



California ISO
Shaping a Renewed Future

FERC Order 764 Compliance 15-Minute Scheduling and Settlement

Revised Straw Proposal

February 5, 2013

15-Minute Scheduling and Settlement Revised Straw Proposal

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1 Introduction

On June 22, 2012, FERC approved Order 764¹ to remove barriers to the integration of variable energy resources by requiring each transmission provider to: (1) offer an option to schedule energy with 15-minute granularity; and, (2) require variable energy resources to provide meteorological and forced outage data for the purpose of power production forecasting. For ISO's the primary impact of the 15-minute scheduling is intertie transactions since internal resources are dispatched every five minutes. The California ISO (ISO) must make a compliance filing with FERC in November 2013 to describe how it proposes to address these items.

The purpose of this revised straw proposal is to discuss the changes to the ISOs real-time market to address item (1) above. On October 29, 2009, the ISO Board of Governors approved outage and forecasting modifications for eligible intermittent resources². The ISO is confirming that the outage and forecasting modifications fully address item (2) above. The ISO will propose changes, if necessary, in this stakeholder initiative.

In this proposal, the ISO is seeking to maximize the use of existing market functionality while not creating seams issues with neighboring balancing authorities. The ISO proposes to introduce a 15-minute financially binding settlement within the real-time market that will apply to both intertie and internal resources as well as load. Currently, the ISO real-time market includes a fifteen minute process for real-time unit commitment (RTUC) and procurement of incremental ancillary services. The hour-ahead scheduling process (HASP), in the existing market, is a special run of the real-time unit commitment run which results in financially binding hourly energy and ancillary services schedules for non-dynamic intertie transactions. Under the proposed 15-minute market, energy and ancillary services schedules for internal generation, and dynamic and non-dynamic intertie transactions will be financially binding every fifteen minutes. Load will also settle in this 15-minute market based on deviations from day-ahead energy schedules and ISO forecast. The ISO does not propose any changes to the existing five minute real-time dispatch (RTD).

FERC Order 764 only requires that transmission providers offer resources an *option* to update energy schedules every fifteen minutes. It does not require a transmission provider to require 15-minute energy scheduling for interties, neither does it address internal resource scheduling. However, it does provide a transmission provider the option to propose a superior approach.

Consequently, the ISO believes that Order 764 is an opportunity to implement real-time market changes that were not possible before the order. As described in more detail below, adding full 15-minute energy scheduling is a superior option because:

- It complies with the Order 764 to allow for 15-minute energy scheduling at the interties. At the same time, it will allow hourly schedules of intertie transactions to remain. However, those schedules would no longer have their price guaranteed for the entire hour.

¹ Additional information is available at www.ferc.gov on the Commission's order in Docket No. RM10-11-000; Order No. 764 Integration of Variable Energy Resources

² The Board documents for the outage and forecasting modifications are available at <http://www.caiso.com/Documents/Board%207%20Decision%20on%20Outage%20and%20Forecasting%20Modifications%20for%20Eligible%20Intermittent%20Resources>

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- It addresses existing real-time imbalance energy offset issues due to changes in system conditions between the HASP optimization and RTD optimizations. The energy settlement of internal and external resources will occur in the same market optimization.
- It addresses convergence bidding issues at the interties, which result from virtual bids for interties settling at the HASP locational marginal price (LMP) and internal nodes settling at the RTD LMP. The proposal would allow for the reinstatement of convergence bidding at the interties.
- It lets variable energy resources provide more frequent energy schedules using forecast updates closer to the financially binding interval.

The ISO believes external parties will take advantage of 15-minute energy scheduling. However, over the next few years, transmission reservations within WECC will likely remain predominantly hourly. There is also no indication that NAESB, NERC or FERC will modify the e-tag deadlines within the compliance timeline of the order. Under the new real-time market design, the ISO would no longer award hourly, financially binding energy schedules in the real-time market for intertie transactions. Instead, the ISO would clear and settle intertie energy schedules on a fifteen minute basis through the RTUC process. In order to align with the twenty minute e-tag submission deadline prior to energy flow, the ISO would align the market timeline for the 15-minute market such that the market results are consistent with WECC tagging practices. If WECC moves to 15-minute transmission reservations and shorter e-tag timelines in the future, the ISO can modify its timeline to run the 15-minute market closer to actual flow.

Order No. 764 does not require that the ISO settle its interties on a fifteen minute basis. But, the Commission recognizes that transmission providers may wish to adopt additional market redesigns that provide better flexibility than the minimal requirements in the order.³ In the past two years, the ISO has identified a number of inefficiencies with its current hour-ahead scheduling processes and real-time market settlement. Introducing the financial settlement of the 15-minute market addresses these market inefficiencies. In its recent stakeholder efforts, the ISO and participants determined a root cause of the market inefficiencies under the current market design. They observed that intertie transactions are financially binding based on the HASP LMPs, however, load and internal generation are financially binding based on the RTD LMPs. The HASP and RTD optimizations run at different time delays and with different market interval durations. As a result, system conditions are not aligned when running these applications which results in price divergence and market uplifts.

By aligning to a single, 15-minute financially binding real-time optimization, most of the current real-time market pricing issues can be addressed. This will enable the reintroduction of convergence bidding on the interties. Prior to suspension, convergence bids for interties were priced in real-time at the HASP LMP and internal nodes were priced at RTD LMPs. Convergence bids settled in different market optimizations negatively impacted the market efficiency of virtual bids. The alignment of the real-time settlement addresses these issues. While the not the driver of suspending convergence bidding on the interties, the other issue that must be addressed in order for convergence bidding to be reinstated on the interties is prices inconsistent with bids as a result of the enforcing both the physical and physical + virtual constraints in the day-ahead market.

³ See Order No. 764 PP 99, 107.

2 Plan for Stakeholder Engagement

Item	Date
Post Revised Straw Proposal	February 5, 2013
Stakeholder Meeting	February 12, 2013
Stakeholder Comments Due	February 26, 2013
Post Draft Final Proposal	March 26, 2013
Stakeholder Meeting	April 2, 2013
Stakeholder Comments Due	April 9, 2013
Board Meeting	May 2013
Tariff Filing	November 2013

3 Changes from Straw Proposal

- Eliminated transmission reservation bidding and settlement
- New hourly process to accept block schedules
- Modification of the HASP Schedules Declines Charge to align with hourly process to accept block schedules and mitigate over-scheduling of imports by variable energy resources
- Clarified real-time intertie bidding options and added option for single intra-hour economic curtailment
- Resolution of dual-constraint issue by not accepting day-ahead tags above transmission scheduling limit
- Added convergence bidding position limits for re-instatement with FERC Order 764 design changes

4 Renewable Integration: Market Vision and Roadmap

During the Renewable Integration: Market and Product Review Phase II initiative, the ISO discussed with stakeholders a potential redesign of the real-time market to a 15-minute dispatch and a new balancing product to manage changes between the dispatch and regulation. During the stakeholder process it was concluded that in the next two to three years 15-minute schedules within WECC would not be realized. Also, the implementation complexity of the 15-minute dispatch design would not be achievable in two to three years due to significant software changes. As a result, the ISO developed seven guiding principles to assess the comparative value and merits of the market enhancements proposed near, mid, and long term market enhancements. The ISO briefed the Board of Governors in December 2011 on these guiding principles. FERC Order 764 significantly shortened the assumed timing for the implementation of 15 minute scheduling in WECC. In considering options to allow 15 minute scheduling, the ISO sought to be consistent with the guiding principles in this proposal.

The seven guiding principles are:

Technology Agnostic

Principle	The ISO market accommodates new resource types based on their performance capabilities, without preference for specific technologies.
Expected Outcomes	<ul style="list-style-type: none"> ✓ Enables any technically capable resource, regardless of technology, to provide services on a level playing field based on performance ✓ Resource technologies are viable based on innovation and competition rather than on resource-specific market rules ✓ Integrates devices that can both produce and consume energy

Transparent

Principle	The ISO market relies on price signals to incent participant behaviors that align with ISO operating needs.
Expected Outcomes	<ul style="list-style-type: none"> ✓ Products are competitively procured through transparent market mechanisms ✓ Procurement targets are transparent and tied to operational needs ✓ Operating constraints are reflected in price signals, minimizing non-market solutions ✓ Prices incent performance from supply and demand that supports operational needs and encourages mitigation of generation variability and congestion ✓ Pricing rules allow transparent allocation of renewable integration costs

Deep and Liquid

Principle	The ISO market attracts robust resource participation.
Expected Outcomes	<ul style="list-style-type: none"> ✓ More economic bids and less self-scheduling ✓ More price responsive demand ✓ Increased participation from resources in other balancing authorities through improved interchange scheduling ✓ Minimal seams issues with neighboring balancing authorities

Durable and Sustainable

Principle	The ISO market ensures an efficient mix of resources to maintain reliability and attracts new investment when and where needed.
Expected Outcomes	<ul style="list-style-type: none"> ✓ Resources are commercially viable through a combination of ISO market revenues and forward contracts ✓ Resource fleet and mix enables the ISO to meet NERC and WECC reliability standards ✓ Resources are incented to enhance availability and performance ✓ Market products and rules are stable ✓ Known real-time market issues are addressed

Flexible and Scalable

Principle	The ISO market easily adapts to new and changing energy policy goals and resource mix.
Expected Outcomes	<ul style="list-style-type: none"> ✓ Establish flexible market design that can accommodate reasonable changes in policies and technologies ✓ Recognize key linkages and coordinate with initiatives and proceedings of state agencies ✓ Compatible with high penetration levels of distributed energy resources

Cost-effective and Implementable

Principle	The ISO market design leverages existing ISO infrastructure, industry experiences and lessons learned.
Expected Outcomes	<ul style="list-style-type: none"> ✓ A market design that is cost-effective to implement for market participants and the ISO ✓ Build on existing functionality and market systems to extent possible ✓ Design leverages the experience of other ISOs/RTOs as to what works and what does not; do not re-invent

Cost Causation

Principle	The ISO market allocates costs based on cost causation
Expected Outcomes	<ul style="list-style-type: none"> ✓ Market participants better manage their load and resource variability ✓ More accurate forecasting and scheduling by market participants reduces operational uncertainty and associated costs

5 Real-Time Market Timeline

The current real-time market is composed of three processes. The HASP establishes hourly financially binding energy and ancillary services for intertie transactions. The RTUC establishes financially binding ancillary services awards and unit commitment for internal generation. The RTD then establishes financially binding energy dispatches for internal generation. In real-time, the RTD optimization is based on demand (including losses) calculated by the ISO's state estimator, and load is settled based upon the actual metered demand.

The ISO proposes to replace the HASP with an hourly process to accept block schedules. To address the need to support hourly intertie energy schedules, in the straw proposal, the ISO proposed leveraging the market functionality gained from the Dynamic Transfers initiative to award financially binding hourly transmission reservations for dynamic intertie transactions. Based upon further discussion with stakeholders, the ISO is no longer proposing to implement transmission reservations bidding and settlement. The Dynamic Transfer initiative assumed that all static intertie energy schedules would be hourly. The transmission reservation established a process to ensure that dynamically scheduled variable energy resources could (1) secure sufficient hourly transmission capacity to meet positive forecast errors and (2) establish a cost of securing hourly transmission capacity in excess of its expected energy to incentivize improved forecasting. Under the FERC Order 764 paradigm, the two objectives above can be met by incentivizing static intertie transactions which can be curtailed if variable energy resources self-schedule above their hourly expected energy in the 15-minute market. As a result, it is no longer necessary to implement transmission reservations to support dynamic transfers. The revised straw proposal includes additional incentives to increase the amount of intertie transactions that can be economically curtailed in the binding 15-minute interval.

The proposed real-time market timeline limits seams issues with neighboring balancing authorities by acknowledging the existing e-tagging and intra-interval ramping practices in the west. The ISO proposes to maintain existing market timelines wherever possible to minimize impact on the business processes of market participants and neighboring balancing authorities.

5.1 Real-Time Bid Submission

The ISO proposes to retain hourly submission of bids to the real-time market. These bids will be used to:

- Economically accept hourly block schedules;
- Economically schedule resources for energy in the 15-minute market; and,
- Economically dispatch resources in the 5-minute real-time market runs.

The bid submission timeline has the same deadline under the current real-time market design. The same economic bids will be used in both the 15-minute market and RTD. Load will clear based on ISO forecasted demand by DLAP. Therefore, load serving entities will not be allowed to bid their load in the real-time market.

There will be no changes to the hourly bid information provided by internal generation. Variable energy resources that plan to self-schedule in the 15-minute market can provide additional bid information that the ISO will use in the 5-min RTD to potentially dispatch them down from 15-minute self-schedules.⁴

⁴ As part of the flexible ramping product design, variable energy resources can submit additional information so that they can be awarded flexible ramping down and can be decremented from their 15-minute self-schedules. The ability to submit a decremental bid to a variable energy resource's

FERC Order 764 does not require changes from hourly transmission reservations to 15-minute transmission reservations – it only addresses *energy* schedules, as opposed to *transmission* scheduling. In addition, the ISO proposes not to require intertie resources to provide 15-minute energy schedule updates.

The ISO believes, over time, the hourly timeline, as illustrated in Figure 1, could be pulled in closer to the start of the hour though additional automation of intertie scheduling checkout business processes. However, it is important to note that the hourly block schedules must be accepted at or before the market optimization starts for the first binding 15-minute market in a trade hour. As shown in Figure 1 below, hourly block schedules are accepted forty-five minutes before the hour. As is explained below, this is 7.5 minutes prior to the start of the optimization for the first 15-minute market in the trade hour.

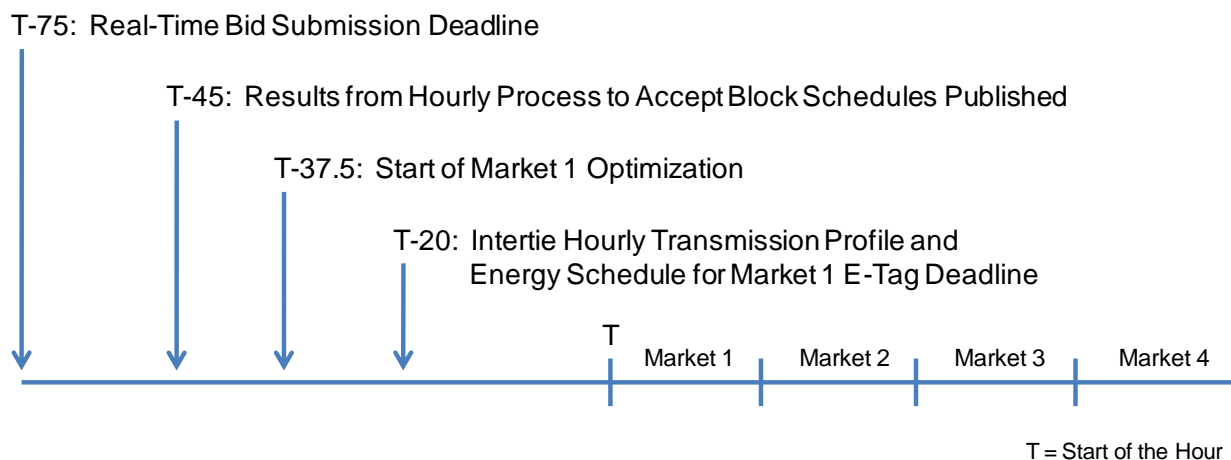


Figure 1 - Timeline of Hourly Real-Time Processes

The bids submitted by intertie resources will change somewhat under the ISO’s proposal to accommodate both hourly and 15-minute economic bids and self-schedules. The ISO will run separate processes for accepting hourly block schedules and determining binding energy schedules and ancillary services awards. Intertie resources will submit the following information:

- a) Energy self-schedule and/or energy bid, same as currently;
- b) Ancillary services bids, same as currently;
- c) Flag to require bid to be considered as an hourly block schedule;
- d) Flag to allow a single curtailment for the remainder of the hour for accepted block schedules; and
- e) Flag to determine participation in the 15-minute market if the intertie transaction is not accepted in the hourly process.

5.2 Hourly Process to Accept Block Schedules

Under the proposed 15-minute market design, the currently financially binding HASP energy schedules for imports and exports will be eliminated. Financially binding energy schedules and

self-schedule will be implemented with the FERC Order 764 market design changes, which is before the implementation of the flexible ramping product.

ancillary services awards will be determined based on the energy self-schedule and/or energy bids and the ancillary services bids simultaneously within each 15-minute interval by the existing RTUC application. As illustrated in figure 1 above, for each trading hourly there will be four 15-minute markets.

The ISO will run a market optimization to accept hourly block schedules and provide advisory energy schedules and ancillary services awards. The results will be published at T-45 which is the same time as current HASP schedules are provided and will be used for tagging hourly transmission profiles.

The following scheduling options will be available for intertie transactions:

1. Self-scheduled hourly block
2. Self-scheduled variable energy resource forecast
3. Economic bid hourly block
4. Economic bid hourly block with single intra-hour curtailment
5. Economic bid with participation in 15-minute market
6. Economic bid with participation in 15-minute market only if cleared in hourly process for block schedules
7. Dynamic Transfer

In the hourly process to accept block schedules, the market optimization will enforce a constraint that each 15-minute interval energy schedule of submitted hourly block schedules will be equal. Then in the financially binding 15-minute market, the accepted hourly block schedule will be considered a self-schedule. For self-scheduled variable energy resource forecast, the market optimization will use the expected energy for each 15-minute interval, thus there is not restriction that the expected energy is flat for the hour. Then in the financially binding 15-minute the variable energy resource can update its forecast and self-schedule used in the 15-minute market. For economic bids with participation in the 15-minute market and dynamic transfers, the market optimization can result in advisory energy schedules that are different in each 15-minute interval. The energy schedule in the financially binding 15-minute market can be different than the advisory schedule that cleared the hourly process to accept block schedules, but not greater than the highest single 15-minute interval from the hourly process. This is done to accommodate block schedules since this value is used for the transmission portion of the corresponding e-tag. The energy schedule cannot exceed the transmission capacity listed on ne-tag.

Ancillary services can also be awarded as a block schedule and will be considered self-provision in the 15-minute market to determine the financially binding ancillary services price. Currently, if a contingency reserve is dispatched the energy schedule remains at the dispatched level for the remainder of the hour. The implementation of the 15-minute market will not change this WECC practice. For example, assume a resource has an hourly block advisory energy schedule of 100 MW and spinning reserve of 50 MW. In the event that the spinning reserve was dispatched in interval 2, the remaining intervals will reflect a self-schedule of energy at 150 MW assuming the entire spinning reserve was called.

Figure 2 below illustrates the outcome of the hourly process to accept block schedules. In this example, the intertie has an import limit of 1,000 MW. The sum of economic bids which would clear if not limited by transmission capacity would be 800 MW in interval 1, 900 MW in interval 2, 1,000 MW in interval 3 and 1,100 MW in interval 4. Since the sum of economic bids which would clear is greater than the import limit, the full sum of economics bids which would clear cannot be awarded in interval 4. The hourly blocks and hourly blocks with intra-hour curtailment clear at the same MW quantity for each 15-minute interval – 300 MW for hourly blocks and 200 MW for hourly blocks with intra-hour curtailment. The ISO will accept hourly e-tags for both

transmission and energy for these quantities. The variable energy resource’s hourly forecast is 100 MW for interval 1, 200 MW for interval 2, 300 MW for interval 3 and 400 MW for interval 4. The ISO will accept an hourly e-tag for 400 MW of transmission capacity. The economic bids that will participate in the 15-minute market and Dynamic Transfers clear at 200 MW for the first three intervals, but at 100 MW for the fourth interval since the import limit has been reached. The ISO will accept an hourly e-tag for 200 MW of transmission capacity. Figure 2 also shows variable energy resources can exceed their forecasted energy up to the MW quantity of economic bids participating in the 15-minute market and the amount of Dynamic Transfers since those advisory schedules can be curtailed economically in the binding 15-minute market.

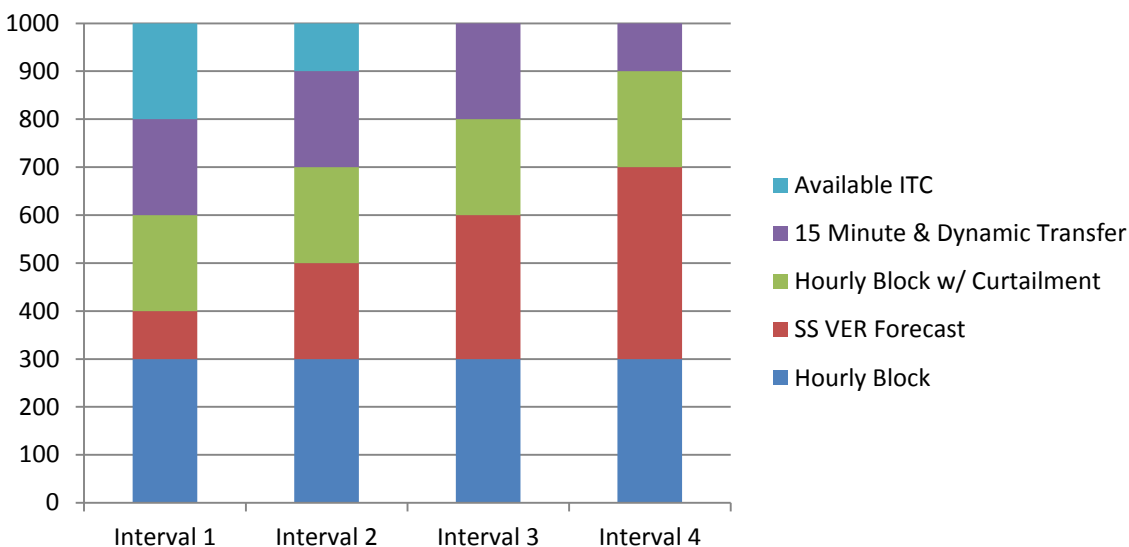


Figure 2 - Example of hourly process to accept block schedules

5.2.1 Self-Scheduled Variable Energy Resource Forecast

Variable energy resources can use the ISO forecast for their 15-minute expected energy in the hourly process to accept block schedules. In addition, a variable energy resource can also use its own forecast of expected energy; however, if the expected energy is not delivered in the 15-minute market, the variable energy resource will be subject to a penalty similar to the existing HASP schedules decline charge, as discussed in more detail in a section 6.2 below. This ensures that variable energy resources do not overstate expected energy that crowds out hourly block schedules. Since the advisory energy schedule that clears from the hourly process to accept block schedules is not financially binding this penalty mechanism is used to incentivize forecasting actual expected energy. The hourly block process schedules declines charge also applies to other intertie transactions that do not e-tag an accepted hourly block schedule.

5.2.2 Economic Bid Hourly Block with Single Intra-Hour Curtailment

In order to increase the amount of energy schedules that can change in the 15-minute process, the ISO proposes to allow hourly block schedules the option of being economically curtailed once in the hour. Given the proliferation of intermittent resources, the ISO believes entities throughout the WECC region will take advantage of 15-minute energy scheduling. However, over the next few years, transmission reservations within WECC will remain predominantly

hourly. Currently WECC allows and has established business processes that support a single intra-hour curtailment of intertie schedules.

The proposed single intra-hour curtailment of intertie schedules will work as follows:

- Assume an hourly block import has bid of \$50.00. In the hourly process to accept block schedules, the import is accepted for 100 MW.
- In interval 1 of the 15-minute market the LMP is \$55.00, the import flows and is paid \$55.00.
- Then in interval 2, the 15-minute market the LMP drops to \$45.00, the import is curtailed and does not flow in interval 2, interval 3, or interval 4.
- If in interval 3 and interval 4, the price increased to \$55.00, the import schedule would remain at the curtailed level in interval 2.

The hourly block schedule with the option to curtail once is eligible for real-time bid cost recovery if it is decremented from its day-ahead schedule. So under the previous scenario, assume the resource has a 100 MW day-ahead schedule, the resource would be eligible for bid cost recovery in interval 3 and interval 4 because the price is above their bid of \$50.00.

5.2.3 Economic Bid Participation in 15-Minute Market

There may be instances when an intertie resource submits an economic bid and is willing to be rescheduled in the 15-minute market, but is not accepted through the market optimization of the hourly process to accept block schedules. When the intertie resource submits its bid, it could select the option of not participating in the 15-minute market unless it has been awarded an advisory energy schedule from the hourly process to accept block schedules.

5.3 15-Minute Market Process

Under the proposed 15-minute market design, 15-minute energy schedules will be financially binding for imports, exports, internal resources, and load. The ISO will leverage the existing real-time unit commitment process which currently co-optimizes energy and ancillary services, but only results in financially binding unit commitment and ancillary services awards. The current co-optimization calculates non-binding 15-minute energy schedules and LMPs. The 15-minute market will clear against the ISO's forecast of real-time demand.

In order to minimize seams issues with intertie transactions, the ISO will align the 15-minute market timeline so that the e-tag deadline at twenty minutes in advance of flow can be met for the energy schedules dispatched by the 15-minute market runs. Aligning the 15-minute market timeline to allow for tagging energy schedules for the 15-minute markets requires that the ISO begin the market optimization 37.5 minutes prior to the binding interval, earlier than the current 22.5 minutes prior to the binding interval, so that the ISO can issue awards at 22.5 minutes prior to the binding interval. This allows 2.5 minutes for intertie transactions to submit updated e-tags reflecting the binding energy schedule twenty minutes prior to flow. Only e-tags for energy schedule changes made in the 15-minute market need to be updated, not all e-tags. During the implementation phase of these market design changes, the ISO will assess if the 15-minute market solution time can be optimized such that the results could be published earlier allowing more time for updating of energy schedules on e-tags. Figure 3 below shows the timeline for the second financially binding 15-minute market interval in a trade hour.

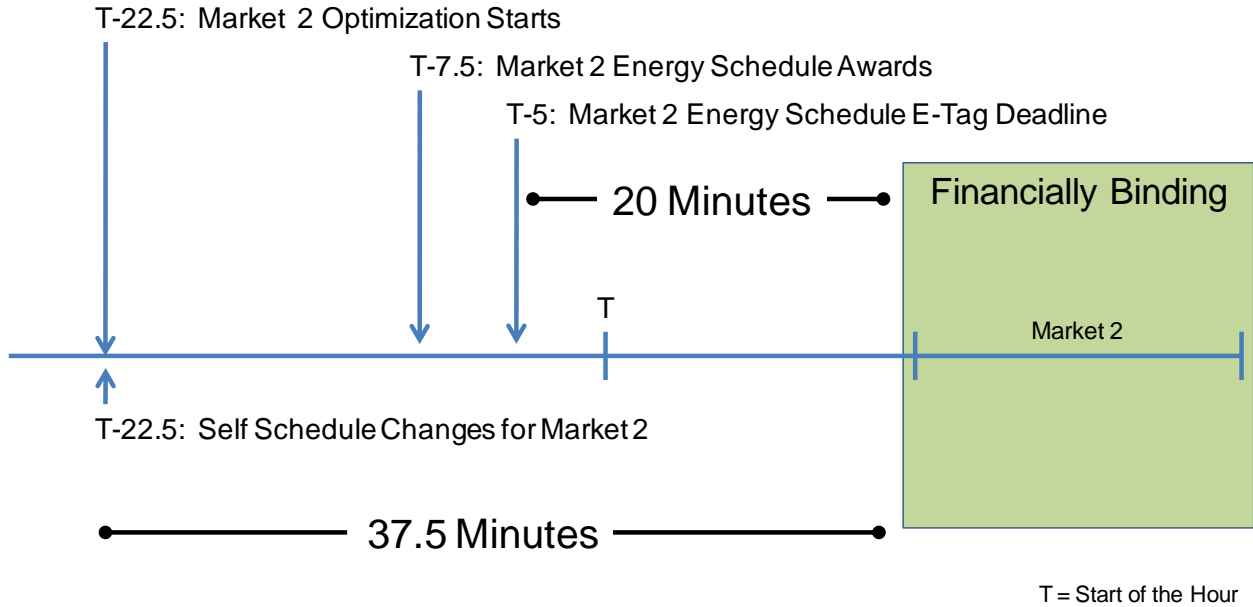


Figure 3 - Timeline of 15 Minute Real-Time Processes

As described above, beginning the run of the optimization for the 15-minute market at 37.5 minutes prior to the binding interval is 15 minutes earlier, than the current real-time unit commitment process, which begins at 22.5 minutes prior to the binding interval. The ISO has analyzed market data⁵ to estimate the impact of extending this timeline. This analysis has compared both the differences between RTUC 15-minute market results for the current binding RTUC interval compared to the binding RTD intervals within each 15-minute period, as well as the RTUC 15-minute market results for the first advisory interval to the corresponding binding RTD intervals. The comparison of the first advisory RTUC interval to the binding RTD intervals is analogous to the ISO proposal for the new 15-minute market. The analysis shows that while the tagging timeline required the ISO to start the new 15-minute market earlier than the existing RTUC process, there is not a material difference in system condition changes that would negatively impact the improved market efficiency of implementing the 15-minute market.

The ISO does not believe that there will be changes to the WECC interval ramping protocols. Currently hourly changes have a 20-minute ramp and 15-minute changes will have 10-minute ramps. The ISO will use the appropriate ramp profile to ensure awarded 15-minute schedules are feasible. As business processes evolve within WECC and the checkout of energy schedules becomes more automated, the ISO anticipates the 15-minute market could be pulled in closer to the binding interval.

⁵ The data and analysis is posted at <http://www.caiso.com/Documents/Stakeholder%20web%20conference%20Oct%2030,%202012>

5.4 5-Minute Real Time Dispatch

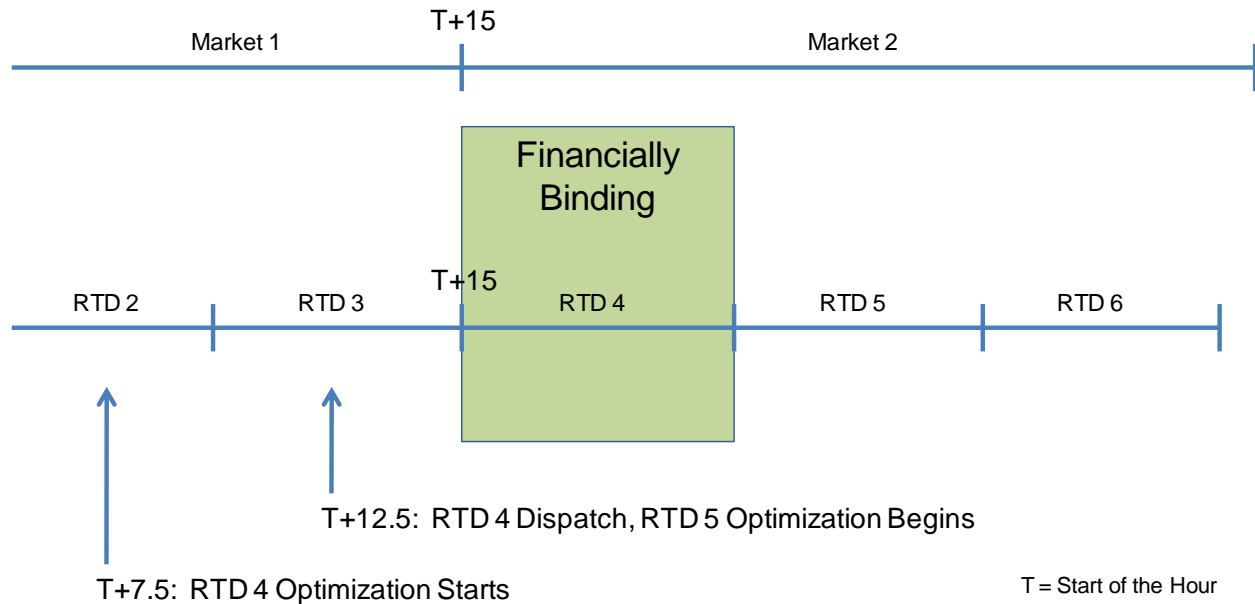


Figure 4 - Timeline of 5 Minute Real-Time Dispatch

The ISO is proposing no changes to the 5-minute real-time dispatch timeline or business processes. The market optimization determines the financially binding dispatch and communicates to resources 2.5 minutes prior to the binding RTD interval. Figure 4 above shows the market timeline for the first RTD run in the binding 15-minute market 2 shown above. The 5-minute RTD will continue to clear against the ISO’s real-time demand forecast.

It is important to note that the market timeline of RTD minimizes potential “implicit” virtual bidding on the interties. It is argued that intertie schedules may not tag their energy schedule awarded in the 15-minute market so that they will be settled at a lower RTD price for their deviation. Since the 15-minute market schedule is determined at 22.5 minutes prior to the start of the first binding RTD interval, the intertie schedule would not have visibility in to actual RTD pricing which is published 2.5 minutes prior to the bidding interval before the tagging deadline of 20-minutes prior to the binding RTD interval. The ISO will monitor for potential “implicit” virtual bidding and if results in reliability issues or market inefficiencies the ISO will consider recommending penalties as part of the future uninstructed deviation penalty discussion.

6 Settlement with 15-Minute Market

6.1 Energy Deviations for Generation and Intertie Transactions

With the introduction of financially binding energy schedules for the 15-minute market, energy in the various markets will be settled as follows⁶:

- Day-ahead energy schedules will be settled at the day-ahead LMP.
- The difference between the 15-minute market energy schedule and the day-ahead energy schedule will be settled at the 15-minute market LMP.

⁶ The ISO has posted an illustrative spreadsheet of energy settlement with the revised straw proposal.

- The difference between RTD energy dispatch and the 15-minute market energy schedule will be settled at the RTD LMP.
- Instructed energy will be calculated every five minutes for both the 15-minute market and RTD. Uninstructed imbalance energy will be calculated every five minutes and settled at the RTD LMP.
- Real-time bid cost recovery will include revenues and costs from both the 15-minute market and RTD using the same hourly bid curve.
- Current make whole payments due to price corrections for export resources will be provided for both 15-minute and, if applicable, for 5-minute LMP corrections.

All intertie transactions will be settled in a consistent manner to internal resources. For intertie transactions, if a 15-minute self-schedule or awarded energy schedule is not e-tagged at twenty minutes prior to flow, the deviation or operational adjustment will be settled at the RTD price in the same manner as internal generation deviations to 15-minute energy schedules. For hourly block schedules, if the energy schedule is curtailed for physical reasons the self-schedule for each of the 15-minute market can be updated. If the outage or other schedule change (e.g., a schedule that is affected by outages or changes in variable energy resources' output in other balancing authority areas, by priorities of transmission service using non-ISO transmission providers, or similar reasons) is known prior to the start of the 15-minute optimization, the 15-minute energy schedule will reflect the schedule change⁷. Thus, it would not be considered as a deviation between the 15-minute energy schedules which is settled at the RTD price.

The ISO proposes to meter generation every five minutes. Currently the ISO receives 5-minute meter data from internal generation, but then sums two five minute intervals to align with the ten minute settlement interval for purposes of calculating uninstructed imbalance energy.

Several stakeholders have advocated that deviations between the 15-minute market and RTD should be settled at the "worst of" price. For example, positive generation deviations would be paid the lower of the 15-minute price or RTD and negative deviations would be charged the higher of the 15-minute price or RTD. This is intended to incentivize resources to follow RTD dispatch since uninstructed deviations can never be profitable, but would be a departure from the settlement of deviations common in LMP markets, i.e. deviations are paid/charged at the price existing in the timeframe in which the deviation occurs. The ISO has proposed several market design changes that have incentivized following dispatch without changing the fundamental settlement of deviations. The recent changes in bid cost recovery approved by the Board have addressed various deviations and their impact on bid cost recovery payments. In addition, the proposed cost allocation of the flexible ramping product allocates costs based upon uninstructed imbalance energy and rescinds flexible ramping product payments if the RTD dispatch is not followed. The ISO believes that if additional measures are needed, such as implementation of uninstructed deviation penalties, they should be reviewed after implementation the new 15-minute market.

In addition, several stakeholders have expressed concern that intertie schedules could engage in "implicit" virtual bidding between the 15-minute market and RTD. Since deviations are settled at the RTD price, an intertie schedule could exploit predicted differences between the 15-minute market price and the RTD price. Based on the historical data provided, no analysis has concluded that there is a predictable price difference. The tagging deadline for 15-minute energy schedules is 20 minutes prior to flow. Since the pricing results of the first RTD interval are not published until 7.5 minutes prior to flow, there is not the ability for an intertie resource to

⁷ See Order on rehearing and clarification and granting motion for extension of time re Integration of Variable Energy Resources under RM10-11, PP 5

observe the first RTD prices and then not tag their energy schedule from the 15-minute market. The ISO believes that if additional measures are needed, such as implementation of uninstructed deviation penalties, they should be reviewed after implementation the new 15-minute market.

6.2 Hourly Block Process Decline Charge

Since the hour ahead process to accept block schedules does not result in financially binding settlements there can be instances where a resource does not bear a financial consequence if it is unable to meet its advisory energy schedule. The following are examples:

- An incremental export when constrained in the import direction;
- An incremental import when constrained in the export direction;
- An import from a variable energy resource that overstates its expected energy output.

Similar issues occur under the HASP market design, since deviations from the hourly HASP schedule are settled at the HASP price. In order to address potential gaming concerns, the HASP Schedules Decline Charge was implemented. The HASP import (exports) schedule decline charge monthly threshold is the highest of 300 MW or 10% of total imports (exports). The price applied to the MW above the threshold is the maximum of \$10.00 or 50% of the HASP LMP.

The hourly block process decline charge applies to various intertie bidding options as follows:

Hourly Block

- All 15 minute declines used to determine threshold. This also includes day-ahead schedules which clear the hour ahead process to accept block schedules.
- No exposure to RTD prices if decline known prior to start of 15-minute market interval

Hourly Block with Curtailment

- Economically curtailed intervals exempt from numerator of threshold
- No exposure to RTD if decline known prior to start of 15-minute market interval

Variable energy resource using its own forecast

- For establishing the threshold, the numerator is the maximum actual 15-minute meter output.
- For establishing the threshold, the denominator is the maximum hour ahead process 15 minute interval (MW)
- Positive deviations can offset negative deviations in monthly threshold calculations

Economic Dispatch in the 15-minute market, Dynamic Transfers and VERs using the ISO forecast are exempt from the hourly block process decline charge

The price applied to MW above the threshold is the maximum of \$10.00 or 50% of the hourly average 15-minute LMP for imports. The price applied to MW above the threshold is the minimum of \$10.00 or 50% of the hourly average 15-minute LMP for exports.

Similar to the HASP Schedules Decline Charge there are separate monthly charges for imports and exports.

6.3 Settlement of Load

As previously described, both the 15-minute market and RTD will clear against the ISO forecasted demand. Non-participating Load will not be allowed to bid in to the 15-minute market

or RTD. (Participating Loads, Proxy Demand Resources, and other dispatchable demand response will continue to participate in the 15-minute market and RTD.) Differences in load from day-ahead schedules will be settled at the weighted average LMP of the 15-minute market and RTD by DLAP. The LMPs will be weighted by the MW cleared in the two respective markets. A spreadsheet has been posted that illustrates the load settlement with this revised straw proposal.

As illustrated in the spreadsheet example, since Load continues to be metered on an hourly basis, the weighted average approach does result in neutrality charges that are allocated to load. SCE requested that these neutrality charges be allocated to all deviations from net load – ISO load forecast less variable energy resources forecast. This is not appropriate as variable energy resources are settled in the 15-minute market based upon their forecasted output. Thus the hourly weighted average is only applicable to Load which is metered hourly. The variable energy resource forecast error is settled correctly as deviations between the 15-minute market and RTD. As a result, only ISO load forecast result in the neutrality charge of the Load settlement.

6.4 Grid Management Charge

The ISOs Grid Management Charge (GMC)⁸ consists three main cost categories or buckets (Market Services, System Operations, and CRR Services), and four transaction fees (bid segment fee, inter SC trade fee, CRR bid fee, and SCID fee).

Since the 15-minute market is now financially binding for both energy and ancillary services, the ISO proposes to include energy and ancillary services awards in two GMC charge codes: Market Services and the Bid Segment Fee.

The Market Services charge code is designed to recover costs the ISO incurs for running the markets. As such, this charge code will be applied to each scheduling coordinator's gross absolute value of awarded MWh of energy and MW per hour of ancillary services each market.

The Bid Segment fee is set at \$0.005 per bid segment and is applied to all bid segments submitted.

7 Variable Energy Resources

7.1 Participating Intermittent Resource Program (PIRP)

PIRP was a compromise. In return for providing meteorological data to allow production forecasting, PIRP resources were allowed to net over the month uninstructed imbalance energy if they submitted the ISO production forecast to establish their 5 minute instructed imbalance energy (hourly forecast divided by 12). FERC Order 764 now requires that variable energy resources provide meteorological data and the ISO believes that with the improved opportunities for variable energy resources to self-schedule their production closer to real time, the existing PIRP will no longer be needed.

Currently PIRP resources must submit the ISO hourly forecast generated 90-105 minutes prior to the hour to be eligible for monthly netting of uninstructed imbalance energy. This hourly forecast is used to establish instructed energy in RTD by dividing the total hourly forecast by twelve. If the PIRP resource does not have a day-ahead schedule (which is very common), the

⁸ Additional information on the Grid Management Charge is available at <http://www.caiso.com/informed/Pages/StakeholderProcesses/Budget-GridManagementCharge.aspx>

resource's scheduled instructed energy output based on the hourly forecast is settled at the average hourly RTD price. Instructed energy is settled at the 10-minute weighted average of the two RTD intervals, but since PIRP instructed energy is flat for the hour, the price is equal to the average hourly RTD price. For non-PIRP resources, uninstructed energy is settled at the 10-minute average price of the two RTD intervals. For PIRP resources, the uninstructed imbalance energy is netted over the month and paid (or charged) the average monthly LMP.

In the Renewable Integration: Market and Product Review Phase 1, several stakeholders argued that PIRP could not be eliminated until changes were made to the real-time market that allowed for closer and more granular schedule updates. Under the 15-minute market settlement, VERs will now be able to secure a forward energy position in real-time based upon a forecast received 37.5 minutes prior to flow. The 15-minute price is less volatile than the RTD price because resource commitment decisions can be made⁹. The variable energy resource will only be subject to the RTD price for forecast error between the 15-minute schedule and RTD interval. With 5-minute metering and if the resource elects to use 5-minute forecast granularity, both instructed and uninstructed imbalance energy are settled at the same 5-minute LMP.

The ISO is willing to consider limited grandfathering of existing PIRP resources for a limited duration, but believes that as the FERC Order 764 design changes are finalized, a clearer discussion can occur of the design elements, if any, that should be grandfathered. For example, do the proponents of grandfathering seek no changes to the existing PIRP program? This could result in design elements that are beneficial to variable energy resources such as more granular forecasting not being available to resources that elect to stay with the PIRP design. For example, would instructed energy be based upon the hourly forecast provided by the ISO and returned by the PIRP resource? Since PIRP resources have the option to participate in PIRP by not submitting the ISO forecast, if 15-minute forecast granularity is used does the forecast from T-52.5 versus T-37.5 need to be used to allow time for the scheduling coordinator to submit the forecast? Also, if PIRP resources request that this new functionality be available to PIRP resources, then how are these changes consistent with existing bilateral contracts that require PIRP participation under the current PIRP design?

7.2 Update of 15-Minute Self-Schedule

In order to use the latest possible forecast under these proposed market changes, variable energy resources will provide at a minimum a two-hour rolling forecast with fifteen minute granularity, although variable energy resources will be able to submit a 5-minute forecast to be used in the RTD dispatch as described further below. The forecast will be received by the ISO for the binding interval at 37.5 minutes prior to flow (the start of the market optimization for the binding interval). If no forecast is provided, the ISO will use the previous binding intervals telemeter energy.

As part of the Dynamic Transfer stakeholder initiative, variable energy resource that are dynamically scheduling can provide a two-hour rolling forecast with five minute granularity. The ISO proposes to also allow internal variable energy resources to optionally provide the same forecast granularity and will use the sum of the three 5-minute forecasts to determine the self-schedule for the binding 15-minute market interval. The ISO will use the forecast data received 37.5 minutes prior to start of the market optimization of the binding 15-minute market.

⁹ The ISO posted DA, advisory RTPD and the weighted average RTD price data on the FERC Order 764 market design changes website on October 26, 2012

Variable energy resources will have the option to use the ISO forecast or its own forecast. Variable energy resources pay \$0.10 per MWh for the ISO to provide forecasting services. If a variable energy resource elects to use its own forecast, it will be subject to the modified HASP schedules decline charge from the hourly process to accept block schedules. There are no other settlement differences if the ISO forecast or resource's forecast is used in the 15-minute market or RTD.

In the resource's master file, variable energy resources will select if they are using the ISO forecast or their own forecast and if they are using 15-minute or 5-minute granularity. The master file update process takes approximately 7-10 business days for changes to become effective in the market. In addition, the ISO will develop a certification process to approve variable energy resources to use their own forecast. The ISO will reserve the right to cancel a variable energy resource's ability to use their forecast if the resource's forecast is significantly less accurate than the ISO forecast.

7.3 Instructed energy in RTD

If the variable energy resource forecast uses 15-minute granularity, the ISO will divide the 15-minute forecast by 3 and return this value as the RTD instructed energy. For example, assume the 15-minute forecast was for 30 MWh. For each of the three relevant RTD intervals the instructed energy will be 10 MWh.

If the variable energy resource forecast uses 5 minute granularity, then the ISO will then use the 5-minute forecast available prior to the start of the RTD optimization to determine the instructed energy of the resource. RTD will return the 5-minute forecast value as the instructed energy for the binding RTD interval.

7.4 Decremental Bid from Self-Schedule

In the Flexible Ramping Product¹⁰ stakeholder initiative, the ISO has proposed to allow decremental bids from variable energy resources that submit real-time self-schedules. The ISO believes that variable energy resource can be suppliers of the flexible ramping product in the downward direction (FRD). By fully participating in the market and providing the flexible ramping product, variable energy resources will offset, at a minimum, the other costs associated with fully participating in the market. A key requirement for providing the flexible ramping down product is that the resource must participate in the market by submitting an energy bid to be used by RTD.

With the implementation of FERC Order 764, there are minor modifications to the decremental bidding proposal discussed in the flexible ramping product. On an hourly basis, variable energy resources that wish to be economically dispatched below their self-schedule and in the future participate in the flexible ramping down product will provide an energy bid that will be used to reduce the 5-minute energy schedule from the 15-minute self-schedule, along with the resource's ramp rate. In the 15-minute market, the ISO will utilize the resource's submitted 15-minute self-schedule to assess the amount of FRD that can be awarded in the 15-minute market and RTD. A variable energy resource can be awarded flexible ramping down based upon the amount it can ramp down in five minutes, which is the same rule for any other resource providing FRD. A variable energy resource with a decremental bid can be dispatched economically in RTD below its 15-minute self-schedule up to the maximum MW to be curtailed

¹⁰ Additional information on the Flexible Ramping Product stakeholder initiative is available at <http://www.caiso.com/informed/Pages/StakeholderProcesses/FlexibleRampingProduct.aspx>

below its 15-minute self-schedule. The settlement of energy dispatches and flexible ramping down awards in the 15-minute market and RTD is the same as for any other resource. The decremental bid is used in both the 15-minute market and RTD.

Beyond the flexible ramping product, decremental bids from variable energy resources can protect against negative prices during periods of over-generation. The ISO bid floor is being reduced from -\$30.00 to -\$150.00 in Fall 2013 and to -\$300.00 in Fall 2014. The lower bid floors provide additional incentives for variable energy resources to provide decremental bids. The ISO is evaluating the implementation of decremental bidding in Fall 2013 which is earlier than the other Order 764 changes planned for in Spring 2014. Since no changes to PIRP would be implemented in this timeframe, the ISO proposes to allow PIRP resources to also supply decremental bids. If in an hour, a PIRP resource's decremental bid is dispatched, that hour will be excluded from the monthly netting of uninstructed imbalance energy. If a PIRP resource's decremental bid is not dispatched within the hour will be included in the monthly netting of uninstructed imbalance energy. Until the implementation of Order 764 changes, a variable energy resource with a decremental bid can be dispatched economically in RTD below its hourly PIRP self-schedule up to the maximum MW to be curtailed below its hourly self-schedule.

8 Convergence Bidding

When the ISO implemented convergence bidding on February 1, 2011, market participants had the ability to submit virtual bids on the intertie scheduling points in the ISO market. On November 28, 2011 the ISO suspended convergence bidding on the interties because of excessive real-time imbalance energy offset uplift charges attributable to convergence bidding on the interties.

8.1 Settlement in Real-Time

Under the proposed 15-minute market design, the ISO proposes to allow convergence bidding on internal nodes and intertie scheduling points. With the implementation of 15-minute market settlement, the ISO will liquidate convergence bidding positions in the same market optimization as physical bids for both internal resources and interties. Virtual supply awards will receive the day-ahead LMP and pay the 15-minute market LMP. Virtual demand awards will pay the day-ahead LMP and receive the 15-minute market LMP.

The ISO proposes not to allow convergence bidding between the 15-minute market and RTD. Unlike the day-ahead market, load will not be able to economically bid in the 15-minute market, thus it would be inappropriate to allow virtual demand to bid in the 15-minute market. In addition, the ability for physical resources to update their 15-minute schedule every fifteen minutes reduces the duration a resource is exposed to 5-minute deviations for an outage.

8.2 Day-Ahead Dual Constraint Issue

During the time convergence bidding was allowed on the interties, the ISO saw cases where physical export bids are clearing the market at LMPs that are inconsistent (higher) than the submitted bid for the scheduled resource. Market participants raised concerns regarding the negative impact this pricing inconsistency may have on their settlement outcome.

Under the current design for convergence bidding on the interties, the ISO enforces two constraints at scheduling points: (1) net physical schedules across each scheduling point, ignoring the accepted virtual schedules to ensure that the physical schedules are within the established scheduling limit for that scheduling point and (2) physical and virtual imports net of

physical and virtual exports must also be within established scheduling limits for that scheduling point.

In the Intertie Pricing and Settlement¹¹ stakeholder holder initiative the ISO proposed an alternative solution. The ISO proposed to eliminate the “physical only” constraint in the day-ahead market. However, in order to comply with WECC interchange scheduling requirements, based on an intertie’s ITC, the ISO would impose a limit on the number of e-tags it will accept for IFM physical market awards.

The ISO proposes to establish the number of e-tags it will accept by enforcing the “physical only” constraint in RUC. The ISO will use penalized energy bids, such as applying a -\$250.00 adder to IFM bid of cleared IFM schedules. This will have the effect of creating a merit order list of IFM schedules which with ISO will accept day-ahead e-tags. The results of the RUC process to determine which IFM schedules can be tagged will be published at the same time as day-ahead market results. IFM schedules that are not allowed to tag in the day-ahead, due to the RUC results, will not be subject to the existing HASP reversal rule. For settlement purposes, these schedules will be assumed to have tagged prior to the start of the hour ahead process to determine block schedules. In addition, IFM schedules whether tagged or not tagged will have scheduling priority over incremental schedule submitted in real-time. This scheduling priority is the same as exists in the current market.

The past rationale for the physical import and export constraints is that they prevented physical intertie market awards from exceeding an intertie’s capacity. However, based on further consideration of the WECC reliability standards, the standards only require that total tagged interchange not exceed an intertie’s capacity¹². Thus, physical intertie market awards could potentially exceed an intertie’s capacity, but the ISO would only accept e-tags for a total net interchange up to the intertie’s capacity. In the hourly process to accept block schedules and the financially binding 15-minute market, the net physical intertie market awards would then be reduced to the intertie’s capacity..

Some market participants have expressed concerns that allowing physically infeasible market awards and imposing a tagging limit would yield undesirable outcomes. First, parties are concerned that giving a physical resource a market award and not allowing it to tag would put the market participant at risk of violating WSPP Schedule C contracts that require market awards be tagged by 3:00 pm of the day prior to delivery. The ISO recognizes that such an approach may lead to e-tags not being accepted but observes that even under the current market design there is no assurance that a physical intertie bid will clear the IFM and consequently be allowed to tag. In addition, the ISO observes the following

- The conditions under which a physical intertie bid clears the IFM but would not be allowed to tag are the same conditions under which the a physical intertie constraint was binding but the physical plus virtual intertie constraint was not binding previous to virtual bidding on the interties being suspended (i.e. virtuals providing counterflow to physicals to meet the tie constraint). As this circumstance did not occur frequently, the ISO anticipates that circumstances in which tags would potentially be cut for day-ahead physical intertie awards will occur relatively infrequently, and when it did occur, the amount of tags that would be cut would be small.

¹¹ Additional information on the Intertie Pricing and Settlement stakeholder initiative is available at http://www.caiso.com/informed/Pages/StakeholderProcesses/IntertiePricing_Settlement.aspx

¹² WECC standard INT-006-3 requirement R1.2 <http://www.nerc.com/files/INT-006-3.pdf>

- Not all IFM physical intertie awards are currently tagged in the day-ahead timeframe. Consequently, even if net physical intertie awards exceed an intertie's capacity, there is a likely possibility that the ISO will accept all e-tags submitted in the day-ahead timeframe.
- E-Tags may be cut for physical market awards under the current market rules. For example, e-tags for physical imports may be cut if e-tags are not submitted for physical exports providing counterflow on an intertie with import congestion.

Nevertheless, in the case an IFM physical intertie award is not allowed to tag prior to the hour ahead process to accept block schedules, two circumstances could result:

- The IFM physical intertie award clears the hour ahead process to accept block schedules. Subsequently, the ISO would accept the e-tag for the market.
- The IFM physical intertie award does not clear or is reduced in the hourly process to accept block schedules. In this case, it is possible that the IFM physical intertie award would be subject to the existing HASP buy-back rule that specifies that untagged imports be bought back at the higher of the IFM or 15-minute price (and that untagged exports are sold back at the lower of IFM or 15-minute price). The ISO proposes that the HASP buy-back rule not be applied to IFM awards that were not tagged as a result of the merit order approval process. These IFM awards will be assumed tagged for settlement purposes.

8.3 Position Limits

At the onset of convergence bidding, there was a position limit on convergence bids of 5 percent of an intertie's average transfer capacity per SC at each intertie. The position limits were to increase from 5 percent to 25 percent after eight months of implementation. Then they were to increase to 50 percent after 12 months from implementation. After 16 months there would be no position limits. However, as previously described, convergence bidding was suspended at the interties about nine months after it was implemented.

Given the challenges and risks that have been demonstrated with convergence bidding on the interties, the ISO believes it is prudent to impose position limits on intertie convergence bids. The ISO proposes that a total virtual intertie position limit be established at 10 percent of the largest intertie across all interties scheduling points for each scheduling coordinator¹³. The use of 10 percent of the largest intertie across all ties will allow sufficient hedging across most ties, while allowing the ISO and stakeholders to assess the effectiveness of the new convergence bidding design. This position limit would remain in place for at least six months after convergence bidding on the interties is reopened. Before lifting this limit, the ISO, in conjunction with the DMM, will examine the performance of convergence bids on the interties to determine if additional measures need be implemented to prevent inefficient market participant behavior or if the position limits can be raised.

This is the same proposal as the ISO made during the Intertie Pricing and Settlement stakeholder initiative.

9 Related Stakeholder Initiatives

The ISO currently plans to implement the FERC Order 764 market design changes in Spring 2014 assuming Board approval in July. The ISO also plans to implement the flexible ramping

¹³ Currently, the single largest intertie is the Tracy intertie at 3,829 MW

product and the integrated IFM/RUC in Fall 2014 assuming that these initiatives can be brought to the Board for approval in Q4 2013. If additional measures are needed to incentivize resources to follow RTD dispatches, the ISO recommends that stakeholders engage in a broader discussion of implementing uninstructed deviation penalties.

9.1 Leveraging iDAM to Separate the Dual Constraints

The integrated IFM and RUC or iDAM may provide additional opportunity to improve the resolution of the dual constraint issue of convergence bidding. The integrated IFM and RUC was discussed with stakeholders during the flexible ramping product initiative late last year.¹⁴ Under iDAM the enforcement of the dual constraints is divided between the IFM and RUC sub-problems that are solved simultaneously in iDAM, co-optimizing energy schedules (IFM objective) and reliability schedules (RUC objective) with a unified unit commitment. Under this proposal, both virtual and physical intertie schedules are constrained by the relevant intertie scheduling limit in the IFM sub-problem of iDAM, whereas only physical intertie schedules are constrained by the relevant intertie scheduling limit in the RUC sub-problem of iDAM. Therefore, since the virtual and physical energy schedules are constrained by the same constraints in the IFM sub-problem, they are both priced at the same marginal price; the IFM LMP. ISO plans to hold a technical workshop in early Q2 2013 to discuss iDAM with stakeholders.

9.2 Flexible Ramping Product

9.2.1 IFM, 15-Minute Market, and RTD

The current proposed flexible ramping design enforces the flexible ramping product requirements in integrated forward market (IFM), RTUC, and RTD. The day-ahead and RTD flexible ramping product awards are financially binding. The RTUC ensures units committed in real-time have sufficient headroom to meet flexible ramping product requirements, but the ramping capability is not financially binding because the energy schedules are not financially binding. This previous design decision was made to address concerns that false opportunity costs could arise since the energy settlement is not financially binding. Since the ISO is proposing in this initiative, to make the 15-minute energy schedules financially binding, we propose to settle the flexible ramping products in the 15-minute market.

The settlement of flexible ramping products is as follows:

- Day-ahead procured flexible ramping products will be settled at the day-ahead flexible ramping prices.
- The difference between the 15-minute market flexible ramping award and the day-ahead flexible ramping award will be settled at 15-minute flexible ramping price.
- The difference between the RTD flexible ramping award and the 15-minute flexible ramping award will be settled at RTD flexible ramping price.
- Flexible ramping products will be included in bid cost recovery. The flexible ramping product bid cost will be added to total bid cost, and the flexible ramping product payment will be added to total revenue.
- When day-ahead and real-time bid cost recovery are separated, IFM procured flexible ramping products will be included day-ahead bid cost recovery, 15-minute market

¹⁴ The iDAM concept is described in the [second revised draft proposal for Flexible Ramping Products](#). A mathematical formulation for iDAM is presented in the [iDAM draft technical description](#).

- procured flexible ramping products will be included in real-time bid cost recovery, and RTD procured flexible ramping products will be included in real-time bid cost recovery.
- Flexible ramping No Pay will be further refined to recognize the difference between RTPD and RTD flexible awards

The ISO will protect a resource's flexible ramping awards from a forward market by using a \$0.00 bid price for previous FRP awards in the subsequent markets. Day-ahead awards will have an assumed 15-minute market bid price of \$0.00. 15-minute awards will have an assumed RTD bid price of \$0.00. A resource can change its flexible ramping product bid price between day-ahead and the real-time markets, but the same rule will apply as for energy in the real-time markets. On an hourly basis a resource will provide a single flexible ramping product bid price and single energy bid curve that will be used in both the 15-minute market and RTD.

No other changes are necessary to align the flexible ramping product design with the implementation of the 15-minute market and settlement.

9.2.2 Cost Allocation

The ISO proposes to initially allocate the costs for the flexible ramping product to three categories based upon movement that requires changes in real-time dispatch of resources. The market changes discussed in this proposal requires the interval in which movement is measured to change from ten minutes to five minutes because of the metering of internal generation moving to five minutes. Movement for load is defined as changes in observed load every five minutes. Movement for supply is defined as changes in uninstructed imbalance energy and change in internal self-schedules every five minutes. Movement for static intertie ramps is calculated based upon the change in MWhs deemed delivered every five minutes.

There are no changes needed for the cost allocation used within the three categories.

9.3 Uninstructed Deviation Penalties

ISO tariff section 11.23 establishes deviation thresholds and administratively determined penalties for uninstructed deviation penalties. With the start of the new market in the 2009, the ISO received a waiver not to enforce uninstructed deviations penalties until additional market design enhancements could be made to improve the modeling of resource operating characteristics.

The flexible ramping product provides a market incentive for resources to accurately follow ISO dispatches versus an administratively determined penalty. The flexible ramping product compensates resources who incur opportunity costs in the binding RTD interval when the resource is not dispatched in order to meet future grid conditions. The compensation at the marginal opportunity cost is equal to the difference between the binding market interval LMP and the bid price of the marginal unit meeting the ramping constraint. As a result, the resource is compensated at or above the revenue that could be attained through an uninstructed deviation settlement. If a resource receives flexible ramping product compensation and then does not follow the RTD dispatch the capacity payments will be rescinded. In addition, the flexible ramping product cost allocation would charge resources that have uninstructed deviations. So a resource that does not follow its RTD dispatch would be worse off since the financial benefit of the uninstructed deviation is removed and the resource incurs additional costs due to the cost allocation.

If stakeholders believe additional measures are needed beyond the flexible ramping product's market incentives are required, a separate stakeholder initiative should be established to discuss of administratively determined penalties

10 Next Steps

The ISO plans to discuss this revised straw proposal with stakeholders during a meeting to be held on February 12. The ISO requests comments from stakeholders on the proposed market design described in this straw proposal. Stakeholders should submit written comments by February 26 to Order764@caiso.com.