



Revisions to Price Correction Requirements

Final Proposal

July 16, 2013

Table of Contents

- I. Plan for Stakeholder Engagement..... 3
- II. Background 4
- III. Stakeholders’ Feedback..... 5
- IV. Scope of Initiative 5
- V. Description of Straw Proposals 7
 - IV.I Revision of the scope for price corrections for the day-ahead..... 7
 - Proposal 8
 - IV.II Time horizon for price corrections 10
 - Proposal 12
 - IV.III Timely updates of issues potentially leading to price corrections 14
 - Proposal 14
- VI. Next Steps..... 16

I. Plan for Stakeholder Engagement

The proposed schedule for stakeholder engagement is listed below. If this stakeholder process results in the need for tariff changes, ISO management will present any proposed changes and policy recommendations to the CAISO Board of Governors in September 2013.

| Date | Event |
|------------------------|--|
| Thu 5/23/13 | Issue Paper Posted |
| Thu 5/30/13 | Stakeholder Call 10 am to 12 pm |
| Thu 6/6/13 | Stakeholder Comments Due |
| Thu 6/20/13 | Straw Proposal Posted |
| Thu 6/27/13 | Stakeholder Call 1 pm to 3 pm |
| Mon 7/8/13 | Stakeholder Comments Due on Straw Proposal |
| Mon 7/16/13 | Draft Final Proposal Posted |
| Mon 7/22/13 | Stakeholder Call 1 pm to 3 pm |
| Mon 7/29/13 | Stakeholder Comments Due on Draft Final Proposal |
| Thu-Fri 9/12-13 | BOG |

II. Background

The ISO FERC Electric Tariff (ISO Tariff) section 35.3 and section 8 of the BPM for Market Operations set forth the scope, process, and time horizon for price corrections. The intent of the price correction process is to ensure appropriate and accurate inputs are used in settlements as well as to ensure prices accurately reflect system conditions. The ISO corrects invalid prices pursuant to a set of requirements defined in the tariff, by either recalculating prices or selecting replacement prices from similar market intervals. The goal of the price correction is to produce prices that are as close as possible to the prices that should have resulted under the terms of the ISO tariff provisions had there been no issue. Under the current ISO tariff provisions, prices can be corrected due to: i) a data input error, ii) a hardware/software failure, or iii) an inconsistency with the tariff.

At the start of its new market design in 2009, the ISO set the time horizon for price corrections at eight days. In 2010, the ISO conducted a stakeholder process to review its price correction rules and processes. Out of that stakeholder process, the ISO proposed to reduce the price correction time horizon to five calendar days, with certain exceptions to accommodate processing and publication issues outside of that time frame.¹

The ISO committed to continuously review its price correction processes and results and consider further changes as necessary over time. Given the importance of producing correct prices and the need to weigh that against price certainty, and in light of its experiences over the past four years of market experience, the ISO is initiating this stakeholder process to discuss and identify improvements in the price correction rules and requirements, and if required, streamline and clarify the scope, reasons, and time horizon for price corrections.

¹ Post-Five Day Price Corrections initiative available at <http://www.caiso.com/informed/Pages/StakeholderProcesses/CompletedStakeholderProcesses/PostDayProcessPriceCorrections.aspx>

III. Stakeholders' Feedback

The ISO hosted a conference call with stakeholders to discuss the Straw Proposal paper posted on June 20, 2013. Stakeholders had the opportunity to provide comments about the initiative and the topics described in the Straw Proposal paper. Following the call, six parties submitted comments to the Revisions to the Price Correction Requirements stakeholder process, including Financial Marketers, Morgan Stanley Capital Group, PG&E, SCE, SMUD and WPTF. The comments and the ISO's responses are available on the initiative site at

<http://www.caiso.com/informed/Pages/StakeholderProcesses/RevisionsPriceCorrectionRequirements.aspx>

IV. Scope of Initiative

This stakeholder initiative is focused on the scope, reasons, criteria, and time horizon of price corrections. In the Issue Paper, the ISO defined four items and invited stakeholders to identify any other pertaining topic that could be within the scope of the initiative.

Based on stakeholders' feedback and the ISO's position, the ISO as focused the scope of this initiative to the following items:

1. Revision of the scope for price corrections for the day-ahead market in order to provide more certainty about the finality of day-ahead prices.
2. Revision to the current five calendar day horizon for price corrections; finality of prices, definition of the scope for processing and publication issues and the use of the 20-day window to resolve processing and publication issues.
3. Timely communication of price corrections and about processing and publication issues impacting price corrections.

Through this process several other items were raised by participants for consideration in this initiative; although linkages of many other market items with price corrections may exist, this initiative is focused on the price correction process. Also, some stakeholders were concerned that this process did not refer to the ISO's effort to address the root causes of price corrections. It is worth to notice that in addition to this price correction initiative related to the process, the ISO has been pursuing mitigation measures for root causes of price corrections, specifically,

- i) In 2012, the ISO launched an internal root cause analysis initiative to address price corrections. In this initiative the various business units with processes impacting the markets are involved. This is an ongoing effort where every price correction event is analyzed to its

root cause and mitigation measures are targeted. As a result of that effort, the ISO has worked along the following items:

- a. Improvements to its day-ahead process. This is explained in detailed in Section IV.I With this approach there is a proactive validation of the day-ahead market and necessary safeguards are in place to minimize the need for price corrections. This effort was introduced to participants in the Market Performance Forum of April 2013 and its material is available at http://www.caiso.com/Documents/Agenda_MarketPerformance_PlanningForumFeb13_2013.pdf
 - b. Internal process improvements related to modeling, data updates, validation and check points across business units.
 - c. Feedback and communications with transmission owners regarding improvements for outage information provided to the ISO.
 - d. Fixes to software defects identified in the validation process in order to eliminate future occurrences of price corrections.
- ii) With outages and its modeling playing a key role in the market, the efficient management of outage information is critical step for price corrections. The ISO is embarking on a redesign of its outage management system; this is a long term solution that will help minimize issues of outages leading to price corrections.
 - iii) Over time the ISO has added mechanisms for more automated and expeditious detection of issues leading to price corrections. As a long term solution, the ISO is currently in the development stage of a more comprehensive market validation tool; this tool will help with faster and more comprehensive validation of the ISO's markets.

V. Description of Proposals

IV.I Revision of the scope for price corrections for the day-ahead

In 2012 the day-ahead market experienced an increased volume and frequency of price corrections. The ISO took certain steps within its current tariff authority to refine its processes for validation of the day-ahead market results prior to publication of prices in order to minimize the need for price corrections. Given the time horizon for conducting the day-ahead market, there is a short window of time to validate market results before publication. The ISO has implemented proactive validation and monitoring of the day-ahead market to identify issues prior to publication. When a data or software issue is identified, the ISO uses the short window to resolve the issue and, if feasible, rerun the day-ahead market with the correct information, before issuing the market results. This validation leverages the ability to run the market two days in advance in what is referred to as the DA+2 pre-market run. Each day, this DA+2 pre-market run is implemented right after the actual run for the next trading day is complete. The same hardware and software is used for this run, using the most recent information available for outages and transmission constraints, and using a set of historical market bids. This DA+2 pre-market run is, therefore, the most readily available and accurate projection of the results for the actual day-ahead market to be run next morning. Having this run two days in advance allows the ISO to identify potential issues that need further investigation to be resolved before reaching the next morning when the actual day-ahead market is run.

In recent months the ISO has found that this validation of the day-ahead market has served to identify and correct the majority of issues related to either software or data that required a rerun of the day-ahead market. However, in some instances where an issue has been identified and is being resolved, publishing results by the 13:00hrs target has been challenging. This effort has resulted in avoiding price corrections after the day-ahead market results are published. In some instances, the ISO has had to proceed to publishing day-ahead market results even after an issue is identified because the ISO was not able to identify the precise cause of the issue and correct the underlying problem within a reasonable time. For example, this has happened when there is a problem with the market functionality which the ISO cannot temporarily fix while running the market. In such instances, a software patch may be required from the software vendor, which could only arrive after publication. After publishing results, the ISO still pursues further validation of market results within the five-day window, and if there proves to be an issue, the ISO will make the price correction, as feasible and as permitted within the tariff requirements. This proactive validation has avoided subsequent price corrections, but the trade-off may be not meeting the publication target for publishing the day-ahead market results of 13:00hrs.

Given the financial impact of price corrections for the day-ahead market, certain stakeholders have expressed their concerns about price accuracy while others have expressed concerns about price certainty for the day-ahead market. Stakeholders have also expressed a need for timely disclosure of major events impacting the day-ahead market. Currently, price corrections impacting the day-ahead market, or the real time market, are known by participants either by reaching the end of the five-day window when corrected prices are actually posted, or by the release of information by the ISO about a specific event through market notices or discussions in the fortnightly market update call. As required by Section 35.6 of the ISO tariff, the ISO provides a price correction report indicating the applicable market run, reasons to correct, and method used to correct prices. Given the cycle for generating this report, the information is posted after the corrected prices are already posted. The timing of this information creates uncertainty of the finality of day-ahead prices.

Based on the experience gained by the enhanced validation of the day-ahead market, the ISO has found that issues affecting the day-ahead market results are identified, and the bulk of these are resolved, before publishing results. When an issue is identified only after the posting of the results, for which the ISO later made a price correction, it has generally been the case that the issue had a more subtle impact on the overall market results or that it had only a local impact. Whether the issue has been identified with the proactive validation or with the post-validation, the information about price corrections is known to participants only by the end of the five-day window. Also, day-ahead market results that did not raise any concerns through the proactive validation and that were not subject to any price correction are treated the same way as those subject to corrections. That is, participants are not informed that there are no corrections for such prices until after the end of the five-day window. Again, there is uncertainty over the finality of all day-ahead prices during that time frame, even when prices do not ultimately require a price correction.

Proposal

Based on the item posed in the Straw Proposal Paper and on the generally supportive feedback from stakeholders the ISO is proposing a modification to the existing requirements of price corrections in regards to both the day-ahead and real-time market.

First, leveraging on the enhanced process to proactively validate the day-ahead market, by the time of publication the ISO is generally aware of any major issues impacting the day-ahead market that may require price correction. If a potential issue is identified and the ISO is not able to reach reliable grounds for correcting an input or is unable to conduct the re-run and correct the issue before publication, this day-ahead case will be flagged and subject to further validation and to a possible correction, if applicable, after publication of results. The ISO would inform the market about such instances right after publication of the day-ahead market results. If the ISO did not find

any potential issue during the monitoring and validation prior to publication, then there will be no notification about the status of the day-ahead prices. The ISO is cognizant that there may be instances where the proactive validation did not detect any issues, but in some cases, more subtle issues impacting the market that may require a price correction are not detectable till later. For this type of instances the ISO will still pursue further validation and any price correction if applicable within the time window for price corrections. In case the ISO deems the prices need to be corrected after publication, the ISO will inform the market as soon as practical within the price correction horizon (three business days for the day-ahead market and five calendar days for the real time market) about the price corrections taking place.

The ISO is certain that the bulk of day-ahead market related issues can be identified, and in several instances actually remediated, before publication and for this reason the ISO is proposing to reduce the time window for price corrections of the day-ahead market to three (3) business days. This reduced window compounded with timely notification of price corrections will provide for more certainty about the finality of day-ahead prices. The ISO believes this proposal strikes a balance between the current requirements and the ideas discussed in the first two rounds of this initiative where the ISO explored whether the prices should be rendered final by the time of publication. This proposal takes into consideration the need to provide price accuracy by ensuring there is a time window to execute further validation and ensure there is sufficient time to not compromise the accuracy of prices for the potential instances where an issue is found after the publication of prices, versus the need to provide greater certainty about the finality of prices as suggested by various stakeholders. It is important to highlight that the ISO is revisiting the requirements to ensure a solid process is in place for when price corrections are needed; however, the primary focus of the ISO is to address the root causes of price corrections. This proposal is in addition to efforts by the ISO to pursue long term solutions to root causes of price corrections as described above.

In adopting the pre-market publication validation process, the ISO is cognizant of the potential impact to the publication target (currently at 13:00 hours). In instances where the ISO is actively resolving any data or software issue that may impact the day-ahead prices, it may result in a delay publication of the day-ahead market results. Stakeholders generally support a certain delay in the publication of the day-ahead market results. However, given the infrequency in which there would be a delay for the integrated forward market results, the proposal is to retain the 13:00 hours target for the integrated forward market results. However, to accommodate the need for more validation and without compromising the publication target of the integrated forward market, two changes to the day-ahead timeline would be appropriate. First, historically there are several instances where the day-head market is complete and ready for publication before 12:00 hours. With the current requirements, the day-ahead market cannot be published before 12:00 hours because the closing time for the inter-scheduling coordinator (SC) trades is at 12:00 hours. The ISO proposes to change the closing time for inter- scheduling coordinator trades from 12:00 hours to 11:00 hours. This new closing time will still provide a time window for participants to revisit their

inter-SC trade bids after the day-ahead market is closed and will eliminate the current barrier for the ISO to be able to publish results only after 12:00 hours. The second change is to unbundle the publication of day-ahead market results. Currently, the day-ahead process consists of three sequential processes: Local Market Power mitigation (LMPM), Integrated Forward Market (IFM) and Residual Unit Commitment (RUC). The current target is the publication of results for all three processes by 13:00 hours. The ISO proposes to have the flexibility to publish results for RUC separately from those of MPM and IFM. This will help ensure IFM results are more consistently published on time, with RUC results being published afterwards when there is need for more validation and resolving issues before publication. The ISO proposes to have a publication target time of 13:00 hours for the integrated forward market and a publication target time of 15:00 hours for results of the residual unit commitment.

IV.II Time horizon for price corrections

Section 35.2 of the ISO tariff provides that up to five calendar days after the applicable trading day, the ISO can make a price correction for the applicable market and intervals. The ISO will not make any price corrections after this price correction window has expired except as otherwise directed by the Federal Energy Regulatory Commission or for the limited reasons stated in section 35.3. Section 35.3 of the ISO tariff stipulates:

All prices shall be considered provisional until the CAISO has completed the price correction process regarding them. All prices for each Trading Day shall be considered final for purposes of this Section 35 once the price correction process for that Trading Day has ended and the CAISO will not make price corrections or change published prices after the price correction process time period has expired except as further discussed in this Section 35.3. The CAISO will not make price corrections after the price correction process time period specified in Section 35.2 has expired, except as otherwise directed by the Federal Energy Regulatory Commission. In addition, for intervals in which the CAISO experiences a problem with the processing or publication of prices, the CAISO will make changes to the affected prices to remedy the processing or publication problems within the time period following the applicable Trading Day as specified in the Business Practice Manual, except as otherwise directed by the Federal Energy Regulatory Commission. After the after expiration of the applicable time horizon for addressing processing and publication issues, as specified in the Business Practice Manual, in the case of a price discrepancy between prices posted on the CAISO's OASIS and prices provided to Scheduling Coordinators through other means, the CAISO will use the price posted on OASIS for Settlement purposes.

The ISO has a time window of 20 business days after the applicable trading day for resolving processing and publication issues, as defined in the business practice manual for Market Operations, section 8.1.6.2.

The price correction end-to-end process is composed of price validation and price-correction implementation. In the first phase, market results, including prices, are programmatically validated. The outcome of that process is the determination of whether a price is correct or not, and if applicable what approach needs to be used to correct the identified prices in error (selective recalculation, rerun, interval replacement). The second part of the process is more related to the actual processing of the corrections, which is conducted through a set of automated procedures with predefined methods for correcting erroneous prices depending on the method chosen to correct prices. Normally, the recalculation of prices is done in a matter of minutes using the automated tools. The prices are then updated in the downstream repository system, and then the corrected prices are posted on OASIS. The majority of price corrections is done with one of the preset methods and the ISO perform all the steps required to have a price correction complete before the end of the fifth day.

The ISO's experiences over the past three years provide a number of processing and publication examples that the ISO now wishes to clarify with stakeholders. The processing and publications challenges experienced by the ISO can be categorized as follows:

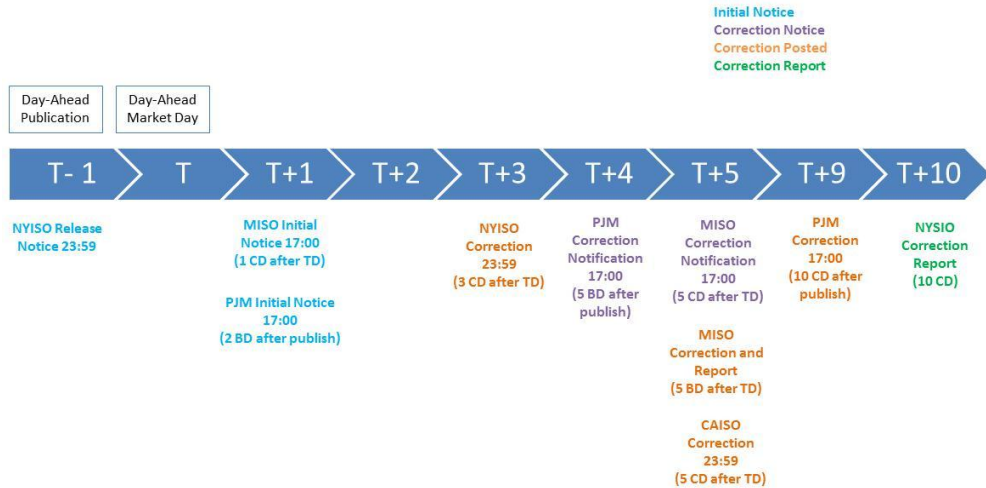
- a) Volumetric issue. In some instances prices need to be corrected for multiple time intervals. Even if there are only a few nodes to be price corrected, process wise, the same sequential steps need to take place. Market intervals to be corrected are queued for processing, and in some cases some of the records may be processed after midnight of the 5th day.
- b) Hardware/software issues. In several instances, although the ISO has made the determination of incorrect prices and the need to correct for those, a software or hardware issues impedes the processing of the corrections by the end of the fifth day. In other instances, the corrected prices may have been corrected within the five-day window, but they are overwritten after-the-fact.
- c) Business process issues. Although the ISO may have made the determination for price corrections, a limitation or failure in the business process to properly reflect such corrections impedes the publication of price corrections by the end of the fifth day.
- d) Complex manual corrections: For the most part, price corrections are implemented using pre-prepared scripts and are readily implementable. On occasion the nature of the issue resulting in erroneous prices may require the use of tailored methodologies and thus the preset methods cannot be used. This approach is required to selectively

correct the prices in error without impacting the overall set of prices. Since prices may need to be corrected for multiple market intervals across all markets, these tailored methodologies need to be comprehensive enough to cover the different potential scenarios found in the market. If the volume of the prices that need to be corrected is large, manually correcting the prices may not be feasible. When such scenarios are found, the ISO may have challenges doing the processing of such price corrections by the end of the fifth day.

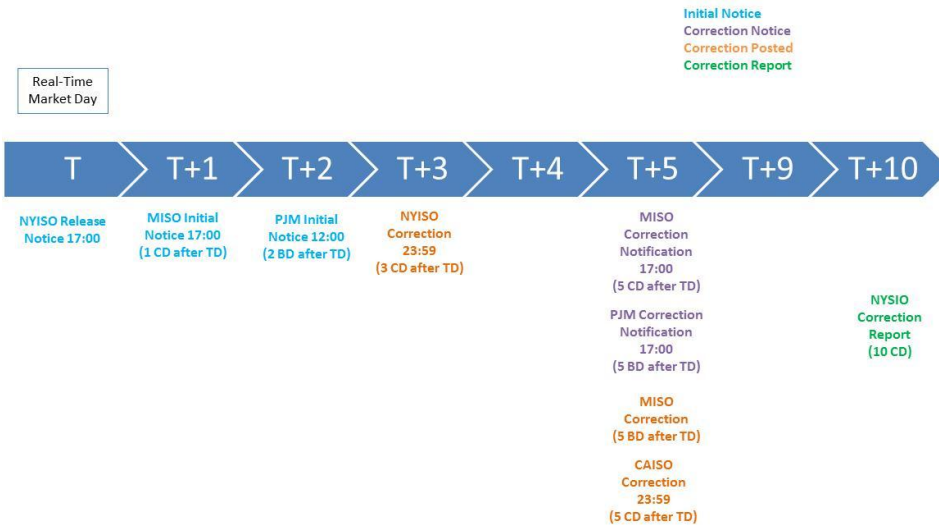
Proposal

Three areas of changes and clarifications to the ISO existing practices are proposed.

First, as described in the previous section, the proposal is to reduce the time horizon for price corrections of the day-ahead market from five (5) *calendar* days to three (3) *business* days. Concurrent with this, the ISO would use the five (5) *business* days instead of the existing five (5) *calendar* days for the real-time market. The current five calendar requirement specified in Section 35.2 of the tariff poses a challenge when the fifth day falls on a weekend or holiday. Using business days will allow to more efficiently handle the instances where there are complex price corrections potentially affecting a large volume of prices to validate and, potentially, correct. For one day, the real time market has 288 five-minute markets plus 96 15-minute pre-dispatch markets plus 24 hourly scheduling markets; this is in contrast to 24 intervals of the day-ahead market. Using the existing calendar days reduces the effective time for validation and may lead to more instances of processing and publication issues to finalize the corrections within the time horizon. This modification would allow the ISO to minimize processing and publication issues that occur during such times. Stakeholders were generally supportive about migrating to the use of five business days. For the sake of reference, the following figures provide a comparison of time horizon for price corrections among other ISOs.



Day-Ahead Correction Timeline among ISOs



Real-time Correction Timeline among ISOs

Second, with the end-to-end process involving the reliance on multiple systems and data flow along these systems and the existence of predefined tools, there are various points for the process to encounter processing and publication issues. Based on the price corrections experiences over the past three years and with the various types of processing and publication issues observed, the ISO seeks to further clarify through this stakeholder process what a processing and publication issue is for which the 20-business day window is used. The proposal is to enhance the tariff detail to include a description of the four different categories described above. This will serve to provide visibility into the course of action the ISO will take when the ISO experiences such type of processing and publication issues. The proposal is to further limit changes in posted prices beyond the price correction time period to these types of processing and publication issues. The current business practice is that the process starts with the validation of market solutions, continues with

any determination of price corrections, and it does not stop until corrected prices are posted on OASIS. If the ISO encounters any challenges to fully process the price corrections that results in posting information beyond the five days as described in the four categories above, the ISO deems this to be part of processing and publication issue, for which the 20-day window exists. Processing and publication issues, even if the issues are not known before the expiration of the five-day window, should not preclude the completion of correcting prices identified to be in error once the determination for price correction has been made and the process has started. Subject to the outcome of this stakeholder process, the ISO tariff would be supplemented with details describing the four categories and the ISO would confine changes to published prices beyond the five days to such identified issues. The specific language change to the tariff will take place through the normal cycle of an initiative, once the policy changes defined through the stakeholder process are approved by the board of governors.

Third, one concern from dealing with processing and publication issues after the five day horizon is the uncertainty about the finality of prices. Through the experiences of the last events, the ISO has also identified a need for improvement in its process to provide more timely communications about price correction when it experiences a processing or publication issue that falls under the 20 day window. When the ISO encounters, and is aware of, a processing and/or publication issue that would impede the successful posting of corrected prices within the five-day calendar window for corrections, the ISO will inform the market about the delay as soon as practical. The ISO will provide details as to the reason for having the price correction, the markets impacted and the expected time to finalize the posting of corrected prices. The ISO will define during the implementation stage of this proposal the programmatic means to have this communication with the market, either through a market notice, an email or a posting on the ISO website.

IV.III Timely updates of issues potentially leading to price corrections

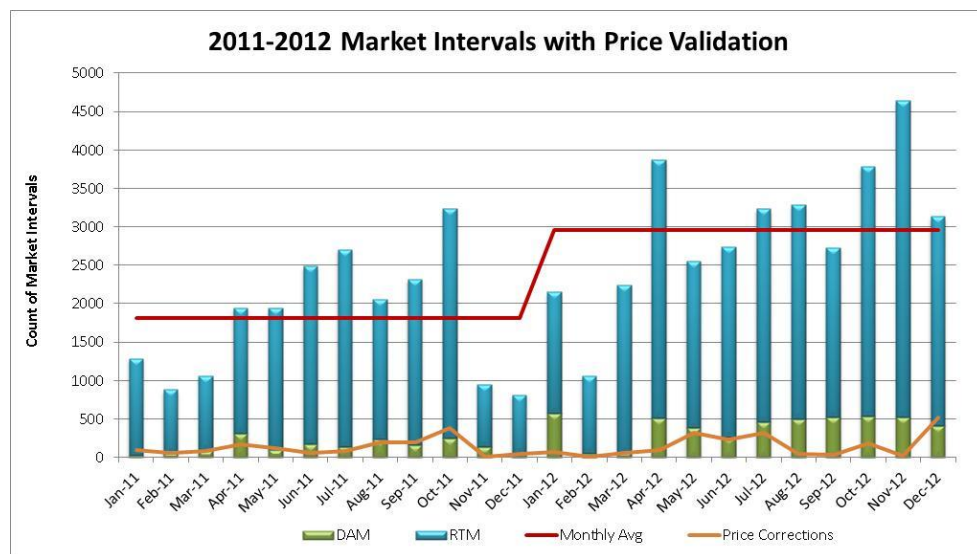
Market Participants have raised concerns about not having timely communications of price corrections. The ISO publishes a price correction reports with details of the market and intervals corrected, including the reason for the correction. This report, however, is posted after the five-day window for corrections. To address participants' concerns, the ISO started to post market notices when major events impacted the day-ahead market and resulted in price corrections.

Proposal

As explained in the previous two subsections, the ISO would provide more timely information about price corrections, namely:

- i) When the day-ahead market is impacted and the ISO is aware of an issue, the ISO will provide a notice after the publication of results indicating these prices are still subject to validation and potential price correction; this notice will provide technical details as to the suspect price as practical as possible. If there are no prices flagged during the pre-publication validation, the ISO will not provide any notices; the lack of a notice will indicate that the pre-publication validation has not detected any issues. If the ISO finds an issue that merits a price correction after the publication of the day-ahead results, the ISO will inform the market about such correction as soon as practical within the proposed three business day window. If the ISO does not find any issues after the publication of results and there are, therefore, no price corrections, there will be no notice to the market about this; the lack of a notice will indicate the ISO did not pursue any further price correction.

- ii) For the real time market, the dynamics is fairly different as for the ability of the ISO to validate prices before publication. Real-time dispatch prices are published every five minutes and there are more elements to validate in comparison to the day-ahead market. On the one hand, some participants prefer to have the prices subject to validation flagged as soon as possible. Historically, a very low percentage of the prices internally flagged for validation actually materialized in price corrections. As pointed out by the ISO and some stakeholders, if too many prices are flagged this mechanism will not provide any greater certainty about the finality of the real-time prices and may hinder the purpose of having a flagging process. For illustration of this concept, the following figure depicts the volume of market intervals that the ISO's validation process has historically flagged for validation in both the day-ahead and real-time markets, and compares that against the volume of intervals actually corrected.



It can be observed that with more activity in the market and more comprehensive validation, the number of intervals subject to validation increased about 70% in 2012. On average the number of intervals actually corrected is a significantly small percentage. For this reason, the ISO is not proposing to implement a flagging of real-time prices subject to validation. However, the ISO recognizes the importance to provide more timely communication of price corrections. For this reason, the proposal is to provide the market with more timely notification of price corrections once the ISO has completed the validation and made the determination that a price correction is granted for a specific interval. Additionally, when there are challenges to fully complete the price corrections the market is unaware of such corrections are in the processing stage. The ISO has also identified a need for improvement in its process to provide more timely updates about price correction when it experiences a processing or publication issue that falls under the 20 day window. When the ISO encounters, and is aware of, a processing and/or publication issue that would impede the successful posting of corrected prices within the five-day calendar window for corrections, the ISO will inform the market about the delay as soon as it becomes aware of such challenges. The ISO will provide details as to the reason for having the price correction, the markets impacted and the expected time to finalize the posting of corrected prices. The ISO will define during the implementation stage of this proposal the programmatic means to have this communication with the market, either through a market notice, an email or a posting on the ISO website.

VI. Next Steps

The ISO will discuss the final proposal paper with stakeholders during a teleconference to be held on July 22, 2013. Stakeholders should submit written comments by July 29 2013 to PCprocess@caiso.com