December 17, 2018

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

Re: California Independent System Operator Corporation
ER19-___-000

Tariff Clarifications Amendment

Dear Secretary Bose:

The California Independent System Operator Corporation (CAISO) submits this tariff amendment to calculate prices at Custom Load Aggregation Points (Custom LAPs) using the methodology the Commission previously approved for calculating prices at default load aggregation points (Default LAPs).[1]

This tariff amendment will eliminate the need for the CAISO to make price corrections when there are certain issues with prices at Custom LAPs.[2] Over the past year, the CAISO has observed that in many intervals, the price at Custom LAPs is incorrect because of data input failures, and it has corrected these prices under its price correction authority under section 35 of the CAISO tariff. In 2013, the CAISO developed and implemented new functionality that enabled it to determine the price at aggregation points based on the effectiveness of the aggregated nodes in relieving congestion, rather than the average effectiveness of the individual nodes of the aggregated locations. The CAISO would have applied the same methodology to the Custom LAPs but did not at that time because it had not observed any issues with the Custom LAP pricing.

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

[2] The bulk of CAISO load is scheduled and settled at Default LAPs, which comprise a set of individual pricing nodes for the largest load serving entities. Other loads such as participating load, load scheduled under an existing contract agreement, station power load, or load scheduled by a metered subsystem from this requirement are settled at more customized load aggregation points. Participating load, existing contract agreements load, and station power load is scheduled and settled at a Custom LAP. MSSs are scheduled and settled at MSS load aggregation points (MSS LAPs).

The CAISO is now observing issues with the reflection of prices at constituent pricing nodes for Custom LAPs. The CAISO proposes to calculate prices at Custom LAPs using the same Commission-approved functionality because it will eliminate the need for corrections due to these new issues.

No stakeholder opposed or expressed concerns with the proposed tariff revisions. The CAISO respectfully requests that the Commission issue an order by February 27, 2019 accepting the proposed tariff revisions effective March 1, 2019. This will provide the CAISO with sufficient time to activate new functionality associated with this amendment.

I. Background

A. Overview of CAISO Markets.

The CAISO administers both day-ahead and real-time wholesale electricity markets. Although the day-ahead market only includes the CAISO balancing authority area, the real-time market extends to balancing authority areas participating in the western energy imbalance market (EIM), which include the CAISO and seven EIM entities.[3]

Both of these interrelated markets ensure electricity supply is sufficient to satisfy demand in the region while maintaining the reliability of the transmission system. Both markets commit resources, and schedule and dispatch them for energy, while respecting transmission security, resource characteristics, and transmission scheduling limits. The markets produce optimal schedules and dispatches and produce locational marginal prices used for financial settlement. The market produces schedules and dispatches for the CAISO balancing authority area for both individual internal and external resources and for non-resource specific bids for energy at the CAISO interties, *i.e.*, imports and exports. The market produces schedules and dispatches for individual or aggregate resources for EIM balancing authority areas.

The CAISO clears the integrated forward market (IFM), as part of the day-ahead market, based on market participant supply and demand bids. The IFM produces unit commitment and financially binding day-ahead energy schedules. Subsequently, the CAISO conducts the residual unit commitment process (RUC) as part of the day-ahead market, which consists of a unit commitment process based on the CAISO's demand forecast for its balancing authority area. This

[3] Currently, PacifiCorp, NV Energy, Arizona Public Service, Puget Sound Energy, Portland General Electric, Powerex Corp., and Idaho Power Company are actively participating in the EIM. Balancing Authority of Northern California will become an active participating in April 2019, while Los Angeles Department of Water & Power, City of Seattle, by and through its City Light Department, and Salt River Project will commence participation in the EIM in 2020.

ensures the CAISO has committed sufficient resources in the day-ahead timeframe to meet its demand forecast. The RUC process uses RUC availability bids, a resource's start-up, and minimum load costs that clear against the CAISO's demand forecast. In the real-time market, which includes the EIM, the CAISO clears supply bids against its load forecast and export bids, and does not accept real-time load demand bids.

Absent operational constraints such as congestion (where scheduled flow exceeds transmission line limitations), the need to honor self-schedules, and reliability requirements, the CAISO matches demand and supply based solely on price. Because those constraints exist, however, the CAISO executes these markets using a software program that performs a mathematical algorithm known as constrained optimization. The goal of the constrained optimization algorithm is to produce a least-cost dispatch based on submitted economic bids by clearing the optimal amounts of the effective "economic bids" submitted by scheduling coordinators, subject to a set of identified constraints that limit the available choices. The economic bids submitted by market participants contain prices paired with quantities.

To achieve the feasible solutions, the software will "redispatch" the system as necessary, *i.e.*, it will adjust the dispatch of generation and dispatchable load that otherwise would have resulted from a purely economic dispatch. The additional cost incurred as a result of this adjustment is the cost of congestion. Ideally, a market solution will produce awards (dispatches, in the case of energy) and prices that are consistent with one another. In other words, if there are no ramping constraints or commitment constraints, a supply bid should only result in an award if the clearing price is equal to or greater than the bid price and for demand bids, only if the clearing price is equal to or lower than the bid-in price. Because of the interplay of market design features in both the day-ahead and real-time markets, the market software may not always produce the expected outcome.

In the day-ahead market, with certain exceptions, load submits demand bids at Default LAPs, which comprise a set of individual pricing nodes for the largest load serving entities. Currently there are four Default LAPs: Pacific Gas & Electric, Southern California Edison; San Diego Gas & Electric; and Valley Electric. Other loads such as participating load, load scheduled under an existing contract agreement, or load scheduled by a metered subsystem from this requirement are settled at more customized load aggregation points.[4] All load is scheduled and settled at the applicable LAPs.

[4] *See* CAISO tariff sections 27.2.1 and 30.5.3.2.

B. Methodology for Producing Prices at Default Load Aggregation Points.

In 2013, the CAISO developed and implemented an enhancement for prices at aggregated locations.[5] Under the new methodology, the CAISO calculates the aggregate pricing based on the price produced by the market optimization for an aggregate location rather than the calculated load weighted price described above. The enhanced methodology produces a price at the aggregate location based on the effectiveness of the total aggregation in relieving congestion.[6] In contrast, the calculated load weighted average price at the constituent nodes reflects the effectiveness of individual nodes at relieving congestion.

The enhanced pricing methodology minimizes price inconsistencies arising from the use of weighted average prices, and the CAISO applied the enhancement to both the day-ahead and real-time markets. Pricing inconsistencies result from an incongruence in how prices and schedules (or dispatches) were produced. The market application determines schedules or dispatches for demand at a Default LAPs or Custom LAPs based on the effectiveness of adjustments of the aggregated resource in relationship to the congested constraint. Thus, the aggregate resource may not be used to relieve congestion if its assigned effectiveness in addressing the constraint (*i.e.*, the shift factor) is under the defined threshold, even though supply at some constituent pricing nodes may be adjusted to relieve congestion on the same constraint. As a result, the price used to determine the schedule or dispatch reflects no adjustment for congestion relief at the constituent pricing nodes. In contrast, the calculated load-weighted average price does reflect the adjustment at constituent nodes. This creates an inconsistency between the prices at which a resource is scheduled based on its bid-in price, as compared to the price at which it is settled.

The following example illustrates the manner in which such price inconsistencies arise using the load-weighted average price. Assume a demand bid at a LAP with two segments: the load will pay up to $40 per megawatt hour (/MWh) for the first five megawatts (MW) of energy and up to $30.20/MWh for the next five MW.

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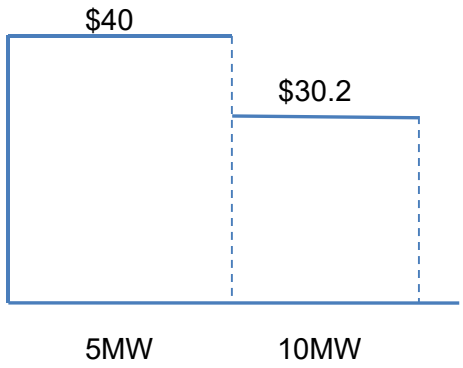
[5] *California Indep. Sys. Operator Corp.*, Letter Order, Docket No. ER13-957-000 (Apr. 3, 2013).

[6] *California Indep. Sys. Operator Corp.*, Transmittal Letter at p 9, Docket No. ER13-957-000 (Feb. 19, 2013).

Figure 1. Example Demand Bid Curve



Also assume that the market outcome is such that the marginal energy component is $30/MWh, there are no losses and there is one transmission constraint with a shadow price of negative $20/MWh. Finally, assume the LAP has five constituent nodes.

The market software will evaluate the effectiveness of the demand bid at the LAP according to its effectiveness as a whole in relieving the congestion constraint. It calculates that effectiveness using both the weighing factors and the shift factors of each constituent node. Table 1, below, assumes certain weighting factors for our example and shows the calculated aggregate shift factor.

Table 1: Weighted Shift Factors for Constituent Nodes of Example Load Aggregation Point.

Node	Weighting Factor	Shift Factor	Weighted Shift Factor
A	40%	0%	0.00%
B	30%	0%	0.00%
C	13%	20%	2.60%
D	13%	-35%	-4.55%
E	4%	5%	0.20%
	Aggregated Shift Factor		-1.75%

The weighted shift factor is negative 1.75 percent, which means that if this bid is incrementally dispatched, each MW will relieve congestion by 0.0175 MW on the binding transmission constraint. The CAISO currently applies an effectiveness threshold of two percent. With a shift factor of negative 1.75 percent, the market application will not use the bid for the aggregate node to manage congestion and there will be no marginal cost of congestion at the LAP. The market application clears the market at an LMP of $30/MWh, and will

schedule the bid at 10 MW.

For settlement purposes, however, the calculated load-weighted average price at that LAP will be based on each pricing node's individual effectiveness in managing the congestion, which is the pricing node's shift factor multiplied by the shadow price of the constraint. Then, using the weighting factors, the CAISO calculates a weighted LMP. Table 2 shows the calculated load-weighted average price for this example.

Table 2: Settlement Price at the Example Load Aggregation Point.

Node	Weighting Factor	Shift Factor	Marginal Energy Cost	Marginal Congestion Cost	Locational Marginal Price	Weighted Locational Marginal Price
A	40%	0%	$30	0% x $-20 = $0	$30 - $0 = $30	40% x $30 =$12
B	30%	0%	$30	0% x $-20 = $0	$30 - $0 = $30	30% x $30 = $9.0
C	13%	20%	$30	20% x $-20 = -$4	$30 - $4 = $26	13% x $26 = $3.4
D	13%	-35%	$30	-35% x $-20 = $7	$30 + $7 = $37	13% x $37 = $4.8
E	4%	5%	$30	5% x $-20 = -$1	$30 – S1 + $29	4% x $29 = $1.2
			Weighted Average Locational Marginal Price for Load Aggregation Point			$30.4

The settlement price for the 10 MW of demand scheduled is thus $30.4/MWh. This price is not consistent with the award because, based on the resource's bid curve, the CAISO would only have scheduled five MWs of demand at this price. Instead, the market scheduled 10 MWs, which will now be charged the $30.4/MWh price instead of $30/MWh.

When the CAISO adopted this enhancement in 2013, it had only observed price inconsistency issues at the Default LAPs and trading hubs and had not observed the same issues at the Custom LAPs. Therefore, the CAISO narrowly targeted the Default LAPs and trading hubs for the pricing enhancement. However, price inconsistencies may occur at all types of aggregation pricing points that used the weighted average of prices at the constituent nodes.

C. Pricing Inconsistencies at Custom LAPs and Need for Amendment.

Consistent with current CAISO tariff requirements, the CAISO calculates a weighted average price for Custom LAPs after prices are produced for each of the constituent pricing nodes, weighted by the quantity of load at each pricing node (*i.e.*, calculated load weighted average price). In the day-ahead market, the weights are based on the proportion of the CAISO Demand (*i.e.*, load) scheduled in the IFM at the applicable Custom LAP. In the real-time market, the weights are based on metered data at the respective locations. As a result, the price published and used for settlement purposes at such aggregated locations will reflect any redispatch adjustments the software makes to the dispatch of supply resources at the individual constituent pricing nodes based on the effectiveness of those resources in relieving congestion.

Over the past year, there have been pricing issues at the Custom LAP locations in the real-time market that required the CAISO to correct prices under its authority prescribed by the CAISO tariff. This arose because of missing information at the constituent pricing nodes, either because the constituent pricing node location was disconnected from the CAISO market model, or the load distribution factors estimated from the meter data at the constituent pricing nodes were zero.

A specific case example at the Custom LAP for the Diablo Canyon generator facility (*i.e.*, CLAP_DIABLO-APND) illustrates the problems the CAISO has observed.[7] The CLAP_DIABLO-APND has two constituent pricing nodes (*i.e.*, DIABLO1_7_N001 and DIABLO2_7_N001). Each of the pricing nodes has a default normalized load distribution factor (LDF) of 50 percent. In a given real-time dispatch interval, *i.e.,* October 29, 2018, hour ending 2, the locational marginal price (LMP) and its components for all 12 intervals are captured in the CAISO OASIS snapshot provided below in Figure 2.

[7] Some generators, such as Diablo Canyon, require more than one pricing node to settle station power load to serve their facility because of their size. In such cases, the CAISO creates a Custom LAP to settle the load at that location.

Figure 2: Snap Shot of Custom LAP Prices October 28, 2018 at Diablo Canyon Custom LAP

Date From: 10/29/2018 To: 10/29/2018 Group Type SELECT_NODE Node 3 item(s) Opr Hour 02 Apply Reset

Download XML Download CSV

Interval Locational Marginal Prices (LMP)

Market	Opr Date/Hour	Node	LMP Type	INTERVAL01	INTERVAL02	INTERVAL03	INTERVAL04	INTERVAL05	INTERVAL06	INTERVAL07	INTERVAL08	INTERVAL09	INTERVAL10	INTERVAL11	INTERVAL12
RTM	10/29/2018 - Hour Ending 2	CLAP_DIABLO-APND	LMP	29.07928	29.16465	28.11494	27.87190	27.77028	27.38505	24.82013	24.26664	24.15374	24.01767	23.49777	22.87931
RTM	10/29/2018 - Hour Ending 2	CLAP_DIABLO-APND	Congestion	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
RTM	10/29/2018 - Hour Ending 2	CLAP_DIABLO-APND	Energy	29.07928	29.16465	28.11494	27.87190	27.77028	27.38505	24.82013	24.26664	24.15374	24.01767	23.49777	22.87931
RTM	10/29/2018 - Hour Ending 2	CLAP_DIABLO-APND	Loss	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
RTM	10/29/2018 - Hour Ending 2	CLAP_DIABLO-APND	Greenhouse Gas	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
RTM	10/29/2018 - Hour Ending 2	DIABLO1_7_N001	LMP	27.78430	27.23692	27.08241	26.53571	26.30711	25.85299	23.70438	23.72549	23.41009	23.19676	22.94087	22.33707
RTM	10/29/2018 - Hour Ending 2	DIABLO1_7_N001	Congestion	-0.69595	-1.32695	-0.45336	-0.75924	-0.88832	-0.96519	-0.56226	0.00000	-0.20502	-0.25169	0.00000	0.00000
RTM	10/29/2018 - Hour Ending 2	DIABLO1_7_N001	Energy	29.07928	29.16465	28.11494	27.87190	27.77028	27.38505	24.82013	24.26664	24.15374	24.01767	23.49777	22.87931
RTM	10/29/2018 - Hour Ending 2	DIABLO1_7_N001	Loss	-0.59903	-0.60079	-0.57917	-0.57695	-0.57484	-0.56687	-0.55349	-0.54115	-0.53863	-0.56922	-0.55690	-0.54224
RTM	10/29/2018 - Hour Ending 2	DIABLO1_7_N001	Greenhouse Gas	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
RTM	10/29/2018 - Hour Ending 2	DIABLO2_7_N001	LMP	27.78430	27.23692	27.08241	26.53850	26.30989	25.85573	23.70438	23.72549	23.41009	23.19676	22.94087	22.33707
RTM	10/29/2018 - Hour Ending 2	DIABLO2_7_N001	Congestion	-0.69595	-1.32695	-0.45336	-0.75924	-0.88832	-0.96519	-0.56226	0.00000	-0.20502	-0.25169	0.00000	0.00000
RTM	10/29/2018 - Hour Ending 2	DIABLO2_7_N001	Energy	29.07928	29.16465	28.11494	27.87190	27.77028	27.38505	24.82013	24.26664	24.15374	24.01767	23.49777	22.87931
RTM	10/29/2018 - Hour Ending 2	DIABLO2_7_N001	Loss	-0.59903	-0.60079	-0.57917	-0.57416	-0.57207	-0.56413	-0.55349	-0.54115	-0.53863	-0.56922	-0.55690	-0.54224
RTM	10/29/2018 - Hour Ending 2	DIABLO2_7_N001	Greenhouse Gas	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

For interval 1, the loss component, and the congestion component for each of the constituent pricing nodes is negative $0.599/MWh and negative $0.695/MWh, respectively. The loss and congestion component of the Custom LAP is zero. The constituent pricing node loss and congestion components are underlined in red and the loss and congestion components for the Custom LAP are underlined in blue).[8] The Custom LAP price reflects only the contribution from the marginal energy component of the LMP, which equals $29.07/MWh.

The Custom LAP LMP components for losses and congestion are zero due to a data input issue. In the real-time market, the CAISO calculates the Custom LAP LMP using meter data to determine load distribution at the constituent pricing nodes. The load distribution factors for the Custom LAPs are calculated in two steps. First, the load distribution is calculated at each pricing point based on the historical data for the entire system, which is then converted to an LDF using the entire CAISO load. These LDFs are known as system LDFs. Second, because the Custom LAP is comprised of a few a small subset of pricing nodes, the system LDFs for these small subset pricing nodes are re-normalized to calculate the Custom LAP LDFs.[9] The system LDFs take values between 0 and 1. The market application calculating the LDFs is configured to set the LDFs to zero if the system LDFs fall below a threshold. In this case, the distributed

[8] Each pricing node LMP and aggregate pricing node LMP is comprised of three components: system marginal energy cost, marginal cost of congestion, and marginal cost of losses. The CAISO can calculate the aggregate pricing node LMP using the weighted average LMP of the individual pricing nodes or the sum of the weighted average of the three components. Since the system marginal energy cost is the same for each location throughout the system for all pricing node and aggregate pricing nodes, the aggregate pricing node LMPs are calculated as the sum of the weighted average of the three components.

[9] The threshold is set at approximately 0.00001 by the software vendor.

amounts fall below the threshold for both of the constituent pricing nodes because the load is so small at each pricing node. The threshold is a necessary safeguard for potential numerical issues in handling numbers too small in the market application. This may result in Custom LAP prices that do not reflect the pricing of its constituent nodes.

In other instances, the price may not reflect the pricing of constituent pricing nodes at Custom LAPs, when either or both locations that constitute the custom LAP disconnect from the system. If one or both locations are disconnected, the weighs of these locations will be zero, and the weighted average will have losses and congestion components that are inconsistent with the prices of the constituent locations.

Consistent with the CAISO's price correction authority under section 35 of the CAISO tariff, the CAISO may correct prices resulting from a data input failure, the occurrence of hardware or software failure, or if the market result is inconsistent with the CAISO tariff.[10] If it were not practicable for the CAISO to recreate the exact price the system would have calculated absent the issue, the CAISO would correct the price so that it is as close as reasonably possible to the price that should have resulted under the CAISO tariff absent the issue.[11] In this case, the CAISO recreated the price using the best alternate data source, which produces prices similar to the ones produced with the pricing methodology the CAISO uses to produce prices as Default LAPs.

The CAISO could not use the Default LAPs pricing methodology for Custom LAPs directly because the CAISO tariff specifies that the Custom LAP pricing should be based on the load-weighted average price at that location; whereas, the Default LAP methodology provides that the CAISO use the price as produced by the software at that aggregate location. The CAISO could only use the same Default LAP methodology under section 35 of the CAISO tariff as a price correction given the issue with the original price computed, which is consistent with the CAISO tariff. The CAISO proposes to modify its tariff so it may apply the Commission-approved Default LAP methodology to Custom LAPs and not have to continue to conduct price corrections at those locations.

Over the past year, the CAISO has persistently corrected the prices for most of the intervals of each day in which similar data input failures have occurred.

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10 *See* CAISO tariff section 35.4.

11 *See* CAISO tariff section 35.5.

D. Stakeholder Process

The CAISO conducted an abridged stakeholder process for this amendment because the proposed changes are consistent with the authority the Board of Governors approved in 2013.[12] The CAISO has discussed its proposed tariff changes with stakeholders. The CAISO posted a draft of the proposed tariff changes on November 16, 2018. Stakeholders submitted comments on the proposed tariff clarification on November 26, 2018. The CAISO held a telephone conference call on November 27, 2018, and responded to questions and comments raised by stakeholders. After the call, the CAISO responded to follow up questions from stakeholders. No stakeholder has expressed any opposition to this change.

II. Proposed Tariff Revisions

The CAISO proposes to modify its tariff so that all pricing at LAPs will be based on the Commission-approved methodology for pricing at Default Laps and trading hubs. Thus, pricing will be calculated on the price derived directly from the market optimization based on the effectiveness of the total aggregation on relieving congestion, rather than the weighted average price of the total awarded quantities at the constituent nodes (based on the effectiveness of individual nodes at relieving congestion). As discussed above, the CAISO has observed pricing issues at Custom LAPs related to missing data due to either computational thresholds or disconnected pricing nodes. The Default LAP methodology will be effective in addressing such issues at Custom LAPs because the Default LAPs methodology does not rely on a load-weighted calculation based on the weights of the constituent pricing nodes. Rather the Default LAPs methodology creates the price based on the shift factors for the aggregation itself and does not rely on the weights for the individual pricing nodes.[13]

Applying the same methodology for deriving the price at Default LAPs to Custom LAPs has two benefits. First, it will remove the possibility that Custom LAP pricing is inconsistent with how market application schedules load at those locations discussed above in section I.B. of this transmittal letter. Second, this would eliminate the need for the CAISO to conduct price corrections because of data input failures when the CAISO market systems do not produce a price at a constituent pricing node.

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[12] *See* CAISO Board of Governors memo approving the enhancement, available at http://www.caiso.com/Documents/DecisionEnhancementsImprovePriceConsistency-Memo-Nov2012.pdf.

[13] *California Indep. Sys. Operator Corp.*, Letter Order, Docket No. ER13-957-000 (Apr. 3, 2013).

The proposed changes require modifications to CAISO Tariff Section 27.2.2. For administrative efficiency, the CAISO proposes to consolidate the description for pricing at Default and Custom LAPs in the tariff. The new tariff provisions will have one single approach for establishing pricing at all LAPs, except for prices for MSS LAPs. The CAISO does not propose to apply the same methodology to MSS LAPs pricing because the provisions for settlement of MSS schedules is based on principles established by agreements with the MSSs, and the CAISO does not propose to change those principles at this time.

The proposed tariff changes also reflect certain clean-ups necessary because of the consolidation of the Default and Custom LAP provisions, as well as corrections to existing incorrect cross references.[14]

III. Effective Date

The CAISO respectfully requests that the Commission accept the tariff revisions contained in this filing effective March 1, 2019, *i.e.,* 74 days from the date of this filing.

IV. Communications

Pursuant to Commission Rule 203(b)(3),[15] the CAISO requests that all correspondence, pleadings, and other communications regarding this filing to be directed to the following:

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V. Service

The CAISO has served copies of this filing, including all attachments, upon the California Public Utilities Commission, and all parties with effective Scheduling Coordinator Agreements under the CAISO tariff. In addition, the CAISO has posted the filing and all attachments on the CAISO website.

[14] The CAISO is also proposing to clean-up cross-references in sections 11.5.2.2 and 27.3 of the CAISO tariff.

[15] 18 C.F.R. § 385.203(b)(3).

VI. Attachments

In addition to this transmittal letter, the following documents support the instant filing:

Attachment A: Proposed clean version of the tariff records incorporating this tariff amendment; and

Attachment B: Red-lined document showing the proposed changes contained in this amendment.

VII. Conclusion

For the reasons set forth in this filing, the CAISO respectfully requests that the Commission issue an order by February 27, 2019, accepting the tariff revisions contained in this filing effective March 1, 2019.

Respectfully submitted,

By: *<u>/s/ Anna A. McKenna</u>*

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Attachment A – Clean Tariff

Custom LAP Clarification

California Independent System Operator Corporation

11.5.2.2 Hourly Real-Time Demand Settlement

The Default LAP Hourly Real-Time Price will apply to CAISO Demand and MSS Demand under net Settlement of imbalance energy, except for CAISO Demand not settled at the Default LAP as provided in Section 30.5.3.2, and per the methodology as may be further defined in the Business Practice Manuals. For each Settlement Interval, the differences between the Day-Ahead Scheduled CAISO Demand and Metered Demand (MWh) is settled at the Default LAP Hourly Real-Time Price or the Custom LAP Hourly Real-Time Price, as appropriate. For each Default LAP, the CAISO calculates the applicable Default LAP Hourly Real-Time Price as the weighted average LMP of the four Default LAP FMM LMPs and the twelve (12) five-minute Default LAP RTD LMPs. The CAISO calculates the weighted average LMP for each Default LAP as the summation of the weighted average SMEC, the weighted average MCC, and the weighted average MCL for that Default LAP. The CAISO calculates the weighted average SMEC, MCC, and MCL for each applicable Trading Hour based on the four applicable Default LAP FMM SMECs, MCCs, and MCLs, respectively, and the twelve (12) applicable Default LAP RTD SMECs, MCCs, and MCLs, respectively. For each Custom LAP, the CAISO calculates the applicable Custom LAP Hourly Real-Time Price as the weighted average LMP of the four Custom LAP FMM LMPs and the twelve (12) five-minute Custom LAP RTD LMPs. The CAISO calculates the weighted average LMP for each Custom LAP as the summation of the weighted average SMEC, the weighted average MCC, and the weighted average MCL for that Custom LAP. The CAISO calculates the weighted average SMEC, MCC, and MCL for each applicable Trading Hour based on the four applicable Custom LAP FMM SMECs, MCCs, and MCLs, respectively, and the twelve (12) applicable Custom LAP RTD SMECs, MCCs, and MCLs, respectively. In calculating the weighted average SMEC, MCC, and MCL for each hour for either the Default LAPs or Custom LAPs, the CAISO determines the weights based on the difference between Day-Ahead Schedules at the applicable LAP and the CAISO Forecast of CAISO Demand used in the FMM multiplied by the relevant FMM LMP at the applicable LAP plus the difference between the CAISO Forecast of CAISO Demand used in the FMM and the CAISO Forecast of CAISO Demand used in the RTD multiplied by the relevant RTD LMP at the applicable LAP divided by the sum of the difference between Day-Ahead Schedules at the applicable LAP and the CAISO Forecast of CAISO Demand used in the FMM plus the difference between the CAISO Forecast Of CAISO Demand used in the FMM and

the CAISO Forecast Of CAISO Demand used in the RTD. Furthermore, the Default LAP Hourly Real-Time Prices and the Custom LAP Hourly Real-Time Prices will be bounded by the maximum and the lowest LMP and its components, for the applicable Trading Hour from those relevant intervals at the relevant LAP. If the calculated price exceeds the upper boundary or is below the lower boundary, then the Default LAP Hourly Real-Time Price or the Custom LAP Hourly Real-Time Price, as appropriate, instead will be calculated based on a weighted average price with the weightings based on gross deviations (absolute value of each deviation).

The Hourly Real-Time LAP Prices are determined by the requirements in Section 27.2.2.2.

* * * * *

22.7.2 Determination of LAP Prices

27.2.2.1 IFM LAP Prices

The IFM LAP Price, except for IFM MSS Price, for Settlement of Demand at any LAP for a given Trading Hour is the price as produced by the IFM optimization run based on the distribution of system Load at the constituent Pricing Nodes within the applicable LAP and is determined by the effectiveness of the Load within the LAP in relieving a Transmission Constraint within the effectiveness threshold as specified in Section 27.4.3.6.

27.2.2.2 Real-Time Market LAP Prices

The FMM and RTD LAP Price, except for the RTD MSS Price and FMM MSS Price, for a fifteen-minute FMM interval and five minute Dispatch Interval is the price as produced by the FMM and RTD optimization runs, respectively, based on the distribution of system Load at the constituent Pricing Nodes within the applicable LAP and is determined by the effectiveness of the Load within the LAP in relieving a Transmission Constraint within the effectiveness threshold as specified in Section 27.4.3.6. The Hourly Real-Time LAP Price is then determined for Settlement purposes as further described in Section 11.5.2.2.

27.3 Trading Hubs

The CAISO shall create and maintain Trading Hubs, including Existing Zone Generation Trading Hubs, to facilitate bilateral Energy transactions in the CAISO Balancing Authority Area. Each Trading Hub will be

based on a pre-defined set of PNodes. The CAISO Market run will produce a Trading Hub price for each Settlement Period or Settlement Interval that is derived from the CAISO Market optimization based on the effectiveness of the Trading Hub aggregation in relieving congestion. The Trading Hub price will reflect congestion on Transmission Constraints whose effectiveness factor for the respective Trading Hub is greater than the effectiveness threshold specified in Section 27.4.3.6. There are three Existing Zone Generation Trading Hubs, which correspond geographically to the three Existing Zones. Each Existing Zone Generation Trading Hub is comprised of an aggregation of PNodes for Generating Units within the corresponding Existing Zone. The specification of seasons will be identical to the seasons used in the annual CRR Allocation, and the annual calculation of Existing Zone Generation Trading Hub weights will be performed in a timely manner to be coordinated with the annual CRR Allocation and CRR Auction processes.

* * * * *

- LAP Price

The marginal price for a particular LAP, except for the IFM MSS Price, FMM MSS Price and RTD MSS Price, calculated as specified in Section 27.2.2.

Attachment B – Marked Tariff

Custom LAP Clarification

California Independent System Operator Corporation

11.5.2.2 Hourly Real-Time Demand Settlement

The Default LAP Hourly Real-Time Price will apply to CAISO Demand and MSS Demand under net Settlement of imbalance energy, except for CAISO Demand not settled at the Default LAP as provided in Section 30.5.3.2, and per the methodology as may be further defined in the Business Practice Manuals. For each Settlement Interval, the differences between the Day-Ahead Scheduled CAISO Demand and Metered Demand (MWh) is settled at the Default LAP Hourly Real-Time Price or the Custom LAP Hourly Real-Time Price, as appropriate. For each Default LAP, the CAISO calculates the applicable Default LAP Hourly Real-Time Price as the weighted average LMP of the four Default LAP FMM LMPs and the twelve (12) five-minute Default LAP RTD LMPs. The CAISO calculates the weighted average LMP for each Default LAP as the summation of the weighted average SMEC, the weighted average MCC, and the weighted average MCL for that Default LAP. The CAISO calculates the weighted average SMEC, MCC, and MCL for each applicable Trading Hour based on the four applicable Default LAP FMM SMECs, MCCs, and MCLs, respectively, and the twelve (12) applicable Default LAP RTD SMECs, MCCs, and MCLs, respectively. For each Custom LAP, the CAISO calculates the applicable Custom LAP Hourly Real-Time Price as the weighted average LMP of the four Custom LAP FMM LMPs and the twelve (12) five-minute Custom LAP RTD LMPs. The CAISO calculates the weighted average LMP for each Custom LAP as the summation of the weighted average SMEC, the weighted average MCC, and the weighted average MCL for that Custom LAP. The CAISO calculates the weighted average SMEC, MCC, and MCL for each applicable Trading Hour based on the four applicable Custom LAP FMM SMECs, MCCs, and MCLs, respectively, and the twelve (12) applicable Custom LAP RTD SMECs, MCCs, and MCLs, respectively. In calculating the weighted average SMEC, MCC, and MCL for each hour for either the Default LAPs or Custom LAPs, the CAISO determines the weights based on the difference between Day-Ahead Schedules at the applicable LAP and the CAISO Forecast of CAISO Demand used in the FMM multiplied by the relevant FMM LMP at the applicable LAP plus the difference between the CAISO Forecast of CAISO Demand used in the FMM and the CAISO Forecast of CAISO Demand used in the RTD multiplied by the relevant RTD LMP at the applicable LAP divided by the sum of the difference between Day-Ahead Schedules at the applicable LAP and the CAISO Forecast of CAISO Demand used in the FMM plus the difference between the CAISO Forecast Of CAISO Demand used in the FMM and

the CAISO Forecast Of CAISO Demand used in the RTD. Furthermore, the Default LAP Hourly Real-Time Prices and the Custom LAP Hourly Real-Time Prices will be bounded by the maximum and the lowest LMP and its components, for the applicable Trading Hour from those relevant intervals at the relevant LAP. If the calculated price exceeds the upper boundary or is below the lower boundary, then the Default LAP Hourly Real-Time Price or the Custom LAP Hourly Real-Time Price, as appropriate, instead will be calculated based on a weighted average price with the weightings based on gross deviations (absolute value of each deviation).

The ~~Default LAP~~ Hourly Real-Time LAP Prices ~~and the Custom LAP Hourly Real-Time Prices~~ are ~~further~~ determined by the requirements in Section 27.2.2.2~~.1 and 27.2.2.2.2, respectively~~.

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22.7.2 Determination of LAP Prices

27.2.2.1 IFM LAP Prices

~~The IFM LAP Price for a given Trading Hour is the weighted average of the individual IFM LMPs at the PNodes within the LAP, with the weights equal to the nodal proportions of Demand associated with that LAP that is scheduled by the IFM, excluding Demand specified in Sections 27.2.1 and 30.5.3.2.~~

~~**27.2.2.1.1 Default LAPs Pricing**~~

The IFM LAP Price, except for IFM MSS Price, for Settlement of Demand at any ~~Default~~ LAP~~s~~ for a given Trading Hour is the price as produced by the IFM optimization run based on the distribution of system Load at the constituent Pricing Nodes within the applicable ~~Default~~ LAP- and is determined by the effectiveness of the Load within the ~~Default~~ LAP- in relieving a Transmission Constraint within the effectiveness threshold as specified in Section 27.4.3.~~4.~~6.

~~**27.2.2.1.2 Custom LAP Pricing**~~

~~The IFM LAP Price for Settlement of Demand at Custom LAPs for a given Trading Hour is calculated as a Load-weighted average of the individual IFM LMPs at the PNodes within the Custom LAP, where the weights are equal to the nodal proportions of CAISO Demand associated with that Custom LAP scheduled by the IFM.~~

27.2.2.2 Real-Time Market LAP Prices

~~The Default LAP Hourly Real-Time Prices and the Custom LAP Hourly Real-Time Prices are calculated as described below and in Section 11.5.2.2.~~

~~27.2.2.2.1 Default LAP Pricing~~

The FMM and RTD ~~Default~~ LAP Price, except for the RTD MSS Price and FMM MSS Price, for a fifteen-minute FMM interval and five minute Dispatch Interval is the price as produced by the FMM and RTD optimization runs, respectively, based on the distribution of system Load at the constituent Pricing Nodes within the applicable ~~Default~~ LAP and is determined by the effectiveness of the Load within the ~~Default~~ LAP in relieving a Transmission Constraint within the effectiveness threshold as specified in Section 27.4.3.~~4.~~6. The ~~Default LAP~~ Hourly Real-Time LAP Price is then determined for Settlement purposes as further described in Section 11.5.2.2.

~~27.2.2.2.2 Custom LAP Pricing~~

~~The FMM and RTD LAP Prices for Settlement of Demand at Custom LAPs for a given fifteen-minute FMM interval and five minute Dispatch interval are calculated as a Load-weighted average of the individual FMM and RTD LMPs at the PNodes within the Custom LAP, respectively, where the weights are calculated based on Meter Data. The Custom LAP Hourly Real-Time Price is then determined for Settlement purposes as further described in Section 11.5.2.2.~~

27.3 Trading Hubs

The CAISO shall create and maintain Trading Hubs, including Existing Zone Generation Trading Hubs, to facilitate bilateral Energy transactions in the CAISO Balancing Authority Area. Each Trading Hub will be based on a pre-defined set of PNodes. The CAISO Market run will produce a Trading Hub price for each Settlement Period or Settlement Interval that is derived from the CAISO Market optimization based on the effectiveness of the Trading Hub aggregation in relieving congestion. The Trading Hub price will reflect congestion on Transmission Constraints whose effectiveness factor for the respective Trading Hub is greater than the effectiveness threshold specified in Section 27.4.3.~~4.~~6. There are three Existing Zone Generation Trading Hubs, which correspond geographically to the three Existing Zones. Each Existing Zone Generation Trading Hub is comprised of an aggregation of PNodes for Generating Units within the corresponding Existing Zone. The specification of seasons will be identical to the seasons used in the

annual CRR Allocation, and the annual calculation of Existing Zone Generation Trading Hub weights will be performed in a timely manner to be coordinated with the annual CRR Allocation and CRR Auction processes.

* * * * *

- LAP Price

The marginal price for a particular LAP, except for the IFM MSS Price, FMM MSS Price and RTD MSS Price, ~~-~~calculated ~~as a weighted average of the nodal LMPs at the associated PNodes~~ as specified in ~~pursuant to~~ Section 27.2.2.