California Independent
System Operator Corporation

August 23, 2010

VIA ELECTRONIC FILING

The Honorable Kimberly D. Bose
Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, D.C. 20246

Re: California Independent System Operator Corporation
Compliance Filing
Docket No. ER10-500-001

Dear Secretary Bose:

        The California Independent System Operator Corporation (ISO)[1] submits this filing in compliance with the Federal Energy Regulatory Commission's June 29, 2010 order accepting and suspending the ISO's tariff revisions to implement scarcity pricing.[2] The ISO's proposed tariff revisions establish demand curves with administrative values that apply to ancillary services during periods when there is insufficient supply for these services.   In its *June 2010 Order*, the Commission accepted and suspended the ISO's tariff provisions to implement scarcity pricing, subject to modification and a further Commission Order. As part of the *June 2010 Order*, the Commission directed the ISO to justify different scarcity reserve demand curve values for ancillary services in the expanded system region and ancillary services sub-regions.[3] In response to comments raised by parties, the Commission also directed the ISO to modify its tariff to include a table reflecting scarcity demand curve values and change the timeframe in which the ISO will conduct a review of its scarcity pricing mechanism. The ISO

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[1]   The ISO is sometimes referred to CAISO. Capitalized terms not otherwise defined herein have the meanings set forth in the Master Definitions Supplement, Appendix A to the currently effective ISO tariff.

[2]   *Cal. Indep. Sys. Operator Corp.*, 131 FERC ¶ 61,280 (2010) ("*June 2010 Order*").

[3]   The ISO tariff defines ancillary service regions to include the *system region* (*i.e.*, the ISO balancing authority area) and the *expanded system region* (*i.e.*, the system region and the intertie scheduling points with adjacent balancing authority areas), and eight sub-regions within them. (*See*, ISO tariff section 8.3.3.) For purposes of its scarcity pricing design, the ISO treats the system region as one of its an ancillary sub-regions.

requests that the Commission issue an order accepting the revised tariff sheets submitted with this filing as being in full compliance with the *June 2010 Order*.[4]

I. Background

As part of its review and approval of the ISO's new market design, the Commission directed the ISO to develop a scarcity pricing mechanism that applies administratively determined prices to various levels of reserve shortage.[5] Under the ISO's scarcity pricing proposal, the price for reserves rises automatically to administratively determined levels when there is a shortage of reserves in either the ISO's expanded system region or ancillary service sub-regions.[6] As part of its design, the ISO proposed different scarcity demand curve values for reserves in the expanded system region and ancillary service sub-regions.[7] Using these values, the ISO proposed to calculate ancillary service marginal prices during a reserve shortage in the same manner in which the ISO calculates ancillary service marginal prices when there is no reserve shortage.[8] The ISO's tariff allows the ISO to use higher quality reserves to meet the procurement requirement for lower quality reserves in the same ancillary services sub-region or in the expanded system region. Under non-scarcity conditions, the ancillary service marginal prices in a sub-region reflect both the shadow prices of the requirement constraint in the sub-region and the constraint in the expanded system region.[9] The ISO proposed to allow scarcity demand curve values to add in a similar fashion when there is scarcity in both a sub-region and the expanded system region. This approach was intended to create a premium for reserves in an ancillary services sub-region when there is a shortage in that ancillary services sub-region.[10]

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[4]   The ISO is submitting a complete set of tariff provisions to implement scarcity pricing with this filing in order to update its electronic tariff in compliance with Order No. 714, *Electronic Tariff Filings*, FERC Stats. & Regs. ¶ 31,276 (2009). Concurrently with this compliance filing, the ISO is also filing a motion to request for an effective date to implement scarcity pricing on December 14, 2010. The ISO is requesting this extension of time to accommodate the transfer of its operational control center in Folsom, California to a new building on or about December 1, 2010.

[5]   *Cal. Indep. Sys. Operator Corp.*, 116 FERC ¶ 61,274 (2006) ("*September 2006 Order*") at PP 1076-1079.

[6]   ISO December 23, 2010 filing at 3.

[7]   *Id.* at 6, Table 1.

[8]   *Id.* at 3, *citing* ISO tariff sections 8.2.35, 27.1.2.1.

[9]   The shadow price is the marginal value of relieving a particular constraint. *See*, ISO tariff, Appendix A.

[10]   ISO Final Proposal for Reserve Scarcity Pricing Design dated November 4, 2009 at 13.

On March 31, 2010, the Commission requested additional information to evaluate the ISO's scarcity pricing proposal, including information related to the different scarcity demand curve values proposed for the expanded system region and ancillary service sub-regions.[11] The ISO responded to the Commission's request for information and also proposed to include a scarcity demand curve for regulation down in the ISO's ancillary services sub-regions as part of its reserve scarcity pricing design.[12] On June 29, 2010, the Commission issued its *June 2010 Order* accepting the ISO's scarcity pricing design and suspending the proposed tariff revisions subject to specific compliance directives, including that the ISO justify the different scarcity demand curve values for reserves in the ISO's expanded system region and ancillary service sub-regions or make these values consistent.

On July 29, 2010, the ISO filed a motion for clarification or, in the alternative, rehearing of the Commission's *June 2010 Order*. In its motion, the ISO stated it is willing to make the scarcity demand curve values consistent in the expanded system region and ancillary services sub-region in compliance with the June 2010 Order for purposes of valuing ancillary services during a scarcity condition. The ISO requested clarification, however, that the Commission does not expect the ISO to add scarcity demand curve values across an ancillary service sub-region and the expanded system region when there is a shortage condition in both regions. Several parties filed answers in support of the ISO's motion, including the Western Trading Power Forum, the California Public Utilities Commission, Southern California Edison Company, Pacific Gas and Electric Company and the California Department of Water Resources. No party filed an answer opposing the ISO's motion.

II.   Proposed Tariff Modifications on Compliance

Pursuant to the Commission's *June 2010 Order*, the ISO proposes the following the amendments to its tariff.

In its *June 2010 Order*, the Commission determined that the ISO did not demonstrate that its proposed scarcity demand curve values for ancillary sub-regions were just and reasonable. These scarcity demand curve values differed from the scarcity demand curve value proposed by the ISO for the expanded system region. The Commission directed the ISO to submit a compliance filing to justify the differences between the scarcity demand curve values in the expanded system region and ancillary service sub-regions or make these values consistent.[13] In this compliance filing, the ISO has made the scarcity demand curve values in the expanded

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[11]   March 31, 2010 letter order requesting additional information at 2.

[12]   ISO April 30, 2010 filing at 2-5 and 12-13.

[13]   *June 2010 Order* at P 43.

system region and ancillary services sub-regions consistent.[14] The ISO has also proposed tariff changes, consistent with its motion for clarification, that state that these scarcity demand curve values will not sum when there is a shortage condition for a particular ancillary services type in the ISO's ancillary services sub-region and expanded system region.[15] Under this approach, when there is sufficient supply, the ISO will calculate ancillary service marginal prices pursuant to tariff section 27.1.2.1. When there is insufficient supply, the ISO will calculate ancillary service marginal prices under tariff section 27.1.2.3. The highest scarcity price for upward reserves in the expanded system region or the ancillary sub-regions will be 100 percent of the maximum energy bid price.

The ISO has also included a table reflecting its proposed scarcity demand curve values consistent with the direction provided in the *June 2010 Order.* In response to comments of the California Department of Water Resources, the Commission directed the ISO to include a table that the ISO used as a reference tool during its stakeholder process as well as in its initial filing.[16] The ISO has updated this table to reflect the proposed scarcity demand curve values submitted in this compliance filing and has included the following table as part of proposed tariff section 27.1.2.3.

| 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 Shortage > 210 MW	70%	70%	$525	$525	$700	$700
Shortage > 70 & ≤ 210 MW	60%	60%	$450	$450	$600	$600
Shortage ≤ 70 MW	50%	50%	$375	$375	$500	$500
Upward Sum	**100%**	**100%**	**$750**	**$750**	**$1000**	**$1000**
Regulation Down Shortage > 84 MW	70%	70%	$525	$525	$700	$700
Shortage > 32 & ≤ 84 MW	60%	60%	$450	$450	$600	$600
Shortage ≤ 32 MW	50%	50%	$375	$375	$500	$500

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[14]   *See* proposed tariff sections 27.1.2.3.1 through 27.1.2.3.4

[15]   *See* proposed ISO tariff section 27.1.2.3. *See also*, proposed changes tariff section 27.1.2.1, clarifying the calculation of ancillary service marginal prices during periods in which supply is sufficient.

[16]   *June 2010 Order* at PP 60-61.

Finally, the ISO has modified its proposed tariff language to provide for an annual review of its scarcity pricing mechanism during the first three years that scarcity pricing is in effect, with the exception that the ISO will not conduct this assessment in any year in which the scarcity pricing is not triggered.[17] This modification is consistent with the Commission's directives in the *June 2010 Order*.[18]

III. Effective Date

The ISO requests an effective date of December 14, 2010 for the tariff provisions submitted with this filing. The Commission's *June 2010 Order* suspended the ISO's scarcity pricing tariff provisions for five months, until November 29, 2010, subject to a compliance filing and a further Commission order. Concurrently with this compliance filing, the ISO has filed and served a motion to extend the effective date for its scarcity pricing tariff provisions until December 14, 2010. If the Commission grants this request, the ISO will deploy the software code associated with scarcity pricing on December 14, 2010.[19] The reason for this short extension of time is to accommodate the transfer of the ISO's control center in Folsom, California to a new building, which is scheduled to occur on or about December 1, 2010.

IV. Materials Provided In This Compliance Filing

The following documents, in addition to this transmittal letter, support this filing:

Attachment A   Clean sheets of the currently effective tariff showing revisions identified in this filing

Attachment B   Sheets showing, in black-line format, the changes to the currently effective tariff identified in this filing

V. Conclusion

The ISO has made its proposed scarcity demand curve values in the expanded system region and the ancillary services sub-regions consistent but has specified these value will not sum during periods in which there is a shortage condition in both regions

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[17]   See, proposed tariff section 27.1.2.3.

[18]   *June 2010 Order* at PP 65-66.

[19]   Under this approach, scarcity pricing will start to apply to real time market intervals on December 14, 2010 and will start to apply to the day-ahead market intervals for the December 15, 2010 trading day.

for a particular ancillary service. The ISO has also included a table in its tariff reflecting its proposed scarcity demand curve values and modified the timeframe in which it will conduct a review of its scarcity pricing mechanism consistent with the *June 2010 Order*. The ISO respectfully requests that the Commission accept this filing as complying with the directives of the Commission's *June 2010 Order*.

      Please do not hesitate to contact the undersigned if you have any questions.

Respectfully submitted,

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CERTIFICATE OF SERVICE

I hereby certify that I have served the foregoing document upon all of the parties listed on the official service list for the captioned proceeding, in accordance with the requirements of Rule 2010 of the Commission's Rules of Practice and Procedure (18 C.F.R. § 385.2010).

Dated at Folsom, California this 23rd day of August 2010.

__Jane Ostapovich__
Jane Ostapovich

Attachment A – Clean Sheets
California Independent System Operator Corporation
Fifth Replacement FERC Electric Tariff
Scarcity Pricing Amendment/Compliance
ER10-500-001

8.2.2 Time-Frame For Revising Ancillary Service Standards

The CAISO shall periodically undertake a review of the CAISO Controlled Grid operation to determine any revision to the Ancillary Services standards to be used in the CAISO Balancing Authority Area. At a minimum the CAISO shall conduct such reviews to accommodate revisions to NERC and WECC Reliability Standards and any requirements of the NRC. If the CAISO modifies its Ancillary Services standards, including its rules to determine minimum procurement requirements for Ancillary Services, the CAISO will notify Market Participants. The CAISO may adjust the Ancillary Services standards temporarily to take into account, among other things, variations in system conditions, Real-Time Dispatch constraints, contingencies, and voltage and dynamic stability assessments. Where practicable, the CAISO will provide notice, via the CAISO Website, of any temporary adjustments to Ancillary Service standards by 6:00 p.m. two (2) days ahead of the Operating Day to which the adjustment will apply. Periodic reviews by the CAISO may include, but are not limited to: (a) analysis of the deviation between actual and forecast Demand; (b) analysis of patterns of unplanned Generating Unit Outages; (c) analysis of compliance with NERC and WECC Reliability Standards and any requirements of the NRC; (d) analysis of operation during system disturbances; (e) analysis of patterns of shortfalls between Day-Ahead Schedules and actual Generation and Demand; and (f) analysis of patterns of unplanned transmission Outages.

27.1.2 Ancillary Service Prices

27.1.2.1 Ancillary Service Marginal Prices – Sufficient Supply

As provided in Section 8.3, Ancillary Services are procured and awarded through the IFM, HASP and the Real-Time Market. The IFM calculates hourly Day-Ahead Ancillary Service Awards and establishes Ancillary Service Marginal Prices (ASMPs) for the accepted Regulation Up, Regulation Down, Spinning Reserve and Non-Spinning Reserve Bids. The IFM co-optimizes Energy and Ancillary Services subject to resource, network and regional constraints. In the HASP, the CAISO procures Ancillary Services from Non-Dynamic System Resources for the next Trading Hour as described in Section 33.7. The CAISO calculates the HASP settlement Ancillary Services price as described herein and further described in Section 33.8. In the Real-Time Market, the RTUC process that is performed every fifteen (15) minutes establishes fifteen (15) minute Ancillary Service Schedules, Awards, and prices for the upcoming quarter

of the given Trading Hour. ASMPs are determined by first calculating Shadow Prices of Ancillary Services procurement requirement Constraints for each Ancillary Service type and the applicable Ancillary Services Regions. The Ancillary Services Shadow Prices are produced as a result of the co-optimization of Energy and Ancillary Services through the IFM, HASP, and the Real-Time Market, subject to resource, network, and requirement constraints. The Ancillary Services Shadow Prices represent the marginal cost of the relevant binding regional Constraint at the optimal solution, or the reduction of the combined Energy and Ancillary Service procurement cost associated with a marginal relaxation of that Constraint. If the Constraint for an Ancillary Services Region is not binding, the corresponding Ancillary Services Shadow Price in the Ancillary Services Region is zero (0). During periods in which supply is sufficient, the ASMP for a particular Ancillary Service type and Ancillary Services Region is then the sum of the Ancillary Services Shadow Prices for the specific type of Ancillary Service and all the other types of Ancillary Services for which the subject Ancillary Service can substitute, as described in Section 8.2.3.5, for the given Ancillary Service Region and all the other Ancillary Service Regions that include that given Ancillary Service Region. During periods in which supply is insufficient, the ASMP for a particular Ancillary Service type and Ancillary Services Region will reflect the Scarcity Reserve Demand Curve Values set forth in Section 27.1.2.3.

27.1.2.2 Opportunity Cost in ASMP

The Ancillary Services Shadow Price, which, as described above, is a result of the Energy and Ancillary Service co-optimization, includes the forgone opportunity cost of the marginal resource, if any, for not providing Energy or other types of Ancillary Services the marginal resource is capable of providing in the relevant market. The ASMPs determined by the IFM or RTUC optimization process for each resource whose Ancillary Service Bid is accepted will be no lower than the sum of (i) the Ancillary Service capacity Bid price submitted for that resource, and (ii) the foregone opportunity cost of Energy in the IFM or RTUC for that resource. The foregone opportunity cost of Energy for this purpose is measured as the positive difference between the IFM or RTUC LMP at the resource's Pricing Node and the resource's Energy Bid price. If the resource's Energy Bid price is higher than the LMP, the opportunity cost measured for this calculation is $0. If a resource has submitted an Ancillary Service Bid but no Energy Bid and is under an obligation to offer Energy in the Day-Ahead Market (e.g. a non-hydro Resource Adequacy Resource), its

Default Energy Bid will be used, and its opportunity cost will be calculated accordingly. If a resource has submitted an Ancillary Service Bid but no Energy Bid and is not under an obligation to offer Energy in the Day-Ahead Market, its Energy opportunity cost measured for this calculation is $0 since it cannot be dispatched for Energy. For Non-Dynamic System Resources that receive Ancillary Services Awards in HASP, the opportunity cost measured for this purpose is $0 because, as provided in Section 33.7, the CAISO cannot Schedule Energy in HASP from the Energy Bid under the same Resource ID as the submitted Ancillary Service Bid.

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, 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, 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 Shortage > 210 MW	70%	70%	$525	$525	$700	$700
Shortage > 70 & ≤ 210 MW	60%	60%	$450	$450	$600	$600
Shortage ≤ 70 MW	50%	50%	$375	$375	$500	$500
Upward Sum	**100%**	**100%**	**$750**	**$750**	**$1000**	**$1000**
Regulation Down Shortage > 84 MW	70%	70%	$525	$525	$700	$700
Shortage > 32 & ≤ 84 MW	60%	60%	$450	$450	$600	$600
Shortage ≤ 32 MW	50%	50%	$375	$375	$500	$500

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 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 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 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 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 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 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 maximum Energy Bid price permitted under Section 39.6.1.1.

27.1.2.3.2 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 maximum Energy Bid price permitted under Section 39.6.1.1.

27.1.2.3.3 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 maximum Energy Bid price permitted under Section 39.6.1.1.

27.1.2.3 Opportunity Cost in LMPs for Energy

In the event that there is insufficient supply to meet an Ancillary Services procurement requirement in a particular Ancillary Service Region or Sub-Region, the Ancillary Services Shadow Prices will rise automatically to the Scarcity Reserve Demand Curve Values in that Ancillary Service Region or Sub-Region. LMPs for Energy will reflect the forgone opportunity cost of the marginal resource, if any, for not providing the scarce Ancillary Services consistent with the CAISO's co-optimization design.

27.1.3 Maximum and Minimum CAISO Markets Prices

For Settlements purposes, all LMPs, ASMPs and RUC Availability Prices for the IFM, RUC, HASP and Real-Time Market, as applicable, shall not exceed $2500 per MWh and shall not be less than negative $2500 per MWh. All prices produced by the CAISO Markets will be posted in accordance with the posting of market results as further provided in Section 6.5, and subject to the price validation and correction procedures provided in Section 35; provided that the only prices that will be initially withheld from

publication are those prices that exceed the above- specified maximum and minimum CAISO Market

prices. Prices exceeding $2500 or less than negative $2500 will be modified for Settlements purposes

pursuant to price correction process in Section 35 and the CAISO will post the results.   In addition to the

analysis provided in the CAISO quarterly market performance reports on the maximum and minimum

prices and price trends, the CAISO shall include in the weekly price correction report specified in Section

35.6 all prices at a non-aggregated level that exceed the minimum and maximum settlement prices

specified in this Section 27.1.3. This Section 27.1.3 will no longer be in effect twelve months after the

effective date of this section 27.1.3.

Appendix A
Master Definition Supplement

- Scarcity Reserve Demand Curve
A demand curve used to clear the Ancillary Services markets when supply is insufficient in an Ancillary

Service Region or Sub-Region to meet Ancillary Services minimum procurement requirements.

- Scarcity Reserve Demand Curve Values
Fixed percentages of the maximum Energy Bid price permitted under Section 39.6.1.1 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**.**

Attachment B – Blacklines

California Independent System Operator Corporation

Fifth Replacement FERC Electric Tariff

Scarcity Pricing Amendment/Compliance

ER10-500-001

8.2.2 Time-Frame For Revising Ancillary Service Standards

The CAISO shall periodically undertake a review of the CAISO Controlled Grid operation to determine any revision to the Ancillary Services standards to be used in the CAISO Balancing Authority Area. At a minimum the CAISO shall conduct such reviews to accommodate revisions to NERC and WECC Reliability Standards and any requirements of the NRC. If the CAISO modifies its Ancillary Services standards, including its rules to determine minimum procurement requirements for Ancillary Services, the CAISO will notify Market Participants.reliability standards, including any requirements of the NRC. The CAISO may adjust the Ancillary Services standards temporarily to take into account, among other things, variations in system conditions, Real-Time Dispatch constraints, contingencies, and voltage and dynamic stability assessments. Where practicable, the CAISO will provide notice, via the CAISO Website, of any temporary adjustments to Ancillary Service standards by 6:00 p.m. two (2) days ahead of the Operating Day to which the adjustment will apply. Periodic reviews by the CAISO may include, but are not limited to: (a) analysis of the deviation between actual and forecast Demand; (b) analysis of patterns of unplanned Generating Unit Outages; (c) analysis of compliance with NERC and WECC Reliability Standards andreliability standards, including any requirements of the NRC; (d) analysis of operation during system disturbances; (e) analysis of patterns of shortfalls between Day-Ahead Schedules and actual Generation and Demand; and (f) analysis of patterns of unplanned transmission Outages.

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27.1.2 Ancillary Service Prices

27.1.2.1 Ancillary Service Marginal Prices – Sufficient Supply

As provided in Section 8.3, Ancillary Services are procured and awarded through the IFM, HASP and the Real-Time Market. The IFM calculates hourly Day-Ahead Ancillary Service Awards and establishes Ancillary Service Marginal Prices (ASMPs) for the accepted Regulation Up, Regulation Down, Spinning Reserve and Non-Spinning Reserve Bids. The IFM co-optimizes Energy and Ancillary Services subject to resource, network and regional constraints. In the HASP, the CAISO procures Ancillary Services from Non-Dynamic System Resources for the next Trading Hour as described in Section 33.7. The CAISO calculates the HASP settlement Ancillary Services price as described herein and further described in Section 33.8. In the Real-Time Market, the RTUC process that is performed every fifteen (15) minutes

establishes fifteen (15) minute Ancillary Service Schedules, Awards, and prices for the upcoming quarter of the given Trading Hour. ASMPs are determined by first calculating Shadow Prices ofthe Ancillary Services procurement requirement Constraintsshadow prices for each Ancillary Service type and the applicable Ancillary Services Regions. The Ancillary Services Shadow Pricesshadow prices are produced as a result of the co-optimization of Energy and Ancillary Services for each Ancillary Service Region through the IFM, HASP, and the Real-Time Market, subject to resource, network, and requirementrequirements constraints. The Ancillary Services Shadow Pricesshadow prices represent the marginal cost sensitivity of the relevant binding regional Constraintconstraint at the optimal solution, or the marginal reduction of the combined Energy and Ancillary Service procurement cost associated with a marginal relaxation of that Constraint.constraint. If the Constraintregional constraint is not binding for an Ancillary Services Region is not binding,, then the corresponding Ancillary Services Shadow Priceshadow price in the Ancillary Services Region is zero (0). During periods in which supply is sufficient, the The ASMP for a particular Ancillary Service type and Ancillary Services Region is then the sum of the Ancillary Services Shadow Pricesshadow prices for the specific type of Ancillary Service and all the other types of Ancillary Services for which the subject Ancillary Service can substitute, as described in Section 8.2.3.5, and for the given Ancillary Service Region and all the other Ancillary Service Regions that include that given Ancillary Service Region. During periods in which supply is insufficient, the ASMP for a particular Ancillary Service type and Ancillary Services Region will reflect the Scarcity Reserve Demand Curve Values set forth in Section 27.1.2.3.

27.1.2.2 Opportunity Cost in ASMP

The Ancillary Services Shadow Priceshadow price, which, as described above, is a result of the Energy and Ancillary Service co-optimization, includes the forgone opportunity cost of the marginal resource, if any, for not providing Energy or other types of Ancillary Services the marginal resource is capable of providing in the relevant market. The ASMPs determined by the IFM or RTUC optimization process for each resource whose Ancillary Service Bid is accepted will be no lower than the sum of (i) the Ancillary Service capacity Bid price submitted for that resource, and (ii) the foregone opportunity cost of Energy in the IFM or RTUC for that resource. The foregone opportunity cost of Energy for this purpose is measured as the positive difference between the IFM or RTUC LMP at the resource's Pricing Node and the

resource's Energy Bid price. If the resource's Energy Bid price is higher than the LMP, the opportunity cost measured for this calculation is $0. If a resource has submitted an Ancillary Service Bid but no Energy Bid and is under an obligation to offer Energy in the Day-Ahead Market (e.g. a non-hydro Resource Adequacy Resource), its Default Energy Bid will be used, and its opportunity cost will be calculated accordingly. If a resource has submitted an Ancillary Service Bid but no Energy Bid and is not under an obligation to offer Energy in the Day-Ahead Market, its Energy opportunity cost measured for this calculation is $0 since it cannot be dispatched for Energy. For Non-Dynamic System Resources that receive Ancillary Services Awards in HASP, the opportunity cost measured for this purpose is $0 because, as provided in Section 33.7, the CAISO cannot Schedule Energy in HASP from the Energy Bid under the same Resource ID as the submitted Ancillary Service Bid.

27.1.2.3 Ancillary Services Pricing – Insufficient~~in the Event of a~~ Supply ~~Insufficiency~~

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, 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, 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
  Shortage > 210 MW
 Shortage > 70 &
       ≤ 210 MW
 Shortage ≤ 70 MW
	70%
	
	60%
	50%
		70%
		
		60%
		50%
			$525
			
			$450
			$375
				$525
				
				$450
				$375
					$700
					
					$600
					$500
						$700
						
						$600
						$500

Upward Sum	**100%**	**100%**	**$750**	**$750**	**$1000**	**$1000**
Regulation Down Shortage > 84 MW Shortage > 32 & ≤ 84 MW Shortage ≤ 32 MW	70% 60% 50%	70% 60% 50%	$525 $450 $375	$525 $450 $375	$700 $600 $500	$700 $600 $500

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 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 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 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 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 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 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 maximum Energy Bid price permitted under Section 39.6.1.1.

27.1.2.3.2 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 maximum Energy Bid price permitted under Section 39.6.1.1.

27.1.2.3.3 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 maximum Energy Bid price permitted under Section 39.6.1.1.

27.1.2.3 Opportunity Cost in LMPs for Energy

In the event that there is insufficientnot sufficient supply to meet an Ancillary Services procurement requirement in a particular Ancillary Service Services Region or Sub-Region, in the IFM or RTM as required by Section 8.3, the applicable market will relax the relevant Ancillary Services Shadow Prices will rise automatically to the Scarcity Reserve Demand Curve Values in thatService procurement requirement and will use the maximum Ancillary Service Region or Sub-Region. LMPsBid price permitted under Section 39.6.1.3 as the pricing parameter for Energy will reflect the forgone opportunity costdetermining the price of the marginal resource, if any, for not providing the scarcedeficient Ancillary Services consistent with the CAISO's co-optimization designService.

27.1.3 Maximum and Minimum CAISO Markets Prices

For Settlements purposes, all LMPs, ASMPs and RUC Availability Prices for the IFM, RUC, HASP and Real-Time Market, as applicable, shall not exceed $2500 per MWh and shall not be less than negative $2500 per MWh. All prices produced by the CAISO Markets will be posted in accordance with the posting

of market results as further provided in Section 6.5, and subject to the price validation and correction procedures provided in Section 35; provided that the only prices that will be initially withheld from publication are those prices that exceed the above- specified maximum and minimum CAISO Market prices. Prices exceeding $2500 or less than negative $2500 will be modified for Settlements purposes pursuant to price correction process in Section 35 and the CAISO will post the results.   In addition to the analysis provided in the CAISO quarterly market performance reports on the maximum and minimum prices and price trends, the CAISO shall include in the weekly price correction report specified in Section 35.6 all prices at a non-aggregated level that exceed the minimum and maximum settlement prices specified in this Section 27.1.3. This Section 27.1.3 will no longer be in effect twelve months after the effective date of this section 27.1.3.

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Appendix A
Master Definition Supplement
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- Scarcity Reserve Demand Curve
A demand curve used to clear the Ancillary Services markets when supply is insufficient in an Ancillary Service Region or Sub-Region to meet Ancillary Services minimum procurement requirements.

- Scarcity Reserve Demand Curve Values
Fixed percentages of the maximum Energy Bid price permitted under Section 39.6.1.1 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.