Comments of Pacific Gas and Electric Company

Response to WPTF Presentation on RTIEO

Submitted by		Company	Date Submitted
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Pacific Gas & Electric (PG&E) submits these comments in response to the presentation given by Western Power Trading Forum[1] (WPTF) on July 19, 2011. The presentation was given as part of a CAISO stakeholder meeting on the Real-Time Imbalance Energy Offset (RTIEO) Initiative[2].

PG&E appreciates the effort made by WPTF to quantify the value of convergence bidding at the interties and recognizes the difficulty of the undertaking since market participants have incomplete data. PG&E has evaluated WPTF's analysis and conclusions.

Based on our evaluation and the analysis provided by the Department of Market Monitoring (DMM), the benefits to the market and load as argued by WPTF appear significantly overstated. Given the known uplift cost created for load by intertie convergence bidding, PG&E continues to strongly support the elimination of such bidding until the Real-Time (RT) market is redesigned.

In general, PG&E makes the following two conclusions regarding the WPTF presentation:

- WPTF's estimation that convergence bidding at the interties results in an annual benefit to load of over $300 million is likely significantly overstated. PG&E's analysis suggests that the benefit to load from such bidding is much smaller.
- The hedging benefits for physical intertie schedules described by WPTF do not appear as significant or widely used as implied in the presentation. This conclusion is based on the discussion and data provided by the DMM and PG&E's own operational experience.

[1] Presentation: Intertie Convergence Bidding in CAISO Markets, WPTF, July 19, 2011, http://www.caiso.com/Documents/WPTF_Presentation-IntertieConvergenceBidding_ISOMarkets.pdf

[2] CAISO Presentation on Impact of Convergence Bidding on Interties, July 19, 2011, http://www.caiso.com/Documents/Presentation-Real-TimeImbalanceEnergyOffset_2011_StakeholderMeetingJul_19_2011.pdf

1. Summary of WPTF Presentation

Convergence Bidding on the Interties Results in Over $300 Million of Annual Savings to Load

In the first part of its presentation WPTF calculates that convergence bidding on the interties provides an annual benefit to load of over $300 million. This calculation is based on the following WPTF-derived factors:

- 500 MW of excess virtual supply exists on the interties during all hours after subtracting balanced and offsetting internal virtual positions;
- Every MW increase in virtual supply reduces the price paid by load $.003/MWh;
- Average load is 25,000 MW.

Virtual Bidding at the Interties Serves a Significant Hedging Role

In the second part of its presentation, WPTF argues that convergence bidding serves a significant role in hedging physical intertie schedules. Specifically WPTF points to the role of intertie convergence bids in managing deliveries of variable generation to meet California's Renewable Portfolio Standard (RPS).

2. Comments on Market Savings Produced by Intertie Convergence Bidding

PG&E's analysis of WPTF's assessment on the benefit to load of intertie convergence bidding leads us to conclude that the $300 million value is likely significantly overstated. Specifically:

A. The Average Tie Virtual Supply above Balanced Virtual Volume (Excess Tie Virtual Supply) of 500 MW may be overstated;

B. WPTF's price impact of virtual supply ($0.003/MWh) appears significantly overstated;

C. WPTF's analysis does not include the impact to load that is priced through bilateral contracts rather than the spot market, thereby overstating the benefit; and

D. WPTF's analysis does not include the impact of higher RT prices paid by load, thereby overstating the benefit.

Each of these is discussed in more detail below.

A. The Excess Tie Virtual Supply Value of 500 MW May be Overstated

WPTF appears to calculate the Excess Tie Virtual Supply as:

Eq. 1: Excess Tie Virtual Supply = (Net Tie VS) – (Balanced Virtuals Volume)

Where: Balanced Virtuals Volume is defined as:

Eq. 2: Balanced Virtuals Volume = Min((Tie VS – Tie VD), (Internal VD – Internal VS))

Expanding the term "Net Tie VS" into its constituent parts and substituting Eq. 2 into Eq. 1 yields:

Eq. 3: Excess Tie Virtual Supply =

= (Tie VS – Tie VD) - Min((Tie VS – Tie VD), (Internal VD – Internal VS))

These definitions are an artifact of the fact the participants only have access to net intertie and net internal virtual bid amounts. The method used to estimate the Excess Tie Virtual Supply reflects this data limitation (i.e., the calculation uses net values). The effect is that internal virtual supply may be incorrectly counted as reducing the amount of Balanced Virtual Bids, thereby overstating Excess Tie Virtual Supply.

This effect is demonstrated in a simple example below. A mathematical proof of the effect is provided as an appendix at the end of these comments.

Numerical Example Showing How Excess Tie Virtual Supply May Be Overstated

Case 1: Assume a market where there is only one market participant. This market participant has executed a balanced virtual trade to arbitrage the systematic price difference between the Hour Ahead Scheduling Process (HASP) and the RT market. Their portfolio is summarized below:

	Internal	**Interties**
Participant 1	100 MW virtual demand	100 MW virtual supply

Calculating the Excess Tie Virtual Supply using Equation 3 yields the following:

Excess Tie Virtual Supply =

= (Tie VS - Tie VD) - Min((Tie VS – Tie VD), (Internal VD – Internal VS))

= (100 - 0) - Min((100 - 0), (100 – 0)

= (100) - Min(100, 100)

= 0

For this case, Equation 3 calculates correctly that there is no Excess Tie Virtual Supply.

Case 2: Now consider a situation with two market participants. The first market participant executes the same balanced virtual bid as above. The second market participant submits a non-balanced internal virtual supply bid. The portfolios of both participants are summarized below, and the Excess Tie Virtual Supply is calculated.

	Internal	**Interties**
Participant 1	100 MW virtual demand	100 MW virtual supply
Participant 2	50 MW virtual supply	

Excess Tie Virtual Supply =

= (Tie VS - Tie VD) - Min((Tie VS – Tie VD), (Internal VD – Internal VS))

= (100 – 0) – Min((100 – 0), (100 – 50))

= (100) – Min(100, 50)

= 100 – 50

= 50

For this case, Equation 2 calculates the Excess Tie Virtual Supply incorrectly. As in case 1, the Excess Tie Virtual Supply is zero. However, the effect of the 50 MW internal virtual supply bid is to reduce the Balanced Virtual Bids by 50 MW and overstate Excess Tie Virtual Supply by 50 MW.

Without access to the gross cleared bids, it is not possible to correctly quantify this effect. However, it is fair to say that this effect may have led to an over-estimation of the Excess Tie Virtual Supply in the WPTF assessment.

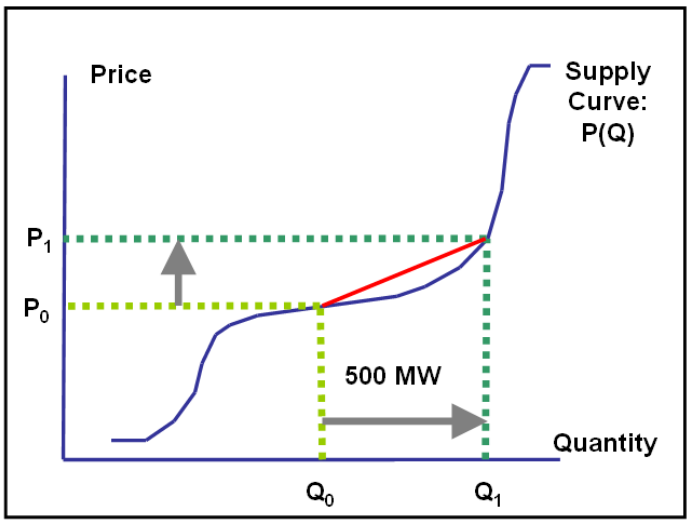
B. WPTF's Price Impact of Intertie Virtual Supply of $0.003/MWh Appears Significantly Overstated

WPTF estimated a price decrease of $0.003 for each MW of intertie virtual supply. This value was determined by WPTF based on "some reasonable observations". To verify this value, PG&E conducted a rigorous analysis of hourly supply curves using public bid data and calculated a median supply curve slope of $0.0016/MWh, roughly half of WPTF's value. The difference in this variable would roughly cut in half WPTF's estimated benefit.

PG&E's analysis used publicly available bid data between February 1, 2011 and April 30, 2011. This period was chosen because it represented three full months after the start of convergence bidding with available physical and virtual supply bids. From this data set we constructed 2,136 individual hourly supply curves. From each curve we calculated a slope by determining the increase in price associated with the removal of 500 MWs of supply. Finally, PG&E determined the median value of the 2,136 supply curve slopes ($0.0016/MWh).

This methodology is shown graphically in Figure 1 below.

Figure 1 - Methodology to Determine Supply Curve Slope



The steps to determine the slope of the supply curve:

1. P_0 is the actual Day-Ahead (DA) clearing price in that hour.
2. Using the hourly supply curve, find quantity Q_0 corresponding to P_0.
3. Quantity Q_1 is Q_0 plus 500 MWs.
4. Using the supply curve, find Price P_1 corresponding to quantity Q_1.
5. Calculate the supply curve slope (the red line) as $(P_1 – P_0) / (Q_1 – Q_0)$.

C. The Impact of Load Priced Through Bilateral Contracts Is Not Factored into the WPTF Analysis

Only a fraction of WPTF's estimated 25,000 MW average hourly load is settled based on day-ahead spot market prices. The majority of generation PG&E uses to meet its load is settled via bilateral contracts and is not directly exposed to market prices. While it is correct that spot prices indirectly affect forward prices, this effect is only noticeable if the price trends are sustained. It is unclear what effect convergence bidding will have on bilateral prices in the long-term. What is clear is that in the short-term most of PG&E's load is not exposed to the DA price, and therefore, the WPTF analysis overstates the benefit.

D. The Impact of Higher Real-time Prices Paid by Load Is Not Factored into WPTF Analysis

Convergence bidding by design produces opposite price effects in the DA and RT markets. If the Excess Tie Virtual Supply is decreasing the DA prices, then there should be an opposite effect on the RT prices. Although the impact may not be great (a relatively small amount of load is settled based on the RT price), the WPTF analysis fails to include the increase in RT load prices in calculating the benefit.

3. Comments on Use of Intertie Convergence Bidding to Hedge

In the second part of its presentation, WPTF argues that convergence bidding serves a significant role in hedging physical intertie schedules and is used extensively to manage deliveries of variable generation to meet California's RPS. Specifically, WPTF asserts that such bidding can lower RPS delivery contract prices because variable resources can:

- Secure DA CAISO transmission with firm congestion prices;
- Capture more predictable DA market prices;
- Buy only transmission to CA that is needed for actual intermittent production; and
- Schedule in HASP more accurate physical deliveries of RPS.

The perceived hedging benefits were largely refuted by the DMM in its August 5th comments.[3] The DMM is in a better position than market participants to comment on these issues since it has access to all of the detailed virtual bidding data.

Little Evidence That Intertie Virtual Demand Is Currently Used to Hedge Physical Imports

The DMM found almost no evidence of physical imports hedging against price risk with intertie virtual demand bids. The DMM noted that of the over 7,000 MW per hour of average imports, only about 11 MW per hour of virtual demand is scheduled by entities with cleared day-ahead physical imports at the same intertie, a *de minimis* amount. This conforms to PG&E's operational experience.

PG&E also notes that virtual demand bids are not a particularly effective tool to hedge import contracts. For PG&E, most of our import contracts are scheduled as Western System Power Pool (WSPP) firm power and are delivered to the CAISO even if the source generator experiences an outage. In the event that this occurs, the neighboring balancing area authority (BAA) keeps the schedule whole and settles with the resource after the fact. The settlement arrangement with the external BAA does not necessarily correlate with the CAISO's HASP price, which is unaffected by the outage.

Use of Intertie Virtual Supply to Hedge Intermittent Imports Offers Questionable Benefits

The DMM also concluded that the use of virtual supply bids is no more effective than the use of physical schedules in avoiding the purchase of excess transmission for intermittent imports. In both cases, the resource can wait until shortly before HASP to purchase and tag transmission according to the resource's hour-ahead forecast.

The DMM does observe that using virtual supply bids at the intertie allows an intermittent resource to get the DA price but avoid the HASP Reversal Rule for any decrease in RT output as compared to the DA schedule. This would seem to provide a motivation for physical imports to schedule via virtual bids in the DA market and thus adversely affect the Residual Unit Commitment calculation

[3] DMM Comments on RTIEO Draft Final Proposal, August 5, 2011, http://www.caiso.com/Documents/DMM_Comments_Real-TimeImbalanceEnergyOffsetDraftFinalProposal.pdf

by under representing physical imports expected in RT. This appears to PG&E as another reason to eliminate convergence bidding at the interties.

4. Concluding Comments

PG&E Is Not Persuaded by WPTF's Analysis or Arguments

PG&E is not persuaded by WPTF that convergence bidding at the interties should be maintained. The benefits of intertie convergence bidding, if material, are difficult to quantify, and PG&E believes WPTF has greatly overestimated the benefits to load. The theoretical hedging benefits delineated by WPTF seem illusionary and not borne out by data, as explained by the DMM. Conversely, the costs to load related to balancing and offsetting virtual bids can be easily calculated and is currently adding millions of dollars each month to the RTIEO uplift allocated to load. Unless a more compelling case can be made for maintaining convergence bidding at the interties, PG&E strongly supports its elimination until the RT market is redesigned.

APPENDIX

Proof that calculation of Net Tie VS above Balanced Virtuals Volume includes Internal VS.[4]

1. **WPTF's 500 MW value attributable to intertie virtual supply appears to be calculated as follows:**

   Net Tie VS above Balanced Virtuals Volume = (Net Tie VS) – (Balanced Virtuals Volume)

2. **Using publicly-available data and the CAISO's stated methodology, Balanced Virtuals Volume is defined as:**

   Balanced Virtuals Volume = Min((Tie VS – Tie VD), (Internal VD – Internal VS))

3. **Substituting the above definition of "Balanced Virtuals Volume" into WPTF's metric yields:**

   Net Tie VS above Balanced Virtuals Volume =

   = Net Tie VS - Min((Tie VS – Tie VD), (Internal VD – Internal VS))

4. **Next, breaking out "Net Tie VS" into its constituent parts**

   Net Tie VS above Balanced Virtuals Volume =

   = (Tie VS – Tie VD) - Min((Tie VS – Tie VD), (Internal VD – Internal VS))

5. **Next, looking at each possible result of the Min function:**

   When (Tie VS – Tie VD) < (Internal VD – Internal VS) then:

   Net Tie VS above Balanced Virtuals Volume =

   (Tie VS – Tie VD) - (Tie VS – Tie VD) = 0

   On the other hand, when (Tie VS – Tie VD) > (Internal VD – Internal VS) then:

   Net Tie VS above Balanced Virtuals Volume =

   (Tie VS – Tie VD) - (Internal VD – Internal VS) =

   Tie VS – Tie VD + Internal VS – Internal VD

6. **Finally, rearranging and simplifying terms gives the following equation:**

   Net Tie VS above Balanced Virtuals Volume = **Max(Tie VS – Tie VD + Internal VS – Internal VD), 0)**

Shows that calculation of Net Tie VS above Balanced Virtuals Volume is affected by Internal VS.

[4] The derivation below is for virtual positions only (does not include physical intertie positions), and is only relevant to WPTF's case (i.e., when the ties have net VS and internal locations have net VD).