Comments on Impact of Convergence Bidding on Real-Time Imbalance Energy Offset

Submitted By	Company or Entity	Date Submitted
Gifford Jung 604-891-6040	Powerex Corp.	May 11, 2011

Powerex is pleased to submit these comments on the issues raised in the Impact of Convergence Bidding on Real-Time Imbalance Energy Offset Issue Paper and Straw Proposal.

The paper addresses an unforeseen outcome of the manner in which convergence bids (also called "virtual bids") are treated on the interties as opposed to at internal locations. Specifically, the paper explains that, while the "first leg" of both types of convergence bids settles in the Integrated Forward Market ("IFM"), the "second leg" of intertie convergence bids settles at the price determined in the Hour-Ahead Scheduling Process ("HASP") whereas the "second leg" of internal convergence bids settles at the price determined in the Real-Time Dispatch ("RTD"). This design has permitted participants to place convergence bids that are balanced with respect to the IFM (*e.g.,* equal quantities of virtual sales on interties and virtual purchases at internal locations), but act as pseudo convergence bids between the HASP and RTD markets, which lack the required mechanisms for convergence bidding. The paper further observes that HASP prices have been persistently below RTD prices, and that this has resulted in a net payment to convergence bids. Since the advent of convergence bidding in February 2011, the payments to "balanced virtual bids" submitted by individual Scheduling Coordinators ("SCs") has grown steadily, and presently total over $10 million per month.

These payments are presently recovered through the Real-Time Imbalance Energy Offset, which is paid pro rata on the basis of measured demand (metered load plus exports). CAISO observes that, contrary to the purpose of convergence bidding, balanced virtual bids by individual SCs "… do[] not contribute to any physical commitment nor do they contribute to the convergence of conditions and prices between the day-ahead and real-time market" (pg. 6). In other words, CAISO load and exports are paying some $10 million per month for an activity of no economic or system benefit.

Powerex agrees with CAISO that the outcomes to date are indicative of a significant design flaw requiring immediate attention. However, Powerex disagrees with CAISO's description of the causes of the escalating costs and with the proposed remedy – which amounts to a clawback on all otherwise-profitable balanced virtual bids submitted by individual SCs. A clawback of profits from rational convergence bidding activity is inappropriate and does little to address the root of the problem – persistent price divergence.

Instead, Powerex believes a comprehensive review of convergence bidding and the treatment of physical and convergence intertie schedules is necessary, and that developing emergency stop-gap measures such as those proposed are a misdirection of resources from achieving a sustainable long-term solution. Powerex therefore recommends that CAISO consider suspending

convergence bidding on the interties for a period no greater than 6 months, and use that time to make the more fundamental design improvements that are necessary.

In these comments, Powerex identifies three broad design principles that will lead to a more properly functioning market:

1. The current HASP algorithm contains a serious flaw, as it appears to inappropriately unwind IFM-RTD internal convergence awards, which should only be liquidated in RTD, thus undermining the convergence impact of these bids.

2. The root causes of persistent price divergence must be addressed. Where improvements to the market models can be made, they should be pursued. Where price divergence is the result of participants' behavior, such behavior should properly bear the cost according to standard principles of cost-causation.

3. CAISO -- and load and exports, as the ultimate guarantors of costs incurred by CAISO – will remain exposed to potential revenue imbalances so long as the quantities that settle in the HASP and RTD do not respectively net to zero. If an hour-ahead scheduling process is to be preserved (which Powerex believes is necessary), CAISO should consider a longer-term solution of replacing HASP with a binding Hour-Ahead market.

The rest of these comments address each recommendation, in turn.

Improper liquidation of IFM-RTD internal convergence awards in HASP

Powerex believes that the current HASP market rules may contain a fundamental flaw in their treatment of convergence awards. Specifically, it appears that the HASP algorithm includes a premature liquidation of internal convergence awards from a quantity perspective, which settle against the RTD price. This flaw creates divergence between the IFM and HASP, while undermining the convergence between the IFM and RTD that otherwise would occur. It may be the most significant reason why balanced virtual bids do not appear to reduce price divergence.

Consider the following example, with no HASP market, in which bid-in demand is 10,000 MW in the IFM; but metered load is expected to be 11,000 MW in RTD by market participants. In the absence of convergence bids, the participants would expect RTD prices to exceed IFM prices, as the 1,000 MW of real-time load must be met from a limited set of flexible resources dispatched above and beyond IFM levels. (Table 1)

Table 1. Without Convergence Bids or HASP				
	Quantity Awards		Financial Settlement	
	IFM	RTD	IFM	RTD
IFM Physical Demand	Buy 10,000		10,000	
IFM Physical Supply	Sell 10,000		(10,000)	
RTD Physical Demand		Buy 1,000		1,000
RTD Physical Supply		Sell 1,000		(1,000)

RTD Physical Demand above IFM Demand is met with additional RTD Physical Supply, causing RTD price to exceed IFM price.

Market participants that anticipate this price outcome may submit, say, 1,000 MW of virtual demand in the IFM and be dispatched. This would cause an additional 1,000 MW of Physical Supply to be committed in the IFM. In the RTD, when the virtual demand is liquidated and the

additional physical demand is revealed, total physical resources are fully adequate, and the only RTD settlement is a 1,000 MW virtual sale (*i.e.,* liquidation of the 1,000 MW IFM virtual purchase) to the 1,000 MW of load that was not bid into the IFM. Prices would converge, as desired. (Table 2)

Table 2. With Convergence Bids, no HASP				
	Quantity Awards		Financial Settlement	
	IFM	RTD	IFM	RTD
IFM Physical Demand	Buy 10,000		10,000	
IFM Physical Supply	Sell 11,000		(11,000)	
RTD Physical Demand		Buy 1,000		1,000
RTD Physical Supply		0		0
Internal Virtual Award	Buy 1,000	Sell 1,000	1,000	(1,000)

IFM Virtual Demand causes IFM and RTD price convergence, as expected additional RTD Physical Demand is met by IFM Physical Supply and no additional RTD Physical Supply is required.

Extending the previous example, consider the situation in which the HASP market operates and convergence bidding is enabled for internal resources only, settled between the IFM and RTD as above.

In the hour-ahead evaluation, it is known that there is 1,000 MW of virtual demand to liquidate in RTD. The fatal flaw appears to be that CAISO is effectively liquidating this 1,000 MW of virtual demand quantity in the HASP run, despite the fact that it settles against the RTD price. This undermines the ability of the IFM-RTD virtual award to create IFM-RTD convergence. This can result in an inappropriate DEC'ing of HASP interties (*i.e.*, exports) of up to 1,000 MW, *causing IFM-HASP divergence and only muted IFM-RTD convergence*.

In the example below it is assumed that 600 MW of intertie Physical Demand and 400 MW of internal Physical Demand comprise the most economic demand offers available in the HASP run to balance the prematurely liquidated IFM-RTD convergence award quantity. The result will be 600 MW of intertie Physical Demand (exports), which pay the HASP price, and 400 MW of advisory awards to internal Physical Demand. However, the 1,000 MW of additional IFM Physical Supply (committed to balance the 1,000 MW convergence demand award in the IFM) was intended to provide additional RTD supply only; instead, it is being used to balance HASP awards of intertie exports. (Table 3)

Table 3. With Convergence Bids and HASP (current algorithm)						
	Quantity Awards			Financial Settlement		
	IFM	HASP	RTD	IFM	HASP	RTD
IFM Physical Demand	Buy 10,000			10,000		
IFM Physical Supply	Sell 11,000			(11,000)		
HASP Physical Demand (export)		Buy 600			600	
HASP Physical Supply (import)						
RTD Physical Demand		Buy 400*	Buy 600**			1,000
RTD Physical Supply			Sell 600			(600)
Internal Virtual Award	Buy 1,000	Sell 1,000		1,000		(1,000)

* Non-binding 400 MW advisory award in HASP; settles at RTD

** In addition to 400 MW advisory HASP award; both awards settle at RTD

Premature IFM Virtual Demand liquidation results in inappropriate HASP Physical Demand awards, causing IFM-HASP price divergence and muting the intended IFM-RT price convergence.

This example illustrates a fatal flaw that appears to exist independent of any IFM-HASP convergence bidding activity on the interties. The fatal flaw is the failure of CAISO to "carry" the IFM-RTD internal convergence award quantities through the HASP, for subsequent liquidation in the RTD run. The solution to this flaw appears to be to force IFM-RTD internal convergence awards to be run in the HASP as self-schedules, resulting in the following outcome. (Table 4)

Table 4. With Convergence Bids and HASP (corrected algorithm)						
	Quantity Awards			Financial Settlement		
	IFM	HASP	RTD	IFM	HASP	RTD
IFM Physical Demand	Buy 10,000			10,000		
IFM Physical Supply	Sell 11,000			(11,000)		
HASP Physical Demand (export)						
HASP Physical Supply (import)						
RTD Physical Demand			Buy 1,000			1,000
RTD Physical Supply						
Internal Virtual Award	Buy 1,000		Sell 1,000	1,000		(1,000)

Note that this is the exact same outcome that is obtained when there is no HASP at all (Table 2), which is appropriate since <u>none</u> of the bids or offers are supplied in the HASP.

Under the corrected algorithm, the virtual award is not pre-maturely liquidated, and no additional physical supply is required in RTD. Consequently, prices converge across all three market timeframes. Moreover, CAISO's revenue neutrality is restored since the HASP and RTD settle equal quantities of supply and demand awards. This is in contrast to the current algorithm (Table 3) in which 600 MW of export are sold at the HASP price, but a net of 600 MW are procured at the RTD price, resulting in the CAISO being exposed to differences in the HASP and RTD prices. Powerex believes that replacing the current HASP algorithm with the proposed corrected algorithm may substantially eliminate the costs associated with balanced virtual bids. This solution directly addresses a root cause of the issue of escalating Real-Time Imbalance Energy Offset charges, in contrast to the clawback proposed by CAISO which merely addresses the outcome.

To summarize, the current HASP algorithm leads to the following undesirable outcomes:

- IFM-RTD convergence awards inappropriately depress HASP prices, which should be unaffected by this activity.

- IFM-RTD convergence awards have a muted impact on RTD prices (to the extent that HASP physical awards result instead of RTD awards).

The addition of intertie convergence bidding activity settled between the IFM and HASP appears to exacerbate the financial outcomes of the flaw. Specifically, in the case of balanced convergence bids, as identified by the CAISO and observed in the market, there appears to be no impact at all on the IFM, HASP or RT prices. To the extent that there exists persistent divergence between IFM and HASP or IFM and RTD (independent of convergence bidding activity), balanced convergence bids by the same or differing participants may result in persistent profits. These persistently profitable convergence bidding activities provide little, if any, market efficiency benefits.

Powerex recommends that the CAISO immediately review its treatment of internal IFM-RTD convergence bids in the HASP calculations, and consider implementing emergency changes that would preserve their price-converging properties. In short, the CAISO should:

1. Treat the IFM-RTD internal convergence demand/supply awards as self-schedules in the HASP market run, waiting to liquidate this IFM-RTD internal convergence award quantity in the subsequent RTD market run.

2. Continue providing binding HASP awards to interties but drop advisory HASP awards to internal resources and dynamic system resources. Alternatively, these HASP advisory awards could be generated through a second HASP run where the HASP self-schedule of IFM-RTD convergence awards are removed immediately after the binding HASP run for interties.

The underlying causes of price divergence must be identified and addressed

There are likely many additional reasons why prices across CAISO's markets do not converge, beyond the apparent design flaw described above. Powerex therefore recommends that CAISO suspend convergence bidding on the interties for a period not to exceed 6 months and conduct a comprehensive review. Such a review should address the following known issues, among others.

Non-performance of committed intertie resources

Intertie resources committed in the IFM that do not actually deliver energy in real-time cause CAISO to rely on a relatively limited set of flexible resources, leading to higher RTD prices. (This comment does not apply to IFM sales that are re-purchased in real-time due to prices falling across the markets, but rather to IFM resources that unwind their commitment because they *fail* to perform.) Similarly, IFM intertie resources that do not submit a valid etag until real-time are effectively providing a convergence intertie supply offer, but are being treated as IFM physical supply. These IFM intertie resources are able to effectively escape the uplift costs associated with the procurement of IFM RUC capacity that is charged to convergence supply awards, inconsistent with cost-causation principles. Given that the CAISO is generally a large net importer, non-performance of IFM commitments in the RTD will lead to pervasive procurement in real-time, and hence RTD prices that are higher than IFM prices.

While non-performance results in the participant paying the real-time (HASP or RTD) price to unwind its commitment, its impact is to depress the IFM prices to the detriment of those resources that do reliably perform on their commitments. Moreover, procurement of the necessary make-up energy from the limited set of flexible resources in the RTD will often be a suboptimal outcome compared to procurement of additional capacity in the IFM RUC had these system resources been appropriately treated as IFM convergence supply offers.

Insufficient IFM capacity procured and charged to variable resource imports

Variable resources -- such as wind or solar – will frequently be unable to deliver in real-time the same quantity that they forecast day-ahead and may have sold in the IFM. This is not improper in itself; it is just the nature of the resources. However, that variable nature implies that substitute resources will need to be arranged in real-time to cover the deviation, and that this will occur more frequently than for schedules that may be interrupted only in the event of conventional contingencies. Powerex believes that many of the imports sold in the IFM and scheduled as

"Firm" or "Unit Contingent" are curtailed significantly more frequently than those terms imply and significantly more frequently than permitted in other regions in WECC. Nevertheless, such schedules are not allocated a higher fraction of either IFM RUC costs or, alternatively, IFM operating reserve capacity. In terms of market outcomes, the same price applies in the IFM to import schedules that are highly reliable as to those that are less reliable. Cost-causation principles are likely being violated on multiple fronts. Effectively, load and exports are backstopping various costs that are reasonably attributable to the non-performance of variable resources on the interties that are inappropriately accepted by CAISO as "Firm" or "Unit Contingent" physical supply.

Sales in HASP are effectively non-binding

An intertie resource that sells energy in the 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) modest formula-based penalties for volumes beyond the first 10%. This clearly is not consistent with principles of cost-causation. A non-performing HASP sale forces CAISO to purchase that energy from internal resources in the RTD. Again, cost-causation principles are being violated with other participants bearing the costs associated with HASP non-performance. Failure to perform on HASP awards should be charged the RTD price, independent of the magnitude, frequency or reason for such failure.

Perverse incentives under CRR clawback rule

Participants that hold Congestion Revenue Rights ("CRRs") may have perverse incentives to schedule physical energy in the IFM independent of whether they are able or willing to show up in the HASP or RTD. This is due to the peculiar implementation of the CRR clawback rule, which claws back CRR revenue in any hour that the holder's liquidated intertie transaction exceeds a 10% threshold on congestion between the specified source and sink locations for the CRR. The clawback rule was intended to thwart behavior in which a participant deliberately caused congestion in order to increase the payoff on its CRR. This legitimate concern is not efficiently addressed by the current rule, however. The behavior of concern to CAISO is only profitable to the extent the CRR quantity (which receives the congestion payment) exceeds the quantity of the congestion-causing transaction (which pays the congestion payment). In fact, the clawback rule appears to exempt the very circumstances in which deliberate congestion-causing behavior is most profitable. An alternative implementation should be explored, such as a clawback that applies only to the excess portion of CRR holdings above the IFM physical and convergence awards that contribute to CRR congestion.

Insensitivity to convergence bids

While the foregoing is a partial list of issues leading to persistent price divergence, CAISO should also explore why convergence bids have thus far been ineffective at reducing or eliminating these price outcomes. As alluded to in the prior section, Powerex believes the HASP is failing to make proper use of internal convergence bids that are designed to be liquidated in the subsequent RTD.

Ensuring CAISO's revenue neutrality across markets

The motivating observation behind CAISO's discussion paper is the high level of uplift costs being borne by load and exports as a result of convergence bids taking an effective short HASP /

long RTD position. This is an unusual outcome, as other organized markets have implemented convergence bidding while maintaining revenue neutrality even in the face of persistent price divergence. The critical issue in the CAISO's market design, however, is that there is an imbalance between the quantity receiving the HASP price and the quantity paying it; the same imbalance can apply to RTD settlement.

Consider the simple example of an uncongested system in which a participant submits price-taking bids to purchase 1,000 MW at an intertie in the HASP. To award this export sale, the CAISO must either (a) accept supply bids on the interties; or (b) accept internal supply bids; or a combination of both.

If the lowest-price resources are on the interties, then these resources will be paid the same HASP price as is being charged to the export, and total payments will equal total receipts. If, however, the lowest-price resources are internal to the CAISO, it will issue a non-binding advisory award, but the internal resource will not settle at the HASP price. Instead, it will be dispatched in the RTD and paid the RTD price. In this case, the CAISO will have been paid the HASP price for the export award, but will pay the RTD price to the internal resources that it dispatched. In other words, the CAISO will be exposed to the difference between RTD and HASP prices. Given the persistent difference in those prices, CAISO's payments in this example will necessarily exceed its receipts. The CAISO is recouping those shortfalls through the uplift charges imposed on load and exports, often inconsistent with cost causation.

In order to minimize the use of uplift charges and to preserve revenue neutrality, CAISO's multi-settlement markets need closer alignment. That is, binding sales awards should be balanced with binding purchase awards within the same market timeframe. One possibility is to make HASP results binding only with respect to quantities on the interties; actual settlement would be at the RTD price. This approach is used in some eastern RTOs, and achieves revenue neutrality. However, this approach is also recognized as leading to highly inefficient real-time intertie scheduling, with high fractions of "false positive[1]" and "false negative[2]" outcomes. Given CAISO's reliance on imports, there may be a significant risk premium to be paid if suppliers are required to commit to quantities that may settle at prices below their offers.

A better longer-term alternative is to convert the HASP to a full binding Hour-Ahead market both for intertie awards and for internal awards. This would restore revenue neutrality in each of the market timeframes, while maintaining efficient real-time intertie scheduling and intertie supply liquidity.

Conclusions

The rise in Real-Time Cost Offset is indicative of various performance issues with CAISO's multi-settlement market design. CAISO's proposed solution is merely a stop-gap measure intended to rein in costs. Powerex strongly urges a more proactive approach, consisting of:

1. an emergency change to treat internal convergence awards as self-schedules in the HASP;

---

[1] False positives are offers (bids) that clear based on HA prices but regret it because the binding RT prices are too low (too high).
[2] False negatives are bids or offers that do not clear based on HA prices but would have cleared under the binding RT prices.

2. the immediate suspension of convergence bidding on the interties for no greater than 6 months; followed by

3. a thorough examination of the root causes of price divergence and how these might be addressed, consistent with cost causation principles.

This approach will make more effective use of CAISO and stakeholder resources than developing and implementing the proposed settlement rule.