



February 22, 2021

The Honorable Kimberly D. Bose
Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, DC 20426

**Re: California Independent System Operator Corporation
Docket No. ER21-____-000**

**Tariff Amendment to Enhance Market Parameters and Import
Bidding Related to Order No. 831**

Dear Secretary Bose:

The California Independent System Operator Corporation (CAISO) submits this tariff amendment to implement market enhancements to revise the tariff provisions on (1) market parameters and (2) import and virtual bidding.¹ The first enhancement is designed to use current market scheduling and pricing parameters based on a \$1,000/MWh soft energy bid cap unless market conditions can support costs and bids above \$1,000/MWh. The second enhancement provides rules for allowing for import bids, export bids, demand bids, and virtual bids above \$1,000/MWh. These changes are related to and complement the CAISO's implementation of the directives in the Commission's Order No. 831.²

The CAISO requests that the Commission accept the changes proposed in this tariff amendment effective no later than June 15, 2021. The CAISO also requests authority to provide at least fourteen days' notice of the actual effective date to the Commission and market participants.³ To allow the CAISO to make

¹ The CAISO submits this filing pursuant to section 205 of the Federal Power Act (FPA), 16 U.S.C. § 824d.

² *Offer Caps in Markets Operated by Regional Transmission Organizations and Independent System Operators*, Order No. 831, FERC Stats. & Regs. ¶ 31,387 (2016) (Order No. 831), *order on reh'g and clarification*, Order No. 831-A, 161 FERC ¶ 61,156 (2017) (Order No. 831-A). Because the CAISO is filing these enhancements pursuant to section 205 of the FPA, the instant filing is severable and distinct from the CAISO's filings to comply with Order No. 831.

³ The CAISO has included an effective date of 12/31/9998 as part of the tariff records submitted with this filing. The CAISO will make a filing pursuant to Type of Filing Code 150 to

the tariff changes effective on the earliest possible date, the CAISO respectfully requests that the Commission issue an order accepting this tariff amendment by April 26, 2021.

I. Executive Summary

In 2016, the Commission issued Order No. 831 to require the CAISO and other Independent System Operators (ISOs) and Regional Transmission Organizations (RTOs) to, among other things, increase their energy market bid caps from \$1,000/MWh to \$2,000/MWh.⁴ Order No. 831 also required suppliers to base energy bids above \$1,000/MWh on verifiable actual or expected costs to be eligible to set market prices. Order No. 831 did not require verification of import bids or virtual bids above \$1,000/MWh.

The Commission accepted the CAISO's tariff revisions to comply with Order No. 831 (Order No. 831 Compliance Filing)⁵ and related tariff revisions to implement commitment cost and default energy bid enhancements (CCDEBE Tariff Amendment).⁶ In this filing the CAISO proposes two additional market enhancements to tailor implementation of the higher bid caps under Order No. 831 to the characteristics of the energy market in the Western Interconnection.

The first proposed enhancement relates to the parameter used in the CAISO market to calculate locational marginal prices (LMPs) when energy

provide notice of the actual effective date of these tariff records at least fourteen days prior to implementation.

⁴ Order No. 831 directed ISOs and RTOs to implement requirements as to (1) offer cap structure, (2) a verification process for cost-based offers for energy above minimum load, (3) resource neutrality, and (4) virtual transactions and external transactions (*i.e.*, imports). Order No. 831 clarified some aspects of those requirements.

⁵ The CAISO submitted the Order No. 831 Compliance Filing in Docket No. ER19-2757-000. On September 21, 2020, the Commission issued an order accepting those tariff revisions subject to the CAISO submitting a further compliance filing within 30 days to clarify one of the tariff revisions. *Cal. Indep. Sys. Operator Corp.*, 172 FERC ¶ 61,262, at P 1 (Order No. 831 Compliance Order), *notice of denial of reh'g by operation of law*, 173 FERC ¶ 62,095 (2020). The CAISO timely submitted the further compliance filing, which the Commission accepted by letter order on December 11, 2020.

⁶ The CAISO submitted the CCDEBE Tariff Amendment in Docket No. ER20-2360-000. On September 21, 2020, the Commission issued an order accepting those tariff revisions subject to the CAISO submitting a compliance filing within 30 days to clarify one of the tariff revisions. *Cal. Indep. Sys. Operator Corp.*, 172 FERC ¶ 61,263, at P 1 (CCDEBE Order), *notice of denial of reh'g by operation of law*, 173 FERC ¶ 62,096 (2020). The CAISO timely submitted the compliance filing, which the Commission accepted by letter order on December 28, 2020. The CCDEBE Tariff Amendment was preceded by an earlier CAISO tariff amendment submitted in Docket No. ER19-2727-000 that included similar (but not identical) tariff revisions, which the Commission rejected in relevant part without prejudice. See CCDEBE Order at PP 8-9 (citing *Cal. Indep. Sys. Operator Corp.*, 170 FERC ¶ 61,015 (2020)).

supply bids are insufficient to meet demand. This administrative price is referred to as a shortage price. The CAISO market enforces a system energy-balance constraint that ensures supply equals demand. If there is insufficient supply and the market must relax the system energy-balance constraint, the market will administratively set prices based on the \$1,000/MWh soft energy bid cap. The CAISO proposes, through this amendment, to enable the market to set appropriate levels of shortage pricing when energy costs exceed the cap. This enhancement does not affect shortage price-setting when energy costs are below the soft energy bid cap.

The market enhancement also will ensure that when energy costs exceed the soft energy bid cap and there is insufficient supply to meet demand, the market will set prices based on the amount of the supply shortfall. Pursuant to this approach, the market will set prices based on the minimum of the soft energy bid cap or the highest-priced cleared energy bid if the shortfall is no more than a small threshold value. However, market prices will be based on the \$2,000/MWh hard energy bid cap if the shortfall is greater than the threshold value. The threshold value will limit shortage pricing when there are small shortfalls in supply that could be the result of forecasting or modeling errors and may not represent a true supply shortage. The threshold value is based on the amount of supply shortfall a balancing authority area can incur and still comply with system reliability standards. The CAISO will calculate the threshold value each year for each balancing authority area participating in the CAISO market using a formula based on the North American Electric Reliability Corporation (NERC) Reliability Standard BAL-001-2 Requirement R2, entitled "Real Power Balancing Control Performance." Thus, implementing this first proposed market enhancement will ensure the market parameters the CAISO uses to establish market prices in shortage conditions, if they are triggered, do not result in excessively high prices. It is therefore just and reasonable.

The second proposed market enhancement consists of rules for allowing import bids, export bids, demand bids, and virtual bids above the soft energy bid cap. Unlike other ISOs/RTOs, the CAISO often is dependent on import bids to meet demand. Therefore, it is just and reasonable for the CAISO to include criteria in the tariff for accepting import bids above the soft energy bid cap. Specifically, the CAISO proposes the market accept non-resource adequacy import bids, export bids, demand bids, and virtual bids priced above the soft energy bid cap only when the CAISO has cost-verified a bid or has calculated a maximum import price that exceeds the soft energy bid cap. The CAISO will calculate the maximum import price using a maximum import bid price index based on prevailing bilateral prices. For resource adequacy import bids, the CAISO proposes to reduce bids priced above \$1,000/MWh to the greater of the soft energy bid cap, the maximum import bid price, or the highest resource-specific cost-verified bid. These enhancements will ensure the CAISO incentivizes imports it depends on to operate its system reliably when there is

insufficient supply to meet demand, while also ensuring energy bids will be based on fair and supportable market prices.

II. Background

A. CAISO Markets

The CAISO market processes include both day-ahead and real-time wholesale electricity markets.⁷ The day-ahead and real-time markets both operate inside the CAISO balancing authority area, while the Energy Imbalance Market (EIM) provides other balancing authority areas in the Western Interconnection with the opportunity to participate in the real-time market. The market optimization schedules resources in two successive runs: the scheduling run, which produces resource schedules, followed by the pricing run, which produces LMPs.⁸

Market participants can submit economic bids and self-schedules of energy and ancillary services in the CAISO market.⁹ The CAISO market design allows suppliers to submit separate bid components for a resource's commitment costs¹⁰ and for incremental energy above minimum load. Market participants can also engage in virtual bidding to speculate on price differences, hedge their physical market positions, and manage their exposure to differences between

⁷ Existing tariff sections 31, *et seq.* and 34, *et seq.*; tariff appendix A, existing definition of "CAISO Markets Process." The day-ahead market includes the market power mitigation process, the integrated forward market (IFM), and the residual unit commitment (RUC). Existing tariff section 31. In the day-ahead market, energy supply clears against economic demand bids. Existing tariff section 31.3. For the sake of clarity, this transmittal letter distinguishes between existing tariff provisions (*i.e.*, provisions in the current CAISO tariff and provisions that, pursuant to orders the Commission has already issued or the CAISO has requested the Commission to issue as discussed below, will be effective on or before the requested June 15, 2021 effective date of the tariff revisions contained in this filing), new tariff provisions (*i.e.*, new provisions that the CAISO proposes to add in this filing), and revised tariff provisions (*i.e.*, existing tariff provisions that the CAISO proposes to revise in this filing).

⁸ Existing tariff sections 31.3 and 34.4.

⁹ Existing tariff section 30, *et seq.*

¹⁰ Commitment costs consist of the costs of starting up resources (start-up costs), the costs of running resources at their minimum operating levels (minimum load costs), and transition costs for resources (called multi-stage generating resources) that can operate in different configurations. In making commitment decisions, the CAISO market separately considers these three types of commitment costs and the costs of bids for energy above minimum load. See existing tariff sections 30.4 and 31.3; tariff appendix A, existing definitions of "Start-Up Cost," "Minimum Load Costs," "Transition Cost," and "Multi-Stage Generating Resources."

day-ahead and real-time prices.¹¹ The CAISO often relies on energy from imports into the CAISO balancing authority area to meet demand.

The CAISO's security constrained unit commitment (SCUC) and security constrained economic dispatch (SCED) optimization software utilizes configurable market scheduling and pricing parameters to reach a feasible solution and set appropriate prices for the market in instances where effective economic bids are insufficient for a feasible market solution.¹² These market parameters used throughout the integrated forward and real-time markets include penalty prices that apply when constraints enforced by the CAISO market, such as constraints to ensure that supply equals demand (the system energy-balance constraint)¹³ and transmission constraints, are binding.

The various types of constraints have different price triggers that represent the cost at which the market will relax a constraint if it cannot reach a feasible solution while enforcing the constraint. If this occurs, the market calculates LMPs based on administratively determined relaxation prices. The administrative price used to calculate LMPs when energy supply bids are insufficient to meet demand is called the shortage price. The scheduling run uses penalty prices that are a larger magnitude than the penalty prices the pricing run uses. As relevant to this filing, the system energy-balance constraint penalty price used by the scheduling run is currently \$6,500/MWh, while the penalty price used by the pricing run is \$1,000/MWh.¹⁴

The day-ahead market schedules energy in hourly intervals one day prior to each operating day. The real-time market includes the short-term unit commitment (STUC), real-time pre-dispatch (RTPD), and real-time dispatch

¹¹ Existing tariff section 30.9.

¹² Existing tariff section 27.4.3, *et seq.* See also business practice manual for market operations, section 6.6.5 (listing market parameter values that are calibrated based on values set in the tariff). The SCUC and SCED software constitute the real-time dispatch the CAISO uses to determine which resources to dispatch and to calculate LMPs. Tariff appendix A, existing definition of "Real-Time Dispatch."

¹³ The system energy-balance constraint ensures that the sum of generation and imports equals the sum of demand, including exports and transmission losses. Tariff appendix C, existing section B. The shadow price of the system energy-balance constraint establishes the system marginal cost of energy, which is a component of the calculation used to determine LMPs. For the day-ahead market, the LMP for each pricing node comprises three components: system marginal energy cost, marginal cost of congestion, and marginal cost of losses. Tariff appendix C, existing section A. For the real-time market, the LMP for each pricing node comprises these same three components plus marginal greenhouse gas cost and, for each pricing node within an EIM entity balancing authority area, an EIM bid adder component. Tariff appendix C, existing section B.

¹⁴ Business practice manual for market operations, section 6.6.5.

(RTD) processes. The STUC process is performed at the beginning of each hour and looks ahead four and a half hours. This process produces a unit commitment solution for every 15-minute interval within its horizon. The RTPD process runs every 15 minutes and also commits resources hourly. The first interval of the RTPD process is the hour-ahead scheduling process (HASP) which schedules hourly intertie transactions. The second interval of the RTPD process produces financially binding fifteen-minute market (FMM) schedules and prices. The RTD process runs every 5 minutes and produces final dispatches and financially binding prices.

B. CAISO Tariff Provisions Relevant to this Tariff Amendment

On or before the requested effective date of the tariff revisions contained in this filing, the existing tariff also will include tariff provisions discussed below that the Commission accepted in the Order No. 831 Compliance Filing Order.¹⁵ The CAISO also has implemented the CCDEBE tariff revisions, and provided notice of their effectiveness to the Commission on February 18, 2021.¹⁶

The maximum energy bid price is \$1,000/MWh until the Order No. 831 Compliance Filing becomes effective.¹⁷ In compliance with the Commission's directives regarding the offer cap structure requirement of Order No. 831,¹⁸ the CAISO implemented a two-tier cap structure: (1) a soft energy bid cap of \$1,000/MWh, which applies to all energy bids¹⁹ except for virtual bids and bids

¹⁵ In the Order No. 831 Compliance Order, the Commission accepted the Order No. 831 Compliance Filing effective March 21, 2021. Order No. 831 Compliance Order at P 1. As explained above, the CAISO requests that the Commission accept the tariff revisions contained in this filing effective no later than June 15, 2021, and issue an order accepting the tariff revisions by April 26, 2021.

¹⁶ *Cal. Indep. Sys. Operator Corp.*, Informational Filing of Effective Date of CCDEBE, Docket No. ER20-2360-000 (Feb. 18, 2021). In the CCDEBE Order, the Commission accepted the tariff revisions proposed in the CCDEBE Tariff Amendment effective as of their actual implementation date to be specified in a future CAISO filing in the proceeding. CCDEBE Order at P 1. The Commission directed the CAISO to notify it of the actual effective date of the tariff revisions within five business days of their implementation. *Id.* at Ordering Paragraph (C).

¹⁷ Tariff section 39.6.1.1 prior to its revision by the Order No. 831 Compliance Filing.

¹⁸ Order No. 831 obligated each ISO and RTO to cap a resource's incremental energy offer at the higher of \$1,000/MWh or the resource's cost-based incremental energy offer. Order No. 831 also required each ISO and RTO to limit cost-based incremental energy offers to a hard cap of \$2,000/MWh for purposes of calculating LMPs. See Order No. 831 at PP 1, 42, 78; transmittal letter for Order No. 831 Compliance Filing at 3.

¹⁹ The types of energy bids include supply bids (including import bids), demand bids (including export bids), and virtual bids. Existing tariff section 30.2; tariff appendix A, existing definitions of "Energy Bid," "Supply Bid," "Import Bid," "Demand Bid," "Export Bid," and "Virtual Bid."

for non-resource-specific system resources (*i.e.*, import bids that come from a resource not identified by a specific resource located outside of the CAISO balancing authority area);²⁰ and (2) a hard energy bid cap of \$2,000/MWh, which applies to all energy bids.²¹

Suppliers with bids subject to the soft energy bid cap may submit energy bids in excess of \$1,000/MWh by requesting the CAISO adjust the prices in a resource's default energy bids (*i.e.*, the resource's cost-based incremental energy offers).²² Once the CAISO verifies and approves a requested change to a resource's default energy bid, the supplier can submit an energy bid up to the price of the modified default energy bid. If the CAISO cannot validate such a request, the supplier's bid for the resource is limited to the soft energy bid cap. However, the supplier may submit a request for after-market cost recovery for any difference between the soft energy bid cap and its actual fuel or fuel-equivalent costs. Because the CAISO enforces the hard energy bid cap in its market processes, energy bids used by the market to set prices cannot exceed \$2,000/MWh, with any costs above this amount limited to after-market verification and recovery.²³

In compliance with Order No. 831, the CAISO or its market monitoring unit must verify the actual or expected costs underlying a resource's cost-based incremental energy offer above \$1,000/MWh before that offer can be used for purposes of calculating LMPs.²⁴ The Commission found this was necessary because market power issues are heightened when a supplier's short-run

²⁰ Resource-specific system resources are resources external to the CAISO balancing authority area (*i.e.*, system resources) that in some respects are treated like resource-specific resources located within the CAISO balancing authority area. For example, resource-specific system resources may submit three-part bids (*i.e.*, start-up bids, minimum load bids, and bids for energy above minimum load). Existing tariff section 30.5.2.4. These resources are guaranteed recovery of these costs through the bid cost recovery process (see existing section 11.8, *et seq.*) and are subject to local market power mitigation (see existing tariff section 39.7, *et seq.*). Therefore, the CAISO can cost-verify offers for energy above minimum load for these resources as it does for internal resources.

²¹ Existing tariff sections 30.7.12.1, 30.7.12.3, and 39.6.1.1.1 – 39.6.1.1.2; tariff appendix A, existing definitions of "Soft Energy Bid Cap" and "Hard Energy Bid Cap."

²² Default energy bids are the CAISO's resource-specific cost-based mechanism for applying energy bid mitigation. Existing tariff section 39.7.1, *et seq.* The process for submitting a request to adjust the prices in a resource's default energy bid is set forth in existing tariff section 30.11.2, *et seq.*

²³ Existing tariff sections 30.11, *et seq.* and 30.12, *et seq.*

²⁴ See Order No. 831 at PP 42, 140; transmittal letter for Order No. 831 Compliance Filing at 3-5. The Commission declined to prescribe the manner in which cost-based incremental energy offers above \$1,000/MWh must be verified. Order No. 831 at P 208.

marginal costs exceed \$1,000/MWh.²⁵ However, pursuant to Order No. 831,²⁶ virtual bids and import energy bids for non-resource-specific system resources are subject to the \$2,000/MWh hard energy bid cap but not to cost verification requirements.²⁷

C. Commission Guidance and CAISO Stakeholder Process Regarding Market Parameters and Import Bidding

In Order No. 831, the Commission stated that an ISO or RTO may propose, pursuant to section 205 of the FPA, modifications to shortage prices or other market elements that require revision in light of the offer cap reforms adopted in Order No. 831. However, the Commission stated such modifications were unnecessary to comply with the Order.²⁸

The Commission also declined to require virtual transactions and imports above \$1,000/MWh be subject to the verification requirement set forth in Order No. 831.²⁹ The Commission stated, however, that ISOs and RTOs could propose, in a separate filing under section 205 of the FPA, measures to address any concerns that arise from permitting virtual transactions up to \$2,000/MWh, or could propose measures to address issues regarding the absence of a verification requirement for imports.³⁰

The CAISO discussed this Commission guidance in its Order No. 831 Compliance Filing. The CAISO explained it proposed to increase the CAISO market's system energy-balance constraint relaxation prices to be consistent with the \$2,000/MWh hard energy bid cap, but noted stakeholders had raised concerns the proposed market parameters might trigger unnecessarily high prices in the CAISO markets, including the EIM. The CAISO stated it planned to conduct a stakeholder process to address this issue. Based on the Commission

²⁵ See *id.* at PP 78, 139-40.

²⁶ Order No. 831 required each ISO and RTO to permit market participants to submit virtual transactions up to \$2,000/MWh, and similarly required each ISO and RTO to permit external transactions (sometimes also called economic exchange transactions or import and export transactions) to offer up to \$2,000/MWh. See *id.* at PP 172, 192; transmittal letter for Order No. 831 Compliance Filing at 5-6.

²⁷ Existing tariff section 30.7.12.5.

²⁸ Order No. 831 at P 213. In issuing this guidance, one of the rulemaking comments the Commission was responding to was the CAISO's comment that it would face implementation challenges if it changed its current offer cap because the administrative penalty prices the CAISO uses in its market model to indicate that constraints have to be relaxed, such as the CAISO's system energy-balance constraint, are based on the offer cap. *Id.* at P 210.

²⁹ *Id.* at PP 172, 192.

³⁰ *Id.* at PP 176, 197.

guidance described above regarding modifications to market elements, the CAISO proposed it would submit a separate tariff amendment under section 205 of the FPA to make any changes to the administratively set parameters contained in the CAISO tariff. The CAISO also explained that, in response to stakeholder input, it was conducting a stakeholder process to discuss concerns that might arise from permitting import prices up to \$2,000/MWh or from the absence of a verification requirement for imports, which also could result in an FPA section 205 filing.³¹

At the time the CAISO submitted its Order No. 831 Compliance Filing, it expected to complete these stakeholder discussions by the third quarter of 2020, so it could file any tariff changes in time to implement them concurrent with its implementation of the revisions contained in the Order No. 831 Compliance Filing.³² However, in a supplemental answer the CAISO explained that based on stakeholder comments and discussions to date, it anticipated submitting any FPA section 205 tariff revisions to address both of these issues after the stakeholder process was complete, and that it was necessary to make software and system changes to accommodate such tariff revisions. The CAISO stated it continued to stand behind a commitment to forego implementing the tariff revisions to comply with Order No. 831 until the CAISO could implement market enhancements resulting from the stakeholder process. Therefore, the CAISO stated it was unprepared to implement the tariff revisions to comply with Order No. 831 until the fall of 2021.³³

As noted above, in the Order No. 831 Compliance Order the Commission directed that the tariff revisions in the Order No. 831 Compliance Filing become effective on March 21, 2021. The Commission also stated it was providing the CAISO with an additional six months to continue working with stakeholders to address the market parameter and import bidding issues discussed above prior to that March 21 effective date.³⁴

On January 26, 2021, the CAISO filed a petition for limited tariff waiver to request the Commission extend the effective date of the tariff revisions accepted in the Order No. 831 Compliance Order from March 21 to June 15, 2021, so they would go into effect concurrently with the revisions contained in the instant tariff

³¹ Transmittal letter for Order No. 831 Compliance Filing at 20-21. These concerns discussed in the stakeholder process that resulted in this tariff amendment are discussed in greater detail below in section II.D of this transmittal letter.

³² See transmittal letter for Order No. 831 Compliance Filing at 21.

³³ Motion for Leave to Answer and Supplemental Answer of the CAISO to Comments and Limited Protests, Docket No. ER19-2757-000, at 4 (Jan. 31, 2020).

³⁴ Order No. 831 Compliance Filing at P 47.

amendment.³⁵ On February 18, 2021, the CAISO filed a notice to withdraw that petition.³⁶

Moreover, due to the freezing temperatures in the south, and ongoing exigent circumstances in the western United States, the CAISO recently has seen unprecedented increases in natural gas prices. On February 17, 2021, the CAISO therefore submitted a request to accelerate the effectiveness of certain tariff revisions the Commission had already accepted as complying with Order No. 831 to permit after-the-fact recovery of energy costs that exceed the CAISO's existing \$1,000/MWh cap on energy bids.³⁷ The CAISO requested the Commission accept that provision effective on February 17, 2021, to mitigate market impact ahead of the March 21, 2021 implementation of the Compliance Filing.

D. Concerns that Resulted in this Tariff Amendment

In 2019, the CAISO initiated a stakeholder process entitled "FERC Order 831 – Import Bidding and Market Parameters" to address CAISO and stakeholder concerns regarding the effect the Order No. 831 compliance tariff revisions would have on the rules for bidding imports into the CAISO markets and on the market parameters used throughout the integrated forward and real-time markets.³⁸ The CAISO identified the specific issues of concern from the start of the stakeholder proceeding.

Regarding the import bidding rules, the CAISO and stakeholders recognized tariff revisions would be needed to protect against suppliers potentially exercising system-level market power. The potential for market power arises because the CAISO depends on import supply from the Western Interconnection to operate its system reliably, and when overall system demand is highest, the CAISO depends on procured import supply to meet its demand. Although analyses performed by the CAISO and its Department of Market Monitoring (DMM) show the CAISO market in the CAISO balancing authority area is structurally competitive in the vast majority of hours, there is no guarantee it will remain so in the future because the mix of suppliers offering imports can change

³⁵ CAISO Petition for Limited Tariff Waiver, Docket No. ER19-2757-0003 (Jan. 26, 2021).

³⁶ CAISO Notice of Withdrawal, Docket No. ER19-2757-003 (Feb. 18, 2021).

³⁷ CAISO Request to Accelerate Implementation of Previously Accepted Tariff Provision, Docket No. ER21-1164-000 (Feb. 17, 2021).

³⁸ Materials related to the stakeholder initiative, including the proposals issued by the CAISO and discussed below in this section of the transmittal letter, are available at <https://stakeholdercenter.caiso.com/StakeholderInitiatives/FERC-Order-831-Import-bidding-and-market-parameters>.

from day to day.³⁹ These risks are increased under Order No. 831 because import resources that are not registered and tied to a specific generator could exercise system-level market power by bidding supply at prices above \$1,000/MWh (*i.e.*, up to \$2,000/MWh) that are not based on short-run marginal costs. Although the tariff revisions to comply with Order No. 831 include safeguards on internal resource bids above \$1,000/MWh, additional tariff revisions are needed to ensure import bids above \$1,000/MWh continue to reflect the marginal cost of supply and do not create the risk of suppliers exercising system-level market power.⁴⁰

Additional tariff revisions are also needed to address potential adverse consequences that could result from scaling the market parameters related to shortage pricing to the \$2,000/MWh hard energy bid cap required by Order No. 831. In particular, simply utilizing the \$2,000/MWh hard energy bid cap to set parameter prices, which is necessary to ensure the CAISO can accept bids above \$1,000/MWh as required by Order No. 831, could unnecessarily and inappropriately trigger high prices in the CAISO market, including the EIM. Using a system energy-balance constraint relaxation penalty price of \$2,000/MWh would set energy prices at \$2,000/MWh any time supply is insufficient to meet demand in a market interval. This extremely high maximum price would be applied market-wide even in situations involving small supply shortfalls that do not indicate actual shortages. To avoid this outcome, the CAISO worked with stakeholders to develop tariff revisions to address this issue and develop a solution that would be “implemented concurrent with the implementation of the FERC Order No. 831 requirements.”⁴¹

The stakeholder process that preceded the filing of this tariff amendment took place over more than a year and included the following opportunities for stakeholder input and participation:

- The CAISO issued six papers;⁴²
- The CAISO held stakeholder conference calls to discuss the issues raised in the CAISO papers and provided opportunities for stakeholders to submit comments on the papers;

³⁹ CAISO Issue Paper and Straw Proposal, Requirements for Import Bids Greater than \$1,000/MWh, at 5-6 (May 10, 2019).

⁴⁰ *Id.* at 6-7.

⁴¹ CAISO Revised Straw Proposal, FERC Order 831 – Import Bidding and Market Parameters, at 6 (Nov. 26, 2019).

⁴² These papers included the Revised Final Proposal provided in attachment D to this filing.

- The CAISO developed draft tariff provisions and subsequently revised them; and
- The CAISO held additional conference calls and provided opportunities for stakeholders to submit written comments on the draft and revised tariff provisions.

Some stakeholders raised issues with the proposals contained in this tariff amendment, which the CAISO addressed as discussed below in this transmittal letter.

The CAISO Governing Board (Board) voted unanimously to authorize this filing at its public meeting held on October 1, 2020.⁴³ Further, the CAISO's Market Surveillance Committee (MSC) issued an opinion supporting the proposals contained in the tariff amendment.⁴⁴

III. Proposed Tariff Revisions Regarding Market Parameters

As explained above, the Commission stated in Order No. 831 that an ISO or RTO could file additional tariff revisions under FPA section 205 to harmonize regional market structures with the offer cap reforms adopted in Order No. 831. Accordingly, this filing includes tariff revisions to establish separate market parameters related to the soft energy bid cap and the hard energy bid cap.⁴⁵ The tariff revisions will address the concerns raised in the stakeholder process⁴⁶ by ensuring the market parameters for shortage pricing, if triggered, do not cause excessively high prices. The administrative penalty prices under the market parameters related to the soft energy bid cap will remain unchanged from the existing tariff, and the administrative penalty prices under the market parameters related to the hard energy bid cap will be established as discussed below. The CAISO also proposes to make other tariff revisions regarding ancillary service pricing, revised bidding rules, and constraint relaxation.

⁴³ Materials related to the Board's authorization are available at <http://www.caiso.com/informed/Pages/BoardCommittees/Default.aspx>. These materials included a memorandum to the Board from Mark Rothleder, Vice President, Market Policy and Performance (Board Memorandum), which is provided in attachment E to this filing.

⁴⁴ See the MSC Opinion of Revisions to Import Bidding and Market Parameters for Compliance With FERC Order 831 (MSC Opinion), which is provided in attachment F to this filing.

⁴⁵ Revised tariff section 27.4.3.2 as renumbered in this filing; new tariff sections 27.4.3.3 – 27.4.3.3.4.

⁴⁶ See *supra* section II.D of this transmittal letter.

A. Minor Revisions Related to the Soft Energy Bid Cap that Result in No Changes to the Administrative Penalty Prices When There Are No Verified Bids Above \$1,000/MWh or the Maximum Import Bid Price Does Not Exceed \$1,000/MWh

As noted above, the SCUC and SCED optimization software for the CAISO market utilizes various configurable market parameters that include parameters for relaxing constraints enforced by the CAISO market. The constraint that ensures supply equals demand is referred to as the system energy-balance constraint (sometimes called the power balance constraint). The system energy-balance constraint relaxation price for the pricing run is currently equal to the maximum energy bid price for price-setting purposes.

Today, in market intervals where there is a shortfall of supply to meet demand, the market sets the system marginal energy cost (SMEC), which is used to calculate LMPs, to the energy bid cap.⁴⁷ This administratively set price must be at least as high as the highest-priced cleared supply bid to ensure pricing is based on economic bids prior to triggering the shortage price, which represents the value of scarce supply. The other constraints in the market are set at prices that are relative to the system energy-balance constraint parameter.

The CAISO proposes no substantive changes to the penalty prices that apply when the energy bid cap is \$1,000/MWh. Instead, the CAISO merely proposes to replace existing references to the maximum energy bid price with references to the soft energy bid cap.⁴⁸ These changes are needed because—in compliance with Order No. 831—the CAISO increased its energy bid cap from \$1,000/MWh (which is now the soft energy bid cap) to \$2,000/MWh (which is now the hard energy bid cap). As discussed below, under certain circumstances the applicable bid cap will still be the soft energy bid cap, *i.e.*, \$1,000/MWh.

Specifically, the energy bid cap will remain at \$1,000/MWh if the CAISO has not cost-verified a request for an energy bid that exceeds \$1,000/MWh or the calculated maximum import price⁴⁹ does not exceed \$1,000/MWh. Because the system energy-balance constraint parameter price must be at least as high as the highest-priced bid in the market for that bid to clear, when the soft energy bid cap is in effect, the CAISO must set that parameter price at \$1,000/MWh. The

⁴⁷ This can be either the marginal energy cost for an individual balancing authority area or the marginal energy cost for a group of balancing authority areas in the EIM.

⁴⁸ Revised tariff sections 27.4.3.2.2 – 27.4.3.2.4 as renumbered in this filing. As explained below, the CAISO does not propose to change the existing penalty prices listed in these sections. The CAISO has also updated the cross-references in these sections to reflect the new and renumbered tariff sections contained in this filing.

⁴⁹ The CAISO discusses the maximum import bid price below in section IV.A of this transmittal letter.

same logic applies to all the scheduling and pricing penalty prices for transmission constraints. Therefore, the CAISO does not propose any changes to the penalty prices for those market intervals in which the soft energy bid cap is in effect.

B. Revisions Related to the Hard Energy Bid Cap

To reflect the implementation of the \$2,000/MWh hard energy bid cap, the CAISO proposes to use a different set of market scheduling and pricing parameters needed to accommodate bids up to \$2,000/MWh only under certain conditions.⁵⁰ First, the CAISO explains below the circumstances in which these market parameters related to the hard energy bid cap will apply. The CAISO then explains how it will determine prices using a constraint relaxation threshold when this different set of market parameters needed to accommodate bids up to \$2,000/MWh is in place. In attachment A to this filing, the CAISO provides hypothetical examples to illustrate how the tariff revisions related to the hard energy bid cap will work.

1. Circumstances in Which the Market Parameters Related to the Hard Energy Bid Cap Will Apply

In the Order No. 831 Compliance Order, the Commission noted protesters' concerns that its acceptance of the proposed tariff revisions "will result in an increase in the power balance penalty price from \$1,000/MWh to \$2,000/MWh because existing Tariff sections governing the penalty price require use of the maximum energy bid price specified in Tariff section 39.6.1.1."⁵¹ In response, the Commission "[found] that the issues raised by protesters are beyond the scope of this proceeding," but "note[d] CAISO's commitment to address issues raised in this proceeding in its ongoing stakeholder process."⁵²

To address stakeholder concerns that energy costs could increase unnecessarily when energy bids above \$1,000/MWh are not justified, the CAISO proposes herein to use the market scheduling and pricing parameters scaled relative to the \$2,000/MWh hard energy bid cap only if (1) the CAISO has

⁵⁰ Compare new tariff section 27.4.3.3.1 with existing tariff section 27.4.3.2.1 as renumbered in this filing; compare new tariff section 27.4.3.3.2 with existing tariff section 27.4.3.2.2 as renumbered and revised in this filing; compare new tariff section 27.4.3.3.3 with existing tariff section 27.4.3.2.3 as renumbered and revised in this filing. In new tariff section 27.4.3.3.1, the CAISO does not propose to double the existing \$1,250/MWh scheduling parameter for the RUC, because RUC availability bids are not energy bids and thus are not subject to an energy bid cap.

⁵¹ Order No. 831 Compliance Order at P 50.

⁵² *Id.* at P 56.

accepted (and validated) a bid with an energy bid price that exceeds the \$1,000/MWh soft energy bid cap, or (2) the maximum import bid price exceeds the soft energy bid cap for any trading hour of the integrated forward market.⁵³ Thus, the market parameters related to the hard energy bid cap will apply only when the soft energy bid cap is exceeded under either of those events. The CAISO will apply these different sets of market parameters in both the market's scheduling and pricing runs.

It is just and reasonable only to use market parameters that are based on the hard energy bid cap when the CAISO has (1) accepted and validated an energy bid above \$1,000/MWh, or (2) the maximum import bid price exceeds \$1,000/MWh. Their use absent such conditions would unnecessarily trigger high energy costs with no expectation of a legitimate verified bid demonstrating one or more suppliers had actually incurred costs greater than \$1,000/MWh. This logic is consistent with the logic the CAISO applies to the penalty prices when the soft energy bid cap is in effect. As noted above, the penalty price has to be at least as high as the highest submitted bid price to ensure the market clears all effective economic bids before resorting to relaxing the relevant constraint. The CAISO anticipates under normal market conditions, *i.e.*, when the soft energy bid cap is in effect, it is unnecessary to have a shortage price signal sent by the system energy-balance constraint relaxation price that exceeds \$1,000/MWh.

If either event (1) or (2) occurs during the day-ahead market,⁵⁴ the market parameters related to the hard energy bid cap will apply for all trading hours of the day-ahead market and the real-time market for the same trading day.⁵⁵ However, if neither event (1) nor event (2) occurs for any trading hour of the day-ahead market, but event (1) or (2) occurs during the real-time market for that trading day, the market parameters will apply in any trading hour of the real-time market for which event (1) or (2) has occurred, and for all intervals of the applicable real-time market run for which event (1) or (2) has occurred in at least one interval of the applicable market run.⁵⁶ This approach is necessary to ensure the market functions consistently across all intervals of the applicable market run. As discussed further below, the CAISO will only accept demand bids, export bids, virtual bids, and bids for non-resource-specific system resources priced greater than \$1,000/MWh if either event (1) or (2) occurs.⁵⁷

⁵³ New tariff section 27.4.3.3(a).

⁵⁴ That is, during the IFM.

⁵⁵ New tariff section 27.4.3.3(a).

⁵⁶ New tariff section 27.4.3.3(b).

⁵⁷ New tariff sections 30.5.8 – 30.5.8.2. See *infra* section IV.B of this transmittal letter.

Examples illustrating the duration of the application of the market parameters related to the hard energy bid cap are set forth in attachment A to this filing.

2. Pricing Based on Use of the Constraint Relaxation Threshold When the Market Parameters Related to the Hard Energy Bid Cap are In Place

When the market parameters related to the hard energy bid cap are in place due to the occurrence of event (1) or (2) described above, those market parameters will include a pricing parameter that applies when there is insufficient energy supply to meet the CAISO forecast of CAISO demand in the real-time market. In such cases, the CAISO will set the system energy-balance constraint pricing parameter to (a) the highest-priced cleared economic bid (but no less than the soft energy bid cap in cases where the infeasibility detected in the scheduling run does not exceed the constraint relaxation threshold); or (b) the hard energy bid cap in cases where the infeasibility detected in the scheduling run exceeds the constraint relaxation threshold.⁵⁸

It is just and reasonable to implement this pricing parameter to ensure a supply shortfall is real and significant before setting prices based on the hard energy bid cap. This aligns with the directives in Order No. 831 that established additional measures for bids above \$1,000/MWh, given such bids would not be expected under most conditions. The proposed pricing parameter will ensure when energy costs exceed the soft energy bid cap and there is insufficient supply to meet demand, the market will set prices based on the amount of the supply shortfall. In the event of a small shortfall (*i.e.*, one that does not exceed the constraint relaxation threshold), the market will set prices, based on the minimum of the soft energy bid cap or the highest-priced cleared energy bid, that will be between \$1,000/MWh and \$2,000/MWh. But if there is a larger shortfall (*i.e.*, one that exceeds the constraint relaxation threshold), the market will set prices at \$2,000/MWh. Thus, the pricing parameter is calibrated to trigger the \$2,000/MWh hard energy bid cap price only when it is needed to address significant shortfalls in supply.

The CAISO proposes to define the constraint relaxation threshold as a MW threshold value used to determine when the pricing parameter will trigger in each balancing authority area participating in the CAISO markets to account for small supply shortfalls. The constraint relaxation threshold will be configured based on the NERC Reliability Standard for maintaining system frequency for each balancing authority area – Reliability Standard BAL-001-2 Requirement

⁵⁸ New tariff section 27.4.3.3.4.

R2.⁵⁹ The CAISO maintains system frequency by matching supply and demand. However, small mismatches and resulting differences from the desired frequency (60 Hz) are acceptable. Reliability Standard BAL-001-2 defines the amount by which supply can be less than demand while still maintaining system frequency within an acceptable limit that does not adversely impact system reliability. This amount represents a reasonable proxy for determining when a supply shortfall becomes significant enough to set the pricing parameter at the \$2,000/MWh hard energy bid cap, and the CAISO will calculate this constraint relaxation threshold annually under that NERC Reliability Standard.⁶⁰

The constraint relaxation threshold reflects the reality that a small amount of system energy-balance constraint relaxation may represent merely “apparent” shortfalls rather than actual shortfalls, such as those due to forecasting and modeling inaccuracies. Moreover, in EIM balancing authority areas outside of the CAISO balancing authority area, apparent shortfalls may not represent actual shortfalls because of other resources those balancing authority areas have that are not in the market. In these instances, it would be inappropriate to set the penalty price at the hard energy bid cap of \$2,000/MWh because there is no actual scarcity condition justifying such a price. Rather, the penalty price is appropriately limited to the highest-priced cleared economic bid.

The constraint relaxation threshold will not apply in the integrated forward market because the relaxation penalty prices for ancillary services in that market are less than the system energy-balance constraint penalty price. Thus, in the integrated forward market, the threshold would apply after the market has already forgone reserves and triggered scarcity pricing. Further, NERC Reliability Standard BAL-001-2 Requirement R2, on which the constraint relaxation threshold is based, is a real-time operating standard. Thus, it does not make sense to apply the threshold value based on this NERC Reliability Standard to the integrated forward market. In contrast, applying the threshold in the real-time market is just and reasonable because the system energy-balance

⁵⁹ Tariff appendix A, new definition of “Constraint Relaxation Threshold.” The purpose of this NERC Reliability Standard, entitled “Real Power Balancing Control Performance,” is to “control Interconnection frequency within defined limits.” <https://www.nerc.com/ layouts/15/PrintStandard.aspx?standardnumber=BAL-001-2&title=Real%20Power%20Balancing%20Control%20Performance&jurisdiction=United%20State> s. Requirement R2 of the Reliability Standard obligates “[e]ach Balancing Authority [to] operate such that its clock-minute average of Reporting ACE [Area Control Error] does not exceed its clock-minute Balancing Authority ACE Limit (BAAL) for more than 30 consecutive clock-minutes . . . for the applicable Interconnection in which the Balancing Authority operates.” *Id.*

⁶⁰ Tariff appendix A, new definition of “Constraint Relaxation Threshold; new tariff section 6.5.2.3.7 (stating that annually the CAISO will post on its open access same-time information system (OASIS) the constraint relaxation thresholds for the CAISO balancing authority area and the other balancing authority areas participating in the EIM).

constraint penalty price is relaxed prior to relaxing penalty prices for ancillary services, and the threshold is based on a real-time operating standard.

Attachment A to this filing sets forth five examples (examples A through E) illustrating the circumstances in which the market parameters related to the hard energy bid cap will apply and the calculation of the pricing parameter discussed immediately above.

C. Other Related Revisions

The CAISO proposes to revise the existing tariff provisions on ancillary service pricing in the event of insufficient supply to (1) reference both the soft energy bid cap and the hard energy bid cap,⁶¹ and (2) establish separate scarcity demand curve value tables for when (a) the energy pricing parameters based on the soft energy bid cap apply and (b) the energy pricing parameters based on the hard energy bid cap apply.⁶² Because the hard energy bid cap is double the level of the soft energy bid cap, the dollar values shown in the table for the hard energy bid cap are likewise double those shown in the table for the soft energy bid cap. In addition, for CAISO market intervals in which the hard energy bid cap market parameters apply, the real-time economic dispatch⁶³ will dispatch contingency only reserves using the hard energy bid cap as the energy bid for such reserves and will set prices accordingly.⁶⁴

The CAISO also proposes tariff revisions related to the bidding rules discussed above. First, prior to market close and to the extent practicable, the CAISO will notify scheduling coordinators whether they may submit demand bids, export bids, virtual bids, and bids for non-resource-specific system resources above the soft energy bid cap.⁶⁵ This tariff revision will ensure scheduling coordinators receive sufficient notice they may submit such bids.

⁶¹ Revised tariff sections 27.1.2.3.1 – 27.1.2.3.4. Existing tariff section 27.1.2 and its subsections address ancillary service prices.

⁶² Revised tariff section 27.1.2.3; new tariff section 27.1.2.3.5; tariff appendix A, revised definition of “Scarcity Reserve Demand Curve Values.” The CAISO also proposes to delete a provision in section 27.1.2.3 regarding the CAISO’s review of the performance of scarcity reserve demand curves during the first three years those curves are effective, because they have been effective for more than three years and thus the provision is outdated.

⁶³ The real-time economic dispatch is the mode of the real-time dispatch the CAISO uses to optimally dispatch resources based on their energy bids, excluding contingency only operating reserves except when needed to avoid an imminent system emergency. Tariff appendix A, existing definition of “Real-Time Economic Dispatch.”

⁶⁴ Revised tariff section 34.10.

⁶⁵ New tariff section 6.5.2.3.8.

The CAISO also proposes to add tariff language to the existing provisions on temporary waiver of timing requirements applicable to the integrated forward market to specify the CAISO may waive the timing requirements if additional time is needed to allow submission of bids in the event that the conditions specified in the bidding rules change prior to market close, and may require the resubmission of bids consistent with the changed bidding requirements.⁶⁶ This is just and reasonable because it will provide much-needed flexibility, allow the CAISO to ensure sufficient time to submit bids, and avoid unnecessary petitions for relief.

Lastly, the CAISO proposes to clarify an existing tariff provision that states in the integrated forward market, the CAISO will relax a transmission constraint rather than curtail a transmission ownership right (TOR), existing transmission contract (ETC), or converted rights self-schedule. The revised tariff will instead state the CAISO will relax a transmission constraint rather than curtail a TOR or ETC self-schedule only.⁶⁷ This revision reflects that a converted rights self-schedule is assigned the same priority as the typical value for an ETC self-schedule, and clarifies the CAISO's practice for market participants.⁶⁸

IV. Proposed Tariff Revisions Regarding Import Bidding

As explained above, Order No. 831 did not require ISOs and RTOs to subject virtual transactions and imports above \$1,000/MWh to the verification requirement.⁶⁹ However, the Commission stated ISOs and RTOs could file additional tariff revisions pursuant to section 205 of the FPA to address any issues that arise from permitting virtual transactions up to \$2,000/MWh and the absence of a verification requirement for imports.⁷⁰

Because the CAISO frequently relies on energy from imports to meet demand, it proposes additional protections for import and virtual bids above the \$1,000/MWh soft energy bid cap. Specifically, the CAISO proposes to revise the existing bid validation rules and related tariff provisions to provide the treatment discussed below for: (1) bids for non-resource-specific system resources that are resource adequacy resources, including the introduction of a maximum import bid price for such resources; and (2) export bids, demand bids, virtual

⁶⁶ New tariff section 31.6.1(v).

⁶⁷ Revised tariff section 27.4.3.4 as renumbered in this filing. Converted rights arise when a recipient of transmission service under an existing contract chooses to become a participating transmission owner and convert its rights to CAISO transmission service. Existing tariff section 4.3.1.6; tariff appendix A, existing definition of "Converted Rights."

⁶⁸ See Revised Final Proposal at 39.

⁶⁹ Order No. 831 at PP 172, 192.

⁷⁰ *Id.* at PP 176, 197.

bids, and bids for non-resource-specific system resources that are not resource adequacy resources.⁷¹ The CAISO also proposes to clarify that neither energy bids for non-resource-specific system resources nor virtual bids are eligible for after-market cost recovery. These tariff revisions will address the concerns raised in the stakeholder process⁷² by ensuring import bids, which the CAISO depends on to operate its system reliably, do not create the risk of system-level market power if they rise above \$1,000/MWh.

A. Bids for Non-Resource-Specific System Resources that Are Resource Adequacy Resources

It is impractical for the CAISO to verify the actual costs of import bids from non-resource-specific imports because the CAISO does not have the cost information associated with the bid. Therefore, the CAISO will reduce bid prices for non-resource-specific system resources that are resource adequacy resources that exceed a maximum import bid price (calculated as discussed below) to the greater of the soft energy bid cap, the maximum import bid price, or the highest-priced cost-verified resource-specific energy bid the CAISO has accepted for the applicable trading hour.⁷³

Import bids should not be reduced below the highest-priced cost-verified resource-specific energy bid above the soft energy bid cap because the CAISO market will accept import bids above that cap where there is a cost-verified resource-specific bid above the cap but the CAISO-calculated maximum import bid price is below the cap. It would be inconsistent to reduce resource adequacy bids to \$1,000/MWh because the CAISO would allow non-resource adequacy import bids above \$1,000/MWh, and the existence of a cost-verified resource-specific bid above \$1,000/MWh shows costs for other resources may also be that high. Further, incorporating the price of cost-verified resource-specific bids will ensure bids for resource adequacy imports reflect current prices in the real-time market. As discussed below, the maximum import bid price is based on day-ahead prices, which may be too low to reflect costs in the real-time market if natural gas prices increase overnight. A resource-specific bid submitted in the real-time market, though, would presumably incorporate current natural gas prices.

Reducing bid prices for these resources under the circumstances described above should not lower the amount of import supply. Resource

⁷¹ The existing bid validation provisions are set forth in existing tariff section 30.7.12 and its subsections.

⁷² See *supra* section II.D of this transmittal letter.

⁷³ Revised tariff sections 30.5.2.4 and 30.7.12.1; new tariff section 30.7.12.5.1; tariff appendix A, revised definition of “Soft Energy Bid Cap.”

adequacy resources are required to submit bids under applicable must-offer obligations. Specifically, resource adequacy imports have a day-ahead must-offer obligation and a real-time must-offer obligation if they receive day-ahead awards.⁷⁴ Although resource adequacy resources will face a small risk their import bids may be reduced below supplier cost, suppliers can factor this risk into their bilateral resource adequacy contracting prices.

The maximum import bid price approximates, on an hourly basis, the prevailing bilateral price of electricity. The CAISO will calculate the maximum import bid price as an index-based price multiplied by an hourly shaping ratio and then multiply that amount by 110 percent. The CAISO will perform these calculations separately for the day-ahead market and the real-time market and for the applicable on-peak and off-peak hours.⁷⁵ The CAISO discusses each of the components of the calculations below.

1. The Hourly Index-Based Price and Hourly Shaping Ratio Components of the Maximum Import Bid Price Calculation

The CAISO will calculate the hourly index-based price based on the greater of the published multi-hour block bilateral electric prices at the Mid-Columbia or Palo Verde trading hub locations. The CAISO will use the higher of the two index prices for those locations to help ensure the CAISO market can compete for imports.⁷⁶

It is just and reasonable to use the price indices for the Mid-Columbia and Palo Verde locations in the calculation of the maximum import bid price. Mid-Columbia and Palo Verde are the primary liquid trading hubs for bilateral electric transactions in the Western Interconnection. Thus, they provide representative electric prices for the bilateral market outside of the CAISO balancing authority area. Further, using the higher of the two bilateral hub prices for Mid-Columbia and Palo Verde ensures the CAISO-calculated maximum import bid price appropriately incentivizes and compensates imports.

⁷⁴ See existing tariff sections 40.6.1 – 40.6.2. The CAISO and stakeholders are considering possible proposals to augment the must-offer obligation for imports in its Resource Adequacy Enhancements stakeholder initiative, for implementation in the fall of 2021. See <https://stakeholdercenter.caiso.com/StakeholderInitiatives/Resource-adequacy-enhancements>.

⁷⁵ New tariff section 30.7.12.5.3; tariff appendix A, new definition of “Maximum Import Bid Price.”

⁷⁶ If for any given trading hour the CAISO cannot calculate the maximum import bid price, the applicable maximum import bid price will be the most recently available calculated (*i.e.*, most recent representative) maximum import bid price. New tariff section 30.7.12.5.3.

The Commission's current liquidity policy for daily or hourly indices requires that at least one of the following conditions should be met, on average, for all non-holiday weekdays within a 90-day review period:

1. Average daily volume traded of at least 25,000 MMBtus for gas or 2,000 MWh for power;
2. Average daily number of transactions of five or more; or
3. Average daily number of counterparties of five or more.⁷⁷

The CAISO analyzed both hubs under these criteria at the time of this filing. The Mid-Columbia index had, across non-holiday weekdays within the 90-day review period, an average of 11,000 MWh, 23 transactions, and 8 counterparties per day. Palo Verde had an average of 2,700 MWh and 5 transactions per day. Based on the analysis, at least one criterion for each hub meets or exceeds the Commission's established criteria. Therefore, the Mid-Columbia and Palo Verde hubs can be considered sufficiently liquid and appropriate for use in the CAISO's tariff and calculated parameters. The CAISO notes that these levels of liquidity also would satisfy the Commission's proposed revised liquidity criteria.⁷⁸ In any case, the CAISO will evaluate these indices periodically to ensure they remain sufficiently liquid. In the event they become insufficiently liquid, the CAISO will re-evaluate these tariff provisions.

Using liquid hub prices is not new to the CAISO markets. For example, the CAISO uses electric price hub indices in calculating hydro default energy bids.⁷⁹ The CAISO will update the electric price in the maximum import bid price calculation for the day-ahead market based on the next-day trading price.⁸⁰ However, it would be inappropriate to use that updated price in the real-time market calculation⁸¹ because the updated price is applicable to the following day.

The CAISO will convert daily prices into hourly prices in calculating the maximum import bid price. The CAISO will perform this conversion because the Mid-Columbia and Palo Verde electric trading hub price indices are daily multi-hour block prices that represent average prices for purchases covering 16 peak hours of the day, but the CAISO market clears and sets prices in the day-ahead

⁷⁷ *Price Discovery in Natural Gas and Electric Markets*, 104 FERC ¶ 61,121 (2003).

⁷⁸ *Actions Regarding the Commission's Policy on Price Index Formation and Transparency, and Indices Referenced in Natural Gas and Electric Tariffs*, Proposed Revised Policy Statement, 173 FERC ¶ 61,237 (2020).

⁷⁹ See existing tariff sections 39.7.1.7.1.2 – 39.7.1.7.3.

⁸⁰ The Revised Final Proposal (at 29-30) provides a hypothetical example to illustrate how the CAISO will update the day-ahead electric price.

⁸¹ On the same day as the updated price, that is.

market on an hourly basis. The electric price indices are published as separate on-peak and off-peak hour prices for each day. Accordingly, the CAISO will calculate the maximum import bid price separately for the applicable on-peak and off-peak hours.

The CAISO will calculate the hourly shaping ratio used in the maximum import bid price calculation for each on-peak hour by dividing the day-ahead market SMEC for the CAISO balancing authority area in that hour of a previous representative trading day by the average day-ahead market SMEC for the CAISO balancing authority area in all on-peak hours of the same previous representative trading day.⁸² The CAISO will perform a similar calculation for the off-peak maximum import bid price using the off-peak hours. Applying this ratio will appropriately scale the hourly maximum import bid price up relative to the daily hub price in hours in which the SMEC is typically greater than the daily average (*i.e.*, on-peak load hours). Likewise, applying the ratio will scale the hourly maximum import bid price down relative to the daily hub price in hours in which the SMEC is typically less than the daily average (*i.e.*, off-peak load hours). To the extent practicable, on a daily basis the CAISO will also post the hourly shaping factors on its OASIS.⁸³

2. The 110 Percent Multiplier Component of the Maximum Import Bid Price Calculation

In the maximum import bid price calculation, the CAISO will multiply the index-based energy price component discussed above by 110 percent in order to arrive at the maximum import bid price. The 110 percent multiplier is similar to the 110 percent multipliers the CAISO uses to calculate default energy bids under the variable cost option and calculate the long-term/geographic component of hydro default energy bids.⁸⁴

The 110 percent multiplier is just and reasonable because, as with these other index-based calculations, it will account for differences in prices between published electric price indices and individual transactions. The electric price indices are based on the weighted average price of all electric transactions. Although the price indices and the prices for individual transactions generally converge, bilateral energy block prices may be lower than the hourly CAISO market prices. Similarly, consistent with the design of the hydro default energy bid, a supplier's actual opportunity costs may differ from the monthly price

⁸² The business practice manual will provide implementation detail regarding the hourly shaping ratio and the definition of the previous representative trading day. The Revised Final Proposal (at 30-31) provides a hypothetical example to illustrate how the CAISO will shape the hourly energy price component of the calculation.

⁸³ New tariff section 6.5.2.3.9.

⁸⁴ See existing tariff sections 39.7.1.1 and 39.7.1.7.1.3.

indices, and individual suppliers' actual gas prices costs may differ from published indices. As a result, a supplier's opportunity costs for individual sales outside of the CAISO balancing authority area may be higher than the corresponding published electric price indices.

B. Virtual Bids, Export Bids, Demand Bids, and Bids for Non-Resource-Specific System Resources that Are Not Resource Adequacy Resources

The CAISO proposes to revise the existing bid validation provisions to accept virtual bids, export bids, demand bids, and bids for non-resource-specific system resources that are not resource adequacy resources that exceed the \$1,000/MWh soft energy bid cap, consistent with the conditions specified in the rules the CAISO proposes for such bids.⁸⁵ The CAISO will not accept such bids that exceed the \$2,000/MWh hard energy bid cap.⁸⁶

In contrast with the reduction of bids for non-resource-specific system resources that are resource adequacy resources in the circumstances described in section IV.A, above, the CAISO will not reduce the prices of bids for imports that are not providing resource adequacy or export, demand, or virtual bids. Reducing the prices of import bids that are not providing resource adequacy could discourage suppliers from offering these additional imports to the CAISO market because of the risk the CAISO could reduce their bids below their costs. As noted above, import suppliers providing resource adequacy capacity are not subject to this same risk because they can factor this risk into their bilateral capacity contracts. Consistent with the rules for non-resource adequacy imports, the CAISO also would not reduce the prices of export, demand, or virtual bids.

There are two reasons why allowing non-resource adequacy import bids up to the hard energy bid cap, without reducing those bids, will cause excessive market prices. First, the market should be able to meet CAISO balancing authority area demand in most conditions using only bids from resource

⁸⁵ These bidding rules permit scheduling coordinators to submit demand bids, export bids, virtual bids, and bids for non-resource-specific system resources above the soft energy bid cap (not to exceed the hard energy bid cap) for: (1) any trading hour of the day-ahead market in which the CAISO has accepted a bid with an energy bid price that exceeds the soft energy bid cap or the maximum import bid price exceeds the soft energy bid cap; or (2) any trading hour of the real-time market in which the conditions described in (1) above apply or in which the CAISO has accepted a bid for the applicable trading hour for the real-time market with an energy bid price that exceeds the soft energy bid cap or the maximum import bid price exceeds the soft energy bid cap. New tariff sections 30.5.8 – 30.5.8.2. As explained above in section III.B.1 of this transmittal letter, these are the same circumstances in which the CAISO will use market parameters that are based on the hard energy bid cap.

⁸⁶ Revised tariff sections 30.7.12.1 and 30.7.12.5; new tariff section 30.7.12.5.2.

adequacy resources. All resource adequacy bids are subject either to cost verification rules or the maximum import bid price pursuant to the tariff provisions discussed above. This means bids priced higher than the highest-priced bid for a resource adequacy resource are unlikely to clear the market and set CAISO market prices.⁸⁷ The day-ahead market has the additional protection that energy supply clears against economic demand bids.⁸⁸ Thus, the market can protect itself against unreasonably high prices by specifying a maximum price at which it wants to schedule demand. However, limiting non-resource adequacy bids to a maximum import bid price would potentially discourage such imports that can supplement resource adequacy imports during very tight conditions. Second, the CAISO will accept non-resource adequacy bids only when the maximum import bid price is greater than the soft energy bid cap or there is a cost-verified resource-specific bid greater than that bid cap. When either of these conditions do not exist, the CAISO will only accept non-resource adequacy import bids up to \$1,000/MWh.

As discussed above,⁸⁹ it is just and reasonable to use the price indices for the Mid-Columbia and Palo Verde locations in the calculation of the maximum import bid price. The Mid-Columbia and Palo Verde price indices are also the appropriate prices to use to determine whether to allow virtual bids priced greater than \$1,000/MWh. Disallowing virtual bids up to \$2,000/MWh, while allowing import and export bids up to \$2,000/MWh, would cause market inefficiencies, because virtual bids would not be able to compete with imports and exports.

C. No After-Market Cost Recovery for Virtual Bids, Export Bids, Demand Bids, and Energy Bids for Non-Resource-Specific System Resources

The CAISO proposes to revise the tariff to state virtual bids, export bids, demand bids, and energy bids for non-resource-specific system resources⁹⁰ are ineligible for after-market cost recovery.⁹¹ There are no costs associated with virtual bids, and they are liquidated in the real-time market. Further, there is no practical methodology the CAISO could use to determine import costs objectively, which would be essential to provide import bidders with a make-whole, after-the-fact payment.

The absence of after-the-fact payments will not reduce import supply provided by non-resource-specific system resources that are resource adequacy

⁸⁷ The CAISO market clears supply bids in price merit order. Existing tariff section 31.3.1.

⁸⁸ Existing tariff section 31.3.

⁸⁹ See *supra* section IV.A.1 of this transmittal letter.

⁹⁰ Regardless of whether they are resource adequacy resources.

⁹¹ Revised tariff section 30.7.12.4.

resources. As explained above, such resources are subject to must-offer requirements obligating them to offer their full available capacity into the market. Further, the proposed treatment of import supply provided by non-resource-specific system resources that are not resource adequacy resources will ensure such supply is not discouraged from offering into the CAISO market during tight supply conditions. No after-market cost recovery will be provided for export bids and demand bids because these bids are offers to buy energy; not offers to supply it. Consequently, exports and demand do not have the costs associated with supplying energy.

V. Responses to Stakeholder Comments

Stakeholders were divided in their views regarding market parameters proposed in this filing. Load-serving entities, EIM participants, and the California Public Utilities Commission (CPUC) generally supported the CAISO's proposal to continue to use a \$1,000/MWh energy bid cap to set prices when the market must relax the system energy-balance constraint and when cost-verified energy prices are no more than \$1,000/MWh. These stakeholders either supported or did not oppose the CAISO's proposal to set prices based on the last cleared bid when cost-verified energy prices are above \$1,000/MWh and the system energy-balance constraint relaxation amount is less than the threshold amount. EIM participants believed there should be a different approach to scarcity pricing in the balancing authority areas in the EIM outside of the CAISO because not all of their resources are reflected in the market.⁹²

On the other hand, suppliers favored a higher energy bid cap. They asserted pricing system energy-balance constraint relaxation at \$2,000/MWh and allowing import bids up to \$2,000/MWh at all times would more appropriately compensate them during supply shortfalls, encourage additional supply, and provide a stronger incentive to deliver on schedules. They stated this would have been particularly important during the August 2020 heat wave when energy prices in the Western Interconnection rose above \$1,000/MWh. Several stakeholders also asserted the CAISO needs to examine its scarcity pricing provisions and make improvements.

As the CAISO explained in response to these stakeholder comments, the CAISO's proposal appropriately balances (1) the concern that \$2,000/MWh is an excessive price for small system energy-balance constraint relaxations that may not represent real shortfalls with (2) the countervailing concern that prices during shortages should be higher than the highest-priced bid so they represent the value of scarce supply during shortages. The CAISO also stresses that this

⁹² The CAISO has committed to explore scarcity pricing enhancements in a separate stakeholder initiative.

proposal complements its compliance with Order No. 831; it is not intended to address all of the potential scarcity pricing issues for the CAISO market. Therefore, the CAISO plans to commence a separate stakeholder process in 2021 to review scarcity pricing more comprehensively.⁹³

Most stakeholders supported or did not oppose the CAISO's separate proposals to (1) limit import bids to the \$1,000/MWh soft energy bid cap except when costs or bilateral prices are above \$1,000/MWh, and (2) reduce resource adequacy bids to a maximum price. However, some stakeholders suggested material modifications. The CPUC and load serving entities contended all imports should be limited to a maximum bid price. In response, the CAISO explained that its proposal balances the CAISO market's ability to compete for imports, while offering protections against unreasonably high import bid costs and additional protections for resource adequacy imports.

DMM generally supported the CAISO's proposal, stating it is a reasonable approach for allowing bids priced above \$1,000/MWh and triggering scarcity pricing under Order No. 831. DMM expressed concern that using published index prices for bilateral trading hubs outside of the CAISO could allow high-priced imports and exports and raise market prices when there is no scarcity in the CAISO. DMM pointed to extremely high bilateral prices during the August 2020 heat wave that were not a result of high fuel costs as Order No. 831 contemplated. DMM also expressed concern that at times trading hubs may not be sufficiently liquid to produce accurate prices.

In response, the CAISO explained that using published bilateral price index prices is a reasonable approach to determine the prevailing price of electricity in areas outside of the CAISO balancing authority area that are the source of imports. This has been evident recently as freezing temperatures in the southern United States have restricted natural gas supply, causing fuel-fired resource costs to rise significantly. The CAISO thus moved to accelerate part of its Order No. 831 compliance to mitigate the risk of under-recovery.⁹⁴ In any case, it is important to avoid overly restricting the price of non-resource adequacy imports because the CAISO may have to rely on non-resource adequacy imports to serve its load. As explained above, the Mid-Columbia and Palo Verde trading hubs are the most liquid hubs outside of the CAISO balancing authority area and

⁹³ See Final 2021 Policy Initiatives Catalog at 16-17 (Sept. 14, 2020), available at <http://www.caiso.com/Documents/2021FinalPolicyInitiativesCatalog.pdf>. The CAISO is also addressing stakeholder concerns regarding scarcity pricing as part of its Flexible Ramping Product Refinements initiative. See <https://stakeholdercenter.caiso.com/StakeholderInitiatives/Flexible-ramping-product-refinements>.

⁹⁴ <http://www.caiso.com/Documents/Feb17-2021-TariffAmendment-ExpediteEffectivenessandModifyTariffProvisions-FERCOrderNo831-ER21-1164.pdf>.

meet the Commission's liquidity criteria for using index prices in the CAISO market.⁹⁵ The CAISO also has determined these indices would meet the Commission's proposed revised liquidity criteria.⁹⁶

The MSC supports the CAISO's proposal, finding that the CAISO's proposal "is consistent with the practice of other ISOs that dispatch capacity needed to meet reserve or regulation requirements to balance load and generation at increasingly higher prices as the resulting shortfall in regulation or reserves rises," and "is also consistent with the intuition that the 'costs' of a violation, as captured in increased risk to the system, increase continuously with the severity of the violation."⁹⁷ The MSC also encourages the CAISO to conduct a subsequent stakeholder process to develop a more holistic approach to scarcity pricing for both the CAISO and EIM balancing authority areas, which process the CAISO has committed to initiate in 2021.

VI. Effective Date and Request for Timely Commission Order

The CAISO requests that the Commission accept the changes proposed in this tariff amendment effective no later than June 15, 2021. The CAISO also requests authority to provide at least fourteen days' notice of the actual effective date to the Commission and market participants.⁹⁸

The CAISO undertook efforts to implement these revisions at the same time as the current effective date of its tariff revisions to comply with Order No. 831: March 21, 2021. However, the CAISO recently determined that doing so was infeasible, in part due to the significant resources the CAISO has committed toward assessing challenges and mitigating risks relating to the summer of 2021. The CAISO expects its external vendor to deliver the software code for the tariff revisions in April 2021. Because this implementation will directly impact scheduling coordinator practices and the market optimization, once the CAISO has received the software code, it must conduct testing and a market simulation stage before moving the tariff revisions into the final implementation phase. After the CAISO completes this final phase, it will promote its software enhancement into its production system on or before June 15.

⁹⁵ See *Cal. Indep. Sys. Operator Corp.*, 157 FERC ¶ 61,059, at P 10 (2016).

⁹⁶ *Actions Regarding the Commission's Policy on Price Index Formation and Transparency, and Indices Referenced in Natural Gas and Electric Tariffs*, Proposed Revised Policy Statement, 173 FERC ¶ 61,237 (2020).

⁹⁷ http://www.aiso.com/Documents/MSC-OpiniononFERC831ImportBiddingandMarketParameters-Sep9_2020.pdf.

⁹⁸ The CAISO has included an effective date of 12/31/9998 as part of the tariff records submitted with this filing. The CAISO will make a filing pursuant to Type of Filing Code 150 to provide notice of the actual effective date of these tariff records at least fourteen days prior to implementation.

The CAISO also respectfully requests that the Commission issue an order accepting the tariff revisions contained in the instant filing by April 26, 2021. Issuance of the order by April 26 will give the CAISO sufficient time to make the necessary changes to its systems to implement the tariff revisions contained in this filing on the earliest possible date.

VII. Communications

Pursuant to Rule 203(b)(3) of the Commission's Rules of Practice and Procedure,⁹⁹ the CAISO requests that all correspondence, pleadings, and other communications concerning this filing be served upon:

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VIII. Service

The CAISO has served copies of this filing on the CPUC, the California Energy Commission, and all parties with Scheduling Coordinator Agreements under the CAISO tariff. In addition, the CAISO has posted a copy of the filing on the CAISO website.

IX. Contents of Filing

Besides this transmittal letter, this filing includes the following attachments:

Attachment A Hypothetical examples of the application of the revisions proposed in this tariff amendment

⁹⁹ 18 C.F.R. § 385.203(b)(3).

- Attachment B Clean CAISO tariff sheets incorporating this tariff amendment
- Attachment C Red-lined document showing the revisions in this tariff amendment
- Attachment D Revised Final Proposal
- Attachment E Board Memorandum
- Attachment F MSC Opinion

X. Conclusion

The CAISO respectfully requests that the Commission issue an order by April 26, 2021 accepting the tariff changes proposed in this filing effective no later than June 15, 2021.

Respectfully submitted,

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**Attachment A –
Hypothetical Examples of Revisions Proposed in This Amendment**

**Tariff Amendment to Enhance Market Parameters and
Import Bidding Related to Order No. 831**

California Independent System Operator Corporation

February 22, 2021

ATTACHMENT A

Hypothetical Examples of the Revisions Proposed in This Tariff Amendment

For greater ease of understanding, the CAISO provides the hypothetical examples shown below to illustrate the operation of the tariff revisions proposed in this filing. These examples concern the circumstances in which the market parameters related to the \$2,000/MWh hard energy bid cap will apply,¹ the duration of those market parameters,² and the calculation of the pricing parameter that is based on use of the constraint relaxation threshold when the market parameters related to the hard energy bid cap are in place.³

I. Examples of How to Determine the Duration of Market Parameters Related to the Hard Energy Bid Cap

Should the CAISO determine that market parameters related to the hard energy bid cap apply, the duration of those market parameters is determined as follows:

- If the market parameters apply for any trading hour of the day-ahead market, the market parameters apply to all 24 trading hours of the day-ahead market and all real-time market intervals for the same trading day.⁴ The real-time market intervals include STUC, RTPD, and RTD intervals.
- If the market parameters do not apply for any trading hour of the day-ahead market, but do apply during the real-time market for that trading day, they apply in any trading hour of the real-time market for which they are triggered, and for all intervals of the applicable real-time market run for which they apply in at least one interval of the relevant market run.⁵
 - For example, assume the conditions⁶ are only met in the real-time market for the hour beginning at 16:00. The final clean bid set submission timeline that occurs for the hour beginning at 16:00 is determined at T-75 minutes before the hour or at 14:45. From there, the \$2,000/MWh penalty price is triggered in the RTPD process that produces results at around 15:00, which is the RTPD run that is also the HASP run for the hour beginning at 16:00. The \$2,000/MWh penalty price is used in all fifteen-minute market intervals of this RTPD run. The \$2,000/MWh penalty price will be triggered for all intervals of the four and a half hour horizon of the

¹ See section III.B.1 of the transmittal letter for this filing.

² See *id.*

³ See section III.B.2 of the transmittal letter for this filing.

⁴ New tariff section 27.4.3.3(a).

⁵ New tariff section 27.4.3.3(b).

⁶ *Id.*

STUC process that produces results at 15:30 and extends to 20:00. Finally, the \$2,000/MWh penalty price is triggered in the RTD process that produces results every five minutes. The \$2,000/MWh penalty price is used in all RTD runs between 15:15 and 17:00. The RTD run occurring at 15:15 is the first RTD run that sees into the hour beginning at 16:00 in the advisory intervals.

II. Examples of How to Determine Which Market Parameters Apply and Calculate the Setting of the Pricing Parameter that Applies When There Is Insufficient Energy Supply to Meet the CAISO Forecast of CAISO Demand in the Real-Time Market

Examples A through E below⁷ illustrate the following two-step approach to (1) determining which set of market parameters apply, and (2) calculating the setting of the pricing parameter that applies when there is insufficient energy supply to meet the CAISO forecast of CAISO demand in the real-time market:

- **Step one:** Determine whether the market parameters related to the soft energy bid cap⁸ or the hard energy bid cap⁹ apply.
 - The market parameters related to the hard energy bid cap apply only if (1) the CAISO has accepted (and validated) a bid with an energy bid price that exceeds the \$1,000/MWh soft energy bid cap, or (2) the maximum import bid price exceeds the soft energy bid cap for any trading hour of the day-ahead market.¹⁰
 - Otherwise, the market parameters related to the soft energy bid cap apply.¹¹
- **Step two:** Calculate the setting of the pricing parameter that applies when there is insufficient energy supply to meet the CAISO forecast of CAISO demand in the real-time market and therefore the CAISO market software relaxes the system energy-balance constraint.
 - If the market parameters related to the soft energy bid cap apply, that pricing parameter is set to the \$1,000/MWh soft energy bid cap for price-setting purposes.¹²

⁷ The CAISO provided these same examples at pages 18-23 of the Revised Final Proposal.

⁸ Tariff sections 27.4.3.2 – 27.4.3.2.3 as renumbered, revised, and added in this filing.

⁹ Tariff sections 27.4.3.3 – 27.4.3.3.4 as renumbered, revised, and added in this filing.

¹⁰ New tariff section 27.4.3.3(a).

¹¹ Tariff section 27.4.3.2 as renumbered and revised in this filing.

¹² Tariff section 27.4.3.2.4 as renumbered and revised in this filing.

- If the market parameters related to the hard energy bid cap apply, for price-setting purposes the pricing parameter is set to: (a) the lower of the \$1,000/MWh soft energy bid cap price or the highest-priced cleared economic bid (which must be at least \$1,000/MWh but can be no more than \$2,000/MWh), if the supply shortfall detected in the scheduling run does not exceed the constraint relaxation threshold described below and thus does not represent a real and significant supply shortfall; or (b) the \$2,000/MWh hard energy bid cap price if the supply shortfall detected in the scheduling run exceeds the constraint relaxation threshold and thus represents a real and significant supply shortfall.¹³

Example A:

The following example illustrates how the pricing parameter will be set when the highest-priced submitted bid from a resource-specific resource is less than \$1,000/MWh and the CAISO-calculated maximum import bid price is less than \$1,000/MWh.

Assume the following market inputs in the real-time market:

- Highest-priced bid from a resource-specific resource = \$900/MWh
- CAISO-calculated maximum import bid price = \$200/MWh
- Constraint relaxation threshold value for the CAISO balancing authority area = 233.7 MW

Step one analysis: Because the highest-priced bid from a resource-specific resource (\$900/MWh) does not exceed the soft energy bid cap, and the maximum import bid price (\$200/MWh) does not exceed the soft energy bid cap, the market parameters related to the soft energy bid cap apply.

Step two analysis: If the market software must relax the system energy-balance constraint, the pricing parameter will be set to the \$1,000/MWh soft energy bid cap for price-setting purposes .

Example B:

The following example illustrates how the pricing parameter will be set when the highest-priced submitted bid from a resource-specific resource is greater than \$1,000/MWh. This example also shows how energy prices are determined in the pricing run based on the amount of supply shortfall.

Assume the following market inputs in the real-time market:

¹³ New tariff section 27.4.3.3.4.

- Highest-priced bid from a resource-specific resource = \$1,200/MWh
- CAISO-calculated maximum import bid price = \$700/MWh
- Constraint relaxation threshold value for the CAISO balancing authority area = 233.7 MW

Step one analysis: Because the highest-priced bid from a resource-specific resource (\$1,200/MWh) exceeds the \$1,000/MWh soft energy bid cap, the market parameters related to the \$2,000/MWh hard energy bid cap apply.

Step two analysis: If the market software must relax the system energy-balance constraint, for pricing purposes the pricing parameter will be set as follows:

- If the scheduling run supply shortfall \leq 233.7 MW, the pricing parameter will be set to the \$1,200/MWh highest-priced cleared economic bid.
- If the scheduling run shortfall $>$ 233.7 MW, the pricing parameter will be set to the hard energy bid cap price.

Example C:

The following example illustrates how the pricing parameter will be set when the CAISO-calculated maximum import bid price is greater than \$1,000/MWh. This example also outlines how energy prices are determined in the pricing run based on the amount of supply shortfall when there is no resource-specific bid greater than \$1,000/MWh.

Assume the following market inputs in the real-time market:

- Highest-priced bid from a resource-specific resource = \$900/MWh
- CAISO-calculated maximum import bid price = \$1,100/MWh
- Constraint relaxation threshold value for the CAISO balancing authority area = 233.7 MW

Step one analysis: Because the CAISO-calculated maximum import bid price (\$1,100/MWh) exceeds the \$1,000/MWh soft energy bid cap, the market parameters related to the \$2,000/MWh hard energy bid cap apply.

Step two analysis: If the market software must relax the system energy-balance constraint, for pricing purposes the pricing parameter will be set as follows:

- If the scheduling run supply shortfall ≤ 233.7 MW, the pricing parameter will be set to the soft energy bid cap price because there is no resource-specific bid greater than \$1,000/MWh.
- If the scheduling run supply shortfall > 233.7 MW, the pricing parameter will be set to the hard energy bid cap price.

Example D:

The following example illustrates how the pricing parameter will be set when the CAISO-calculated maximum import bid price is greater than \$1,000/MWh. This example also shows how a submitted resource adequacy import bid will be reduced to the CAISO-calculated maximum import bid price. Further, this example shows how energy prices are determined in the pricing run based on the amount of supply shortfall.

Assume the following market inputs in the real-time market:

- Highest-priced bid from a resource-specific resource = \$900/MWh
- Highest-priced resource adequacy import bid = \$1,200/MWh
- CAISO-calculated maximum import bid price = \$1,100/MWh
- Constraint relaxation threshold value for the CAISO balancing authority area = 233.7 MW

Step one analysis: Because the CAISO-calculated maximum import bid price (\$1,100/MWh) exceeds the \$1,000/MWh soft energy bid cap, the market parameters related to the \$2,000/MWh hard energy bid cap apply.

Step two analysis: If the market software must relax the system energy-balance constraint, for pricing purposes the pricing parameter will be set as follows:

- If the scheduling run supply shortfall ≤ 233.7 MW, the pricing parameter will be set to the \$1,100/MWh highest-priced cleared economic bid.
- If the scheduling run supply shortfall > 233.7 MW, energy prices in the pricing parameter will be set to the hard energy bid cap price.

Example E:

The following example illustrates how the pricing parameter will be set when the highest-priced submitted bid from a resource-specific resource is greater than \$1,000/MWh. This example also shows how energy prices are determined based on the amount of supply shortfall for an EIM entity balancing authority area when it is

import-constrained and the market software must relax the system energy-balance constraint for that specific EIM entity balancing authority area.

Assume the following market inputs in the real-time market:

- Highest-priced bid from a resource-specific resource within the import-constrained EIM entity balancing authority area = \$1,200/MWh
- CAISO-calculated maximum import bid price = \$900/MWh
- Constraint relaxation threshold value for the EIM entity balancing authority area = 25 MW
- Available balancing capacity supply for the EIM entity balancing authority area = 20 MW @ \$100/MWh

Pursuant to the existing tariff, the constraint relaxation threshold value for the EIM entity balancing authority area will be adjusted to include the available balancing capacity supply for the EIM entity balancing authority area.¹⁴ The adjusted constraint relaxation threshold value will be 45 MW (*i.e.*, the sum of the 25 MW and 20 MW values shown above).

Step one analysis: Because the highest-priced bid from a resource-specific resource (\$1,200/MWh) exceeds the \$1,000/MWh soft energy bid cap, the market parameters related to the \$2,000/MWh hard energy bid cap apply. This is the case for the market parameters for all individual balancing authority areas in the EIM area (*i.e.*, the CAISO balancing authority area and all EIM entity balancing authority areas)¹⁵ and the market parameters for the EIM area as a whole.

Step two analysis: If the market software must relax the system energy-balance constraint in the import-constrained EIM entity balancing authority area, for pricing purposes the pricing parameter will be set as follows:

- If the scheduling run supply shortfall \leq 45 MW, the pricing parameter will be set to the \$1,200/MWh highest-priced cleared economic bid.
- If the scheduling run supply shortfall $>$ 45 MW, the pricing parameter will be set to the hard energy bid cap price.

¹⁴ Existing tariff section 29.34(r)(1) (“The CAISO will use EIM Available Balancing Capacity identified in the EIM Resource Plan to address power balance constraint infeasibilities in the EIM Balancing Authority Area for which the EIM Available Balancing Capacity is designated by the responsible EIM Entity Scheduling Coordinator”).

¹⁵ Tariff appendix A, existing definition of “EIM Area.”

Because the market outside of this import-constrained EIM entity balancing authority area can reach a feasible solution, the system energy-balance constraint for the overall system does not need to be relaxed in this example, and prices outside the constrained balancing authority area are produced using the market's normal process.

Attachment B

Clean Tariff

**Tariff Amendment to Enhance Market Parameters and
Import Bidding Related to Order No. 831**

California Independent System Operator Corporation

February 22, 2021

6.5.2.3.7 Constraint Relaxation Threshold

Annually, the CAISO will post on its OASIS the Constraint Relaxation Thresholds for the CAISO Balancing Authority Area and the Balancing Authority Areas participating in the Energy Imbalance Market.

6.5.2.3.8 Energy Bid Parameters

Prior to Market Close, to the extent practicable, the CAISO will notify Scheduling Coordinators whether they may submit Demand Bids, Export Bids, Virtual Bids and Bids for Non-Resource-Specific System Resources above the Soft Energy Bid Cap.

6.5.2.3.9 Hourly Shaping Factor

Daily, to the extent practicable, the CAISO will post on OASIS the hourly shaping factors used to calculate the Maximum Import Bid Price for the Day-Ahead Market and the Real-Time Market.

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27.1.2 Ancillary Service Prices

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27.1.2.3 Ancillary Services Pricing – Insufficient Supply

The CAISO will develop Scarcity Reserve Demand Curves as further described in an applicable Business Practice Manual that will apply to both the Day-Ahead Market and the Real-Time Market during periods in which supply is insufficient to meet the minimum procurement requirements for Regulation Down, Non-Spinning Reserve, Spinning Reserve and Regulation Up as required by Section 8.3. The CAISO shall review the performance of the Scarcity Reserve Demand Curves and assess whether changes are necessary every three (3) years or more frequently, if the CAISO determines more frequent reviews are appropriate. When supply is insufficient to meet any of the minimum procurement requirements for Regulation Down, Non-Spinning Reserve, Spinning Reserve and Regulation Up, the Scarcity Reserve Demand Curve Values for the affected Ancillary Services, as set forth in this Section 27.1.2.3 and as reflected in the Scarcity Demand Curve Value described in Section 27.1.2.3.5, shall apply to determine the Shadow Prices of the affected Ancillary Services. ASMPs for an Ancillary Service type will not sum these Shadow Prices across Ancillary Service Regions, if there is insufficient supply for the Ancillary Service type in both the Expanded System Region and an Ancillary Service Sub-Region.

27.1.2.3.1 Regulation Down Pricing – Insufficient Supply

When the shortage of supply to meet the Regulation Down requirement in the Expanded System Region or in an Ancillary Service Sub-Region is less than or equal to thirty-two (32) MW, the Scarcity Reserve Demand Curve Value for Regulation Down shall be fifty (50) percent of the Soft Energy Bid Cap or the Hard Energy Bid Cap, as applicable based on the conditions specified in Sections 27.4.3.2 and 27.4.3.3, as specified in the tables in Section 27.1.2.3.5. When the shortage of supply to meet the Regulation Down requirement in the Expanded System Region is less than or equal to eighty-four (84) MW but greater than thirty-two (32) MW, the Scarcity Reserve Demand Curve Value for Regulation Down shall be sixty (60) percent of the Soft Energy Bid Cap or the Hard Energy Bid Cap, as applicable based on the conditions specified in Sections 27.4.3.2 and 27.4.3.3, as specified in the tables in Section 27.1.2.3.5. When the shortage of supply to meet the Regulation Down requirement in the Expanded System Region is greater than eighty-four (84) MW, the Scarcity Reserve Demand Curve Value for Regulation Down shall be seventy (70) percent of the Soft Energy Bid Cap or the Hard Energy Bid Cap, as applicable based on the conditions specified in Sections 27.4.3.2 and 27.4.3.3, as specified in the tables in Section 27.1.2.3.5.

27.1.2.3.2 Non-Spinning Reserve Pricing – Insufficient Supply

When the shortage of supply to meet the Non-Spinning Reserve requirement in the Expanded System Region or in an Ancillary Service Sub-Region is less than or equal to seventy (70) MW, the Scarcity Reserve Demand Curve Value for Non-Spinning Reserve shall be fifty (50) percent of the Soft Energy Bid Cap or the Hard Energy Bid Cap, as applicable based on the conditions specified in Sections 27.4.3.2 and 27.4.3.3, as specified in the tables in Section 27.1.2.3.5. When the shortage of supply to meet the Non-Spinning Reserve requirement in the Expanded System Region is less than or equal to two-hundred ten (210) MW but greater than seventy (70) MW, the Scarcity Reserve Demand Curve Value for Non-Spinning Reserve shall be sixty (60) percent of the Soft Energy Bid Cap or the Hard Energy Bid Cap, as applicable based on the conditions specified in Sections 27.4.3.2 and 27.4.3.3, as specified in the tables in Section 27.1.2.3.5. When the shortage of supply to meet the Non-Spinning Reserve requirement in the Expanded System Region is greater than two-hundred ten (210) MW, the Scarcity Reserve Demand Curve Value for Non-Spinning Reserve shall be seventy (70) percent of the Soft Energy Bid Cap or the Hard Energy Bid Cap, as applicable based on the conditions specified in Sections 27.4.3.2 and 27.4.3.3,

as specified in the tables in Section 27.1.2.3.5.

27.1.2.3.3 Spinning Reserve Pricing – Insufficient Supply

The Scarcity Reserve Demand Curve Value for Spinning Reserve in the Expanded System Region or in an Ancillary Service Sub-Region shall be ten (10) percent of the Soft Energy Bid Cap or the Hard Energy Bid Cap, as applicable based on the conditions specified in Sections 27.4.3.2 and 27.4.3.3, as specified in the tables in Section 27.1.2.3.5.

27.1.2.3.4 Regulation Up Pricing – Insufficient Supply

The Scarcity Reserve Demand Curve Value for Regulation Up in the Expanded System Region or in an Ancillary Service Sub-Region shall be twenty (20) percent of the Soft Energy Bid Cap or the Hard Energy Bid Cap, as applicable based on the conditions specified in Sections 27.4.3.2 and 27.4.3.3, as specified in Section 27.1.2.3.5.

27.1.2.3.5 Scarcity Demand Curve Value Tables

Scarcity Demand Curve Value (\$/MWh) When Energy Pricing Parameters based on Soft Energy Bid Cap as Specified In Section 27.4.3.2				
	Percent of Soft Energy Bid Cap			
Reserve	Expanded System Region	System Region and Sub-Region	Expanded System Region	System Region and Sub-Region
Regulation Up	20%	20%	\$200	\$200
Spinning	10%	10%	\$100	\$100
Non-Spinning Shortage > 210 MW	70%	70%	\$700	\$700
Non-Spinning Shortage > 70 & ≤ 210 MW	60%	60%	\$600	\$600
Non-Spinning Shortage ≤ 70 MW	50%	50%	\$500	\$500
Upward Sum	100%	100%	\$1000	\$1000
Regulation Down Shortage > 84 MW	70%	70%	\$700	\$700
Regulation Down Shortage > 32 & ≤ 84 MW	60%	60%	\$600	\$600
Regulation Down Shortage ≤ 32 MW	50%	50%	\$500	\$500

Scarcity Demand Curve Value (\$/MWh) When Energy Pricing Parameters based on Hard Energy Bid Cap as Specified In Section 27.4.3.3				
	Percent of Hard Energy Bid Cap			
Reserve	Expanded System Region	System Region and Sub-Region	Expanded System Region	System Region and Sub-Region
Regulation Up	20%	20%	\$400	\$400
Spinning	10%	10%	\$200	\$200
Non-Spinning Shortage > 210 MW	70%	70%	\$1,400	\$1,400
Non-Spinning Shortage > 70 & ≤ 210 MW	60%	60%	\$1,200	\$1,200
Non-Spinning Shortage ≤ 70 MW	50%	50%	\$1,000	\$1,000
Upward Sum	100%	100%	\$2,000	\$2,000
Regulation Down Shortage > 84 MW	70%	70%	\$1,400	\$1,400
Regulation Down Shortage > 32 & ≤ 84 MW	60%	60%	\$1,200	\$1,200
Regulation Down Shortage ≤ 32 MW	50%	50%	\$1,000	\$1,000

* * * * *

27.4.3 CAISO Markets Scheduling and Pricing Parameters

27.4.3.1 Generally

The SCUC and SCED optimization software for the CAISO Markets utilize a set of configurable scheduling and pricing parameters to enable the software to reach a feasible solution and set appropriate prices in instances where Effective Economic Bids are not sufficient to allow a feasible solution. The scheduling parameters specify the criteria for the software to adjust Non-priced Quantities when such adjustment is necessary to reach a feasible solution. The scheduling parameters are configured so that the SCUC and SCED software will utilize Effective Economic Bids as far as possible to reach a feasible solution, and will skip Ineffective Economic Bids and perform adjustments to Non-priced Quantities pursuant to the scheduling priorities for Self-Schedules specified in Sections 31.4 and 34.10. The scheduling parameters utilized for relaxation of enforced internal and Intertie Transmission Constraints are specified in Section 27.4.3.2.1 and 27.4.3.3.1. The pricing parameters specify the criteria for

establishing market prices in instances where one or more Non-priced Quantities are adjusted by the Market Clearing software. The pricing parameters are specified in Sections 27.4.3.2.2, 27.4.3.2.3, 27.4.3.2.4, 27.4.3.3.2, 27.4.3.3.3, and 27.4.3.3.4. The complete set of scheduling and pricing parameters used in all CAISO Markets is maintained in the Business Practice Manuals.

27.4.3.2 Parameters Related to Soft Energy Bid Cap

For CAISO Market intervals for which the conditions specified in Section 27.4.3.3 do not apply, the CAISO will apply the parameters specified in Sections 27.4.3.2.1 through 27.4.3.2.4 and the Ancillary Services Scarcity Prices in Section 27.1.2.3.5.

27.4.3.2.1 Scheduling Parameters for Transmission Constraint Relaxation

In the IFM, the enforced internal and Intertie Transmission Constraint scheduling parameter is set to \$5,000 per MWh for the purpose of determining when the SCUC and SCED software in the IFM will relax an enforced Transmission Constraint rather than adjust Supply or Demand bids or Non-priced Quantities as specified in Sections 31.3.1.3, 31.4 and 34.12 to relieve Congestion on the constrained facility. This scheduling parameter is set to \$1,500 per MWh for the RTM. The effect of this scheduling parameter value is that if the optimization can re-dispatch resources to relieve Congestion on a Transmission Constraint at a cost of \$5,000 per MWh or less for the IFM (or \$1,500 per MWh or less for the RTM), the Market Clearing software will utilize such re-dispatch, but if the cost exceeds \$5,000 per MWh in the IFM (or \$1,500 per MWh for the RTM) the market software will relax the Transmission Constraint. The corresponding scheduling parameter in RUC is set to \$1,250 per MWh.

27.4.3.2.2 Pricing Parameters for Transmission Constraint Relaxation

For the purpose of determining how the relaxation of a Transmission Constraint will affect the determination of prices in the IFM and RTM, the pricing parameter of the Transmission Constraint being relaxed is set to the Soft Energy Bid Cap. In the case of Contingency-related Transmission Constraints, the CAISO will determine the amount of relaxation required to clear the market using the most limiting condition among the applicable Contingencies and the base case. The CAISO will establish prices based on the parameter pricing specified in this Section as it applies to the most limiting Contingency and base case. The corresponding pricing parameter used in the RUC is set at the maximum RUC Availability Bid price specified in Section 39.6.1.2.

27.4.3.2.3 Insufficient Supply to Meet Self-Schedule Demand in IFM

In the IFM, when available supply is insufficient to meet all self-scheduled Demand, self-scheduled Demand is reduced to the point where the available supply is sufficient to clear the market. For price-setting purposes in such cases, the cleared self-scheduled Demand is deemed to be willing to pay the Soft Energy Bid Cap price.

27.4.3.2.4 Insufficient Supply to Meet CAISO Forecast of CAISO Demand in the RTM

In the RTM, in the event that Energy offers are insufficient to meet the CAISO Forecast of CAISO Demand, the SCUC and SCED software will relax the system energy-balance constraint. In such cases the software utilizes a pricing parameter set to the Soft Energy Bid Cap for price-setting purposes.

27.4.3.3 Parameters Related to Hard Energy Bid Cap

- (a) **Integrated Forward Market and Real-Time Market.** The scheduling and pricing parameters in Sections 27.4.3.3.1 through 27.4.3.3.4 will apply for all Trading Hours of the IFM and Real-Time Market for the same Trading Day if the CAISO has accepted a Bid with an Energy Bid price that exceeds the Soft Energy Bid Cap pursuant to Section 30.7.12, or the Maximum Import Bid Price exceeds the Soft Energy Bid Cap for any Trading Hour of the IFM.
- (b) **Real-Time Market Only.** If the CAISO has not accepted a Bid with an Energy Bid price that exceeds the Soft Energy Bid Cap pursuant to Section 30.7.12, or the Maximum Import Bid Price does not exceed the Soft Energy Bid Cap for any Trading Hour of the IFM for the same Trading Day, the parameters in Sections 27.4.3.3.1 through 27.4.3.3.4 will apply
 - (i) in any Trading Hour of the Real-Time Market for which the CAISO has accepted a Bid with an Energy Bid price that exceeds the Soft Energy Bid Cap pursuant to Section 30.7.12, or the Maximum Import Bid Price exceeds the Soft Energy Bid Cap; and
 - (ii) for all intervals of the applicable Real-Time Market run for which these conditions apply in at least one interval of the applicable market run.

27.4.3.3.1 Scheduling Parameters for Transmission Constraint Relaxation

In the IFM, the enforced internal and Intertie Transmission Constraint scheduling parameter is set to \$10,000 per MWh for the purpose of determining when the SCUC and SCED software in the IFM will relax an enforced Transmission Constraint rather than adjust Supply or Demand bids or Non-priced Quantities as specified in Sections 31.3.1.3, 31.4 and 34.12 to relieve Congestion on the constrained facility. This scheduling parameter is set to \$3,000 per MWh for the RTM. The effect of this scheduling parameter value is that if the optimization can re-dispatch resources to relieve Congestion on a Transmission Constraint at a cost of \$10,000 per MWh or less for the IFM (or \$3,000 per MWh or less for the RTM), the Market Clearing software will utilize such re-dispatch, but if the cost exceeds \$10,000 per MWh in the IFM (or \$3,000 per MWh for the RTM) the market software will relax the Transmission Constraint. The corresponding scheduling parameter in RUC is set to \$1,250 per MWh.

27.4.3.3.2 Pricing Parameters for Transmission Constraint Relaxation

In the case of Contingency-related Transmission Constraints, the CAISO will determine the amount of relaxation required to clear the market using the most limiting condition among the applicable Contingencies and the base case. The CAISO will establish prices based on the parameter pricing specified in this Section as it applies to the most limiting Contingency and base case. The corresponding pricing parameter used in the RUC is set at the maximum RUC Availability Bid price specified in Section 39.6.1.2.

27.4.3.3.3 Insufficient Supply to Meet Self-Schedule Demand in IFM

In the IFM, when available supply is insufficient to meet all self-scheduled Demand, self-scheduled Demand is reduced to the point where the available supply is sufficient to clear the market. For price-setting purposes in such cases, the cleared self-scheduled Demand is deemed to be willing to pay the Hard Energy Bid Cap price.

27.4.3.3.4 Insufficient Supply to Meet CAISO Forecast of CAISO Demand in the RTM

In the RTM, in the event that Energy offers are insufficient to meet the CAISO Forecast of CAISO Demand, the SCUC and SCED software will relax the system energy-balance constraint. In such cases, for price-setting purposes the software utilizes a pricing parameter set to

- (a) the highest-priced cleared Economic Bid if the infeasibility detected in the scheduling run does not exceed the Constraint Relaxation Threshold, but no less than the Soft Energy

- Bid Cap price; or
- (b) the Hard Energy Bid Cap price if the infeasibility detected in the scheduling run exceeds the Constraint Relaxation Threshold.

27.4.3.4 Protection of TOR, ETC and Converted Rights Self-Schedules in the IFM

In accordance with the submitted and accepted TRTC Instructions, valid Day-Ahead TOR Self-Schedules, Day-Ahead ETC Self-Schedules and Day-Ahead Converted Rights Self-Schedules shall not be adjusted in the IFM in response to an insufficiency of Effective Economic Bids. The scheduling parameters associated with the TOR, ETC, or Converted Rights Self-Schedules will be set to values higher than the scheduling parameter associated with relaxation of an enforced internal and Intertie Transmission Constraint as specified in Section 27.4.3.2, so that when there is a congested Transmission Constraint that would otherwise subject a Supply or Demand resource submitted in a valid and balanced ETC, TOR or Converted Rights Self-Schedule to adjustment in the IFM, the IFM software will relax the Transmission Constraint rather than curtail the TOR or ETC Self-Schedule. This priority will be adhered to by the operation of the IFM Market Clearing software, and if necessary, by adjustment of Schedules after the IFM has been executed and the results have been reviewed by the CAISO operators.

27.4.3.5 Effectiveness Threshold

The CAISO Markets software includes a lower effectiveness threshold setting that governs whether the software will consider a bid “effective” for managing congestion on a congested Transmission Constraint, which in the case of Nomograms will be applied to the individual flowgates that make up the Nomogram, rather than to the Nomogram itself. The CAISO will set this threshold at two percent (2%).

* * * * *

30.5.2.4 Supply Bids for System Resources

In addition to the common elements listed in Section 30.5.2.1, Supply Bids for Resource-Specific System Resources shall also contain Start-Up Bids and Minimum Load Bids. Resource-Specific System Resources are subject to the Proxy Cost methodology or the Registered Cost methodology for Default Start-Up Bids and Default Minimum Load Bids as provided in Section 30.4, and Transaction ID as created by the CAISO. Other System Resources are not eligible to recover Start-Up Costs and Minimum Load

Costs. Resource-Specific System Resources are eligible to participate in the Day-Ahead Market on an equivalent basis as Generating Units and are not obligated to participate in RUC or the RTM if the resource did not receive a Day-Ahead Schedule unless the resource is a Resource Adequacy Resource. If the Resource-Specific System Resource is a Resource Adequacy Resource, the Scheduling Coordinator for the resource is obligated to make it available to the CAISO Market as prescribed by Section 40.6. Dynamic Resource-Specific System Resources are also eligible to participate in RTM on an equivalent basis as Generating Units. The quantity (in MWh) of Energy categorized as Interruptible Imports (non-firm imports) can only be submitted through Self-Schedules in the Day-Ahead Market and cannot be incrementally increased in the RTM. Bids submitted to the Day-Ahead Market for ELS Resources will be applicable for two days after they have been submitted and cannot be changed the day after they have been submitted. Bids for System Resources that exceed the Soft Energy Bid Cap are subject to the rules in Sections 30.7.12, as applicable.

* * * * *

30.5.8 Demand Bids, Export Bids, Virtual Bids, and Bids for Non-Resource-Specific System Resources Above the Soft Energy Bid Cap

30.5.8.1 Day-Ahead Market.

Scheduling Coordinators may submit Demand Bids, Export Bids, Virtual Bids, and Bids for Non-Resource-Specific System Resources above the Soft Energy Bid Cap, not to exceed the Hard Energy Bid Cap, for any Trading Hour of the DAM in which the CAISO has accepted a Bid with an Energy Bid price that exceeds the Soft Energy Bid Cap pursuant to Section 30.7.12, or the Maximum Import Bid Price exceeds the Soft Energy Bid Cap.

30.5.8.2 Real-Time Market.

Scheduling Coordinators may submit Demand Bids, Export Bids, Virtual Bids, and Bids for Non-Resource-Specific System Resources above the Soft Energy Bid Cap, not to exceed the Hard Energy Bid Cap, for any Trading Hour of the Real-Time Market in which

- (a) The conditions in Section 30.5.8.1 applied to the same Trading Hour of the Day-Ahead Market; or

- (b) The CAISO has accepted a Bid for the applicable Trading Hour of the Real-Time Market with an Energy Bid price that exceeds the Soft Energy Bid Cap pursuant to Section 30.7.12, or the Maximum Import Bid Price exceeds the Soft Energy Bid Cap.

* * * * *

30.7.12 Validation of Bids in Excess of Soft Energy Bid Cap, Hard Energy Bid Cap, or Minimum Load Cost Hard Cap

30.7.12.1 Generally

Except as otherwise stated in this Section 30.7.12, the validation rules in this Section 30.7.12 apply to all Energy Bids and Minimum Load Bids submitted by Scheduling Coordinators. The provisions of Sections 30.7.12.1 through 30.7.12.4 do not apply to Virtual Bids and Energy Bids submitted for Non-Resource-Specific System Resources; the provisions of Section 30.7.12.5 apply to Virtual Bids and Energy Bids submitted for Non-Resource-Specific System Resources. The CAISO will allow Bids for Non-Resource-Specific System Resources that are Resource Adequacy Resources and that exceed the Soft Energy Bid Cap subject to the Bid price screens described in Section 30.7.12.5.1. The CAISO will allow Virtual Bids, Export Bids, Demand Bids, and Bids for Non-Resource-Adequacy System Resources that are not Resource Adequacy Resources and that exceed the Soft Energy Bid Cap subject to the rules specified in Section 30.7.12.5.2. The CAISO will reject Virtual Bids, Export Bids, Demand Bids, and Bids for Non-Resource-Specific System Resources that exceed the Hard Energy Bid Cap.

30.7.12.2 Energy Bids that Exceed the Soft Energy Bid Cap

In addition to all other Bid validation rules that apply to Energy Bids, if a Scheduling Coordinator submits an Energy Bid price that exceeds the Soft Energy Bid Cap, the CAISO will modify the Energy Bid price for purposes of clearing the relevant CAISO Market Process to the higher of the Soft Energy Bid Cap or the resource's Default Energy Bid as modified pursuant to a Reference Level Change Request pursuant to Section 30.11.

30.7.12.3 Energy Bids that Exceed the Hard Energy Bid Cap and Minimum Load Bids that Exceed the Minimum Load Cost Hard Cap

All Energy Bid prices and Minimum Load Bid prices used in the CAISO Market Processes shall not exceed the Hard Energy Bid Cap or the Minimum Load Cost Hard Cap, respectively.

30.7.12.4 After-Market Cost Recovery

For any Energy Bid, except for Energy Bids for Non-Resource-Specific System Resources, Virtual Bids, Export Bids, Demand Bids, or Minimum Load Bid price submitted above the Energy Bid price or the Minimum Load Bid the CAISO uses in the CAISO Market Processes, the Scheduling Coordinators may be eligible for after-market cost recovery pursuant to Section 30.12.

30.7.12.5 Virtual Bids, Export Bids, Demand Bids, and Bids for Non-Resource-Specific System Resources

30.7.12.5.1 Bids for Non-Resource-Specific System Resources that are Resource Adequacy Resources

The CAISO will reduce Bids for Non-Resource-Specific System Resources that are Resource Adequacy Resources that exceed the Maximum Import Bid Price to the greater of the Soft Energy Bid Cap, the Maximum Import Bid Price, or the highest-priced Energy Bid from a Resource-Specific System Resource that the CAISO has accepted for the applicable Trading Hour pursuant to Section 30.7.12.2.

30.7.12.5.2 Virtual Bids, Export Bids, Demand Bids, and Bids for Non-Resource-Specific System Resources that are not Resource Adequacy Resources

The CAISO will accept Virtual Bids, Export Bids, Demand Bids, and Bids for Non-Resource-Specific System Resources that are not Resource Adequacy Resources that exceed the Soft Energy Bid consistent with the conditions specified in Section 30.5.8. The CAISO will not accept Export Bids, Demand Bids, Virtual Bids, or Bids for Non-Resource-Specific System Resources that are not Resource Adequacy Resources that exceed the Hard Energy Bid Cap.

30.7.12.5.3 Maximum Import Bid Price

The CAISO calculates hourly Maximum Import Bid Prices for the Day-Ahead Market and Real-Time Market, separately, including for on-peak and off-peak hours. The CAISO calculates the Maximum Import Bid Price as 110 percent of the greater of the published bilateral electric index prices for the Mid-Columbia or Palo Verde trading hub locations, multiplied by an hourly shaping ratio. As detailed in the CAISO Business Practice Manual, the CAISO calculates the hourly shaping ratio for each hour by dividing the Day-Ahead Market System Marginal Energy Cost for the CAISO Balancing Authority Area in that hour of a previous representative Trading Day by the average Day-Ahead Market System Marginal Energy Cost for the CAISO Balancing Authority Area in all on-peak hours of the same previous representative Trading Day. If for any given Trading Hour the CAISO cannot calculate the Maximum

Import Bid Price, the applicable Maximum Import Bid Price will be the most recently available calculated Maximum Import Bid Price.

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31.6 Timing of Day-Ahead Scheduling

31.6.1 Criteria for Temporary Waiver of Timing Requirements

The CAISO may at its sole discretion implement any temporary variation or waiver of the timing requirements of this Section 31 and Section 6.5.3 (including the omission of any step) if any of the following criteria are met:

- (i) such waiver or variation of timing requirements is reasonably necessary to preserve System Reliability, prevent an imminent or threatened System Emergency or to retain Operational Control over the CAISO Controlled Grid during an actual System Emergency;
- (ii) because of error or delay, the CAISO requires additional time to fulfill its responsibilities;
- (iii) problems with data or the processing of data cause a delay in receiving or issuing Bids or publishing information on the CAISO's secure communication system;
- (iv) problems with telecommunications or computing infrastructure cause a delay in receiving or issuing Day-Ahead Schedules or publishing information on the CAISO's secure communication system; or
- (v) additional time is needed to allow for the submission of Bids in the event that the conditions specified in Section 30.5.8 change prior to the Market Close, and may require the resubmission of Bids consistent with the changed bidding requirements.

* * * * *

34.10 Dispatch of Energy from Ancillary Services

The CAISO may issue Dispatch Instructions to Participating Generators, Participating Loads, Proxy Demand Resources, (via communication with the Scheduling Coordinators of Demand Response

Providers) System Units and System Resources contracted to provide Ancillary Services (either procured through the CAISO Markets, Self-Provided by Scheduling Coordinators, or through Exceptional Dispatch or dispatched in accordance with a Legacy RMR Contract) for the Supply of Energy. During normal operating conditions, the CAISO may Dispatch those Participating Generators, Participating Loads, Proxy Demand Resources, System Units and System Resources that have contracted to provide Spinning and Non-Spinning Reserve, except for those reserves designated as Contingency Only, in conjunction with the normal Dispatch of Energy. Contingency Only reserves are Operating Reserve capacity that have been designated, either by the Scheduling Coordinator or the CAISO, as available to supply Energy in the Real-Time only in the event of the occurrence of an unplanned Outage, a Contingency or an imminent or actual System Emergency. During normal operating conditions, the CAISO may also elect to designate any reserve not previously identified as Contingency Only by Scheduling Coordinator as Contingency Only reserves. In the event of an unplanned Outage, a Contingency or a threatened or actual System Emergency, the CAISO may dispatch Contingency Only reserves. If Contingency Only reserves are dispatched through the RTCD, which as described in Section 34.5.2 only Dispatches in the event of a Contingency, such Dispatch and pricing will be based on the original Energy Bids. If Contingency Only reserves are dispatched in response to a System Emergency that has occurred because the CAISO has run out of Economic Bids when no Contingency event has occurred, the RTED will Dispatch such Contingency Only reserves using the Soft Energy Bid Cap as the Energy Bids for such reserves and will set prices accordingly. For CAISO Market intervals for which the conditions and parameters specified in Section 27.4.3.3 apply, the RTED will Dispatch such Contingency Only reserves using the Hard Energy Bid Cap as the Energy Bids for such reserves and will set prices accordingly. If a Participating Generator, Participating Load, System Unit or System Resource that is supplying Operating Reserve is dispatched to provide Energy, the CAISO shall replace the Operating Reserve as necessary to maintain NERC and WECC reliability standards, including any requirements of the NRC. If the CAISO uses Operating Reserve to meet Real-Time Energy requirements, and if the CAISO needs Operating Reserves to satisfy NERC and WECC reliability standards, including any requirements of the NRC, the CAISO shall restore the Operating Reserves to the extent necessary to meet NERC and WECC reliability standards, including any requirements of the NRC through either the procurement of additional Operating Reserve in the RTM

or the Dispatch of other Energy Bids in SCED to allow the resources that were providing Energy from the Operating Reserve to return to their Dispatch Operating Target. The Energy Bid Curve is not used by the AGC system when Dispatching Energy from Regulation. For Regulation Up capacity, the upper portion of the resource capacity from its Regulation Limit is allocated to Regulation regardless of its Energy Bid Curve. For a resource providing Regulation Up or Operating Reserves the remaining Energy Bid Curve shall be allocated to any RTM AS Awards in the following order from higher to lower capacity where applicable: (a) Spinning Reserve; and (b) Non-Spinning Reserve. For resources providing Regulation Up, the applicable upper Regulation Limit shall be used as the basis of allocation if it is lower than the upper portion of the Energy Bid Curve. The remaining portion of the Energy Bid Curve, if there is any, shall constitute a Bid for RTM Energy. For Regulation Down capacity, the lower portion of the resource capacity from its applicable Regulation Limit is allocated to Regulation regardless of its Energy Bid Curve.

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Appendix A

Master Definitions Supplement

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- Constraint Relaxation Threshold

A MW threshold value used to determine when the parameters specified in Section 27.4.3.3.4 will trigger in each Balancing Authority Area participating in the CAISO Markets to account for small supply shortfalls configured based on the Balancing Authority Area's BAL-001-2 Requirement R2, calculated by the CAISO annually. The CAISO will post the annual values for each Balancing Authority Area on the CAISO Website or its OASIS.

* * * * *

- Hard Energy Bid Cap

The maximum Energy Bid price the CAISO will use for purposes of clearing the CAISO Market Processes. The Hard Energy Bid Cap is \$2,000 per MWh.

* * * * *

- Maximum Import Bid Price

An index-based price used to screen Bids by Non-Resource-Specific System resources that are Resource Adequacy Resources that exceed the Soft Energy Bid Cap.

* * * * *

- Scarcity Reserve Demand Curve Values

Fixed percentages of the Soft Energy Bid Cap or Hard Energy Bid Cap reflected in the Scarcity Reserve Demand Curve that the CAISO uses to calculate Ancillary Service Shadow Prices for Regulation Up, Spinning Reserve, Non-Spinning Reserve and Regulation Down from which the CAISO determines Ancillary Service Marginal Prices when there is insufficient supply in an Ancillary Service Region or Sub-Region to meet an Ancillary Services minimum procurement requirement.

* * * * *

- Soft Energy Bid Cap

The maximum Energy Bid price submitted by Scheduling Coordinators for resources the CAISO will use for purposes of clearing the CAISO Market Processes without cost verification pursuant to Section 30.11. The Soft Energy Bid Cap is \$1,000 per MWh.

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Attachment C

Marked Tariff

**Tariff Amendment to Enhance Market Parameters and
Import Bidding Related to Order No. 831**

California Independent System Operator Corporation

February 22, 2021

6.5.2.3.7 Constraint Relaxation Threshold

Annually, the CAISO will post on its OASIS the Constraint Relaxation Thresholds for the CAISO Balancing Authority Area and the Balancing Authority Areas participating in the Energy Imbalance Market.

6.5.2.3.8 Energy Bid Parameters

Prior to Market Close, to the extent practicable, the CAISO will notify Scheduling Coordinators whether they may submit Demand Bids, Export Bids, Virtual Bids and Bids for Non-Resource-Specific System Resources above the Soft Energy Bid Cap.

6.5.2.3.9 Hourly Shaping Factor

Daily, to the extent practicable, the CAISO will post on OASIS the hourly shaping factors used to calculate the Maximum Import Bid Price for the Day-Ahead Market and the Real-Time Market.

* * * * *

27.1.2 Ancillary Service Prices

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27.1.2.3 Ancillary Services Pricing – Insufficient Supply

The CAISO will develop Scarcity Reserve Demand Curves as further described in an applicable Business Practice Manual that will apply to both the Day-Ahead Market and the Real-Time Market during periods in which supply is insufficient to meet the minimum procurement requirements for Regulation Down, Non-Spinning Reserve, Spinning Reserve and Regulation Up as required by Section 8.3. ~~During the first three (3) years in which the CAISO's Scarcity Reserve Demand Curves are effective, the CAISO shall conduct an annual review of the performance of the Scarcity Reserve Demand Curves and assess whether changes are necessary, with the exception that the ISO will not conduct this assessment in any year in which the Scarcity Reserve Demand Curves are not triggered. Thereafter, t~~The CAISO shall review the performance of the Scarcity Reserve Demand Curves and assess whether changes are necessary every three (3) years or more frequently, if the CAISO determines more frequent reviews are appropriate.

When supply is insufficient to meet any of the minimum procurement requirements for Regulation Down, Non-Spinning Reserve, Spinning Reserve and Regulation Up, the Scarcity Reserve Demand Curve

Values for the affected Ancillary Services, as set forth in this Section 27.1.2.3 and as reflected in the ~~in~~ ~~the~~ Scarcity Demand Curve Value ~~table below~~ described in Section 27.1.2.3.5, shall apply to determine the Shadow Prices of the affected Ancillary Services. ASMPs for an Ancillary Service type will not sum these Shadow Prices across Ancillary Service Regions, if there is insufficient supply for the Ancillary Service type in both the Expanded System Region and an Ancillary Service Sub-Region.

Reserve	Scarcity Demand Curve Value (\$/MWh)					
	Percent of Energy Max Bid Price		Max Energy Bid Price = \$750/MWh		Max Energy Bid Price = \$1000/MWh	
	Expanded System Region	System Region and Sub-Region	Expanded System Region	System Region and Sub-Region	Expanded System Region	System Region and Sub-Region
Regulation Up	-20%	-20%	-\$150	-\$150	\$200	-\$200
Spinning	-10%	-10%	-\$75	-\$75	\$100	-\$100
Non-Spinning	-70%	-70%	-\$525	-\$525	-\$700	-\$700
Shortage > 210 MW	-60%	-60%	-\$450	-\$450	-\$600	-\$600
Shortage > 70 & ≤ 210 MW	-50%	-50%	-\$375	-\$375	-\$500	-\$500
Shortage ≤ 70 MW						
Upward Sum	100%	100%	\$750	\$750	\$1000	\$1000
Regulation Down	-70%	-70%	-\$525	-\$525	-\$700	-\$700
Shortage > 84 MW	-60%	-60%	-\$450	\$450 \$375	-\$600	-\$600
Shortage > 32 & ≤ 84 MW	-50%	-50%	-\$375		-\$500	-\$500
Shortage ≤ 32 MW						

27.1.2.3.1 Regulation Down Pricing – Insufficient Supply

When the shortage of supply to meet the Regulation Down requirement in the Expanded System Region or in an Ancillary Service Sub-Region is less than or equal to thirty-two (32) MW, the Scarcity Reserve Demand Curve Value for Regulation Down shall be fifty (50) percent of the Soft Energy Bid Cap or the Hard Energy Bid Cap, as applicable based on the conditions specified in Sections 27.4.3.2 and 27.4.3.3, as specified in the tables in Section 27.1.2.3.5 ~~maximum Energy Bid price permitted under Section 39.6.1.4~~. When the shortage of supply to meet the Regulation Down requirement in the Expanded System Region is less than or equal to eighty-four (84) MW but greater than thirty-two (32) MW, the

Scarcity Reserve Demand Curve Value for Regulation Down shall be sixty (60) percent of the Soft Energy Bid Cap or the Hard Energy Bid Cap, as applicable based on the conditions specified in Sections 27.4.3.2 and 27.4.3.3, as specified in the tables in Section 27.1.2.3.5~~the maximum Energy Bid price permitted under Section 39.6.1.1.~~ When the shortage of supply to meet the Regulation Down requirement in the Expanded System Region is greater than eighty-four (84) MW, the Scarcity Reserve Demand Curve Value for Regulation Down shall be seventy (70) percent of the Soft Energy Bid Cap or the Hard Energy Bid Cap, as applicable based on the conditions specified in Sections 27.4.3.2 and 27.4.3.3, as specified in the tables in Section 27.1.2.3.5~~the maximum Energy Bid price permitted under Section 39.6.1.1.~~

27.1.2.3.2 Non-Spinning Reserve Pricing – Insufficient Supply

When the shortage of supply to meet the Non-Spinning Reserve requirement in the Expanded System Region or in an Ancillary Service Sub-Region is less than or equal to seventy (70) MW, the Scarcity Reserve Demand Curve Value for Non-Spinning Reserve shall be fifty (50) percent of the Soft Energy Bid Cap or the Hard Energy Bid Cap, as applicable based on the conditions specified in Sections 27.4.3.2 and 27.4.3.3, as specified in the tables in Section 27.1.2.3.5~~maximum Energy Bid price permitted under Section 39.6.1.1.~~ When the shortage of supply to meet the Non-Spinning Reserve requirement in the Expanded System Region is less than or equal to two-hundred ten (210) MW but greater than seventy (70) MW, the Scarcity Reserve Demand Curve Value for Non-Spinning Reserve shall be sixty (60) percent of the Soft Energy Bid Cap or the Hard Energy Bid Cap, as applicable based on the conditions specified in Sections 27.4.3.2 and 27.4.3.3, as specified in the tables in Section 27.1.2.3.5~~maximum Energy Bid price permitted under Section 39.6.1.1.~~ When the shortage of supply to meet the Non-Spinning Reserve requirement in the Expanded System Region is greater than two-hundred ten (210) MW, the Scarcity Reserve Demand Curve Value for Non-Spinning Reserve shall be seventy (70) percent of the Soft Energy Bid Cap or the Hard Energy Bid Cap, as applicable based on the conditions specified in Sections 27.4.3.2 and 27.4.3.3, -as specified in the tables in Section 27.1.2.3.5~~maximum Energy Bid price permitted under Section 39.6.1.1.~~

27.1.2.3.3 Spinning Reserve Pricing – Insufficient Supply

The Scarcity Reserve Demand Curve Value for Spinning Reserve in the Expanded System Region or in an Ancillary Service Sub-Region shall be ten (10) percent of the Soft Energy Bid Cap for the Hard Energy

Bid Cap, as applicable based on the conditions specified in Sections 27.4.3.2 and 27.4.3.3, as specified in the tables in Section 27.1.2.3.5maximum Energy Bid price permitted under Section 39.6.1.1.

27.1.2.3.4 Regulation Up Pricing – Insufficient Supply

The Scarcity Reserve Demand Curve Value for Regulation Up in the Expanded System Region or in an Ancillary Service Sub-Region shall be twenty (20) percent of the Soft Energy Bid Cap or the Hard Energy Bid Cap, as applicable based on the conditions specified in Sections 27.4.3.2 and 27.4.3.3, as specified in Section 27.1.2.3.5maximum Energy Bid price permitted under Section 39.6.1.1.

27.1.2.3.5 Scarcity Demand Curve Value Tables

<u>Scarcity Demand Curve Value (\$/MWh) When Energy Pricing Parameters based on Soft Energy Bid Cap as Specified In Section 27.4.3.2</u>				
	<u>Percent of Soft Energy Bid Cap</u>			
<u>Reserve</u>	<u>Expanded System Region</u>	<u>System Region and Sub-Region</u>	<u>Expanded System Region</u>	<u>System Region and Sub-Region</u>
Regulation Up	20%	20%	\$200	\$200
Spinning	10%	10%	\$100	\$100
Non-Spinning Shortage > 210 MW	70%	70%	\$700	\$700
Non-Spinning Shortage > 70 & ≤ 210 MW	60%	60%	\$600	\$600
Non-Spinning Shortage ≤ 70 MW	50%	50%	\$500	\$500
<u>Upward Sum</u>	<u>100%</u>	<u>100%</u>	<u>\$1000</u>	<u>\$1000</u>
Regulation Down Shortage > 84 MW	70%	70%	\$700	\$700
Regulation Down Shortage > 32 & ≤ 84 MW	60%	60%	\$600	\$600
Regulation Down Shortage ≤ 32 MW	50%	50%	\$500	\$500

<u>Scarcity Demand Curve Value (\$/MWh) When Energy Pricing Parameters based on Hard Energy Bid Cap as Specified In Section 27.4.3.3</u>				
	<u>Percent of Hard Energy Bid Cap</u>			
<u>Reserve</u>	<u>Expanded System Region</u>	<u>System Region and Sub-Region</u>	<u>Expanded System Region</u>	<u>System Region and Sub-Region</u>
Regulation Up	20%	20%	\$400	\$400
Spinning	10%	10%	\$200	\$200

<u>Non-Spinning Shortage > 210 MW</u>	<u>70%</u>	<u>70%</u>	<u>\$1,400</u>	<u>\$1,400</u>
<u>Non-Spinning Shortage > 70 & ≤ 210 MW</u>	<u>60%</u>	<u>60%</u>	<u>\$1,200</u>	<u>\$1,200</u>
<u>Non-Spinning Shortage ≤ 70 MW</u>	<u>50%</u>	<u>50%</u>	<u>\$1,000</u>	<u>\$1,000</u>
<u>Upward Sum</u>	<u>100%</u>	<u>100%</u>	<u>\$2,000</u>	<u>\$2,000</u>
<u>Regulation Down Shortage > 84 MW</u>	<u>70%</u>	<u>70%</u>	<u>\$1,400</u>	<u>\$1,400</u>
<u>Regulation Down Shortage > 32 & ≤ 84 MW</u>	<u>60%</u>	<u>60%</u>	<u>\$1,200</u>	<u>\$1,200</u>
<u>Regulation Down Shortage ≤ 32 MW</u>	<u>50%</u>	<u>50%</u>	<u>\$1,000</u>	<u>\$1,000</u>

* * * * *

27.4.3 CAISO Markets Scheduling and Pricing Parameters

27.4.3.1 Generally

The SCUC and SCED optimization software for the CAISO Markets utilize a set of configurable scheduling and pricing parameters to enable the software to reach a feasible solution and set appropriate prices in instances where Effective Economic Bids are not sufficient to allow a feasible solution. The scheduling parameters specify the criteria for the software to adjust Non-priced Quantities when such adjustment is necessary to reach a feasible solution. The scheduling parameters are configured so that the SCUC and SCED software will utilize Effective Economic Bids as far as possible to reach a feasible solution, and will skip Ineffective Economic Bids and perform adjustments to Non-priced Quantities pursuant to the scheduling priorities for Self-Schedules specified in Sections 31.4 and 34.10. The scheduling parameters utilized for relaxation of enforced internal and Intertie Transmission Constraints are specified in Section 27.4.3.2.14 and 27.4.3.3.1. The pricing parameters specify the criteria for establishing market prices in instances where one or more Non-priced Quantities are adjusted by the Market Clearing software. The pricing parameters are specified in Sections 27.4.3.1.2.2, 27.4.3.2.3, 27.4.3.2.4, 27.4.3.3.2, 27.4.3.3.3, and 27.4.3.3.4.3 and 27.4.3.4. The complete set of scheduling and pricing parameters used in all CAISO Markets is maintained in the Business Practice Manuals.

27.4.3.2.1 Parameters Related to Soft Energy Bid Cap

For CAISO Market intervals for which the conditions specified in Section 27.4.3.3 do not apply, the CAISO will apply the parameters specified in Sections 27.4.3.2.1 through 27.4.3.2.4 and the Ancillary Services Scarcity Prices in Section 27.1.2.3.5.

27.4.3.2.1 Scheduling Parameters for Transmission Constraint Relaxation

In the IFM, the enforced internal and Intertie Transmission Constraint scheduling parameter is set to \$5,000 per MWh for the purpose of determining when the SCUC and SCED software in the IFM will relax an enforced Transmission Constraint rather than adjust Supply or Demand bids or Non-priced Quantities as specified in Sections 31.3.1.3, 31.4 and 34.12 to relieve Congestion on the constrained facility. This scheduling parameter is set to \$1,500 per MWh for the RTM. The effect of this scheduling parameter value is that if the optimization can re-dispatch resources to relieve Congestion on a Transmission Constraint at a cost of \$5,000 per MWh or less for the IFM (or \$1,500 per MWh or less for the RTM), the Market Clearing software will utilize such re-dispatch, but if the cost exceeds \$5,000 per MWh in the IFM (or \$1,500 per MWh for the RTM) the market software will relax the Transmission Constraint. The corresponding scheduling parameter in RUC is set to \$1,250 per MWh.

27.4.3.2.2 Pricing Parameters for Transmission Constraint Relaxation

For the purpose of determining how the relaxation of a Transmission Constraint will affect the determination of prices in the IFM and RTM, the pricing parameter of the Transmission Constraint being relaxed is set to the Soft Energy Bid Cap~~maximum Energy Bid price specified in Section 39.6.1.1~~. In the case of Contingency-related Transmission Constraints, the CAISO will determine the amount of relaxation required to clear the market using the most limiting condition among the applicable Contingencies and the base case. The CAISO will establish prices based on the parameter pricing specified in this Section as it applies to the most limiting Contingency and base case. The corresponding pricing parameter used in the RUC is set at the maximum RUC Availability Bid price specified in Section 39.6.1.2.

27.4.3.2.3 Insufficient Supply to Meet Self-Schedule Demand in IFM

In the IFM, when available supply is insufficient to meet all self-scheduled Demand, self-scheduled Demand is reduced to the point where the available supply is sufficient to clear the market. For price-setting purposes in such cases, the cleared self-scheduled Demand is deemed to be willing to pay the

~~maximum Energy Bid price specified in Section 39.6.1.1-Soft Energy Bid Cap price.~~

27.4.3.2.4 Insufficient Supply to Meet CAISO Forecast of CAISO Demand in the RTM

In the RTM, in the event that Energy offers are insufficient to meet the CAISO Forecast of CAISO Demand, the SCUC and SCED software will relax the system energy-balance constraint. In such cases the software utilizes a pricing parameter set to the ~~Soft Energy Bid Cap maximum Energy Bid price specified in Section 39.6.1.1~~ for price-setting purposes.

27.4.3.3 Parameters Related to Hard Energy Bid Cap

- (a) **Integrated Forward Market and Real-Time Market.** The scheduling and pricing parameters in Sections 27.4.3.3.1 through 27.4.3.3.4 will apply for all Trading Hours of the IFM and Real-Time Market for the same Trading Day if the CAISO has accepted a Bid with an Energy Bid price that exceeds the Soft Energy Bid Cap pursuant to Section 30.7.12, or the Maximum Import Bid Price exceeds the Soft Energy Bid Cap for any Trading Hour of the IFM.
- (b) **Real-Time Market Only.** If the CAISO has not accepted a Bid with an Energy Bid price that exceeds the Soft Energy Bid Cap pursuant to Section 30.7.12, or the Maximum Import Bid Price does not exceed the Soft Energy Bid Cap for any Trading Hour of the IFM for the same Trading Day, the parameters in Sections 27.4.3.3.1 through 27.4.3.3.4 will apply—
- (i) in any Trading Hour of the Real-Time Market for which the CAISO has accepted a Bid with an Energy Bid price that exceeds the Soft Energy Bid Cap pursuant to Section 30.7.12, or the Maximum Import Bid Price exceeds the Soft Energy Bid Cap; and
- (ii) for all intervals of the applicable Real-Time Market run for which these conditions apply in at least one interval of the applicable market run.

27.4.3.3.1 Scheduling Parameters for Transmission Constraint Relaxation

In the IFM, the enforced internal and Intertie Transmission Constraint scheduling parameter is set to \$10,000 per MWh for the purpose of determining when the SCUC and SCED software in the IFM will relax an enforced Transmission Constraint rather than adjust Supply or Demand bids or Non-priced

Quantities as specified in Sections 31.3.1.3, 31.4 and 34.12 to relieve Congestion on the constrained facility. This scheduling parameter is set to \$3,000 per MWh for the RTM. The effect of this scheduling parameter value is that if the optimization can re-dispatch resources to relieve Congestion on a Transmission Constraint at a cost of \$10,000 per MWh or less for the IFM (or \$3,000 per MWh or less for the RTM), the Market Clearing software will utilize such re-dispatch, but if the cost exceeds \$10,000 per MWh in the IFM (or \$3,000 per MWh for the RTM) the market software will relax the Transmission Constraint. The corresponding scheduling parameter in RUC is set to \$1,250 per MWh.

27.4.3.3.2 Pricing Parameters for Transmission Constraint Relaxation

In the case of Contingency-related Transmission Constraints, the CAISO will determine the amount of relaxation required to clear the market using the most limiting condition among the applicable Contingencies and the base case. The CAISO will establish prices based on the parameter pricing specified in this Section as it applies to the most limiting Contingency and base case. The corresponding pricing parameter used in the RUC is set at the maximum RUC Availability Bid price specified in Section 39.6.1.2.

27.4.3.3.3 Insufficient Supply to Meet Self-Schedule Demand in IFM

In the IFM, when available supply is insufficient to meet all self-scheduled Demand, self-scheduled Demand is reduced to the point where the available supply is sufficient to clear the market. For price-setting purposes in such cases, the cleared self-scheduled Demand is deemed to be willing to pay the Hard Energy Bid Cap price.

27.4.3.3.4 Insufficient Supply to Meet CAISO Forecast of CAISO Demand in the RTM

In the RTM, in the event that Energy offers are insufficient to meet the CAISO Forecast of CAISO Demand, the SCUC and SCED software will relax the system energy-balance constraint. In such cases, for price-setting purposes the software utilizes a pricing parameter set to

- (a) the highest-priced cleared Economic Bid if the infeasibility detected in the scheduling run does not exceed the Constraint Relaxation Threshold, but no less than the Soft Energy Bid Cap price; or
- (b) the Hard Energy Bid Cap price if the infeasibility detected in the scheduling run exceeds the Constraint Relaxation Threshold.

27.4.3.54 Protection of TOR, ETC and Converted Rights Self-Schedules in the IFM

In accordance with the submitted and accepted TRTC Instructions, valid Day-Ahead TOR Self-Schedules, Day-Ahead ETC Self-Schedules and Day-Ahead Converted Rights Self-Schedules shall not be adjusted in the IFM in response to an insufficiency of Effective Economic Bids. The scheduling parameters associated with the TOR, ETC, or Converted Rights Self-Schedules will be set to values higher than the scheduling parameter associated with relaxation of an enforced internal and Intertie Transmission Constraint as specified in Section 27.4.3.24, so that when there is a congested Transmission Constraint that would otherwise subject a Supply or Demand resource submitted in a valid and balanced ETC, TOR or Converted Rights Self-Schedule to adjustment in the IFM, the IFM software will relax the Transmission Constraint rather than curtail the TOR ~~or, ETC, or Converted Rights~~ Self-Schedule. This priority will be adhered to by the operation of the IFM Market Clearing software, and if necessary, by adjustment of Schedules after the IFM has been executed and the results have been reviewed by the CAISO operators.

27.4.3.65 Effectiveness Threshold

The CAISO Markets software includes a lower effectiveness threshold setting that governs whether the software will consider a bid “effective” for managing congestion on a congested Transmission Constraint, which in the case of Nomograms will be applied to the individual flowgates that make up the Nomogram, rather than to the Nomogram itself. The CAISO will set this threshold at two percent (2%).

* * * * *

30.5.2.4 Supply Bids for System Resources

In addition to the common elements listed in Section 30.5.2.1, Supply Bids for Resource-Specific System Resources shall also contain Start-Up Bids and Minimum Load Bids. Resource-Specific System Resources are subject to the Proxy Cost methodology or the Registered Cost methodology for Default Start-Up Bids and Default Minimum Load Bids as provided in Section 30.4, and Transaction ID as created by the CAISO. Other System Resources are not eligible to recover Start-Up Costs and Minimum Load Costs. Resource-Specific System Resources are eligible to participate in the Day-Ahead Market on an equivalent basis as Generating Units and are not obligated to participate in RUC or the RTM if the

resource did not receive a Day-Ahead Schedule unless the resource is a Resource Adequacy Resource. If the Resource-Specific System Resource is a Resource Adequacy Resource, the Scheduling Coordinator for the resource is obligated to make it available to the CAISO Market as prescribed by Section 40.6. Dynamic Resource-Specific System Resources are also eligible to participate in RTM on an equivalent basis as Generating Units. The quantity (in MWh) of Energy categorized as Interruptible Imports (non-firm imports) can only be submitted through Self-Schedules in the Day-Ahead Market and cannot be incrementally increased in the RTM. Bids submitted to the Day-Ahead Market for ELS Resources will be applicable for two days after they have been submitted and cannot be changed the day after they have been submitted. Bids for System Resources that exceed the Soft Energy Bid Cap are subject to the rules in Sections 30.7.12, as applicable.

* * * * *

30.5.8 Demand Bids, Export Bids, Virtual Bids, and Bids for Non-Resource-Specific System Resources Above the Soft Energy Bid Cap

30.5.8.1 Day-Ahead Market.

Scheduling Coordinators may submit Demand Bids, Export Bids, Virtual Bids, and Bids for Non-Resource-Specific System Resources above the Soft Energy Bid Cap, not to exceed the Hard Energy Bid Cap, for any Trading Hour of the DAM in which the CAISO has accepted a Bid with an Energy Bid price that exceeds the Soft Energy Bid Cap pursuant to Section 30.7.12, or the Maximum Import Bid Price exceeds the Soft Energy Bid Cap.

30.5.8.2 Real-Time Market.

Scheduling Coordinators may submit Demand Bids, Export Bidss, Virtual Bids, and Bids for Non-Resource-Specific System Resources above the Soft Energy Bid Cap, not to exceed the Hard Energy Bid Cap, for any Trading Hour of the Real-Time Market in which—

- (a) The conditions in Section 30.5.8.1 applied to the same Trading Hours of the Day-Ahead Market; or
- (b) The CAISO has accepted a Bid for the applicable Trading Hour of the Real-Time Market with an Energy Bid price that exceeds the Soft Energy Bid Cap pursuant to Section

30.7.12, or the Maximum Import Bid Price exceeds the Soft Energy Bid Cap.

* * * * *

30.7.12 Validation of Bids in Excess of Soft Energy Bid Cap, Hard Energy Bid Cap, or Minimum Load Cost Hard Cap

30.7.12.1 Generally

Except as otherwise stated in this Section 30.7.12, the validation rules in this Section 30.7.12 apply to all Energy Bids and Minimum Load Bids submitted by Scheduling Coordinators. The provisions of Sections 30.7.12.1 through 30.7.12.4 do not apply to Virtual Bids and Energy Bids submitted for Non-Resource-Specific System Resources; the provisions of Section 30.7.12.5 apply to Virtual Bids and Energy Bids submitted for Non-Resource-Specific System Resources. The CAISO will allow Bids for Non-Resource-Specific System Resources that are Resource Adequacy Resources and that exceed the Soft Energy Bid Cap subject to the Bid price screens described in Section 30.7.12.5.1. The CAISO will allow Virtual Bids, Export Bids, Demand Bids, and Bids for Non-Resource-Adequacy System Resources that are not Resource Adequacy Resources and that exceed the Soft Energy Bid Cap subject to the rules specified in Section 30.7.12.5.2. The CAISO will reject Virtual Bids, Export Bids, Demand Bids, and Bids for Non-Resource-Specific System Resources that exceed the Hard Energy Bid Cap.

30.7.12.2 Energy Bids that Exceed the Soft Energy Bid Cap

In addition to all other Bid validation rules that apply to Energy Bids, if a Scheduling Coordinator submits an Energy Bid price that exceeds the Soft Energy Bid Cap, the CAISO will modify the Energy Bid price for purposes of clearing the relevant CAISO Market Process to the higher of the Soft Energy Bid Cap or the resource's Default Energy Bid as modified pursuant to a Reference Level Change Request pursuant to Section 30.11.

30.7.12.3 Energy Bids that Exceed the Hard Energy Bid Cap and Minimum Load Bids that Exceed the Minimum Load Cost Hard Cap

All Energy Bid prices and Minimum Load Bid prices used in the CAISO Market Processes shall not exceed the Hard Energy Bid Cap or the Minimum Load Cost Hard Cap, respectively.

30.7.12.4 After-Market Cost Recovery

For any Energy Bid, except for Energy Bids for Non-Resource-Specific System Resources, Virtual Bids,

Export Bids, Demand Bids, or Minimum Load Bid price submitted above the Energy Bid price or the Minimum Load Bid the CAISO uses in the CAISO Market Processes, the Scheduling Coordinators may be eligible for after-market cost recovery pursuant to Section 30.12.

30.7.12.5 Virtual Bids, Export Bids, Demand Bids, and Bids for Non-Resource-Specific System Resources

~~The CAISO will reject Virtual Bid prices and Bids for Non-Resource-Specific System Resources that exceed the Hard Energy Bid Cap.~~

30.7.12.5.1 Bids for Non-Resource-Specific System Resources that are Resource Adequacy Resources

~~The CAISO will reduce Bids for Non-Resource-Specific System Resources that are Resource Adequacy Resources that exceed the Maximum Import Bid Price to the greater of the Soft Energy Bid Cap, the Maximum Import Bid Price, or the highest-priced Energy Bid from a Resource-Specific System Resource that the CAISO has accepted for the applicable Trading Hour pursuant to Section 30.7.12.2.~~

30.7.12.5.2 Virtual Bids, Export Bids, Demand Bids, and Bids for Non-Resource-Specific System Resources that are not Resource Adequacy Resources

~~The CAISO will accept Virtual Bids, Export Bids, Demand Bids, and Bids for Non-Resource-Specific System Resources that are not Resource Adequacy Resources that exceed the Soft Energy Bid consistent with the conditions specified in Section 30.5.8. The CAISO will not accept Export Bids, Demand Bids, Virtual Bids, or Bids for Non-Resource-Specific System Resources that are not Resource Adequacy Resources that exceed the Hard Energy Bid Cap.~~

30.7.12.5.3 Maximum Import Bid Price

~~The CAISO calculates hourly Maximum Import Bid Prices for the Day-Ahead Market and Real-Time Market, separately, including for on-peak and off-peak hours. The CAISO calculates the Maximum Import Bid Price as 110 percent of the greater of the published bilateral electric index prices for the Mid-Columbia or Palo Verde trading hub locations, multiplied by an hourly shaping ratio. As detailed in the CAISO Business Practice Manual, the CAISO calculates the hourly shaping ratio for each hour by dividing the Day-Ahead Market System Marginal Energy Cost for the CAISO Balancing Authority Area in that hour of a previous representative Trading Day by the average Day-Ahead Market System Marginal Energy Cost for the CAISO Balancing Authority Area in all on-peak hours of the same previous representative Trading Day. If for any given Trading Hour the CAISO cannot calculate the Maximum~~

Import Bid Price, the applicable Maximum Import Bid Price will be the most recently available calculated Maximum Import Bid Price.

* * * * *

31.6 Timing of Day-Ahead Scheduling

31.6.1 Criteria for Temporary Waiver of Timing Requirements

The CAISO may at its sole discretion implement any temporary variation or waiver of the timing requirements of this Section 31 and Section 6.5.3 (including the omission of any step) if any of the following criteria are met:

- (i) such waiver or variation of timing requirements is reasonably necessary to preserve System Reliability, prevent an imminent or threatened System Emergency or to retain Operational Control over the CAISO Controlled Grid during an actual System Emergency;
- (ii) because of error or delay, the CAISO requires additional time to fulfill its responsibilities;
- (iii) problems with data or the processing of data cause a delay in receiving or issuing Bids or publishing information on the CAISO's secure communication system; ~~and~~
- (iv) problems with telecommunications or computing infrastructure cause a delay in receiving or issuing Day-Ahead Schedules or publishing information on the CAISO's secure communication system; or
- (v) additional time is needed to allow for the submission of Bids in the event that the conditions specified in Section 30.5.8 change prior to the Market Close, and may require the resubmission of Bids consistent with the changed bidding requirements.

* * * * *

34.10 Dispatch of Energy from Ancillary Services

The CAISO may issue Dispatch Instructions to Participating Generators, Participating Loads, Proxy Demand Resources, (via communication with the Scheduling Coordinators of Demand Response

Providers) System Units and System Resources contracted to provide Ancillary Services (either procured through the CAISO Markets, Self-Provided by Scheduling Coordinators, or through Exceptional Dispatch or dispatched in accordance with a Legacy RMR Contract) for the Supply of Energy. During normal operating conditions, the CAISO may Dispatch those Participating Generators, Participating Loads, Proxy Demand Resources, System Units and System Resources that have contracted to provide Spinning and Non-Spinning Reserve, except for those reserves designated as Contingency Only, in conjunction with the normal Dispatch of Energy. Contingency Only reserves are Operating Reserve capacity that have been designated, either by the Scheduling Coordinator or the CAISO, as available to supply Energy in the Real-Time only in the event of the occurrence of an unplanned Outage, a Contingency or an imminent or actual System Emergency. During normal operating conditions, the CAISO may also elect to designate any reserve not previously identified as Contingency Only by Scheduling Coordinator as Contingency Only reserves. In the event of an unplanned Outage, a Contingency or a threatened or actual System Emergency, the CAISO may dispatch Contingency Only reserves. If Contingency Only reserves are dispatched through the RTCD, which as described in Section 34.5.2 only Dispatches in the event of a Contingency, such Dispatch and pricing will be based on the original Energy Bids. If Contingency Only reserves are dispatched in response to a System Emergency that has occurred because the CAISO has run out of Economic Bids when no Contingency event has occurred, the RTED will Dispatch such Contingency Only reserves using the ~~Soft Hard~~ Energy Bid Cap as the Energy Bids for such reserves and will set prices accordingly. For CAISO Market intervals for which the conditions and parameters specified in Section 27.4.3.3 apply, the RTED will Dispatch such Contingency Only reserves using the Hard Energy Bid Cap as the Energy Bids for such reserves and will set prices accordingly. If a Participating Generator, Participating Load, System Unit or System Resource that is supplying Operating Reserve is dispatched to provide Energy, the CAISO shall replace the Operating Reserve as necessary to maintain NERC and WECC reliability standards, including any requirements of the NRC. If the CAISO uses Operating Reserve to meet Real-Time Energy requirements, and if the CAISO needs Operating Reserves to satisfy NERC and WECC reliability standards, including any requirements of the NRC, the CAISO shall restore the Operating Reserves to the extent necessary to meet NERC and WECC reliability standards, including any requirements of the NRC through either the procurement of additional Operating Reserve in the RTM

or the Dispatch of other Energy Bids in SCED to allow the resources that were providing Energy from the Operating Reserve to return to their Dispatch Operating Target. The Energy Bid Curve is not used by the AGC system when Dispatching Energy from Regulation. For Regulation Up capacity, the upper portion of the resource capacity from its Regulation Limit is allocated to Regulation regardless of its Energy Bid Curve. For a resource providing Regulation Up or Operating Reserves the remaining Energy Bid Curve shall be allocated to any RTM AS Awards in the following order from higher to lower capacity where applicable: (a) Spinning Reserve; and (b) Non-Spinning Reserve. For resources providing Regulation Up, the applicable upper Regulation Limit shall be used as the basis of allocation if it is lower than the upper portion of the Energy Bid Curve. The remaining portion of the Energy Bid Curve, if there is any, shall constitute a Bid for RTM Energy. For Regulation Down capacity, the lower portion of the resource capacity from its applicable Regulation Limit is allocated to Regulation regardless of its Energy Bid Curve.

* * * * *

Appendix A

Master Definitions Supplement

* * * * *

- Constraint Relaxation Threshold

A MW threshold value used to determine when the parameters specified in Section 27.4.3.3.4 will trigger in each Balancing Authority Area participating in the CAISO Markets to account for small supply shortfalls configured based on the Balancing Authority Area's BAL-001-2 Requirement R2, calculated by the CAISO annually. The CAISO will post the annual values for each Balancing Authority Area on the CAISO Website or its OASIS.

* * * * *

- Hard Energy Bid Cap

The maximum Energy Bid Price the CAISO will use for purposes of clearing the CAISO Market Processes. The Hard Energy Bid Cap is \$2,000 per MWh.

* * * * *

- Maximum Import Bid Price

An index-based price used to screen Bids by Non-Resource-Specific System resources that are Resource Adequacy Resources that exceed the Soft Energy Bid Cap.

* * * * *

- Scarcity Reserve Demand Curve Values

Fixed percentages of the Soft Energy Bid Cap or Hard Energy Bid Cap reflected in the Scarcity Reserve Demand Curve that the CAISO uses to calculate Ancillary Service Shadow Prices for Regulation Up, Spinning Reserve, Non-Spinning Reserve and Regulation Down from which the CAISO determines Ancillary Service Marginal Prices when there is insufficient supply in an Ancillary Service Region or Sub-Region to meet an Ancillary Services minimum procurement requirement.

* * * * *

- Soft Energy Bid Cap

The maximum Energy Bid price submitted by Scheduling Coordinators for resources, ~~except for Virtual Bids and Bids for Non-Resource-Specific System Resources,~~ the CAISO will use for purposes of clearing the CAISO Market Processes without cost verification pursuant to Section 30.11. The Soft Energy Bid Cap is \$1,000 per MWh.

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Attachment D

Revised Final Proposal

**Tariff Amendment to Enhance Market Parameters and
Import Bidding Related to Order No. 831**

California Independent System Operator Corporation

February 22, 2021



California ISO

**FERC Order No. 831 –
Import Bidding and Market Parameters
Revised Final Proposal**

September 10, 2020

Prepared by:
Danielle Tavel

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Revision History

Date	Revision
08/24/2020	Initial Release
09/10/2020	Updated Section 4.1 to include provisions to only apply the pricing run threshold value in the real-time market and to apply the \$2,000/MWh power balance penalty price in the real-time market if it is in place in the day-ahead market. Updated Section 4.2.1 to reflect change of reducing resource-adequacy import bids to the greater of the CAISO-calculated maximum import bid price, the highest priced cost-verified bid for a resource-specific resource, or \$1,000/MWh.

1 Executive Summary

This initiative explores modifications related to the CAISO's compliance filing with Federal Energy Regulatory Commission (FERC) Order No. 831. In its compliance filing, the CAISO revised its tariff to raise the energy bid cap from \$1,000/MWh to \$2,000/MWh. It also revised its tariff to require suppliers within the CAISO balancing authority area that submit energy bids above \$1,000/MWh to base bids on verifiable actual or expected costs.¹ This initiative addresses modifications to two topics related to the changes the CAISO proposed to comply with Order No. 831:²

- The “penalty prices” at which the CAISO markets will relax market constraints under the increased energy bid cap in order to comply with FERC Order No. 831. The CAISO market uses these penalty prices or market constraint relaxation price parameters, to relax constraints in the market and set prices if needed to reach a solution. This includes the power balance constraint that requires supply to equal demand, which sets the system marginal energy cost under such conditions.
- A price-screening methodology for import bids greater than \$1,000/MWh.

FERC Order No. 831 requires RTOs/ISOs to verify costs underlying cost-based bids above \$1,000/MWh before a bid is used in the market. The order additionally provides for after-the-fact make-whole payments to the extent an RTO/ISO cannot verify a resource's costs before the market runs. The order did not require verification of import or virtual bids above \$1,000/MWh. However, the Commission indicated that it would consider proposals by RTOs/ISOs to verify or otherwise review the costs of imports or exports and/or develop additional mitigation provisions for import and export transactions above \$1,000/MWh.³

Similarly, Order No. 831 did not specify how the RTO/ISO should set its market constraint relaxation prices (also referred to as penalty prices) to be consistent with the increased bid cap. However, it stated an RTO/ISO may file, pursuant to section 205 of the Federal Power Act, to propose modifications to shortage prices or other market elements that require revision in light of the offer cap.⁴ The CAISO intends to present its proposal to FERC in a separate filing, under section 205 of the Federal Power Act, consistent with FERC's direction.

¹ FERC Order No. 831 available at <https://cms.ferc.gov/sites/default/files/whats-new/comm-meet/2016/111716/E-2.pdf>

² Note that this document addresses these topics in different order than the revised straw proposal.

³ FERC Order No. 831 at p. 197 available at <https://cms.ferc.gov/sites/default/files/whats-new/comm-meet/2016/111716/E-2.pdf>

⁴ FERC Order No. 831 at p. 213 available at <https://cms.ferc.gov/sites/default/files/whats-new/comm-meet/2016/111716/E-2.pdf>

FERC Order No. 831 - Import Bidding and Market Parameters
Final Proposal

In the CAISO's proposed tariff changes to comply with FERC Order No. 831⁵, it did not propose to cost-verify non-resource specific import bids and proposed to allow suppliers to submit such import bids up to \$2,000/MWh.⁶ The CAISO also proposed to set the market constraint relaxation penalty prices relative to the new \$2,000/MWh bid cap in all market intervals. Subsequently, the CAISO initiated this policy initiative to explore alternative approaches to these topics. In January 2020, the CAISO notified FERC that it would extend implementation of its compliance with Order No. 831 to fall 2021 to allow more time for policy development and implementation resulting from this policy initiative.

The CAISO proposes to set the power balance penalty price used by the market to \$2,000/MWh, and scale related price parameters accordingly, only for those intervals in which verified energy costs are greater than \$1,000/MWh. Specifically, it will use these higher priced parameters only when (1) there is a submitted and cost-verified energy bid from a resource-specific resource greater than \$1,000/MWh or (2) a CAISO-calculated "maximum import bid price," used to screen the costs of imports, is greater than \$1,000/MWh. Resource-specific resources include CAISO generating units, EIM participating resources, and resource-specific import bids.⁷

When the market uses the penalty prices scaled to a \$2,000/MWh power balance penalty price and must relax the power balance constraint, the CAISO proposes to set energy prices based on the amount of the shortfall in supply to meet demand. If the system wide shortfall is no more than a calculated threshold value based on the NERC BAL-001-2 BAAL_{Low} limit, then the market will set energy prices based on the price of the highest-priced cleared economic bid. Otherwise, the market will set prices based on the \$2,000/MWh power balance penalty price. This design reflects that small supply shortfalls do not represent actual shortages.

The CAISO proposes using a variation of the NERC BAL-001-2 BAAL_{Low} limit as the threshold value for each balancing authority area in the EIM. This objective threshold value represents the amount of supply that can be less than load while still maintaining system frequency within reliability criteria.⁸

⁵ Submitted in September 2019.

⁶ As part of the CAISO compliance to Order No. 831, the CAISO has already proposed to verify import bids from resource specific system resources' costs similarly to the cost-verification for internal resources' energy bids. See CAISO Order No. 831 Compliance Filing, transmittal letter at pp. 10-11. <http://www.caiso.com/Documents/Sep52019-TariffAmendment-OrderNo831ComplianceFiling-ER19-2757.pdf>

⁷ A resource-specific system resource, a term used in the CAISO tariff, is a resource with specific generation design characteristics registered in Master File and modeled as either a generating unit or a system resource. A list of import tariff definitions can be found here: <http://www.caiso.com/InitiativeDocuments/ImportTariffMatrix-Feb042020.xlsx>

⁸ Appendix A discusses the calibrations necessary for all penalty prices or ancillary services scarcity prices that are tied to the maximum energy bid price as described in the tariff and BPMs. The CAISO proposes to scale ancillary services scarcity prices relative to \$2,000/MWh when there are bids greater than \$1,000/MWh. This is the same approach for when bids are below \$1,000/MWh.

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The CAISO proposes to calculate and publish the threshold values for each balancing authority area yearly as the NERC defined Frequency Bias Setting amounts for each balancing authority area are updated.

Regarding the second topic this policy initiative addresses, this final proposal presents a methodology to price screen non-resource specific import bids greater than \$1,000/MWh. This methodology differs from what the CAISO has recently filed with FERC for cost-verifying energy bids for resource-specific resources.⁹ Rather than verifying actual or expected operating costs, as the CAISO will do for resource-specific resources, the CAISO proposes to calculate a “maximum import bid price” that it will use to screen non-resource specific import bids. The CAISO will calculate this maximum import bid price based on published bilateral energy price indices. Under this approach, the CAISO market will only accept import bids priced higher than \$1,000/MWh in periods when the CAISO-calculated maximum import bid price is also greater than \$1,000/MWh.

The import bid price screening will apply differently to non-resource specific import bids providing resource adequacy capacity than it will to those not providing resource adequacy capacity. The CAISO market will reduce resource adequacy non-resource specific import bids priced higher than \$1,000/MWh to the greater of the CAISO-calculated maximum import bid price, the highest-priced cost verified bid or \$1,000/MWh.

The CAISO market will not reduce the price of non-resource adequacy non-resource specific import bids higher than \$1,000/MWh. However, the CAISO will only accept these bids when the maximum import bid price is greater than \$1,000/MWh or there is a cost-verified resource-specific bid greater than \$1,000/MWh. When either of these conditions exist, the market will accept non-resource adequacy non-resource specific import bids up to \$2,000/MWh.

Similarly, the CAISO market will only accept virtual bids greater than \$1,000/MWh in the event the maximum import bid price is greater than \$1,000/MWh or there is a cost-verified resource-specific bid greater than \$1,000/MWh. This rule is necessary because as a result of the penalty pricing proposal, the CAISO market cannot accept import bids or virtual bids greater than \$1,000/MWh when the power balance penalty price is \$2,000/MWh. This will only be when the CAISO-calculated maximum import bid price is greater than \$1,000/MWh or there is a cost-verified resource-specific bid greater than \$1,000/MWh. The market will not clear bids greater than \$1,000/MWh when the power balance penalty price is set at \$1,000/MWh.

⁹ The cost-verification approach for resource-specific resources was developed in the *Commitment Cost and Default Energy Bid Enhancements* policy initiative and was recently submitted to the FERC in Docket ER20-2360, available at <http://www.caiso.com/Documents/Jul9-2020-TariffAmendment-CommitmentCostsandDefaultEnergyBidEnhancementsCCDEBE-ER20-2360.pdf>.

2 Background

In 2016, the Federal Energy Regulatory Commission (FERC) issued FERC Order No. 831 that required Independent System Operators and Regional Transmission Organizations (ISOs/RTOs) to revise their tariffs to raise the energy bid cap from \$1,000/MWh to \$2,000/MWh, and generally required suppliers that submit bids above \$1,000/MWh to base those bids on verifiable costs. The rule changes in Order No. 831 created a structure where internal supply offers above \$1,000/MWh are effectively automatically mitigated to an amount equal to a supplier's expected or actual costs.

Order No. 831 required that ISOs verify the costs underlying these cost-based offers above \$1,000/MWh before an offer could be used to calculate energy prices. If an ISO could not verify the costs underlying the offer before the market clearing process begins then that offer may not be used to calculate energy prices. However, the supplier may be eligible for an after-the-fact make-whole payment if the resource is dispatched and the resource's costs can be verified after-the-fact. Suppliers will also be eligible for make-whole payments if the ISO dispatches a resource and its verified cost-based incremental energy bid exceeds \$2,000/MWh. The order did not require verification of import or virtual bids above \$1,000/MWh. However, the Commission indicated that it would consider proposals by RTOs/ISOs to verify or otherwise review the costs of imports or exports and/or develop additional mitigation provisions for import and export transactions above \$1,000/MWh.¹⁰

Similarly, Order No. 831 did not specify how the RTO/ISO should set its penalty prices but indicated an RTO/ISO may file, pursuant to section 205 of the Federal Power Act, to propose modifications to shortage prices or other market elements that require revision in light of the offer cap.¹¹

The CAISO submitted its proposed tariff changes to comply with FERC Order No. 831 in September 2019 and proposed that they go into effect in fall 2020. In its proposed tariff changes,¹² the CAISO did not submit a separate filing requesting authority to cost-verify or price screen import bids above \$1,000/MWh. However, the CAISO decided to further address this topic in this initiative because of the CAISO balancing authority area's increasing dependence on imports.

In addition, a number of stakeholders objected to continuing to set the power balance penalty price at the hard energy bid cap, which under Order No. 831 increases from \$1,000/MWh to \$2,000/MWh. This would result in market prices being set to

¹⁰ FERC Order No. 831 at p. 197 available at <https://cms.ferc.gov/sites/default/files/whats-new/comm-meet/2016/111716/E-2.pdf>

¹¹ FERC Order No. 831 at p. 213 available at <https://cms.ferc.gov/sites/default/files/whats-new/comm-meet/2016/111716/E-2.pdf>

¹² Developed in the CAISO's Commitment Cost and Default Energy Bid Enhancements (CCDEBE) stakeholder initiative available at <http://www.caiso.com/StakeholderProcesses/Commitment-costs-and-default-energy-bid-enhancements>.

\$2,000/MWh if the market has to relax the power balance constraint. Consequently, this initiative also addresses this topic.

In January 2020, the CAISO notified FERC that it would likely extend implementation of its Order No. 831 compliance requirements to fall 2021 to allow more time for policy development and implementation resulting from this policy initiative.¹³

3 Stakeholder Comments and Changes from the Draft Final Proposal

The CAISO appreciates the written stakeholder comments received in response to this initiative's revised draft final proposal and the subsequent stakeholder call. The following summarizes these comments and the changes resulting from them.

Power Balance Constraint Relaxation Pricing Comments and Changes

In the revised draft final proposal, the CAISO proposed that the market would set energy prices based on the amount of shortfall in supply to meet demand when the market must relax the power balance constraint and there are energy costs greater than \$1,000/MWh. In this event, the market uses constraint penalty prices scaled to a \$2,000/MWh power balance penalty price and would otherwise set prices based on the \$2,000/MWh power balance penalty price. The CAISO proposed to compare shortfall amounts to a threshold value based on operators' good utility practices of managing the real-time balancing of their respective balancing authority area.

Stakeholders generally supported the CAISO's proposal to scale penalty prices to the \$2,000/MWh power balance penalty price only during market intervals when verified energy costs are greater than \$1,000/MWh. However, some stakeholders opposed the CAISO's proposal to use threshold values based on each balancing authority area's good utility practice. They pointed out that this is a subjective value that has no significant reliability justification and would be difficult to validate.

EIM entities were supportive of the CAISO's proposal to avoid setting energy prices based on the \$2,000/MWh power balance penalty price when there are small shortages or infeasibilities; however, they maintained that the CAISO's characterization of shortages was not accurate. They noted that intervals in which shortages exist are associated with an inability to maintain operating reserves, rather than intervals in which operators need to take action. Further, they stated that when EIM balancing authority area operators need to take action to resolve shortfalls in supply to meet demand, they do so based on the NERC defined control performance criteria. Therefore, they recommended the CAISO implement a threshold value consistent with NERC reliability

¹³ See CAISO Motion for Leave to Answer and Supplemental Answer of the California Independent System Operator Corporation to Comments and Limited Protest, FERC Docket No. ER19-2757, at page 3-5 (January 31, 2020) (available at: <http://www.caiso.com/Documents/Jan31-2020-SuppAnswer-to-Comments-Order831Compliance-ER19-2757.pdf>)

requirements that is indicative of true shortage conditions. They stated this would provide an objective threshold value based on each balancing authority area's characteristics.

A stakeholder urged the CAISO to simply scale penalty prices to the \$2,000/MWh power balance penalty price regardless of the size of the infeasibility. It advocated that the current practice of setting penalty prices to the current bid cap of \$1,000/MWh when the power balance constraint is relaxed is not based on the size of infeasibilities and, therefore, doing so would be inconsistent with the existing practice.

Additionally, a stakeholder recommended that penalty prices should be scaled relative to \$2,000/MWh in any interval when there is a power balance constraint infeasibility greater than the threshold, irrespective of there being verified energy costs greater than \$1,000/MWh. It contended that limiting penalty pricing based on the presence of verified energy costs being greater than \$1,000/MWh will lead to arbitrary price differences.

Market Surveillance Committee (MSC) members expressed the opinion that using the highest-priced cleared economic bid to set energy prices may not send an appropriate shortage price signal to the market. They pointed out that under the current market design, when the market has to relax the power balance constraint, it sets prices at \$1,000/MWh, which can be greater than the last economic bid. The MSC members advocated that shortage price signals provide incentives for flexible resources and will help ensure that imports are delivered.

Based on consideration of all of these comments, in this final proposal the CAISO proposes to only scale the market constraint penalty prices in the relative to a \$2,000/MWh power balance penalty price used for the pricing run during intervals when verified energy costs are greater than \$1,000/MWh. When penalty prices are scaled to a \$2,000/MWh power balance penalty price and there is a power balance constraint infeasibility, the CAISO proposes to set energy prices in the pricing run based on the amount of shortfall in supply to meet demand. For each balancing authority area the market will compare shortfall amounts to a threshold value based the BAL-001-2 BAAL_{Low} limit, which incorporates an annually updated frequency bias term unique to each balancing authority area.

This proposed threshold value represents the amount of supply that can be less than load while still maintaining system frequency within reliability criteria. Frequency is related to the balance of supply and load. System frequency is maintained by matching supply to demand. However, small mismatches and resulting differences in frequency from the desired 60 Hz are acceptable. Consequently, this threshold value is intended to account for small supply shortfalls for which it is not appropriate to send the strong shortage pricing signal that setting prices based on \$2,000/MWh would. These small

apparent shortfalls may not actually represent actual shortfalls because of forecast and modeling inaccuracies.

The CAISO continues to assert that \$2,000/MWh is far greater than prices and the bid cap under typical conditions and it is appropriate that there be additional measures to ensure a supply shortfall is real and significant before setting prices based on \$2,000/MWh. This is aligned with the FERC Order No. 831 policy direction that established additional measures for bids above \$1,000/MWh as such costs would not be expected under most conditions.

The CAISO proposes to maintain its approach to relax the power balance constraint before pricing the power balance penalty price at \$2,000/MWh. If the system wide shortfall is, for example, no more than the calculated threshold value of 233.7 MW, then the market will set energy prices based on the price of the highest-priced cleared economic bid. Otherwise, the market will set prices based on the \$2,000/MWh power balance penalty price.

This proposal also addresses an unintended consequence under a previous approach that did not have a threshold value for setting prices at the highest-priced cleared bid. This unintended consequence was that it may have set the energy price in the pricing run at a value less than the current \$1,000/MWh power balance penalty price when market constraint penalty prices are scaled to \$2,000/MWh.

Finally, multiple stakeholders recommend the CAISO focus its efforts on accurately reflecting scarcity pricing conditions in the market. They suggest the CAISO prioritize a separate scarcity pricing stakeholder effort to adopt scarcity pricing market design mechanisms.

The CAISO acknowledges the concerns stakeholders have regarding scarcity pricing, and is addressing these as part of the Flexible Ramping Product (FRP) Refinements initiative. Additionally, concerns will be addressed in Bundle 3 of the Extended Day-Ahead Market (EDAM) initiative or in a separate stakeholder initiative.¹⁴ Within the FRP refinements initiative, the CAISO is proposing to make the flexible ramping product nodal-based, which will increase the utilization and deployment of this product. This will ensure the power balance constraint is not triggered prior to the flexible ramping product constraints being fully relaxed, because it will ensure the resources awarded flexible ramping product are accessible. When the flexible ramping product requirements are relaxed, the demand curve price gradually increases the energy price above the marginal energy offer. As the requirement relaxation increases, the energy price increases to higher levels prior to relaxing the power balance constraint. The power

¹⁴ Information on the CAISO's Flexible Ramping Product Refinements initiative is available at: <http://www.caiso.com/StakeholderProcesses/Flexible-ramping-product-refinements>.
Information on the CAISO's Extended Day-Ahead Market initiative is available at: <http://www.caiso.com/StakeholderProcesses/Extended-day-ahead-market>

balance penalty price is only triggered after the full flexible ramping product requirement cannot be met.

In Bundle 3 of the EDAM initiative, which is scheduled to begin in Q2 2021, the CAISO will explore enhancing its market's scarcity pricing provisions. The scope of these enhancements will be defined at the onset of that part of the initiative.

Import Bid Cost Verification Requirements Comments and Changes

In this initiative's revised draft final proposal, the CAISO proposed to price-screen all import bids greater than \$1,000/MWh using a CAISO-calculated "maximum import bid price" based on published electrical price indices. The CAISO proposed to calculate a single maximum import bid price based on the maximum of the Mid-C and Palo Verde bilateral electrical hub prices that was shaped by a previous days day-ahead SMEC. Additionally, the CAISO proposed to not attempt to verify the actual costs behind an import. The revised draft final proposal also proposed to apply the maximum import bid price to non-resource specific import bids and reduce any offer greater than the maximum import bid price or \$1,000/MWh. Finally, the revised draft final proposal proposed to not provide after-the fact cost recovery for import bids that were reduced.

Stakeholders continue to support the CAISO's intent to screen import bid prices greater than \$1,000/MWh. However, stakeholders differed on the type of imports that should be subject to price screening. Some stakeholders maintain all import resources, regardless of resource adequacy status should be screened using the maximum import bid price. They stated that limiting the bid price of only resource adequacy imports constitutes discriminatory treatment. Further, they stated that all imports should be subject to the price screen because the CAISO's *System Market Power Mitigation* initiative does not propose to mitigate imports.¹⁵ They maintain that all resources are necessary to promote real-time liquidity. On the other side, some stakeholders continue to maintain that "voluntary" non-resource adequacy import supply should not be subject to price screening. They stated it is not practical to develop a methodology that would accurately determine imports' actual costs. This is because the CAISO market does not link import bids to specific generators for which the CAISO would have information to estimate costs. In addition, the costs include opportunity costs that can be very subjective.

The CAISO depends on resource adequacy imports to meet its load, it is appropriate to have the same safeguards that are in place for internal resource adequacy resources to protect against unjustified prices greater than \$1,000/MWh. Non-resource adequacy imports do not have the same requirement to offer to the market that resource adequacy imports do. Because of this, importers may not offer to the CAISO market if

¹⁵ Information on the CAISO's System Market Power Mitigation initiative is available at: <https://stakeholdercenter.caiso.com/StakeholderInitiatives/System-market-power-mitigation>

they were faced with the risk of having their bid reduced below actual costs with no provisions for after-the-market cost recovery.

Consequently, in this final proposal, the CAISO continues to propose to only reduce resource adequacy import bids greater than \$1,000/MWh to a CAISO calculated price. The CAISO proposes this price to be to the higher of the CAISO-calculated maximum import bid price or the highest-priced cost verified bid for a resource-specific resource. The CAISO also maintains its proposal to not provide for after-the-fact cost recovery for import bids. This proposal will not have the effect of reducing the quantity of import supply because resource adequacy resources are required to offer these imports to the CAISO market. The CAISO does not believe this is discriminatory treatment because suppliers have the opportunity to take the potential to have an import bid reduced when negotiating resource adequacy contracts. Suppliers not providing resource adequacy capacity do not have this opportunity.

Although this proposal allows non-resource adequacy import bids not limited by the maximum import bid price to set prices, there are two factors to mitigate the risk that they will inappropriately inflate CAISO market prices. First, the market should be able to use only resource adequacy resources to meet CAISO balancing authority area demand. Limiting non-resource adequacy bids to a maximum import bid price would have the adverse effect of potentially discouraging non-resource adequacy imports that can supplement resource adequacy imports during very tight conditions. Second, the CAISO will only accept non-resource adequacy bids when the maximum import bid price is greater than \$1,000/MWh or there is a cost-verified resource-specific bid greater than \$1,000/MWh. When either of these conditions do not exist, the market will only accept non-resource adequacy non-resource specific import bids up to \$1,000/MWh.

Stakeholders also suggested modifications to the proposed maximum import bid price calculation. A stakeholder recommended the CAISO revert to the previous proposal of calculating two separate maximum import bid prices for the north and south interties, rather than calculating a single maximum import bid price to screen import and virtual bids greater than \$1,000/MWh. They maintained that when supply conditions are tight and bids are justified to be greater than \$1,000/MWh, importers cannot simply choose between importing from the north or south. They contend in these instances, importers cannot access transmission to choose where they import from.

Further, a stakeholder recommended the CAISO modify their proposal to use the day-ahead net load forecast to shape bilateral hub prices, instead of using a previous days day-ahead SMEC. They suggested the day-ahead net load forecast provides a more relevant depiction of prices and can be a more accurate indication of competitive conditions. Alternatively, this stakeholder suggested if using the day-ahead net load forecast is not an option for the CAISO, then using an average of the previous five days of day-ahead SMEC would provide a better indication of load conditions changing from

day to day rather than using a single day to shape bilateral prices. The CAISO notes that it had previously revised its approach to use SMEC rather than load based on suggestions that SMEC is a more direct indication of prices than load.

Market Surveillance Committee (MSC) members expressed the opinion that hourly price patterns are different on high price days (i.e. days when prices are greater than \$200/MWh). They suggested using previous high price days to shape the bilateral hub prices. The CAISO proposes to adopt this approach. Section 4.2.2 reflects these changes.

Based on consideration of these comments, in this final proposal the CAISO proposes to maintain the proposal to calculate a single maximum import bid price to screen import and virtual bids greater than \$1,000/MWh. The use of bilateral price indices and the shaping factor provide an approximate indication of hourly prices. The CAISO proposes to use the higher bilateral hub price to ensure it does not overly constrain import bids.

4 Proposal

This section describes the CAISO's proposal for setting market prices when the market must relax the power balance constraint, as well as associated rules for setting market constraint relaxation price parameters, in the context of the \$2,000/MWh hard energy bid cap. It also describes the CAISO's proposal for price screening import bids priced greater than \$1,000/MWh.

The CAISO proposes to set the power balance penalty price used by the market in its pricing to \$2,000/MWh, and scale related price parameters accordingly, only during periods when energy costs are greater than \$1,000/MWh.

When the market uses the penalty prices scaled to a \$2,000/MWh power balance penalty price and must relax the power balance constraint, the CAISO proposes to set energy prices based on the amount of the shortfall in supply to meet demand. The CAISO proposes using a variation of the NERC defined BAL-001-2 BAAL_{Low} limit as an appropriate threshold for each balancing authority area. This objective value represents the amount that supply can be less than load while still maintaining system frequency within reliability criteria.

The CAISO proposes to price screen import bids greater than \$1,000/MWh to determine the bids used by the CAISO market. The CAISO proposes to calculate a "maximum import bid price" that it will use to screen import bids, calculated based on published bilateral energy price indices.

The CAISO market will only accept import bids priced greater than \$1,000/MWh in periods in which the CAISO-calculated maximum import bid price is greater than \$1,000/MWh or a cost-verified energy bid for a resource-specific resource is greater

than \$1,000/MWh. In this event, the market will reduce resource adequacy import bids above \$1,000/MWh to the CAISO-calculated maximum import bid price, the highest-priced cost verified bid for a resource-specific resource or to \$1,000/MWh, whichever is higher. In this event, the market will accept non-resource adequacy import bids and virtual bids up to \$2,000/MWh.¹⁶

4.1 Power Balance Constraint Relaxation Pricing and Constraint Penalty Prices

The CAISO tariff specifies the relevant scheduling and pricing parameters that apply when the CAISO market must relax a constraint to reach a feasible solution.¹⁷

The power balance constraint ensures that the sum of generation and imports equals the sum of demand, including exports and transmission losses.¹⁸ The shadow price of the power balance constraint establishes the system marginal energy cost, which the market uses to determine locational marginal prices. Today, this constraint is set to the maximum energy bid price (the “hard” bid cap) of \$1,000/MWh in the pricing run. This allows for bids to clear up to the hard bid cap.

The tariff also specifies the scheduling and pricing parameters for relaxing transmission constraints,¹⁹ the pricing parameters when there is insufficient supply to meet demand (power balance constraint),²⁰ ancillary services scarcity pricing,²¹ and for protecting existing contracts and transmission ownership rights.²² These parameters, included in Appendix A, are established based on the existing \$1,000/MWh maximum bid price market participants can submit to the CAISO markets. The Market Operations Business Practice Manual (BPM) documents the full set of scheduling and pricing parameters used in the various markets that are calibrated based on the values set in the CAISO tariff.²³

The additional pricing parameters outlined in the BPM and included in Appendix A, are associated with constraints in the optimization and govern the conditions under which constraints may be relaxed and the setting of market prices when any constraints are

¹⁶ Likewise, the CAISO will only accept physical demand and export bids above \$1,000/MWh when one of these conditions is met.

¹⁷ See Section 27.4.3 of the CAISO tariff available at <http://www.caiso.com/Documents/Section27-CAISOMarkets-Processes-asof-Aug12-2019.pdf>.

¹⁸ See Appendix C Part B of the CASIO tariff available at <http://www.caiso.com/Documents/AppendixC-LocationalMarginalPrice-asof-Aug1-2019.pdf#search=power%20balance%20constraint>.

¹⁹ See Sections 27.4.3.1 and 27.4.3.2 of the CAISO tariff available at <http://www.caiso.com/Documents/Section27-CAISOMarkets-Processes-asof-Aug12-2019.pdf>.

²⁰ See Sections 27.4.3.3 and 27.4.3.4 of the CAISO tariff available at <http://www.caiso.com/Documents/Section27-CAISOMarkets-Processes-asof-Aug12-2019.pdf>.

²¹ See Section 27.1.2 and its subsections of the CAISO tariff available at http://www.caiso.com/Documents/Section27_CAISOMarkets_Processes_Jan28-2020.pdf.

²² See Section 27.4.3.5 of the CAISO tariff available at <http://www.caiso.com/Documents/Section27-CAISOMarkets-Processes-asof-Aug12-2019.pdf>.

²³ Additional information is available in the Business Practice Manual for Market Operations available at https://bpmcm.caiso.com/BPM%20Document%20Library/Market%20Operations/BPM_for_Market%20Operations_V63_redline.pdf

relaxed. Importantly, the magnitude of the penalty price values in the tables for each market reflect the hierarchical priority order in which the associated constraint may be relaxed in that market by the market software.²⁴

The power balance constraint needs to be at least as high as the highest submitted energy bid price. Otherwise, the optimization will relax the constraint rather than clear bids priced above its value.

The CAISO market utilizes both a scheduling and pricing run to produce awards (dispatches) and prices. In the scheduling run, the market optimizes all submitted bids and clears awards based on the most effective economic solution. In the event a solution cannot be achieved, the market will adjust non-priced parameters (*i.e.*, uneconomic adjustments) or relax constraints to attain a solution. The awards and resulting prices of this solution are passed to the pricing run. The pricing run information of the potential uneconomic adjustments and/or constraint relaxation is retained because after solving the scheduling run, the amounts of the adjustments and relaxations are known. These instances are modeled in the pricing run with slack variables with a small range beyond the solution of the scheduling run in order to have room in the optimization of the pricing run to find a solution and produce binding prices. In the event uneconomic adjustments are made or constraints are relaxed, the relevant penalty prices are applied.

The CAISO proposes that the power balance penalty price in the market's pricing run remain at \$1,000/MWh under routine conditions and all other market constraint penalty prices will remain scaled to \$1,000/MWh. The CAISO proposes to set the power balance penalty price to a \$2,000/MWh pricing run price, and scale the rest of the market constraint penalty prices relative to \$2,000/MWh, only under specific conditions. Consequently, this assumes that under normal market conditions the shortage price signal sent by the power balance constraint relaxation price should be based on the \$1,000/MWh soft energy bid cap.

Specifically, under this proposal, the CAISO market would utilize two sets of pricing parameters²⁵:

1. Pricing parameters will be scaled to a \$1,000/MWh power balance penalty price when both of the following conditions exist in any interval of the market horizon:
 - i. Resource-specific resources²⁶ have not submitted a cost-verified energy bid greater than \$1,000/MWh.

²⁴ Additional information is available in the Business Practice Manual for Market Operations available at https://bpmcm.aiso.com/BPM%20Document%20Library/Market%20Operations/BPM_for_Market%20Operations_V63_redline.pdf

²⁵ The two sets of market constraint pricing parameters are outlined in Appendix A.

²⁶ See Footnote 7.

- ii. The CAISO-calculated maximum allowable import bid price is not greater than \$1,000/MWh.
2. Pricing parameters will be scaled to a \$2,000/MWh power balance penalty price when either of the following conditions exist in any interval of the market horizon:
 - i. Resource-specific resources have submitted a cost-verified energy bid greater than \$1,000/MWh.
 - ii. The CAISO-calculated maximum allowable import bid price is greater than \$1,000/MWh.

The CAISO proposes that if the conditions are satisfied to set the pricing parameter for the power balance constraint to \$2,000/MWh and the market must relax the power balance constraint, the market would set energy prices in the pricing run based on the amount of infeasibility from the scheduling run. The amount of infeasibility in the scheduling run will be compared to a small threshold value. If the infeasibility is less than the threshold value, the market would set prices based on the price of the highest-priced cleared bid. If the infeasibility is more than the threshold value, prices will be set based on the \$2,000/MWh power balance penalty price. The CAISO proposes to only apply this pricing threshold to the real-time market.

The threshold value is intended to account for small supply shortfalls for which it is not appropriate to send the strong shortage pricing signal that setting prices based on \$2,000/MWh would. These small apparent shortfalls may not actually represent actual shortfalls because of forecast and modeling inaccuracies. In addition, in balancing authority areas other than the CAISO in the EIM, they may not represent actual shortfalls because of other resources these balancing authority areas have that are not in the market.

This approach is different than when energy costs are below \$1,000/MWh and the power balance penalty price is set at \$1,000/MWh. In that case there is no threshold value and prices are set based on the \$1,000/MWh penalty price for any amount of supply shortfall. This difference is appropriate because \$2,000/MWh is far greater than prices and the bid cap under typical conditions. It is appropriate that there be additional measures to ensure a supply shortfall is real and significant before setting prices based on \$2,000/MWh. This is aligned with the FERC Order No. 831 policy direction that established additional measures for bids above \$1,000/MWh as such costs would not be expected under most conditions.

The CAISO proposes to establish this threshold value for each balancing authority area in the EIM based on the NERC BAL-001-2 Requirement R2.²⁷ The requirement aims to

²⁷Information on the NERC Standard BAL-001-2 – Real Power Balancing Control Performance Requirement R2 is available at: <https://www.nerc.com/pa/Stand/Reliability%20Standards/BAL-001-2.pdf>

maintain reliability by controlling interconnection frequency within defined limits. This is accomplished by ensuring Balancing Authority Area Control Error (ACE) is kept between predefined limits (BAAL).²⁸ These BAAL limits (BAAL_{Low} and BAAL_{High}) are defined individually for each balancing authority area.

The CAISO proposes to utilize the BAAL_{Low} limit to define the threshold value for each balancing authority area in the EIM. This value can be used to represent the amount of supply that can be less than load while still maintaining system frequency within acceptable reliability criteria. Frequency is related to the balance of supply and load. System frequency is maintained by matching supply to demand. However, small mismatches and resulting differences in frequency from the desired 60 Hz are acceptable.

The BAAL_{Low} limit, as defined by NERC is the following²⁹:

$$BAAL_{Low} = (-10B_i \times (FTL_{Low} - F_s)) \times \frac{(FTL_{Low} - F_s)}{(F_A - F_s)}$$

Where:

- $BAAL_{Low}$ is the Low Balancing Authority ACE Limit (MW)
- 10 is a constant to convert the Frequency Bias Setting from MW/0.1 Hz to MW/Hz
- B_i is the Frequency Bias Setting for a Balancing Authority (expressed as MW/0.1 Hz)
- F_A is the measured frequency in Hz.
- F_s is the scheduled frequency in Hz.
- FTL_{Low} is the Low Frequency Trigger Limit (calculated as $F_s - 3\epsilon_{1l}$ Hz)
- Where ϵ_{1l} is the constant derived from a targeted frequency bound for each Interconnection.
 - Western Interconnection $\epsilon_{1l} = 0.0228$ Hz

For establishing the threshold value, the CAISO proposes to assume the Western Interconnection is balanced and the scheduled frequency is 60 Hz. Therefore, the CAISO proposes to not apply the following term from the BAAL_{Low} limit equation in the calculation of the threshold values: $\frac{(FTL_{Low} - F_s)}{(F_A - F_s)}$. This part of the equation modifies the frequency limits based on actual frequency in real-time. Consequently, it is not possible

²⁸ Information on the background and rationale for NERC Standard BAL-001-2 – Real Power Balancing Control Performance Requirement R2 predefined Balancing Authority Area Control Error (ACE) Limits (BAAL) is available at: https://www.nerc.com/pa/Stand/Project%202010141%20%20Phase%201%20of%20Balancing%20Authority%20Re/BAL-001-2_Background_%20Document-Clean-20130701.pdf#search=cps1

²⁹ See pages 8 and 9 for equations supporting the NERC Standard BAL-001-2 – Real Power Balancing Control Performance Requirement R2 available at: <https://www.nerc.com/pa/Stand/Reliability%20Standards/BAL-001-2.pdf>

to incorporate this part of the equation to calculate set threshold limits in advance. It would not be practical to use limits that change for pricing purposes.

Consequently, the CAISO proposes to calculate the threshold value for each EIM balancing authority area and the CAISO using the first term of the BAAL_{Low} limit as follows:

$$Threshold = (-10B_i \times (FTL_{Low} - F_s)).$$

The CAISO proposes to calculate and publish the threshold values for each balancing authority area yearly as the NERC defined frequency bias setting amounts for each balancing authority area are updated.

Table 1 lists the applicable frequency bias setting values and the corresponding calculated threshold values for each participating EIM balancing authority area and the CAISO based on 2020 information.

Table 1 Frequency Bias Settings and Calculated Threshold Values

Balancing Authority Area	2020 Frequency Bias Setting (MW/0.1 Hz)³⁰	CAISO Calculated Threshold Values (MW)
AZPS	-99.1	67.8
BANC – total	-28.4	19.4
BCHA	-112.9	77.2
CAISO	-341.7	233.7
IPCO	-37.7	25.8
NEVP	-63.0	43.1
PACE	-89.9	61.5
PACW	-46.1	31.5
PGE	-39.5	27.0
PSEI	-35.1	24.0
SCL	-39.0	26.7
SRP	-56.7	38.8

The CAISO real-time market includes individual power balance constraints for each EIM balancing authority area and an overall power balance constraint for the market. The overall power balance constraint for the market applies to the CAISO balancing authority area as well. The CAISO will set all of these power balance constraints at \$2,000/MWh, and scale the other market constraints accordingly, when the conditions are met to set the power balance penalty price to \$2,000/MWh.

³⁰Published 2020 Frequency Bias Settings for each Balancing authority in each interconnection effective 6/2/2020 are available at: https://www.nerc.com/comm/OC/Documents/BAL-003_Frequency_Bias_Settings_02Jun2020.pdf

Additionally, it is important to note that if the conditions are met to set the power balance penalty price to \$2,000/MWh for any hour in the day-ahead market, the \$2,000/MWh power balance penalty price will apply for all trading hours of the day-ahead market and real-time market for the same trading day. If the conditions are not met to set the power balance penalty price to \$2,000/MWh in the day-ahead market, but the conditions apply to set the power balance penalty price to \$2,000/MWh in the real-time market, the real-time market will use the \$2,000/MWh power balance penalty price for all intervals of overlapping real-time market horizons. If the conditions to set the power balance penalty price to \$2,000/MWh in all intervals of a real-time market horizon are not met, a \$1,000/MWh power balance penalty price will be used in all intervals of that real-time market horizon. This is irrespective of the fact that a \$2,000/MWh power balance penalty price may have been used for one or more of these intervals in a previous real-time market run. This approach is necessary so the market functions consistently across all intervals in its horizon.

Further, the CAISO proposes the threshold value will not be applied in the day-ahead market. The CAISO acknowledges it is inappropriate to apply the threshold value in the day-ahead market because in the day-ahead market the relaxation penalty prices for ancillary services are less than the power balance penalty price. In this market, the threshold would apply after the market has already foregone reserves and triggered scarcity pricing. Additionally, since the NERC BAL-001-2 Requirement R2 is a real-time operating standard, it does not make sense to apply the threshold value based on this standard to the day-ahead market. Applying the threshold value in the real-time market would be appropriate because the power balance constraint penalty price is relaxed prior to relaxing penalty prices for ancillary services and is consistent with the NERC real-time operating standard.³¹

The examples below illustrate the CAISO's overall proposed approach for establishing penalty prices and setting prices when the market relaxes the power balance constraint.

Example A:

The following example illustrates how penalty prices will remain set to the \$1,000/MWh power balance penalty price when the highest-priced submitted bid from a resource-specific resource is less than \$1,000/MWh and the CAISO-calculated maximum allowable import bid price is less than \$1,000/MWh.

Assume the following market inputs in the real-time market:

- Highest-priced bid from a resource-specific resource = \$900/MWh

³¹ The relaxation penalty prices for both the day-ahead and real-time markets are outlined in Appendix A.

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- CAISO-calculated maximum allowable import bid price = \$200/MWh
- CAISO threshold value = 233.7 MW

Given the conditions listed above, in the power balance penalty price would be set to \$1,000/MWh to determine the dispatch and prices.

Assume the market must relax the power balance constraint. Energy prices would be set based on the \$1,000/MWh power balance penalty price.

Example B:

The following example illustrates how penalty prices will be set to the \$2,000/MWh power balance penalty price when the highest-priced submitted bid from a resource-specific resource is greater than \$1,000/MWh. This example also outlines how energy prices are determined in the pricing run based on the amount of infeasibility.

Assume the following market inputs in the real-time market:

- Highest-priced bid from a resource-specific resource = \$1,200/MWh
- CAISO-calculated maximum allowable import bid price = \$700/MWh
- CAISO threshold value = 233.7 MW

The power balance penalty price would be set to \$2,000/MWh to determine the dispatch because there is a submitted and cost-verified energy bid from a resource-specific resource greater than \$1,000/MWh.

Assume the market must relax the power balance constraint and the highest-priced cleared economic bid is \$1,200/MWh. Energy prices in the pricing run would be set based on the following:

- If the scheduling run infeasibility \leq 233.7 MW, energy prices in the pricing run will be based on the \$1,200/MWh highest-priced cleared economic bid.
- If the scheduling run infeasibility $>$ 233.7 MW, energy prices in the pricing run will be based on the \$2,000/MWh power balance penalty price.

Example C:

The following example illustrates how penalty prices will be set to the \$2,000/MWh power balance penalty price when the CAISO-calculated maximum allowable import bid

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price is greater than \$1,000/MWh. This example also outlines how energy prices are determined in the pricing run based on the amount of infeasibility when there is no resource-specific bid greater than \$1,000/MWh.

Assume the following market inputs in the real-time market:

- Highest-priced bid from a resource-specific resource = \$900/MWh
- CAISO-calculated maximum allowable import bid price = \$1,100/MWh
- CAISO threshold value = 233.7 MW

The power balance penalty price would be set to \$2,000/MWh to determine the dispatch because the CAISO-calculated maximum allowable import bid price is \$1,100/MWh, which is greater than \$1,000/MWh.

Assume the market must relax the power balance constraint and the highest-priced submitted bid from a resource-specific resource is \$900/MWh. Energy prices in the pricing run would be set based on the following:

- If the scheduling run infeasibility ≤ 233.7 MW, energy prices in the pricing run will be based on the \$1,000/MWh because there is no resource-specific bid greater than \$1,000/MWh.
- If the scheduling run infeasibility > 233.7 MW, energy prices in the pricing run will be based on the \$2,000/MWh power balance penalty price.

Example D:

The following example illustrates how penalty prices will be set to the \$2,000/MWh power balance penalty price when the CAISO-calculated maximum allowable import bid price is greater than \$1,000/MWh. This example also outlines how a submitted resource-adequacy import bid will be reduced to the CAISO-calculated maximum allowable import bid price. Further, this example highlights how energy prices are determined in the pricing run based on the amount of infeasibility.

Assume the following market inputs in the real-time market:

- Highest-priced bid from a resource-specific resource = \$900/MWh
- Highest-priced resource adequacy import bid = \$1,200/MWh
- CAISO-calculated maximum allowable import bid price = \$1,100/MWh
- CAISO threshold value = 233.7 MW

The power balance penalty price would be set to \$2,000/MWh to determine the dispatch because the CAISO-calculated maximum allowable import bid price is \$1,100/MWh, which is greater than \$1,000/MWh. The market reduces the submitted \$1,200/MWh resource adequacy import bid to the \$1,100/MWh maximum allowable import bid price.

Assume the market must relax the power balance constraint and the highest-priced cleared economic bid is the \$1,100/MWh import bid. Energy prices in the pricing run would be set based on the following:

- If the scheduling run infeasibility ≤ 233.7 MW, energy prices in the pricing run will be based on the \$1,100/MWh highest-priced cleared economic bid.
- If the scheduling run infeasibility > 233.7 MW, energy prices in the pricing run will be based on the \$2,000/MWh power balance penalty price.

Example E:

The following example illustrates how penalty prices will be set to the \$2,000/MWh power balance penalty price when the highest-priced submitted bid from a resource-specific resource is greater than \$1,000/MWh. This example also outlines how energy prices are determined in based on the amount of infeasibility for an EIM balancing authority area when it is import constrained and the market must relax the power balance constraint for that specific EIM balancing authority area.

Assume the following market inputs in the real-time market:

- Highest-priced bid from a resource-specific resource within an EIM balancing authority area = \$1,200/MWh
 - This EIM balancing authority area is import constrained.
- CAISO-calculated maximum allowable import bid price = \$900/MWh
- EIM balancing authority area's threshold value = 25 MW
- EIM balancing authority area's available balancing capacity supply = 20 MW @ \$100/MWh

Given the conditions listed above, the power balance penalty price would be set to \$2,000/MWh to determine the dispatch because there is a submitted and cost-verified energy bid from a resource-specific resource greater than \$1,000/MWh.

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This applies to all individual balancing authority area power balance constraints in the EIM area and the market power balance constraint for the EIM area as a whole.

Assume the market must relax the power balance constraint in the import constrained EIM balancing authority area. The highest-priced cleared economic bid within the balancing authority is the \$1,200/MWh bid. Energy prices in the pricing run would be set based on the following:

- If the scheduling run infeasibility ≤ 45 MW, energy prices in the pricing run will be based on the \$1,200/MWh highest-priced cleared economic bid.
- If the scheduling run infeasibility > 45 MW, energy prices in the pricing run will be based on the \$2,000/MWh power balance penalty price.

The scheduling run infeasibility is compared to the sum of the EIM balancing authority area's threshold value and their available balancing capacity supply amount.

Since the market outside of this import constrained EIM balancing authority area can reach a feasible solution, the overall system's power balance constraint does not need to be relaxed in this example, and prices outside the constrained balancing authority area are produced using its normal process.

The "available balancing capacity" feature currently implemented in the EIM allows the market to recognize additional resources outside the market EIM participants use to meet their balancing authority area responsibilities.³² It includes bids for these resources in the market's bid stack, when the market must relax the power balance constraint for an EIM balancing authority area. This allows the marginal economic bid to set the energy price within the balancing authority area and not the power balance penalty price.

In the event the market would otherwise relax the power balance constraint for a balancing authority area in the EIM other than the CAISO, the available balancing capacity feature uses the capacity from the out-of-market available balancing capacity at penalty prices from \$1,050/MWh to \$1,200/MWh. This ensures that all available bids submitted up to the bid cap of \$1,000/MWh are scheduled prior to releasing available balancing capacity into the bid stack. The pricing run then produces prices incorporating bids from the available balancing capacity resources.

Under the approach described in this final proposal, the available balancing capacity will be released between \$2,100/MWh and \$2,400/MWh in the scheduling run when the

³² Additional information on the available balancing capacity feature is available in the Energy Imbalance Market Transition period Draft Final Proposal http://www.aiso.com/Documents/DraftFinalProposal_EIMTransitionPeriod.pdf.

\$2,000/MWh set of pricing parameters is used in the market. This will ensure the priority level of available balancing capacity is maintained in the bid stack in the scheduling run.

4.2 Screening import and virtual bids greater than \$1,000/MWh

This section describes the CAISO's proposal to price-screen import bids greater than \$1,000/MWh.

The CAISO proposes that its market will only accept import bids priced higher than \$1,000/MWh in periods in which a CAISO-calculated "maximum import bid" price is also greater than \$1,000/MWh or when the CAISO has cost-verified a resource-specific resource bid greater than \$1,000/MWh. Similarly, the CAISO market will only accept virtual bids greater than \$1,000/MWh under these conditions.

This import bid price screening will apply differently to imports providing resource adequacy capacity than it will to imports not providing resource adequacy capacity. The CAISO market will reduce resource adequacy import bids priced higher than \$1,000/MWh and higher than the CAISO-calculated maximum import bid price to the greater of the CAISO-calculated maximum import price or the highest-priced cost verified bid for a resource-specific resource. When it does this, it will not reduce a bid to a price below \$1,000/MWh.

The CAISO market will not reduce the price of non-resource adequacy import bids higher than \$1,000/MWh. However, the CAISO will only accept these bids when the maximum import bid price is greater than \$1,000/MWh or when there is a cost-verified resource-specific bid greater than \$1,000/MWh. When either of these conditions exist, the market will accept non-resource adequacy import bids up to \$2,000/MWh.

Because the CAISO also proposes to calibrate its penalty prices based on the availability of a cost-verified bid or the price of the maximum import bid price, the CAISO market can only accept import bids or virtual bids greater than \$1,000/MWh when the market's power balance penalty price is set at \$2,000/MWh. Under the approach presented in this final proposal, this is only when the CAISO-calculated maximum import bid price is greater than \$1,000/MWh or when the CAISO has cost-verified a resource-specific resource bid greater than \$1,000/MWh. The market will not clear bids greater than \$1,000/MWh when the power balance penalty price is set at \$1,000/MWh, *i.e.*, when it has not received a cost-verified supply bid greater than \$1,000/MWh and when the CAISO-calculated maximum import bid price is not greater than \$1,000/MWh.

The import bid price screening approach differs somewhat from the CAISO's approach for cost-verifying energy bids for resource-specific resources.³³ For bids for resource-specific resources (internal or external) greater than \$1,000/MWh, the CAISO will verify each resource's actual or expected costs based on the supplier's contemporaneously available information. In contrast, the CAISO-calculated maximum import bid price represents prevailing energy prices based on published bilateral energy price indices. It is not representative of the source of a particular import's actual operating costs, although it may represent opportunity costs. The CAISO will not require suppliers to submit import bids based on actual or expected costs.

4.2.1 Application to Resource Adequacy Imports

As described above, the CAISO proposes to reduce the price of only resource adequacy import bids greater than \$1,000/MWh to the CAISO-calculated maximum import bid price, the highest-priced cost verified bid for a resource-specific resource, or \$1,000/MWh, whichever is higher. It also proposes to not provide for after-the-fact cost recovery for import bids for which it reduced the price.

As described in Section 3, the CAISO agrees with stakeholders that provisions to reduce non-resource adequacy import bids to a maximum import bid price without cost recovery would discourage imports from bidding into the CAISO market. Suppliers would likely be reluctant to offer imports to the CAISO market if they would be at risk of having their bid reduced to a CAISO calculated price or the highest-priced cost verified bid without provisions for an after-the-fact make-whole payment if they could demonstrate that their bid represented actual costs. However, the CAISO does not believe there is a practical methodology for it to objectively determine import costs, which would be needed to provide importers with a make-whole after-the-fact payment.

However, reducing resource adequacy imports to the maximum import bid price or to the highest-priced cost verified bid will not reduce import supply. Resource adequacy resources are required to submit bids under the must-offer requirements as they apply to imports to the CAISO market. Although this may impose a small risk that a resource adequacy import bid may be reduced to a price below a supplier's cost, suppliers could presumably factor this risk into their bilateral resource adequacy contracting price. This proposed approach will allow non-resource adequacy import bids (and virtual bids) in the market above the CAISO-calculated maximum import bid price and up to \$2,000/MWh during certain periods. However, two factors will mitigate the risk that this will result in excessive market prices. First, the market will not allow any energy bids

³³ These include supply resources within the CAISO balancing authority area and resources outside the CAISO modeled as resource-specific system resources. The cost-verification approach for resource-specific resources was developed in the *Commitment Cost and Default Energy Bid Enhancements* policy initiative and was recently submitted to the FERC in Docket ER20-2360, available at <http://www.aiso.com/Documents/Jul9-2020-TariffAmendment-CommitmentCostsandDefaultEnergyBidEnhancementsCCDEBE-ER20-2360.pdf>.

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greater than \$1,000/MWh unless the CAISO-calculated maximum import bid price is greater than \$1,000/MWh or there is a cost-verified resource-specific bid greater than \$1,000/MWh. Second, the market should be able to meet CAISO balancing authority area demand using only bids from resource adequacy resources. All resource adequacy bids are subject to either cost-verification rules or the maximum import bid price. This means bids priced higher than the highest-priced bid for a resource adequacy resource are unlikely to clear the market and set CAISO market prices.³⁴ The day-ahead market has the additional protection that energy supply clears against economic demand bids. Thus, demand can protect itself against unreasonably high prices through specifying a maximum price at which it wants to schedule demand.

The CAISO proposes to reduce resource adequacy imports to the higher of the CAISO-calculated maximum import bid price or the price of the highest cost-verified bid for a resource-specific resource to be consistent with the rules for accepting import bids, including non-resource adequacy imports, priced above \$1,000/MWh. Import bids should not be reduced below the highest-priced cost-verified resource specific bid above \$1,000/MWh since the CAISO market will accept import bids above \$1,000/MWh in the situation in which there is a cost-verified resource specific bid above \$1,000/MWh but the CAISO-calculated maximum import bid price is below \$1,000/MWh. It would be inconsistent in this situation to reduce resource adequacy bids to \$1,000/MWh in this circumstance.

In addition, incorporating the price of cost-verified resource-specific bids provides for limiting bids for resource adequacy imports to a more current price in the real-time market. The CAISO-calculated maximum import bid price is based on day-ahead prices that may be too low in the real-time market if natural gas prices increase overnight. A resource-specific bid submitted to the real-time market would presumably incorporate the current gas prices. As discussed above, the CAISO's approach for price-screening import bids differs based on whether the import bid is from a resource adequacy resource. In the *System Market Power Mitigation* initiative the CAISO proposes to treat both resource adequacy and non-resource adequacy imports the same - all import bids would not be subject to system-level market power mitigation. The respective approach the CAISO has proposed in the two initiatives is different because the two initiatives have different objectives.

The objective of CAISO's FERC Order No. 831 policy initiative is to ensure all supply needed to meet the ISO's load responsibility (resource adequacy resources) that provide bids priced above \$1,000/MWh represent verified costs. As discussed in FERC's Order No. 831, market power concerns are heightened when a resource's energy bid is greater than \$1,000/MWh. Although the Commission did not require

³⁴ The CAISO's market clears supply bids in price merit order.

verification of import bids as it did for internal resource bids greater than \$1,000/MWh, it recognized similar concerns could exist and each ISO/RTO could request measures necessary to address such issues.

In the CAISO's case, the CAISO has determined that its reliance on import energy makes it appropriate to also verify import bids represent actual costs. In contrast to mitigation the CAISO performs for local market power mitigation for all bids, including those below \$1,000/MWh, Order No. 831 recognizes that bids above \$1,000/MWh must be cost verified irrespective of whether the ISO/RTO has evaluated whether or not there exists the ability to exercise market power. In the case of bids above \$1,000/MWh, there is a presumption that such bids exceed what would typically be actual costs and therefore there is a need to validate those bids. In particular, the CAISO relies on resource adequacy requirements to ensure there is enough capacity to serve its load. Therefore, it relies on the resource adequacy import bids differently than it does for non-resource adequacy import bids.

That said, as discussed above, the CAISO is proposing that it would not allow an import bid above \$1,000/MWh from a non-resource adequacy import if it has not found that the maximum import bid price exceeds \$1,000/MWh or there is no cost verified resource-specific resource bid above \$1,000/MWh.

In contrast, in the system market power initiative, the CAISO is proposing rules to test whether there is a need to mitigate energy bids because of the potential that suppliers, through concentration of supply, may be able to exercise market power at the balancing authority area level. Based on its approach for testing whether there exists such circumstances, the CAISO has determined that import bids, whether resource adequacy or not, would not be subject to mitigation because imports are most likely not pivotal supply. Therefore, there would be no basis for mitigating import resources, similar to the CAISO's proposal to not mitigate internal resources that are not pivotal.

4.2.2 Maximum Import Bid Price Calculation

As described above, the CAISO-calculated maximum import bid price would be used to screen import and virtual supply bids and is intended to represent prevailing energy prices. The CAISO proposes to calculate the maximum import bid price based on an energy price component that uses the maximum of two published bilateral electrical prices, Mid-C or Palo Verde.

The CAISO will calculate separate maximum import bid prices for the day-ahead and real-time markets.

Both the bilateral electric hub prices are published as multi-hour block rather than hourly prices. The energy price component methodology will convert these multi-hour block prices into hourly prices to reflect that hourly prices change throughout the day. This

reflects that CAISO prices vary by hour. The calculation will convert daily multi-hour block electrical prices from the published electric price indices into hourly prices by using a previous high priced day's day-ahead SMEC. This calculation will be performed separately for on and off-peak hours. The resulting price will be multiplied by 110 percent.

The CAISO would perform this calculation each day and use the resulting maximum import bid prices in the respective CAISO markets.

The CAISO proposes to calculate this maximum import bid price for each hour as follows:

$$\text{Maximum import bid price} = \text{Energy Price} \times 1.1$$

The maximum import bid price approximates the prevailing bilateral price of electricity as an hourly price. As described further below, the energy price component uses the maximum of two published bilateral electrical index prices from Mid-Columbia or Palo Verde.

Both of these prices are daily prices rather than hourly prices. The energy price component converts these daily prices into hourly prices.

The 110 percent multiplier is to account for differences in prices between published price indices and individual transactions. The published electrical price indices are based on the weighted average price of all electric transactions. Therefore, a supplier's opportunity costs for individual sales outside of the CAISO may be higher than the corresponding published electrical indices.

The following subsections describe the components of the maximum import bid price calculation.

Energy Price Component

As described above, the energy price component of the proposed maximum import bid price equation estimates the current prevailing hourly bilateral electricity price. It does this by converting daily published electric hub index prices into hourly prices.

The calculation must convert daily prices into hourly prices because electrical indices are daily multi-hour block prices, while CAISO prices are hourly prices in the day-ahead market. The electrical price indices are published as separate peak and off-peak hour prices for each day. The peak price represents the price for a 16-hour block of energy. Whereas, the CAISO market clears and sets prices hourly in the day-ahead market and clears and sets prices every 15-minutes in the real-time market.

The energy price component of the proposed maximum import bid price equation calculates an hourly energy price based on the daily electric hub index price. This

hourly energy price will be adjusted based on the historical relationship of each hour's SMEC in the day-ahead market to the average SMEC over the day. The energy price will increase the hourly maximum import bid price relative to the daily hub price in hours in which the SMEC is typically greater than the daily average, i.e. in the peak load hours. The maximum import bid price will decrease the price in hours that the SMEC is typically less than the daily average. The CAISO proposes to shape the price in each hour based on the ratio of the day-ahead system marginal energy cost to the average system marginal energy cost of a previous high priced day. It would do this using the day-ahead SMEC from a recent day in which the day-ahead SMEC prices were at least an established amount, such as \$200/MWh. The CAISO proposes to calculate these hourly SMEC ratios based on a recent high-priced day because prices are typically proportionally higher in the peak hours on high-priced days than they are on other days. This calculation would be performed separately for on and off-peak hours.

The energy price component of the maximum import bid price equation will be calculated hourly as follows:

Energy Price =

Electric Hub Price x Hourly Shaping Factor

Where, Hourly Shaping Factor is:

$$\left[1 + \frac{\text{CAISO Hourly DA SMEC} - \text{CAISO Average DA SMEC of on/off peak hrs}}{\text{CAISO Average DA SMEC of on/off peak hrs}}\right]$$

Electric Hub Price

The CAISO proposes to use the highest price for each on/off peak prices from either the Mid-Columbia or Palo Verde electric trading hub price indices. The CAISO proposes to use Mid-Columbia and Palo Verde because they are representative electrical prices for the bilateral market outside of the CAISO balancing authority area. This is the appropriate price to use to determine whether or not to allow virtual bids priced greater than \$1,000/MWh. It would result in market inefficiencies to not allow virtual bids up to \$2,000/MWh while allowing import bids up to \$2,000/MWh. Further, using the higher bilateral hub price ensures that the CAISO-calculated maximum import bid price does not overly constrain import bids.

The CAISO market currently uses electric price hub indices to calculate hydro default energy bids. It uses next day electric prices published the previous day for both the day-ahead and the real-time markets that run on a particular day. This results in an appropriate price for the real-time market but results in a one-day old price used by the day-ahead market. This is because the final published next-day electric price is not

published until the end of the day, which is after the CAISO runs the day-ahead market for the applicable operating day.

The following example illustrates how the day-ahead market is currently using a one-day old electric price.

Example F:

Assume today is Wednesday, July 22, 2020.

The prior evening, July 21, the Intercontinental Exchange (ICE) published electric prices for trade-date July 22 at around 8 pm. At 9 pm on July 21, the CAISO uses the published electric price for trade-date July 22 to calculate real-time prices beginning with hour-ending 1.

On July 22, the CAISO is preparing to run the day-ahead market for July 23. However, the only published electric price information available at that time is for trade-date July 22, published the prior evening on July 21. Therefore, the CAISO is using a “day-old” electric price in the day-ahead market.

The CAISO understands using a day-old electric price in the day-ahead market is problematic. Consequently, the CAISO proposes to update day-ahead electric prices similar to its natural gas price procedure for the day-ahead market. The CAISO would use these updated electric prices for both the maximum import bid price and for the hydro default energy bid. The following example illustrates the CAISO’s proposal:

Example G:

Assume today is Wednesday, July 22, 2020. Electric bilateral trading is occurring for trade-date July 23.

At 8:30 am on July 22, the CAISO proposes to review trading on ICE for the next-day electric prices applicable for trade-date July 23. This is considered a “snap shot” of prices for July 23 until a final price is received by the CAISO around 8 PM later that evening. The CAISO would use this “snap shot” of prices in the day-ahead market that runs at 10 am on July 22 for trade-date July 23.

Meanwhile, the same July 23 product described above continues to trade during the remainder of July 22. The final electric price for trade-date July 23 is received by the CAISO around 8 pm on July 22 by ICE. This price is then used in the CAISO real-time market beginning with July 23 hour-ending 1.

The CAISO’s proposal allows for a more up-to-date electric price to be used in the day-ahead market. The updated electrical price based on next day trading that the CAISO

proposes to use above for the day-ahead market would not be appropriate to use in the real-time market because these prices are applicable to the following day.

Hourly Shaping Factor

The CAISO proposes to shape bilateral multi-hour block energy prices based on previous high priced days within the same season.³⁵ A Market Surveillance Committee (MSC) member suggested using high priced days to shape daily bilateral prices because prices on these days are proportionally much higher in peak load hours.³⁶ It was recommended to use \$200/MWh as an appropriate value to screen for the highest priced days.

Previously, the CAISO proposed to calculate the hourly shaping factor using a previous day's day-ahead SMEC rather than based on previous high priced days SMEC. This prior proposal assumed that the previous day was an indicator of expected hourly price variation for the current day.

However, this assumption is likely to not be true for the first day of a high priced series of days. Therefore, the CAISO proposes to use the most recent day in which prices were at least an established amount in the day-ahead market, such as \$200/MWh.³⁷ Therefore, if the previous day is not a high priced day, this methodology would look back to identify the most recent high priced day. However, because the shape of prices throughout the hours of the day varies based on seasonal conditions, the CAISO proposes to only look back to the beginning of the current season. If there are no high priced days in the current season, the CAISO would base the shaping methodology on representative high priced days from the same season in previous years.³⁸

The following example illustrates how the hourly shaping factor would be determined using the most recent day in which day-ahead market SMEC reached at least \$200/MWh:

Example H:

Assume the CAISO is calculating an energy price for trade date August 20, 2020, hour ending 11 on the evening of August 19, 2020. The CAISO would use the most recent day in which day-ahead SMEC was at least \$200/MWh.

³⁵ The CAISO proposes to retain the flexibility to define the seasons. They could be potentially calendar quarters or other groups of months. The CAISO would define these based on further analysis and potentially modify them in the future based on changes to system and market conditions.

³⁶ Data analysis supporting the Market Surveillance Committee suggestion is available at: http://www.aiso.com/Documents/FERC831Bushnell-Presentation-July30_2020.pdf

³⁷ The CAISO proposes to retain the flexibility to establish this threshold based on further analysis and potentially modify them based on changes to system and market conditions.

³⁸ The CAISO would define these representative high priced days based on further analysis and potentially modify them based on changes to system and market conditions.

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The CAISO determines based on historical data that the most recent day in which the day-ahead SMEC reached at least \$200/MWh was on August 19, 2020.

The Hourly Shaping Factor calculation would be as follows:

$$1 + \left[\frac{(\text{DA SMEC of Aug 20, 2020 HE 11}) - (\text{Avg DA SMEC of ON peak hrs of Aug 19, 2020})}{\text{Avg DA SMEC of ON peak hrs of Aug 19, 2020}} \right]$$

5 Energy Imbalance Market Governing Body Advisory Role

As described above this initiative considers two topics:

1. Methodology to establish market constraint relaxation penalty prices under a \$2,000/MWh hard energy bid cap.
2. Price screening methodology for import bids greater than \$1,000/MWh.

These two topics must be presented together for approval because they are linked. The CAISO believes the EIM Governing Body should have an advisory role in the approval of the proposed changes.

An initiative proposing to change rules of the real-time market falls within the primary authority of the EIM Governing Body if either the proposed new rule is EIM-specific in the sense that it applies uniquely or differently in the balancing authority areas of EIM Entities, as opposed to a generally applicable rule or, for proposed market rules that are generally applicable, if “an issue that is specific to the EIM balancing authority areas is the primary driver for the proposed change.”

The initiative does not satisfy the first test, because the market rules proposed to address the two topics described above are not EIM-specific. The screening of import bids is limited to imports into the CAISO balancing authority area and, moreover, all such imports are governed by a single set of rules that apply to all imports regardless of source or location. The market constraint relaxation penalty prices and proposed price mechanism when the power balance constraint must be relaxed is applicable to the entire CAISO market footprint, including other balancing authority areas participating in the EIM. Moreover, the primary driver for addressing these topics is not specific to the EIM balancing authority areas. The effects of any change to the market constraint penalty prices would be similar in the CAISO balancing authority area and EIM balancing authority areas. Accordingly, this initiative would fall entirely within the advisory role of the EIM Governing Body.

In comments on earlier papers, a group of EIM Entities objected to this proposed classification. Their objection was focused exclusively on the classification of the item involving penalty prices when a power balance constraint is relaxed, as opposed to the method for screening import bids. To gain a better understanding of their concerns, CAISO staff discussed the objections with representatives of some of the EIM Entities. These representatives agreed that the proposed market rule regarding penalty prices is generally applicable to the entire market, as opposed to EIM-specific. Their concern about the proposed classification involves the second test described above – whether “an issue that is specific to the EIM balancing authority areas is the primary driver for the proposed change.” They emphasized the fact that it was the EIM Entities who filed

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the primary protest of the ISO's initial compliance filing at FERC, which would have resulted in penalty prices at the cap. Without this protest, they maintain, the CAISO would not have asked FERC for time to pursue this initiative.

CAISO appreciates the role that the EIM Entities played in pushing for a harder look at penalty prices through the protest they filed at FERC. Management continues to believe, however, that the penalty price item is properly classified as advisory, because the test is not which entity or set of entities complained. A generally applicable market rule, such as the proposed rule about penalty prices, falls within the primary authority of the Governing Body only if "an issue that is specific to the EIM balancing authorities" was the primary driver of the proposed change. Here, the issue is the level of penalty prices when a market constraint is relaxed, an issue that is not "specific to" EIM balancing authority areas to the exclusion of the CAISO balancing authority area. This is an issue for the entire market footprint. Accordingly, the primary driver test is not met, even if it is the EIM balancing authority areas that may arguably care more about the issue, or cared more at an early critical point. (Moreover, a rule that the determining factor is who protested first or loudest could create undesirable incentives.) In sum, the CAISO believes the initiative is properly classified.

With that said, stakeholders are encouraged to submit a response to the EIM classification of this initiative as described above in their written comments, particularly if they have concerns or questions.

6 Stakeholder engagement

The schedule for stakeholder engagement is provided below. The CAISO will present its proposal to the Energy Imbalance Market Governing Body at their September 16, 2020 meeting and to the Board of Governors' at their September 30 – October 01, 2020 meeting.

Date	Event
9/10/2020	Publish revised final proposal and draft tariff language
9/17/2020	Draft tariff language and stakeholder conference call
9/24/2020	Stakeholder comments on draft tariff language due
Sept 16, 2020	Energy Imbalance Market Governing Body meeting
Sept 30 – Oct 01, 2020	Board of Governors meeting
Fall 2021	Expected implementation, concurrent with FERC 831 compliance implementation

7 Appendix A - Market constraint relaxation penalty parameters values

This section provides the specific value settings for the set of CAISO market parameters that are used for adjusting non-priced quantities in the market optimizations.

The parameter values below are all of the market parameters that are based on the hard energy bid cap specifically documented in the CAISO tariff and in the Business Practice Manual (BPM) for Market Operations. This section includes two tables based on market process: the Integrated Forward Market (IFM) and the Real Time Market (RTM).

The magnitude of the penalty factor values in the following tables for each market reflect the hierarchical priority order in which the associated constraint may be relaxed in that market by the market software. These tables are organized by penalty price, scheduling run value, and pricing run value. Based on the proposal described in Section 4.1, there are two columns dedicated to each scheduling run and pricing run values depending on if the pricing parameters are scaled to a \$1,000/MWh or \$2,000/MWh power balance penalty price. Since the price floor of -\$150/MWh is not being adjusted, all existing negative pricing parameter values will remain the same as today even when the power balance penalty price is set to \$2,000/MWh.

All of the following parameter values will be specified in the BPM for Market Operations³⁹ and the CAISO Tariff Sections 27 and 30.⁴⁰

³⁹These parameter values will be specified in Section 6.6.5 of the Business Practice Manual for Market Operations available at [https://bpmcm.caiso.com/Pages/BPMDetails.aspx?BPM=Market Operations](https://bpmcm.caiso.com/Pages/BPMDetails.aspx?BPM=Market%20Operations)

⁴⁰ See Sections 27 and 30 of the CAISO tariff available at [http://www.caiso.com/Documents/Section27-CAISO Markets-Processes-asof-Aug12-2019.pdf](http://www.caiso.com/Documents/Section27-CAISO%20Markets-Processes-asof-Aug12-2019.pdf) and at [http://www.caiso.com/Documents/Section30-Bid-Self-ScheduleSubmission-CAISO Markets-asof-Nov13-2019.pdf](http://www.caiso.com/Documents/Section30-Bid-Self-ScheduleSubmission-CAISO%20Markets-asof-Nov13-2019.pdf) respectively.

Integrated Forward Market (IFM) Parameter Values

Described in BPM for Market Operations or Tariff Section	Penalty Price Description	Scheduling Run Value ⁴¹ when submitted and cost-verified bids are below \$1,000/MWh and the CAISO-calculated maximum import bid price is not greater than \$1,000/MWh (\$/MWh)	Pricing Run Value when submitted and cost-verified bids are below \$1,000/MWh and the CAISO-calculated maximum import bid price is not greater than \$1,000/MWh (\$/MWh)	Scheduling Run Value when submitted and cost-verified bids are greater than \$1,000/MWh or the CAISO-calculated maximum import bid price is greater than \$1,000/MWh (\$/MWh)	Pricing Run Value when submitted and cost-verified bids are greater than \$1,000/MWh or the CAISO-calculated maximum import bid price is greater than \$1,000/MWh (\$/MWh)	Comment
BPM for Market Operations Section 6.6.5	Power balance constraint <i>(Market energy balance)</i>	6,500	1,000	13,000	2,000	Market energy balance is the requirement that total supply equal the sum of total demand plus losses for the entire system. In the IFM energy balance reflects the clearing of bid-in supply and demand; in the MPM component of the DAM it reflects the scheduling of bid-in supply against the ISO demand forecast.
BPM for Market Operations Section 6.6.5 and Tariff Section 27.4.3.1	Transmission constraints: Intertie scheduling	5,000	1,000	10,000	2,000	Intertie scheduling constraints limit the total amount of energy and ancillary service capacity that can be scheduled at each scheduling point.
BPM for Market Operations Section 6.6.5	Legacy Reliability Must-Run	-6000	-150	-6,000	-150	The ISO considers transmission

⁴¹ Penalty values in the scheduling run are negatively valued for supply reduction and positively valued for demand reduction.

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Described in BPM for Market Operations or Tariff Section	Penalty Price Description	Scheduling Run Value ⁴¹ when submitted and cost-verified bids are below \$1,000/MWh and the CAISO-calculated maximum import bid price is not greater than \$1,000/MWh (\$/MWh)	Pricing Run Value when submitted and cost-verified bids are below \$1,000/MWh and the CAISO-calculated maximum import bid price is not greater than \$1,000/MWh (\$/MWh)	Scheduling Run Value when submitted and cost-verified bids are greater than \$1,000/MWh or the CAISO-calculated maximum import bid price is greater than \$1,000/MWh (\$/MWh)	Pricing Run Value when submitted and cost-verified bids are greater than \$1,000/MWh or the CAISO-calculated maximum import bid price is greater than \$1,000/MWh (\$/MWh)	Comment
	(LRMR) pre-dispatch curtailment (supply)					constraints when determining LRMR scheduling requirements. After the ISO has determined the LRMR scheduling requirements, the market optimization ensures that the designated capacity is scheduled in the market.
BPM for Market Operations Section 6.6.5	Pseudo-tie layoff energy	-4,000	-150	-4,000	-150	Pseudo-tie layoff energy is scheduled under contractual arrangements with the balancing authority in whose area a pseudo-tie generator is located.
BPM for Market Operations Section 6.6.5 and Tariff Section 27.4.3.1	Transmission constraints: branch, corridor, nomogram (base case and contingency analysis)	5,000	1,000	10,000	2,000	In the scheduling run, the market optimization enforces transmission constraints up to a point where the cost of enforcement (the "shadow price" of the constraint) reaches the parameter

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						value, at which point the constraint is relaxed.
BPM for Market Operations Section 6.6.5	Transmission Ownership Right (TOR) self schedule	5,900, -5,900	1,000, -150	11,800, -5,900	2,000,-150	A TOR Self-Schedule will be honored in the market scheduling in preference to enforcing transmission constraints.
BPM for Market Operations Section 6.6.5	Existing Transmission Contract (ETC) self schedule	5,100 to 5,900, -5,100 to -5,900	1,000, -150	10,200 to 11,800, -5,100 to -5,900	2,000,-150	An ETC Self-Schedule will be honored in the market scheduling in preference to enforcing transmission constraints. The typical value is set at \$5,500/MWh, but different values from \$5,100/MWh to \$5,900/MWh are possible if the instructions to the ISO establish differential priorities among ETC rights. For some ETC rights the ISO may use values below the stated scheduling run range if that is required for consistency

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Described in BPM for Market Operations or Tariff Section	Penalty Price Description	Scheduling Run Value ⁴¹ when submitted and cost-verified bids are below \$1,000/MWh and the CAISO-calculated maximum import bid price is not greater than \$1,000/MWh (\$/MWh)	Pricing Run Value when submitted and cost-verified bids are below \$1,000/MWh and the CAISO-calculated maximum import bid price is not greater than \$1,000/MWh (\$/MWh)	Scheduling Run Value when submitted and cost-verified bids are greater than \$1,000/MWh or the CAISO-calculated maximum import bid price is greater than \$1,000/MWh (\$/MWh)	Pricing Run Value when submitted and cost-verified bids are greater than \$1,000/MWh or the CAISO-calculated maximum import bid price is greater than \$1,000/MWh (\$/MWh)	Comment
						with the instructions provided to the ISO by the PTO.
BPM for Market Operations Section 6.6.5	Converted Right (CVR) self schedule	5,500, -5,500	1,000, -150	11,000, -5,500	2,000, -150	A CVR Self-Schedule is assigned the same priority as the typical value for ETC Self-Schedules.
BPM for Market Operations Section 6.6.5	Ancillary Service Region Regulation-up and Regulation-down Minimum Requirements	2,500	250	5,000	500	In the event of bid insufficiency, AS minimum requirements will be met in preference to serving generic Self-Scheduled demand, but not at the cost of overloading transmission into AS regions.
BPM for Market Operations Section 6.6.5	Ancillary Service Region Spin Minimum Requirements	2,250	250	4,500	500	Spinning reserve minimum requirement is enforced with priority lower than regulation up minimum requirement in scheduling run.
BPM for Market Operations Section 6.6.5	Ancillary Service Region Non-Spin Minimum Requirements	2,000	250	4,000	500	Non-spin reserve minimum requirement is enforced with priority lower than spin minimum

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Described in BPM for Market Operations or Tariff Section	Penalty Price Description	Scheduling Run Value ⁴¹ when submitted and cost-verified bids are below \$1,000/MWh and the CAISO-calculated maximum import bid price is not greater than \$1,000/MWh (\$/MWh)	Pricing Run Value when submitted and cost-verified bids are below \$1,000/MWh and the CAISO-calculated maximum import bid price is not greater than \$1,000/MWh (\$/MWh)	Scheduling Run Value when submitted and cost-verified bids are greater than \$1,000/MWh or the CAISO-calculated maximum import bid price is greater than \$1,000/MWh (\$/MWh)	Pricing Run Value when submitted and cost-verified bids are greater than \$1,000/MWh or the CAISO-calculated maximum import bid price is greater than \$1,000/MWh (\$/MWh)	Comment
						requirement in scheduling run.
BPM for Market Operations Section 6.6.5	Ancillary Service Region Maximum Limit on Upward Services	1,500	250	3,000	500	In the event of multiple AS regional requirements having bid insufficiency, it is undesirable to have multiple constraints produce AS prices equaling multiples of the AS bid cap. An alternative way to enforce sub-regional AS requirements is to enforce a maximum AS requirement on other AS regions, thereby reducing the AS prices in the other regions without causing excessive AS prices in the sub-region with bid insufficiency.
BPM for Market Operations Section 6.6.5	Self-scheduled CAISO demand and self-scheduled exports using identified non-RA supply resource	1,800	1,000	3,600	2,000	Pursuant to section 31.4, the uneconomic bid price for self-scheduled demand in the scheduling run exceeds the uneconomic bid price for self-scheduled

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Described in BPM for Market Operations or Tariff Section	Penalty Price Description	Scheduling Run Value ⁴¹ when submitted and cost-verified bids are below \$1,000/MWh and the CAISO-calculated maximum import bid price is not greater than \$1,000/MWh (\$/MWh)	Pricing Run Value when submitted and cost-verified bids are below \$1,000/MWh and the CAISO-calculated maximum import bid price is not greater than \$1,000/MWh (\$/MWh)	Scheduling Run Value when submitted and cost-verified bids are greater than \$1,000/MWh or the CAISO-calculated maximum import bid price is greater than \$1,000/MWh (\$/MWh)	Pricing Run Value when submitted and cost-verified bids are greater than \$1,000/MWh or the CAISO-calculated maximum import bid price is greater than \$1,000/MWh (\$/MWh)	Comment
						supply and self-scheduled exports not using identified non-RA supply resources.
BPM for Market Operations Section 6.6.5	Self-scheduled exports not using identified non-RA supply resource	1,150	1,000	2,300	2,000	The scheduling parameter for self-scheduled exports not using identified non-RA capacity is set below the parameter for generic self-schedules for demand.
BPM for Market Operations Section 6.6.5	Regulatory Must-Run and Must Take supply curtailment	-1,350	-150	-1,350	-150	Regulatory must-run and must-take supply receive priority over generic self-schedules for supply resources.
BPM for Market Operations Section 6.6.5	Price-taker supply bids	-400	-150	-400	-150	Generic self-schedules for supply receive higher priority than Economic Bids at the bid floor.
BPM for Market Operations Section 6.6.5	Conditionally qualified Regulation Up or Down self-provision	-405	NA	-405	NA	Conversion of AS self-schedules to Energy pursuant to section 31.3.1.3 received higher priority to maintaining the availability of regulation, over

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Described in BPM for Market Operations or Tariff Section	Penalty Price Description	Scheduling Run Value ⁴¹ when submitted and cost-verified bids are below \$1,000/MWh and the CAISO-calculated maximum import bid price is not greater than \$1,000/MWh (\$/MWh)	Pricing Run Value when submitted and cost-verified bids are below \$1,000/MWh and the CAISO-calculated maximum import bid price is not greater than \$1,000/MWh (\$/MWh)	Scheduling Run Value when submitted and cost-verified bids are greater than \$1,000/MWh or the CAISO-calculated maximum import bid price is greater than \$1,000/MWh (\$/MWh)	Pricing Run Value when submitted and cost-verified bids are greater than \$1,000/MWh or the CAISO-calculated maximum import bid price is greater than \$1,000/MWh (\$/MWh)	Comment
						spinning and non-spinning reserve.
BPM for Market Operations Section 6.6.5	Conditionally qualified Spin self-provision	-400	NA	-400	NA	Conversion of AS self-schedules to Energy pursuant to section 31.3.1.3 receives higher priority to maintaining the availability of spinning reserve, over non-spinning reserve.
BPM for Market Operations Section 6.6.5	Conditionally qualified Non-Spin self-provision	-395	NA	-395	NA	This penalty price for conversion of self-provided non-spinning reserves balances the maintenance of AS self-schedules with ensuring that the conversion to energy occurs before transmission constraints are relaxed.
BPM for Market Operations Section 6.6.5	Conditionally unqualified Reg Up or Down self-provision	-195	NA	-195	NA	In instances where AS self-provision is not qualified pursuant to the MRTU tariff, the capacity can still be considered as an AS bid, along with

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Described in BPM for Market Operations or Tariff Section	Penalty Price Description	Scheduling Run Value ⁴¹ when submitted and cost-verified bids are below \$1,000/MWh and the CAISO-calculated maximum import bid price is not greater than \$1,000/MWh (\$/MWh)	Pricing Run Value when submitted and cost-verified bids are below \$1,000/MWh and the CAISO-calculated maximum import bid price is not greater than \$1,000/MWh (\$/MWh)	Scheduling Run Value when submitted and cost-verified bids are greater than \$1,000/MWh or the CAISO-calculated maximum import bid price is greater than \$1,000/MWh (\$/MWh)	Pricing Run Value when submitted and cost-verified bids are greater than \$1,000/MWh or the CAISO-calculated maximum import bid price is greater than \$1,000/MWh (\$/MWh)	Comment
						regular AS bids. The price used for considering unqualified AS self-provision is lower than the AS bid cap, to allow it to be considered as an Economic Bid.
BPM for Market Operations Section 6.6.5	Conditionally unqualified Spin self-provision	-170	NA	-170	NA	Same as above.
BPM for Market Operations Section 6.6.5	Conditionally unqualified Non-Spin self-provision	-155	NA	-155	NA	Same as above.
Tariff Section 27.1.2.3.1	Regulation Down Pricing – Insufficient Supply	Price set as percentage of \$1,000/MWh, depending on the amount the CAISO market is short of supply needed to meet the Regulation Down requirement.	Price set as percentage of \$1,000/MWh, depending on the amount the CAISO market is short of supply needed to meet the Regulation Down requirement.	Price set as percentage of \$2,000/MWh, depending on the amount the CAISO market is short of supply needed to meet the Regulation Down requirement.	Price set as percentage of \$2,000/MWh, depending on the amount the CAISO market is short of supply needed to meet the Regulation Down requirement.	N/A
Tariff Section 27.1.2.3.2	Non-Spinning Reserve Pricing – Insufficient Supply	Price set as percentage of \$1,000/MWh, depending on the amount the CAISO market is short of supply needed to meet the Non-Spinning Reserve requirement.	Price set as percentage of \$1,000/MWh, depending on the amount the CAISO market is short of supply needed to meet the Non-Spinning Reserve requirement.	Price set as percentage of \$2,000/MWh, depending on the amount the CAISO market is short of supply needed to meet the Non-Spinning Reserve requirement.	Price set as percentage of \$2,000/MWh, depending on the amount the CAISO market is short of supply needed to meet the Non-Spinning Reserve requirement.	N/A

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Described in BPM for Market Operations or Tariff Section	Penalty Price Description	Scheduling Run Value ⁴¹ when submitted and cost-verified bids are below \$1,000/MWh and the CAISO-calculated maximum import bid price is not greater than \$1,000/MWh (\$/MWh)	Pricing Run Value when submitted and cost-verified bids are below \$1,000/MWh and the CAISO-calculated maximum import bid price is not greater than \$1,000/MWh (\$/MWh)	Scheduling Run Value when submitted and cost-verified bids are greater than \$1,000/MWh or the CAISO-calculated maximum import bid price is greater than \$1,000/MWh (\$/MWh)	Pricing Run Value when submitted and cost-verified bids are greater than \$1,000/MWh or the CAISO-calculated maximum import bid price is greater than \$1,000/MWh (\$/MWh)	Comment
Tariff Section 27.1.2.3.3	Spinning Reserve Pricing – Insufficient Supply	Price set as 10% of \$1,000/MWh.	Price set as 10% of \$1,000/MWh.	Price set as 10% of \$2,000/MWh.	Price set as 10% of \$2,000/MWh.	N/A
Tariff Section 27.1.2.3.4	Regulation Up Pricing – Insufficient Supply	Price set as 20% of \$1,000/MWh.	Price set as 20% of \$1,000/MWh.	Price set as 20% of \$2,000/MWh.	Price set as 20% of \$2,000/MWh.	N/A
Tariff Section 27.4.3.3	Insufficient Supply to Meet Self-Schedule Demand in IFM	NA	1000	NA	2000	Pricing run parameter set at hard energy bid cap.
Tariff Section 27.4.3.5	Protection of TOR, ETC and Converted Rights Self-Schedules in the IFM	To be calculated according detail in comment.	To be calculated according detail in comment.	To be calculated according detail in comment.	To be calculated according detail in comment.	Penalty prices must be set higher than values specified in section 27.4.3.1.

Real Time Market Parameters

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Described in BPM for Market Operations or Tariff Section	Penalty Price Description	Scheduling Run Value ⁴² when submitted and cost-verified bids are below \$1,000/MWh and the CAISO-calculated maximum import bid price is not greater than \$1,000/MWh (\$/MWh)	Pricing Run Value when submitted and cost-verified bids are below \$1,000/MWh and the CAISO-calculated maximum import bid price is not greater than \$1,000/MWh (\$/MWh)	Scheduling Run Value when submitted and cost-verified bids are greater than \$1,000/MWh or the CAISO-calculated maximum import bid price is greater than \$1,000/MWh (\$/MWh)	Pricing Run Value when submitted and cost-verified bids are greater than \$1,000/MWh or the CAISO-calculated maximum import bid price is greater than \$1,000/MWh (\$/MWh)	Comment
BPM for Market Operations Section 6.6.5	Energy balance/Load curtailment and Self-Scheduled exports utilizing non-RA capacity	1,450	1,000	2,900	2,000	Scheduling run penalty price is set high to achieve high priority in serving forecast load and exports that utilize non-RA capacity. Energy bid cap as pricing run parameter reflects energy supply shortage.
BPM for Market Operations Section 6.6.5 and Tariff Section 27.4.3.1	Transmission constraints: Intertie scheduling	1,500	1,000	3,000	2,000	The highest among all constraints in scheduling run, penalty price reflects its priority over load serving. Energy bid cap as pricing run parameter reflects energy supply shortage.
BPM for Market Operations Section 6.6.5	Legacy Reliability Must-Run (LRMR) pre-dispatch curtailment (supply), and Exceptional Dispatch Supply	-6,000	-150	-6,000	-150	LRMR scheduling requirement is protected with higher priority over enforcement of internal transmission constraint in scheduling run. Energy bid floor is used as the pricing run

⁴² Penalty values in the scheduling run are negatively valued for supply reduction and positively valued for demand reduction.

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Described in BPM for Market Operations or Tariff Section	Penalty Price Description	Scheduling Run Value ⁴² when submitted and cost-verified bids are below \$1,000/MWh and the CAISO-calculated maximum import bid price is not greater than \$1,000/MWh (\$/MWh)	Pricing Run Value when submitted and cost-verified bids are below \$1,000/MWh and the CAISO-calculated maximum import bid price is not greater than \$1,000/MWh (\$/MWh)	Scheduling Run Value when submitted and cost-verified bids are greater than \$1,000/MWh or the CAISO-calculated maximum import bid price is greater than \$1,000/MWh (\$/MWh)	Pricing Run Value when submitted and cost-verified bids are greater than \$1,000/MWh or the CAISO-calculated maximum import bid price is greater than \$1,000/MWh (\$/MWh)	Comment
						parameter for any type of energy self-schedule.
BPM for Market Operations Section 6.6.5	Pseudo-tie layoff energy	-1,500	-150	-1,500	-150	Energy bid floor is used as the pricing run parameter for any type of energy self-schedule.
BPM for Market Operations Section 6.6.5 and Tariff Section 27.4.3.1	Transmission constraints: branch, corridor, nomogram (base case and contingency analysis)	1,500	1,000	3,000	2,000	Scheduling run penalty price will enforce internal transmission constraints up to a re-dispatch cost of \$ of congestion relief in \$1,500/MWh or \$3,000/MWh. Energy bid cap as pricing run parameter consistent with the value for energy balance relaxation under a global energy supply shortage.
BPM for Market Operations Section 6.6.5	Real Time TOR Supply Self Schedule	-5,900	-150	-5,900	-150	In RTM, TOR self-schedule scheduling run penalty price is much higher in magnitude than generic self-schedule but lower than transmission constraint. Energy bid floor

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Described in BPM for Market Operations or Tariff Section	Penalty Price Description	Scheduling Run Value ⁴² when submitted and cost-verified bids are below \$1,000/MWh and the CAISO-calculated maximum import bid price is not greater than \$1,000/MWh (\$/MWh)	Pricing Run Value when submitted and cost-verified bids are below \$1,000/MWh and the CAISO-calculated maximum import bid price is not greater than \$1,000/MWh (\$/MWh)	Scheduling Run Value when submitted and cost-verified bids are greater than \$1,000/MWh or the CAISO-calculated maximum import bid price is greater than \$1,000/MWh (\$/MWh)	Pricing Run Value when submitted and cost-verified bids are greater than \$1,000/MWh or the CAISO-calculated maximum import bid price is greater than \$1,000/MWh (\$/MWh)	Comment
						is used as the pricing run parameter as any type of energy self-schedule.
BPM for Market Operations Section 6.6.5	Real Time ETC Supply Self Schedule	-5,100 to -5,900	-150	-5,100 to -5,900	-150	In RTM the range of penalty prices for different ETCs supply self-schedules are much higher in magnitude than generic supply self-schedules but lower than TOR. Energy bid floor is the pricing parameter for all energy supply self-schedules.
BPM for Market Operations Section 6.6.5	Ancillary Service Region Reg-Up and Reg-Down Minimum Requirements	1,450	250	2,900	500	Scheduling run penalty price is below the one for transmission constraint. Pricing run parameter is set to the AS market bid cap to reflect AS supply shortage.
BPM for Market Operations Section 6.6.5	Ancillary Service Region Spin Minimum Requirements	1,400	250	2,800	500	Scheduling run penalty price is lower than the one for regulation-up minimum requirement. Pricing run

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						parameter is set to the AS market bid cap to reflect AS supply shortage.
BPM for Market Operations Section 6.6.5	Ancillary Service Region Non-Spin Minimum Requirements	1,350	250	2,700	500	Scheduling run penalty price is lower than the one for spin minimum requirement. Pricing parameter is set to the AS market bid cap to reflect AS supply shortage.
BPM for Market Operations Section 6.6.5	Ancillary Service Region Maximum Limit on Upward Services	1,200	250	2,400	500	Scheduling run penalty price is lower than those for minimum requirements to avoid otherwise system-wide shortage by allowing sub-regional relaxation of the maximum requirement. AS market bid cap as pricing run to reflect the otherwise system-wide shortage.
BPM for Market Operations Section 6.6.5	Self-scheduled exports not using identified non-RA supply resource	1,150	1,000	2,300	2,000	Scheduling run penalty price reflects relatively low priority in protection as compared to

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Described in BPM for Market Operations or Tariff Section	Penalty Price Description	Scheduling Run Value ⁴² when submitted and cost-verified bids are below \$1,000/MWh and the CAISO-calculated maximum import bid price is not greater than \$1,000/MWh (\$/MWh)	Pricing Run Value when submitted and cost-verified bids are below \$1,000/MWh and the CAISO-calculated maximum import bid price is not greater than \$1,000/MWh (\$/MWh)	Scheduling Run Value when submitted and cost-verified bids are greater than \$1,000/MWh or the CAISO-calculated maximum import bid price is greater than \$1,000/MWh (\$/MWh)	Pricing Run Value when submitted and cost-verified bids are greater than \$1,000/MWh or the CAISO-calculated maximum import bid price is greater than \$1,000/MWh (\$/MWh)	Comment
						other demand categories. Energy bid cap as pricing run parameter to reflect energy supply shortage.
BPM for Market Operations Section 6.6.5	Final IFM Supply Schedule	-750	-150	-750	-150	Scheduling run penalty price is much higher in magnitude than supply generic self-schedule but lower than ETCs. Energy bid floor is the pricing parameter for all energy supply self-schedules.
BPM for Market Operations Section 6.6.5	Regulatory Must-Run and Must Take supply curtailment	-1,400	-150	-1,400	-150	Scheduling run penalty price reflects the higher priority of regulatory must-run and must-take supply received over generic self-schedules for supply resources. Energy bid floor is the pricing parameter for all energy supply self-schedules.
BPM for Market Operations Section 6.6.5	Price-taker supply bids	-400	-150	-400	-150	Energy bid floor is the pricing parameter for all energy supply self-schedules.

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BPM for Market Operations Section 6.6.5	Qualified Load Following self-provision Up or Down	-8,500	0	-8,500	0	Scheduling run penalty price reflects the highest priority among all categories of AS self-provision. AS bid floor is used as the pricing parameter for any type of AS self-provision.
BPM for Market Operations Section 6.6.5	Day ahead conditionally qualified Reg Up or Down Award	-7,750	0	-7,750	0	Scheduling run penalty price is higher than the penalty price for energy balance constraint to reflect higher in priority over energy. AS bid floor is pricing parameter for any type of AS self-provision.
BPM for Market Operations Section 6.6.5	Day ahead conditionally qualified Spin Award	-7,700	0	-7,700	0	Scheduling run penalty price is lower than the one for Reg-up. AS bid floor is pricing parameter for any type of AS self-provision.
BPM for Market Operations Section 6.6.5	Day ahead conditionally qualified Non-spin Award	-7,650	0	-7,650	0	Scheduling run penalty price is lower than the one for Spin. AS bid floor is pricing parameter for any type of AS self-provision.

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BPM for Market Operations Section 6.6.5	Conditionally qualified Reg Up or Down Real Time self-provision (RTUC only)	-405	0	-405	0	Scheduling run penalty price allows the conversion of AS self-schedules to energy to prevent LMP of local area from rising so high as to trigger transmission constraint relaxation. AS bid floor is pricing parameter for any type of AS self-provision.
BPM for Market Operations Section 6.6.5	Conditionally qualified Real Time Spin self-provision (RTUC only)	-400	0	-400	0	Scheduling run penalty price is below the one for regulating-up. AS bid floor is pricing parameter for any type of AS self-provision.
BPM for Market Operations Section 6.6.5	Conditionally qualified Real Time Non-Spin self-provision (RTUC only)	-395	0	-395	0	Scheduling run penalty price is below the one for spin. AS bid floor is pricing parameter for any type of AS self-provision.
BPM for Market Operations Section 6.6.5	Conditionally unqualified Reg Up or Down Real Time self-provision (RTUC only)	-195	0	-195	0	In scheduling run, AS self-provision not qualified in pre-processing can still be considered as an AS bid with higher priority in the

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						energy/AS co-optimization along with regular AS bids. AS bid floor is pricing parameter for any type of AS self-provision.
BPM for Market Operations Section 6.6.5	Conditionally unqualified Spin Real Time self-provision (RTUC only)	-170	0	-170	0	Same as above.
BPM for Market Operations Section 6.6.5	Conditionally unqualified Non-Spin Real Time self-provision (RTUC only)	-155	0	-155	0	Same as above.
BPM for Market Operations Section 6.6.5	System power balance constraint	1,100, -155	1,000, -155	2,200, -155	2,000, -155	To reflect the role regulation plays in balancing the system for undersupply conditions when economic bids are exhausted, the ISO allows the system power balance constraint to relax by as much as the seasonal regulation requirement. For over-supply conditions, when economic bids are exhausted, the ISO allows the system power

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Described in BPM for Market Operations or Tariff Section	Penalty Price Description	Scheduling Run Value ⁴² when submitted and cost-verified bids are below \$1,000/MWh and the CAISO-calculated maximum import bid price is not greater than \$1,000/MWh (\$/MWh)	Pricing Run Value when submitted and cost-verified bids are below \$1,000/MWh and the CAISO-calculated maximum import bid price is not greater than \$1,000/MWh (\$/MWh)	Scheduling Run Value when submitted and cost-verified bids are greater than \$1,000/MWh or the CAISO-calculated maximum import bid price is greater than \$1,000/MWh (\$/MWh)	Pricing Run Value when submitted and cost-verified bids are greater than \$1,000/MWh or the CAISO-calculated maximum import bid price is greater than \$1,000/MWh (\$/MWh)	Comment
						balance constraint to relax to about 10% of the seasonal regulation requirement. The prices are selected to allow for coordinated dispatch of bids that may exist at or near the bid cap, or at or near the bid floor.
BPM for Market Operations Section 6.6.5	Power Balance constraint for individual EIM areas	1,100, -750	1,000, -150	2,200, -750	2,000, -150	Subject to the FERC order granting waiver of tariff sections 27.4.3.2 and 27.4.3.4, and consistent with Section 10.1.6 of the BPM for Energy Imbalance Market, which implement the price discovery mechanism overriding the pricing parameters and yielding the last economic signal under constraint relaxation. The scheduling run parameter is set to -750 for the individual EIM areas to

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Described in BPM for Market Operations or Tariff Section	Penalty Price Description	Scheduling Run Value ⁴² when submitted and cost-verified bids are below \$1,000/MWh and the CAISO-calculated maximum import bid price is not greater than \$1,000/MWh (\$/MWh)	Pricing Run Value when submitted and cost-verified bids are below \$1,000/MWh and the CAISO-calculated maximum import bid price is not greater than \$1,000/MWh (\$/MWh)	Scheduling Run Value when submitted and cost-verified bids are greater than \$1,000/MWh or the CAISO-calculated maximum import bid price is greater than \$1,000/MWh (\$/MWh)	Pricing Run Value when submitted and cost-verified bids are greater than \$1,000/MWh or the CAISO-calculated maximum import bid price is greater than \$1,000/MWh (\$/MWh)	Comment
						coordinate the relaxation of the EIM power balance constraint during over-generation conditions relative to congestion on non-EIM constraints.
BPM for Market Operations Section 6.6.5	EIM Upward Available Balancing Capacity Range	1,200 through 1,050	Bid in Prices Range for EIM Participating resource and DEB for EIM Non-Participating	2,400 through 2,100	Bid in Prices Range for EIM Participating resource and DEB for EIM Non-Participating	The Penalty Price Range used for the Available Capacity Range prices to maintain the economic merit order reflected in the energy bid prices of the allocated energy bid portions
BPM for Market Operations Section 6.6.5	EIM Downward Available Balancing Capacity	-250 through -350	Bid in Prices Range for EIM Participating resource and DEB for EIM Non-Participating	-250 through -350	Bid in Prices Range for EIM Participating resource and DEB for EIM Non-Participating	The Penalty Price Range used for the Available Capacity Range prices to maintain the economic merit order reflected in the energy bid prices of the allocated energy bid portions
BPM for Market Operations Section 6.6.5	EIM Transfer Constraint	1,500	1,000	3,000	2,000	Penalty price and pricing parameter consistent with the

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						transmission constraint;
BPM for Market Operations Section 6.6.5	EIM Entitlement Rate of Change Constraint (RTD Only)	1,500	0	3,000	0	Penalty price aligned with EIM transfer constraint is currently applicable to RTD 5 minute rate of change.
BPM for Market Operations Section 6.6.5	Administrative Flexible Ramp Down Price Floor	-152	-152	-152	-152	Downward Demand Curve Price Cap
BPM for Market Operations Section 6.6.5	Administrative Flexible Ramp Up Price Ceiling	247	247	494	494	Upward Demand Curve Price Cap
Tariff Section 27.1.2.3.1	Regulation Down Pricing – Insufficient Supply	Price set as percentage of \$1,000/MWh, depending on the amount the CAISO market is short of supply needed to meet the Regulation Down requirement.	Price set as percentage of \$1,000/MWh, depending on the amount the CAISO market is short of supply needed to meet the Regulation Down requirement.	Price set as percentage of \$2,000/MWh, depending on the amount the CAISO market is short of supply needed to meet the Regulation Down requirement.	Price set as percentage of \$2,000/MWh, depending on the amount the CAISO market is short of supply needed to meet the Regulation Down requirement.	N/A
Tariff Section 27.1.2.3.2	Non-Spinning Reserve Pricing – Insufficient Supply	Price set as percentage of \$1,000/MWh, depending on the amount the CAISO market is short of supply needed to meet the Non-Spinning Reserve requirement.	Price set as percentage of \$1,000/MWh, depending on the amount the CAISO market is short of supply needed to meet the Non-Spinning Reserve requirement.	Price set as percentage of \$2,000/MWh, depending on the amount the CAISO market is short of supply needed to meet the Non-Spinning Reserve requirement.	Price set as percentage of \$2,000/MWh, depending on the amount the CAISO market is short of supply needed to meet the Non-Spinning Reserve requirement.	N/A
Tariff Section 27.1.2.3.3	Spinning Reserve Pricing –	Price set as 10% of \$1,000/MWh.	Price set as 10% of \$1,000/MWh.	Price set as 10% of \$2,000/MWh.	Price set as 10% of \$2,000/MWh.	N/A

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	Insufficient Supply					
Tariff Section 27.1.2.3.4	Regulation Up Pricing – Insufficient Supply	Price set as 20% of \$1,000/MWh.	Price set as 20% of \$1,000/MWh.	Price set as 20% of \$2,000/MWh.	Price set as 20% of \$2,000/MWh.	N/A
Tariff Section 27.4.3.4	Insufficient Supply to Meet CAISO Forecast of CAISO Demand in the RTM	1,000	1,000	2,000	2,000	Pricing run parameter set at hard energy bid cap.
Tariff Section 30.6.2.1.2.1	Marginal Real-Time Dispatch Option	To be calculated according detail in comment.	To be calculated according detail in comment.	To be calculated according detail in comment.	To be calculated according detail in comment.	Penalty prices set as a percentage of the hard energy bid set forth in Section 39.6.1.1.
Tariff Section 30.6.2.1.2.2	Discrete Real-Time Dispatch Option	To be calculated according detail in comment.	To be calculated according detail in comment.	To be calculated according detail in comment.	To be calculated according detail in comment.	Penalty prices set as a percentage of the hard energy bid set forth in Section 39.6.1.1.

Attachment E

Board Memorandum

**Tariff Amendment to Enhance Market Parameters and
Import Bidding Related to Order No. 831**

California Independent System Operator Corporation

February 22, 2021



Memorandum

To: ISO Board of Governors

From: Mark Rothleder, Vice President, Market Policy and Performance

Date: September 23, 2020

Re: Decision on FERC Order No. 831 - Import Bidding and Market Parameters Proposal

This memorandum requires Board action.

EXECUTIVE SUMMARY

In 2016, the Federal Energy Regulatory Commission (FERC) issued Order No. 831 requiring ISOs/RTOs to increase their market bid caps from \$1,000/MWh to \$2,000/MWh. FERC issued the order in response to the polar vortex in the northeast that caused extreme natural gas prices that resulted in generator costs in excess of the \$1,000/MWh bid cap. Order No. 831 includes the provision that suppliers must verify costs above \$1,000/MWh to be eligible to set market prices. The order does not require verification of import or virtual bids above \$1,000/MWh.

Management proposes two market enhancements in addition to the compliance requirements to tailor the implementation of the higher bid cap to better align with characteristics of the western energy market. The first enhancement is designed to enable the use of the current market pricing parameters based on \$1,000/MWh unless market conditions can support costs and bids above \$1,000/MWh. The second enhancement provides additional protections for import and virtual bids above \$1,000/MWh.

The first proposed enhancement relates to the pricing parameter used in the ISO market to calculate locational marginal prices when energy supply bids are not sufficient to meet demand. This administrative price is referred to as a shortage price. The ISO market enforces a power balance constraint that ensures supply equals demand. Today, if there is insufficient supply and the market must relax the power balance constraint, the market will set prices based on the current \$1,000/MWh bid cap. Management's proposed enhancement will enable the ISO market to set appropriate levels of shortage pricing when energy costs exceed \$1,000/MWh. This enhancement does not affect shortage price setting when energy costs are below \$1,000/MWh.

This enhancement will also ensure that when energy costs exceed \$1,000/MWh and there is insufficient supply to meet demand, the market will set prices based on the amount of the supply shortfall. The market will base prices on the price of the highest-priced cleared energy bid if the shortfall is no more than a small threshold value. Market prices will be based on \$2,000/MWh if the shortfall is greater than the threshold value.

The threshold will limit shortage pricing when there are small shortfalls in supply that could be the result of modeling or forecast errors and may not represent a true supply shortage. The threshold value is based on the amount of supply shortfall a balancing authority area can incur and still comply with system reliability standards. The proposed threshold would be calculated each year for each balancing authority area in the energy imbalance market using a formula based on a North American Electric Reliability Corporation (NERC) reliability standard.

The second proposed enhancement consists of rules for allowing import and virtual bids greater than \$1,000/MWh. Unlike other American ISOs/RTOs, the ISO is often dependent on import bids to meet demand. Therefore, Management finds it necessary to include criteria for accepting import bids above \$1,000/MWh. Management proposes that the market accept non-resource adequacy import and virtual bids priced above \$1,000/MWh only when the ISO has cost-verified a bid or the ISO has calculated a maximum import price that exceeds \$1,000/MWh. The ISO would calculate the maximum import price using a maximum import bid price index that is based on prevailing bilateral prices. For resource adequacy import bids, Management proposes to reduce the price of bids priced above \$1,000/MWh to the maximum import bid price index or the highest resource-specific cost-verified bid.

Management proposes the following motions:

Moved, that the ISO Board of Governors approves the FERC Order No. 831 - Import Bidding and Market Parameters proposal described in the memorandum dated September 23, 2020; and

Moved, that the ISO Board of Governors authorizes Management to make all necessary and appropriate filings with the Federal Energy Regulatory Commission to implement the proposal described in the memorandum, including any filings that implement the overarching initiative policy but contain discrete revisions to incorporate Commission guidance in any initial ruling on the proposed tariff amendment.

Management presented this FERC Order No. 831 – Import Bidding and Market Parameters proposal to the EIM Governing Body on September 16, 2020. The EIM Governing Body will be providing advisory input to the Board regarding this proposal.

BACKGROUND

In 2016, FERC issued Order No. 831 requiring all Independent System Operators and Regional Transmission Organizations (ISOs/RTOs) to revise their tariffs to raise the energy bid cap from \$1,000/MWh to \$2,000/MWh, and generally required that suppliers base bids priced above \$1,000/MWh on verifiable expected or actual costs.

Order No. 831 requires that ISOs/RTOs verify the costs underlying these cost-based offers above \$1,000/MWh before using them in their market to calculate energy prices. The order also states that an offer may not be used to calculate energy prices if an ISO/RTO cannot verify the costs underlying the offer before a market runs. However, it also states the ISOs/RTOs must provide for after-the-fact make-whole payments for costs that they can later verify and for verified cost-based incremental energy bids above \$2,000/MWh. The Order does not require verification of import or virtual bids above \$1,000/MWh, but states individual ISOs/RTOs could propose to do so in a separate filing to FERC.

Similarly, Order No. 831 did not specify whether ISOs/RTOs should modify their rules for setting shortage prices under a \$2,000/MWh bid cap, but stated that individual ISOs/RTOs could propose modifications to their existing rules if they require revision in light of the increased offer cap.

In March 2018 the Board approved certain market rule changes that enable the ISO to comply with Order No. 831 as part of Management's commitment cost and default energy bid enhancements proposal. These rule changes did not include the enhancements that are the subject of this memorandum. Without these enhancements, the market will set the system marginal energy price at \$2,000/MWh whenever there is a supply shortfall and import and virtual bids will be allowed at all times priced up to \$2,000/MWh.

In September 2019, the ISO submitted its proposed tariff changes to FERC by the deadline to comply with Order No. 831 and proposed that they go into effect in fall 2020, concurrent with the changes resulting from the commitment cost and default energy bid proposal. However, a number of stakeholders continued to object to setting the system marginal energy price at \$2,000/MWh whenever there was a supply shortfall and concern arose regarding import bids above \$1,000/MWh given the concerns that had arisen fairly recently about system-level market power in the ISO balancing authority area.

Consequently, in January 2020, the ISO requested that FERC extend implementation of its Order No. 831 compliance requirements to fall 2021 to allow more time for policy development and implementation of the enhancements this memorandum describes. However, on September 21, 2020, FERC issued an order accepting the ISO's compliance filing and ordered that the ISO implement the changes by March 31, 2021. Management is currently evaluating whether it can accelerate implementing the

enhancements this memorandum describes so that they can be implemented concurrently with the Order No. 831 compliance requirements.

PROPOSAL

The following sections describe Management's proposal for calculating the system marginal energy cost when there is insufficient supply to meet demand and for rules for import and virtual bids priced above \$1,000/MWh under the higher \$2,000/MWh energy bid cap required by FERC Order No. 831.

Market Constraint Price Parameters

The ISO market enforces various constraints such as constraints to ensure supply equals demand and to ensure schedules and dispatches do not overload transmission lines. The constraint that ensures supply equals demand is referred to as the power balance constraint. The various types of constraints have different price parameters, which are the cost at which the market will relax a constraint if it cannot come to a feasible solution while enforcing the constraint. If this occurs, the market calculates locational marginal prices based on these administratively determined relaxation prices.

The power balance constraint relaxation price is currently equal to the \$1,000/MWh energy bid cap in the market run that calculates prices. Consequently, the market sets the marginal energy cost, used to calculate locational marginal prices, to \$1,000/MWh in market intervals when there is a shortfall of supply to meet demand.¹ This price is higher than the highest-priced cleared supply bid and is intended to represent the value of scarce supply during shortages. The price parameters of the other constraints in the market are set at prices that are relative to the \$1,000/MWh power balance constraint price parameter.

As described above, FERC Order No. 831 requires the ISO to increase its energy bid cap from \$1,000/MWh to \$2,000/MWh. The power balance constraint parameter price must be at least as high as the highest-priced bid in the market for that bid to clear. If the ISO set the administrative parameter price to something less than the maximum bid a supplier can submit, the market would relax the power balance constraint rather than meet demand with a higher priced bid.

However, FERC Order No. 831 specifies that bids priced above \$1,000/MWh are only allowed when resource specific costs, generally fuel costs, exceed \$1,000/MWh. Historically, it has been exceedingly rare in the west to have fuel costs high enough to justify a bid in the ISO market above \$1,000/MWh. Consequently, the bid cap in the ISO most likely will effectively remain at \$1,000/MWh the vast majority of the time.

¹ This can be either the marginal energy cost for either an individual balancing authority area or for a group of balancing authority areas in the EIM.

Because of this, Management proposes that the power balance constraint relaxation price parameter remain at \$1,000/MWh and that the price parameters of the other market constraints remain scaled relative to \$1,000/MWh, unless verified energy costs are greater than \$1,000/MWh.² This approach will avoid drastically increasing the administrative price the market uses to calculate prices in the event it must relax the power balance constraint in a market interval and when fuel costs are in their typical range.

Management proposes to use a \$2,000/MWh power balance constraint relaxation price parameter and use other constraints with price parameters scaled relative to \$2,000/MWh only if: (1) there is a submitted and cost-verified energy bid from a resource-specific resource³ greater than \$1,000/MWh, or (2) the ISO-calculated “maximum import bid price” is greater than \$1,000/MWh. As described further below, Management proposes to calculate the maximum import price based on published day-ahead bilateral electrical price indices.

Management proposes an additional enhancement that would apply when the ISO has triggered the \$2,000/MWh pricing parameters to recognize that small amounts of power balance relaxation may not represent actual shortfalls, such as those due to forecast and modeling inaccuracies.

Management proposes to set energy prices based on the amount of supply shortfall when the \$2,000/MWh power balance constraint is in place. If the shortfall is no more than a pre-determined threshold, then the market will set energy prices based on the price of the highest-priced cleared economic bid. The market will set prices based on the \$2,000/MWh power balance constraint relaxation price if the shortfall is greater than the threshold. This threshold will not be applied in the day-ahead market because the day-ahead market forgoes procuring reserves before relaxing the power balance constraint, which would indicate actual scarcity conditions.

Management proposes to establish this pricing threshold for each balancing authority area in the EIM based on the NERC reliability standard for maintaining system frequency. System frequency is maintained by matching supply to demand. However, small mismatches and resulting differences in frequency from the desired 60 Hz are acceptable. The reliability standard defines the amount that supply can be less than demand while still maintaining system frequency within an acceptable limit.

Import Bid Price Screening

As described earlier, FERC Order No. 831 did not require verification of import or virtual bids priced above \$1,000/MWh, but states individual ISOs/RTOs could propose rules

² The ISO market schedules and dispatches resources using two market runs, an initial “scheduling run,” followed by the “pricing run.” The power balance constraint price parameter is \$1,000/MWh in the pricing run, which is the market run that produces market prices. The power balance constraint price parameter is a higher value in the scheduling run and the other market constraints in the scheduling run are scaled relative to this higher value.

³ Resource-specific resources include ISO generating units, EIM participating resources, and resource-specific import bids.

that limits these bids in a separate filing. However, since the ISO often relies on energy from imports to meet demand, Management proposes additional protections for import and virtual bids above \$1,000/MWh.

For import bids that are not resource-specific, it is not practical for the ISO to verify the actual costs behind such import bids because it does not have the cost information associated with the bid. Instead, Management proposes to use a maximum import bid price index to evaluate import bids priced above \$1,000/MWh. The maximum import bid price index is calculated using the higher of the Mid-Columbia and Palo Verde published bilateral day-ahead electrical price indices, plus 10 percent. Mid-Columbia and Palo Verde are the primary liquid trading hubs for bilateral electrical transactions in the west and are representative of prevailing energy prices outside of the ISO. Management proposes to use the higher of the two index prices to help ensure the ISO market can compete for imports.

The published index prices represent average prices for purchases covering the sixteen peak hours of the day. Management proposes to convert the published index prices into hourly prices by scaling the index price by an hourly multiplier. The ISO will calculate the multiplier for each hour based on the hourly shape of prices during a representative previous period. It will increase the price in the hours that typically have higher prices and decrease it in the hours that typically have lower prices.

Management proposes to use the maximum import bid price index used to: 1) screen non-resource adequacy imports and virtual bids above \$1,000/MWh and 2) limit resource adequacy import bids above \$1,000/MWh. Under the proposal, non-resource adequacy imports and virtual supplier bids greater than \$1,000/MWh are allowed only if one of the following two conditions is present: 1) the maximum allowable import bid index is greater than \$1,000/MWh or 2) the ISO has verified a specific resource's cost to be greater than \$1,000/MWh. On the other hand, resource adequacy import bids are treated differently. Resource adequacy import bids above \$1,000/MWh are reduced to the greater of: 1) highest resource specific verified cost, 2) maximum allowable import bid index, or 3) \$1,000/MWh.

Management proposes to not reduce the prices of virtual bids or bids for imports that are not providing resource adequacy. Reducing the prices of the import bids that are not providing resource adequacy resources could discourage suppliers from offering these additional imports to the ISO market because there would be a risk the ISO could reduce their bid below their costs. Import suppliers providing resource adequacy capacity can factor this risk into their capacity contract. Consistent with the rules for non-resource adequacy imports, the ISO would not reduce the price of virtual bids.

STAKEHOLDER POSITIONS

Stakeholders are generally divided in their support for Management's proposal.

Load serving entities, EIM participants, and the California Public Utilities Commission are generally supportive of Management's proposal to continue to use \$1,000/MWh to set prices when the market must relax the power balance constraint when cost-verified energy prices are no more than \$1,000/MWh. These stakeholders either support or do not oppose Management's proposal to set prices based on the last cleared bid when cost-verified energy prices are above \$1,000/MWh and the power balance constraint relaxation amount is less than a threshold amount. EIM participants maintain there should be a different approach to scarcity pricing in the balancing authority areas in the energy imbalance market outside of the ISO because not all of their resources are reflected in the market.

On the other hand, suppliers and the Western Power Trading Forum maintain that pricing power balance constraint relaxation at \$2,000/MWh and allowing import bids up to \$2,000/MWh at all times would more appropriately compensate supply during supply shortfalls, encourage additional supply and provide stronger incentive to deliver on schedules. They point out this would have been particularly important during the August heat wave when energy prices rose above \$1,000/MWh. A number of stakeholders point to the need for the ISO to examine its market's scarcity pricing provisions and make improvements.

Management believes its proposal balances the concern that \$2,000/MWh may be an excessive price for small power balance constraint relaxations that may not represent real shortfalls with the countervailing concern that prices during shortages should be higher than the highest-priced bid so that they represent the value of scarce supply during shortages. However, Management acknowledges that this proposal, which is necessary to complement its compliance with FERC Order No. 831, does not address all of the potential scarcity pricing issues for the ISO market. Management plans to conduct a stakeholder process next year to more comprehensively review scarcity pricing.

While most stakeholders support or do not oppose Management's proposal to limit import bids to \$1,000/MWh except when costs or bilateral prices are above \$1,000/MWh and to reduce resource adequacy bids to a maximum price, a number of stakeholders suggest modifications. The California Public Utilities Commission and many load serving entities believe all imports should be limited to a maximum bid price.

Management believes its proposal balances the ISO market's ability to compete for imports with a level of protection against unreasonably high import bid costs with additional protection for resource adequacy imports.

The ISO Department of Market Monitoring generally supports Management's proposal stating it is a reasonable approach for allowing bids priced above \$1,000/MWh and triggering scarcity pricing under FERC Order No. 831. However, the DMM is concerned that the use of published index prices for bilateral trading hubs outside the ISO could allow high-priced imports and exports and raise ISO market prices when there is not scarcity in the ISO. DMM points to extremely high bilateral prices during the August heat

wave that was not a result of high fuel costs that FERC Order No. 831 contemplated. Additionally, DMM is concerned that at times the trading hubs may not be sufficiently liquid to produce accurate prices.

Management believes the use of published bilateral price index prices is a reasonable approach to determine the prevailing price of electricity in areas outside the ISO balancing authority area that are the source of imports. It is important to not overly restrict the price of imports because the ISO relies on imports to serve its load. The Mid-Columbia and Palo Verde trading hubs are the most liquid hubs outside of the ISO balancing authority area.

The ISO Market Surveillance Committee supports Management's proposal but encourages the ISO to conduct a subsequent stakeholder process to develop a more holistic and consistent approach to scarcity pricing for both the ISO and EIM regions.

Attachment A presents a more detailed summary of stakeholder comments and Management's responses.

The Market Surveillance Committee provided a formal opinion on Management's proposals, which is included as Attachment B.

CONCLUSION

Management recommends the Board of Governors approve this proposal. The FERC Order No. 831 - Import Bidding and Market Parameters proposal will allow the ISO market to set appropriate prices when there is insufficient supply to meet demand. The proposal also provides additional protection to the market against unreasonably high import bid prices while allowing price levels that reflect prevailing prices for import energy. The different application of the import protections to resource adequacy and non-resource adequacy imports will ensure that non-resource adequacy supply is not discouraged from offering into the ISO market during tight supply conditions.

Attachment F

MSC Opinion

**Tariff Amendment to Enhance Market Parameters and
Import Bidding Related to Order No. 831**

California Independent System Operator Corporation

February 22, 2021

**Opinion on
Revisions to Import Bidding and Market Parameters for
Compliance with FERC Order 831**

by

James Bushnell, Member
Scott M. Harvey, Member
Benjamin F. Hobbs, Chair

Members of the Market Surveillance Committee of the California ISO

September 9, 2020

I. Introduction

The Market Surveillance Committee (MSC) of the California Independent System Operator (CAISO) has been asked to comment on the ISO's proposal for compliance with FERC order 831.¹ The initiative leading to this proposal has been discussed during MSC meetings on Dec. 6, 2019, May 8, 2020, and July 30, 2020.

There are two key aspects to this proposal: the determination of allowable offer prices and the setting of penalty values and market prices. We support the approach of screening offers above \$1000/MWh from specific resources using methods also utilized for other market power screening purposes. We also support the proposal for calculating a maximum import price based upon regional bilateral price indices. Although Order 831 was primarily concerned with periods of very high gas prices, experiences with the mid-August heat-wave demonstrate the need for allowing for higher priced import offers (and export prices) during periods of regional scarcity. As we discuss, below, however, there are challenges with adapting these multi-hour bilateral index prices for use as an hourly import price screen, and the CAISO should carefully monitor and be ready to modify, if necessary, its formula for calculating these prices.

We also support the proposal's approach to setting penalty values, which determine market prices during periods of scarcity. Our support, however, is based upon the fact that this initiative was intended to focus primarily on allowable offers and not on the wider set of issues associated with the topic of scarcity pricing. Given this fact, we believe the compromises made in the development of this proposal are reasonable and an improvement over current practice. However, we strongly urge the CAISO to undertake an initiative that will be focused specifically on scarcity pricing, so that a more holistic and consistent approach to scarcity pricing with both the CAISO and EIM regions can be developed. The experiences of mid-August again signal the urgency of such an initiative. These conditions will likely grow more frequent and the region is in need of a more coordinated approach to managing scarcity conditions.

¹ California ISO, "FERC Order No. 831 – Import Bidding and Market Parameters, Revised Draft Final Proposal," July 22, 2020, <http://www.caiso.com/InitiativeDocuments/RevisedDraftFinalProposal-FERCOrder831-ImportBidding-MarketParameters.pdf>

II. Background

The changes proposed in this initiative are related to compliance with Order 831, issued by the Federal Energy Regulatory Commission (FERC) in 2016.² Order 831 required all Independent System Operators and Regional Transmission Organizations (ISOs/RTOs) to raise their caps on allowed energy supply offer prices from \$1000 to \$2000. Whereas most (unmitigated) offers under \$1000 are not required to be cost justified, under Order 831 offers over \$1000 will require cost justification.

The order was issued in the wake of the 2014 polar vortex when natural gas prices in the Midwest and northeast spiked to levels where marginal generation costs plausibly rose over the \$1000 offer caps then in place. The spirit of the order was to allow supply resources to earn prices at least sufficient to recover their operating costs during periods of high generation costs, thereby helping to ensure reliable electricity supply during these periods. The order did not specify exactly how the increased offer caps should interact with other aspects of price formation in ISO/RTO markets.

To understand this interaction, it is important to consider the distinction between offer caps and “price” caps (e.g., maximum prices) in ISO/RTO markets. An offer cap is the maximum price a supplier can bid into the pricing process. Under most circumstances this is *not* the maximum price a supplier may earn on the energy it does provide. US ISO markets operate under a uniform-pricing approach where all suppliers earn, and all load-serving entities (LSEs) pay, the market-clearing price. Therefore, most suppliers earn a price, set by the marginal supplier, that is above their offer price. In periods of scarcity, *all* suppliers can potentially earn a price above their offer prices.

In practice these scarcity prices are usually determined by penalty values imposed by the market software that are triggered when certain scarcity conditions arise, or equivalently, certain market constraints are relaxed. In the CAISO and EIM markets, the penalty value on the constraint balancing systemwide supply and demand, called the *power balance constraint*, is currently set at \$1000/MWh.

This CAISO initiative has primarily been concerned with two aspects of Order 831 implementation. The first is how to screen and cost justify the prices of import supply offers that are not linked to a specific supply source, and therefore cannot be cost-verified by conventional methods. The second aspect relates to if and how to raise the penalty prices in the market software and also how to set prices when the CAISO cannot balance generation and load in the energy market.

² Federal Energy Regulatory Commission (FERC). Order No. 831, Final Rule. November 17, 2016. <https://ferc.gov/sites/default/files/2020-06/RM16-5-000.pdf>

III. Summary of the Proposal

The two key aspects of the proposal concern the determination of allowable offer prices and the setting of penalty values and market prices.

Screening Allowable Offer Prices

Under the CAISO proposal, offer prices linked to specific resources with known characteristics operating within the EIM footprint will be screened using the same methods currently applied for market power mitigation. These involve calculating benchmark marginal cost estimates for units based upon fuel price indices, unit efficiencies, opportunity costs, and other considerations. These costs form the basis of the default energy bid (DEB) that is applied to resources subject to local market power mitigation. Under the Order 831 compliance proposal, when the DEB of a resource rises above \$1000, the submission of offer prices at DEBs in excess of \$1000 would be allowed by the market software.³ Effectively, the bids of all units with costs above \$1000 would be “mitigated” to their default energy bid (DEB), regardless of whether or not they possess local market power. There are also provisions in the proposal to allow resources to recover additional costs not reflected in their DEB, if the owners can provide evidence of these additional costs. These additional costs could therefore be recovered by the unit owner but would not set the market price.

To screen the prices of import and virtual supply offers that are not linked to a specific resource, the CAISO proposes calculating a “maximum allowed import bid price.” This is an hourly value that would be imputed from bilateral prices at regional trading hubs at Palo Verde and Mid-Columbia (Mid-C). We discuss this maximum import bid calculation in more detail below. The CAISO proposes to apply this maximum bid price differently to imports providing resource adequacy capacity (and subject to must-offer obligations) than to other non-RA imports and virtual supply.

For imports associated with RA capacity, offer prices above \$1000 would be reduced to the greater of \$1000, the CAISO calculated maximum import bid price, or the highest priced cost-justified bid. For virtual and non-RA import supply, the maximum bid price would be used as a threshold condition, rather than as a bid cap. These supply offers would be allowed up to \$2000 if *either* the CAISO calculated maximum import bid price or a cost-verified offer from any specific resource (internal or external) rises above \$1000.⁴

Unlike resource specific offers, offers from non-resource specific imports would *not* be eligible for after the fact cost recovery. Non-RA imports would have more flexibility to bid up to \$2000, and RA imports would be assumed to incorporate any risks created by these rules into their costs of selling RA.

³ *Revised Draft Final Proposal*, op. cit., p. 14.

⁴ *Revised Draft Final Proposal*, op. cit., p. 21. While this version describes RA bids being reduced to the higher of \$1000 or the maximum import bid price, it is our understanding that the CAISO intends to modify this to also include the highest price cost-justified offer in the tariff language it is developing.

Setting of Penalty Values and Market Prices

A second important element of the proposal changes the penalty parameters that are applied in the market software when a constraint needs to be relaxed to reach a solution.⁵ While not strictly price caps per se, these penalty parameters can play a similar role in that they determine market prices during intervals when supply and demand do not balance and neither supply offers or demand bids set prices. The primary focus in the proposal is on the penalty associated with the power balance constraint (PBC), which captures the requirement in the market software that energy supply must equal energy demand.⁶ Other parameters, such as those associated with relaxing transmission constraints would also be scaled proportionately to the scaling of the PBC penalty value.⁷ These penalty parameters are in place to ensure that constraints are relaxed only under extreme conditions and that market prices at least partially reflect the scarcity value associated with the constraint that is relaxed. Conceptually, the scarcity value is the benefit – in terms of reduced cost or increased reliability – of having enough additional capacity to *not* have to relax the constraint.

From a mathematical and economic standpoint, it makes little sense to deploy a PBC penalty parameter that is lower than the maximum allowable bid price. If this were the case, the market software would choose to relax the PBC constraint and incur a penalty rather than tap a resource whose bid costs are higher than the penalty. Therefore, for the proposed changes to allowed offer prices to be meaningful, the penalty prices will need to be at least as high as the highest possible bid. Initially, the CAISO proposed doubling all penalty values, which would have increased the penalty value associated with the PBC and most transmission constraints from \$1000 to \$2000, under all conditions.⁸

In comments, the CAISO DMM pointed out that doubling penalty prices in all hours was not technically required to accommodate higher bid caps.⁹ Other stakeholders, particularly a group

⁵ There are two sets of penalty values, but only those used in what is known as the pricing run are used to set prices. In the CAISO and the EIM market allocations are first determined in a scheduling run that utilizes much larger penalty values than the subsequent pricing run. The pricing run uses the quantities from the scheduling run to adjust formulations of the constraints in such a way that the final (pricing run) penalty values, or in some cases offers, set prices. The proposal discussed here would proportionally increase penalty values in both the scheduling and the pricing run.

⁶ Note that, while relaxation of the PBC is a signal of extreme scarcity, doing so does *not* necessarily imply a need to involuntarily curtail load. Rather relaxation of the PBC signals that the offered supply that is committed (or available to be committed) into the market is not capable of meeting expected demand at the time the market solution is calculated. Operators would draw down energy from regulation and ancillary services and deploy other out-of-market actions before resorting to load curtailment.

⁷ Appendix A. *Revised Draft Final Proposal*, p. 31.

⁸ California ISO. Draft Tariff Language – Commitment Cost and Default Energy Bid Enhancements. May, 2019. <http://www.caiso.com/InitiativeDocuments/CommitmentCost-DefaultEnergyBidEnhancements-DraftTariffLanguage.docx>. See discussion of “Hard Energy Bid Cap” pp. 82.

⁹ California ISO Department of Market Monitoring. Comments on FERC Order 831 -Import Bidding and Market Parameters: Issue Paper and Straw Proposal. December 20, 2019.

of EIM entities, objected to the blanket increase of penalty values at all times in response to an initiative whose focus is on a bid-cap policy that will likely be rarely triggered.¹⁰ These comments also stressed a need for more graduated scarcity prices. In response the CAISO has iterated through several design options before producing the current proposal. The current proposal would leave the PBC (and associated) penalties at their current levels (\$1000 for the PBC penalty) under normal conditions. The penalty parameters would double only when an approved offer price (after the screening procedure described above) rises above \$1000.

Under these conditions, the scheduling-run calculation of market outcomes would be based upon doubled penalty values. However, the \$2000 PBC penalty would not necessarily be used to set the energy prices used for settlements. If an offer price rises above \$1000, one of two outcomes for the setting of market prices could result, depending upon the magnitude of the constraint violation. The CAISO now proposes that if the PBC is violated by only a small amount – currently 233.7 MW in the CAISO system – then the systemwide marginal energy cost (SMEC) would be capped at the highest energy price bid to pass the screens described above.¹¹ In other words, systemwide energy prices would be capped at the highest approved offer price for “small” PBC violations. The MW size of the threshold for EIM balancing areas will be based upon a formula considering NERC standards for managing area control error (ACE) magnitudes.¹² Locational marginal prices (LMP) could still rise above these levels as other elements of an LMP, notably the marginal costs of transmission congestion and losses at a given node, would be added to the systemwide energy cost.

If screened offer prices rise above \$1000 *and* there is a PBC constraint violation of a large magnitude (e.g. in excess of the thresholds described above), then prices would be set, as is normal procedure, according to the PBC and associated penalty values which would be doubled from their “normal” levels under these circumstances. Under these conditions the systemwide energy component of prices could be set at \$2000 even if the highest energy bid is less than \$2000. Although the most recent proposal implies this threshold would be applied in both the day-ahead and real-time markets, it is now our understanding that it will only be applied in real-time. In the DAM, a PBC relaxation of any magnitude will set prices at the \$2000 penalty price, if any of the conditions allowing offer prices above \$1000 apply.

<http://www.caiso.com/InitiativeDocuments/DMMComments-FERCOrder831-ImportBidding-MarketParameters-RevisedStrawProposal.pdf>

¹⁰ Joint Party Comments. Commitment Costs and Default Energy Bid Draft Tariff Language. May 28, 2019. <http://www.caiso.com/InitiativeDocuments/JointPartiesComments-CommitmentCostsandDefaultEnergyBidEnhancements-DraftTariffLanguage.pdf>

¹¹ California ISO, “FERC Order No. 831 – Import Bidding and Market Parameters, Final Proposal,” August 24, 2020, pp. 17. <http://www.caiso.com/InitiativeDocuments/FinalProposal-FERCOrder831-ImportBidding-MarketParameters.pdf>.

¹² *Final Proposal*, op. cit., p. 15-16.

IV. Discussion

Given recent history, the conditions under this proposal would be applicable are likely to be very rare, but are not unimaginable. In 2018 and 2019 there were no more than 3 days in which the maximum import bid price had the potential to exceed \$1000. However, as the experience with the mid-August heat wave has shown, there are reasons to believe that prices in both the natural gas and electricity markets will become more volatile in future years and power markets need to be prepared to accommodate conditions when the marginal costs of generation could rise above \$1000. The CAISO is required by FERC order to do so.

Two areas where the CAISO had some discretion in implementing Order 831 were the specific methodology used to screen generation and import offers, and how to modify the price-setting process, including penalty values, if generation costs did rise above the default offer cap of \$1000. We support the CAISO's general approach but in the following sections discuss some potential areas for further refinement.

Screening Allowable Offer Prices

For the bulk of supply offers into the market, the CAISO will apply the same methods to screening offers as it utilizes to evaluate potential market power in energy price offers. These methods underwent important updates in 2018 with the changes implemented under the Commitment Costs and Default Energy Bid Enhancements (CCDEBE) initiative. Changes were made to improve the timeliness of gas price data used in the calculation of DEBS, and major changes were made to the calculation of opportunity costs used in the offers of hydro generation sources. While there are still significant challenges to calculating accurate DEBs, particularly in times of volatile gas prices,¹³ it is logical and internally consistent that the proposal would adopt an approach to the verification of cost consistent with that used for various other purposes in the CAISO and EIM.

Import Supply Offers

For import supply offers not linked to specific units, the CAISO will deploy an index based upon the higher price at two regional over-the-counter (OTC) trading hubs. These OTC contracts, which are traded on the Intercontinental Exchange (ICE), are typically traded in a liquid market and their prices are representative of regional market prices for blocks of hours during the trading period. However, these contracts clear only in off-peak or on-peak multi-hour blocks. In order to transform a 16-hour (in the case of peak contracts) average price into an allowable hourly import bid, the CAISO will apply a "shaping factor." Earlier proposals first considered using the average price profile for the month, and then the price profile based upon the previous day's CAISO day-ahead market SMEC price. This proposal was then modified to instead use the profile based upon the most recent day in which there was at least one hour with a SMEC

¹³ J. Bushnell, S. Harvey, and B. Hobbs, "Opinion on Commitment Costs and Default Energy Bid Enhancements (CCDEBE)." March 5, 2018. http://www.caiso.com/Documents/MSCFinalOpinion-CommitmentCost_DefaultEnergyBidEnhancements-Mar5_2018.pdf

over \$200/MWh in the CAISO day-ahead market.¹⁴ This “reference day” will be adjusted seasonally, so that if there is no high price day in the current season of the current year, the index would be based upon the most recent high price day from the same season from a previous year.¹⁵

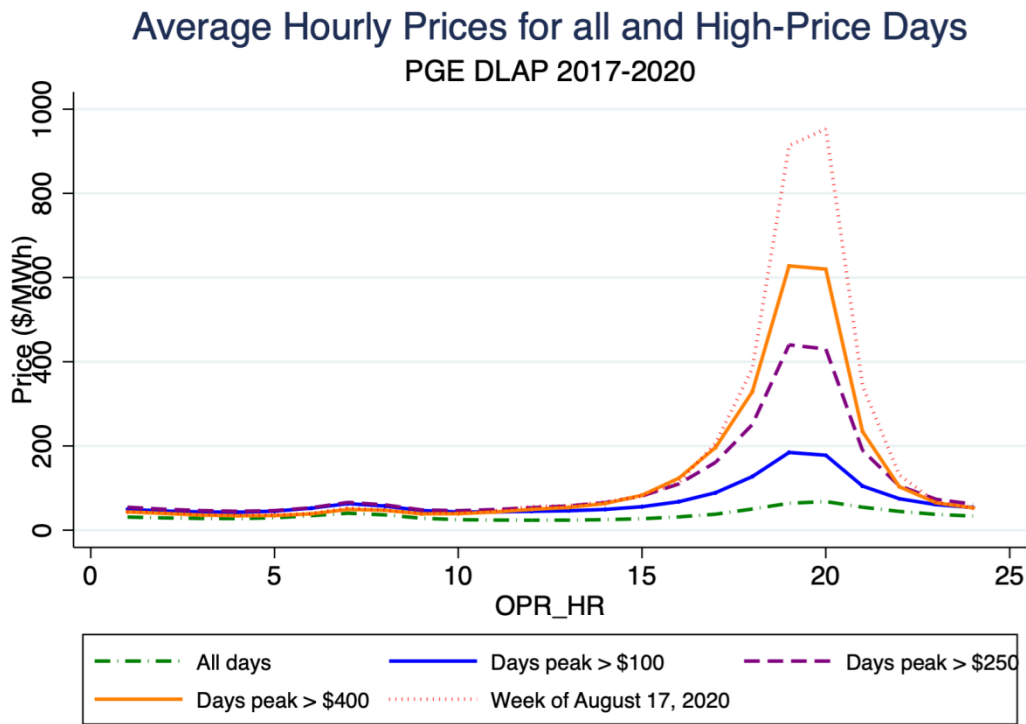


Figure 1: Average Price Differences with Previous Day

The main reason for this recent change is that, while under most conditions the previous day’s price pattern is very similar to that of the current day, this relationship can break down during high price events. The difficulty is illustrated in Figure 1, which plots average hourly DAM prices from the PG&E DLAP zone during all hours and during hours in which peak prices reach various thresholds. The higher the peak price in CAISO, the larger the disparity between those peak prices and the average daily price.

While not perfect, using prices from the previous high-priced day rather than from the month as a whole to calculate the shaping factor is an improvement over previous proposals and less likely to materially understate or overstate the level of hourly prices. However, as currently configured, during the beginning of a period of very high price events the index could very likely understate the true extremity of prices, relative to the daily average, in evening ramp hours 18-

¹⁴ Specifically, for peak hours, the ratio would take the difference between the SMEC price is hour X and the average of all SMEC peak prices divided by the average of all SMEC peak prices. For example, if the hour 18 price were 150 and the average peak price were 100, the ratio would then be $(150-100)/100$ or .5. This value would be added to 1 and multiplied by the 16 hour ICE hub price to calculate an index price for that hour.

¹⁵ *Final Proposal*, op. cit., p. 27. August 24, 2020.

22, which are the hours in which gas fired generation or imports are likely to be on the margin and the index would be most relevant. This is therefore a somewhat conservative formula for capping the prices at which import supply would be accepted in those hours. An alternative would be to use some additional observable characteristics, such as weather or even the daily average price, to better “match” a given day’s price pattern to those of previous days. While it would be important for the CAISO continue to investigate the feasibility of fine tuning this calculation if this price index had a general applicability to capping import prices during high gas price periods, the CAISO currently proposes to use this index only in very limited circumstances.

The experiences from the recent mid-August heat wave are instructive. The DAM SMEC exceeded \$1000 for at least one hour on August 17th, 18th and 19th, and approached \$1000 on August 14th and 15th. The 16-hour peak block ICE price at the PV hub rose from about \$175 on the 14th to \$1400 on the 18th. The relationship between the hour 19 price and the on-peak average price in the CAISO DAM also grew more extreme. The August 15th shaping factor for hour 20 based upon the August 14th DAM would have been just under 4, whereas the shaping factor for hour 20 based upon the August 18th DAM would have been just under 12. This experience implies that (a) the shaping factors can be quite volatile even within this set of high-priced days, and (b) the market in the most severely constrained days and hours would have allowed bids above \$1000 and potentially allowed \$2000 scarcity prices. We believe that certainly would have been appropriate and most likely beneficial to the CAISO’s reliability situation on these days. The index may not have allowed higher bids on August 14th and 15th, days that did not see \$1000 SMEC prices but did come close in several hours. That raises a note of caution that this index and the shaping factors applied to it will not be ideal under all circumstances.

For some supply offers, the maximum import price would be applied as a blunt threshold screen rather than as a precise cap on offer prices, but it would only be applied to a subset of import supply. Import supply procured via resource adequacy contracts would be limited to the higher of the highest verified bid or the maximum import bid price as described above. However, under the proposal, non-RA import supply and virtual supply offers would be allowed up to \$2000 if either the DEB for a specified resource (internal or external) or the maximum import price calculation described above rises above \$1000. One implication of this policy is that a mismeasurement of the “true” import costs during peak hours would only discourage import offers if it resulted in a maximum import price falling falsely below \$1000. If the calculated hourly price rises above \$1000, bids from non-RA imports would be allowed up to \$2000.

Setting of Penalty Parameters

The other main area of focus in the proposal is the determination of when and how to raise penalty prices. An early proposal by the CAISO would have doubled all penalty prices under all conditions. We supported this proposal because we believe there is a growing need to refine and improve scarcity pricing in the CAISO and EIM markets. There is a large growing role for alternative resources - ranging from variable energy renewable sources to battery and other storage resources to demand response – in California and the west in general. The proper utilization of these resources depends upon being able to calculate and deploy these resources during hours in which their value is determined by scarcity, rather than by conventional fuel

costs. This is true regardless of the role that resource adequacy and regulatory policies play in investment. In addition, we have repeatedly stressed the role of short-term pricing in providing proper value to flexible resources of all types. All these things depend upon significant scarcity prices that would ideally be based upon the reliability and consumer benefits of supply.

That said, we also recognize that offer prices, not penalty or scarcity pricing, are the subject of FERC Order 831. Therefore, while some changes to penalty pricing need to be made in order for the offer price changes to be accommodated, it is also reasonable to reserve consideration of more general changes to penalty parameters for an initiative that is dedicated to the subject of scarcity pricing in the CAISO and EIM.

Note that while bid caps and penalty values are related mechanically in the pricing software, the economic issues are fairly distinct. The “cost” of scarcity is ultimately based upon the economic costs of interruptions and grid instability. These costs do not move in lockstep with the marginal costs of generators, but rather with the stability of the grid and the values consumers place upon reliable service. Current methods in fact *reduce* the value of scarcity to suppliers when marginal generation costs rise. The penalty values are fixed so the gap between the marginal cost and penalty value declines when marginal costs rise. In the extreme, setting prices at the highest approved offer price guarantees there are *no* scarcity rents earned by suppliers.

While we agree that this is not the proper initiative in which to determine scarcity pricing policy, and that it is complicated to determine what a “just and reasonable” scarcity value is, we note that capping prices at the last accepted bid effectively sets the scarcity value to zero. We believe this is unreasonable unless there is indeed no actual scarcity. Further, as we discuss below, there are different ways to define “scarcity” and there are good reasons to apply scarcity prices before needing to resort to leaning or involuntary load shedding. The distinction is between a scarcity of supply that restricts continuing of normal operations and a more severe scarcity that risks systemwide failures.

Some stakeholders have argued that scarcity pricing should be treated differently in the EIM markets operating outside of the CAISO system. Among the reasons put forward for this are the fact that i) EIM only transacts energy and does not dispatch ancillary services, ii) EIM entities maintain all their responsibilities as balancing area authorities (BAAs), iii) EIM is a voluntary market.¹⁶ The general point of these arguments is that scarcity in the EIM market within an area does not equate to a reserve deficiency, area control error (ACE) violation, or any other reliability-based operating standard enforced by NERC. These are arguments that raise fundamental questions about the role of scarcity pricing that are somewhat distinct from the question of what the appropriate level of a scarcity price should be. We discuss these below.

¹⁶ “Comments of Select EIM Entities.” FERC Order No. 831 – Import Bidding and Market Parameters Draft Final Proposal, August 12, 2020. <http://www.caiso.com/InitiativeDocuments/EIMEntitiesJointComments-FERCOrder831-ImportBidding-MarketParameters-RevisedDraftFinalProposal.pdf>. See also “POU EIM Entities Comments.” FERC Order No. 831 – Import Bidding and Market Parameters Draft Final Proposal, August 13, 2020. “<http://www.caiso.com/InitiativeDocuments/POUEIMEntitiesComments-FERCOrder831-ImportBidding-MarketParameters-RevisedDraftFinalProposal.pdf>”

First, as we have discussed above, a PBC violation does *not necessarily* imply a violation of NERC operating standards. It reflects that fact that available committed energy supply is insufficient to meet expected demand. The CAISO market software enforces ancillary service constraints as strictly as the PBC and unless the CAISO is in a state of emergency does not allow for a drawing down of AS based energy before triggering a PBC constraint violation.¹⁷ Therefore, all CAISO markets, including EIM, price energy distinctly from ancillary services and “scarcity” in the energy market is exactly that, a signal that bid-in *energy* supply is insufficient to meet *energy* demand. The fact that EIM entities maintain their AS operations separately from the EIM is therefore consistent with the price-formation approach in the CAISO’s software inside and outside of the CAISO control area.

Second, the fact that participation in the EIM market is voluntary does not mean that maintaining resource sufficiency beyond day-ahead scheduling is voluntary. Scarcity pricing will only impact load serving entities that have not procured (or supplied) enough generation in the EIM to meet their load. Before relaxing the PBC in the EIM, the EIM software will draw upon all available resources from all connected EIM regions to try to prevent that violation. If the PBC constraint is violated and the scarcity penalties are set too low, this could be viewed as a form of “leaning” via the EIM because it results in drawing supply from other regions at prices limited by the penalty parameter. It is not “free-riding” on neighboring regions, but it is arguably “under-priced riding,” particularly during periods of regional electricity scarcity or high gas prices.

The conditions of August 18, 2020 illustrate the types of incentive problems that can be created in EIM regions if scarcity prices are set too low. The 16 hour block on-peak ICE contract at Palo Verde traded at slightly over \$1400 on Tuesday August 18, implying that energy was valued at least at that level, and mostly likely higher, for many of the peak hours of that day. Because the PBC penalty value remains at \$1000 pending the resolution of this initiative, LSEs faced an opportunity to sell energy at prices well above \$1000 from generation not participating in EIM, while facing a more limited penalty from any prospective imbalance within the EIM itself.

The self-sufficiency test is intended to prevent this kind of leaning on the EIM but this “pseudo-leaning” is nevertheless occurring during some power balance violations. The possibility that a balancing area might have additional resources that it did not make available to the dispatch that could have avoided the need to lean on other EIM participants would make it more egregious that the load serving entity is leaning on other participants in this manner, not less. And this leaning could be even more egregious during gas shortage conditions – the kind of conditions where these penalty values would be triggered - when holding back resources from the EIM dispatch might enable one EIM entity to conserve gas supplies by effectively leaning on the gas supplies of other EIM entities.

There is certainly a legitimate argument that the scarcity implied by a PBC violation may occur too frequently under current market operations due to the continuing dysfunction of the flexi-

¹⁷ It is our understanding that in the real-time pre-dispatch (RTPD) all ancillary services are protected with a high penalty value. Within the real-time dispatch (RTD) intervals, non-contingent spin and non-spin can be dispatched to provide energy but regulation is protected at a hard limit.

ramp product which does not procure enough ramp in the right locations to avoid these PBC violations. Nevertheless, the violations are occurring. We agree that a graduated increase in the scarcity price would be an improvement over the current approach, but such a graduated increase only implies that prices would be higher when ramp is tight but there is no PBC violation, it would not lower prices when there is a PBC violation. We see these questions as about improving the *implementation* of scarcity pricing whereas some of the arguments put forward by the EIM entities seemed to question whether *any* scarcity pricing was appropriate in the EIM. We believe that scarcity pricing is not only important but also critical for efficiently managing tight supply conditions and for the efficient integration of unconventional resources such as renewable generation, storage assets, and demand response into the western grid.

As we note in our related opinion on modifications to the flexiramp product,¹⁸ if flexiramp were working as intended, it would result in a form of graduated scarcity. Prices should rise as the system becomes short on ramp capacity leading to a more gradual step-up to the PBC constraint penalty. However, flaws in the flexiramp design have instead produced ramp prices that are zero even during periods of PBC violations. The proposed changes evaluating the deliverability of flexiramp should help, but it is hard to know at this stage how much of these problems will be resolved by the deliverability change.

For the CAISO system, the debate over the appropriate penalty value for PBC violations may become moot given the ability of firms to bid up to \$2000 for non-RA import and virtual supply. It is quite possible firms could maintain offers at this level and under the current proposal the market software would accept energy from these sources before allowing a PBC violation. In this sense the current proposal encourages offers at this level during high price periods given the possibility that a small violation would produce a lower SMEC price.

V. Summary and Conclusions

The current proposal represents a modest first step toward a more comprehensive reform of scarcity pricing. It establishes a range of “modest” scarcity, within which scarcity would be considered incidental. For these “small” scarcity outcomes, SMEC prices would be based upon the highest approved offer price.¹⁹ If the PBC relaxation is “large” – currently proposed to be based upon operational standards that imply a threshold of 233.7 MW in the CAISO – then SMEC prices would be set at the penalty value of \$2000.

We support the general framework of stepping-up penalty prices in relation to the severity of the constraint violation. This is consistent with the practice of other ISOs that dispatch capacity needed to meet reserve or regulation requirements to balance load and generation at increasingly higher prices as the resulting shortfall in regulation or reserves rises. It is also consistent with the intuition that the “costs” of a violation, as captured in increased risk to the system, increase

¹⁸J. Bushnell, S.M. Harvey, and B.F. Hobbs, "Opinion on Flexible Ramping Product Refinements", Draft of Sept. 2, 2020, http://www.aiso.com/Documents/MSO-OpiniononFlexibleRampingProductEnhancements-Sep8_2020.pdf

¹⁹ Again, individual LMPs could rise well above this level, and above even \$2000 when congestion costs, losses and other components are included.

continuously with the severity of the violation. It is a fiction that these implicit costs would jump by potentially thousands of dollars simply by crossing a constraint threshold by 1 MW. That said, we are not in a position to judge the merits of the current threshold calculation as the appropriate threshold, either in the CAISO or elsewhere. We agree that it is almost certainly the case that the appropriate “near-scarcity bandwidth” should be scaled to the size of the balancing area in which it is applied, something that the current proposal does.²⁰

We therefore support the provisions in this proposal for applying the DEB approach for specific generation units, and the import cost index approach for unspecified imports as the means of cost-justifying offers over \$1000. We also support the provision that non-RA import offers be allowed to rise up to \$2000 when specific or indexed offer prices rise above the \$1000 threshold. The import cost index will not be a perfect measure of the hourly cost of supply outside of CAISO, but will hopefully be representative enough of those costs to allow for the market to adjust during extreme high gas cost periods or during periods of scarcity such as those experienced in mid-August. If California has adequately procured sufficient resources, it would not need rely upon those no-RA imports. If, however the CAISO is indeed experiencing scarcity despite the RA policies in place, the flexibility to offer up to \$2000 is greatly preferably to involuntary load shedding.

We also support the penalty pricing aspects of this proposal, as a reasonable measure for Order 831 compliance. We also believe this process has led to discussions that will hopefully result in developing a better approach to scarcity pricing. We strongly recommend the CAISO consider a stakeholder process devoted to scarcity pricing both in real-time and its role within a potentially expanded day-ahead market. The experiences of mid-August have revealed that periodic scarcity is a real prospect in the CAISO and the entire western system and there should be a strong push to reach some consensus on the appropriate way to price and manage scarcity in both the CAISO and the EIM.

²⁰ California ISO, “FERC Order No. 831 – Import Bidding and Market Parameters, Final Proposal,” August 24, 2020, page 17, <http://www.caiso.com/InitiativeDocuments/RevisedDraftFinalProposal-FERCOrder831-ImportBidding-MarketParameters.pdf>