Settlement of Interties in Real-Time

Straw Proposal

February 13, 2012
Settlement of Interties in Real-Time

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1 Introduction
This 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 were being 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 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. These initiatives have since been included in the initiative that is the subject of this straw proposal. 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.

Through this current initiative that is the subject of this straw proposal, the ISO is seeking solutions to intertie pricing and settlement that will reduce the pattern of offsetting virtual bids at the interties that gave rise to the suspension of convergence bidding at intertie locations, reduce the magnitude of real-time imbalance energy offset charges, and resolve the price inconsistency caused by intertie constraints. The ISO’s objective is to identify solutions that can be implemented relative soon and allow the return of convergence bidding on the interties. Implementing any such solution will not necessarily rule-out more comprehensive future market modifications.

Because the ISO has implemented (or will soon implement) mechanisms that have significantly reduced real-time imbalance energy offset charges, the ISO is not proposing changes to the settlement of physical intertie resources as part of this straw proposal. However, in order to reintroduce convergence bidding back on the interties, the ISO proposes to settle intertie convergence bids using a method similar to the approach IESO Ontario uses to settle intertie convergence bids using a method similar to the approach IESO Ontario uses to settle intertie convergence bids using a method similar to the approach IESO Ontario uses to settle intertie convergence bids using a method similar to the approach IESO Ontario uses to settle intertie convergence bids using a method similar to the approach IESO Ontario uses to settle intertie convergence bids using a method similar to the approach IESO Ontario uses to settle intertie convergence bids using a method similar to the approach IESO Ontario uses to settle intertie convergence bids using a method similar to the approach IESO Ontario uses to settle intertie convergence bids using a method similar to the approach IESO Ontario uses to settle intertie convergence bids using a method similar to the approach IESO Ontario uses to settle intertie convergence bids using a method similar to the approach IESO Ontario uses to settle intertie convergence bids using a method similar to the approach IESO Ontario uses to settle intertie convergence bids using a method similar to the approach IESO Ontario uses to settle intertie convergence bids using a method similar to the approach IESO Ontario uses to settle intertie convergence bids using a method similar to the approach IESO Ontario uses to settle intertie convergence bids using a method similar to the approach IESO Ontario uses to settle intertie convergence bids using a method similar to the approach IESO Ontario uses to settle intertie convergence bids using a method similar to the approach IESO Ontario uses to settle intertie convergence bids using a method similar to the approach IESO Ontario uses to settle intertie convergence bids using a method similar to the approach IESO Ontario uses to settle intertie convergence bids using a method similar to the approach IESO Ontario uses to settle intertie convergence bids using a method similar to the approach IESO Ontario uses to settle inte

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² [http://www.caiso.com/informed/Pages/StakeholderProcesses/PriceInconsistencyCausedIntertieConstrains.aspx](http://www.caiso.com/informed/Pages/StakeholderProcesses/PriceInconsistencyCausedIntertieConstrains.aspx)
resources. Lastly, to resolve the price inconsistencies caused by intertie constraints, the ISO proposes to use different settlement LMPs for physical awards and virtual awards when both constraints are binding.

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 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 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.

<table>
<thead>
<tr>
<th>Date</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>November 8</td>
<td>Post Issue Paper</td>
</tr>
<tr>
<td>November 15</td>
<td>Working Group Meeting</td>
</tr>
<tr>
<td>November 29</td>
<td>Working Group Meeting</td>
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<tr>
<td>January 25</td>
<td>Working Group Meeting</td>
</tr>
<tr>
<td>February 10</td>
<td>Post straw proposal</td>
</tr>
<tr>
<td>February 17</td>
<td>Stakeholder meeting on straw proposal</td>
</tr>
<tr>
<td>February 24</td>
<td>Stakeholder comments on straw due</td>
</tr>
<tr>
<td>March 13</td>
<td>Post revised straw proposal</td>
</tr>
<tr>
<td>March 20</td>
<td>Stakeholder meeting on revised straw proposal</td>
</tr>
<tr>
<td>March 27</td>
<td>Stakeholder comments on revised straw due</td>
</tr>
<tr>
<td>April 12</td>
<td>Post draft final proposal</td>
</tr>
<tr>
<td>April 19</td>
<td>Stakeholder meeting on draft final proposal</td>
</tr>
<tr>
<td>April 26</td>
<td>Stakeholder comments due on draft final proposal</td>
</tr>
<tr>
<td>May 16-17</td>
<td>Board of Governors</td>
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</table>
3 Redesign of Real-Time Imbalance Energy Offset
The ISO has made several improvements to the accuracy of the ISO 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 asymmetrical 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). 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 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.

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3 Additional documentation can be found in the Settlements & Billing BPM Configuration Guide available at [https://bpm.caiso.com/bpm/bpm/version/0000000000000085](https://bpm.caiso.com/bpm/bpm/version/0000000000000085)

4 Additional information on the first Real-Time Imbalance Energy Offset (2009) stakeholder process is available at [http://www.caiso.com/2406/2406e2a640420.html](http://www.caiso.com/2406/2406e2a640420.html)
As Figure 1 illustrates, from April 2009 through December 2011 the average monthly real-time imbalance energy offset has been just over $10.5M. 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 introduced, through December of 2011, the monthly real-time imbalance energy offset averaged just over $11.1M 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. After intertie convergence bidding was suspended in late-November 2011, the real-time imbalance energy offset amount reached a nearly two year low in December 2011.

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.

**Figure 1 – Monthly Real Time Imbalance Energy offset January 2010 through September 2011**

![Graph showing monthly real-time imbalance energy offset and RTD-HASP prices from April 2009 to December 2011.]

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. 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, 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.⁵

### 3.3 The Working Group Process

The ISO engaged a stakeholder working group to assist in the formation of this 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 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.

The first working group meeting was held on November 15, 2011. Participants at this meeting formed two groups. One group chose to focus on the creation of a full hour-ahead market. The other group examined smaller, more incremental solutions. Both groups favored solutions to reduce real-time imbalance energy offset that would allow the reintroduction of convergence at the interties.

The second working group session, held on November 29, 2011, had all working group members in a single group. This working group session examined the advantages and disadvantages of various methodologies to reduce real-time imbalance energy offset amounts. The working group assessed the impacts of each of the identified options in terms of the impact to real-time imbalance energy offset costs, costs to implement, whether it would accommodate the reinstatement of convergence bidding at the interties, and the impact on market liquidity.⁶

The working group illuminated the complexities of reducing real-time imbalance energy offset charges. For example, some working group members favored the development of a full hour-ahead market because they felt it would address real-time imbalance energy offsets, allow convergence bidding back on the Interties, and potentially solve other market inefficiencies. Meanwhile other working group members pointed out that this option was not practical, as it would be the most costly, challenging, and time consuming solution to implement.

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⁵ 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)

⁶ See the final slide of the ISO presentation at the FERC technical conference on convergence bidding on the interties. Available at [http://www.caiso.com/informed/Pages/StakeholderProcesses/IntertiePricing_Settlement.aspx](http://www.caiso.com/informed/Pages/StakeholderProcesses/IntertiePricing_Settlement.aspx)
At the end of the meeting there was no consensus amongst the working group regarding the best option. As a result, the participants requested the ISO to modify the original schedule to allow for additional opportunities to discuss the components of a straw proposal. All thirteen members of the working group affirmatively agreed to extend the original schedule and move approval of a final resolution from the March Board of Governors meeting to the May meeting.

The third meeting of the working group convened on January 25, 2012. The working group focused on addressing proposals brought by Powerex and Southern California Edison (SCE).

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. 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. Powerex proposes increased assurance that energy will be available in real-time through items such as modifications to e-tagging timelines to avoid undelivered energy and mitigate price spikes in real-time. The measures Powerex proposes are:

1) Charging HASP award that do not deliver the worse of HASP or RTD and charging IFM awards that do not deliver the worse of IFM or RTD
2) Enforce product definitions for firm and non-firm energy and requiring an e-tag by 3:00pm the day before real-time
3) Reduce price floor
4) Discontinue premature liquidation of internal convergence bids
5) Create a post HASP procurement mechanism (i.e. a post HASP procurement process)

Phase two would allow for the reinstatement of convergence bidding at the interties and consists of:

6) System Marginal Energy Cost or bid cost guarantee
7) Modify implementation of position limits to eliminate intertie-specific constraints on liquidity

The focus of the third phase of the Powerex proposal is promoting long term market efficiency and includes:

8) The creation of a post HASP RUC process
9) Additional measures to ensure proper use of firm energy

Powerex’s proposal for HASP dispatches that fail to deliver in real-time is specifically addressed below in Section 4.1.3. Pursuing refinements to the e-tagging, as Powerex suggests, will not provide significant benefit at this time. However, modifying the ISO’s current e-tagging practices would reduce flexibility, hurting 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 addresses the Powerex proposal in Section 4 below.

3.3.2 The SCE Proposal
SCE provided a proposal 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 export 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. While the proposals in 3.4.1 through 3.4.4 provide 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.

3.4.1 Pay as Bid
This option is essentially the method for settling intertie transactions that existed in the ISO market prior to the new locational marginal price (LMP) market introduced in April 2009. Under this option, HASP timelines and bidding processes would remain unchanged; however, the HASP settlement for physical intertie transactions and liquidation of intertie virtual demand/supply would be eliminated. All intertie virtual demand/supply will be liquidated at the RTD price. The HASP process would determine indicative prices used to select which HASP intertie transactions that are accepted. Bids to export or reduce day-ahead imports would be accepted if the bid is below the indicative HASP price. Bids to export or reduce day-ahead imports would not be accepted if the bid is above the indicative HASP price. For incremental imports and reductions in day-ahead exports, the bids would be accepted if lower than the indicative price. The accepted physical transactions would be paid their bid price and difference between the bid price and the actual RTD price would be included as a credit/debit to the real-time imbalance energy offset. See Table 1 and 2 for example of the rule and impact to the offset.
As noted by several stakeholders, this would be a step backwards from the LMP market design. The previous concerns with bidding behavior that takes into consideration a market participant’s expectation of real-time pricing versus bidding the resource’s marginal cost could impact market efficiency. However, prior to the LMP market introduced in April 2009, the Pay as Bid process did operate without excessive undesirable side effects.

3.4.2 Pay as Bid or Better

Under the pay as bid or better option, HASP timelines and bidding processes would remain unchanged; however, the HASP settlement for physical intertie transactions and liquidation of intertie virtual demand/supply would be eliminated. All intertie virtual demand/supply would be liquidated at the RTD price. The HASP process would determine indicative prices used to select the HASP intertie transactions that are accepted. Bids to export or reduce day-ahead imports would be accepted if the bid is below the indicative HASP price. Bids to export or reduce day-ahead imports would not be accepted if the bid is above the indicative HASP price. For incremental imports and reductions in day-ahead exports, the bids would be accepted if lower than the indicative price. The accepted physical exports would pay the lower of their bid price or actual RTD price. The accepted physical imports would receive the higher of their bid price or actual RTD price. The difference between the bid price and the actual RTD price would be included as a charge to the real-time imbalance energy offset. See Table 1 and 2 for example of the rule and impact to the offset.

Pay as bid or better received less stakeholder support than the pay as bid option. Similar to the issues with pay as bid, the ISO and market participants have expressed concerns with any mechanism that provides an incentive to bid something other than a resource’s marginal costs based upon expectations of the market outcome. For this reason, this option is not a viable intermediate term option.

Tables 1 and 2 below show examples of pay as bid and bid or better would work under different relationships between HASP and real-time price. Table 1 shows pay as bid and bid or better when HASP price is less than the real-time price. Table 2 shows a similar example, except that HASP price is greater than real-time price.

| Table 1 - Pay as Bid and Bid or Better Settlement HASP Price < RTD Price |
|-----------------|-----|-----|-----|-----|-----|
|                  | Bid | Award | As Bid | RTIEO | Bid or Better | RTIEO |
| HASP Price       | $60.00 | $80.00 | $40.00 | ($40.00) | $80.00 | $-
| Export A         | $100.00 | $100.00 | $100.00 | ($20.00) | $80.00 | $-
| Export C         | $60.00 | $60.00 | $20.00 | 20.00 | 60.00 | 20.00 |
* A negative real-time imbalance energy offset (RTIEO) amount is a credit to the offset, positive is a charge to the offset.

**Table 2 – Pay as Bid and Bid or Better Settlement HASP Price > RTD Price**

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<thead>
<tr>
<th></th>
<th>HASP Price</th>
<th>RTD Price</th>
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<tbody>
<tr>
<td><strong>Bid</strong></td>
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</tr>
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<td>Import C</td>
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<tr>
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</tr>
<tr>
<td>Export A</td>
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<tr>
<td>Export B</td>
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</tr>
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<td>Export D</td>
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</tr>
</tbody>
</table>

* A negative RTIEO amount is a credit to the offset, positive is a charge to the offset.

**3.4.3 Comparison with NYISO Intertie Scheduling and Virtual Bidding**

The New York ISO (NYISO) is the most relevant ISO/RTO for comparison with the ISO. Like the ISO, the NYISO is a large net importer of power and has an hour-ahead scheduling process similar to the ISO. 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 ISO’s HASP process. The NYISO process/software tool is called RTC. RTC initializes and runs every 15 minutes, looking forward nine 15 minute intervals in time. In addition to scheduling imports, RTC is used to commit quick start units, primarily 10 minute and 30 minute gas turbines. 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 pay-as-bid element into the market design that is not ideal, but concluded to be necessary to ensure the availability of import supply. The NYISO, like the 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 at this time. All virtual supply and demand bids are cleared at zonal prices. 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 ISO under the current convergence bidding design.

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 at that time. Since this initiative has additional time to consider the modifications that would be necessary to make the NYISO process applicable to the ISO, there is now more time and merit in examining this option 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; however, at this time there is no data to support this view and the ISO, like NYISO, has to consider the merits of imposing new uplift costs to its market participants.

3.4.4 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, intertie resources 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

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7 A simple training presentation of Virtual Trading in NYISO can be found at
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 operating costs, then intertie offer guarantee returns the resource to zero operating profits. 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 energy price and the external energy price. The difference between the internal price and the external price in called the “intertie congestion price” (ICP). The ICP is similar to the ISO’s marginal loss and marginal congestion components. IESO Ontario then settles the resources on congested interties at the real time price plus the ICP.

4 The ISO Proposal

As part of the working group, the ISO stated that it would propose to reintroduce convergence bidding on the interties when conditions changed so that the expected benefits outweighed the expected costs. Therefore the ISO is proposing to reintroduce convergence bidding back to the interties contingent on the adoption of the following key elements:

1. There would be no changes to HASP pricing for physicals resources.
2. Virtual bids would be priced based upon a modified Ontario approach discussed above.
3. For intertie resources:
   a. Deviations to HASP schedules would be settled at the RTD price.
   b. The HASP schedules decline charge threshold and penalty would remain.
4. The ISO would utilize “Option A” to solve the intertie price inconsistency issue.
5. A 5 percent position limit of the largest intertie ATC would be applied system wide per SC.
6. An overall $3.5M per month threshold for the amount of real-time imbalance energy offset charges due to offsetting virtual bids bid. Exceeding this threshold would trigger convergence bidding on the interties to be suspended again.

Requiring scheduling coordinators that fail to provide HASP awards in real-time to pay for the replacement power at real-time prices should reduce volume difference between HASP and real-time. Additionally, by utilizing the IESO Ontario approach detailed above for virtual bids, the ISO believes that, with two additional measures, it is possible to reintroduce convergence bidding on the interties. The ISO proposes imposing position limits for virtual bids as well as establishing a trigger, based on Real-Time Imbalance Energy Offset, that once reached would lead to suspension of Convergence bidding on the interties.
4.1.1 No Changes to HASP Pricing for Physicals Resources
Real-time imbalance energy offset charges due to dispatch of physical resources has steadily decreased over the last six months. This reduction is the result of improved consistency with procurement targets as well as the implementation of the Flexi-Ramp constraint. Once the ISO lowers the bid floor and implements the Flexi-ramp product, the ISO will have sufficient tools to mitigate the real-time imbalance energy offset charges attributable to the dispatch of physical resources. Therefore, at this time, there appears to be no need to change the settlement and pricing for physical intertie resources (except as noted in section 5.1 below).

4.1.2 Virtual bids Priced using a Modified Ontario Approach
As a goal of this initiative is to provide an appropriate market structure under which convergence bidding on the interties can resume, it is appropriate to modify how intertie convergence bids are settled to mitigate the adverse impact of the bidding strategies and observed market inefficiencies that lead to the suspension of convergence bidding on the interties. The ISO proposes to clear virtual bids on the interties using a methodology similar to the Ontario model described above. When there is no congestion, virtual bids will be automatically liquidated with the opposite sell/buy position in the HASP, but will settle at real-time prices. When there is congestion, virtual bids will be automatically liquidated with the opposite sell/buy position at in the HASP and will settle at the real-time system marginal energy cost plus the HASP marginal loss and marginal congestion costs. There will not be bid-cost recovery for convergence bids. Thus, there is no need to consider the bid cost recovery proposal offered in the SCE proposal.

4.1.3 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%. As a non-performing HASP sale results in the ISO purchasing that energy from internal resources in the RTD, this straw proposal proposes that failure to deliver on HASP awards should be charged the RTD price, 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 (Imports/exports originally scheduled in the IFM are charged for the real-time price for non-delivery in real-time).

Stakeholder comments to the revised straw proposal in the real-time imbalance energy offset stakeholder process have highlighted that additional measures to address non-delivery may have negative unintended consequences that could result in reduced liquidity at the interties. As such, the ISO concluded that no additional measures beyond those that were included as

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8 See ISO Tariff, Section 11.31
part of the original convergence bidding design were prudent at the time of the Real-time Imbalance Energy Offset initiative. However, the ISO believes it is prudent to re-examine this matter given the proposed re-introduction of convergence bidding at the interties and continued concern about the effects of non-delivery of imports in real-time.

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

<table>
<thead>
<tr>
<th>Month</th>
<th>Penalties</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/1/2011</td>
<td>$25,861.87</td>
</tr>
<tr>
<td>2/1/2011</td>
<td>$60,375.89</td>
</tr>
<tr>
<td>3/1/2011</td>
<td>$16,872.14</td>
</tr>
<tr>
<td>4/1/2011</td>
<td>$24,562.05</td>
</tr>
<tr>
<td>5/1/2011</td>
<td>$13,721.57</td>
</tr>
<tr>
<td>6/1/2011</td>
<td>$12,284.98</td>
</tr>
<tr>
<td>7/1/2011</td>
<td>$94,221.41</td>
</tr>
<tr>
<td>8/1/2011</td>
<td>$75,741.50</td>
</tr>
<tr>
<td>9/1/2011</td>
<td>$32,545.35</td>
</tr>
<tr>
<td>10/1/2011</td>
<td>$17,995.75</td>
</tr>
<tr>
<td>11/1/2011</td>
<td>$8,478.53</td>
</tr>
<tr>
<td>12/1/2011</td>
<td>$4,295.47</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>$386,956.51</strong></td>
</tr>
</tbody>
</table>

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 failure 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. However, when there is import congestion, there may system benefits because a resource does not deliver its HASP commitment in real-time. Therefore, the ISO believes that the Powerex proposal does not provide the proper incentives. While some have asserted that such a requirement would negatively impact the liquidity of the market for imports, Figure 2 demonstrates that the quantity of imports that fail to deliver on HASP awards are typically small. Therefore, such a replacement rule should have very little impact on the liquidity of the market at interties. Additionally, though the ISO will require resources that fail to deliver on HASP commitments to buy back their deviations at the real-time price, the ISO will not eliminate the penalty charge for resources with volumes beyond the first 10%. Keeping this penalty acts as a deterrent for resources that might become continuous problem for failing to deliver on HASP commitments and provides reliability benefits by limiting the difference between HASP dispatches and RTD.

Figure 2: HASP Awards – Delivered versus Undelivered

4.1.4 Issue with Convergence Bidding Liquidation and Settlement Timing
Another issue with the current market design for convergence bidding is the structural disconnect between the liquidation of virtual supply/demand and the establishment of real-time binding settlement LMPs for physical supply/demand. The current market design has three binding settlement LMPs for physical supply/demand (IFM, HASP for interties, RTD for internal generation/load), three binding settlement LMPs for virtual supply and demand (IFM HASP for interties, and RTD for internal nodes), but only two liquidation market optimizations for virtual supply and demand (IFM and HASP).
By adopting the proposal presented in this straw proposal to close-out intertie virtual bids based on the real-time energy price (modified by HASP loss and congestion prices), the market design will result in only one real-time settlement energy price for virtual bids and one day-ahead settlement energy price for virtual bids. This eliminates the market inefficiency described above.

### 4.1.5 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 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 and (2) physical and virtual imports net of physical and virtual exports must also be within established scheduling limits for that scheduling point. Since convergence bidding was implemented, the ISO has seen cases where physical export bids are clearing the market at LMPs that are inconsistent (higher) than the submitted bid for the scheduled resource. Market participants 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 which could lead to day-ahead revenue adequacy issues. 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; however, the allocation of this new uplift would require significant stakeholder discussion. In addition, the impact of price divergence for exports has reduced since the immediate months following the implementation of convergence bidding. As a result, 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.

### 4.1.5.1 The ISO’s Proposal (Option A)

Prior to curtailing convergence bidding at the interties, only the net virtual plus physical constraint was used in pricing. In order 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 for cleared physical and virtual bids. The virtual award will still be settled at LMP*V, while the physical award will be settled at:

\[ LMP^P = x^SYS - x^PVI - x^PI + x^PVE + x^PE \]

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9 Additional documentation for the Price Inconsistency Cause by Interties Constraints stakeholder initiative is available at [http://www.caiso.com/2b6d/2b6dbef62e710.html](http://www.caiso.com/2b6d/2b6dbef62e710.html).
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 poses no adverse outcome because even today where only one constraint is being priced, the two shadow prices of both constraints already affect the dispatches in the market optimization. In other words, even today 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, which makes this option the most transparent and mathematically correct approach to maintain price consistency.

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 at the ITC priced at LMP*V. In order to accommodate the two different settlement prices, the ISO needs to create an additional pricing node for the physical resources at LMP*P at the 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.

Parties 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, physical export will receive a lower price than a virtual export, so the virtual export may opt to be physical and liquidate in the real-time market. While this strategy would not be prohibited, it cannot generate sustainable revenue, because the increased physical exports can relieve the physical constraint congestion, rendering this strategy less profitable. It is also possible that the strategy could create congestion in the export direction resulting in an adverse affect. 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 monies paid due the difference between the day-ahead price and the HASP price for any MW quantity that is not e-tagged. 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. 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

<table>
<thead>
<tr>
<th>MW</th>
<th>DA</th>
<th>HASP</th>
<th>Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Import</td>
<td>100</td>
<td>$50.00</td>
<td>5,000.00</td>
</tr>
<tr>
<td>Virtual Export</td>
<td>20</td>
<td>($55.00)</td>
<td>60.00</td>
</tr>
<tr>
<td>HASP Outage</td>
<td>20</td>
<td>($60.00)</td>
<td>($1,200.00)</td>
</tr>
<tr>
<td>Actual with Hedge</td>
<td>80</td>
<td>$48.75</td>
<td>$3,900.00</td>
</tr>
<tr>
<td>Actual w/o Hedge</td>
<td>80</td>
<td>$47.50</td>
<td>$3,800.00</td>
</tr>
</tbody>
</table>

Some market participants advocate that the ISO provide bid cost recovery to exports to remedy the inconsistencies that result from the existing approach for settling the two constraints. Bid cost recovery has the indirect effect of settling virtual and physical bids at different net prices; therefore, the ISO finds that it is preferable to settle at the two LMPs that could result from the two different constraints, but renders the pricing consistent with the resources bid.

4.1.6 Position Limits

At the onset of convergence bidding, there was a 5 percent position limit on convergence bids 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. As an initial position, the ISO proposes that a total virtual intertie position limit be established at 5 percent of the largest intertie across all interties scheduling points for each scheduling coordinator. The use of 5 percent of the largest intertie across all ties will allow sufficient hedging across most ties, while allowing the ISO to assess the effectiveness of the new convergence bidding design. This position limit would remain in place for at least one year 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.

4.1.7 Real-Time Imbalance Energy Offset Trigger

The real-time imbalance energy offset can be used as a key indicator of the performance of convergence bidding. While real-time imbalance energy offset charges are a function of numerous factors, it is possible to isolate the portion of the real-time imbalance energy offset that is caused by virtual bids. Offsetting virtual bids created significant uplift between March 2011 and May 2011. Therefore, the ISO proposes putting a cap at the maximum uplift created by residual offsetting virtual bids, or 3.5 million dollars as shown in Figure 3. If the real-time
imbalance energy offset charges attributable to offsetting by virtual bids reaches $3.5 million per month, the ISO would suspend convergence bidding on the interties. Once this trigger is reached, convergence bidding will be suspended until we have a single market optimization that prices the liquidation of virtual bids.

**Figure 3: Real-Time Imbalance Energy Offsets Since Convergence Bidding Implemented (30-Day Rolling Average)**

![30-Day Rolling Cumulative](image)

5 Next Steps

The ISO is will host a stakeholder meeting on February 17, 2012. Comments on this straw proposal are due on February 24, 2012. Stakeholders interested in participating in the working group should notify the ISO via email to intertiepricing@caiso.com by written comments by February 15, 2012.