Comments on Testimony of Dr. Richard Tabors

Submitted by Eric Hildebrandt, California ISO July 9, 2001

These comments respond to comments submitted by Dr. Richard Tabors on analysis of competitive market prices by the ISO that have been filed in these proceedings and presented at the settlement conference.

Calculation of Marginal System Costs (Heat Rates)

Dr. Tabors most specific and detailed comments focus of the calculation of hourly heat rates (representing system marginal costs) which form "the critical underpinnings" for the analysis of competitive baseline price used to assess potential refund levels (p.3). Dr. Tabors fundamental argument is that the validity of the model used to calculate the competitive baseline prices should be judged based on its ability to "predict" the actual heat rate or the marginal unit actually dispatched to meet demand, since (1) the model does not appear to be alleging physical withholding of capacity, and (2) that even if suppliers exercise market power by bidding above costs, they will still bid units in true merit order, so that the dispatch of units will not be distorted by "economic withholding".

As Dr. Tabors explains:

Since Dr. Hildebrandt does not appear to be alleging physical withholding, and given that suppliers would leave their units in merit order [even if bidding above cost], then the true test of the validity of the Hildebrandt model would be if it were able to predict the marginal unit or type of unit, i.e. the heat rate of the marginal gas unit. The model does not. (p.4-5).

As explained below, both of the two key assumptions underlying Dr. Tabor's logic are incorrect.

First, the modeling approach used to calculate the competitive baseline price <u>does</u> assume and account for physical withholding (albeit <u>conservatively</u>). There are two potential forms of physical withholding: declaring a unit unavailable, or simply not bidding all capacity that is not declared unavailable into the market. The model fully accounts for this <u>second</u> form of physical withholding, since the model calculates the competitive price based on the full "available capacity" of each gas-fire unit, with the "available capacity" of each unit being calculated "based on the rating of the unit (filed with the ISO) less any capacity reported to be unavailable due to scheduled or forced outages." (ISO-5). Thus, the model "conservatively" accounts for withholding, in that it does accept "at face value" all outage and derations reported to the ISO. Thus, based on Dr. Tabor's own logic, the fact that the model does account for capacity that is reported to be available but not bid into the market does indeed explain why results of the competitive baseline model are lower than the heat rates of the marginal units actually dispatched by the ISO.

Second, Dr. Tabors erroneously concludes that the widespread practice of bidding capacity at prices in excess of costs would <u>not</u> distort the merit order of units actually dispatched i.e., would <u>not</u> raise the heat rates of the marginal units actually dispatched by the ISO above the competitive baseline model. Dr. Tabors reasons that although generation companies may bid generation above its actual cost, each individual generating company "would always keep the relative order of its under when bidding them into the spot market. This is a critical fact when analyzing the Hildebrandt model, because it means that there is not reason for the marginal unit [actually dispatched] to be different from the marginal unit that is the outcomes of the model." (p.4)

The most obvious flaw of Dr. Tabor's logic is illustrated by this simple example:

Suppose Generator A bids 100 MW of capacity with a marginal cost of \$50 at a price of \$200, while Generator B bids 100 MW capacity with a marginal cost of \$75 at a price of \$150. Based on these bid prices, Generator B's capacity (with an actual cost of \$75) would be dispatched to meet demand of 100 MW <u>in place of</u> Generator's A's capacity (with an actual cost of \$50). A calculation of the highest cost unit actually dispatched would indicate system marginal costs of \$75 during this hour. However, the true system marginal cost (in the absence of the exercise of market power) during this hour is just \$50.

Thus, rather than exposing "fatal flaws" in the ISO's analysis of competitive baseline prices, Dr. Tabor's own logical examples (once corrected), help to explain <u>why</u> results of the competitive baseline model should in fact be <u>lower</u> than the heat rates of the marginal units actually dispatched by the ISO.¹

¹ Dr. Tabor's logic about bidding above costs only holds if it is assumed that <u>all generators</u> bid capacity at the <u>uniform markup above cost</u> (i.e. all generators bid capacity at 200% above cost). While real time market bidding data submitted to the Commission as part of these proceedings does indicate systematic bidding of capacity above costs by all major non-utility thermal generators, the markup of each generator's bids above costs is not perfectly uniform. Moreover, if the markup of each generators bid above costs were perfectly uniform, this would simply raise even more serious questions about collusive bidding behavior.

Comparison of Results

Dr. Tabors also presents a discussion of the differences in the degree to which the hourly heat rates of the competitive baseline model are lower than the heat rates of the marginal units actually dispatched by the ISO. As explained above, the premise of this discussion -- that the validity of the competitive baseline model should be judged based on the degree to which it replicates the heat rate of the marginal unit actually dispatched by the ISO – is fatally flawed. Nevertheless, the discussion of heat rates is misleading in several respects.

First, Dr. Tabors notes that two calculations were provided of the heat rate of the marginal units actually dispatched by the ISO. The first of these files was found to contain an incorrect heat rate for a single 25 MW cogeneration unit that was identified in this initial calculation as being the marginal cost unit dispatched by the ISO in about 60% of the hours from May 200 to 2001. Further investigation and analysis of the heat rate reported by the plant operator of this unit (14,500) indicated that this was in fact the average heat rate at minimum load, and that the heat rate declines from 14,500 to 12,000 at the higher load levels at which the unit operates when selling energy to the ISO. Thus, the actual incremental heat rate of this unit at its dispatch point of about 20 MW is 9,500, rather than 14,500. After this correct heat rate was verified with the operator and through engineering simulations, a corrected file was provided (See Figure 1).

Second, Dr. Tabors cites the fact that the second (corrected) heat rates provided are about 25% higher than the heat rates calculated as part of the ISO's competitive baseline model as evidence that the model is fundamentally biased. It should noted that the competitive baseline model used in the "backcast" based on the June 19 order includes a 10% adder, which makes the effective heat rate 10% higher, or only about 15% higher than the average of the marginal units actually dispatched. As discussed above, the difference between the competitive baseline model and "actuals" is simply attributable to the fact that the competitive model accounts for the impact of capacity that is clearly available but not bid into the market (one form of physical withholding) and the widespread practice of bidding in excess of costs (economic witholding). From this perspective, the relatively narrow difference between the two system marginal costs derived from the sets of results (15%), supports – rather than refutes – the validity of the competitive baseline model.

Figure 1. Initial and Corrected Heat Rates of Marginal Units dispatched by ISO in Real Time Market



Imports

Another concern raised by Dr. Tabors is that the ISO's analysis treats California as a separate market, without regard to the WSCC, despite the fact that "the market are in fact interrelated and must be examined together in analyzing behavior and pricing." However, Dr. Tabors provides little further evidence and specific suggestions as to how this may render results "fatally flawed". As Dr. Tabor himself notes, "the effect of not including the WSCC [in the analysis] could go either way." Dr. Tabor simply suggests that the high loads and below normal hydro conditions experienced in the Western region over the last year support his conclusion that "a reasonable hypotheses is that all of these effects were missed in the ISO model and as a result understate the equilibrium price [in California]" (p.7).

First, it should be noted that the high loads and below normal hydro conditions experienced in the Western region over the last year are in fact directly incorporated into the model in the form of a <u>reduction in actual imports</u>, which has the effect of increasing the amount (and marginal cost) of gas-fired generation needed to meet demand in the ISO system.

Second, while high loads and below normal hydro conditions clearly crated "tight" supply conditions and high prices in the Western region over the last year, there is virtually no evidence of absolute shortages of capacity over the last year in the Western region. Blackouts in California during the recent winter and spring months of were clearly the result of a financial crisis (precipitated by the impact of market power on wholesale prices during previous months), rather than an absolute shortage of supply. In other words, while there was a clear shortage of credit worthy buyers in California, there is not evidence of an absolute shortage of capacity except during a relatively few hours. On the contrary, many suppliers publically announced their reluctance or refusal to sell available supply to the California market. This provides clear evidence that the amount of supply actually available from other regions was in fact much higher than actual supplies procured during many hours. Thus, it seems more reasonable to conclude that by simply "netting out" actual imports from demand, the CAISO model underestimates the amount of imports and overestimates the amount (and marginal cost) of gas-fired generation needed to meet demand in the ISO system.

Finally, actual empirical experience over the last year suggests that the ISO market tends to <u>drive</u> – rather than <u>follow</u> -- other regional supply markets. Figure 2 compare average real-time prices with daily spot market prices to examine the degree to which prices in these markets track, diverge, and follow one another. When comparing prices in these two markets, it is important to note that hourly real-time prices must be averaged over the 16-hour period used to calculate spot market price indices that are used to report prices in these markets. As shown in Figure 2, prices in these markets track closely, but tend to diverge during high priced periods, with spikes in spot prices lagging behind spikes in the real-time market. Prices in the two markets continued to track in a similar manner in July and August following the reduction of the ISO's price cap from \$750 to \$500/MWh and then to \$250/MWh, with overall prices in both markets lower despite high loads during the last week in July and later months.

In general, reducing price caps lowered prices in the CAISO real-time market on high load days. Regional spot market prices were affected in the same fashion. (Prices on high load days tend to approach the price cap level and, therefore, are influenced most by price caps. Prices on low load days or monthly average prices do not show a clear indication that price caps reduce real-time market prices.) Together, these trends provide a limited indication that spot market prices (for transactions at the beginning of each operating day) tend to be driven in large part by the previous day's real-time prices. In this sense, California was the price leader during most of the summer of 2000.

Another indicator of the relationship between the California market and other regional markets is that until the gas price spikes in December 2000 and the subsequent financial crisis, out-of-market (OOM) purchase prices (mostly from out-of-state suppliers) were clearly controlled by the ISO real-time price cap levels (i.e. out-of-market purchases rarely exceeded the price cap and average prices of OOM purchases was approximately equal t o the real time imbalance price. This is summarized in Figure 3.



Palo Verde and SP15

Figure 2.Comparison of Daily Spot vs. Real-time Price

COB and NP15





Figure 3. Out-of-Market Purchases of Imports vs. Real-time Price

Comparison with Other Studies

Finally, Dr. Tabors concludes that "the CAISO model is strictly an academic exercise," and that "neither the input assumptions or the underlying methodology have been vetted for accuracy or reliability. Those of us who have attempted to reproduce the results of the model using our own tools have failed." (p.8).

In practice, as noted in Dr. Tabors' own testimony, the ISO's model is based on the same fundamental approach developed by members of the ISO Market Surveillance Committee and PX Market Monitoring Committee, and has been subjected to a long history of review and verification. As Dr. Tabor's notes:

"During the past three years there have been a series of reports prepared by the CAISO [based on] the methodology initially presented by Wolak, Nordhaus and Shapiro [of the ISO Market Surveillance Committee].²

Both the methodology and results of studies by the ISO are consistent with that of Borenstein, Busnell and Wolak (1998). Although Dr. Tabor's attempts to reproduce the results of the model may have failed, other leading researchers have reached similar results using publically available data (see Joskow and Kahn, 2000 and Joskow and Kahn 2001).

² For sake of accuracy, we note that the development and presentation of this approach was actually done by Borenstein, Bushnell and Wolak (1999). The other member of the ISO Market Surveiliance Committee to which Dr. Tabors attributes this methodology [Nordhous and Shapiro] reviewed the methodology and results of this approach.