there is congestion. However, if there is no congestion, then the HASP transaction and real-time energy buy-back cancel each other out. This is essentially the same settlement used for generators for real-time energy market dispatches that are undelivered. While some have asserted that requiring deviation be bought back at real time prices would negatively impact the liquidity of the market for imports, Figure 2 demonstrates that the quantity of imports that fail to deliver on final HASP schedules are typically small.

**Figure 2: HASP Awards – Delivered versus Undelivered**



#### 4.5 Price Inconsistency Caused by Intertie Constraints

In a stakeholder initiative run in parallel to the real-time imbalance energy offset initiative, the ISO has worked to resolve price inconsistency<sup>12</sup> issues that are caused by enforcing the two intertie constraints implemented with convergence bidding. Under the current design, the ISO enforces 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:

$$\text{Physical imports minus physical exports} \leq \text{Line limit.}$$

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

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

Since convergence bidding was implemented, the ISO has seen cases where physical export bids are clearing the market at LMPs that are inconsistent (higher) than the submitted bid for the

<sup>12</sup> Additional documentation for the Price Inconsistency Cause by Interties Constraints stakeholder initiative is available at <http://www.caiso.com/2b6d/2b6dbef62e710.html>.

scheduled resource. It is also possible that an economic import may be only partially dispatched, or not dispatched at all. Market participants have raised concerns regarding the negative impact this pricing inconsistency may have on their settlement outcome.

In the straw proposal for that previous initiative, the ISO included two options that would result in consistent pricing: (A) different settlement LMPs for physical awards and virtual awards and (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.

Stakeholders did not support option A because it would result in different price for virtuals and physical imports/exports. 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 proposed by the ISO, stakeholders have proposed additional options. These options are: (1) make no changes (i.e. leave the dual constraints in place and market participants will accept the risks of the price inconsistency), (2) remove the physical only constraint, or (3) a two-pass pricing approach. Each of these options are discussed below.

#### 4.5.1 The ISO's 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 ISO proposes to allow the shadow prices of both constraints that are currently implemented to be factored into the settlement LMPs. This will produce two different settlement LMPs: one for cleared physical bids and one for cleared virtual bids. The virtual award will still be settled at LMP\*V, while the physical award will be settled at:

$$\text{LMP}^*P = x^*\text{SYS} - x^*\text{PVI} - x^*\text{PI} + x^*\text{PVE} + x^*\text{PE}$$

xPVI = import physical plus virtual constraint

xPI = import physical constraint

xPVE = export physical plus virtual constraint

xPE = export physical constraint

\* = Optimal solution

One outcome of this option is that the virtual awards do 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 are 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.

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 Option A 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 receive 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 5 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 4 – 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

#### 4.5.2 Other Options to Resolve Dual Constraint Problem

As noted above, other options have been presented to address the dual constraints question. However, at this time, these options do not appear to be viable 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<sup>13</sup> 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. 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, 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.

Eliminating the physical only constraint, which would then allow virtual bids to provide counterflow to resolve congestion, 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. However, the ISO’s past interpretation is that the WECC reliability standards prevent physical schedules from exceeding an intertie’s limit in the day-ahead market. As part of this initiative, the ISO will further review the WECC standards and determine if the current interpretation is correct and/or a WECC rule change is required to remove the physical only

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<sup>13</sup> This approach was suggested by Powerex in comments to the straw proposal. Available at [http://www.caiso.com/Documents/Powerex\\_Comments-IntertiePricing-SettlementStrawProposal.pdf](http://www.caiso.com/Documents/Powerex_Comments-IntertiePricing-SettlementStrawProposal.pdf)

constraint. The ISO proposes to use “Option A” pending a determination that WECC standards allow the removal of the physical only constraint.

## **5 Next Steps**

The ISO is will host a stakeholder meeting on April 30, 2012. Comments on this revised straw proposal are due on May 7, 2012. Stakeholders interested in participating in the working group should notify the ISO via email to [intertiepricing@caiso.com](mailto:intertiepricing@caiso.com) by April 26, 2012.