



Imbalance Conformance Enhancements

Draft Final Proposal

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Imbalance Conformance Enhancements Issue Paper & Straw Proposal

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1. Purpose

The purpose of this initiative is to describe how and why conformance is necessary to meet system reliability needs when imbalance occurs. The California Independent System Operator Corporation (ISO) proposes enhancements for the imbalance conformance limiter used in the ISO's real time market. The proposal put forth in this paper expands upon the Issue Paper/Straw Proposal and includes stakeholder feedback. The scope has been expanded to improve the conforming process, which will enable the conformance limiter to be sunset in two years.

2. Scope Changes from Issue Paper/Straw Proposal

2.1. Original Scope

The scope proposed in the Issue Paper/Straw Proposal¹ included:

- Clarification of the ISO's authority to conform for imbalance in the real-time market,
- Clarification of the ISO's authority to conform for imbalance in the day ahead market through the residual unit commitment (RUC) net short process, and
- Implementation of enhancements to improve the imbalance conformance limiter currently used in the real-time market.

2.2. Expanded Scope

Based on stakeholder feedback (see [Section 3.2: Conforming – Stakeholder Comments and Response](#) and [Section 4.3: Conformance Limiter – Stakeholder Comments and Response](#)) the scope of this initiative has been expanded.

In addition to the original scope, this initiative will address:

- Improvements to the conformance process in the ISO BAA, and
- Removal of the conformance limiter from the real-time market within approximately two years.

¹ Reference the Issue Paper/Straw Proposal, section 3: <http://www.caiso.com/Documents/IssuePaper-StrawProposal-ImbalanceConformanceEnhancements.pdf>

3. Conforming

This section explains the importance and necessity of conforming. In addition, stakeholder comments related to conforming are summarized. The ISO responds to stakeholder comments, proposes a revised scope, and provides data to support the proposal.

Stakeholder comments, the ISO response, and the revised proposal related to the conformance limiter are addressed in [Section 4](#).

3.1. Background

Grid operators in the ISO and EIM balancing authority areas are responsible for continually balancing supply and demand to maintain system reliability. When the system is not balanced (i.e. energy generated does not equal energy consumed), area control error (ACE) will increase or decrease from zero, which can cause frequency deviations.

To maintain system balance, the market system will commit units and dispatch them up or down to match the load forecast. If the forecast is correct, all generating units follow their dispatch, and there are no contingencies or unpredictable grid events, the system will remain balanced. In reality, however, the forecast is not always accurate, generating units do not necessarily follow their market dispatch, and unpredictable events such as unanticipated outages occur. This can result in an unbalanced system, which the ISO operators must manually correct. The ISO uses the term “conforming” to refer to the process of updating the load forecast to account for observed system conditions.

Conforming is not an exact science and must be completed quickly to ensure the market is aware of system conditions in a timely manner. There is no feasible way for the grid operator to quickly and simultaneously inform the market of each individual reason for deviations from forecasted system conditions. It would be impossible to manually update the VER deviations, generator outages, *and* load deviations (for example) every five minutes with 100% accuracy. Therefore, the adjusting the load forecast allows the operator to use an aggregated value and correct for various system changes in an expedited manner. Using the load forecast enables the conformance to be dispersed evenly across the system based on distribution factors without causing congestion.

In summary, the load forecast is used as a tool for conforming imbalance energy needs even though the reason for the conformance, in some cases, is not related to the accuracy of the load forecast itself. Conformance is needed to balance the continually changing system conditions and the load forecast provides a quick and effective tool to maintain reliability.

Conforming is a standard practice for ISOs and balancing authorities (BAs). With this initiative, the ISO proposes to clarify the authority of the ISO to conform in the real-time market and through the RUC net short process in the day ahead market. These clarifications will provide needed transparency.

3.2. Summary of Stakeholder Comments

Stakeholder comments were submitted in response to the Issue Paper/Straw proposal, which was published on November 29, 2017 and discussed during a stakeholder call on December 8, 2017. These stakeholders submitted written comments: Arizona Public Service (APS), Department of Market Monitoring (DMM), Pacific Gas & Electric (PG&E), Portland General Electric (PGE), Public Generating Pool (PGP), Powerex, Southern California Edison (SCE), and Six Cities.

All stakeholders supported the proposed tariff clarifications. The ISO will continue to move forward with tariff revisions to clarify the authority of the ISO to conform in the real time and day ahead markets.

In addition, there was general support from stakeholders to review the process of conforming specifically in the ISO balancing authority area. For example, Pacific Gas & Electric requests: “To the extent that imbalance conformances are used to correct for shortcomings in the energy market design including VER forecasts, the CAISO should prioritize enhancements to those market-based designs.”² The Public Generating Pool requested the scope be expanded to address, “The high frequency, large magnitude and same direction of conformances in the CAISO BAA.”³ These sentiments were mimicked by other stakeholders including PGE, Powerex, and SCE.

In response to stakeholder comments, the ISO agrees to expand the scope of this initiative. The ISO proposes tool enhancements to improve the conforming process. [Section 3.4: Conforming – Revised Proposal](#) explains the revised proposal, which includes analysis of the current conformance process.

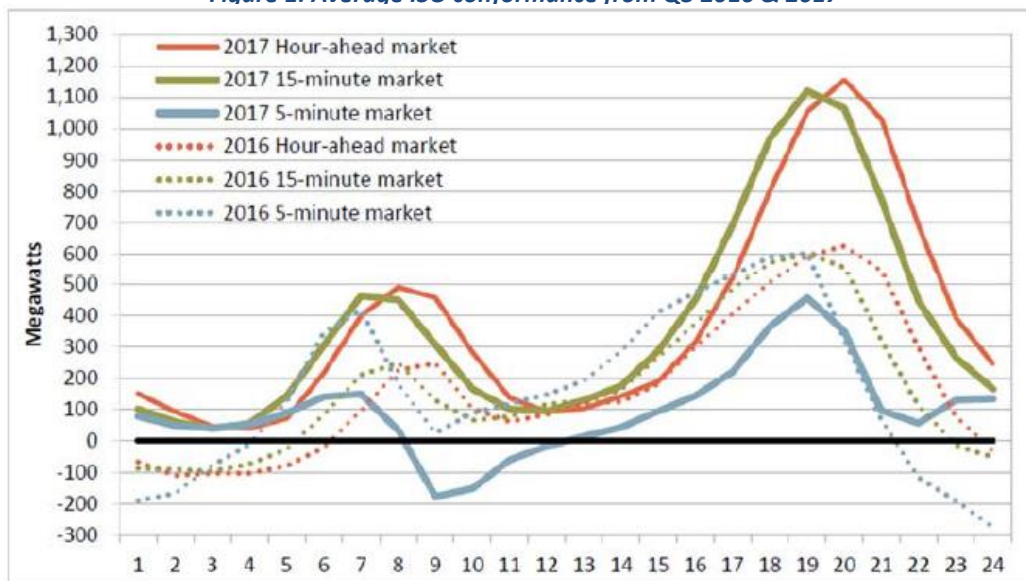
3.3. ISO Response to Stakeholder Comments

Stakeholders commented on the frequency, magnitude, and pattern in which the ISO conforms. Figure 1 was cited by Powerex and originally published in the DMM Q3 2017 report. It shows a conformance trend. The magnitude of the trend has roughly doubled between 2016 and 2017.

² PG&E written comments in response to the ISO’s Issue Paper/Straw Proposal:
<http://www.caiso.com/Documents/PG-EComments-ImbalanceConformanceEnhancements-IssuePaper-StrawProposal.pdf>

³ PGP written comments in response to the ISO’s Issue Paper/Straw Proposal:
<http://www.caiso.com/Documents/PGPCComments-ImbalanceConformanceEnhancements-IssuePaper-StrawProposal.pdf>

Figure 1: Average ISO conformance from Q3 2016 & 2017



In addition to the trend and magnitude, Powerex points out that the ISO conforms with greater frequency than the majority of participating EIM entities as shown in Figure 2.⁴

Figure 2: Average frequency and magnitude of conformance for EIM Entities (July – September 2017)

	Positive load adjustments			Negative load adjustments			Average hourly bias MW
	Percent of intervals	Average MW	Percent of total load	Percent of intervals	Average MW	Percent of total load	
California ISO							
15-minute market	57%	674	2.0%	6%	-328	1.2%	367
5-minute market	48%	370	1.1%	29%	-289	1.1%	97
PacifiCorp East							
15-minute market	11%	87	1.4%	4%	-85	1.5%	7
5-minute market	37%	83	1.4%	15%	-76	1.3%	19
PacifiCorp West							
15-minute market	3%	56	2.3%	4%	-42	1.8%	0
5-minute market	6%	55	2.3%	22%	-47	2.2%	-7
NV Energy							
15-minute market	15%	90	1.5%	5%	-136	2.7%	7
5-minute market	22%	63	1.1%	32%	-105	2.1%	-20
Puget Sound Energy							
15-minute market	3%	45	1.5%	14%	-65	2.9%	-8
5-minute market	4%	51	1.8%	21%	-65	2.8%	-11
Arizona Public Service							
15-minute market	91%	155	3.5%	4%	-317	8.0%	129
5-minute market	90%	155	3.5%	4%	-356	9.1%	126

⁴ Powerex written comments in response to the ISO’s Issue Paper/Straw Proposal: <http://www.caiso.com/Documents/PowerexComments-ImbalanceConformanceEnhancements-IssuePaper-StrawProposal.pdf>

Frequency of Conforming: Based on data published in the DMM Q3 2017 quarterly report, it appears the ISO conforms with a greater frequency (percentage of intervals) than all participating EIM entities other than Arizona Public Service. However, it is critical to note that all generators within the ISO BAA are participating resources. In comparison, EIM entities can select which resources are participating or non-participating. Therefore, EIM entities can use non-participating resources or other tools at their disposal, such as manual out-of-market dispatches, to account for unpredictable system conditions. They are not limited to conforming using the ISO markets. Both manual dispatches and movement of non-participating resources minimize the need for market conformance. The use of manual dispatches and movement of non-participating resources are not captured in Figure 2. It is therefore it is not a fair comparison to analyze the frequency of conformance in the ISO to the frequency of conformance in other EIM entities.

Additionally, the ISO has over 17,000 MW of solar and wind generation connected to the bulk electric grid. The ISO typically has 30% of its supply generated by renewable resources. As a result, the ISO experiences more variable energy resources (VERs) deviations compared to many neighboring balancing authority areas. When a VER deviation occurs, it is often corrected with an operator conformance. The larger amount of VERs in the ISO compared to other EIM BAAs is a direct correlation to the increase in conformance.

The ISO is addressing VER deviations and improving market inputs with the Real-Time Dispatch Persistence Market Model Enhancement.⁵ Implementation of these enhancements will minimize the need for operators to conform for VER deviations. This will decrease the frequency with which the ISO conforms.

Magnitude of Conforming: It was stated in stakeholder comments that the ISO conforms with a large magnitude. However, the magnitude of conformance as a percentage of load is roughly 1% - 2%. This is comparable to other EIM entities as shown in Figure 2.

Pattern of Conforming: Figure 1 identifies a pattern of conformance that occurs daily in the ISO. The trend follows the load curve and has doubled within the last calendar year. The most significant contributing factor for the increase in conformance between 2016 and 2017 is the large increase in renewable energy in the ISO's BAA. Based on current market design, any renewable deviation must be compensated for with a conformance input. The increase in renewable output across the ISO BAA has contributed to the conformance increase. The Real-Time Dispatch Persistence Market Model

⁵ Additional information for the Real-Time Dispatch Persistence Market Model Enhancement effort can be found in the Market Notice published on December 7, 2017:
<http://www.caiso.com/Documents/RenewableForecastingReal-TimeDispatchPersistenceMarketModelEnhancement.html>

Enhancements will allow the market to recognize VER deviations more quickly and therefore will reduce the need to conform for renewable deviation.

In addition to the other initiatives in progress, the ISO agrees with stakeholders that if the conformance trend is known and predictable, the need for the conformance should be addressed with automation or tool enhancements to eliminate the need for a manual operator action. The revised proposal includes tool and system improvements/enhancements to address the regular pattern with which the ISO conforms.

Flexible Ramping Product: PG&E asked the ISO to expand the scope of this initiative to include analysis of flexible ramping product and reserves. Specifically, PG&E asks if the ISO is procuring enough flexible ramping product to ensure operational needs are met. They imply with an increased amount of flexing ramping resources available, the ISO may not need to conform as frequently.

The ISO is updating the Business Practice Manual (BPM) for Market Operations. With this update, the ISO will change the procurement process for flexible ramping product.⁶ The design change will ensure flexible ramping product can be awarded in another EIM balancing authority area if there is available transfer capability that can be used if dispatched in a subsequent market run. It is anticipated that improvements to the flexible ramping procurement process will decrease the need for conformance in the ISO BAA. These changes will be discussed at the Market Surveillance Committee meeting on February 2, 2018.⁷

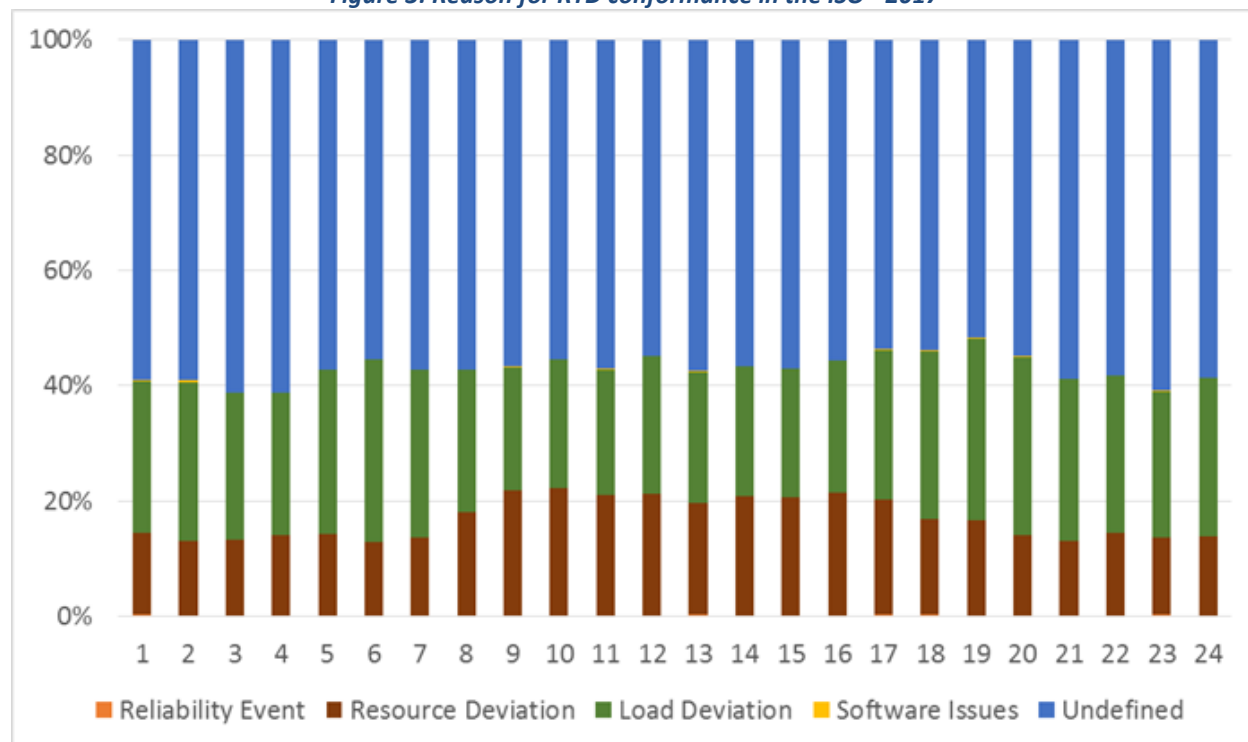
Because these enhancements are already being addressed by the ISO, this initiative will not be broadened to include the procurement process for flexible ramping product or reserves.

Reason for Conformance: Many stakeholders requested data from the ISO to identify the reasons why conformance occurs in the real-time market. Figure 3 shows the reason for conformance in the real time dispatch (RTD) market, as input by the operator, for the 2017 calendar year.

⁶ Reference section 7.1.3: *Flexible Ramping Product* of the BPM for Market Operations: https://bpmcm.caiso.com/BPM%20Document%20Library/Market%20Operations/BPM_for_Market%20perations_V54_clean.doc

⁷ MSC meetings are open to the public. To access information for the February 2, 2018 MSC meeting, go the calendar on the ISO's website: <http://www.caiso.com/Pages/Calendar.aspx?IsDlg=true>

Figure 3: Reason for RTD conformance in the ISO - 2017



As explained in the Issue Paper, conformance occurs for various reasons. The operator typically inputs a conformance for multiple grid occurrences and the action of the operator physically inputting the conformance requirement must occur quickly. For these reasons, about 60% of RTD conformances were input when an “undefined” reason.

The ISO recognizes there is a need for increased transparency related to the conformance process. Currently, the Department of Market Monitoring (DMM) publishes conformance information on a quarterly basis. With the implementation of this initiative, the ISO will increase transparency by providing conformance information in the *Monthly Market Performance Report* in the “Market Interventions” section.⁸ Additionally, the ISO will update the menu of reasons available to the operator when a conformance occurs and attempt to decrease the number of “undefined” conformances.

Conformance vs. Exceptional Dispatch: When an operator adjusts the conformance, the market will use this new input in the next market optimization run and re-dispatch generation accordingly. An exceptional dispatch (ED) is a transaction outside of the market optimized dispatch. The ISO has made efforts to decrease the frequency of exceptional dispatches to ensure the market optimized dispatch is used when possible. In general, a conformance will occur for unpredictable system conditions and allows the market to solve for the optimal solution. An ED occurs when there is not enough time for the

⁸ The Monthly Market Performance Reports can be located on the CAISO website under Reports and Bulletins. The direct link is: <http://www.caiso.com/Pages/documentsbygroup.aspx?GroupID=A9180EE4-8972-4F3B-9CB8-21D0809B645E>

market to solve or there are no available bids to mitigate the constraint.

3.4. Revised Proposal

As stated in the Issue Paper/Straw Proposal, the ISO proposes to make tariff changes clarifying the ISO's authority to conform in the real time and day ahead markets. Stakeholders support increased transparency and therefore the ISO will move forward with the proposed tariff changes. In addition and based on stakeholder feedback, the ISO has expanded the scope of this initiative to include improvements to the conformance process.

Authority to conform in the Real Time Market: Currently the ISO Tariff does not explicitly specify the authority of the ISO to conform in the real time market; however, the tariff does give the ISO discretion to create a load forecast it deems appropriate to maintain grid reliability. The ISO believes it would be beneficial to explicitly specify the authority of the ISO to make imbalance conformances and the reasons for taking such actions.

The factors for which ISO and EIM balancing area authorities may conform for imbalance include but are not limited to:

- Inaccurate load forecast
- Area control error (ACE) adjustments
- Variable energy resource (VER) deviation
- Generator outage that has not yet been input to the market
- Generator testing
- Reliability curtailments due to transmission/equipment outages
- Weather changes
- Pumping schedule changes
- Averages that do not reflect dramatic load increase or decrease

Authority to conform in the Day Ahead Market: Similar to conforming in the real time market, a version of conforming occurs in the day ahead market through the residual unit commitment (RUC) net short process.

When the results from the Integrated Forward Market (IFM) are published, the operator may realize that the RUC, which procures to the RUC Procurement target, may not obtain enough capacity to address anticipated real-time conditions. To ensure there is enough capacity for the next trade date, the operator will employ what is referred to as the "RUC net short" process. RUC net short will procure additional capacity to better reflect overall system conditions. This adjustment to the forecast is a form of conformance for the day ahead market.

The ISO has the authority to set the CAISO Forecast of CAISO Demand (CFDF) as it deems appropriate. However, the tariff does not provide any details for how it sets the forecast or the activity of adjusting the forecast to reflect the system conditions (specified below) to procure additional capacity through the RUC net short process. The rationale for the adjustment is to ensure the RUC procures sufficient capacity to meet anticipated system conditions.

The ISO believes it would be beneficial to explicitly specify the authority of the ISO to make imbalance conformances in the day ahead market and the reasons for taking such actions. The factors for which ISO conforms for imbalance in the day ahead market include but are not limited to:

- Load forecast error
- Dramatic weather pattern that is expected to continue or change with the next trade day
- Generator outage resulting in a different availability than was bid into the day ahead market
- Fire danger that threatens transmission lines and/or corridors
- Reliability concern that the generation committed will not meet the anticipated demand
- Reliability Coordinator (RC) next-day analysis

Improvements to the Conformance Process: The ISO is continually committed to tool, market, and process improvements to ensure reliable operation of the bulk electric grid. This includes improvements to the conformance process and the tools used for conforming. The following efforts are currently underway and will minimize the need for manual conformance by the operator.

- *Real-Time Dispatch Persistence Market Model Enhancement:* A forecasting enhancement for registered eligible intermittent resources (EIRs) that will shorten the time cycle to produce a forecast for EIRs resulting in improved accuracy for the RTD timeframes. More accurate renewable forecasts will minimize the need for conformance in the real time market.
- *Day Ahead Market Enhancements:* A policy initiative aimed at increasing reliability by providing fifteen minute granularity in the day ahead market and a day ahead flexible reserve product. This will enable the procurement of energy and capacity to more closely follow the net load forecast curve. A more accurate day ahead market will take pressure off of the real-time market to make up for deviations that occur. Enhancements to the day ahead market will minimize the need for conformance in both the day ahead and real time markets.
- *Flexible Ramping Product Improvements:* The ISO is in the processes of making technology improvements to the flexible ramping product procurement process. This effort will ensure there is adequate flexible ramping product award available and deliverable. These improvements will minimize the need for conformance in the real time market.

The items listed above are separate efforts that will all indirectly reduce the need for conformance in the ISO BAA. In addition to these items and as a result of this initiative, the ISO proposes specific improvements to the imbalance conformance tools and process.

The ISO commits to improve the imbalance conformance process with tool enhancements:

- *Imbalance Conformance Tool*: Build a tool that compiles inputs based on real time grid conditions and estimates a conformance value that may be appropriate. This tool can ensure the conformance requirement that is input into the market is accurate. Ultimately, this tool may be automatically used as a market input essentially eliminating the need for real-time conformance based on systematic variations such as ACE, renewables, and load forecast error.
- *Ramping Capacity Tool*: Build a tool that displays the ramping capacity available for each market run. This will provide transparency for the operator and reduce the need for the limiter. If the ramping capacity tool shows 500 MW is available in the next 5-minute market run, the operator will determine if that amount is adequate or not. He will no longer need to “guess” what is available and over-estimate the conformance requirement in hopes of procuring everything available. If the operator needs more than is available, he will still input that amount which will then accurately trigger penalty prices. The Ramping Capacity Tool improves situational awareness and decreases the need for the limiter.

These tool improvements will increase situational awareness and address the coarse conformances currently input by the operator.

4. Conformance Limiter

4.1. Background

Conforming is done for reliability reasons. The grid operator’s primary objective is to ensure grid reliability with disregard to how this may impact prices throughout the balancing area. Said explicitly, the grid operator does not conform to influence market pricing. However, the conformance either increases or decreases the demand requirement recognized by the market. The market outcome determines pricing and quantities cleared, which therefore may be indirectly affected by the conformance.

If the conformance requirement exceeds the ramping capability in a single interval, the market result will be infeasible, the power balance constraint will relax, and prices will administratively set at the relevant penalty price. In order to avoid invalid price spikes, which can occur when an operator overestimates the conformance requirement or inputs a coarse adjustment, the conformance limiter will trigger. When triggered, the limiter allows the market to solve by reducing the conformance to the

feasible ramp that is available based on economic bids. The clearing price is then set based on the bid stack instead of the penalty price.

The primary reason the limiter is necessary is that conformance requirements are typically coarse and over-estimated. A coarse and/or over-estimated adjustment often results in an artificial market infeasibility and a corresponding penalty price. The limiter ensures this does not occur.

Coarse Adjustment:

Operators typically input coarse adjustments because they cannot input a ramping timeline to align with the conformance. Generally, the coarse adjustment does not reflect the actual system need and is simply the fastest way for the operator to correct the upcoming market runs. The limiter will protect against invalid price spikes resulting from the coarse adjustment.

To explain a coarse adjustment, imagine an operator needs to conform by 500 MW to correct for an ACE deviation. The time it takes to correct for the deviation ACE depends on other grid conditions and the preference of the operator. In theory, the 500 MW correction could occur gradually over multiple market runs. According to the NERC standards, the operator has 30 minutes to correct for the ACE deviation. In reality, however, the operator typically inputs the correction all at once because it is the fastest and most efficient way to make the correction.

The operator does not have the tools or time available at his disposal to “ramp” the adjustment into the market. Therefore, he puts the entire 500 MW requirement into the market at once. This requirement results in the market attempting to procure 500 MW within the next market run. Does the market really need to make the 500 MW adjustment in one five minute interval? Likely not. Yet the operator is unable to take the time to input the 500 MW in 100 MW intervals over the next few market runs. The action of putting the entire conformance requirement into one market interval, instead of ramping it in, is a “coarse” adjustment.

Over-Estimated Adjustment:

As explained in the Issue Paper/Straw Proposal, operators typically over-estimate the conformance requirement they input into the market. Conformance adjustments are made for multiple grid deviations occurring simultaneously. The limiter allows for the operator to over-estimate the conformance needed and conservatively make corrections without setting artificial price spikes.

For example, the operator will conservatively over-estimate the conformance requirement for the following scenario:

REASON FOR CONFORMANCE	ACTUAL	OPERATOR ESTIMATED
LOAD FORECAST DEVIATION	137 MW	150 MW
RENEWABLE DEVIATION	126 MW	150 MW
ACE EXCEEDANCE	75 MW	100 MW
FORCED GENERATOR OUTAGE	200 MW	200 MW
TOTAL	538 MW	600 MW

Due to time limitations, the operator rounds and conservatively over-estimates the conformance requirement that is needed.

4.2. Summary of Stakeholder Comments

The majority of stakeholders support the proposed enhancements for the conformance limiter. The enhancements will ensure the limiter triggers correctly, and are an improvement from the current limiter functionality.

The minority of stakeholders oppose the limiter enhancements. One party believes the limiter should be implemented in a two-step approach enabling the limiter to trigger more frequently therefore preventing price spikes. A small minority oppose the limiter all together stating that the limiter is fundamentally flawed and suppresses potentially valid penalty prices.

4.3. ISO Response to Stakeholder Comments

Inclusion of the Limiter in the ISO Tariff: In their written comments, PWRX requested the limiter be included in the ISO Tariff. The ISO agrees and will make revisions to include the limiter in the tariff.

Two-Step Approach: SCE has requested the limiter be implemented with a two-step approach. Existing limiter functionality would be applied in the first pass. If triggered based on the existing functionality, the enhanced logic would then be applied in a second pass. This methodology would cause the limiter triggering more frequently which SE believes would decrease price volatility in the real time market.

The ISO would like to acknowledge that the enhanced limiter logic actually reduces the frequency with which the limiter will trigger. Currently, the limiter is triggering in scenarios when it shouldn't; this will be corrected with the enhanced logic. The ISO maintains it is critical that the limiter trigger, or not trigger, based on changes between intervals. The purpose of the limiter is not to suppress prices, but to ensure invalid penalty prices do not result from an operator's coarse or over-estimated adjustment. The

enhanced limiter logic will trigger, and not trigger, correctly based on changes between market intervals. The ISO will not move forward with a two-step approach for the conformance limiter.

Stepped Penalty Prices: PG&E requested the ISO consider stepped penalty prices in conjunction with this initiative. Stepped penalty prices were investigated in the *Stepped Constraint Parameters* initiative. This initiative was ultimately closed and will not be re-addressed with this initiative. Additional information can be found on the initiative website:

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

Limiter Memory Component & Missing Information: The Department of Market Monitoring (DMM) requested the ISO investigate what occurs when a memory component value is non-zero and what occurs if a required piece of information is missing.

Every time the limiter logic runs, information from the previous interval is used. This information is built up to form the memory component which allows the limiter to determine if a conformance change is the result from the current interval, or a previous change. If a non-zero value resulted in the limiter triggering for an interval, this value would then be used in the $Max(0, C_{i-1})$ (or $Min(0, C_{i-1})$) component of the limiter logic. This allows for the result from previous intervals to be used in the logic for the current interval.

Missing information will be addressed in the implementation details of this project.

Impacts of FERC Order 831: The DMM states “that while there was no significant price separation between the approaches in 2017, there could be a significant impact on prices with the implementation of FERC Order No. 831.”⁹ The ISO agrees.

Currently, pricing does not dramatically change based on use of the current limiter, enhanced limiter, and no limiter. This is largely because proxy demand response (PDR) resources bid into the ISO markets near the bid cap, roughly \$950/MWh. Therefore, even when the limiter is triggered, a price of \$950/MWh is set based on the bid cap from PDR. However, with Order Number 831, penalty prices will increase to \$2000/MWh. Therefore, the limiter may have a greater impact.

If the limiter is not applied when Order Number 831 goes into effect, pricing will be set at \$2000/MWh (instead of the current penalty price of \$1000/MWh) anytime the operator conformance requirement

⁹ DMM written comments in response to the ISO’s Issue Paper/Straw Proposal:
<http://www.caiso.com/Documents/DMMComments-ImbalanceConformanceEnhancements-IssuePaper-StrawProposal.pdf>

exceeds the available ramping capacity. This could result in increased price volatility if the limiter is not used.

Valid Scarcity Condition: Some stakeholders requested data to determine how frequently the limiter is triggered correctly or incorrectly. They agree that the limiter logic identifies scenario in which the operator incorrectly signals a scarcity condition and in these situations the limiter should trigger. However, stakeholders claim it is possible for the limiter to trigger when in reality the operator input is valid and a scarcity truly does exist. In these situations stakeholders claim the limiter should not trigger and penalty pricing should correctly result.

As discussed during the December 8th stakeholder call, it is impossible to determine when the limiter “correctly” or “incorrectly” triggers. The ISO agrees this is a shortcoming of the limiter and is part of the reasoning behind removing the limiter from the markets in approximately two years. Within those two years, the limiter will protect for course adjustments (as shown in Figure 4) and over-estimations that would result in a market infeasibility. If the limiter were removed immediately, there would be an increase in scarcity pricing when scarcity may not actually exist. Therefore, it is the best approach to ultimately remove the limiter, but this must be done in a phased and controlled approach.

4.4. Conformance Limiter Data Analysis

Data analysis was completed to quantify that operators conform with coarse adjustments. Figure 4 displays coarse conformance adjustments. Figure 5 confirms that when the limiter triggers it is typically due to the coarse adjustment in the first interval. For these reasons, the limiter is needed until the coarse adjustments are corrected. Until then, the limiter enhancements will be introduced to prevent the limiter from continuing to incorrectly trigger (Figure 5).

Figure 4: CAISO RTD conformances changes (“deltas”) between intervals for 2017.

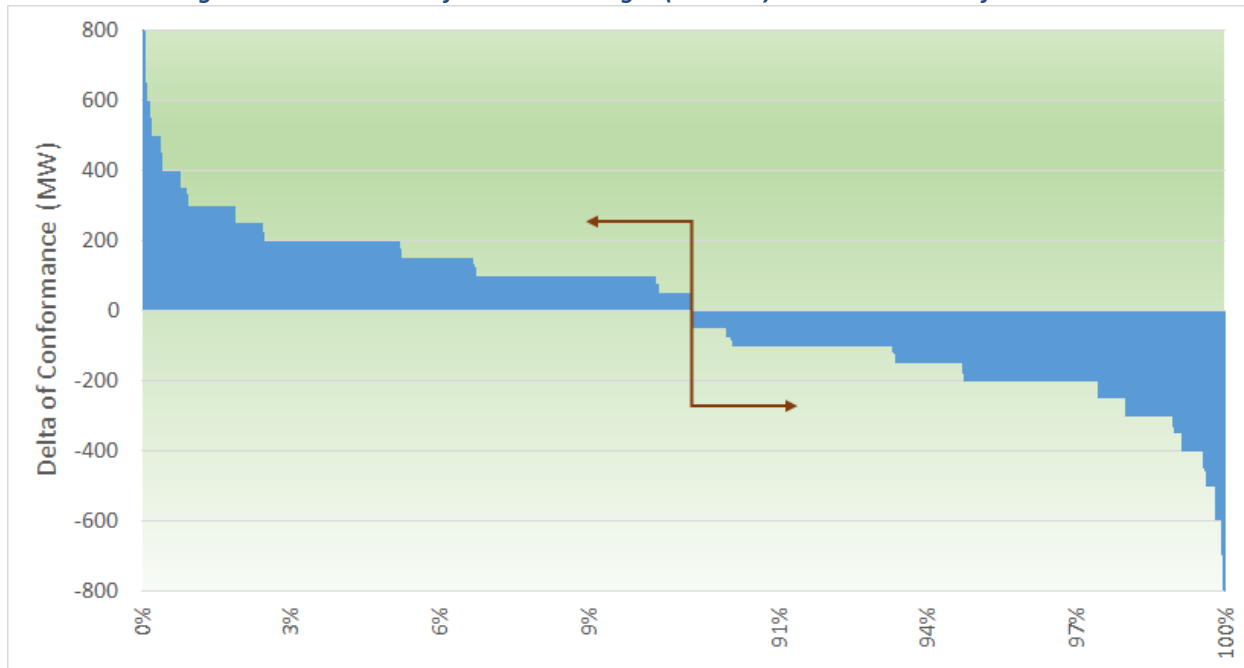


Figure 4 shows RTD intervals (CAISO, 2017) with a change in conformance between intervals. A positive conformance delta indicates the conformance requirement increased between intervals (under-supply). A negative conformance delta indicates the conformance requirement decreased between intervals (over-supply). The data compiled represents all RTD intervals for 2017 in which a conformance requirement was input in the market.

Out of all intervals with an RTD requirement, approximately 10% of intervals had a positive conformance delta (shown to the left of the red arrow) and 10% of intervals had a negative conformance delta (shown to the right of the red arrow). The straight red line represents a break in the graph (see Appendix A for full-scale graph) in which there was no delta change. 80% of RTD intervals had a conformance requirement with no change between intervals – the conformance was left over from the previous interval.

This shows that of all intervals in which imbalance conforming is being used, only 20% have a change in conformance between intervals. When a conformance delta occurs, it is a large, coarse adjustment as identified by the blocks. The delta is not gradually ramped across multiple market runs.

This data in Figure 4 proves:

1. Operators use large coarse values, and
2. Once the conformance value is input into the market, it is frequently left for subsequent intervals with no change.

As a result, the limiter is needed to protect for large coarse adjustments the first time they are input into the market.

Coarse adjustments (i.e. a conformance delta of 100 MW) likely do not represent the true grid conditions for the individual corresponding interval. A coarse adjustment is the operator’s way to respond to an event or prepare for an anticipated event. The operator does not have time to ramp the change into the market and instead inputs a large requirement at one time and allows it to stay in the market for multiple intervals. The coarse adjustments are frequently the interval in which the limiter is triggered and needed (see Figure 5).

Figure 5: CAISO RTD conformances as a percentage of total RTD intervals in which the limiter is triggered.

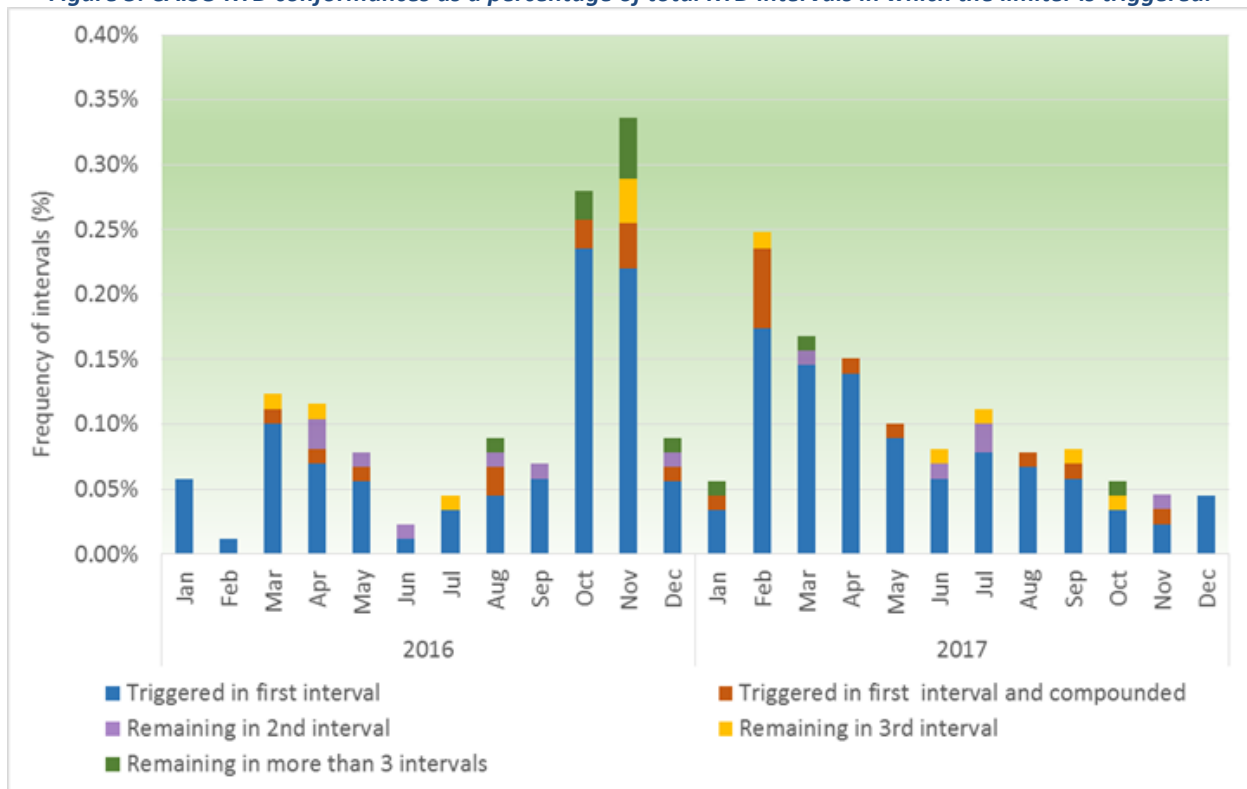


Figure 5 displays the RTD intervals in which the limiter is triggered for 2016 and 2017 in the CAISO. The colored bars represent the interval when the limiter was triggered.

- **Blue** – A conformance change from one interval to the next causes a market infeasible solution and therefore results in the limiter triggering.
- **Red** – A conformance change from one interval to the next causes a market infeasible solution and therefore results in the limiter triggering (the Blue group) and a new conformance delta still results in a market infeasible solution and the triggering of the limiter. The limiter triggering is a compounded /carry-over effect.
- **Purple** – A conformance change from one interval to the next causes a market infeasible solution and therefore results in the limiter triggering and the conformance requirement is so large that the infeasibility consecutively remains for a second interval. The limiter triggers for two intervals even though the conformance requirement was input in the first interval.
- **Yellow** – A conformance change from one interval to the next causes a market infeasible solution and therefore results in the limiter triggering and the conformance requirement is so large that the infeasibility consecutively remains for a second and third interval. The limiter triggers for three intervals even though the conformance requirement was input in the first interval.
- **Green** – A conformance change from one interval to the next causes a market infeasible solution and therefore results in the limiter triggering and the conformance requirement is so large that the infeasibility consecutively remains for four or more intervals. The limiter triggers for four or more intervals even though the conformance requirement was input in the first interval.

Figure 5 shows that the limiter is often triggered when the conformance is first entered in the market. When the conformance is large enough, the limiter will continue to trigger. In reality, the limiter should only trigger for the first interval in which the conformance requirement is “coarse” as described in Figure 4. The memory component of the enhanced limiter will prevent the limiter from continuing to trigger for subsequent intervals when the reason for the limiter triggering is due to the conformance change in the first interval.

4.5. Revised Proposal

The enhancements put forth in this proposal ensure the limiter triggers accurately. The enhancements are an improvement from the current limiter. Having the limiter in action, and ensuring it triggers correctly, is a necessity while the ISO works to improve the conforming process. When the tools and process of conforming are improved to a point that coarse over-estimations no longer occur, the limiter becomes superfluous. At that time, the limiter can be removed from the real-time market.

As stated by the Department of Market Monitoring, “It is reasonable to have a mechanism in place to limit unintended market impacts due to changes in imbalance conformance.” Until the ISO can minimize the frequency of large coarse conformance adjustments, the limiter is needed. The ISO will use the next two years to make necessary changes and proposes to remove the limiter from production after the changes have been successfully implemented.

As recognized by stakeholders, the ISO will include the limiter in the tariff.

The ISO also recognizes a minority of stakeholders oppose the limiter all together. The importance of accurate penalty pricing based on scarcity conditions, as mandated by FERC in Order #825, is recognized. However, immediate removal of the limiter would likely have unintended negative consequences for the ISO and EIM Entities.

The ISO believes it is in the best interest of all parties to keep the limiter, with proposed enhancements, while the addressing the root cause of the coarse adjustments. Once the improvements have been implemented and the coarseness with which the operators are conforming have been diminished, the limiter is no longer necessary. At the time, the limiter will be removed from the real-time market. The ISO targets a sunset date for the limiter in the Fall of 2020. Analysis will be completed prior to the removal of the limiter to ensure to adverse impacts to market pricing.

As discussed in the Issue Paper/Straw proposal, the enhanced limiter logic is as follows:

- Will be based on the conformance and infeasibility changes between intervals,
- Will not be limited to information from the current interval,
- Will not be subject to the infeasibility and the conformance being in the same direction, and
- Will consider the conformance magnitudes in previous intervals and whether the limiter was applied in the corresponding intervals.

The limiter will solve for C_i . The limiter will trigger for **under supply**, as indicated by a positive infeasibility, when the value of C_i is less than 0:

$$C_i = (PBC_inf_i - PBC_inf_{i-1}) - (Conf_i - Conf_{i-1}) + \max(0, C_{i-1}) \quad (1)$$

If $C_i < 0$, limiter is triggered.

If $C_i > 0$, limiter is not triggered.

The limiter will solve for C_i . The limiter will trigger for **over supply**, as indicated by a negative infeasibility, when the value of C_i is greater than 0:

$$C_i = (PBC_inf_i - PBC_inf_{i-1}) - (Conf_i - Conf_{i-1}) + \min(0, C_{i-1}) \quad (2)$$

If $C_i > 0$, limiter is triggered.

If $C_i < 0$, limiter is not triggered.

Where:

i	is the index for current interval
$(i - 1)$	is the previous interval
C_i	is the remaining available capability to absorb power balance constraint infeasibilities in the current interval
$(PBC_inf_i - PBC_inf_{i-1})$	is the change of power balance constraint infeasibility between current and previous intervals
$(Conf_i - Conf_{i-1})$	is the change of load conformance between current and previous intervals
$\max(0, C_{i-1})$	is the carry-over capability from previous interval.

If in any interval the power balance constraint infeasibility results in a value of 0, C_i is reset to 0.

Examples of the current and proposed logic can be found in the Issue Paper/Straw Proposal and the presentation discussed during the December 8 stakeholder call.¹⁰

¹⁰ Examples are explained in sections 3.3 and 3.4 of the Issue Paper/Straw Proposal and slides 22-28 of the stakeholder presentation:
<http://www.caiso.com/Documents/IssuePaper-StrawProposal-ImbalanceConformanceEnhancements.pdf>
http://www.caiso.com/Documents/Agenda-Presentation-ImbalanceConformanceEnhancements-Dec8_2017.pdf

5. Stakeholder Engagement and EIM Governing Body Role

Stakeholder input is critical for developing market design policy. The schedule proposed below allows opportunity to for stakeholder involvement and feedback. This initiative will require briefing to EIM Governing Body to support its advisory role and approval from the ISO Board of Governors.

5.1. Schedule

Table 1 lists the schedule for the Imbalance Conformance Enhancements stakeholder process.

Table 1: Schedule for Imbalance Conformance Enhancements Stakeholder Process

Item	Date
<i>Post Issue Paper/Straw Proposal</i>	<i>November 29, 2017</i>
<i>Stakeholder Conference Call</i>	<i>December 8, 2017</i>
<i>Stakeholder Comments Due</i>	<i>December 20, 2017</i>
Post Draft Final Proposal	January 30, 2018
Stakeholder Conference Call	February 6, 2018
Stakeholder Comments Due	February 20, 2018
EIM Governing Body Meeting	April 24, 2018
ISO Board of Governors Meeting	May 16, 2018

The ISO will present its proposal to the respective EIM Governing Body and ISO Board of Governors when the stakeholder process has been completed. The EIM Governing Body Meeting and ISO Board of Governors proposed meeting dates are May 2, 2018 and May 16, 2018 respectively.

The ISO is committed to providing ample opportunity for stakeholder input into its market design, policy development, and implementation activities. The ISO requests stakeholders to submit written comments to InitiativeComments@caiso.com.

5.2. EIM Governing Body Role

The Imbalance Conformance Enhancements initiative proposes changes to market rules and if necessary the development of new market rules that are generally applicable to the ISO markets. The process of conforming, which is handled manually by ISO and EIM Entity operations personnel, is necessary for

system reliability to maintain balance between supply and demand. The Imbalance Conformance Enhancements initiative will likely add or revise tariff provisions to govern conformance and propose enhancements for the conformance limiter, which is part of the ISO's market software. The new or revised rules that the ISO expects to develop will apply generally to the conformance process used in all markets, including the real-time market, without rules that are specific to EIM balancing authority areas. As such, this initiative is being classified as E2 – the policy initiative falls entirely within the EIM Governing Body's advisory role.

As explained in the Guidance for Handling Policy Initiatives document¹¹, "To the extent a policy initiative proposes modification of generally applicable rules of the ISO's real-time market or rules that govern all ISO markets, the EIM Governing Body has an advisory and consultative role. It has the right to submit to the Board its advice on any such issue, which the Board will consider when deciding on the amendment."

Stakeholders are encouraged to submit a response to the EIM categorization in their written comments following the conference call for the Issue Paper/Straw Proposal, particularly if they have concerns or questions.

6. Next Steps

The ISO will discuss the Draft Final Proposal during the stakeholder conference call on February 6, 2018. The ISO requests stakeholders submit written comments in response to the Imbalance Conformance Enhancements Draft Final Proposal paper and conference call by February 20, 2018.

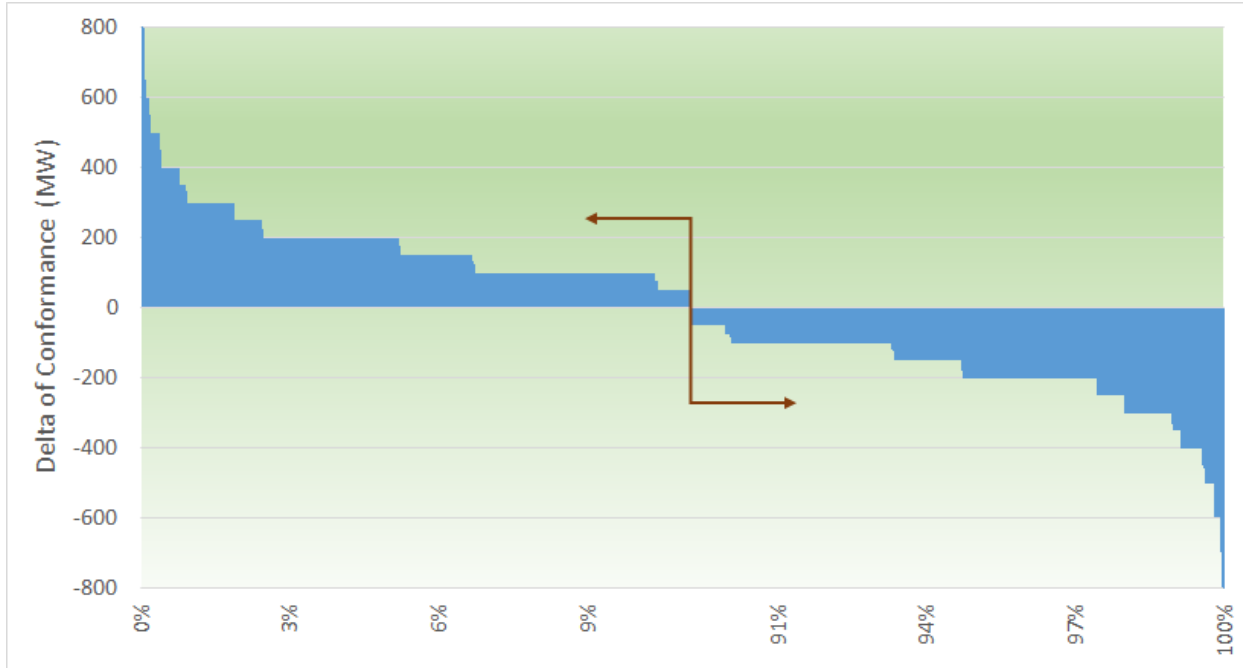
The Imbalance Conformance Enhancements proposal will be presented to the EIM Governing Body under their advisory role on April 24, 2018. The initiative will then be presented to the ISO Board of Governors for their approval on May 16, 2018. With support and approval of the Governing Body and Board of Governors, tariff changes will be drafted and submitted to FERC.

The ISO targets an implementation date for the limiter enhancements in the Fall of 2018. Improvements to the conformance process including tool enhancements and automation will begin immediately and continue through the Fall of 2019. Successful improvements to the conformance process will eliminate the need for the limiter at which time it will be removed from production. The ISO plans to sunset the limiter by the Fall of 2020.

¹¹ Additional information related to the EIM classification for initiatives and the EIM Governing Body's advisory role can be referenced in the Guidance for Handling Policy Initiatives document at: <https://www.westerneim.com/Documents/GuidanceforHandlingPolicyInitiatives-EIMGoverningBody.pdf>

7. Appendix A: Conformance Deltas

CAISO RTD conformance changes (“deltas”) between intervals for 2017. Intervals with no conformance change have been removed, as indicated by the red arrows. X-axis indicates percentage of total RTD intervals with a conformance input.



CAISO RTD conformance changes (“deltas”) between intervals for 2017. Intervals with no conformance change are included. X-axis indicates the total number of RTD intervals in 2017 with a conformance input.

