Technical Bulletin

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Process for Biasing Flowgate/Nomogram Operating Limits For Day Ahead & Real Time Markets

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Purpose

This document outlines the California Independent System Operator Corporation's (ISO) process for biasing operating limits for the Day-Ahead Market (DAM) and Real Time Market (RTM). As further discussed below, under certain circumstances, in operating the markets the ISO will bias operating limits for select flowgate (also known as transmission interface) constraints that become binding consistently in the DAM and RTM. This is done to ensure that measurable or predictable differences between actual and market-calculated flows are accounted for and adequate operating margins are maintained such that reliability of the grid is not adversely impacted.

Biasing to maintain adequate operating margins is a prudent operating practice that was also used by the ISO prior to the launch of the new markets. Under the ISO's prior zonal market structure, in the Day Ahead, actual flows on flow-based transmission constraints were not addressed for Intra-zonal constraints and only scheduling limits were addressed for Inter-zonal transmission constraints. No flowgate biasing was done in DAM. In Real Time, for Inter-Zonal constraints, limits were biased by the operators to compensate for differences between actual flows and scheduled flows and for Intra-zonal constraints adequate margins were maintained through the Intra-zonal congestion management process using Out-Of-Sequence (OOS) real-time dispatches. Under the old zonal market structure, the costs of OOS dispatches were recovered through uplift charges and did not affect market cleared energy prices. With the implementation of the new markets based on Locational Marginal Pricing (LMP), the market optimization tools used in conjunction with the Full Network Model (FNM) in the DAM and RTM now perform congestion management through automated processes that calculate locational energy prices that reflect the costs of congestion at such locations. For reasons discussed below, the new markets have not, however, eliminated the occurrence of measurable and often predictable differences between actual and market-calculated flows. The process of biasing is, therefore, a necessary operational tool for ensuring that the markets result in schedules and real-time dispatches that more accurately reflect expected real-time flows, respect actual flow limits and fully support reliable grid operation.

Note that biasing is not applied to scheduling limits; it is applied only to market operating limits for certain branch groups (flow gates/transmission interfaces), as necessary.

Day Ahead & Real Time Limit Adjustment Level

Flowgates that consistently become binding in the RTM and are biased in RTM may need to be biased in the DAM runs. Such biasing is needed to provide for better consistency of margin management for these flowgates in the day ahead, such that the congestion/reliability issues are manageable in real-time. Biasing may be necessary to account for the difference in flows between DAM and RTM that are caused by changes in load forecast, generation and transmission etc.

It is worth noting that each of the constraints is unique and may require different levels of biasing in the DAM, based on the congestion experienced in Real Time.

The adequate level of adjustment in the DAM is based on measurable or predictable difference between actual flows (from telemetry) in the real-time and DAM estimated flows. The degree to which these differ may require further review of the historical and DAM flow differences. In determining the biasing need, the ISO also considers the conditions leading to flow differences and their interplay with reserve/regulation management and the level of scheduled intermittent resources.

Reasons for Biasing in the Day Ahead & Real Time Markets

The key reasons for biasing operating limits in the DAM and RTM are:

A. To align calculated market flows with measurable or predictable actual flows;
B. To accommodate mismatch due to inherent design differences of DAM, Real-Time Unit Commitment (RTUC) and the Real-Time Dispatch (RTD) runs;
C. To allow reliability margins for certain flowgates; and
D. To adjust margins for flowgates impacted by telemetry issues.

A. <u>Biasing to align calculated market flows with measurable or predictable flows</u>

In the RTM, flows for certain flowgates may not align closely with real-time telemetry flows. In these cases, the flowgates are biased when the market flows approach binding limits in the market or if the telemetry flows get close to reliability limits in EMS. Reasons for flow differences may include: (i) unscheduled flow, (ii) differences in load distribution, (iii) deviations on resources internal to CAISO and (iv) external network model limitations. Pursuant to good utility practice, efforts are made to minimize the flow differences. However, to the extent a flowgate is susceptible to significant differences between actual and market flow; it is necessary to have a process for monitoring and adjustment of limits in RTUC and RTD on a more frequent basis. These flowgates with flow mismatches in real-time, typically also need to be biased in the DAM so that calculated market flows align closely with the predictable actual flows.

B. Biasing to accommodate mismatch due to inherent design of DAM, RTUC & RTD runs

Typically, a different level of biasing is required for enforcement of the same constraint in the DAM, RTUC and RTD runs. The biasing for DAM run typically needs to be more conservative than biasing in RTUC, in turn needs to be more conservative than biasing in RTD. This stems from the fact that flowgate limits are hourly and DAM optimization is hourly while the RTM optimization is done on 15 (RTUC) and 5 (RTD) minute boundaries.

Different level of biasing is typically also necessary for the same constraint in RTUC versus the RTD runs. This is necessary to accommodate the mismatch between theory and reality of RTUC and the RTD runs. While RTUC can provide a solution for a 15 minute interval that is 30 minutes into the future using a 15 minute ramp of resources, RTD, ran 20 to 30 minutes later, when it gets to dispatch that 15 minute interval is only able to use 5 minute ramp of resources. At that time, it is possible that the exact initial condition predicted by RTUC 20 to 30 minutes prior does not occur. If a constraint is binding in RTUC then RTD has a high chance of not having the means (resource ramp rate) to respect that limit if no additional margin is available.

C. Biasing to allow for operating reliability margin in real time

Biasing is necessary in real-time to maintain a reliable operating margin for select flowgates that are approaching their actual operating limits. There are numerous reasons why operating margins are required in the real-time. The operating margin required in real-time is determined using EMS Data and Market Contingency Reserve Awards available in real-time. In most cases, the same operating margins are also implemented in the DAM.

1. Historical Contingency Reserve procurement

If it is expected that Contingency reserves procured through the market may not be delivered from one location within ISO Balancing Authority Area to other locations due to expected congestion on the transmission lines connecting the one or more locations, then it is prudent to incorporate operating margin for the Branch Group that comprises these transmission lines. Having a reliable operating margin is needed in this case to ensure that operating reserves can be delivered and reliability issues can be addressed through the market.

2. Historical AGC awards

Energy delivery for AGC awards are not considered in the market model. The optimal solution will consider the market awarded Dispatch Operating

Point (DOP) for a resource that is awarded AGC and is being used in mitigation. Energy dispatched from AGC awards is above the DOP for up-wards AGC and below the DOP for AGC down-wards. The Energy dispatch from AGC awards is based on ACE and is dispatched in 4 second intervals from the EMS system, not the market system.

Example: A resource has an AGC down-ward and a DOP that has the resource moving up to resolve congestion on a System Operating Limit (SOL). In real-time ACE is in the positive direction and EMS is dispatching resources on AGC down to recover ACE. The down ward movement of this resource responding to AGC was not considered in the market solution so the SOL constraint is no longer being mitigated in real-time.

3. Intermittent resource deviations

The Day-Ahead Schedules and the real-time actual generation for various intermittent resources can deviate significantly. This can potentially cause congestion and/or reliability issues in the real-time. It may, therefore, be necessary to bias in the DAM for branch groups that are affected by intermittent resource deviations. Biasing these branch groups in the DAM helps account for these deviations and build appropriate margins so that sufficient generation is committed in the DAM. This enables the ISO to better anticipate and manage congestion in real-time.

4. Adverse operating conditions

Adverse operating conditions, such as fire, wind storms may also necessitate the need to temporarily bias flowgates in the Real Time market runs. This is usually needed to maintain appropriate operating margin for flowgates impacted by these adverse operating conditions.

D. Biasing to adjust margins for flowgates impacted by telemetry issues

The ISO also biases select flowgates that are impacted by lack of telemetry in the area. This is typically an issue for the 115 kV and below part of the transmission system. Certain pockets for this kV level have little or no telemetry. Therefore the state estimator (SE) solution is impacted by the lack of visibility. Most of these flowgates are typically un-enforced in the market model. However, if a flowgate comes close to its limit in real-time based on the SE solution, then the ISO enforces this flowgate into the market with a bias, as needed.

Flowgate Biasing Example:

Below is an example to demonstrate how biasing is done for a flowgate, if needed, to account for the mismatch between calculated market flows and measured actual flows.

Assuming
A = Normal limit for a flowgate
B = Calculated market flow for this flowgate (from power flow, utilizing RTD run closest in time to telemetry data)
C = Actual flow for this flowgate (observed from telemetry)

If this flowgate needs to be enforced in the market with a bias, then the new flow limit to be used in the market is calculated by the formula:
D (New limit for the flowgate) = A – (C – B)
Also, the Bias Percentage for this flowgate is calculated by the formula:
E (Bias %) = 100 * D/A

Example 1. If, A = 500, B = 475, C = 550.
Then, D (New flow limit for the market) = 425.
E (Bias %) = 85%

Example 2. If, A = 500, B = 525, C = 475.
Then, D (New flow limit for the market) = 550.
E (Bias %) = 110%