California Independent
System Operator Corporation

April 21, 2016

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. ER16-_____-000
Frequency Response – Phase 1

Dear Secretary Bose:

The California Independent System Operator Corporation (CAISO) submits this filing to revise its tariff rules to help ensure it can comply with the new frequency response requirements of North American Electric Reliability Corporation (NERC) Reliability Standard BAL-003-1 – *Frequency Response and Frequency Bias Setting*.[1] The CAISO requests that the Commission accept the tariff revisions contained in this filing on 60 days' notice and make them effective June 21, 2016.

I. Introduction

Reliable operation of an electric power system depends on the balance between generation and load to ensure that the system maintains frequency within a narrow range around a scheduled value. This value is 60 Hz in the Western Interconnection. If generation output falls below demand, frequency on the electric system will drop below 60 Hz.

Frequency response reflects the system's ability to arrest and stabilize a frequency deviation after an event such as the loss of a large generator. Primary frequency response is the first stage of frequency response beginning seconds after an event, and it occurs automatically through the operation of mechanical equipment on generators, known as governors, rather than through response to

[1] The CAISO submits this filing pursuant to Section 205 of the Federal Power Act, 16 U.S.C. § 824d, and Section 35.13 of the Commission's regulations, 18 C.F.R. § 35.13. Capitalized terms not otherwise defined herein have the meanings set forth in Appendix A to the CAISO tariff.

dispatch instructions by an electric system operator like the CAISO. Most conventional synchronous generators are equipped with governors that enable the generator to respond automatically to these events.

The CAISO's proposed tariff revisions seek to clarify and enhance market rules regarding primary frequency response capabilities of generators with governor controls. The CAISO's proposal also would authorize the CAISO to procure transferred frequency response from other balancing authorities in the Western Interconnection and allocate the cost of that procurement to load on the CAISO system.[2] Finally, the tariff revisions clarify that the CAISO will designate day-ahead procured operating reserve as contingency only reserves in the real-time market in order to reserve frequency responsive headroom on resources. These measures will help the CAISO ensure it can comply with the requirements of NERC Reliability Standard BAL-003-1, which will take effect on December 1, 2016.

II. Background

In January 2014, the Commission approved NERC Reliability Standard BAL-003-1, which established new frequency response requirements for balancing authority areas.[3] Requirement 1 of Reliability Standard BAL-003-1 requires each balancing authority to achieve an annual frequency response measure that equals or exceeds its frequency response obligation. A balancing authority's frequency response obligation is determined each year and reflects its proportionate share - based on generation and load - of the interconnection's frequency response obligation. The Western Interconnection frequency response obligation reflects an event involving the loss of two units at the Palo Verde Nuclear Generating Station.

Under the standard, a balancing authority's annual measure is the median value of its frequency response performance during selected events over the course of a year.[4] NERC will evaluate the CAISO's performance and compliance

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[2] Transferred frequency response reflects an adjustment that a Balancing Authority will make on its compliance reports associated with Reliability Standard BAL-003-1. This adjustment is expressed in MW/0.1 Hz that a receiving Balancing Authority may acquire under an arrangement whereby another Balancing Authority increases its performance obligation by the same amount, or that a delivering Balancing Authority may provide under an arrangement whereby another Balancing Authority reduces its performance obligation by the same amount. Transferred frequency response is solely an instrument to comply with Reliability Standard BAL-003-1; there is no exchange of physical services between Balancing Authorities.

[3] *Frequency Response and Frequency Bias Setting Reliability Standard*, Order No. 794, 146 FERC ¶ 61,024 (2014).

[4] *See Essential Reliability Services and the Evolving Bulk-Power System—Primary Frequency Response*, Notice of Inquiry in Docket RM16-6, 154 FERC ¶ 61,117 (2016) at PP 27-28.

with BAL-003-1 by selecting the median value of sampled events. For the CAISO, frequency response performance for each event will reflect the difference in generation output before and after the frequency event given the magnitude of the change in frequency. Performance is measured by the system's response in megawatts per tenth of a hertz. For example, if generation within the CAISO increases by 500 MW in response to a 0.2 Hz frequency drop, the CAISO's performance for that event would be 250 MW per 0.1 Hz.

In 2015, the CAISO undertook an assessment of its current frequency response capabilities and historical frequency response performance. The analysis reflected that the CAISO faces a risk of not meeting its target frequency response measure under Reliability Standard BAL-003-1. For this reason, the CAISO commenced a stakeholder initiative to examine clarifying and enhancing its market rules to mitigate this risk. In light of the impending December 1, 2016 compliance obligation, the CAISO divided its stakeholder process into two phases. This filing reflects the outcome of phase 1 of the initiative – near-term steps the CAISO can take to ensure compliance with Reliability Standard BAL-003-1 beginning December 1, 2016. Phase 2 of the CAISO's initiative will examine additional means to ensure the CAISO has adequate frequency response capabilities over the long-term, including a potential market mechanism to secure sufficient primary frequency response.

The CAISO analyzed its historical frequency response in MW/0.1 Hz based on an estimate of its annual frequency response obligation under BAL-003-1.[5] For the period January 2012 through January 2016, the CAISO's frequency response performance deteriorated year-after-year under an estimated annual frequency response measure of 30 percent of the Western Interconnection's frequency response obligation. The CAISO's median performance steadily decreased from approximately 263 MW/0.1Hz in 2012 to 184 MW/0.1Hz in 2015. Table 1 reflects that the CAISO's primary frequency response shortfall on average for an event increased to almost 100 MW/0.1Hz for 2015 relative to a surplus in 2012.

Table 1: CAISO's Annual Frequency Response Performance Trend

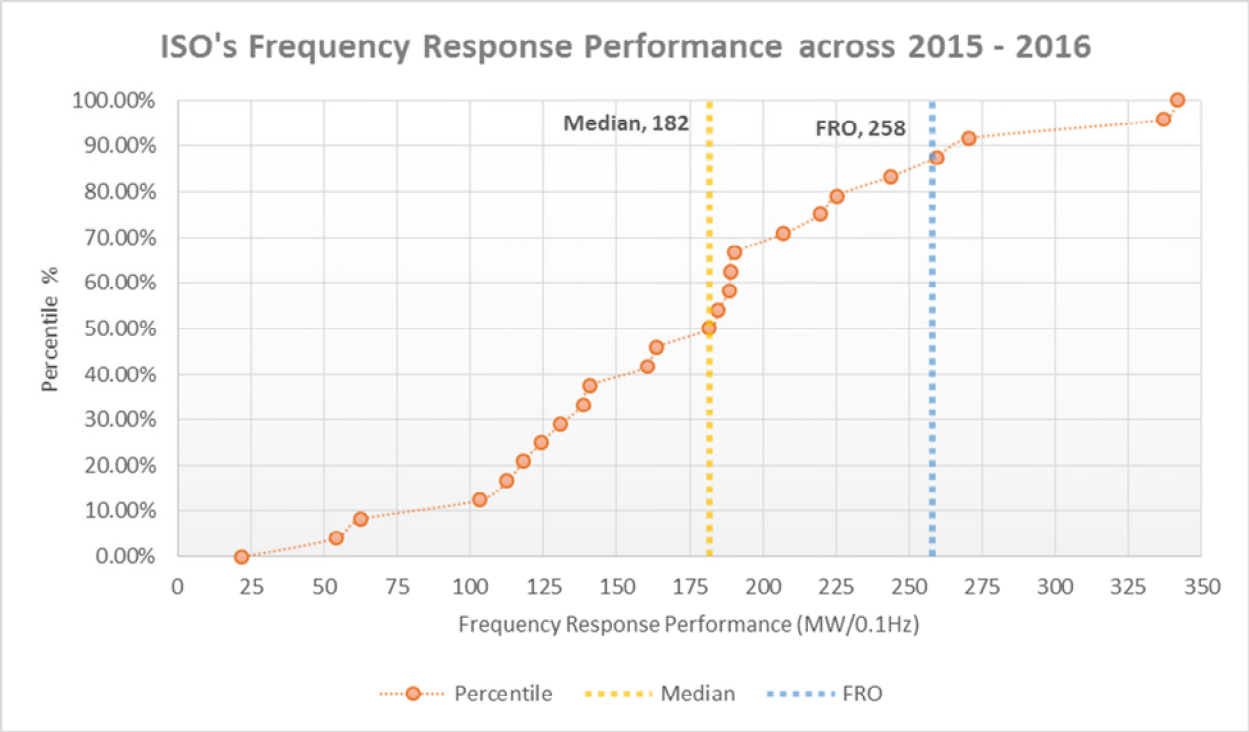
Compliance Period	Obligation MW/0.1Hz	Median Response MW/0.1Hz	Shortfall MW/0.1Hz
2012	252	262.77	(13)
2013	252	209.52	24
2014	285	218.80	60
2015	272	184.71	96

[5] CAISO Frequency Response Draft Final Proposal, February 4, 2016, Section 5, at 9-16. http://www.caiso.com/Documents/DraftFinalProposal_FrequencyResponse.pdf

The increased proportion of renewable resources operating in the CAISO's balancing authority area is likely contributing to the deterioration of the CAISO's frequency response performance. In particular, when there is high output from non-synchronous, renewable resources and low load levels, there may not be sufficient frequency-responsive capable resources on-line. Other factors such as how resources have configured their governors and plant control systems may also be affecting performance. For example, time delay or the deadband settings employed on governors will affect when the arrested point occurs during a frequency disturbance because the frequency dip will continue until the governors trigger the automatic response. Plant level controls may also hold a resource at a prescheduled output - usually set at the resources' dispatch operating target - without reference to grid frequency.

The downward trend in performance caused the CAISO to analyze additional data. The CAISO isolated 25 frequency disturbance events during 2015 and January 2016 to assess its performance over this period. In only four of the events did the CAISO meet its estimated frequency response obligation. During this timeframe, the CAISO's performance dropped to a median value of 182 MW/0.1 Hz relative to the CAISO's estimated frequency response obligation of 258 MW/0.1 Hz during this timeframe. Figure 1 shows the ranked single event performance data in MW/0.1 Hz. This data suggests the CAISO's performance would not have complied with the relevant requirement of BAL-003-1, had the CAISO been subject to a compliance obligation during this period.

Figure 1
CAISO Frequency Response Performance 2015 – 2016



The CAISO reached out to several scheduling coordinators with resources with governor controls. The CAISO discovered that some resources did not respond as expected to frequency events because they had implemented load controls at generating facilities that can override governor response.[6] These controls may not coordinate frequency bias across the entire facility, thereby reducing the automated response of the resource to a frequency disturbance. Temperature controls at some resources also override governor response to protect against mechanical damage. In addition, certain regulatory considerations such as environmental constraints at hydroelectric resources may cause resources to constrain their governor response.

III. Proposed Tariff Amendments

In this section, the CAISO describes its proposed tariff revisions. The revisions encompass five general categories:

- **Clarify requirements for participating generators with governor controls.** These proposed revisions incorporate requirements specified in

[6] CAISO Frequency Response Draft Final Proposal, February 4, 2016, Section 5, at 14-16. http://www.caiso.com/Documents/DraftFinalProposal_FrequencyResponse.pdf

WECC criteria and NERC reliability guidelines for primary frequency control into the CAISO tariff. The revisions will require resources to coordinate controls from their generator turbine through each level of plant controls to enable governor response, except for controls needed to manage operational constraints.

- **Establish authority to procure transferred frequency response.** These proposed revisions provide the CAISO with authority to negotiate contracts for transferred frequency response with another balancing authority, or its authorized seller, in the Western Interconnection for purposes of complying with Reliability Standard BAL-003-1.

- **Allocate the cost of transferred frequency response to CAISO demand.** These proposed revisions would allocate the costs of transferred frequency response to load using a scheduling coordinator's NERC/WECC metered demand. The costs of ancillary services procured to satisfy contingency reserve requirements also are allocated to load but with the use of different allocation methodology.[7] The CAISO calculation of NERC/WECC metered demand is an annual calculation and is a just and reasonable allocator in this case for the following reasons. First, the costs associated with transferred frequency response benefit the overall reliable operation of the interconnection in a manner similar to the benefits offered by the services of a reliability coordinator and NERC/WECC, the costs of which are allocated based on metered demand. Second, the CAISO's frequency response obligation is determined each year, just like NERC/WECC and reliability coordinator charges. Third, the new frequency response requirement is an annual measure based on the CAISO's performance during the course of a compliance year, *e.g.*, December 1, 2016-November 30, 2017.

- **Clarify the CAISO's practice of designating day-ahead procured operating reserve to contingency only reserves in the real-time market.** This proposed revision will help preserve frequency responsive headroom, and the contingency reserve capability, by not dispatching operating reserves for energy in the real-time market.

- **Clarify which entity generally issues voltage schedules under the coordinated function registration agreement between the CAISO and its participating transmission owners.** These proposed revisions clarify that participating transmission owners and, from time to time, the CAISO may issue voltage schedules.

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7 *See* CAISO tariff sections 11.10.3.2 and 11.10.4.2.

A. Participating generators must configure their governors and plant level controls in manner that enables primary frequency response

The CAISO tariff currently requires participating generators to meet all applicable reliability criteria.[8] Under the CAISO tariff, applicable reliability criteria includes "the Reliability Standards *and reliability criteria established by NERC and WECC* and Local Reliability Criteria, as amended from time to time, including any requirements of the NRC."[9] Currently, WECC criterion PRC-001-WECC-CRT-1.2 requires generator owners with generator units that have governor function to set the governor droop for each generating unit to greater than or equal to 3 percent but less than or equal to 5 percent.[10] The purpose of this criterion is to facilitate primary frequency support in the Western Interconnection by requiring generating resources with a governor to have a droop setting within a specified range.[11]

Given the deteriorating performance during frequency disturbance events, the CAISO proposes to clarify requirements for participating generators with governors. These parameters include:

- setting the governor droop for each generating unit with governor controls no higher than 4 percent droop for combustion turbines and 5 percent droop for other technology types;

- using a deadband no larger than +/- 0.036 Hz.[12]

These parameters align with a guideline related to primary frequency control approved by NERC's operating committee on December 15, 2015.[13]

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8 CAISO tariff section 4.6.5.1.

9 CAISO tariff Appendix A, Master Definitions Supplement (emphasis added).

10 WECC Criterion PRC-001-WECC-CRT-1.2 – Governor Droop Setting. https://www.wecc.biz/Reliability/PRC-001-WECC-CRT-1.2.pdf

11 *Id.*

12 Proposed changes to CAISO tariff section 4.6.5.1 and Appendix K, Part B 1.2. The CAISO has restructured Appendix K, Part B1.2 because a portion of that tariff section applies to resources without governors.

NERC offered this guideline to assist balancing authorities, generator operators, and generator owners in providing more effective frequency response during major grid events, and to address techniques of measuring frequency response at a resource level. With respect to the maximum governor settings, NERC identified values to achieve desired frequency, subject to legitimate technical, operational, or regulatory considerations that would prevent governors from achieving the maximum governor settings. The setting, known as droop, reflects the amount of frequency change that is necessary to cause the main prime mover control mechanism of a generating unit to move from fully closed to fully open. A lower droop means that a generating unit with governor controls will respond more quickly to frequency disturbances outside of a deadband.

By requiring droop settings not to exceed 4 percent for combustion turbines and not to exceed 5 percent for all other resources with governor controls, NERC's guideline is more restrictive than, although consistent with, WECC's criterion of maintaining a governor droop setting between three and five percent. However, NERC's guideline specifically states that many combustion turbines have a 4 percent droop setting. Given NERC's finding that combustion turbine units can respond to frequency deviations with their governors set at a 4 percent droop setting, the CAISO believes this is an appropriate rule to include in the CAISO tariff. Units with a 4 percent governor droop setting will respond more rapidly when frequency declines. With the increased participation of renewable resources in the CAISO balancing authority, the CAISO risks a loss of inertia. Lower system inertia resulting from increased renewable penetration increases the rate of change of frequency immediately following disturbances. Having resources that can technically respond to frequency deviations faster will enhance the CAISO's ability to arrest frequency decline.

One stakeholder suggested that the CAISO retain a range of droop settings instead of specifying maximum values. The CAISO is not precluding the use of a range of droop settings. The CAISO is merely establishing a maximum droop setting. Resources can still configure their droop setting at lower levels within the range allowed by WECC's criterion, i.e. down to three percent. Stakeholders also asked if these parameters should apply solely to generating units that fall within the NERC's definition of the bulk electric system. Under the CAISO tariff, these provisions would apply to all participating generators with governor controls. Given the CAISO's annual frequency response performance trend, it is important that these requirements apply to all generators with governor controls. This will also ensure that all similarly situated resources are treated the same.

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[13] Reliability Guideline: Primary Frequency Control v1.0 Final at 9. http://www.nerc.com/comm/OC/Reliability%20Guideline%20DL/Primary_Frequency_Control_final.pdf

NERC's guideline also recommends governor deadband maximums of ± 0.036 Hz for the Eastern, Western and ERCOT interconnections. The deadband settings employed on governors affect when the arrested point occurs during a frequency disturbance. This is an important parameter because the frequency dip will continue until a governor triggers an automatic response from a generating unit. A deadband provides a range around the scheduled frequency where minor disturbances will not trigger a governor response. Under the CAISO's proposed requirement, governors should be fully responsive to frequency deviations exceeding ± 0.036 Hz. This deadband is consistent with NERC's guideline and with the CAISO's current certification requirements for resources providing spinning reserve.[14] As such, the Commission should accept this tariff revision.

In addition, the CAISO proposes to clarify that resources will not inhibit primary frequency response except under certain operational constraints such as ambient temperature limitations, outages of mechanical equipment, or regulatory considerations.[15] This clarification is important so participating resources with governor controls understand their obligations not to inhibit governor performance. Blocking the governor of a generator unit can result in system instability because fewer units will be capable of reacting for system frequency deviations and may impede restoring system frequency following a disturbance. Again, the CAISO proposes to align its requirements with NERC's guideline and require resources to coordinate controls from their generator turbine through each level of plant controls to enable governor response.[16] NERC's guideline explains that "in order to provide sustained primary frequency response, it is essential that the prime mover governor, plant controls and remote plant controls are coordinated."[17] The lack of coordination between governor and load control systems can reduce primary frequency response and allow additional control systems to countermand the primary frequency response and reverse the action of the governor.[18] By incorporating NERC's guideline into a tariff rule that applies to all participating generators with governor controls, the CAISO will strengthen the system's capability to respond to frequency deviations.

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[14] Reliability Guideline: Primary Frequency Control v1.0 Final at 9; Appendix K of the CAISO tariff, Part B 1.2.

[15] Proposed changes to CAISO tariff section 4.6.5.1 and Appendix K, Part B 1.2

[16] Reliability Guideline: Primary Frequency Control v1.0 Final at 4-5.

[17] *Id.* at 4.

[18] *Id.*

The CAISO also proposes to require generators to submit their physical parameters for frequency response capability to the CAISO.[19] The CAISO proposes to require generators to certify that they have not inhibited the real power response of any generating unit by any means that would override the governor response except as necessary to address physical operational constraints for reasons that include ambient temperature limitations, outages of mechanical equipment, or regulatory considerations such as environmental regulations. These conditions track NERC's guidance to industry on acceptable reasons that would prevent governors from achieving the maximum governor settings.[20]

In the event there is a need to inhibit the real power response of any generating unit, the participating generator shall provide a written description of this limitation with its certification. These proposed tariff changes will provide the CAISO with increased visibility into the generation fleet's frequency response capability and establish a written explanation of any needed controls to inhibit governor response consistent with the criteria set forth in the CAISO tariff. With more information about the system's frequency response capabilities, the CAISO can more effectively explore mechanisms to enhance the CAISO's frequency response performance.

B. The CAISO proposes to procure transferred frequency response to support compliance with Reliability Standard BAL-003-01

Although the Commission has modified its rules for sellers with market based rate authority to offer frequency response services,[21] the CAISO is not in this filing proposing to procure frequency response service. To address the concerns that the CAISO may not have sufficient frequency response capability to meet its annual frequency response measure under Reliability Standard BAL-003-1, the CAISO proposes to procure transferred frequency response in advance from other balancing authorities. This is an interim measure until the CAISO can develop a more permanent means to secure frequency response capabilities through a dedicated stakeholder process.

Transferred frequency response is a compliance instrument; it does not involve the provision or exchange of physical services. Instead, transferred frequency response merely reflects an adjustment on a NERC compliance form. A balancing authority selling transferred frequency response would decrease its

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[19] *See* proposed changes to CAISO tariff section 4.6.4.

[20] Reliability Guideline: Primary Frequency Control v1.0 Final at 9.

[21] *Third-Party Provision of Primary Frequency Response Service*, 153 FERC ¶ 61,220 (Order 819) (2015).

frequency response performance by the amount it sold. A balancing authority procuring transferred frequency response would increase its frequency response performance by the procured amount and may reflect transactions with multiple balancing authorities. The CAISO is proposing to define transferred frequency response to capture these elements.[22]

The CAISO proposes to procure transferred frequency response in advance of the compliance year under Reliability Standard BAL-003-1. This purchase would give the CAISO the right to make an adjustment on its NERC compliance forms associated with the standard. The right would apply to all frequency response events during the year for which NERC assesses the CAISO's annual frequency response measure. In other words, the CAISO will not procure transferred frequency response on a daily or as-needed basis, but instead will purchase this compliance instrument upfront for all reportable frequency events that occur during the compliance year.

NERC's standard drafting team recognized contractual arrangements as a means for a balancing authority to meet a frequency response standard.[23] NERC's proposed reporting forms associated with BAL-003-01 also reflect this approach.[24] With respect to reporting transferred frequency response, NERC's compliance form instructs balancing authorities in part:

> Transferred Frequency Response: This value is the amount agreed upon between the entities expressed in MW/0.1 Hz. Form 2 will adjust this amount for the frequency deviation experienced. (e.g. if an entity agrees to provide 20 MW/0.1 Hz to another entity and a frequency event with a deviation of 50 MHz occurs, the delivering entity should enter +20 in the data column of Form 2 and the receiving entity should enter - 20….
>
> Values for the entity receiving the response must be entered as a negative number.

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22 *See* proposed addition to Appendix A of the CAISO tariff, Master Definitions Supplement.

23 Frequency Responsive Standard Background Document *Methods of Obtaining Frequency Response* at 38 (November 2012). http://www.nerc.com/pa/Stand/Project%20200712%20Frequency%20Response%20DL/Bal-003-1-Background_Document-Clean-2013_FILING.pdf

24 See NERC FRS Form 1 submitted as part of Appendix K of Petition of NERC for Approval of Proposed Reliability Standard BAL-003-1 - Frequency Response and Frequency Bias Setting under RM13-11; http://elibrary.ferc.gov/idmws/common/opennat.asp?fileID=13219072

> Values for the entity delivering the response must be entered as a positive number.
>
> Values between entities must sum to zero.

These instructions contemplate a contractual arrangement to transfer frequency response reporting obligation between entities. The requirement of BAL-003-1 to meet an annual frequency response measure applies to balancing authorities. These entities, or their authorized sellers, would be the entities to transfer obligations within an interconnection.[25]

The following example explains how transferred frequency works. Balancing authority 1 has a frequency response obligation of 200 MW/0.1 Hz as determined by NERC. Balancing authority 2 has a frequency response obligation of 100 MW/0.1 Hz as determined by NERC but has a surplus of frequency response capabilities from resources that operate on its system. Balancing authority 1 procures transferred frequency response in the amount of 20 MW/0.1 Hz from balancing authority 2. For every frequency disturbance event identified by NERC for reporting purposes, balancing authority 1 would adjust its frequency response obligation downward by the amount of transferred frequency response it procured. Balancing authority 2 would increase its frequency response obligation by 20 MW/0.1 Hz.

Table 2 – Example of Transferred Frequency Response

Compliance Entity	Frequency Response Obligation	Adjusted Frequency Response Obligation
Balancing Authority 1	200MW/0.1Hz	180 MW/0.1Hz
Balancing Authority 2	100 MW/0.Hz	120 MW/0.1Hz

The CAISO has structured its tariff to permit, but not require, the CAISO to procure transferred frequency response. In effect, transferred frequency response will act as an insurance policy and permit the CAISO to adjust its reporting on NERC's compliance form consistent with an agreement with another balancing authority to make a corresponding adjustment on its report. Procuring transferred frequency response will allow the CAISO to avoid using inefficient manual market interventions such as exceptional dispatches to commit

[25] Based on comments received during its stakeholder process, the CAISO recognizes that in some unique instances the contracting parties may not be the actual balancing authorities. For example, Powerex has informed the CAISO that it is authorized to sell transferred frequency response on behalf of BC Hydro.

resources. This will assist the CAISO in complying with the new reliability standard in an efficient, cost-effective manner.

If the CAISO were to rely on exceptional dispatches to secure frequency response capabilities, it might be necessary at times to commit non-resource adequacy resources and constrain their output. Such a commitment requires the CAISO to provide the non-resource adequacy resource a capacity procurement mechanism designation that lasts for 30 days, which could increase costs relative to the procurement of transferred frequency response.[26] In addition, at times of low load and high renewable output, the CAISO may need to curtail renewable output in order to commit a frequency responsive unit. This action could require market payments based on a renewable resource's negative bid. Procuring transferred frequency response would avoid these costs. Importantly, the CAISO will be able to implement this proposal in a timely manner that will ensure compliance with the new standard beginning December 1, 2016. There is not sufficient time for the CAISO to develop and implement a market mechanism to meet the requirements of BAL-003-1 by December 1, 2016.

To secure transferred frequency response, the CAISO proposes to conduct a competitive solicitation.[27] The CAISO is modeling this authority on existing tariff provisions that authorize the CAISO to undertake, among other actions, competitive solicitation to ensure it has adequate facilities to meet operating and planning reserve criteria.[28] The Commission initially granted the CAISO the authority to engage in forward contracting in 2000 to ensure it had the means to reliably operate the grid and meet minimum reliability criteria.[29] In this

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[26] See CAISO tariff section 43.3.6.

[27] *See* CAISO proposed tariff section 42.2.

[28] *See* CASIO tariff section 42.1. Section 42.1.4 provides that if the CAISO requires ancillary services contracts, short-term generation supply contracts, or load curtailment contracts to meet applicable reliability criteria, it shall select the bids that permit satisfaction of those applicable reliability criteria at the lowest cost. Notwithstanding this section, section 42.1.5 provides that if the CAISO concludes that it may be unable to comply with applicable reliability criteria, it may, acting in accordance with good utility practice, take such steps as necessary to ensure compliance, including negotiating contracts other than through competitive solicitation.

[29] *San Diego Gas & Electric Co., et al*., 93 FERC ¶ 61,294 (2000). For example, consistent with this general authority, in the summer of 2000, the CAISO solicited proposals from suppliers to provide up to 3,000 MW of new generation in the form of peaking capacity to the CAISO during upcoming summer periods to support reliability on the CAISO system. Several generators responded to the CAISO's request for proposals, and the CAISO selected bids from parties to either build new generation or add to the capability of existing units. The CAISO subsequently executed Summer Reliability Agreements with the unit owners. The Summer Reliability Agreements were filed with the Commission. The CAISO's request for proposals, issued on August 4, 2000, was open and public, it clearly defined the product the CAISO was seeking and the requirements for any winning bidder, it specified the CAISO's evaluation criteria, and it required executed Summer Reliability Agreements to be filed with the Commission. The

case, the CAISO is proposing to use a similar hedge to help ensure it has the means to comply with BAL-003-1 standard. The CAISO expects to use this competitive solicitation process for a limited time.

The CAISO's proposed tariff provisions specify that the CAISO will select the lowest cost bid consistent with a seller's demonstrated ability to provide transferred frequency response.[30] In its competitive solicitation, the CAISO will request annual commitments from bidders because the use of transferred frequency response seeks to manage a regulatory risk that exists across a year. The solicitation will specify that transferred frequency response will be reported consistently for all events selected by NERC.

The CAISO proposes to evaluate the offers based on an estimate of costs the market might incur by committing additional generation on-line and ensuring the resources have sufficient headroom in order to secure frequency response capability. The CAISO may also choose not to select a winning bidder. In that case, CAISO will rely on manual commitments through exceptional dispatches as necessary to ensure it has sufficient frequency response capability on the system to meet the requirements of BAL-003-1. Once the CAISO completes that solicitation, it will file any contract with a winning bidder with the Commission for approval. At that time, the CAISO will justify any costs it proposes to allocate to scheduling coordinators under a contract by comparing potential costs associated with using out of market mechanisms to commit resources and constrain their output.

The CAISO's proposed solicitation is consistent with the guidance the Commission has provided for competitive solicitation processes to ensure that affiliates do not receive undue preference.[31] In this context, the Commission has established the following four principles for evaluating competitive solicitation processes:

- *Transparency* – The competitive solicitation should be open and fair.

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proposed competitive solicitation for transferred frequency response follows a similar framework. In addition, consistent with its general tariff authority, the CAISO issued a Request for Bids in connection with its Demand Relief Program for persons to provide a net demand reduction during summer peak periods in 2000 and 2001. The CAISO submitted Demand Relief Agreement with the Commission for informational purposes. *California Independent System Operator Corp.,* 91 FERC ¶ 61,256 (2000); *California Independent System Operator Corp.,* 97 FERC ¶ 61,149 (2001).

30 *Id.*

31 *See generally Allegheny Energy Supply Co., LLC,* 108 FERC ¶ 61,082, P 22 (2004). Although the CAISO does not have an affiliate that could provide transferred frequency response, the Commission guidance is still instructive.

- *Definition* – The product or products sought through the competitive solicitation process should be precisely defined.

- *Evaluation* – Evaluation criteria should be standardized and applied equally to all bids and bidders.

- *Oversight* – An independent third party should design the solicitation, administer bidding, and evaluate bids prior to selection.

The transferred frequency response competitive solicitation process satisfies these four principles. First, the competitive solicitation is open to all balancing authorities in the Western Interconnection, or their authorized sellers, that can provide transferred frequency response.[32] The CAISO will also file any contracts with the winning bidder or bidders with the Commission. Second, the CAISO is proposing in this filing to define transferred frequency response as the product subject to the solicitation.[33] This definition is consistent with the instructions for reporting transferred frequency response on NERC's compliance forms. Third, the CAISO will select bids, if any, based on lowest cost and the bidders' ability to provide transferred frequency response.[34] The CAISO will apply these criteria to all bids and bidders for transferred frequency response. Fourth, the CAISO, an independent entity, will administer the competitive solicitation and evaluate the bids.[35]

One stakeholder asserted that the CAISO's proposal to procure transferred frequency response constitutes undue discrimination against resources within the CAISO's balancing authority that could provide primary frequency response capability as a service. The CAISO disagrees. The CAISO is not proposing to procure frequency response service from other balancing authorities. Instead, the CAISO is proposing only to procure the right to adjust its performance obligation in connection with selected frequency response events for purposes of NERC compliance.

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[32] The CAISO is hosting a workshop on April 25, 20016 to discuss a draft agreement and draft Request for Proposal regarding transferred frequency response to comply with Reliability Standard BAL-003-01. http://www.caiso.com/Documents/TransferredFrequencyResponseAgreement-Request-ProposalWorkshop42516.htm

[33] CAISO proposed definition for transferred frequency response in Appendix A to the CAISO tariff, Master Definitions Supplement.

[34] CAISO proposed tariff section 42.2.1.

[35] The CAISO's Department of Market Monitoring will have access to all bid information and will be able to monitor for any potential manipulation.

Finally, some stakeholders questioned why the CAISO has not developed a market product for primary frequency response. To comply with the new requirement commencing December 1, 2016, the CAISO simply does not have sufficient information or time to design, implement, and test a market mechanism for primary frequency response. The CAISO would need to explore either a market constraint that solves for the least cost commitment and dispatch constrained by the need for sufficient headroom to provide frequency response or create a new product that would allow economic bidding to provide primary frequency response from capable resources. Either approach would require significant discussion with stakeholders, market design work, and development of software, as well as testing and market simulation. The earliest the CAISO could complete such work would be the fall of 2017. The CAISO also notes that current Commission rules do not require organized markets to develop a market product for frequency response, and the Commission expressly rejected requests to establish a deadline for organized markets to implement primary frequency response compensation mechanisms.[36] In particular, the Commission has not mandated that ISO/RTOs develop a frequency response market to comply with the new requirements in BAL-003-1 by December 1, 2016.

That effort will be within the scope of phase 2 of the CAISO's frequency response initiative that the CAISO will commence during the third quarter of 2016. The CAISO also notes that the Commission itself is actively examining these issues in its notice of inquiry involving primary frequency response.[37] In this notice of inquiry, the Commission recognizes that no stand-alone frequency response product exists within organized wholesale electric markets and has invited comments on the need for and the nature of frequency response compensation within the context of current market optimization processes conducted by independent system operators and regional transmission operators.[38] The record developed by the Commission in its notice of inquiry will inform phase 2 of the CAISO's stakeholder process.

C. The CAISO proposes to allocate the cost of transferred frequency response to scheduling coordinators' NERC/WECC metered demand

The CAISO's proposed tariff revisions would allocate any payments for transferred frequency response to scheduling coordinators' NERC/WECC

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[36] *Third-Party Provision of Primary Frequency Response Service,* 153 FERC ¶ 61,220 at P37 (2015).

[37] *Essential Reliability Services and the Evolving Bulk-Power System—Primary Frequency Response*, Notice of Inquiry in Docket RM16-6, 154 FERC ¶ 61,117 (2016). Comments are due in this Notice of Inquiry on April 25, 2016.

[38] *Id*. at P 39.

metered demand.[39] Effectively, this serves to allocate the cost of transferred frequency response to load, similar to ancillary services costs in the CAISO's markets. The requirements of BAL-003-1 apply to balancing authorities. Ultimately, these requirements benefit load because they ensure the reliability of the interconnection and balancing authority areas within the interconnection.

The CAISO calculates scheduling coordinators' NERC/WECC metered demand under existing CAISO tariff section 11.20.4.[40] This calculation reflects the scheduling coordinators metered demand for the calendar year two years prior to the applicable assessment year. Accordingly, the CAISO would invoice scheduling coordinators for the costs of any procured transferred frequency response for December 1, 2016 through November 30, 2017 based on scheduling coordinators' NERC/WECC metered demand for 2015. The CAISO currently uses this calculation for purposes of allocating fees associated with NERC/WECC operations as well as reliability coordinator charges.[41] These functions generally advance the reliable operation of the interconnection, which ultimately benefits load. Similarly, any transferred frequency response would support the overall reliable operation of the interconnection for the benefit of load. Using scheduling coordinators' NERC/WECC metered demand leverages an existing allocation methodology for a cost that the CAISO does not expect to re-occur beyond the initial years of compliance with BAL-003-1.

The use of NERC/WECC metered demand also provides symmetry to the compliance obligations under BAL-003-1. The CAISO's frequency response obligation is determined each year, just like NERC/WECC and reliability coordinator charges. Moreover, the new frequency response requirement is an annual measure based on the CAISO's performance during the course of a

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[39] Proposed CAISO tariff section 11.34.1.

[40] Appendix A of the CAISO tariff, Master Definitions Supplement defines NERC/WECC Metered Demand as follows:

> For purposes of calculating NERC/WECC Charges, a Scheduling Coordinator's net metered CAISO Demand plus Unaccounted for Energy for net metered CAISO Demand and Transmission Losses for metered CAISO Demand. A Scheduling Coordinator's net metered CAISO Demand equals the Scheduling Coordinator's metered CAISO Demand (which adds Energy associated with imports from and subtracts Energy associated with exports to other Balancing Authority Areas), less metered CAISO Demand for Station Power and for Energy required for storage at electric energy storage facilities, such as pumped storage. For purposes of calculating NERC/WECC Metered Demand, Unaccounted for Energy and Transmission Losses allocable to net metered CAISO Demand will be allocated pro rata to each Scheduling Coordinator based on the Scheduling Coordinator's net metered CAISO Demand.

[41] *See generally* CAISO tariff section 11.20.

compliance year, e.g., December 1, 2016-November 30, 2017. The calculation of scheduling coordinators' NERC/WECC metered demand is an annual calculation similar to the annual timeframe for complying with the BAL-003-1 requirements.

One stakeholder argued that this calculation appears to depart from cost causation principles because the CAISO would impose a charge for a forward procurement based on a past metered demand quantity. The allocator, however, represents a reasonable proxy for purposes of allocating the cost of transferred frequency response to demand. NERC's process for allocating to each balancing authority its share of the interconnection frequency response obligation uses historical data. For purposes of calculating the 2017 balancing authorities' frequency response obligation, NERC will use data submitted in June 2016 for calendar year 2015.[42] Therefore, the data establishing the CAISO's frequency response obligation and the data used for allocating the cost of transferred frequency response are from a comparable period. In response to the one stakeholder's comment, the CAISO also notes that both reliability coordinator charges and NERC/WECC charges for the current year are allocated to scheduling coordinators based on their NERC/WECC metered demand for the calendar year two years prior to the current NERC/WECC charge assessment year.[43]

In proposed section 11.34, the CAISO has also proposed a set of invoicing rules to explain the mechanics of how the CAISO will calculate and assess a charge for transferred frequency response.[44] These rules and validation requirements are substantially the same as the process for calculating and assessing reliability coordinator charges and NERC/WECC charges.[45] The rules explain the schedule for the invoicing process and the responsibility of scheduling coordinators to pay charges as well as the opportunity to validate and dispute those charges. These rules limit the grounds for dispute to an error in the invoice due to a typographical or other ministerial error by the CAISO.[46] This is consistent with the CAISO's tariff authority regarding the allocation of reliability coordinator and NERC/WECC charges.[47] This is reasonable because total costs

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42 *See* BAL-003-1 Detailed Implementation Timeline, North American Electric Reliability Corporation, August 20, 2014. http://www.nerc.com/comm/oc/rs%20landing%20page%20dl/frequency%20response%20standard%20resources/bal-003-1_implementation_plan_timeline_20140820.pdf

43 CAISO tariff sections 11.20.4 and 11.20. 9.2.

44 *See generally*, proposed CAISO tariff section 11.34.

45 *Cf.* CAISO tariff section 11.20.9.

46 Proposed CAISO tariff section 11.34.5.

47 CAISO tariff section 11.20.7.3 and 11.20.9.5.

of transferred frequency response will be subject to review in a separate section 205 filing when the CAISO presents any contract to the Commission. Scheduling coordinators can separately dispute the CAISO's calculation of their NERC/WECC metered demand through the process set forth in section 11.20.4 of the CAISO tariff.

These invoicing provisions also address collateral and credit requirements.[48] The CAISO's calculation of collateral requirements and other credit requirements will include an adjustment for the scheduling coordinator's allocable share of the charge for transferred frequency response, if applicable. In addition, the CAISO proposed tariff revisions clarify that the estimated aggregated liability calculated for the scheduling coordinator shall not include extrapolated amounts for the charge under Section 12.1.3.1.1(d). The estimated aggregated liability is a calculation of a market participant's estimated total financial liability at any given point in time, which the CAISO uses as an input to determine the market participant's financial security obligations.[49] By including the transferred frequency response charge within this calculation, the CAISO will adjust market participant's financial security obligation upwards to account for the liability associated with an invoice for transferred frequency response charges. The provision excludes extrapolated amounts because these amounts reflect estimate upcoming market invoice liabilities based on a scheduling coordinator's recent market activity. The transferred frequency response charge will likely be a one-time annual charge not related to specific market activity. Accordingly, the CAISO does not believe it is appropriate to extrapolate amounts of this charge for purposes of a scheduling coordinator's estimated aggregated liability.

The CAISO tariff revisions also explain how the CAISO will manage payment default. These rules are necessary because the CAISO will have a contractual obligation to make payments to a provider of transferred frequency response even if invoiced scheduling coordinators do not pay invoiced charges. Proposed tariff section 11.34.6 provides that if a scheduling coordinator defaults on payment of all or part of an invoice for transferred frequency response charges, the CAISO will follow existing tariff authority applicable to payment defaults. In the event of a default, the CAISO may exercise its rights under section 11.29.13.3 to enforce the financial security provided by the defaulting scheduling coordinator, or take other action under sections 11.29.12 or 11.29.13 to obtain payment from the defaulting scheduling coordinator for the amount owed.

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[48] Proposed CAISO tariff section 11.34.3(b).

[49] Appendix A to the CAISO tariff, Master Definitions Supplement defines Estimated Aggregate Liability as "[t]he sum of a Market Participant's known and reasonably estimated potential liabilities for a specified time period arising from charges described in the CAISO Tariff, as provided for in Section 12."

One stakeholder requested that the CAISO include on any invoice the quantity, price, terms and conditions of any procured transferred frequency response. The CAISO proposes to include the quantity and price of transferred frequency response in scheduling coordinators' settlement statements. The CAISO uses this standard approach in connection with its settlement statement process.[50] The terms and conditions of any procured transferred frequency response will be set forth in a contract that the CAISO will file with the Commission for review and approval.

D. The CAISO proposes to clarify that as part of normal operations it may elect to designate all operating reserves procured in the day-ahead market as contingency only

One of the tools the CAISO proposes to use to help ensure it meets the requirements of BAL-003-1 is to rely on contingency reserves to provide frequency responsive capacity in the event of a frequency disturbance. The CAISO's existing tariff provides that resources providing spinning reserve must be responsive to frequency deviations.[51] Currently, the CAISO procures 100 percent of its forecasted ancillary service requirements in the day-ahead market.[52] This includes procuring spinning reserve that scheduling coordinators may designate as contingency only, i.e. only available for dispatch in the event of contingency or an imminent or actual System Emergency.[53] In real-time, the CAISO procures ancillary services, including spinning reserve, to meet incremental requirements.[54] Spinning reserve procured in the real-time market is always contingency only.[55]

Under its current tariff, the CAISO may designate any reserve not previously identified as contingency only by a scheduling coordinator as contingency only reserves, as necessary to maintain NERC and WECC reliability standards.[56] Although the CAISO already engages in this practice, the CAISO proposes to clarify that it may do so as part of normal operating conditions on the

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50 *See generally* Section 2.1.1 of the CAISO's Business Practice Manual for Settlement and Billing: "Each Settlement Statement contains details for only one Trading Day and includes all information needed by Business Associates to validate their calculations." https://bpmcm.caiso.com/Pages/SnBBPMDetails.aspx?BPM=Settlements%20and%20Billing

51 CAISO tariff section 8.3.4; 8.4.4, and Appendix L, Part B.1.2.

52 CAISO tariff section 8.3.1.

53 *Id*. at section 30.5.2.6.2.

54 *Id* at section 34.2.3.

55 *Id.*

56 CAISO tariff at section 34.10.

system. Accordingly, the CAISO proposes revisions to section 34.10 of the tariff to clarify the CAISO's authority to treat day-ahead procured operating reserve as contingency only in the real-time market regardless of the resource's election. This measure helps preserve frequency responsive headroom on resources providing spinning reserve, as well as the contingency reserve capability, by not making it available for energy dispatch in the real-time market.

Some stakeholders raised concerns that this action will deprive market participants of the opportunity to have their economic bids for non-contingency ancillary services co-optimized with energy bids as part of the real-time market. This argument contends market participants will incur opportunity costs for capacity sold as ancillary services in the day-ahead market because this capacity will not be dispatched for energy in the real-time market. This argument is misplaced and fails to recognize what is actually occurring. The CAISO optimizes energy and ancillary service bids in the day-ahead market and provides scheduling coordinators with financially binding schedules. The ancillary service marginal price a resource receives reflects any lost opportunity costs the day-ahead market would have otherwise paid the resource had it received a financially binding award to provide energy in the day-ahead market. By designating non-contingency ancillary services as contingency only ancillary services, the CAISO is holding these reserves back from the real-time market, but that does not mean the prices market participants receive do not reflect an opportunity cost to provide energy. Such prices reflect the opportunity cost, if any, of receiving a financially binding energy schedule in the day-ahead market. Capacity procured as ancillary services in the day-ahead market is not entitled to receive additional revenue by selling energy in the real-time market because it has already been compensated based on the opportunity costs of forgoing energy sales in the day-ahead market. In the real-time market ancillary services market, the CAISO only procures ancillary services designated as contingency only. Ancillary service marginal prices for ancillary services procured in real time reflect the lost opportunity costs of providing energy in the real-time market.

Another stakeholder raised concerns that designating non-contingency ancillary services as contingency only ancillary services may result in over procurement of ancillary services and increase the price of spinning reserve. The CAISO, however, is not changing the amount of ancillary services requirements it procures in the day-ahead market or to meet incremental needs through the real-time market. This stakeholder also suggested the CAISO explore joining a frequency response sharing group, presumably with other balancing authorities in the Western Interconnection. The CAISO will examine this possibility, as well as other alternatives, as part of phase 2 of this stakeholder initiative.

E. The CAISO clarifies that participating transmission owners and, from time to time, the CAISO will issue voltage schedules

As part of the tariff revisions submitted with this filing, the CAISO proposes to make a minor change to tariff sections 4.6.5.1 and 8.2.3.3 to clarify an existing practice in which that the CAISO's participating transmission owners are generally responsible for issuing voltage schedules to resources interconnected to their systems. Currently, the CAISO tariff states that the CAISO will issue voltage schedules. The CAISO proposes to state that participating generators and the CAISO, from time to time, will issue voltage schedules. The CAISO tariff requires resources to adhere to these voltage schedules.[57] This change is consistent with the coordinated functional registration agreement that the CAISO has executed with its participating transmission owners that allocates the various responsibility of a transmission operator under NERC's functional reliability model.[58] The CAISO tariff will still recognize that the CAISO has authority to issue voltage schedules, but the changes more accurately reflect that the participating transmission owners are the entities that regularly do so.

IV. Stakeholder Process

The CAISO conducted a stakeholder initiative that lasted several months. The process included developing an issue paper, straw proposal, and draft final proposal. The CAISO held multiple stakeholder telephone calls and a working group meeting, and it accepted written comments. During the process, the CAISO elected to bifurcate the process into two phases: phase 1 to address near term compliance strategies; and phase 2 to address will evaluate a market mechanism to ensure sufficient primary frequency response performance in long-term. The CAISO concluded phase 1 of its process at its March 2016 Board of Governors meeting at which the Board of Governors authorized the CAISO to make this filing.

Many stakeholder comments pertained more to long-term solutions to comply with the new frequency response requirement whether through a market product, joining a frequency response sharing group with other balancing authorities, or extending existing requirements to provide frequency responsive capability to variable energy resources. Other stakeholders encouraged the CAISO to undertake additional study efforts to understand the frequency response capability of the existing resource mix. The CAISO, however, has

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[57] *See* CASIO tariff sections 4.6.5.1 and 8.2.3.3.

[58] *See e.g.* CAISO and PG&E Coordinated Functional Registration Agreement, Appendix 3 at 70 specifying either the CAISO or the Transmission Entity as the responsible entity to meet various requirements of reliability Standard VAR-001-4. http://www.caiso.com/Documents/ISOandPGECoordinatedFunctionalRegistration.pdf

observed a trend that reflects a declining ability to provide frequency response. As a result, it is proposing these near term measures to ensure compliance starting December 1, 2016 until it can examine a more detailed, longer-term mechanism to secure frequency response capability.

Stakeholders encouraged the CAISO to coordinate any proposal with NERC. The CAISO has conducted outreach to NERC and WECC to explain the elements of this filing. Based on this outreach, the CAISO believes that the proposals contained in this filing are appropriate mechanisms to help ensure compliance with BAL-003-1. The CAISO expects it will conduct additional outreach to NERC and WECC as part of phase 2 of this initiative.

During its stakeholder process, the CAISO proposed to develop a look-ahead tool to estimate any frequency response deficiency and primarily rely on spinning reserves to secure additional frequency responsive unloaded capacity to cover the deficiency. Based on the look-ahead forecast, the CAISO could increase the percentage of spinning reserve versus non-spinning reserve that the market procures, or it could cause the market to procure excess reserves as spinning reserves. After internal evaluation and stakeholder feedback, the CAISO elected not to pursue this tool as a short-term solution. Spinning reserve, while frequency responsive, may not provide adequate capability to respond to a frequency event. In addition, simply procuring more spinning reserve does not necessarily improve frequency response performance. For this reason, the CAISO has proposed additional measures in this filing to refine governor settings and related parameters for those resources equipped with governors and to procure transferred frequency response. The CAISO will examine market mechanisms to procure primary frequency capability from resources with those capabilities in phase 2 of this initiative.

The CAISO also held a tariff stakeholder process. The CAISO published draft tariff language, accepted written comments, and held a call with stakeholders. The CAISO has accepted a number of stakeholders' recommended changes in the tariff revisions submitted in this filing. The CAISO has posted on its website responses to written comments it received on draft tariff language.[59]

V. Effective Date

The CAISO requests that the Commission make the tariff revisions contained in this filing effective June21, 2016 to give the CAISO sufficient time to implement these provisions and conduct a solicitation for transferred frequency

[59] *See* Stakeholder Comments Matrix – Frequency Response Draft Tariff Language http://www.caiso.com/Documents/StakeholderCommentsMatrix_FrequencyResponseDraftTariffLanguage.pdf

response before compliance with Reliability Standard BAL-003-1 begins on December 1, 2016. The CAISO plans to commence a competitive solicitation for frequency response in June 2016 and plans to file, for the Commission's review and approval, any contract arising out of that solicitation by October 2016. Approving these tariff revisions by June 21, 2016 will provide regulatory certainty that the competitive solicitation process for transferred frequency response may proceed. In addition, the CAISO will have sufficient lead-time in advance of December 1, 2016 to validate whether participating generators have set their governor parameters consistent with the requirements in this filing. The CAISO will also have time to confer with scheduling coordinators in order to inventory any plant level controls that may inhibit governor performance based on the criteria set forth in the tariff.

VI. Communications

Please provide communications regarding this filing to the following individuals, whose names should appear on the official service list established by the Commission with respect to this submittal:

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VII. Service

The CAISO has served copies of this transmittal letter, and all attachments, on the CPUC, the California Energy Commission, and all parties with effective scheduling coordinator service agreements under the CAISO tariff. In addition, the CAISO is posting this transmittal letter and all attachments on its public website.

VIII. Attachments

The following attachments, in addition to this transmittal letter, support the instant filing:

Attachment A	Revised CAISO tariff sheets that incorporate the proposed changes described above
Attachment B	The proposed changes to the CAISO tariff shown in red-line format
Attachment C	March 2016 Board of Governors' Materials

IX. Conclusion

The CAISO requests that the Commission accept the proposed tariff revisions without modification. These amendments will increase the CAISO's tools to comply with NERC Reliability standard BAL-00-1. The CAISO plans to initiate phase 2 of its frequency response stakeholder initiative later this year in which it will explore the development of a market product for frequency response service.

Please contact the undersigned if you have any questions regarding this matter.

Respectfully submitted,

_____

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Attachment A – Clean Tariff Records

Frequency Response – Phase 1

California Independent System Operator Corporation

April 21, 2016

4.6.4 Identification Of Generating Units

Each Participating Generator shall provide data identifying each of its Generating Units and such information regarding the capacity and the operating characteristics of the Generating Unit as may be reasonably requested from time to time by the CAISO. Each Participating Generator shall provide information on its governor setting and certify that it has not inhibited the real power response of any Generating Unit by any means that would override the governor response except as necessary to address physical operational constraints for reasons that include ambient temperature limitations, outages of mechanical equipment or regulatory considerations. In the event there is a need to inhibit the real power response of any Generating Unit, the Participating Generators shall provide a written description of this limitation with its certification. All information provided to the CAISO regarding the operational and technical constraints in the Master File shall be accurate and actually based on physical characteristics of the resources except for the Pump Ramping Conversion Factor, which is configurable.

4.6.5 NERC and WECC Requirements

4.6.5.1 Participating Generator Performance Standard

Participating Generators shall, in relation to each of their Generating Units, meet all Applicable Reliability Criteria, including any standards regarding governor response capabilities, use of power system stabilizers, voltage control capabilities and hourly Energy delivery.

Participating Generators with governor controls that are synchronized to the CAISO Controlled Grid must respond immediately and automatically outside a deadband in proportion to frequency deviations through the action of a governor to help restore frequency to the scheduled value. Participating Generators shall set the governor droop for each Generating Unit with governor controls no higher than 4 percent droop for combustion turbines and 5 percent droop for other technology types; with a deadband no larger than +/- 0.036 Hz. Participating Generators will not inhibit the real power response of their Generating Units with governor controls by any means that would override the governor response except as necessary to address physical operational constraints for reasons that include ambient temperature limitations,

outages of mechanical equipment or regulatory considerations. For each Generating Unit with governor controls, Participating Generators shall coordinate all plant control systems, locally or remotely controlled, so that they include frequency bias to ensure that each Generating Unit can respond immediately and automatically in proportion to frequency deviations to help restore frequency to the scheduled value. Unless otherwise agreed by the CAISO, a Generating Unit must be capable of operating at capacity registered in the CAISO Controlled Grid interconnection data, and shall follow the voltage schedules issued by the PTO or, from time to time, the CAISO.

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8.2.3.3 Voltage Support

The CAISO shall determine on an hourly basis for each day the quantity and location of Voltage Support required to maintain voltage levels and reactive margins within NERC and WECC reliability standards, and any requirements of the NRC using a power flow study based on the quantity and location of scheduled Demand. The PTO or, from time to time, the CAISO shall issue daily voltage schedules (Dispatch Instructions) to Participating Generators, Participating TOs and UDCs, which are required to be maintained for CAISO Controlled Grid reliability. All other Generating Units shall comply with the power factor requirements set forth in contractual arrangements in effect on the CAISO Operations Date, or, if no such contractual arrangements exist and the Generating Unit exists within the system of a Participating TO, the power factor requirements applicable under the Participating TO's TO Tariff or other tariff on file with the FERC.

All Participating Generators that operate Asynchronous Generating Facilities subject to the Large Generator Interconnection Agreement set forth in Appendix BB or CC shall maintain the CAISO specified voltage schedule if required under Appendix H of the Large Generator Interconnection Agreement, while operating within the power factor range specified in their interconnection agreements. For all other Generating Units, Participating Generators shall maintain the CAISO specified voltage schedule at the Generating Unit terminals to the extent possible, while operating within the power factor range specified in their interconnection agreements, or, for Regulatory Must-Take Generation with Existing QF Contracts or Amended QF Contracts, Regulatory Must-Run Generation and Reliability Must-Run Generation, consistent with existing obligations. For Generating Units that do not operate under one of these

agreements, the minimum power factor range will be within a band of 0.90 lag (producing VARs) and 0.95 lead (absorbing VARs) power factors. Participating Generators with Generating Units existing at the CAISO Operations Date that are unable to meet this operating power factor requirement may apply to the CAISO for an exemption. Prior to granting such an exemption, the CAISO shall require the Participating TO, UDC or other utility to whose system the relevant Generating Units are interconnected to notify it of the existing contractual requirements for Voltage Support established prior to the CAISO Operations Date for such Generating Units. Such requirements may be contained in CPUC Electric Rule 21 or the Interconnection Agreement with the Participating TO, UDC or other utility. The CAISO shall not grant any exemption under this Section from such existing contractual requirements. The CAISO shall be entitled to instruct Participating Generators to operate their Generating Units at specified points within their power factor ranges. Participating Generators shall receive no compensation for operating within these specified ranges.

If the CAISO requires additional Voltage Support, it shall procure this either through Reliability Must-Run Contracts or, if no other more economic sources are available**,** by instructing a Generating Unit to move its MVar output outside its mandatory range. Only if the Generating Unit must reduce its MW output in order to comply with such an instruction will it be eligible to recover its opportunity cost in accordance with Section 11.10.1.4.

All Loads directly connected to the CAISO Controlled Grid shall maintain reactive flow at grid interface points within a specified power factor band of 0.97 lag to 0.99 lead. Loads shall not be compensated for the service of maintaining the power factor at required levels within the bandwidth. A UDC interconnecting with the CAISO Controlled Grid at any point other than a Scheduling Point shall be subject to the same power factor requirement.

The CAISO will establish voltage control standards with UDCs and the operators of other Balancing Authority Areas and will enter into operational agreements providing for the coordination of actions in the event of a voltage problem occurring.

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11.34 Invoice Charges for Transferred Frequency Response

The CAISO will invoice charges as specified in this Section 11.34 for all legitimate costs invoiced to the CAISO by a Balancing Authority under a contract for Transferred Frequency Response.

11.34.1 Charge Allocation Basis

Each Scheduling Coordinator's responsibility for the Transferred Frequency Response charges shall be allocated based on the most recent Scheduling Coordinator's NERC/WECC Metered Demand determined under Section 11.20.4.

11.34.2 Calculation and Assessment

(a) Within five (5) Business Days after receiving an invoice for legitimate Transferred Frequency Response costs, the CAISO shall issue a market notice setting forth the Transferred Frequency Response rate, which shall be calculated using the total charges invoiced to the CAISO divided by the most recent total NERC/WECC Metered Demand determined under Section 11.20.4.

(b) The CAISO shall calculate the Transferred Frequency Response charges allocable to each Scheduling Coordinator by using the Transferred Frequency Response rate determined under Section 11.34.2(a), multiplied by the most recent NERC/WECC Metered Demand for that Scheduling Coordinator determined under Section 11.20.4.

(c) Within 10 Business Days after receiving the invoice for legitimate Transferred Frequency Response costs, the CAISO shall issue an invoice to each Scheduling Coordinator for its allocable share of the costs determined under Section 11.34.2(b).

(d) Scheduling Coordinators shall make timely payment to the CAISO within fifteen

(15) Business Days of the date the invoices were issued pursuant to Section 11.34.2(c).

11.34.3 Responsibility to Pay Charges

(a) Each Scheduling Coordinator shall be obligated to pay the CAISO the charges the Scheduling Coordinator is invoiced by the CAISO for Transferred Frequency Response.

(b) The CAISO's calculation of collateral requirements and other credit requirements under the CAISO Tariff shall include an adjustment for the Scheduling Coordinator's allocable share of the charge for transferred Frequency Response, if applicable, except that the Estimated Aggregated Liability calculated for the Scheduling Coordinator shall not include extrapolated amounts for the charge under Section 12.1.3.1.1(d).

11.34.4 Validation

(a) Each Scheduling Coordinator shall have the opportunity to review the terms of the invoice for the charge for Transferred Frequency Response and shall be deemed to have validated that invoice unless it raises a dispute within five (5) Business Days of the date of issuance.

(b) Once validated, an invoice for the charge under this Section shall be binding on the Scheduling Coordinator to which it relates.

11.34.5 Disputes and Corrections

(a) Scheduling Coordinators shall be prohibited from disputing any charge invoiced under this Section, except on grounds that an error in the invoice is due to a mere typographical or other ministerial error by the CAISO.

(b) Any dispute of an invoice on the grounds specified in Section 11.34.5 (a) shall be submitted and processed in accordance with the dispute procedure related to the charges for Transferred Frequency Response set forth in the Business Practice Manual,

(c) If the CAISO determines that an invoice contains a typographical or other ministerial error, and the resolution of the dispute makes correction necessary, the CAISO will issue a corrected invoice within 15 Business Days of the date the initial invoice was issued.

(d) Each Scheduling Coordinator that receives an invoice for a charge under this Section shall pay any net debit and shall be entitled to receive any net credit specified on a corrected invoice. Payment of any net debit shall be due within 10 business days of the date the corrected invoice was issued.

11.34.6 Payment Default

(a) In the event a Scheduling Coordinator defaults on the payment of all or any portion of the charge invoiced under this Section, the CAISO shall have the right under Section 11.29.13.3 to enforce the financial security provided by the defaulting Scheduling Coordinator, and to take any such other action under Sections 11.29.12 or 11.29.13, as necessary, to obtain payment for the default amount.

(b) To the extent all or any portion of the default amount remains unpaid, the CAISO:

(1) may at its discretion issue an invoice for the unpaid portion of the charge invoiced under this Section; and

(2) if such invoice is issued for a payment default, shall allocate responsibility for the unpaid amount to Scheduling Coordinators using the same allocation basis for the charge as identified in section 11.34.1, but excluding the CAISO Debtor that has not paid the payment default amount, based on the most recent data of the allocation basis for the charge.

(c) Scheduling Coordinators shall make timely payment to the CAISO within 15 Business Days of the date the default invoices were issued pursuant to Section 11.34.6.

11.34.7 Modification to Schedule.

Notwithstanding the provisions in Section 11.34, the CAISO may issue a Market Notice informing Scheduling Coordinators that the CAISO will implement a temporary modification to the billing and payment schedule for the charge and setting forth the reasons for such modification, in which case the modified schedule described in that Market Notice shall govern.

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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 dispatched in accordance with the 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 maximum Bid prices as provided in Section 39.6.1 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 Point. 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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42 Adequacy Of Facilities To Meet Applicable Reliability Criteria

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42.2 Transferred Frequency Response

42.2.1 Procurement of Transferred Frequency Response

If the CAISO concludes that it may be unable to provide sufficient frequency response consistent with

Applicable Reliability Criteria, the CAISO may, acting in accordance with Good Utility Practice, negotiate contracts for Transferred Frequency Response. The CAISO will solicit bids for contracts for Transferred Frequency Response. The CAISO shall select the bids that permit the CAISO to satisfy Applicable Reliability Criteria at lowest cost consistent with the seller's capability to provide Transferred Frequency Response.

42.2.2 Allocation of Transferred Frequency Response Costs Incurred by CAISO

The costs incurred by the CAISO for any contract for Transferred Frequency Response entered into under Section 42.2.1 are recovered from Scheduling Coordinators pursuant to Section 11.34.

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Appendix A, Master Definitions Supplement

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Transferred Frequency Response

A frequency response performance obligation under Applicable Reliability Criteria expressed in MW/0.1 Hz that a receiving Balancing Authority may acquire under an arrangement whereby another Balancing Authority increases its performance obligation by the same amount, or that a delivering Balancing Authority may provide under an arrangement whereby another Balancing Authority reduces its performance obligation by the same amount. Transferred Frequency Response is a compliance instrument and there is no exchange of physical services between Balancing Authorities.

Transferred Frequency Response is reported on applicable NERC/WECC forms, and applied consistently to each reported frequency disturbance event. On these forms, the delivering Balancing Authority increases its performance obligation and the receiving Balancing Authority decreases its performance obligation by the same amount.

Transferred Frequency Response may reflect an aggregate amount from multiple contracts.

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Appendix K Ancillary Service Requirements Protocol (ASRP)

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PART B
CERTIFICATION FOR SPINNING RESERVE

B 1 An Ancillary Service Provider wishing to provide Spinning Reserve as an Ancillary Service from a resource whether pursuant to a CAISO award or as part of a self-provision arrangement must meet the following requirements in order to be certified by the CAISO to provide Spinning Reserve service:

B 1.1 the rated capacity of the resource must be 500 KW or greater (i.e. the resource must be capable of providing at least 500 KW of Spinning Reserve) unless the resource is participating in an aggregation arrangement approved by the CAISO;

B 1.2 For a resource with a governor**,** the resource must respond immediately and automatically in proportion to frequency deviations to help restore frequency to the scheduled value in accordance with the following requirements:

Minimum Governor Performance:

a. 5 percent droop (4 percent droop in the case of combustion turbines);

b. +/- 0.036 Hz deadband;

c. Power output changes in one second for any frequency deviation outside of the deadband;d. Participating Generators will not inhibit the real power response of their Generating Units with governor controls by any means that would override the governor response except as necessary to address physical operational constraints for reasons that include ambient temperature limitations, outages of mechanical equipment or regulatory considerations; and

e. For each Generating Unit with governor controls, Participating Generators shall coordinate all plant control systems, locally or remotely controlled, so that they include frequency bias to ensure that each Generating Unit can respond immediately and automatically in proportion to frequency deviations to help restore frequency to the scheduled value.

For a resource without a governor but with a frequency responsive control system, the resource must respond immediately and automatically in proportion to frequency deviations to help restore frequency to the scheduled value in accordance with the following requirements:

Minimum Frequency Responsive Device Performance:

a. If frequency is less than or equal to 59.92 Hz, the resource must reach ten (10) percent of its awarded spinning capacity within eight (8) seconds; and

b. The resources must change the power it delivers or consumes in one (1) second if system frequency is less than or equal to 59.92 Hz

B 1.3 the operator of the resource must have a means of receiving Dispatch Instructions to initiate an increase or decrease in real power (MW) within one (1) minute of the CAISO Control Center determination that Energy from Spinning Reserve capacity must be dispatched;

B 1.4 the resource must be able to increase or decrease its real power (MW) by the maximum amount of Spinning Reserve to be offered within ten (10) minutes and be capable of maintaining its real power for thirty (30) minutes from the time the resource reaches its award capacity;

B 1.5 CAISO approved voice communications services must be in place to provide both primary and alternate voice communication between the CAISO Control Center and the operator controlling the resource; and

B 1.6 The communication system and the resource must pass a qualification test to demonstrate the overall ability to meet the performance requirements of the ASRP for Spinning Reserve.

B 2 An Ancillary Service Provider wishing to be considered for certification for Spinning Reserve service by the CAISO must make a written request to the CAISO, giving details of the technical capability of the resource concerned and identifying the Scheduling Coordinator through whom the Ancillary Service Provider intends to offer Spinning Reserve service. The Ancillary Service Provider shall at the same time send a copy of its request to that Scheduling Coordinator. Technical review request forms will be available from the CAISO.

B 3 No later than one week after receipt of the request, the CAISO shall provide the Ancillary Service Provider with a listing of acceptable communication options and interface equipment options for Spinning Reserve. The CAISO shall send a copy of the listing to the Ancillary Service Provider's Scheduling Coordinator.

B 4 The Ancillary Service Provider may elect to implement any of the approved options defined by the CAISO, and, if it wishes to proceed with its request for certification, shall give written notice to the CAISO of its selected communication option, with a copy to its Scheduling Coordinator.

B 5 When it receives the Ancillary Service Provider notice, the CAISO shall notify the Ancillary Service Provider and the Scheduling Coordinator in writing no later than two weeks after receipt of the notice confirming receipt of the notice and issuing provisional approval of the selected options. Upon receipt of the CAISO acknowledgment, the Ancillary Service Provider may proceed as indicated below to secure the necessary facilities and capabilities required.

B 6 The Ancillary Service Provider may also propose alternatives that it believes may provide an equivalent level of control for consideration by the CAISO. Such proposals shall be in writing and contain sufficient detail for the CAISO to make a determination of suitability. The CAISO may request additional information, if required, to assist in its evaluation of the proposal.

B 7 The CAISO shall respond by accepting the alternative proposal, rejecting the alternative proposal, or suggesting modifications to the alternative proposal. Such acceptance, rejection, or suggested revision must be provided not later than six weeks after the proposal is received by the CAISO. The Ancillary Service Provider and the CAISO shall keep the Scheduling Coordinator informed of this process by each sending to the Scheduling Coordinator a copy of any written communication which it sends to the other.

B 8 Upon agreement as to the method of communication and control to be used by the resource, the CAISO shall provisionally approve the Ancillary Service Provider's proposal in writing providing a copy to the resource's Scheduling Coordinator at the same time. The Ancillary Service Provider may then proceed to procure and install the equipment and make arrangements for the required communication.

B 9 Design, acquisition, and installation of the resource's equipment shall be under the control of the respective Ancillary Service Provider. The CAISO shall bear no cost responsibility or functional responsibility for such equipment. The CAISO shall be responsible for the design, acquisition and installation of any necessary modifications to its own equipment at its own cost.

B 10 The Ancillary Service Provider shall perform its own testing of its equipment to ensure that the control system performs to meet the CAISO requirements.

B 11 When it is satisfied that its plant, equipment and communication systems meet the CAISO's requirements, the Ancillary Service Provider shall request in writing that the CAISO conduct a certification test with a suggested primary date and time and at least two alternative dates and times. The CAISO shall, within two Business Days of receipt of the request, accept a proposed time if possible or suggest at least three alternatives to the Ancillary Service Provider. If the CAISO responds by suggesting alternatives, the Ancillary Service Provider shall, within two Business Days of receipt of the CAISO's response, respond in turn by accepting a proposed alternative if possible or suggesting at least three alternatives, and this procedure shall continue until agreement is reached on the date and time of the test. The Ancillary Service Provider shall inform its Scheduling Coordinator of the agreed date and time of the test.

B 12 Testing shall be performed under the direction of the CAISO. Such tests shall include, but not be limited to, the following:

B 12.1 confirmation of control communication path performance for Dispatch Instruction;

B 12.2 confirmation of primary and secondary voice circuits for receipt of Dispatch Instructions;

B 12.3 confirmation of the resource performance to include changing the resource's real power over the range of Spinning Reserve proposed from minimum to maximum, and at different rates of change from the minimum to the maximum permitted by the design of the resource; and

B 12.4 testing the resource's governor or other control system performance characteristics by simulating frequency excursions outside the allowed deadband and measuring the response of the resource.

B 13 Upon successful completion of the test the CAISO shall certify the resource as being permitted to provide Spinning Reserve as an Ancillary Service Provider and shall provide a copy of the certificate to the Scheduling Coordinator at the same time. The Scheduling Coordinator shall request the CAISO to update its database to reflect the ability of the resource to provide Spinning Reserve.

B 14 The Scheduling Coordinator may bid Spinning Reserve from the certified resource into the CAISO Markets starting with the Day-Ahead Market for the hour ending 0100 on the Second Trading Day after the CAISO's database reflects the resource's certificate.

B 15 The certification to provide Spinning Reserve shall remain in force until withdrawn by the Scheduling Coordinator or the Ancillary Service Provider by written notice to the CAISO to take effect at the time notified in the notice, which must be the end of a Trading Day.

B 16 The certification may be revoked by the CAISO only under provisions of the CAISO Tariff.

Attachment B – Marked Tariff Records

Frequency Response – Phase 1

California Independent System Operator Corporation

April 21, 2016

4.6.4 Identification Of Generating Units

Each Participating Generator shall provide data identifying each of its Generating Units and such information regarding the capacity and the operating characteristics of the Generating Unit as may be reasonably requested from time to time by the CAISO. Each Participating Generator shall provide information on its governor setting and certify that it has not inhibited the real power response of any Generating Unit by any means that would override the governor response except as necessary to address physical operational constraints for reasons that include ambient temperature limitations, outages of mechanical equipment or regulatory considerations. In the event there is a need to inhibit the real power response of any Generating Unit, the Participating Generators shall provide a written description of this limitation with its certification. All information provided to the CAISO regarding the operational and technical constraints in the Master File shall be accurate and actually based on physical characteristics of the resources except for the Pump Ramping Conversion Factor, which is configurable.

4.6.5 NERC and WECC Requirements

4.6.5.1 Participating Generator Performance Standard

Participating Generators shall, in relation to each of their Generating Units, meet all Applicable Reliability Criteria, including any standards regarding governor response capabilities, use of power system stabilizers, voltage control capabilities and hourly Energy delivery.

Participating Generators with governor controls that are synchronized to the CAISO Controlled Grid must respond immediately and automatically outside a deadband in proportion to frequency deviations through the action of a governor to help restore frequency to the scheduled value. Participating Generators shall set the governor droop for each Generating Unit with governor controls no higher than 4 percent droop for combustion turbines and 5 percent droop for other technology types; with a deadband no larger than +/- 0.036 Hz. Participating Generators will not inhibit the real power response of their Generating Units with governor controls by any means that would override the governor response except as necessary to address physical operational constraints for reasons that include ambient temperature limitations,

outages of mechanical equipment or regulatory considerations. For each Generating Unit with governor controls, Participating Generators shall coordinate all plant control systems, locally or remotely controlled, so that they include frequency bias to ensure that each Generating Unit can respond immediately and automatically in proportion to frequency deviations to help restore frequency to the scheduled value.

Unless otherwise agreed by the CAISO, a Generating Unit must be capable of operating at capacity registered in the CAISO Controlled Grid interconnection data, and shall follow the voltage schedules issued by the PTO or, from time to time, the CAISO ~~from time to time~~.

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8.2.3.3 Voltage Support

The CAISO shall determine on an hourly basis for each day the quantity and location of Voltage Support required to maintain voltage levels and reactive margins within NERC and WECC reliability standards, and any requirements of the NRC using a power flow study based on the quantity and location of scheduled Demand. The PTO or, from time to time, the CAISO shall issue daily voltage schedules (Dispatch Instructions) to Participating Generators, Participating TOs and UDCs, which are required to be maintained for CAISO Controlled Grid reliability. All other Generating Units shall comply with the power factor requirements set forth in contractual arrangements in effect on the CAISO Operations Date, or, if no such contractual arrangements exist and the Generating Unit exists within the system of a Participating TO, the power factor requirements applicable under the Participating TO's TO Tariff or other tariff on file with the FERC.

All Participating Generators that operate Asynchronous Generating Facilities subject to the Large Generator Interconnection Agreement set forth in Appendix BB or CC shall maintain the CAISO specified voltage schedule if required under Appendix H of the Large Generator Interconnection Agreement, while operating within the power factor range specified in their interconnection agreements. For all other Generating Units, Participating Generators shall maintain the CAISO specified voltage schedule at the Generating Unit terminals to the extent possible, while operating within the power factor range specified in their interconnection agreements, or, for Regulatory Must-Take Generation with Existing QF Contracts or Amended QF Contracts, Regulatory Must-Run Generation and Reliability Must-Run Generation,

consistent with existing obligations. For Generating Units that do not operate under one of these agreements, the minimum power factor range will be within a band of 0.90 lag (producing VARs) and 0.95 lead (absorbing VARs) power factors. Participating Generators with Generating Units existing at the CAISO Operations Date that are unable to meet this operating power factor requirement may apply to the CAISO for an exemption. Prior to granting such an exemption, the CAISO shall require the Participating TO, UDC or other utility to whose system the relevant Generating Units are interconnected to notify it of the existing contractual requirements for Voltage Support established prior to the CAISO Operations Date for such Generating Units. Such requirements may be contained in CPUC Electric Rule 21 or the Interconnection Agreement with the Participating TO, UDC or other utility. The CAISO shall not grant any exemption under this Section from such existing contractual requirements. The CAISO shall be entitled to instruct Participating Generators to operate their Generating Units at specified points within their power factor ranges. Participating Generators shall receive no compensation for operating within these specified ranges.

If the CAISO requires additional Voltage Support, it shall procure this either through Reliability Must-Run Contracts or, if no other more economic sources are available**,** by instructing a Generating Unit to move its MVar output outside its mandatory range. Only if the Generating Unit must reduce its MW output in order to comply with such an instruction will it be eligible to recover its opportunity cost in accordance with Section 11.10.1.4.

All Loads directly connected to the CAISO Controlled Grid shall maintain reactive flow at grid interface points within a specified power factor band of 0.97 lag to 0.99 lead. Loads shall not be compensated for the service of maintaining the power factor at required levels within the bandwidth. A UDC interconnecting with the CAISO Controlled Grid at any point other than a Scheduling Point shall be subject to the same power factor requirement.

The CAISO will establish voltage control standards with UDCs and the operators of other Balancing Authority Areas and will enter into operational agreements providing for the coordination of actions in the event of a voltage problem occurring.

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11.34 Invoice Charges for Transferred Frequency Response

The CAISO will invoice charges as specified in this Section 11.34 for all legitimate costs invoiced to the CAISO by a Balancing Authority under a contract for Transferred Frequency Response.

11.34.1 Charge Allocation Basis

Each Scheduling Coordinator's responsibility for the Transferred Frequency Response charges shall be allocated based on the most recent Scheduling Coordinator's NERC/WECC Metered Demand determined under Section 11.20.4.

11.34.2 Calculation and Assessment

(a) Within five (5) Business Days after receiving an invoice for legitimate Transferred Frequency Response costs, the CAISO shall issue a market notice setting forth the Transferred Frequency Response rate, which shall be calculated using the total charges invoiced to the CAISO divided by the most recent total NERC/WECC Metered Demand determined under Section 11.20.4.

(b) The CAISO shall calculate the Transferred Frequency Response charges allocable to each Scheduling Coordinator by using the Transferred Frequency Response rate determined under Section 11.34.2(a), multiplied by the most recent NERC/WECC Metered Demand for that Scheduling Coordinator determined under Section 11.20.4.

(c) Within 10 Business Days after receiving the invoice for legitimate Transferred Frequency Response costs, the CAISO shall issue an invoice to each Scheduling Coordinator for its allocable share of the costs determined under Section 11.34.2(b).

(d) Scheduling Coordinators shall make timely payment to the CAISO within fifteen (15) Business Days of the date the invoices were issued pursuant to Section 11.34.2(c).

11.34.3 Responsibility to Pay Charges

(a) Each Scheduling Coordinator shall be obligated to pay the CAISO the charges the Scheduling Coordinator is invoiced by the CAISO for Transferred Frequency Response.

(b) The CAISO's calculation of collateral requirements and other credit requirements under the CAISO Tariff shall include an adjustment for the Scheduling Coordinator's allocable share of the charge for transferred Frequency Response, if applicable, except that the Estimated Aggregated Liability calculated for the Scheduling Coordinator shall not include extrapolated amounts for the charge under Section 12.1.3.1.1(d).

11.34.4 Validation

(a) Each Scheduling Coordinator shall have the opportunity to review the terms of the invoice for the charge for Transferred Frequency Response and shall be deemed to have validated that invoice unless it raises a dispute within five (5) Business Days of the date of issuance.

(b) Once validated, an invoice for the charge under this Section shall be binding on the Scheduling Coordinator to which it relates.

11.34.5 Disputes and Corrections

(a) Scheduling Coordinators shall be prohibited from disputing any charge invoiced under this Section, except on grounds that an error in the invoice is due to a mere typographical or other ministerial error by the CAISO.

(b) Any dispute of an invoice on the grounds specified in Section 11.34.5 (a) shall be submitted and processed in accordance with the dispute procedure related to the charges for Transferred Frequency Response set forth in the Business Practice Manual,

(c) If the CAISO determines that an invoice contains a typographical or other ministerial error, and the resolution of the dispute makes correction necessary, the

CAISO will issue a corrected invoice within 15 Business Days of the date the initial invoice was issued.

(d) Each Scheduling Coordinator that receives an invoice for a charge under this Section shall pay any net debit and shall be entitled to receive any net credit specified on a corrected invoice. Payment of any net debit shall be due within 10 business days of the date the corrected invoice was issued.

11.34.6 Payment Default

(a) In the event a Scheduling Coordinator defaults on the payment of all or any portion of the charge invoiced under this Section, the CAISO shall have the right under Section 11.29.13.3 to enforce the financial security provided by the defaulting Scheduling Coordinator, and to take any such other action under Sections 11.29.12 or 11.29.13, as necessary, to obtain payment for the default amount.

(b) To the extent all or any portion of the default amount remains unpaid, the CAISO:

(1) may at its discretion issue an invoice for the unpaid portion of the charge invoiced under this Section; and

(2) if such invoice is issued for a payment default, shall allocate responsibility for the unpaid amount to Scheduling Coordinators using the same allocation basis for the charge as identified in section 11.34.1, but excluding the CAISO Debtor that has not paid the payment default amount, based on the most recent data of the allocation basis for the charge.

(c) Scheduling Coordinators shall make timely payment to the CAISO within 15 Business Days of the date the default invoices were issued pursuant to Section 11.34.6.

11.34.7 Modification to Schedule.

Notwithstanding the provisions in Section 11.34, the CAISO may issue a Market Notice informing Scheduling Coordinators that the CAISO will implement a temporary modification to the billing and payment schedule for the charge and setting forth the reasons for such modification, in which case the modified schedule described in that Market Notice shall govern.

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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 dispatched in accordance with the RMR Contract) for the Supply of Energy. During normal operating conditions, the CAISO mayshall 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, Tthe CAISO may also elect to designate any reserve not previously identified as Contingency Only by Scheduling Coordinator as Contingency Only reserves, as necessary to maintain NERC and WECC reliability standards, including any requirements of the NRC. 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,. Ssuch 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 maximum Bid prices as provided in Section 39.6.1 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 Point. 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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42 Adequacy Of Facilities To Meet Applicable Reliability Criteria ~~Operating & Planning Reserve~~

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42.2 Transferred Frequency Response

42.2.1 Procurement of Transferred Frequency Response

If the CAISO concludes that it may be unable to provide sufficient frequency response consistent with Applicable Reliability Criteria, the CAISO may, acting in accordance with Good Utility Practice, negotiate contracts for Transferred Frequency Response. The CAISO will solicit bids for contracts for Transferred Frequency Response. The CAISO shall select the bids that permit the CAISO to satisfy Applicable Reliability Criteria at lowest cost consistent with the seller's capability to provide Transferred Frequency Response.

42.2.2 Allocation of Transferred Frequency Response Costs Incurred by CAISO

The costs incurred by the CAISO for any contract for Transferred Frequency Response entered into under Section 42.2.1 are recovered from Scheduling Coordinators pursuant to Section 11.34.

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Appendix A, Master Definitions Supplement

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Transferred Frequency Response

A frequency response performance obligation under Applicable Reliability Criteria expressed in MW/0.1 Hz that a receiving Balancing Authority may acquire under an arrangement whereby another Balancing Authority increases its performance obligation by the same amount, or that a delivering Balancing Authority may provide under an arrangement whereby another Balancing Authority reduces its performance obligation by the same amount. Transferred Frequency Response is a compliance instrument and there is no exchange of physical services between Balancing Authorities.

Transferred Frequency Response is reported on applicable NERC/WECC forms, and applied consistently to each reported frequency disturbance event. On these forms, the delivering Balancing Authority increases its performance obligation and the receiving Balancing Authority decreases its performance obligation by the same amount.

Transferred Frequency Response may reflect an aggregate amount from multiple contracts.

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Appendix K Ancillary Service Requirements Protocol (ASRP)

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PART B
CERTIFICATION FOR SPINNING RESERVE

B 1 An Ancillary Service Provider wishing to provide Spinning Reserve as an Ancillary Service from a resource whether pursuant to a CAISO award or as part of a self-provision arrangement must meet the following requirements in order to be certified by the CAISO to provide Spinning Reserve service:

B 1.1 the rated capacity of the resource must be 500 KW or greater (i.e. the resource must be capable of providing at least 500 KW of Spinning Reserve) unless the resource is participating in an aggregation arrangement approved by the CAISO;

B 1.2 For a resource with a governor, the resource must respond immediately and automatically in proportion to frequency deviations ~~through the action of a governor or other control system~~ to help restore frequency to the scheduled value in accordance with the following requirements:

Minimum Governor Performance:

a. 5 percent droop (4 percent droop in the case of combustion turbines);

b. +/- 0.036 Hz deadband; ~~and~~

c. Power output changes in one second for any frequency deviation outside of the deadband;

d. Participating Generators will not inhibit the real power response of their Generating Units with governor controls by any means that would override the governor response except as necessary to address physical operational constraints for reasons that include ambient temperature limitations, outages of mechanical equipment or regulatory considerations; and

e. For each Generating Unit with governor controls, Participating Generators shall coordinate all plant control systems, locally or remotely controlled, so that they include frequency bias to ensure that each Generating Unit can respond immediately and automatically in proportion to frequency deviations to help restore frequency to the scheduled value.

For a resource without a governor but with a frequency responsive control system, the resource must respond immediately and automatically in proportion to frequency deviations to help restore frequency to the scheduled value in accordance with the following requirements:

Minimum Frequency Responsive Device Performance:

a. If frequency is less than or equal to 59.92 Hz, the resource must reach ten (10) percent of its awarded spinning capacity within eight (8) seconds; and

b. The resources must change the power it delivers or consumes in one (1) second if system frequency is less than or equal to 59.92 Hz

B 1.3 the operator of the resource must have a means of receiving Dispatch Instructions to initiate an increase or decrease in real power (MW) within one (1) minute of the CAISO Control Center determination that Energy from Spinning Reserve capacity must be dispatched;

B 1.4 the resource must be able to increase or decrease its real power (MW) by the maximum amount of Spinning Reserve to be offered within ten (10) minutes and be capable of maintaining its real power for thirty (30) minutes from the time the resource reaches its award capacity;

B 1.5 CAISO approved voice communications services must be in place to provide both primary and alternate voice communication between the CAISO Control Center and the operator controlling the resource; and

B 1.6 The communication system and the resource must pass a qualification test to demonstrate the overall ability to meet the performance requirements of the ASRP for Spinning Reserve.

B 2 An Ancillary Service Provider wishing to be considered for certification for Spinning Reserve service by the CAISO must make a written request to the CAISO, giving details of the technical capability of the resource concerned and identifying the Scheduling Coordinator through whom the Ancillary Service Provider intends to offer Spinning Reserve service. The Ancillary Service Provider shall at the same time send a copy of its request to that Scheduling Coordinator. Technical review request forms will be available from the CAISO.

B 3 No later than one week after receipt of the request, the CAISO shall provide the Ancillary Service Provider with a listing of acceptable communication options and interface equipment options for Spinning Reserve. The CAISO shall send a copy of the listing to the Ancillary Service Provider's Scheduling Coordinator.

B 4 The Ancillary Service Provider may elect to implement any of the approved options defined by the CAISO, and, if it wishes to proceed with its request for certification, shall give written notice to the CAISO of its selected communication option, with a copy to its Scheduling Coordinator.

B 5 When it receives the Ancillary Service Provider notice, the CAISO shall notify the Ancillary Service Provider and the Scheduling Coordinator in writing no later than two weeks after receipt of the notice confirming receipt of the notice and issuing provisional approval of the selected options. Upon receipt of the CAISO acknowledgment, the Ancillary Service Provider may proceed as indicated below to secure the necessary facilities and capabilities required.

B 6 The Ancillary Service Provider may also propose alternatives that it believes may provide an equivalent level of control for consideration by the CAISO. Such proposals shall be in writing and contain sufficient detail for the CAISO to make a determination of suitability.

The CAISO may request additional information, if required, to assist in its evaluation of the proposal.

B 7 The CAISO shall respond by accepting the alternative proposal, rejecting the alternative proposal, or suggesting modifications to the alternative proposal. Such acceptance, rejection, or suggested revision must be provided not later than six weeks after the proposal is received by the CAISO. The Ancillary Service Provider and the CAISO shall keep the Scheduling Coordinator informed of this process by each sending to the Scheduling Coordinator a copy of any written communication which it sends to the other.

B 8 Upon agreement as to the method of communication and control to be used by the resource, the CAISO shall provisionally approve the Ancillary Service Provider's proposal in writing providing a copy to the resource's Scheduling Coordinator at the same time. The Ancillary Service Provider may then proceed to procure and install the equipment and make arrangements for the required communication.

B 9 Design, acquisition, and installation of the resource's equipment shall be under the control of the respective Ancillary Service Provider. The CAISO shall bear no cost responsibility or functional responsibility for such equipment. The CAISO shall be responsible for the design, acquisition and installation of any necessary modifications to its own equipment at its own cost.

B 10 The Ancillary Service Provider shall perform its own testing of its equipment to ensure that the control system performs to meet the CAISO requirements.

B 11 When it is satisfied that its plant, equipment and communication systems meet the CAISO's requirements, the Ancillary Service Provider shall request in writing that the CAISO conduct a certification test with a suggested primary date and time and at least two alternative dates and times. The CAISO shall, within two Business Days of receipt of the request, accept a proposed time if possible or suggest at least three alternatives to the Ancillary Service Provider. If the CAISO responds by suggesting alternatives, the Ancillary Service Provider shall, within two Business Days of receipt of the CAISO's response, respond in turn by accepting a proposed alternative if possible or suggesting at least three alternatives, and this procedure shall continue until agreement is reached on the date and time of the test. The Ancillary Service Provider shall inform its Scheduling Coordinator of the agreed date and time of the test.

B 12 Testing shall be performed under the direction of the CAISO. Such tests shall include, but not be limited to, the following:

B 12.1 confirmation of control communication path performance for Dispatch Instruction;

B 12.2 confirmation of primary and secondary voice circuits for receipt of Dispatch Instructions;

B 12.3 confirmation of the resource performance to include changing the resource's real power over the range of Spinning Reserve proposed from minimum to maximum, and at different rates of change from the minimum to the maximum permitted by the design of the resource; and

B 12.4 testing the resource's governor or other control system performance characteristics by simulating frequency excursions outside the allowed deadband and measuring the response of the resource.

B 13 Upon successful completion of the test the CAISO shall certify the resource as being permitted to provide Spinning Reserve as an Ancillary Service Provider and shall provide

a copy of the certificate to the Scheduling Coordinator at the same time. The Scheduling Coordinator shall request the CAISO to update its database to reflect the ability of the resource to provide Spinning Reserve.

B 14 The Scheduling Coordinator may bid Spinning Reserve from the certified resource into the CAISO Markets starting with the Day-Ahead Market for the hour ending 0100 on the Second Trading Day after the CAISO's database reflects the resource's certificate.

B 15 The certification to provide Spinning Reserve shall remain in force until withdrawn by the Scheduling Coordinator or the Ancillary Service Provider by written notice to the CAISO to take effect at the time notified in the notice, which must be the end of a Trading Day.

B 16 The certification may be revoked by the CAISO only under provisions of the CAISO Tariff.

Attachment C – Board Materials

Frequency Response – Phase 1

California Independent System Operator Corporation

April 21, 2016

Memorandum

To: ISO Board of Governors

From: Keith Casey, Vice President, Market & Infrastructure Development

Date: March 17, 2016

Re: **Decision on phase 1 frequency response proposal**

This memorandum requires Board action.

EXECUTIVE SUMMARY

In January 2014, FERC approved new frequency response requirements for balancing authority areas proposed by the North American Electric Reliability Council (NERC). With the approval of this standard, NERC created a new obligation for balancing authorities, including the ISO, to demonstrate sufficient frequency response to disturbances in system frequency. Frequency response is the initial or primary response of resources and load to arrest and quickly recover from changes in system frequency. Under the new standard, balancing authority areas are allocated their load share of the western interconnection's frequency response needs. Each balancing authority area must meet the new standard beginning December 1, 2016 or risk being assessed penalties.

To comply with this new requirement, Management initiated a stakeholder initiative in August 2015. The ISO assessed its current frequency response capabilities and historical frequency response rates and compared them to the new NERC requirements. The analysis showed that the ISO could, at times, be short of its required share of frequency response. In particular, when there is high renewable output and low load levels, there may not be sufficient frequency-responsive resources on-line to meet the new NERC requirement. Management proposes a two phased process to ensure the ISO has sufficient frequency response capabilities to meet the new standard. The first phase provides a short-term solution that can be implemented by December 1, 2016. The second phase will consider more comprehensive, long-term design solutions to be implemented at a later date.

Management requests Board approval of its phase 1 proposal. Under the phase 1 proposal, the ISO will conduct a request for offers to transfer a portion of the ISO's frequency response obligation to another balancing authority area in the western interconnection. The phase 1 proposal also includes a proposal for more specific

frequency response standards for resources within the ISO balancing authority. The current market rules do not require generators that are capable of providing frequency response to be operated in a manner that maintains that capability. This contributes to lower primary frequency response levels than expected for most contingency events. The proposed standards are designed to increase the frequency response performance of ISO resources. In phase 2, the ISO will work with stakeholders to consider more comprehensive design solutions that could include the development of a new frequency response product procured through the ISO market.

Management recommends the following motion:

> ***Moved, that the ISO Board of Governors approves the phase 1 frequency response proposal, as described in the memorandum dated March 17, 2016; 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 proposed tariff change.***

DISCUSSION AND ANALYSIS

Background

Frequency is constant across an interconnection and balanced when the generation on the system is matched to the demand. If generation output falls below demand, frequency will drop below the scheduled frequency of 60 Hz. Frequency response is the system's ability to arrest and stabilize a frequency drop after a sudden generation loss. Primary frequency response is the first stage of frequency response beginning seconds after an event and is provided automatically by mechanical equipment on generators, known as governors, rather than through response to dispatch or control by the ISO systems. Most conventional synchronous generators come equipped with governors or equivalent control systems that enable the generator to respond to events with an automatic, autonomous response triggered by a frequency drop.

The amount of frequency response the ISO system can provide depends on the amount of conventional synchronous generators that are on-line with governor or equivalent control systems, the physical capabilities of those control systems and the amount of available capacity to provide frequency response. Currently, only conventional synchronous generators typically provide frequency response. The ISO's system's ability to provide frequency response has decreased over the past few years as the amount of asynchronous variable energy resources increased.

ISO's frequency response requirement

The new NERC frequency response standard (Reliability Standard BAL-003-1) will require each balancing area to demonstrate they provided the required amount of frequency

response based on actual frequency disturbances throughout the year. The ISO must comply with the new standard beginning in December 2016.

The ISO's frequency response performance under the standard for each event will be based on the difference in generation output before and after the frequency event given the magnitude of the change in frequency. For example, if generation within the ISO increases by 500 MW in response to a 0.2 Hz frequency drop, its performance for that event would be 250 MW per 0.1Hz. NERC will evaluate the ISO's performance and compliance with its standard by selecting the median value of sampled events.

Propose procuring frequency response from external balancing area

Under the phase 1 proposal, Management proposes to procure frequency response capability from neighboring balancing areas as an interim measure to comply with the NERC frequency response standard. This will allow the ISO to comply with the standard while it continues to pursue requirements and market mechanisms for resources to provide frequency response capabilities.

Management proposes that the ISO transfer some of its frequency response obligation to one or more neighboring balancing areas through a competitive solicitation process. This proposed process will help to ensure the ISO is in compliance with the new NERC standard at lowest cost while maintaining reliability.

This re-allocation of the ISO's frequency response obligation would be done through a competitive solicitation process to transfer a portion of the ISO's frequency response obligation to an external balancing authority area(s). Through the competitive solicitation process the ISO would purchase the right to transfer a portion of its frequency response requirement to another balancing authority area(s) on its NERC reporting form. The selling balancing area or areas would make a corresponding adjustment in their NERC reporting form. The procurement costs would be allocated to demand.

Propose ensuring spinning reserves held for contingency events

To ensure the ISO has the ability to provide its remaining frequency response obligation, Management proposes to clarify in the tariff that it may convert day-ahead procured operating reserve to contingency-only reserves in the real-time market regardless of the resource's election. This is necessary to preserve the frequency responsive headroom, and the contingency reserve capability, by not dispatching it for energy.

Propose improving market transparency

Providing frequency response service is essential to the reliability and stability of the bulk-electric system, and if not provided to the Western Interconnection it can undermine market

quality for the entire West. Management proposes to routinely monitor and report its primary frequency response performance through its Monthly Market Quality Report.

Propose strengthening participating generator requirements

Management proposes to introduce stronger requirements for all participating generators able to provide frequency services. Generators with frequency response capability will be required to have frequency responsive equipment enabled. Currently, the tariff only requires resources providing spinning reserve to have frequency responsive equipment enabled. In addition, generators will have to have the physical parameters of their control systems according to NERC's regional reliability guidance. Specifically, NERC published reliability guidelines for primary frequency control which recommend plant coordination of its control systems as well as specific settings for the systems physical parameters. Management proposes to align its requirements with these guidelines and require resources to coordinate controls from their generator turbine through each level of plant controls to enable governor response, except for controls needed to manage operational constraints. Management also proposes to require generators to tune their frequency response equipment to NERC recommended settings. These proposed changes provide guidance that restricting frequency response service is acceptable only for operational needs.

Management also proposes to require generators to submit their physical parameters for frequency response capability to the ISO. This proposed change will provide the ISO increased visibility into the generation fleet's frequency response capability.

Management anticipates the stronger requirements in combination with its own efforts to improve market transparency by regularly communicating frequency response performance will promote consistent improvements to the ISO's frequency response performance levels.

POSITIONS OF THE PARTIES

Stakeholders largely support Management's phase 1 proposal to ensure compliance with BAL-003-1 in the short-term and continued evaluation of longer-term market design solutions as the result of this stakeholder process. Some generators contend it is discriminatory to procure frequency response from other balancing areas without also considering procuring it from generators within the ISO. Management believes procuring frequency response externally will be an economic solution that is the only practical means to comply with the new frequency response standard until it can examine the market product and generator-specific frequency response performance requirements that would be needed to procure frequency response capability from resources within the ISO. A stakeholder comment matrix is included as Attachment A.

CONCLUSION

Management recommends the Board approve its phase 1 frequency response proposal to meet the new NERC requirements. The proposal helps to ensure that the ISO will be

able to meet the new frequency requirements by transferring a portion of its obligation to another balancing authority area and strengthening requirements for generators with governor or equivalent control systems to enable service provision consistent with NERC's regional reliability guidance.

Attachment A

Stakeholder Process: Phase 1 Frequency Response Proposal

Summary of Submitted Comments

Stakeholders submitted four rounds of written comments to the ISO on the following dates:

- Round One (comments on Issue Paper), 08/27/15
- Round Two (comments on Straw Proposal), 11/02/15
- Round Three (comments on Working Group Presentation), 01/04/16
- Round Four (comments on Draft Final Proposal), 02/23/16

Stakeholder comments are available here:
http://www.caiso.com/informed/Pages/StakeholderProcesses/FrequencyResponse.aspx

Other stakeholder efforts include:

- Stakeholder web conference on Issue Paper 08/13/15
- Stakeholder web conference on Straw Proposal 10/19/15
- Working Group web conference, 12/14/15
- Stakeholder web conference on Draft Final Proposal, 02/09/16

Management Proposal			
Stakeholder Comments	**Procure frequency response from neighboring balancing areas as an interim measure.**	**Revise governor tariff requirements.**	**Designate spinning and non-spinning reserves as contingency only**
California Department of Water Resources State Water Project (CDWR)	Conditional support — if lowest cost solution. Does not believe costs should fall solely on measured demand as frequency response benefits all market participants.	No comment	No comment
California Energy Storage Alliance (CESA)	Conditional support — seeks definitive assurance that the ISO will develop a robust and efficient in-market solution.	No comment	No comment
California Large Energy Consumers Association (CLECA)	Supports	Supports	Supports
Calpine	Supports	Supports — suggests ISO reevaluate overall performance and need for further requirements.	No comment

Management Proposal			
Stakeholder Comments	**Procure frequency response from neighboring balancing areas as an interim measure.**	**Revise governor tariff requirements.**	**Designate spinning and non-spinning reserves as contingency only**
NRG Energy, Inc. (NRG)	Opposes — Believes compensation to external balancing areas discriminates against internal generators.	Seeks clarification — requests ISO detail what information it will require from generators concerning coordinating plant controls and frequency response modeling prior to the conclusion of this stakeholder process.	Observes this will likely impact bidding behavior of market participants.
Pacific Gas & Electric Company (PG&E)	Supports — seeks assurance that ISO's competitive solicitation process is, in fact, competitive, and that parties will have the opportunity to intervene based on evaluation of contract terms.	Supports — seeks clarification on specificity of acceptable controls.	No comment
Powerex	Supports	No comment	No comment

Management Proposal			
Stakeholder Comments	**Procure frequency response from neighboring balancing areas as an interim measure.**	**Revise governor tariff requirements.**	**Designate spinning and non-spinning reserves as contingency only**
Six Cities	Conditional support — suggests rejecting bids from external Balancing Areas that are higher than the cost of using exceptional dispatch to meet the frequency response obligation.	No comment	No comment
Southern California Edison (SCE)	No comment	No comment	Conditional support — believes ISO should apply such designations only in hours with primary frequency response deficiencies.
San Diego Gas & Electric (SDG&E)	Supports	Supports	Supports

Management Proposal			
Stakeholder Comments	**Procure frequency response from neighboring balancing areas as an interim measure.**	**Revise governor tariff requirements.**	**Designate spinning and non-spinning reserves as contingency only**
Western Power Trading Forum (WPTF)	Uncertain — Concerned about efficiency of exceptional dispatches competing with external Balancing Area Authorities. Concerned that the proposed structure discriminates against resources within the ISO system.	No comment	No comment
Management response	Management proposes to transfer a portion of the ISO's frequency response obligation to neighboring balancing areas as an interim means of complying with the NERC frequency response standard. This will be an efficient means to comply with the standard given such an approach is implementable in the interim and many balancing authority areas in the Western Interconnection have excess frequency response capability. Although the ISO expects to receive competitive offers, if offers are not competitive, the ISO will rely on exceptional dispatch as an interim solution. A balancing authority's frequency response capability is a function of its generation fleet. Currently the ISO dispatches its generation fleet to optimize energy and ancillary service needs of the system. Management will examine options for a more comprehensive,	The proposed adjustments to minimum governor performance align with the NERC reliability guidelines on primary frequency control. The requirement for generators to provide governor control system and plant control system data provides resource-specific data such as droop settings, dead bands, frequency responsive maximum output level, and temperature loop control levels necessary as inputs for the development of an eventual market-based solution. Accessing such data would enable the ISO to account efficiently for related generation deviations and avoided unit damages related to temperature and other reliability controls. The ISO tariff revisions would clarify under Section 4.6.5 that resources with governor controls are responsive to frequency deviations in accordance with Good Utility Practice. The ISO finds these adjustments to minimum governor	The ISO is clarifying its existing authority to designate spinning-reserves as *contingency only* for reliability purposes. This practice enables the ISO to ensure primary frequency response capability from reserves when needed to comply with the reliability standard. Management does not believe that this will have detrimental impacts on market efficiency for two reasons: 1) it will provide greater assurance of how much frequency response will be provided from the ISO generation fleet, which will reduce the amount of frequency response obligation that needs to be transferred to neighboring balancing authority areas; and 2) operations frequently designates spinning reserves as contingency only today to maintain reserve levels.

Management Proposal			
Stakeholder Comments	**Procure frequency response from neighboring balancing areas as an interim measure.**	**Revise governor tariff requirements.**	**Designate spinning and non-spinning reserves as contingency only**
	long-term solution, including dispatching the fleet in a way to provide more frequency response, in a second phase of the stakeholder initiative. Allocating the costs to load is consistent with the allocation of costs of NERC reliability fees and other types of reserves.	performance align with the NERC reliability guidelines on primary frequency control. Specifically, the ISO is requesting the coordination of governor control system and plant control system data such as droop settings, dead bands, frequency responsive maximum output level, and temperature loop control levels as inclusions in the ISO Masterfile. These inputs support the development of an eventual market-based solution. Accessing such data would enable the ISO to account efficiently for related generation deviations and avoided unit damages related to temperature and other reliability controls.	

Decision on phase 1 frequency response proposal

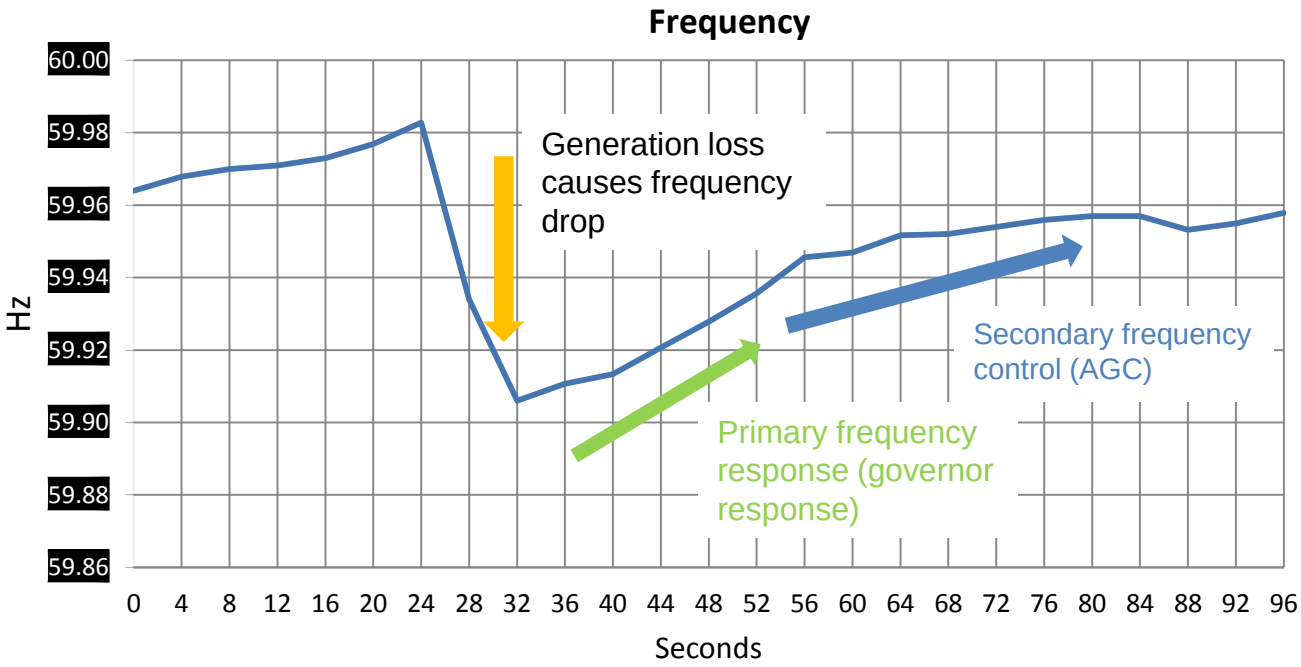
Greg Cook
Director, Market & Infrastructure Policy

Board of Governors Meeting
General Session
March 25, 2016

New NERC reliability obligation for balancing authorities to provide sufficient frequency response during contingency events

- Compliance obligation begins December 1, 2016
- Analysis shows ISO could have periods of insufficient frequency response
- ISO is completing policy development in two phases:
  - Phase 1 proposal address near-term compliance
  - Phase 2 scope is to evaluate more comprehensive solutions

Primary frequency response is activated in the first 30 seconds following a contingency.



Management proposes new provisions to help ensure compliance with the new NERC requirement.

- Conduct an RFO to transfer a portion of the ISO's primary frequency response obligation to another balancing area
- Hold all spinning reserves for contingency events
- Monitor and report on ISO's frequency response performance
- Introduce stronger requirements for all participating generators able to provide frequency services

Proposal would allow for transfers of a portion of the ISO's frequency response obligation to another balancing area through a competitive solicitation process.

- Selling balancing authority area(s) would include corresponding, offsetting adjustment as part of their compliance obligation
- Procurement costs allocated to demand
- Helps ensure compliance with new reliability standard and mitigate the risk of incurring penalty

New provision proposed to ensure spinning reserves are available for contingency events.

- Hold all spinning reserves for contingency events to improve ISO's frequency response capability

- Preserves the frequency responsive headroom, and the contingency reserve capability, by not dispatching reserves for energy

Propose to align ISO tariff requirements with NERC guidelines for frequency response.

Require generators to:

- Coordinate generator controls to enable frequency response
  - Except for controls to manage operational constraints or environmental regulations
- Set frequency response equipment to recommended settings
- Submit information to the ISO regarding resource's frequency responsive equipment's physical parameters

Proposal includes monitoring and reporting on ISO's frequency response performance.

- Routinely monitor and report ISO balancing area's primary frequency response performance through ISO's Monthly Market Quality Report

- Enables market participants to better understand the fleet's performance and the frequency response needs of the ISO balancing area

Stakeholders largely support stronger generator requirements and transferring a portion of the ISO's obligation.

- Stakeholders largely support proposals as necessary to ensure compliance in short-term
- Some generators argue its discriminatory to procure frequency response from other balancing areas without also considering procuring it from generators within ISO.
  - Transferring obligation is an established NERC procedure
  - Management will consider more comprehensive long-term design solutions that could include the development of a new frequency response product

Management recommends the Board approve the phase 1 frequency response proposal.

- Helps ensure ISO will meet new NERC reliability obligation in the first compliance period beginning December 1

- Improves grid reliability
  - hold reserves for contingency events
  - strengthen requirements of participating generators able to provide frequency response

Board of Governors March 24-25, 2016 Decision on phase 1 frequency response proposal

General Session

Motion

Moved, that the ISO Board of Governors approves the phase 1 frequency response proposal, as described in the memorandum dated March 17, 2016; 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 proposed tariff change.

Moved: Olsen Second: Galiteva

Board Action: **Passed**	Vote Count: **5-0**
Bhagwat	Y
Ferron	Y
Galiteva	Y
Maullin	Y
Olsen	Y

Motion Number: 2016-03-G3