

Memorandum

To: ISO Board of Governors

From: Mark Rothleder, Vice President, Market Quality & Renewable Integration

Date: December 10, 2014

Re: **Decision on pricing enhancements proposal**

This memorandum requires Board action.

EXECUTIVE SUMMARY

Management proposes market rule changes to improve pricing efficiency in four areas: administrative pricing rules that apply when market clearing prices are not available; validation of self-schedules supported with transmission contract or ownership rights; formulation of contingency-related constraints; and formulation of market constraints to ensure unique market clearing prices.

Administrative pricing is used during market disruptions or suspensions for when prices cannot be generated through its normal market clearing mechanism. After the September 8, 2011 southwest outage, the ISO committed to revise its administrative pricing rules that would apply for similar system emergencies or market disruptions. The ISO launched this effort in August 2012, and resumed it in June 2014 as part of a broader stakeholder process that led to the proposed changes. The current rule is to use the last available price produced in the market, referred to as the “last best price.” Management now proposes a tiered approach for administrative pricing that will provide simple and practical rules and price certainty, and have minimum impact on the market as a whole. The proposal also addresses settlements implications for both physical and financial resources and will clarify market participants’ financial obligations for force majeure events.

In June 2014, the ISO launched an effort to consider refinements to its market rules aimed at increasing price certainty and efficiency of prices cleared through its market. As a result, Management proposes the following three modifications to its market rules. First, a modification of the validation of self-schedules supported by transmission contract or ownership rights to avoid creating artificial congestion and to ensure efficient use of the ISO-controlled transmission grid. Second, a modification of the mathematical formulation for pricing constraint relaxation to eliminate the compounded pricing effect of penalty parameters for relaxation of contingency-related constraints. Third, a

modification of the mathematical formulation of market clearing logic to ensure that the market application produces a unique price in cases where constraints would otherwise create an array of possible prices. These three enhancements will strengthen market outcomes and provide more accurate and appropriate price signals.

Management proposes the following motion:

Moved, that the ISO Board of Governors approves the pricing enhancements proposal as described in the memorandum dated December 10, 2014; and

Moved, that the ISO Board of Governors authorizes Management to make all necessary and appropriate filings with the Federal Energy Regulatory Commission to implement the proposed tariff change.

DISCUSSION AND ANALYSIS

Administrative pricing rules

On June 13, 2012, FERC granted the ISO's petition to waive tariff provisions related to setting administrative prices and settling real-time market transactions in response to the September 8, 2011 southwest power outage. FERC found that the administrative prices established by the ISO to set price signals in order to manage the emergency were not authorized by the tariff, but granted the ISO's waiver request. FERC also granted a tariff waiver to permit the ISO to hold tripped load and resources harmless by reversing out the day-ahead awards for both load and resources. FERC declined to decide whether the September 8 southwest power outage constituted a force majeure event or whether the ISO had tariff authority to hold resources harmless in the event of a force majeure event. FERC acknowledged the ISO's commitment to consider tariff changes to avoid confusion regarding pricing in the event of a similar emergency or market disruption in the future through a stakeholder process.

Management recognized that the existing administrative pricing tariff rule of using the last best price, while useful in filling brief gaps caused by intermittent market disruptions, may not provide appropriate price signals for more serious and lengthy market disruptions such as the 2011 southwest power outage, where the ISO had to suspend the market for several hours. Management also recognized the need to clarify the settlement implications in the event of a force majeure event. The following three part proposal for administrative pricing rules addresses these elements:

(1) Day-ahead administrative pricing

While such occurrences are very rare, it is possible that the day-ahead market outcome is either not available or is unreliable. For such cases, Management proposes that the ISO have the authority to use either day-ahead results – for both awards and prices – from the previous day, or rely fully on the results of the real-time market to operate and

price the energy transactions. The ISO will notify the market of its intended election by 6:00 PM the day before the operational day and will use it unless the ISO is ultimately able to clear the day-ahead market with a reliable solution in time to issue schedules and prices for the next day. This approach provides notice to the market of the ISO's anticipated use of the administrative pricing option while it continues to address the issues preventing a market clearing solution. Management believes that this approach will allow the ISO to pursue a day-ahead market solution that is superior to an administrative price option if one can be achieved.

The selection of the administrative option will be based on system conditions. If system conditions are not reasonably similar to the previous day, the ISO will rely on the real-time market. Although the ISO proposed to seek authority to use either the previous day's results or the real-time market, the ISO's preferred option will be to use the previous day's results if at all possible, for the following reasons. First, use of the previous day's day-ahead market results mitigates against the worst case scenario in which the real-time market might also be suspended. Second, using the previous day's solution provides the ISO with a starting point for dispatch and settlement, while the real-time market can provide the incremental or decremental differences between the day-ahead and real-time, thereby minimizing the need for manual instructions. Third, market participants will know in advance their awards and prices for the applicable trading date, minimizing uncertainty and allowing them to secure fuel and prepare their resources for commitment.

These rules are accompanied with corresponding settlements provisions. If the ISO decides to use the previous day's results of the day-ahead market, congestion revenue rights will be settled also with the prices of the previous day's results. Convergence bids will be suspended for the day when the day-ahead market is suspended. If the ISO determines it must rely on the real-time results, resources will be fully settled with real-time prices, and there will also be no convergence bids to settle. Based on feedback from stakeholders and the Market Surveillance Committee, Management proposes to settle congestion revenue rights with the hourly average of the fifteen-minute real-time market prices if there is the need to rely fully on the real-time market. This is necessary because, in such cases, resources will settle fully on real-time prices and will still be subject to congestion charges; this provision will provide the hedge for the real-time congestion.

(2) Real-time market administrative pricing

For the real-time market, the current requirement of using the last best price is well suited for minor market disruptions involving a limited number of missing fifteen-minute market or real-time dispatch intervals. This approach does not work as well for other circumstances in which, for example, the ISO experiences prolonged disruptions over multiple intervals. Therefore, Management proposes a three-tier approach that addresses the broader array of circumstances more effectively.

a) Tier 1- Brief non-emergency market disruptions

If the fifteen-minute market prices are missing for fewer than four consecutive intervals, or if the five-minute real-time dispatch interval prices are missing for fewer than twelve consecutive five-minute intervals, Management proposes to preserve the current administrative pricing of using the last best price for each market accordingly.

b) Tier 2 - Longer non-emergency market disruptions

If either the fifteen-minute market prices are missing for more than three consecutive intervals or the five-minute real-time dispatch interval prices are missing for more than eleven consecutive intervals under non-emergency system conditions, then the ISO will fill in missing prices as follows:

- i. Where the real-time dispatch interval dispatch prices are not available but the fifteen-minute market prices are available, then the fifteen-minute market prices will be used to fill in missing real-time dispatch prices. Conversely, if the fifteen-minute market prices are missing but the five-minute real-time dispatch interval prices are available, then the simple average of the three applicable five-minute real-time dispatch interval prices will be used to fill for the missing fifteen-minute market intervals. This approach utilizes prices for the same corresponding hour, thus reflecting as closely as possible the same market conditions and would minimize the participants' exposure to imbalance charges between the fifteen-minute market and the five-minute market.
- ii. Where both the fifteen-minute market and five-minute real-time dispatch interval prices are not available, the ISO would use prices from the day-ahead market cleared for the same trading hours. This provides greater price certainty and transparency and also minimizes imbalance charges across markets.

c) Tier 3 - Market suspension

The ISO already has tariff-based authority to suspend its market under specific conditions, and Management does not propose changes to that authority. Generally, suspension of the market, or elements of the market, occur under two scenarios: (1) the market could fail as a result of catastrophic software failure; or (2) the market results are of such poor quality that system operations cannot use them for reliable operation of the grid. The September 8, 2011 event involved such a large scale system emergency where generation and load tripped. Although the ISO's market software continued to function, the market results did not reflect the major system changes and did not align with actual conditions. For such instances in which the ISO suspends the real-time market, Management proposes to use prices from the day-ahead market cleared for the same trade hours. This approach provides the following benefits: First, it provides certainty to the marketplace as the prices are already known. Second, use of the day-ahead prices minimizes the settlements implications since any deviation of resources

between the day-ahead and the real-time markets will be settled at zero price difference. Third, using day-ahead prices also addresses the settlements for convergence bids since they will be liquidated at zero cost/profit. In case the day-ahead prices do not fully compensate resources, the bid cost recovery mechanism will use bids from the previous day-ahead market, while resources instructed manually will settle with the standard mechanism of exceptional dispatches. In the extreme case where both the day-ahead and real-time markets are not functioning and the ISO relies on using the previous day's results, the same applicable settlements provisions apply for the scenario of using the previous day's results for the real-time market suspension.

(3) Force majeure

Management proposes to preserve the current imbalance energy settlement rules that apply under force majeure events, but proposes to add language to the tariff that explicitly states that force majeure events do not alter the rules for settling deviations from day-ahead schedules and awards. As part of its tariff waiver filing in connection with the September 8, 2011 outage, the ISO argued that both tripped load and resources should be held harmless during the term of the massive outage and requested a tariff waiver to allow this result. FERC granted the ISO the relief through a tariff waiver, but its waiver was not based on a finding of whether the force majeure provision in section 14 of the tariff authorizes this result.

Management does not propose to extend force majeure to excuse imbalance energy charges as such. The ISO market design at its core relies on a two-step settlement between the financially binding day-ahead and real time markets. It imposes financial obligations on parties to pay or be paid based on the day-ahead award; if deviations from such awards take place in the real time, uninstructed deviations are settled accordingly. Such mechanism provides a framework for allocating price risk between the day-ahead and real-time markets. If a participant does not deliver its day-ahead award, it has the financial obligation to pay for the uninstructed deviation. When a market participant submits bids into the day-ahead market based on its location, economic strategy and risk premium, among other factors, participants are taking on the risk and consequences of participating in the market under such settlement terms. This rationale is important to consider for the efficient economical operation of a market.

Bid validation for bids supported with transmission rights

Currently, all market self-schedules submitted pursuant to the terms of existing transmission contract or ownership rights are exempt from any congestion charges accruing out of the congestion component of the locational marginal price. Scheduling coordinators must submit specific types of self-schedules in order to exercise this right. These special self-schedules are also afforded a higher scheduling priority than ordinary self-schedules that are not supported by transmission contract or ownership rights.

The self-schedules supported by transmission contract or ownership rights are validated during the bid submission process to ensure that only authorized holders of such rights receive the perfect hedge by validating that the special self-schedules are associated

with registered contract reference numbers. Under the current rules, if a scheduling coordinator submits a self-schedule supported by a transmission contract or ownership right that is not consistent with the contractual terms, the self-schedule is not always rejected entirely. Instead, in some cases the ISO accepts the self-schedule as an ordinary self-schedule and designates it with the same lower priority afforded to ordinary self-schedules. The ISO still provides the self-schedule the perfect hedge for the capacity scheduled within the terms of the agreement. This may result in artificial congestion in the system and may impact others participating in the market through either higher congestion charges for their energy or congestion revenue rights charges caused by the artificial congestion.

Management proposes to modify the bid validation rules so that if the validation detects an erroneous self-schedule, it is rejected entirely rather than allowing it to flow into the market as an ordinary self-schedule. Participants have the mechanism to identify bids in error during the bid submission process and will have the ability to resubmit a corrected self-schedule if it is submitted in time.

Enhanced formulation of contingency-related constraints

The ISO market system enforces transmission constraints that protect the system in case of a contingency of an outage of another transmission element. In some cases a transmission constraint may be affected by multiple contingencies that may occur. The market application uses a set of pricing parameters to indicate the cost associated with relaxing any of these constraints. There are instances when the market application produces a solution in which a transmission constraint cannot be resolved and must be relaxed due to multiple contingencies. Since each base and contingency case is treated as a separate constraint, each contingency case will have a congestion cost that will in turn be compounded in the marginal congestion component of the various locations impacted based on the shift factors. The cost of relaxing a constraint is based on a set of penalty prices, which are currently administratively pegged to the maximum bid caps. Therefore, in these cases where multiple constraints are relaxed, the market solution reflects a compounded price based on the totality of the penalty prices. This pricing is not the optimal way to price energy, because the compounding of penalty prices does not provide any further congestion relief than the congestion cost based on the pricing of the most relaxed contingency.

Management proposes to modify the current market application formulation so that the price will reflect the cost of congestion associated with the most limiting contingency under constraint relaxation conditions. With this proposal, all credible contingencies determined by operations studies will continue to be enforced in the market, as usual, but only the most limiting contingency will bind and be priced.

Modified market application formulation to attain unique prices

In an ideal market clearing process, prices are optimally set at the point where the downward sloping demand curve and upward sloping supply curves intersect. In cases where the curves intersect at a single point, this price is unique. This simplistic

characterization of supply and demand curves does not hold for markets with a step-wise bidding structure. Multi-step-wise bids can create the so-called “degenerate” pricing conditions that can result in multiple market-clearing prices under economic dispatch.

Although degenerate cases can lead to multiplicity of possible pricing solutions for the same dispatch, any of these solutions is optimal from a market clearing perspective. Degeneracy is rooted in the mathematical formulation and (pricing) optimization of a physical problem and is a well-known and understood condition. Linear programming commercial software products, like the one used in the ISO market application, often produce only one of the optimal solutions even though many others may also exist. This does not pose a problem for the physical market itself, but it does for when such prices are used outside of the physical energy market, as is the case for the day-ahead market whose prices are used for settlement of congestion revenue rights.

The ISO enforces multiple constraints in its market application to reflect the physical and scheduling, limitations of the system under various possible conditions. One type of constraint is the intertie constraint to limit import/export schedules between the ISO and neighboring balancing authority areas based on system conditions. Certain conditions, such as where an intertie is derated to zero limit in one direction but not in the other, can produce degenerate pricing solutions, and it is possible under such circumstances that a scheduling coordinator can set the price through a bid that creates artificial congestion even though no megawatts actually clear.

Management proposes an alternative solution formulation that will eliminate the condition leading to multiple prices and enable the market optimization to select the optimal price. That is, if the market clearing problem is limited by any constraint, the market clearing process would create a price for the constraint only when the relaxation of the constraint would result in a reduction in the total cost to operate the system. To do so, the existing linear programming model would be modified into a quadratic programming model using a new slack variable in both the objective cost function and in the constraint definition, which guarantees the uniqueness of prices associated with the various constraints in the system, including intertie constraints. The new formulation will ensure the price attained is consistent with existing least-cost dispatch principles already embodied in the ISO tariff. The new formulation will also ensure that for those cases in which the intertie is derated to a zero limit in only one direction, the resulting price does not create artificial congestion that creates complications for other products settled on the basis of the cost of congestion at the applicable locations.

POSITIONS OF THE PARTIES

There was general support for the proposals associated with: 1) the validation of self-schedules supported by transmission contract or ownership rights to avoid creating artificial congestion and to ensure efficient use of the ISO-controlled transmission grid, 2) the modification of the mathematical formulation for pricing constraint relaxation to eliminate the compounded pricing effect of penalty parameters for relaxation of

contingency-related constraints, and 3) the modification of the mathematical formulation of market clearing logic to ensure that the market application produces a unique price in cases where constraints would otherwise create an array of possible prices.

For the administrative pricing rules, there is one opposing view of the policy for settlements provisions for force majeure events, where a participant believes that intertie resources need to be financially excused of imbalance charges under force majeure events. Management believes that the current policy adheres to the market principle where participants bear the risk and cost of participating in a market. The market surveillance committee also expressed their opinion about having an alternate approach instead of using the day-ahead market prices for real-time market suspension. Management believes that using day-ahead prices provides a certain price signal and most importantly minimizes the settlement implications for resources dispatched under a market suspension.

The attached matrix of stakeholder comments discusses the positions of the parties related to each of Management's proposals.

MANAGEMENT RECOMMENDATION

Management recommends that the Board approve the various elements of the pricing policy enhancements proposed in this memorandum.