

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

| Submitted By | Company or Entity | Date Submitted |
|------------------------------|-------------------|----------------|
| Gifford Jung 604-891-6040 | Powerex Corp. | June 1, 2011 |

On April 27, 2011, the California Independent System Operator Corporation (“CAISO”) issued a document entitled “Impact of Convergence Bidding on Real-Time Imbalance Energy Offset”. Powerex Corp. (“Powerex”) submitted comments on May 11, and CAISO issued its revised proposal on May 18. Powerex is pleased to provide comments on the revised proposal.

In its initial comments, Powerex described a design flaw in the manner that internal convergence bids are handled in the Hour Ahead Scheduling Process (“HASP”). Specifically, Powerex explained that the current approach improperly liquidates internal convergence bids in the HASP, whereas they should be conserved until the Real Time Dispatch (“RTD”). Powerex also highlighted several potential causes of underlying price divergence. Additionally, other stakeholders proposed a range of recommendations intended to improve convergence of prices across the three markets. Having reviewed the stakeholder comments, Powerex believes the recommendations should be considered in three phases:

- **Immediately:** adopt the Powerex HASP rule, and also a rule that charges HASP awards that fail to perform in Real Time the RTD price;
- **Near term:** review the remaining causes of the Real Time Imbalance Energy Offset and address these causes directly consistent with cost-causation principles; and
- **Long term:** upon implementation of the first two sets of changes, re-evaluate market convergence to determine if additional changes are merited, including alternative HASP market designs such as a potential full HAM market.

Powerex further recommends that the CAISO consider suspending convergence bidding on the interties and/or internally for a period of up to six months in the event that the CAISO is unable to quickly implement the necessary changes to ensure that price convergence is achieved, on average, between the IFM, HASP and RTD markets. It is important to recognize that the sole purpose of convergence bidding is to improve the efficiency of commitment and dispatch of physical resources in the CAISO markets. While participants who enter into virtual transactions may do so to manage their exposure to prices in the different markets, it is not the core purpose of convergence bidding – or CAISO in general – to provide a platform for market participants to execute risk management transactions. Convergence bidding activity should only be enabled to the extent it is designed and implemented in a manner that achieves its intended purpose.

Immediate Changes

In its comments, Powerex identified various market design issues that it believes contribute to persistent price divergence across the CAISO’s IFM, HASP and RTD markets. We recommend that changes be prioritized and implemented in a phased manner, to achieve immediate results from the most critical changes.

Two changes should be considered for immediate implementation. First, the proposed HASP rule would address a fundamental flaw, which presently undermines the convergence-enhancing effects of internal virtual bids. Second, the settlement of non-performing HASP dispatches at the RTD price would

appropriately align the costs of non-performance with cost-causation principles, encouraging HASP and RTD price convergence.

1, Proposed Powerex HASP Rule

Powerex has further refined its proposal and developed an explicit rule governing the net change that CAISO should be permitted to make to the resource balance in the HASP:

1. Permitted HASP DEC Qty. = MAX [0 , Desired DEC – IFM Internal Net Virtual Load]
2. Permitted HASP INC Qty. = MAX [0 , Desired INC – IFM Internal Net Virtual Supply]

Where “Desired INC/DEC” is CAISO’s evaluation of committed resources relative to the load forecast at the time of the HASP.

The effect of the rule is to create a “deadband” in the HASP that is equal to the net resources committed in the IFM as a result of internal virtual bids. These virtual bids reflect an amount of resources that market participants intended to shift between IFM and RTD via their virtual bids. The proposed rule preserves this shift until the RTD, and prevents CAISO’s judgment in the HASP run from undermining the financial commitments entered into by participants - and the appropriate physical dispatch and price consequences of these commitments.

In Appendix A to these comments, we present a series of examples of how the proposed HASP rule would work under a range of different scenarios. Importantly, the rule results in appropriate dispatch and price signals in each market regardless of whether the market cleared “too many” or “too few” virtual trades either internally and/or on the interties. Moreover, the rule would not interfere with CAISO adjusting resources commitments in the HASP to the extent the desired adjustment exceeds the net internal virtual transactions, or if it is in the opposite direction. Finally, the rule appropriately handles the situation of offsetting quantities of internal and intertie virtual demand/supply awards, causing appropriate physical dispatch and price consequences between the HASP and RTD.

2. Non-Performance of HASP Intertie Awards settled at RTD price

The current settlement of non-performing HASP intertie dispatches clearly departs from cost-causation principles by not liquidating the non-performing award at the RTD price. This settlement is in contrast to non-performance of IFM intertie awards which are appropriately charges the RTD price. While there may be both legitimate and unavoidable reasons why a participant may fail to deliver on a physical award in either the IFM or HASP market, it is nonetheless highly appropriate to charge those participants the costs of such non-delivery. This provides an essential price signal to encourage performance of physical awards.

Charging participants something less than the costs of their non-performance is a clear invitation to participants to submit offers despite knowing they may not be able to perform. Moreover, such misalignment of non-performance charges of HASP awards with cost causation principles can lead to systemic and substantial unintended market consequences. One example of these unintended consequences is escalating Real-Time Imbalance Energy Offset charges due to price divergence between the HASP and RTD which may be largely driven by, or at least exacerbated by, the non-performance of HASP intertie awards.

Near-Term

Additional changes should be pursued but likely will require additional discussion before they can be implemented. In particular, the remaining underlying causes of the Real-Time Imbalance Energy Offset should be identified and where possible, market changes should be implemented which more directly align costs incurred with cost causation principles. For example, interruptible energy imports that are misrepresented as Firm or Unit Contingent imports, may result in additional capacity or start-up costs incurred by the CAISO which become borne by load and exports through uplift charges. A more appropriate mechanism would be to directly charge capacity costs and start-up costs to those causing the dispatch.

Long-Term

Powerex expects that a considerable part of the current lack of price convergence may be resolved by implementing the aforementioned changes. After these changes are implemented and there is sufficient experience to yield a view on the efficacy of the changes, the need for additional improvements should be evaluated.

Additional long-term changes may include alternative HASP market designs. While there are several alternative HASP market designs which may have merit, Powerex cautions against moving too quickly in this direction. Alternative HASP market designs may yield their own unintended consequences, especially if they are implemented without thorough analysis and consideration. These alternative market designs may also necessitate substantial changes to several other market design elements, including the re-design and/or elimination of the virtual bidding intertie framework. Of the various potential alternative HASP market designs discussed by the CAISO and market participants through the stakeholder processes, Powerex believes a full HAM market which includes binding commitments for both intertie and internal resources and demand has early promise.

Appendix A

- Appended following are Slides that Illustrate the Powerex proposal under various virtual supply/virtual load scenarios with a “Proposed HASP Rule”;
- Appended separately are:
 - HASP Rule Summary Table – Summary Table for various scenarios that compare the current HASP rule with the Proposed HASP rule;
 - HASP Rule Virtual Demand Examples – Table showing how Proposed HASP rule would work with various virtual demand scenarios;
 - HASP Rule Virtual Supply Examples – Table showing how Proposed HASP rule would work with various virtual supply scenarios; and
 - HASP Rule Overlapping Examples – Table showing how Proposed HASP rule would work with both overlapping virtual supply and demand scenarios

SLIDES ILLUSTRATING POWEREX PROPOSED HASP RULE

Proposed rule to carry internal convergence bids to RTD

- Current market algorithm improperly liquidates internal virtual bids in HASP rather than carrying to RTD
 - Virtual load in IFM results in additional commitment of resources;
 - In HASP evaluation, CAISO perceives system as "long" relative to its load forecast, and hence DECS resources in HASP
 - In RTD, if CAISO forecast proves "wrong" but virtual participants were "right", CAISO must re-purchase the energy it just sold in the HASP
- Proposed rule would prevent CAISO from prematurely liquidating internal virtual bids
 - Creates a "deadband" within which CAISO may not rebalance resources in HASP
 - Does not prevent CAISO from adjusting resources if imbalance exceeds deadband
- Proposed HASP rule:
 - Permitted HASP DEC Qty. = MAX [0 , Desired DEC – IFM Internal Net Virtual Load]
 - Permitted HASP INC Qty. = MAX [0 , Desired INC – IFM Internal Net Virtual Supply]

Summary of proposed rule under different scenarios

| Phys. Load | IFM Awards | | Total | HASP Load Forecast | Actual Load | Real Time Awards | | | |
|------------|---------------|----------------|--------|--------------------|-------------|-------------------------|---------|---------|-------------------|
| | Internal Load | Virtual Supply | | | | Current Algorithm HASP* | RTD | HASP* | Proposed Rule RTD |
| 10,000 | - | - | 10,000 | 10,000 | 11,000 | - | 1,000 | - | 1,000 |
| 10,000 | 1,000 | - | 11,000 | 10,000 | 11,000 | (1,000) | 1,000 | ↑ | ↓ |
| 10,000 | 500 | - | 10,500 | 10,000 | 11,000 | (500) | 1,000 | ↑ | ↓ 500 |
| 10,000 | 2,000 | - | 12,000 | 10,000 | 11,000 | (2,000) | 1,000 | ↑ | ↓ (1,000) |
| 10,000 | 500 | - | 10,500 | 11,000 | 11,000 | 500 | - | 500 | - |
| 10,000 | 1,000 | - | 11,000 | 9,500 | 11,000 | (1,500) | 1,500 | ↑ (500) | ↓ 500 |
| 12,000 | - | - | 12,000 | 12,000 | 11,000 | - | (1,000) | - | (1,000) |
| 12,000 | - | (1,000) | 11,000 | 12,000 | 11,000 | 1,000 | (1,000) | ↓ | ↑ |
| 12,000 | - | (500) | 11,500 | 12,000 | 11,000 | 500 | (1,000) | ↓ | ↑ (500) |
| 12,000 | - | (2,000) | 10,000 | 12,000 | 11,000 | 2,000 | (1,000) | ↓ | ↑ 1,000 |
| 12,000 | - | (500) | 11,500 | 11,000 | 11,000 | (500) | - | (500) | - |
| 12,000 | - | (1,000) | 11,000 | 12,500 | 11,000 | 1,500 | (1,500) | ↓ 500 | ↑ (500) |

*HASP awards include awards on internal INCs or DECS, which are advisory and settle at the RTD price, but nevertheless affect the HASP price

Arrows indicate expected market prices relative to Current Algorithm

- Current rule effectively undermines convergence bids by prematurely liquidating them in the HASP.
- Proposed rule would require CAISO to preserve the net resource position implied by virtual bids, carrying it to RTD as intended.
- Proposed rule would improve market convergence
- For balanced intertie/internal convergence bids, only the internal awards are carried to RTD; intertie awards liquidate in HASP. Thus such bids would improve HASP/RTD convergence, whereas at present they do not affect any of the markets

Internal virtual bids are liquidated in HASP, undermining convergence

| | Current algorithm | | |
|-----------------|-------------------|-----------------------|--------------------|
| | IFM | HASP | RTD |
| Bid Demand | 10,000 | | |
| Internal | | | |
| Virtual Load | 1,000 | | |
| Virtual Supply | - | | |
| | | CAISO Forecast 10,000 | |
| | | Change (1,000) | |
| | | | Actual Load 11,000 |
| | | INC awards - | INC awards 1,000 |
| | | DEC awards (1,000) | DEC awards - |
| Total resources | 11,000 | 10,000 | 11,000 |

- CAISO forecast in HASP indicates long resource position, so sells 1,000 MW in HASP.
- Buys it all back in RT (generally at higher price due to smaller pool of flexible resources).
- Awards imply higher prices in RT than in IFM, but prices in HASP are same or lower than in IFM (i.e., poor convergence, despite the exact correct level of convergence bids).

Proposed rule carries internal virtual bids into Real Time

| | Current algorithm | | | | Proposed rule | | |
|-----------------|-------------------|-----------------------|--------------------|-----------------|---------------|----------------------------|--------------------|
| | IFM | HASP | RTD | | IFM | HASP | RTD |
| Bid Demand | 10,000 | | | Bid Demand | 10,000 | | |
| Internal | | | | Internal | | | |
| Virtual Load | 1,000 | | | Virtual Load | 1,000 | | |
| Virtual Supply | - | | | Virtual Supply | - | | |
| | | CAISO Forecast 10,000 | | | | CAISO Forecast 10,000 | |
| | | Change (1,000) | | | | Forecast imbalance (1,000) | |
| | | | Actual Load 11,000 | | | Deadband to carry (1,000) | |
| | | | | | | Allowed change - | |
| | | INC awards - | INC awards 1,000 | | | | Actual Load 11,000 |
| | | DEC awards (1,000) | DEC awards - | | | INC awards - | INC awards - |
| | | | | | | DEC awards - | DEC awards - |
| Total resources | 11,000 | 10,000 | 11,000 | Total resources | 11,000 | 11,000 | 11,000 |

- Internal virtual load creates a "deadband" – a minimum long HASP position – that limits CAISOs ability to DEC resources in the HASP.
- Deadband forces CAISO to carry the IFM resources associated with internal virtual load into RT, as intended
- In this example, virtual participants were correct, and the additional IFM resources were just enough to serve actual load.

Proposed rule works when virtual bids are *less* than optimal

| Current algorithm | | | Proposed rule | | |
|-------------------|----------------|-------------|-----------------|--------------------|-------------|
| IFM | HASP | RTD | IFM | HASP | RTD |
| Bid Demand | 10,000 | | Bid Demand | 10,000 | |
| Internal | | | Internal | | |
| Virtual Load | 500 | | Virtual Load | 500 | |
| Virtual Supply | - | | Virtual Supply | - | |
| | CAISO Forecast | 10,000 | | CAISO Forecast | 10,000 |
| | Change | (500) | | Forecast imbalance | (500) |
| | | Actual Load | | Deadband to carry | (500) |
| | | 11,000 | | Allowed change | - |
| | INC awards | 1,000 | | | Actual Load |
| | DEC awards | - | | INC awards | 500 |
| | | | | DEC awards | - |
| Total resources | 10,500 | 11,000 | Total resources | 10,500 | 11,000 |

- Proposed rule prevents CAISO from selling its perceived 500 MW long position in HASP.
- In RTD, needs to INC an additional 500 MW.
- Under current algorithm, CAISO would DEC 500 MW in HASP, and INC 1,000 MW in RTD.
- Proposed rule would raise HASP prices, lower RTD price compared to current algorithm.
- RTD price would still exceed IFM price, indicating that additional virtual load bids would have been profitable.

Proposed rule works when virtual bids are *more* than optimal

| Current algorithm | | | Proposed rule | | |
|-------------------|----------------|-------------|-----------------|--------------------|-------------|
| IFM | HASP | RTD | IFM | HASP | RTD |
| Bid Demand | 10,000 | | Bid Demand | 10,000 | |
| Internal | | | Internal | | |
| Virtual Load | 2,000 | | Virtual Load | 2,000 | |
| Virtual Supply | - | | Virtual Supply | - | |
| | CAISO Forecast | 10,000 | | CAISO Forecast | 10,000 |
| | Change | (2,000) | | Forecast imbalance | (2,000) |
| | | Actual Load | | Deadband to carry | (2,000) |
| | | 11,000 | | Allowed change | - |
| | INC awards | 1,000 | | | Actual Load |
| | DEC awards | - | | INC awards | - |
| | | | | DEC awards | (1,000) |
| Total resources | 12,000 | 11,000 | Total resources | 12,000 | 11,000 |

- Proposed rule prevents CAISO from selling its perceived 2,000 MW long position in HASP.
- In RTD, needs to DEC 1,000 MW.
- Under current algorithm, CAISO would DEC 2,000 MW in HASP, and INC 1,000 MW in RTD.
- Proposed rule would raise HASP prices, lower RTD price compared to current algorithm.
- RTD price likely lower than IFM price, making this level of virtual load bidding unprofitable and thus discouraging it.

Proposed rule works when CAISO forecast is correct

| Current algorithm | | | Proposed rule | | |
|-------------------|----------------|-------------|-----------------|--------------------|-------------|
| IFM | HASP | RTD | IFM | HASP | RTD |
| Bid Demand | 10,000 | | Bid Demand | 10,000 | |
| Internal | | | Internal | | |
| Virtual Load | 500 | | Virtual Load | 500 | |
| Virtual Supply | - | | Virtual Supply | - | |
| | CAISO Forecast | 11,000 | | CAISO Forecast | 11,000 |
| | Change | 500 | | Forecast imbalance | 500 |
| | | Actual Load | | Deadband to carry | (500) |
| | | 11,000 | | Allowed change | 500 |
| | INC awards | 500 | | | Actual Load |
| | DEC awards | - | | INC awards | 500 |
| | | DEC awards | | DEC awards | - |
| | | - | | | 11,000 |
| Total resources | 10,500 | 11,000 | Total resources | 10,500 | 11,000 |

- Proposed rule does not prevent CAISO from making HASP awards if its evaluation indicates an imbalance in the direction opposite the net virtual bids.
- In this case, proposed rule prevents CAISO from selling out of a perceived long position; CAISO may still INC resources if it perceives a short position.

Proposed rule allows CAISO to make HASP awards outside of deadband

| Current algorithm | | | Proposed rule | | |
|-------------------|----------------|-------------|-----------------|--------------------|-------------|
| IFM | HASP | RTD | IFM | HASP | RTD |
| Bid Demand | 10,000 | | Bid Demand | 10,000 | |
| Internal | | | Internal | | |
| Virtual Load | 1,000 | | Virtual Load | 1,000 | |
| Virtual Supply | - | | Virtual Supply | - | |
| | CAISO Forecast | 9,500 | | CAISO Forecast | 9,500 |
| | Change | (1,500) | | Forecast imbalance | (1,500) |
| | | Actual Load | | Deadband to carry | (1,000) |
| | | 11,000 | | Allowed change | (500) |
| | INC awards | 1,500 | | | Actual Load |
| | DEC awards | (1,500) | | INC awards | 500 |
| | | DEC awards | | DEC awards | - |
| | | - | | | 11,000 |
| Total resources | 11,000 | 11,000 | Total resources | 11,000 | 11,000 |

- In this example, CAISO's HASP evaluation is that it is long 1,500 MW. Proposed rule permits CAISO to liquidate its perceived long position to the extent it exceeds the virtual load awards of 1,000 MW (i.e., it may DEC 500 MW in HASP).

Proposed rule improves HASP-RTD convergence, relieving Offset issue (1)

| Current algorithm | | | Proposed rule | | |
|-------------------|-----------------------|-------------|-----------------|---|-------------|
| IFM | HASP | RTD | IFM | HASP | RTD |
| Bid Demand | 10,000 | | Bid Demand | 10,000 | |
| Internal | | | Internal | | |
| Virtual Load | 500 | | Virtual Load | 500 | |
| Virtual Supply | - | | Virtual Supply | - | |
| Intertie | | | Intertie | | |
| Virtual Load | - | | Virtual Load | - | |
| Virtual Supply | (500) | | Virtual Supply | (500) | |
| | CAISO Forecast change | Actual Load | | CAISO Forecast | Actual Load |
| | | 11,000 | | 10,000 | 11,000 |
| | INC awards | INC awards | | Resources for expiring virtuals | 500 |
| | DEC awards | DEC awards | | Total resources | 10,500 |
| | | - | | Forecast imbalance | (500) |
| Total resources | 10,000 | 11,000 | | Deadband to carry internal virtuals to RT | (500) |
| | | | | Allowed change | - |
| | | | | INC awards | 500 |
| | | | | DEC awards | - |
| | | | Total resources | 10,000 | 11,000 |

- In current algorithm, opposing internal and intertie convergence bids cancel out in HASP.
- Do not affect prices in any market (IFM, HASP or RTM). Due to price divergence, however, such bids entail payments recovered through uplift costs.
- Under proposed rule, only intertie virtual bids expire in the HASP. Internal virtual bids must be carried through to RTD.
- In this example, CAISO INCs 500 MW in HASP and another 500 MW in RTD. Implies higher HASP and lower RTD prices than current algorithm (and hence improved convergence).

Proposed rule improves HASP-RTD convergence, relieving Offset issue (2)

| Current algorithm | | | Proposed rule | | |
|-------------------|-----------------------|-------------|-----------------|---|-------------|
| IFM | HASP | RTD | IFM | HASP | RTD |
| Bid Demand | 10,000 | | Bid Demand | 10,000 | |
| Internal | | | Internal | | |
| Virtual Load | 2,000 | | Virtual Load | 2,000 | |
| Virtual Supply | - | | Virtual Supply | - | |
| Intertie | | | Intertie | | |
| Virtual Load | - | | Virtual Load | - | |
| Virtual Supply | (2,000) | | Virtual Supply | (2,000) | |
| | CAISO Forecast change | Actual Load | | CAISO Forecast | Actual Load |
| | | 11,000 | | 10,000 | 11,000 |
| | INC awards | INC awards | | Resources for expiring virtuals | 2,000 |
| | DEC awards | DEC awards | | Total resources | 12,000 |
| | | - | | Forecast imbalance | (2,000) |
| Total resources | 10,000 | 11,000 | | Deadband to carry internal virtuals to RT | (2,000) |
| | | | | Allowed change | - |
| | | | | INC awards | 2,000 |
| | | | | DEC awards | (1,000) |
| | | | Total resources | 10,000 | 11,000 |

- As quantity of overlapping intertie/internal virtual bids increases, the price effects in HASP and RTD become more pronounced.
- In this example, CAISO INCs 2,000 MW in HASP, but DEC 1,000 MW in RTD (reflecting very high internal virtual load awards in IFM).
- Convergence is properly proportional to quantity of virtual bids.