

**Opinion on
Order 764 Compliance and Related Market Design Changes**

by

**James Bushnell, Member
Scott M. Harvey, Member
Benjamin F. Hobbs, Chair
Shmuel S. Oren, Member**

Members of the Market Surveillance Committee of the California ISO

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1. Introduction

The Market Surveillance Committee (MSC) of the California Independent System Operator has been asked to provide an opinion on the ISO's proposal for complying with FERC Order 764 and related market design changes.¹ Order 764 requires that jurisdictional transmission providers allow interchange to be scheduled on a 15 minute basis, and that variable energy resources provide data to market operators for the purpose of forecasting power output. The ability to schedule on a 15 minute basis would potentially reduce the burden on balancing authority areas (BAAs) that are the source of intermittent resource output and shift this burden to the destination or sink BAAs. The ISO's proposal to comply with the Order would implement full 15 minute energy scheduling and settlements.

The proposed changes have three main threads, two of which have been the subject of prior stakeholder processes and MSC opinions. The first thread is the California ISO's compliance with FERC Order 764, particularly its requirement that jurisdictional utilities allow 15 minute scheduling of interchange transactions. The second thread consists of associated changes to the way the California ISO prices interchange transactions, which has been the subject of multiple stakeholder processes over the past two years and was discussed in our August 16, 2011 opinion.² Significantly, the changes proposed by the California ISO would extend beyond the pricing of interchange transactions with external BAAs to also change the way internal generation and load are settled. The third thread is comprised of changes to the PIRP program that would serve to align the design of the PIRP program with the new elements of the California

¹ California ISO, *FERC Order 764 Compliance, 15-Minute Scheduling and Settlement*, Draft Final Proposal, March 26, 2013, www.caiso.com/Documents/DraftFinalProposal-FERC-Order764MarketChanges.pdf

² Market Surveillance Committee of the California ISO, *Final Opinion on Intertie Convergence Bidding and the Imbalance Energy Offset*, August 16, 2011, www.caiso.com/Documents/FinalOpinion_IntertieConvergenceBidding_ImbalanceEnergyOffset.pdf

ISO market and allow PIRP resources to participate in the economic dispatch. We discussed some of these changes in our prior December 8, 2011 opinion.³

More recently, potential changes to the way the California ISO settles interchange transactions have been discussed in several MSC meetings over the past two years, and these specific changes were discussed in MSC meetings in Folsom on January 17, 2013, and March 19, 2013. In addition, MSC members have participated in stakeholder calls discussing Order 764 compliance and these associated changes on October 30, 2012, December 18, 2012, February 12, 2013, April 2, 2013, and May 1, 2013.

The Order 764 proposal is relatively complicated, and although stakeholders generally agree the proposal makes beneficial market changes, some features have raised concerns among stakeholders. In this opinion, we focus on the above three main elements of the proposed market changes.

Our overall recommendation is that we support those three elements. The introduction of 15 minute energy scheduling is not only necessary to comply with FERC Order 764, it also offers the potential to improve the performance of California ISO markets (and indeed markets throughout the West) and reduce the cost of meeting load by enabling more optimal scheduling of interchange with adjacent BAAs. Extending the present real-time pre-dispatch (RTPD) process to include energy scheduling and settlements in addition to its present unit commitment and operating reserve roles has the potential to significantly improve the consistency of the ISO's markets.⁴ Importantly, the associated changes in the settlement of interchange transactions and virtual bids (in which they are based on binding 15-minute/RTPD market prices) should allow interchange to be settled at prices that are better aligned with real-time prices than is the case with the present HASP-based settlement process for interchange transactions. Finally, we anticipate that scheduling interchanges involving intermittent resources closer to real-time and allowing internal and external intermittent resources to be dispatched based on price will have several benefits. In particular, this element of the proposal should improve the California ISO's ability to balance load and generation in real-time with reduced price volatility; enable external variable energy resources to supply power to California at lower cost; and allow internal variable energy resources to participate more efficiently in the real-time market.

³ Market Surveillance Committee of the California ISO, Opinion on Integration; Market and Product Review, Phase I, December 8, 2011, www.caiso.com/Documents/MSF_Final_Opinion_RenewableIntegrationMarket-ProductReviewPhase1.pdf

⁴The name of the present 15-minute process--"Real time pre-dispatch" (RTPD)--will therefore become something of a misnomer under this proposal, because the revised 15 minute scheduling software will both commit and dispatch generation, and yield financially binding market prices for both ancillary services and energy for the first 15 minute interval. Presently, under MRTU, energy schedules from RTPD are not binding financially, so "pre-dispatch" was a more appropriate description in that case. Nonetheless, under the ISO's proposal, the 15 minute process will remain advisory for the second and subsequent intervals, and so would still be a predispatch evaluation which has a purpose of informing commitment decisions.

There are some risks associated with the implementation of these changes that will need to be analyzed by the California ISO as this design moves toward implementation, as well as monitored following implementation.

- First, it cannot be assumed that there will necessarily be a liquid supply of 15 minute interchange bids and offers when this design is first implemented. Uncertainty concerning the impact of implementing these changes could lead to somewhat higher offer prices for import supplies scheduled in real-time. Further, the overall elasticity of import supply in real-time, both hourly and 15 minute transactions, may initially be somewhat lower than under the current design, but there will be offsetting benefits in the form of reduced costs from uneconomic import and export transactions.⁵
- Second, while settling interchange transactions at RTPD prices determined closer to real-time should tend to reduce uplift costs (real-time energy offset costs), settling internal generation and load deviations from day-ahead schedules at RTPD prices and then settling deviations from RTPD schedules at RTD prices will give rise to new uplift costs. We anticipate that the net effect of these changes will likely be a reduction in overall uplift costs relative to the current design. Nonetheless, the California ISO will need to carefully monitor the relationship between RTPD solutions and the real-time dispatch to minimize both systematic errors and large random errors in order to achieve the intended benefits of these design changes.
- Third, if the supply of 15 minute interchange bids and offers is initially not very liquid, the elements of the design that allow output-contingent intermittent offers to displace fixed hourly import schedules may contribute to the volatility of RTPD and RTD prices. This potential can be studied prior to implementation and managed by the way the California ISO forecasts variable resource output for the HASP process.

While the introduction of 15 minute scheduling will pose some operational challenges for the California ISO and adjacent control areas, experience at other ISOs and RTOs indicates that these challenges should not be unmanageable. PJM has been allowing 15 minute changes of price-taking interchange transactions with some adjacent control areas for more than a decade, and the Midwest ISO and PJM have been managing large volumes of price-taking 15 minute schedule changes for around 8 years. Moreover, the New York ISO implemented price-based scheduling of 15 minute transactions with Hydro Quebec in 2011 and with PJM in 2012. Hence, the California ISO is not entering uncharted waters in implementing 15 minute scheduling; this is something that other ISOs and RTOs have been able to manage and the California ISO should be able to successfully implement if given flexibility in the timing and manner of implementation.

The remainder of this opinion is organized as follows. The next section summarizes some economic principles underlying our assessment of this proposal. Section 3 reviews the salient features of the most recent CAISO proposal, and offers some observations on those features. Our recommendations are presented in Section 4.

⁵ There has generally been a reduction in imports into the California ISO in real-time in recent years (day-ahead net imports are larger than real-time net imports), although this relationship varies from hour to hour and day to day, see California ISO, Department of Market Monitoring, 2012 Annual Report on Market Issues and Performance, Figure 2.8, p. 67

2. Economic Principles

The following principles of design of economically efficient electricity markets underlie our assessment of the ISO's proposal.

- Smaller intervals for scheduling will result in increased flexibility of interchange schedules, and allow better matching of supply and demand.
- Settling internal, external, and virtual transactions with the same set of RTPD prices will eliminate the potential for market participant bidding strategies that magnify the costs resulting from systematic errors in California ISO forecasts.
- Scheduling and settling ancillary services and energy on the same basis will reduce inconsistencies resulting from the present system in which ancillary services are scheduled and settled based on RTPD prices, while real-time energy deviations are instead settled solely based on RTD prices.⁶ Simultaneous scheduling and pricing of both ancillary services and energy will, for instance, cause ancillary service prices to reflect opportunity costs arising from actual energy schedules and prices. As another example, this element of the design change will allow resource shortages that trigger scarcity pricing of ancillary services in RTPD to propagate over to 15-minute energy prices that will be used for energy settlements under the proposed design.⁷
- Imbalances for all resources, including intermittent supply, should be settled at prices reflecting market conditions for the relevant intervals

From the point of view of each of these principles, the creation of a system of 15 minute market so that real-time exchanges, internal energy, and ancillary services are all priced on the basis of the same market optimization is appropriate. Of course, details in market design matter, and in the next section, we comment on a number of these details.

3. The CAISO Proposal

The California ISO's draft final proposal of March 26, 2013 has three main elements that we discuss below. The first set of changes involved the scheduling of interchange with other BAAs. The second set of changes pertained to real-time settlements for internal generation, load and virtual transactions. The third set of changes concerns the PIRP program.

A. *Scheduling and Pricing of Interchange on a 15 Minute Basis*

Instead of exclusively scheduling net interchange with adjacent BAAs in the HASP based on hourly transactions, the California ISO proposes to use the capabilities of its existing RTPD

⁶Note that under the proposal, the 15 minute interval whose schedules and pricing will be binding for ancillary services and energy will occur 37.5 minutes after execution of RTPD. This is fifteen minutes later than the present RTPD system's first interval, which is when ancillary services are presently scheduled and priced.

⁷These shortage prices will not be reflected in RTD energy prices, but RTD prices will continue to be impacted by the load balance constraint when resources are scarce.

program to schedule interchange with adjacent control areas on a 15 minute basis. Market participants would continue to have the option to offer hourly interchange schedules that would continue to be scheduled in the HASP. These hourly transactions would include both hourly self-schedules and hourly transactions with economic bids. In addition, the California ISO proposes that two additional types of transactions could be offered in the HASP: (1) a self-scheduled variable energy resource forecast, and (2) hourly transactions with economic offers that allow for a single intra-hour schedule change.

In addition, the California ISO would allow market participants to submit economic bids for transactions that would be dispatchable every 15 minutes, whose dispatch would be evaluated and scheduled in RTPD. These economic bids would be fixed over the hour, but the California ISO would evaluate them over 15 minute time increments and the schedules could be changed every 15 minutes.

The California ISO would also maintain the ability of resources to dynamically transfer power in or out of the balancing areas. Because the rules and processes applicable to dynamic transfers will not be materially impacted by these changes, they are not discussed below.

Potential Benefits. The ability to schedule interchange on a 15 minute basis will have four advantages for the California ISO and its market participants. First, being able to adjust interchange schedules on a 15 minute basis will better allow the California ISO to align interchange levels with known, intra-hour demand and supply changes such as pumps starting or stopping or large generators coming on-line or going off-line.

Second, because the RTPD run that will be used to determine 15 minute interchange schedules will initialize roughly 37.5 minutes before the beginning of the schedule and 52.5 minutes before the end of the schedule, RTPD will be able to better align the level of imports with actual load levels than is the case with the HASP. HASP initializes 75 minutes before the beginning of the period and 2 hours and 15 minutes before the end of the hourly block period and hence is more prone to material load forecast error.

Third, scheduling some interchange on a 15 minute basis will provide the California ISO more flexibility in using adjustments in net interchange to accommodate changes in variable resource output and other changes in supply that cannot be anticipated in the HASP scheduling process.

Fourth, RTPD will be better able to match the level of imports to the level of demand, avoiding the typical pattern during ramping hours of RTD prices that plunge at the top of the hour when imports schedules increase, then rise steadily through the hour. This has the effect that the hourly import schedules are uneconomic at the beginning of the hour and additional import supply would be economic at the end of the hour.

Settlement of Hourly Transactions. Another important element of the California ISO design that has been a subject of contention among some stakeholders is that there will be no bid cost recovery (BCR) for hourly transactions that are scheduled on an economic basis in the HASP but that turn out to be uneconomic, i.e., that do not recover their as-bid costs with RTPD prices over the course of the hour. The proposed design will settle real-time interchange transactions based

on RTPD prices, rather than based on HASP prices. Significantly, hourly interchange schedules will be scheduled in the HASP based on the prices projected in the HASP, but the prices used for settlements will be the prices determined in RTPD. This design introduces the potential for hourly import transactions that are scheduled in the HASP to be paid less than their offer price if RTPD prices are lower than HASP prices. Conversely, there is a potential for exports scheduled in the HASP to be charged more than their bid prices if RTPD prices are higher than HASP prices.

The potential for import transactions to be paid less than their offer price could have some impact on offer prices, causing import suppliers to offer hourly supply at a slightly higher price so as to increase the likelihood that they will recover their costs. Any such increase in offer prices would be offset, at least in part, by the cost savings from avoiding the uplift costs associated with BCR. If this is the case, the actual likelihood of import suppliers on average recovering less than their offer prices may be very low and in general have little impact on either import offer prices or the elasticity of import supply.

Furthermore, price risk for import suppliers may be mitigated for some transactions by the feature of the ISO's proposal that gives importers a single curtailment option in which they can curtail the rest of the hour's schedule after any 15 minute market outcomes are announced in that hour. Thus, if, for instance, the first 15 minutes shows RTPD prices that are much lower than HASP prices, an importer who is concerned that it won't recover its bid cost can decide to cancel its schedule for the other three 15 minute intervals in that hour. It is possible that this provision will lessen the price risk for hourly transactions.

On the other hand, this curtailment provision may be of only marginal value in practice. First, it would be limited to hourly transactions involving FERC jurisdictional and other BAAs that allow mid-hour schedule changes for economic reasons. Second, this provision does not ensure that the underlying energy transaction will be curtailable if the market participant selling power into the California ISO market is distinct from the entity operating the generating resource that supplies the power. It is not clear whether or when a workable method will be developed to allow intra-hour curtailment of power sold under forward bilateral contracts and delivered into the California ISO. Third, this feature will not reduce price risk if the CAISO forward (advisory) RTPD prices (for second and subsequent intervals) are high relative to the financially binding RTPD prices, so that transactions that are uneconomic are not curtailed.

The relationship between HASP and RTPD prices, both in general and during particular conditions, such as high loads, will undoubtedly be analyzed by market participants as the implementation date for these changes approaches. The California ISO should similarly be monitoring this relationship prior to implementation so as to anticipate and address any potential problems arising if the variability of RTPD prices relative to HASP prices introduces a material potential for losses by import suppliers offering supply during particular market conditions. Even if HASP prices are centered on RTPD prices on average, hourly suppliers may be somewhat risk averse and offer less supply if there is a perceived risk of large losses or opportunity costs under particular conditions. Any such potential reduction in the elasticity of import supply from hourly transactions will have little impact if it is offset by supply available at similar cost from 15 minute transactions. Whether this will initially be the case is uncertain, and

it is also uncertain how rapidly the supply of 15 minute import supply transactions will increase over time.

While the potential for import suppliers selling power through hourly transactions to incur opportunity costs exists with the proposed design and may have some impact on the level and elasticity of offers of hourly import transactions, we agree with the California ISO's decision to not provide bid cost recovery for hourly transactions that turn out to be uneconomic at RTPD prices. The goal of the California ISO design is to move to a market design in which import suppliers and export buyers submit flexible 15 minute schedules. This goal risks being defeated if BCR is paid on hourly transactions to imports suppliers, so that the expected payment for hourly import transactions is higher than for 15 minute schedules even if the average hourly and 15 minute prices are the same. Moreover, if the California ISO were to provide bid cost recovery for hourly transactions on interfaces that allow 15 minute schedules, there would be a potential for market participants to submit offsetting hourly and 15 minute schedules that would generate net revenues when RTPD prices differ from HASP prices.⁸

Finally, the California ISO's design in which there is no BCR for price based hourly transactions is consistent with the approach the New York ISO took in implementing 15 minute scheduling. The New York ISO has historically settled price-based interchange transactions at real-time prices and paid BCR for economically scheduled transactions that do not recover their offer price at real-time prices. But as the New York ISO has introduced price-based 15 minute scheduling on its external interfaces over the past two years, it has eliminated its bid production cost guarantee for hourly transactions on those interfaces.⁹ Moreover, other ISOs, such as the Midwest ISO, do not even schedule interchange transactions based on bids and hence all interchange transactions are pricing taking, with no bid cost recovery.

Self-Scheduling Variable Energy Resources. While RTPD would determine binding interchange schedules for the 15 minute time period beginning roughly 37.5 minutes after it initializes and 22.5 minutes after it posts its results, HASP would determine advisory schedules for 15 minute offers over the four 15 minute intervals of each hour. An important element of the California ISO design is that while these advisory schedules for 15 minute intervals over the remainder of the hour will not be financially binding on the California ISO, in the sense that the

⁸ This would be similar to the problems that arose when California provided an intertie offer guarantee for both imports and exports under its Real-time Market Application software that was implemented on October 1, 2004. In part because of scheduling and pricing practices unique to the California ISO, this pricing system gave rise to extremely high uplift costs because market participants were able to submit offsetting import and export schedules, one or the other of which would qualify for an import offer guarantee, enabling the supplier to realize profits even when no power flowed, see See Department of Market Monitoring, California ISO, "2005 Annual Report, Market Issues and Performance," April 2006 pp. 1-2 to 1-4 and 3-24 to 3-25. Because of these problems, the California ISO's Real-Time Market Application pricing system was quickly modified by Amendment 66 effective March 25, 2005 to settle transactions on a pay-as-bid basis, See California ISO filing letter in Docket ER05-718-000 March 23, 2005; the change in the tariff was accepted by FERC in 111 FERC ¶61,008 April 7, 2005 effective March 25, 2005; See also Department of Market Monitoring, California ISO, "2005 Annual Report, Market Issues and Performance," April 2006 pp. 1-2 to 1-4 and 3-24 to 3-25.

⁹ See New York ISO Filing in Docket ER11-2547-000, December 28, 2010.

California ISO will only schedule and pay for this interchange if the 15 minute interchange bid or offer clears in the RTPD run that determines the actual interchange schedules, the advisory schedules will require the market participant to adhere to these schedules if they are confirmed in RTPD. Hence, while a market participant submitting an economic bid for 15 minute schedules of import supply for the hour can subsequently reduce the amount of supply offered for the hour (by reducing its energy profile on the associated e-tag), it can only reduce its offers down to the level of the advisory schedules determined in HASP.¹⁰ This rule is an important and necessary element of the overall design because it serves to ensure that if the HASP does not schedule an hourly interchange transaction based on the availability of a 15 minute transaction that could be dispatched during the hour, that 15 minute transaction will be available for dispatch during the hour. Since it is not assured that there will be a highly liquid supply of 15 minute transactions, the withdrawal of 15 minute schedules that received an advisory schedule in HASP could lead to substantial price volatility in RTPD and in RTD. Hence we support this element of the California ISO's proposed design.

There is, however, one feature of the California ISO's proposed design that allows this kind of inconsistency between HASP schedules and RTPD supply to arise. This is the treatment of self-scheduled variable energy forecasts. In determining advisory schedules, the HASP will treat these variable energy schedule as a normal transaction in its evaluation and hence will not schedule any advisory 15 minute transactions to account for the possibility that the output of the intermittent resource will not be not available in real-time. Furthermore, HASP will not consider the availability of such back-up 15 minute schedules to replace self-scheduled variable energy forecasts in choosing whether or not to schedule price-based hourly block transactions.

Hence, if the variable energy resource schedule is lower in RTPD than in the HASP, there is no assurance that 15 minute interchange transactions will be available to replace the variable energy schedule, nor is there a guarantee at what price level 15 minute replacement transactions might be offered. Conversely, variable energy schedules could also increase in RTPD relative to the forecast in HASP, creating additional price volatility if there is not a liquid supply of 15 minute interchange schedules that can be dispatched down in RPTD.

While the scheduling of imports from these variable energy resources in the HASP will generally be based on a California ISO forecast, this forecast will be made at least 75 minutes prior to the beginning of the hour and at least 2 hours before the beginning of the last 15 minute interval of the hour. Hence, there is a potential for differences between the level of variable energy resource output projected at the time HASP initializes and the level projected during the operating hour. If there is a liquid market of 15 minute interchange transactions, the California ISO should be able to manage the variability of these intermittent resource schedules; however, there is no assurance that there will be a liquid market of 15 market schedules.

The California ISO already has to manage the uncertain real-time output of variable energy resources internal to the California ISO BAA, but the intra-hour variability of intermittent resource interchange schedules in the 764 design introduced by the proposed design will be in addition to the current level of intra-hour variability associated with internal intermittent

¹⁰ California ISO, Draft Final Proposal, March 26, 2013, Section 5.2.3, p.15.

resources. While the variability of the external intermittent resource transaction schedules will likely not be materially correlated with the short-term variability of internal resources, there would be some incremental impact on the overall variability of intermittent resource output delivered to the California ISO. Hence there is a potential for increased intra-hour variability in net load from this feature of the design that does not exist today. This is to a degree simply a consequence of Order 764, which tends to shift the impact of the uncertainty associated with intermittent resource schedules from the source BAA to the sink BAA. It is intended that the California ISO will be able to manage the variable output of these resources by dispatching up or down 15 minute interchange transactions during the hour. There is no assurance, however, that the amount of dispatchable 15 minute interchange schedules available will be sufficient to compensate for additional intra-hour changes in variable energy resource interchange supply.

Whether the intra-hour variability of intermittent resources schedules will pose any operational issues or creates any price risk will depend on the magnitude of the differences between the HASP and RTPD forecasts relative to the supply of 15 minute interchange transaction offers. Since 15 minute granular HASP forecasts have average errors on the order of 8%, there is a potential for significant differences in HASP and RTPD forecasts, especially as VER import schedules grow in future years.[]

B. Settlement of Internal Generation, Load and Virtual Transactions at RTPD prices

A second important element of the California ISO 764 design changes is that not only interchange transactions but all deviations between day-ahead schedules and RTPD schedules will be settled at RTPD prices. By settling internal and external transactions as well as virtual transactions at common RTPD prices, the proposed design will avoid the situation in which interchange transactions settle deviations from day-ahead schedules at different prices than virtual transactions.

RTPD and RTD Prices. The proposed design eliminates the potential for market participants to submit schedules intended to take advantage of predictable differences between HASP and RTD prices, which had contributed to very high real-time uplifts prior to suspension of convergence bidding on the interties. However, it needs to be recognized there is still a potential for differences between RTPD and RTD prices to give rise to additional costs. When RTPD prices and schedules are between the day-ahead prices and schedule and the real-time prices and schedule, the additional settlement will tend to reduce the volatility of real-time settlements and will not give rise to additional costs relative to purchasing power at the real-time price. Conversely, however, if the RTPD price and schedule are higher than both the day-ahead and RTD prices or lower than both the day-ahead and RTD prices, these variations will tend to create additional costs that will be reflected in the average settlement price for power consumers. If the RTPD price is above both the day-ahead market price and the real-time price, additional supply will be bought in RTPD at the higher price, then sold back in RTD at a lower price. Conversely, if the RTPD price is lower than both the day-ahead price and the real-time price, supply purchased day-ahead will sold at a lower price in RTPD, then bought back at a higher price in RTD.

If the RTPD price is reasonably centered on the RTD price there will not be any undue costs associated with the proposed changes in the settlement system. However, if the RTPD price is systematically lower than the RTD price, so that the California ISO will systematically sell power at the RTPD price then buy it back at a higher real-time price, then the impact of these changes on the total cost of serving load may be material. In this regard, it is important to recognize that while the RTPD price should be more accurate relative to the RTD price than the HASP price, the amount of market volume being settled at the RTPD price, and hence the impact of systematic biases in the RTPD price will be larger than the impact of a similar systematic bias in the HASP price. All external and internal deviations from day-ahead market schedules will be settled at the RTPD price, whereas in the current design only deviations of interchange transactions from day-ahead schedules are settled at HASP prices.

Systematic biases in RTPD prices and schedules could also have a feedback impact on the day-ahead market. If RTPD prices and schedules were systematically low relative to RTD, for example, with the result that load serving entities were consistently selling back incremental day-ahead market schedules at lower RTPD prices, this pattern would make it profitable for load serving entities to reduce their day-ahead market schedules below their estimated real-time load to mimic the likely level of RTPD schedules. This would be cost reducing for a load serving entity because it would reduce the amount of market purchases that load serving entities would make day-ahead that would then be sold for a loss in RTPD.

In assessing the magnitude of this potential effect, it is important to recognize that uplift costs do not simply arise from RTPD prices that are lower than day-ahead market and RTD prices but from schedules that are lower. If RTPD schedules are very close to the day-ahead and RTD schedules, then little output will be sold at the RTPD price and little output bought at the RTD price, even if there is a real-time price spike due to real-time ramp constraints. The generators able to respond to the real-time dispatch instructions will, however, be paid the high price for their incremental output, providing an incentive for them to offer more ramp capability.

Data that was provided by the California ISO to market participants on day-ahead schedules, RTPD schedules and prices, and RTD prices and schedules indicate that the RTPD prices and schedules are reasonably well centered on RTD prices. Our calculations using these data suggest that this design would raise the real-time cost of power by only around \$15 million a year relative to settling all deviations at RTD prices. However, the California ISO recently explained that the RTPD prices in that data are the T-22.5 prices rather than corresponding to the T-37.5 prices that would be used for settlements under the proposed design because the latter prices are not currently being archived.¹¹ Moreover, the data provided is based upon aggregate weighted average data, rather than LAP data and prices, so the settlement impact would likely be larger than indicated by this calculation. It is important that the California ISO promptly begin

¹¹See D. Tretheway, "FERC Order 764 Compliance Implementation of 15 minute scheduling and settlement," California ISO, Presentation, May 1, 2013, www.caiso.com/Documents/Presentation-FERC_Order764MarketChanges-DraftFinalProposalAddendumMay1_2013.pdf. The present RTPD system executes at T-22.5 minutes, where T is the start of the first 15 minute scheduling interval. Under the proposed Order 764 revisions, RTPD will be shifted, executing instead at T-37.5. As a result, the historical RTPD prices that are most relevant for the comparison we are making are the second interval prices (for the interval starting T+15, which is 37.5 minutes after execution).

archiving these 2nd interval data so that the relationship between RTD prices and the RTPD prices that will be used for settlements is understood by the California ISO and its stakeholders well before the proposed new settlement design is implemented.

The implication of these observations is that it will be important for the California ISO to focus on eliminating systematic differences between RTPD prices and schedules and RTD prices and schedules as it moves toward implementation of the new design.

Virtual Bidding at the Interties. A related change incorporated in the California ISO proposal is the reintroduction of virtual bidding at the interties. In the most recent version of the proposal, implementation of virtual bidding on the interties would be deferred until a year following the introduction of 15 minute interchange scheduling and settlements.

Under this design, virtual bids at the interties, internal virtual bids, interchange transactions, and deviations between day-ahead and RTPD schedules for internal load and generation will all settle at the RTPD price. With this change in pricing, virtual bids at the interties will settle at the same price as internal virtual bids, hence the pricing rule will not provide a mechanism for arbitraging systematic differences between RTD and RTPD prices.

In most ISOs and RTOs there is no compelling need to explicitly define virtual transactions on the interties, because unlike internal transactions in which only physical loads could otherwise buy power day-ahead and only physical generators could sell power day-ahead, any credit worthy market participant can schedule a physical import or export in the day-ahead market. Moreover, market participants in other ISOs and RTOs are free to, and often do, zero out interchange transactions between day-ahead and real-time if market conditions change. Hence, no other ISO or RTO has designs that include explicit virtual transactions on the interties.

There are, however, a few situations in which such an explicit identification of virtual interchange transactions might make sense, in part due to other unique California ISO policies and market rules. First, the explicit identification of particular interchange transactions as virtual transactions permits the California ISO to correctly account for these transactions in the RUC commitment and also to apply appropriate collateral policies to a virtual supplier on the interties.

A second situation in which the identification of an interchange transaction as virtual might make economic sense is unique to California and is a result of other California ISO market rules. California ISO rules will preclude a profitable settlement for day-ahead transactions that are uneconomic in real-time because real-time prices are lower than day-ahead prices, unless an e-tag is maintained through the HASP.¹² The existence of this rule may make it profitable for market participants to submit physical transactions as virtual transactions in the day-ahead market so that they can efficiently respond to real-time conditions without tagging transactions and perhaps without acquiring transmission for transactions that would not flow in real-time if they are no longer economic. Hence, because of these other market rules that are unique to the California ISO, there may also be a unique need for market participants to be able to schedule physical transactions as if they are virtual if the market participant intends to respond in an efficient manner to real-time market conditions.

¹² California ISO, Draft Final Proposal section 5.1 p. 26.

Two other motivations for submitting virtual transactions might be that some other market participants are for some reason not submitting offers in the day-ahead market for transactions that consistently flow in real-time. This might in some circumstances create price discrepancies between the day-ahead market and real-time that might be arbitrated by virtual transactions at the ties if the transactions would contribute to congestion in real-time. However, if transactions were likely to create congestion in real-time, the physical supplier would be likely to schedule the transaction day-ahead if it were likely to flow.

Another perhaps more likely motivation is that virtual transactions might be used by market participants to profit from the congestion impact of real-time parallel (or “loop”) flows not accurately modeled in the day-ahead market. If the California ISO were to predictably fail to accurately account for parallel flows or other factors leading to real-time transmission deratings in the day-ahead market, this would lead to predictable price discrepancies between day-ahead and real-time that might be arbitrated by virtual trades.

The reintroduction of virtual trading on the ties leads to two sets of related changes in the California ISO market design. These are the reintroduction of position limits for virtual transactions on the ties and the application of rules to address the situation in which virtual transactions provide counterflow on constrained interfaces in the day-ahead market.

The introduction of position limits is apparently motivated by the goal of reducing the potential for large uplift costs arising from virtual bids at the interties.¹³ The position limits, however, only limit the positions of individual market participants, not the total collective positions of all market participants. The position limits may therefore effectively constrain the ability of individual market participants to take substantial advantage of market design flaws that they might be uniquely situated to take advantage of. However, if flaws in the market design, settlement design, or transmission system modeling are apparent to--and can be taken advantage of by--a broad base of market participants, then those limits would be less effective in preventing material uplift costs.

The change in the pricing rules proposed by the California ISO will avoid the uplift costs that occurred over the past two years due to differences in settlement prices for intertie transactions and virtual bids. However, uplift due to virtual bids designed to profit from parallel flows or other deratings that are not modeled in the day-ahead market could exist and these uplift costs will not be very effectively limited by position limits if these modeling issues are recognized by a broad set of market participants.¹⁴ Consequently, the risk of large such uplifts will need to be addressed by avoiding such predictable differences between day-ahead and real-time limits.

The other change related to the introduction of virtual bidding at the interties are the rules the California ISO has introduced to address the potential for virtual transactions on the interties to provide counterflow in the day-ahead market that allows physical transactions in excess of the

¹³ California ISO, Draft Final Proposal section 8.3 pp. 28-29.

¹⁴ Position limits would potentially reduce the potential profits to an individual market participant from identifying such inconsistencies.

scheduling limit to clear in the day-ahead market. The California ISO proposes to allow these physical transactions in clear in the day-ahead market but will limit the number of transaction e-tags it accepts day-ahead for physical transactions to those that are feasible absent the counterflow provided by the virtual transactions. The proposed rules introduce the possibility that some physical import transactions that clear in the day-ahead market might not be able to submit e-tags day-ahead. However, the physical transactions able to submit e-tags will exhaust the transfer capability of the grid and if some transactions that submit e-tags day-ahead do not clear in RTPD, transactions that did not get tags day-ahead will be able to flow in real-time.

It is likely that virtual traders will not submit substantial amounts of counterflow transactions on constrained interfaces, as such transactions have a potential to incur large losses if market participants with day-ahead schedules submit low bids in RTPD to ensure that their import transactions flow (or high bids to ensure that their export transactions flow). By pricing physical and virtual transactions consistent with their schedules, the California ISO will eliminate the incentives that could motivate the scheduling of counter flow virtual transactions and gave rise to pricing inconsistencies within the HASP settlement design. Hence, while the California ISO's approach to taking account of counterflow virtual transactions is somewhat ad hoc, it is reasonable to anticipate that the pricing system will deter virtual traders from submitting such counterflow transactions, so the California ISO design is likely to be workable.

C. Participating Intermittent Resource Program

The third set of changes pertain to the Participating Intermittent Resource Program (PIRP) program, which would be retained, but modified in several ways made possible by the associated market changes. First, the schedules used for settlements of PIRP and other intermittent resource schedules would be determined in RTPD rather than in the HASP. Hence they would be determined much closer to real-time, 37.5 minutes prior to the beginning of the schedule rather than 90 minutes to 2-1/4 hours before the beginning of the 15 minute period under the current design. This change will allow more accurate intermittent resource schedules to be submitted. Another important change is that PIRP resources will be able to submit economic bids that will allow intermittent resources participating in the PIRP program to be dispatched down when price are too low for the intermittent resource generation to be profitable. Third, these changes will allow and require intermittent resources participating in PIRP to settle deviations between their RTPD schedule and real-time output dispatch to be settled at real-time prices during each interval, rather than netted over the month.¹⁵

This design will align prices, schedules and incentives because the RTPD price used to settle variable energy resource schedules will reflect the value of the power in the RTPD time frame in which the California ISO can accommodate changes in intermittent resource output both by adjusting net interchange and by adjusting the output of internal resources. Meanwhile deviations between the RTPD forecast and a resource's real-time output will be settled at real-time prices, which will reflect the cost of resources available to accommodate changes in output in the time frame of the real-time dispatch.

¹⁵ California ISO, Draft Final Proposal, Section 7, pp. 22-23.

Another desirable feature of this element of the California ISO proposal is that by maintaining the PIRP program, it avoids unnecessary triggering of renegotiation of existing contracts that directly or indirectly require or assume that the intermittent resource participate in the PIRP program.

4. Recommendations

We support the three key elements of the California ISO proposal. The introduction of 15 minute scheduling is not only necessary to comply with FERC Order 764, it offers the potential to improve the performance of California ISO markets (and indeed markets throughout the West) and reduce the cost of meeting load by enabling more optimal scheduling of interchange with adjacent BAAs. The associated changes in the settlement of interchange transactions and virtual bids (in which they are based on binding RTPD prices) should allow net interchange to be settled at prices that are better aligned with real-time prices than is the case with the present HASP-based settlement process for interchange. Finally, we anticipate that scheduling interchanges involving intermittent resources closer to real-time and allowing internal and external intermittent resources to be dispatched based on price will have several benefits. In particular, this element of the proposal should improve the California ISO's ability to balance load and generation in real-time with reduced price volatility; enable external variable energy resources to supply power to California at lower cost; and allow internal variable energy resources to participate more efficiently in the real-time market.

There are some risks associated with the implementation of these changes which will need to be analyzed by the California ISO as this design moves toward implementation as well as monitored following implementation.

- First, there will not necessarily be a liquid supply of 15 minute interchange bids and offers when the California ISO design is first implemented. If this is the case, then uncertainty concerning the impact of implementing these changes could lead to somewhat higher offer prices for import supply. Further, it should be anticipated that the overall elasticity of import supply in real-time, both hourly and 15 minute transactions, may, at least initially, be somewhat lower than under the current design. There will, however, be offsetting benefits in the form of reduced costs from uneconomic import and export transactions. The California ISO will need to monitor the relationship between prices projected in HASP and binding RTPD prices and make changes needed to maintain convergence to help maintain the elasticity of import supply.
- Second, while settling interchange transactions at RTPD prices determined closer to real-time should tend to reduce uplift costs (real-time energy offset costs) relative to the current design, settling internal generation and load deviations from day-ahead schedules at RTPD prices and then settling deviations from RTPD schedules at RTD prices will give rise to new uplift costs. We anticipate that the net effect of these changes will likely be a reduction in overall uplift costs relative to the current design. Nonetheless, the California ISO will need to carefully monitor the relationship between RTPD solutions and the real-time dispatch to minimize both systematic errors and large random errors in order to achieve the intended benefits of these design changes. We also recommend that the California ISO promptly begin archiving second interval RTPD data so that the

relationship between RTD prices and the RTPD prices that will be used for settlements is understood by the California ISO and its stakeholders well before the proposed new settlement design is implemented.

- Third, if the supply of 15 minute interchange bids and offers is initially not very liquid, the elements of the design that allow output-contingent intermittent offers to displace fixed hourly import schedules may contribute to the volatility of RTPD and RTD prices. This potential can be studied prior to implementation and managed by the way the California ISO forecasts variable resource output for the hour-ahead scheduling process.