163 FERC ¶ 61,211
UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Before Commissioners: Kevin J. McIntyre, Chairman;
Cheryl A. LaFleur, Neil Chatterjee,
Robert F. Powelson, and Richard Glick.

California Independent System Operator Corporation Docket No. ER18-1169-000

ORDER ACCEPTING IN PART, SUBJECT TO CONDITION, AND REJECTING IN PART, PROPOSED TARIFF REVISIONS

(Issued June 21, 2018)

1. On March 23, 2018, the California Independent System Operator Corporation (CAISO) submitted proposed tariff revisions under section 205 of the Federal Power Act (FPA),[1] related to opportunity cost adders, Master File registered characteristics, and other clarifying changes. As discussed below, we reject the proposals to allow scheduling coordinators to register market values in the Master File and to remove all ramp rates as components of daily bids, and accept CAISO's other proposed tariff revisions, effective November 1, 2018, as requested, subject to condition, and require CAISO to submit a compliance filing within 30 days of this order.[2]

I. Background

A. Opportunity Cost Adders for Use-Limited Resources

2. Under its current market design, CAISO optimizes economic commitment and dispatch of generating resources in its markets based on the resources' energy bids and submitted commitment costs.[3] Resources with limits on energy output or numbers of starts or run-hours (use-limited resources) do not have an efficient option to reflect

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[1] 16 U.S.C. § 824d (2012).

[2] The Appendix to this order identifies both the tariff records that we reject and those we accept (including those accepted subject to a further compliance filing).

[3] Commitment cost is the cost to start-up a unit and keep it running at its minimum operating level.

opportunity costs associated with their use limitations, which hinders the commitment and dispatch of such resources.[4]

3. Such use-limited resources may elect to bid their commitment costs pursuant to either the proxy cost or the registered cost methodologies.[5] Under the proxy cost methodology, a resource submits daily bids for its start-up costs, minimum load costs, and transition costs subject to a cap set at 125 percent of the calculated proxy cost (the proxy cost bid cap), which for gas-fired generators is largely based on daily natural gas prices. Under the registered cost methodology, use-limited resources can elect to register fixed commitment cost values of their choosing in the Master File on a 30-day basis.[6] The registered costs are subject to a cap set at 150 percent of the calculated projected proxy cost (the registered cost bid cap), which for gas-fired generators includes monthly natural gas futures prices.[7] The registered cost methodology is only available to use-limited resources. These two options are designed to compensate resources for start-up and minimum load costs while also mitigating potential market power concerns by setting a cap on the resources' allowed daily bids for those costs.

4. CAISO's market commitment decisions do not explicitly recognize use limitations that span more than one day because the market optimization tool makes unit commitment decisions that look ahead only one day at the most; thus, the market optimization cannot take into account that dispatching a use-limited resource for a particular day may reduce or eliminate its ability to run later in the month or year.[8] CAISO states that because its tariff does not include an opportunity cost adder for commitment costs, use-limited resources often elect the registered cost methodology because the 150 percent bid cap provides additional room to reflect the opportunity costs of their monthly and annual use limitations. However, because the registered cost methodology is locked on a 30-day basis, it provides no bidding flexibility and, consequently, cannot reflect daily gas price volatility. In contrast, the proxy cost methodology allows daily bidding flexibility by allowing CAISO to make daily adjustments to the bid cap to reflect gas price volatility. CAISO contends that as a result, the CAISO market's commitment of use-limited resources subject to the registered cost

[4] CAISO Transmittal at 3.

[5] CAISO Tariff, § 30.4.

[6] The Master File is an electronic repository of generator-provided data on resources participating in the CAISO markets.

[7] CAISO Tariff, §§ 30.4.1.1 and 30.4.1.2.

[8] CAISO Transmittal at 9.

methodology is often inefficient compared with its commitment of use-limited resources subject to the proxy cost methodology.[9]

5. CAISO states that scheduling coordinators sometimes manage their resources' use limitations by bidding the resources into the CAISO market for only a subset of hours to prevent the market from dispatching the resources too often. This method of managing limitations did not create operational issues for CAISO in the past because market participants could reliably predict when the grid needed their resources to meet peak load. However, CAISO explains that the increasing number of variable energy resources on the system has made supply on the CAISO system increasingly unpredictable and resulted in CAISO potentially needing use-limited resources at any time. CAISO states that the negative impact of these market inefficiencies has been magnified as the number of use-limited resources has grown to approximately 35,000 megawatts of total capacity, which represents more than 50 percent of the capacity provided in the CAISO market.[10]

6. CAISO's current tariff definition of use-limited resources captures a broad range of resources, including variable energy resources that are not available 24 hours a day.[11] Certain types of resources are deemed by the tariff to be use-limited resources and are not currently required to apply for use-limited status.[12] Scheduling coordinators for other types of resources may request that CAISO grant use-limited status for such resources pursuant to an application process.[13] In 2015, CAISO filed a tariff amendment with the Commission that proposed revisions to the definition of, and application process to become, a use-limited resource, including a proposal to change the name of the term to "use-limited capacity." The Commission rejected the proposed tariff revisions, finding

[9] CAISO Transmittal at 13-14.

[10] CAISO Transmittal at 3, 14.

[11] CAISO's tariff currently defines a use-limited resource as "a resource that, due to design considerations, environmental restrictions on operations, cyclical requirements, such as the need to recharge or refill, or other non-economic reasons, is unable to operate continuously." CAISO Tariff, Appendix A.

[12] Hydroelectric, proxy demand, and reliability demand response resources, as well as participating load, are deemed by the current CAISO tariff to be use-limited resources. CAISO Tariff, § 40.6.4.1.

[13] CAISO Tariff, § 40.6.4.1.

that the proposal was not sufficiently clear in explaining what capacity would be deemed use-limited.[14]

B. Master File Resource Market Characteristics

7. As noted above, the Master File is an electronic repository of generator-provided data on resources participating in the CAISO markets. The existing tariff requires that all information provided to CAISO regarding the operational and technical constraints of resources registered in the Master File be accurate and based on the physical characteristics of the resources.[15]

II. Notice and Responsive Pleadings

8. Notice of CAISO's filing was published in the *Federal Register*, 83 Fed. Reg. 13,984 (2018), with interventions and protests due on or before April 13, 2018. Southern California Edison Company, NRG Power Marketing LLC (NRG), GenOn Energy Management, LLC, Modesto Irrigation District, California Department of Water Resources State Water Project, and Northern California Power Agency filed timely motions to intervene. The Department of Market Monitoring of the California Independent System Operator Corporation (DMM), NRG, San Diego Gas & Electric Company (SDG&E), Pacific Gas and Electric Company (PG&E), Nevada Power Company and Sierra Pacific Power Company (NV Energy), and the Cities of Anaheim, Azusa, Banning, Colton, Pasadena, and Riverside, California (Six Cities) filed motions to intervene and comments or protests. The California Public Utilities Commission (CPUC) filed a late motion to intervene. CAISO filed an answer to the protests. DMM filed an answer to CAISO's answer.

III. Discussion

A. Procedural Matters

9. Pursuant to Rule 214 of the Commission's Rules of Practice and Procedure, 18 C.F.R. § 385.214 (2017), the timely, unopposed motions to intervene serve to make the entities that filed them parties to this proceeding. Pursuant to Rule 214(d) of the Commission's Rules of Practice and Procedure, 18 C.F.R. § 385.214(d) (2017), the Commission will grant the CPUC's late-filed motion to intervene given its interest in the

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[14] *Cal. Indep. Sys. Operator Corp.*, 152 FERC ¶ 61,185, at PP 34-39 (2015) (2015 Order).

[15] CAISO Tariff, § 4.6.4 and Appendix A.

proceeding, the early stage of the proceeding, and the absence of undue prejudice or delay.

10. Rule 213(a)(2) of the Commission's Rules of Practice and Procedure, 18 C.F.R. § 385.213(a)(2) (2017), prohibits an answer to a protest and/or answer unless otherwise ordered by the decisional authority. We accept the answers filed by CAISO and DMM because they have provided information that assisted us in our decision-making process.

B. Substantive Matters

1. Implementation of Opportunity Cost Adders and Revisions to the Definition of Use-Limited Resources

a. CAISO Proposal

11. CAISO proposes to allow use-limited resources to be eligible for an opportunity cost adder, over and above the use-limited resources' commitment and energy bid costs. Specifically, use-limited resources that have established a sufficient energy price history will be required to use the proxy cost methodology[16] and will be able to submit a request to include an opportunity cost adder in their market bids for start-up and minimum load costs.[17] The opportunity cost adder will capture the value of a use-limited resource's limited availability so that the use limitation is not reached until the end of the monthly or annual use limitation period and the resource may be dispatched when it is valued most. The ability to include an opportunity cost adder will enable all use-limited resources with a sufficient energy price history to bid 24 hours a day, seven days a week using the proxy cost methodology. According to CAISO, its market will then be able to determine the optimal commitment and dispatch of the use-limited resources based on the highest-value hours and given their qualifying limitations. CAISO states that dispatching use-limited

[16] CAISO states that only use-limited resources with fewer than 12 months of energy price history will continue to have the option to use the registered cost methodology. CAISO explains that a sufficient energy price history is needed to allow the scheduling coordinator and CAISO to engage in the process of developing an opportunity cost adder. CAISO Transmittal at 28-29.

[17] Variable energy opportunity costs would be recovered as an adder to default energy bids if the resource uses the variable cost methodology. The variable cost methodology is one of three options a resource can choose for calculating default energy bids. CAISO Transmittal at 17.

resources when they are valued most and enabling them to bid continuously and flexibly will make the markets more efficient.[18]

12. Under the proposal, a use-limited resource may seek to establish an opportunity cost adder if it meets CAISO's revised definition of a use-limited resource, explained in detail below, and if the resource's limitation applies for a period longer than the daily time horizon considered by the day-ahead market and can be reflected in a monthly, annual, and/or rolling 12-month period.[19] If the use-limited resource cannot satisfy all of these requirements, it will not be eligible for an opportunity cost adder.[20]

13. CAISO states that it will use two processes for developing opportunity costs: the calculated process and the negotiated process. The calculated opportunity costs will equal the difference in estimated profits if the use-limited resource had one less unit of starts, run-hours, or energy output, whichever is applicable, in the future time period of the validated limitation.[21] An opportunity cost adder associated with a limit on the number of starts would be applied to the resource's start-up cost cap, an adder associated with a limit on the number of run-hours would be applied to the resource's minimum load cost cap, and an adder associated with a limit on the energy output would be applied to the resource's mitigated default energy bid.

14. Under the proposal, CAISO will reduce the actual limitation on starts, run-hours, or energy output by a margin when calculating opportunity costs. CAISO explains that the margin is designed to address stakeholder concerns that resources might otherwise use up their allowed starts or run-hours over an annual period by December, which is currently the month when the flexible resource adequacy capacity obligation is highest. For example, if a resource is limited to 100 starts per year and the margin is ten percent, CAISO would model the resource as having 90 starts per year as the base case and compare it to the case of 89 starts per year. The resource's estimated opportunity cost would equal the difference in overall profits between 90 starts (the base case) and 89 starts (one less unit of starts). CAISO states that it will initially set the margin at ten percent and may subsequently adjust it as needed. CAISO states that the tariff will

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[18] CAISO Transmittal at 15-16.

[19] Proposed CAISO Tariff, § 30.4.1.1.6.1.2. Under this revised tariff section, CAISO also states that Condition 2 Reliability Must Run units, reliability demand response resources, and regulatory must-take capacity are not eligible for an opportunity cost adder.

[20] CAISO Transmittal at 17.

[21] Proposed CAISO Tariff, § 30.4.1.1.6.2.2.

specify that the opportunity cost calculation includes a margin and the business practice manual (BPM) will specify the level of the margin.[22]

15. CAISO states that it will calculate the opportunity costs for each validated limitation based on the estimated market commitment of the resource using historical 15-minute locational marginal prices (LMPs) that will be used to establish forecasted hourly LMPs.[23] CAISO explains that almost all use-limited resources are committed and de-committed in the short-term unit commitment and real-time unit commitment processes of the real-time market based on 15-minute LMPs, and it expects that the same will be true for the majority of use-limited resources under the revised tariff provisions.[24]

16. If CAISO is unable to calculate opportunity costs, it will use the negotiated process to establish them. Under the proposal, the scheduling coordinator will provide CAISO with a proposed opportunity cost methodology, updated schedule, and supporting documentation. CAISO will either approve the methodology and schedule, or enter into good-faith negotiations with the scheduling coordinator, similar to the existing process for negotiating major maintenance expense adders and negotiated default energy bids.[25] CAISO notes that it will not be able to replicate the complex models used by several hydroelectric, participating load, and pumped storage resources to develop their opportunity costs. Instead, CAISO proposes to work with scheduling coordinators for those resources to establish an appropriate methodology and schedule for updating opportunity costs.[26]

17. CAISO states that once an opportunity cost is developed using either approach, it will remain in place unless and until the resource's scheduling coordinator submits updated documentation, either to establish a new limitation or modify an existing one.[27] CAISO also states that it will update its opportunity cost calculations on a monthly basis, unless circumstances prevent it, or suggest a basis to update the calculations more

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[22] CAISO Transmittal at 19-20.

[23] CAISO Transmittal at 20-21 (citing Proposed CAISO Tariff, § 30.4.1.1.6.2.2).

[24] CAISO Transmittal at 20.

[25] Proposed CAISO Tariff, § 30.4.1.1.6.3.

[26] CAISO Transmittal at 21.

[27] Proposed CAISO Tariff, § 30.4.1.1.6.1.2.

frequently.[28] CAISO proposes to include calculated and negotiated opportunity costs in its monthly informational filing with the Commission of all negotiated bid components.[29]

18. CAISO also proposes to revise the existing tariff definition of a use-limited resource. Under the proposed tariff provisions, no resource will receive use-limited status by default. Instead, a scheduling coordinator seeking use-limited status for any resource must provide sufficient documentation demonstrating that: (1) the resource has one or more limitations affecting its number of starts, its number of run-hours, or its energy output due to a) design considerations,[30] b) environmental restrictions,[31] or c) qualifying contractual limitations;[32] (2) the CAISO market process used to dispatch the resource cannot recognize the resource's limitations; and (3) the resource's ability to select operating hours is not dependent on any energy source outside of the resource's control being available during such hours.[33]

19. The revised definition reflects CAISO's proposal to exclude resources that have limitations that the CAISO market process can recognize (i.e., daily limitations). If the market process can recognize a limitation, the resource can be treated like any other resource and does not need an opportunity cost adder. Though previously defined as use-limited, resources that are not necessarily available all of the time, e.g., variable energy resources, will also be excluded. CAISO notes that a use limitation that precludes operation is different than the unavailability of a fuel source to enable the resource to operate. CAISO explains that it is excluding such resources because use-limited status

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[28] Proposed CAISO Tariff, § 30.4.1.1.6.2.1. CAISO states that it will prioritize workload based on opportunity costs most likely to need updating.

[29] Proposed CAISO Tariff, § 39.7.1.3.2.2. CAISO files its monthly informational filings in Docket No. ER06-615-000.

[30] Design considerations are those resulting from physical equipment limitations. Other design considerations that satisfy this requirement are those resulting from performance criteria for demand response resources established pursuant to programs or contracts approved by local regulatory authorities.

[31] Environmental restrictions are those imposed by regulatory bodies, legislation, or courts. This includes, but is not limited to, limits on emissions, water use restrictions, and run-hour limitations in operating permits.

[32] Certain long-term contracts approved by local regulatory agencies will meet the definition of use-limited for a three-year period, as discussed below.

[33] Proposed CAISO Tariff, § 30.4.1.1.6.1.1.

previously only exempted them from resource adequacy generated bidding rules, but they will continue to be exempt from the generated bidding rules under different tariff provisions.[34]

20. Regarding the qualifying contractual limitations criteria, CAISO states that it maintains its longstanding position that economic limitations such as those originating from contracts, like power purchase or tolling agreements, are not acceptable limitations for establishing an opportunity cost adder under the resource's bid cap.[35] According to CAISO, if it were to allow contractual limitations to qualify resources for use-limited status and make such resources possibly eligible to recover opportunity costs, contracting parties would be able to both physically and economically withhold resources from the market by simply contracting obligations away. However, CAISO acknowledges that existing long-term contracts approved through a robust regulatory process before discussions regarding the possible addition of opportunity cost adders for use-limited resources commenced would not reflect attempts to exercise market power. Thus, CAISO proposes to allow a resource to qualify as a use-limited resource if it is has contractual limitations that were reviewed and approved by a local regulatory authority on or before January 1, 2015,[36] and were evaluated by the local regulatory authority for the cost implications of those contracts with regard to the limitations on the resource's numbers of starts, numbers of run-hours, or energy output.[37] CAISO proposes to allow such contractual limitations to qualify a resource for the opportunity cost adder for three years after the proposed revisions go into effect; i.e., after November 1, 2021, no

[34] CAISO Transmittal at 23. CAISO generates cost-based bids when a resource adequacy resource subject to a must-offer requirement does not submit a bid. However, certain resources, such as variable energy resources, are exempted from the generated bidding rules. CAISO proposes to expand the exemption to include resources that are currently classified as use-limited resources. *See* Proposed CAISO Tariff, § 40.6.8.

[35] CAISO states that its current policy is that economic contractual limits do not make a resource use-limited under its tariff. CAISO Transmittal at 24.

[36] Contractual limitations that were pending approval by a local regulatory authority on or before January 1, 2015 and were later approved would also qualify. Proposed CAISO Tariff, § 30.4.1.1.6.1.1.

[37] Contractual limitations that provide for higher payments when start-up, run-hour, or energy output thresholds are exceeded cannot be qualifying contractual limitations. CAISO Transmittal at 25-26.

contractual limitations will constitute qualifying contractual limitations under the revised use-limited definition.[38]

21. CAISO explains that the proposed three-year cutoff period will provide sufficient time for CAISO and the relevant local regulatory authority to consider the implications of the change for resource adequacy and provide time for market participants either to renegotiate the contracts or work with DMM to obtain a more accurate major maintenance adder. CAISO states that given the uncertainty regarding the quantity of capacity that will be covered by the tariff revisions, and increasing flexibility needs of the markets, CAISO cannot at this time fully assess the market impacts of extending the provisions regarding qualifying contractual limitations beyond three years. However, CAISO commits to evaluate, before the end of the three-year period, potential market and reliability impacts if the provisions were to be extended at that time.[39]

22. CAISO requests a waiver of the Commission notice requirements to allow the tariff revisions to go into effect November 1, 2018, more than 120 days after the submittal of its filing. CAISO states that good cause exists to grant the waiver because the additional time will permit CAISO and market participants to work through the opportunity cost calculator and negotiated opportunity cost processes.[40]

b. Comments, Protests, and Answers

23. NRG states that CAISO did not adequately explain how it will develop the forecasted prices used in the opportunity cost calculator. NRG further argues that CAISO's proposal to use historical costs alone to estimate forward costs is not just and reasonable because forward price information is available. NRG also argues that the proposal does not allow a resource owner to timely resolve a dispute with CAISO over forecasted prices, and consequently, a calculated opportunity cost. The dispute resolution tariff provisions require the resource owner and CAISO to engage in good faith negotiations, which NRG argues could take months or years. In the meantime, NRG contends, the resource owner will be forced to accept the calculated opportunity cost and if it turns out to be wrong, the resource owner will bear the consequences. NRG

[38] Proposed CAISO Tariff, § 30.4.1.1.6.1.1.

[39] CAISO Transmittal at 26-27.

[40] *Id*. at 35.

recommends that any disputes related to opportunity costs be ruled on by CAISO no more than ten business days following submission of the dispute.[41]

24. SDG&E states that if CAISO sets the calculated opportunity cost adder too low such that a unit reaches its use limitations before the end of the year, the resource could be subject to Resource Adequacy Availability Incentive Mechanism (RAAIM) penalties even if the resource always used the maximum opportunity cost value.[42] SDG&E argues that in practice this could unfairly penalize the resource for choices made beyond its control. SDG&E recommends that CAISO exempt resources that always use the maximum opportunity cost adder from RAAIM penalties.[43] NV Energy requests that CAISO confirm that it is appropriate to use the short-term use limit reached outage card to limit resource use if the CAISO-calculated opportunity cost proves to be too low to prevent overuse of the resource.[44]

25. SDG&E, PG&E, and NRG protest the qualifying contractual limitations criteria. Specifically, SDG&E and PG&E argue that the contractual limitations should be respected for the length of the contract, as opposed to a three-year cutoff period. They contend that if the contracts do not raise withholding concerns now, they will not raise any at the end of the three-year period. PG&E explains that the contracting process is arduous and complex, and counterparties would have the benefit of knowing the CAISO requirements and associated deadlines, putting PG&E in an unfavorable bargaining position.[45] SDG&E states that the cost to its ratepayers – either in renegotiation or in contractual penalties for CAISO forcing SDG&E to incur more starts than it has contractual rights to – is likely to be substantial. SDG&E further states that it is party to five contracts totaling 1,000 megawatts that would be cut off from opportunity cost adder eligibility after the three-year period. SDG&E argues that allowing these contracts to remain eligible for an opportunity cost adder after the three-year period would not adversely impact reliability because the contractual limitation on start-ups is adequate to

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[41] NRG Protest at 4-6.

[42] RAAIM is a bid-based mechanism to incent resources providing resource adequacy capacity to meet their must-offer obligations and provide substitute capacity if they go on forced outage.

[43] SDG&E Protest at 6-7.

[44] NV Energy Comments at 7.

[45] PG&E Comments at 3, 6-9.

cover reliability needs.[46] NRG states that, given California's reliance on bilaterally-negotiated long-term contracts to support new investment in generation, the fact that CAISO is proposing to discard those use limits that were negotiated as part of arms-length transactions is alarming.[47]

26. DMM contends that no contract limitations should qualify a resource as use-limited, and requests that the Commission reject the proposed three-year cutoff period. DMM argues that it is inefficient and inequitable to treat contractual limitations as actual physical or environmental limitations when calculating bid caps in the market optimization and that major maintenance adders represent the only efficient and appropriate way to incorporate incremental maintenance costs associated with starting up and operating resources into unit commitments. DMM states that resources have been on notice for almost three years that economic limitations would not be eligible for opportunity cost adders and that grandfathering contractual limitations until 2021 will only extend the contract renegotiation process.[48] DMM further argues that CAISO's commitment to reevaluate the market and reliability impacts of extending the eligibility of contractual limitations beyond three years sends the wrong signal to market participants about the need to modify contracts. DMM expresses concern that 5,000 to 10,000 megawatts of recently-built gas-fired capacity may be eligible for the three-year exemption, much of which is located in transmission-constrained areas.[49] Finally, DMM contends that the proposed criteria for qualifying contractual limitations lack clarity and enforceability. DMM asserts that it is unclear how CAISO will verify that a local regulatory authority specifically took contractual limitations on starts or run hours into consideration in its review of a particular contract.[50]

27. In its answer, CAISO responds to NRG's claims regarding the tariff methodology stating that the tariff revisions provide sufficient information regarding the opportunity cost calculation, and that it will include the equations and other implementation details in a BPM. CAISO explains that the technical appendix to the draft final proposal and business requirements specification documentation gave market participants details regarding the equation and implementation details. According to CAISO, it will utilize

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[46] SDG&E Protest at 3-6.

[47] NRG Protest at 6-7.

[48] DMM Protest at 3-6 (citing CAISO's Commitment Cost Enhancements Phase 3 Straw Proposal, at 8 (Aug. 24, 2015)).

[49] *Id*. at 7-9.

[50] *Id*. at 14-15.

both historical data and forecasts of future conditions in calculating opportunity costs. CAISO states that this is consistent with the tariffs of PJM Interconnection, L.L.C. (PJM) and Southwest Power Pool, Inc. (SPP), both of which include methodologies to determine opportunity costs and references to the relevant manuals containing calculation details to implement the methodologies.[51]

28. CAISO argues that it has built features into its proposal to address SDG&E's concern about RAAIM penalties. It explains that first, the margin will reduce the risk that use limits will be reached during the applicable period. Second, the opportunity cost adder is intended to allow a resource adequacy resource to participate in the market at all times, and to bid accordingly. Third, the BPM includes two nature-of-work outage card categories[52] that can be used to exempt use-limited resources from RAAIM penalties if their use limits are reached or are expected to be prematurely reached. CAISO states that reasonable use of the outage card should be limited to cases where the opportunity cost has been reflected in bids but proven not to be fully effective, and the resource is at risk of reaching its limitation prematurely even with bids reflecting the opportunity cost. For these reasons, CAISO contends that the implementation of the adder will not increase the risk of incurring RAAIM penalties.[53]

29. In response to NRG's concern regarding the dispute resolution process, CAISO argues that there is no reason for a different dispute resolution process for opportunity cost decisions because there will be nothing to dispute except whether CAISO correctly applied the opportunity cost formula. CAISO explains that the only flexibility in the opportunity cost formula will be establishment of the margin, which will be the same for all resources. Further, CAISO states that resources eligible for negotiated opportunity costs will negotiate pursuant to a process similar to the existing tariff provisions for a major maintenance adder, which is a 60-day process, though it is sometimes longer in practice.[54]

30. CAISO states that the proposal to establish qualifying contractual limitations with a defined transitional period represents a practical path to realizing CAISO's policy of not recognizing economic contract limits. CAISO notes that some market participants

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[51] CAISO Answer at 6-11, citing PJM Operating Agreement, Schedule 2, §1.1(a); PJM Manual 15, Cost Development Guidelines, § 12; SPP OATT, Attachment AF, § 3.2(D); SPP Market Protocols, Appendix G, § G.11.

[52] The two outage categories are "use limit reached" and "short-term use limit reached."

[53] CAISO Answer at 11-14.

[54] *Id*. at 15-17.

have entered into contractual restrictions on starts and/or run-hours to address maintenance costs, which is inconsistent with CAISO's market design. As a matter of principle, CAISO agrees with DMM that contract limitations should not qualify a resource for opportunity costs, but given the diversity and polarization of stakeholder views on the issue, CAISO believes it is appropriate to implement the transitional approach. CAISO states that the tariff is sufficiently clear regarding the proposed eligibility criteria for qualifying contracts, but that any uncertainty regarding the meaning of the tariff language can be resolved in the documentation and review process. CAISO estimates that 6,000 megawatts of capacity may be eligible for the exemption and states that the exact amount of capacity and effect of the exemption will remain uncertain until CAISO has actual experience with the proposal. CAISO also clarifies that the three-year cutoff is not solely for market power purposes, but will allow CAISO to more efficiently utilize flexibility from resources currently constrained by contractual limitations.[55]

31. DMM filed a reply to CAISO's answer stating that the Commission should reject the tariff revisions relating to contract limitations. DMM contends that CAISO's answer did not adequately address its concern that the definition for contract limitations lacks clarity and would be difficult to implement. DMM states that CAISO failed to respond to DMM's concerns regarding equal treatment of resources and how CAISO will determine if a local regulatory entity evaluated the "cost-benefit" of a contract when approving it.[56] DMM believes that the proposed tariff sections regarding contractual use limitations are severable from the remainder of CAISO's proposal and thus can be rejected without affecting the rest of the proposal. But DMM contends that if the Commission does not believe the proposal is severable, then the entire filing should be rejected.[57]

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[55] *Id*. at 18-26.

[56] The proposed tariff criteria for use-limited status requires the contract to have been "evaluated by the local regulatory authority for the cost-implications of those contracts with regard to the limitations on such resources' numbers of starts, number of run hours, or energy output." Proposed CAISO Tariff, § 30.4.1.1.6.1.1.

[57] DMM Answer at 2-4.

c. Commission Determination

32. We find, subject to the conditions discussed below,[58] that CAISO's proposed methodology to allow use-limited resources to include opportunity cost adders in their bids and the proposed revision to the definition of use-limited resources to be just and reasonable, and not unduly discriminatory or preferential and, therefore, we accept them effective November 1, 2018.[59] We find that the proposal is an improvement over the existing commitment cost recovery mechanism because the market optimization tool will be able to dispatch use-limited resources when they are most needed.[60] However, we agree with NRG's concern that details regarding how CAISO will develop the forecasted prices used in the opportunity cost calculator affect rates, terms and conditions of service and, therefore, must be filed as a part of CAISO's tariff, rather than the BPM.[61] Therefore, we direct CAISO to submit a compliance filing, within 30 days of the date of this order, revising the tariff to add additional detail regarding the opportunity cost methodology to tariff Section 30.4.1.1.6.2.2, consistent with its answer. The additional detail should include a list of the underlying components that provide the basis for forecasted prices and a citation to the BPM that contains the specific equations and other implementation details.[62]

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[58] The United States Court of Appeals for the District of Columbia Circuit has held that, in certain circumstances, the Commission has "authority to propose modifications to a utility's [FPA section 205] proposal *if the utility consents to the modifications*." *NRG Power Mktg., LLC v. FERC*, 862 F.3d 108, 114-15 (D.C. Cir. 2017). In this instance, we are not substantively modifying CAISO's proposal, but asking CAISO to place language in its tariff rather than the business practice manual and to clarify proposed tariff sections, as discussed below.

[59] We grant CAISO's request to waive the Commission's 120-day notice requirement. 18 C.F.R. § 35.11 (2017).

[60] We note that CAISO's proposal resolves the problems identified by the Commission in the 2015 Order because the proposal is sufficiently clear as to who will be impacted and how CAISO will implement it.

[61] *See, e.g.*, *City of Cleveland, Ohio v. FERC*, 773 F.2d 1368, 1376 (D.C. Cir. 1985); *Energy Storage Ass'n v. PJM Interconnection, L.L.C.*, 162 FERC ¶ 61,296, at P 103. (2018).

[62] We note that this requirement is consistent with the level of detail provided in both the PJM and SPP tariffs. *See* PJM Operating Agreement, Schedule 2, § 1.1(a); SPP OATT, Attachment AF, § 3.2(D).

33. We note that proposed tariff Section 30.4.1.1.6.1.2 provides that any opportunity cost that is determined either through the calculated or negotiated process will remain in place until a scheduling coordinator submits documentation of a new or modified limitation. However, several of the underlying inputs to CAISO's proposed opportunity cost calculator are monthly values (e.g., monthly start-up, minimum load, and variable energy costs). To the extent these values or forecasted LMPs change from month-to-month, the opportunity cost calculator would produce varying opportunity costs, even if the limitation on the resource remains the same.[63] We therefore believe it is appropriate for CAISO to calculate and update opportunity costs on a monthly basis as described in proposed tariff Section 30.4.1.1.6.2.1. We therefore direct CAISO, in its compliance filing, to modify tariff Section 30.4.1.1.6.1.2 to address this ambiguity and clarify that the opportunity cost value can change based on CAISO's monthly calculations and not only based on a new or modified limit.

34. We find that CAISO has included features in the proposal, specifically the margin and the two nature-of-work outage card categories, to sufficiently address SDG&E's concern that implementation of the adder will not increase the risk of incurring RAAIM penalties. NRG's concern regarding the timeliness of the dispute resolution process is mitigated by two factors. First, as noted by CAISO, the opportunity cost methodology, including forward price calculations, is formulaic and will apply equally to all resources. Because we are directing CAISO to include additional information regarding the forward price calculations in the tariff, and all specific equations will be in the BPM, NRG will have an opportunity to raise any concerns via comments on CAISO's compliance and/or through the BPM revision process as specified in CAISO tariff Section 22.11.1. Second, the margin feature reduces the likelihood that the opportunity cost calculated by CAISO will be too low; if the calculated opportunity cost is too high, the resource can choose to offer at a lower level.

35. We also accept CAISO's revised definition of a use-limited resource, because it provides a better understanding of what resources qualify as use-limited.[64] For example, CAISO included examples in the tariff as to what would qualify a resource as use-limited for design and environmental considerations, and specific criteria for qualifying economic contract limitations. We believe that the tariff provisions regarding economic contract limitations are sufficiently clear to allow scheduling coordinators and CAISO to

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[63] Similarly, formulas used to calculate opportunity costs for resources with negotiated methodologies may also contain inputs that vary monthly.

[64] We note that the tariff section title of "Use-Limited Resource" in Appendix A of the CAISO tariff is incorrect. We therefore direct CAISO in its compliance filing to change the tariff section title from "Use-Limited Capacity" to "Use-Limited Resource."

determine which contract limitations qualify.[65] In addition, we find that CAISO's proposed limited three-year exemption period for contractual limitations strikes a reasonable balance between requiring load-serving entities to renegotiate their contracts immediately and allowing contractual limitations to qualify for the entire life of the contracts. Although CAISO commits to evaluate potential market and reliability impacts if the provisions were to be extended, we view three years as an adequate length of time for the load-serving entities to renegotiate their contracts.

2. Resource Characteristics Registered in the Master File

a. CAISO Proposal

36. CAISO proposes to clarify and revise what information is registered in the Master File. First, CAISO proposes to replace "physical characteristics" with "design capability values." Under design capability values, information provided must reflect the design capabilities (rather than the physical characteristics) of a unit when operating at maximum sustainable performance over minimum run time, recognizing that resource performance may degrade over time. CAISO explains that the design capability approach considers how a unit was initially designed to be used, rather than a unit's capability when operated to its breaking point. CAISO asserts that these changes will ensure that the Master File includes the most robust information possible and that the information aligns with resources' participation in the markets.[66]

37. Second, CAISO proposes to allow scheduling coordinators to register "market values" for certain parameters in the Master File. Specifically, a resource could register market values for maximum daily start-ups, maximum daily number of multi-stage generating (MSG) resource transitions, operational ramp rate values, operating reserve

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[65] As noted by CAISO in its answer, the proposed tariff requires scheduling coordinators to provide sufficient documentation demonstrating that it meets the eligibility criteria. *See* Proposed Tariff, § 30.4.1.1.6.1.1. CAISO will then review the documentation to determine whether the scheduling coordinator has provided sufficient information to demonstrate that resource qualifies as use-limited for contractual reasons. Thus, any uncertainty as to whether a resource qualifies as use-limited may be resolved in the documentation and review process.

[66] CAISO Transmittal at 29-30. CAISO also proposes to clarify that a scheduling coordinator may not submit a bid or offer that could not feasibly be delivered based on the registered operational and technical constraints of the unit, and that all information registered in the Master File must be consistent with the offers and services provided by the resource in the CAISO markets. Proposed CAISO Tariff, § 4.6.4.1.

ramp rate values, and regulation ramp rate values.[67] CAISO explains that it may be beneficial for its market optimization to consider values other than design capability. For example, CAISO states, a resource may be designed to start up five times a day, but starting it up more than twice a day could dramatically increase wear and tear and increase the probability of catastrophic failure.[68]

38. CAISO proposes three limitations to the market values: (1) the maximum daily start-ups must be at least two per day, unless the design capability is one start-up per day; (2) the maximum daily number of MSG transitions must be at least two for every MSG transition registered in the transition matrix, unless the design capability is one MSG transition per day; and (3) the operational ramp rate values must be sufficient to permit the resource to provide its flexible resource adequacy capacity obligation.[69] CAISO explains that requiring at least two start-ups or MSG transitions per day will mitigate the concern that a unit could exploit CAISO's twice-daily peak by only starting once or transitioning once per day and essentially forcing CAISO to keep the unit on all day even if it is not needed in the middle of the day. CAISO states that the requirement will also avoid potential reliability issues. For example, if the day-ahead market committed a resource with one start-up per day for the evening load peak, but the real-time market then dispatched it for the morning peak followed by an instruction to shut down, the resource would be unable to meet its day-ahead schedule.[70]

39. As proposed, CAISO will utilize the market values in the CAISO markets and in automated exceptional dispatch tools. However, CAISO explains it may issue exceptional dispatch instructions based on the design capability of a generating unit, regardless of whether the resource also provides a market value.[71]

40. CAISO represents that scheduling coordinators will be able to use the market values to reflect contractual limitations. CAISO states that this change will be particularly valuable to those resources with contractual limitations that either do not

[67] The proposed tariff provisions authorize CAISO to reject a market value if that value is infeasible given the design capabilities of a resource or is inconsistent with a resource's commitment to provide resource adequacy capacity. Proposed CAISO Tariff, § 4.6.4.2.

[68] CAISO Transmittal at 30.

[69] Proposed CAISO Tariff, § 4.6.4.2.

[70] CAISO Transmittal at 31-32.

[71] Proposed CAISO Tariff, § 4.6.4.2.

meet the proposed criteria to qualify as use-limited, or continue to have a contractual limitation after the three-year cutoff period has expired.[72]

b. Comments, Protests, and Answers

41. SDG&E and NRG support the Master File market values proposal, with a few caveats. SDG&E supports allowing market participants a mechanism to reflect values other than design capability in CAISO's market optimization, but states that the two start-ups requirement is unnecessary. SDG&E argues that even if a resource set its preferred operating value to one start-up per day, that preference would not deprive CAISO of the ability to call the resource for a second start if it is capable.[73] NRG states that it understood that CAISO would use the design capability values only under stressed system conditions, but notes that the proposed tariff revisions reference tariff Section 34.11, which authorizes CAISO to issue exceptional dispatch for a host of additional reasons. NRG therefore requests that the Commission direct CAISO to modify the tariff to limit CAISO's use of design capability values to stressed system conditions.[74] PG&E states that the additional flexibility provided by the market values proposal is limited by the requirements imposed on the market values, particularly the requirement that resources must provide at least two start-ups per day.[75] DMM notes that exemptions to the two start-ups per day requirement should not be granted on the grounds that starting a unit up twice a day may increase maintenance costs, as such costs can be reflected in major maintenance adders.[76]

42. NV Energy protests the market values proposal as it applies to EIM participating resources. NV Energy argues that CAISO's two justifications for requiring two starts or transitions a day are more appropriately directed at CAISO resource adequacy resources that have a must-offer obligation than at EIM participating resources. NV Energy states that EIM participating resources are expressly prohibited from participating in the day-ahead market and therefore do not present the gaming concerns that a unit could exploit the twice-daily load peak by only starting or transitioning once per day and essentially forcing CAISO to keep the unit on all day even if it is not needed in the middle of the day. NV Energy explains that it must preserve its EIM participating resources for

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[72] CAISO Transmittal at 30.

[73] SDG&E Protest at 7.

[74] NRG Protest at 7-8.

[75] PG&E Comments at 8.

[76] DMM Protest at 16-17.

meeting its native load requirements and for system reliability, and currently there is no market mechanism to reserve limitations for native load needs in the EIM other than removing bids from the market.[77]

43. In its answer, CAISO agrees with DMM that resources should not be granted an exemption from the two start-ups requirement because two start-ups may increase maintenance costs.[78] CAISO clarifies that its use of the phrase stressed-system conditions during the stakeholder process refers to its exceptional dispatch authority in tariff Section 34.11.[79] CAISO argues that NV Energy appears to overlook that the current tariff requires resource owners, including EIM participants, to register values in the Master File based on a resource's actual physical capabilities. As such, CAISO's proposal to allow a set of market values with a minimum of two start-ups per day represents an increase in flexibility, rather than a more onerous restriction. CAISO confirms that the requirement of at least two start-ups per day does not impose a must-offer requirement on EIM participating resources and that the EIM entities may continue to self-manage the voluntary participation of their resources.[80]

c. Commission Determination

44. We reject CAISO's proposal regarding resource characteristics registered in the Master File. We find that CAISO has not sufficiently shown that the proposal to allow scheduling coordinators to register market values in the Master File for certain resource characteristics is just and reasonable. CAISO proposes to utilize the design capability values of a resource when CAISO issues exceptional dispatch instructions to ensure that the market value cannot be allowed to undermine system reliability.[81] We are concerned that, outside of exceptional dispatch, CAISO's proposal does not include a mechanism to ensure that market values cannot be used to undermine the market's economic resource dispatch when transmission constraints or other supply limitations create opportunities for the exercise of market power.

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[77] NV Energy Comments at 3-7.

[78] CAISO Answer at 32-33.

[79] *Id*. at 33-34.

[80] *Id*. at 31-32.

[81] CAISO states that it will otherwise utilize the market values in the CAISO markets and in automated exceptional dispatch tools. *See* Proposed CAISO Tariff, § 4.6.4.2.

45. Under CAISO's proposal, the use of market value parameters[82] that do not reflect the full design capability of resources may have the effect of reducing the amount of capacity available to the market.[83] Permitting market participants to make less capacity available to the market raises the potential for physical withholding, which can affect dispatch and increase energy and ancillary service prices that may benefit the market participants' affiliated resources. At times of tight supply conditions, it is more likely that withholding capacity could be a profitable action. CAISO does not propose market power mitigation provisions to address this concern.

46. CAISO's existing market power mitigation lacks the ability to adjust market value parameters should a resource withhold capacity. If CAISO finds the potential for market power, it may mitigate affected resources' supply offers, if appropriate. Currently, because a resource's physical operating parameters registered in the Master File are required to reflect the physical limitations of the resource, there is no need to mitigate the resource's physical parameters in addition to its energy bid. However, we find that the introduction of market values creates a need for CAISO to assess whether a market participant is using a resource's market value to engage in physical withholding, and if so, to mitigate that parameter to the design capability. Under the proposal there is no ability for the mitigation to adjust parameters submitted to the Master File.[84] We recognize that CAISO has proposed certain limitations to the market values to mitigate the concern that a unit could exploit the CAISO system's typical twice-daily peak load pattern. However, CAISO has not demonstrated that the limitations will be sufficient in all circumstances, e.g., in a scenario where a resource lowers its ramp rate or maximum daily startup market values allowing it to engage in physical withholding. Because we reject CAISO's proposal to register market values in the Master File, protesters' arguments thereto are moot.

47. Finally, we reject CAISO's proposal to replace physical characteristics with design capability values because it is not severable from the market values proposal. The design capability proposal is in the same tariff record as the market values proposal, and

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[82] We interpret CAISO's proposal to allow for market values as only applying to the following parameters: maximum daily start-ups, maximum daily number of MSG resource transitions, operational ramp rate values, operating reserve ramp rate values, and regulation ramp rate values.

[83] For example, under CAISO's proposal, if a resource is operating at a level below its economic maximum and has a market value ramp rate lower than its design capability value, the market may not be able to access the resource's full capacity in a particular interval that would be available based on the design capability values.

[84] *See* CAISO Tariff, § 39.7.

thus, since we are rejecting the market values proposal, we must also reject the design capability values proposal.

3. Additional Proposals

a. CAISO Proposal

48. CAISO proposes to revise the tariff to remove all ramp rates (e.g., operational ramp rates, operating reserve ramp rates, and regulation ramp rates) as components of daily bids and to make conforming changes to reflect that its market processes will utilize ramp rates that will be solely registered in the Master File. CAISO explains that since the existing provisions went into effect, it has enhanced the modeling capabilities of resources in the CAISO markets, reducing the need to accommodate daily bid-in ramp rates. In addition, the instant proposal to allow for market ramp rate values will further obviate the need for ramp rates to be a component of daily bids. CAISO argues that having all ramp rates in the Master File will provide scheduling coordinators the flexibility to register two Master File values (market and design capability values), similar to the flexibility currently offered by the ramp rate component of daily bids.[85]

49. CAISO also proposes to revise the tariff to allow CAISO to require the renegotiation of certain values including major maintenance adders, negotiated default energy bids, and negotiated opportunity costs that have become outdated, are erroneous, or for which the scheduling coordinator has changed. In the renegotiation process, CAISO may review and propose modifications to such values, and may require the scheduling coordinator to provide updated information to support continuation of the values.[86]

50. CAISO proposes to make minor clarifications to its tariff to reflect the accurate use of defined terms and provide more specific cross-references.[87] CAISO also clarifies that the scheduling coordinator for a non-natural gas-fired resource subject to the proxy cost methodology, rather than CAISO, will provide the fuel or fuel-equivalent input costs

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[85] CAISO Transmittal at 33-34 (citing Proposed CAISO Tariff, §§ 8.3.7, 8.4.1.1(b), 30.5.2.2 through 30.5.2.4, 30.5.2.6, 30.5.2.7, 34.17.1(c), 34.17.5, Appendix A, and deleted Section 30.7.7).

[86] CAISO Transmittal at 34 (citing Proposed CAISO Tariff, § 39.7.1.3.2).

[87] CAISO Transmittal at 34 (citing Proposed CAISO Tariff, §§ 30.4.1.1.1, 30.4.1.1.2, 30.5.2.2, 30.5.2.6, 30.7.3.5, 30.7.9, 40.6.8(d), 40.6.8(e), and Appendix A).

that CAISO will maintain in the Master File.[88] Further, CAISO clarifies that it will include a greenhouse gas cost adder, if applicable, in its calculation of default energy bids for non-natural gas-fired resources subject to the variable cost option, as it currently does for natural gas-fired resources.[89]

b. Comments, Protests, and Answers

51. Six Cities state that proposed tariff Section 40.6.8(e), regarding which types of resources are exempt from CAISO's generated bidding rules, includes a new reference to tariff Section 30 that is too general to be instructive. Six Cities request that the Commission require CAISO to modify this provision to either delete the reference or refer to specific subsections of Section 30.[90]

52. In response to Six Cities, CAISO maintains that the reference to Section 30 is intended to contrast the complex software infrastructure bidding rules from the resource adequacy must-offer bid generation rules. The reference is not intended to substantively change the tariff provisions governing when the generally applicable bidding rules apply instead of an exemption from generated bid insertion.[91]

c. Commission Determination

53. We reject CAISO's proposal to revise the tariff to remove all ramp rates as components of daily bids because it is not severable from the Master File proposal. If we were to accept the ramp rate proposal and reject the Master File proposal, scheduling coordinators would lose the flexibility currently afforded to them by the existing daily bid-in ramp rate functionality. We also reject CAISO's minor clarifications to tariff Sections 30.5.2.2, 30.5.2.6, and 30.7.9 because those sections contain edits to implement the Master File and ramp rate proposals. We accept CAISO's remaining tariff revisions: (1) to allow CAISO to require the renegotiation of certain values; (2) to reflect the accurate use of defined terms and provide more specific cross-references; and (3) to make certain minor tariff clarifications. In response to Six Cities, we understand, based on CAISO's answer, that the reference to Section 30 in revised tariff Section 40.6.8(e) is a cross-reference for clarity and not a change to when the generally applicable bidding rules apply instead of an exemption from generated bid insertion, and will therefore not

[88] CAISO Transmittal at 35 (citing Proposed CAISO Tariff, §§ 30.4.1.1.2 and 39.7.1.1.1.2).

[89] CAISO Transmittal at 35 (citing Proposed CAISO Tariff, § 39.7.1.1).

[90] Six Cities Protest at 2-3.

[91] CAISO Answer at 34-35.

require CAISO to delete the reference. We find that the revisions are just and reasonable because they will ensure that negotiated values are based on current information and provide clarity to market participants.

The Commission orders:

(A) CAISO's proposed tariff revisions are hereby accepted in part, subject to condition, and rejected in part, with the accepted revisions to become effective November 1, 2018, as discussed in the body of this order.

(B) CAISO is hereby directed to submit a compliance filing within 30 days of the date of this order, as discussed in the body of this order.

By the Commission.

(S E A L)

Nathaniel J. Davis, Sr.,
Deputy Secretary.

Appendix

Tariff Records Accepted

30.4, Proxy Cost and Registered Cost Methodologies, 9.0.0
30.4.1, Start-Up and Minimum Load Costs, 11.0.0
30.7.9, Format and Validation of Start-Up Costs and Shut-Down Costs, 9.0.0
30.7.10, Format and Validation of Minimum Load Costs, 4.0.0
39.7.1, Calculation of Default Energy Bids, 23.0.0
40.6.4, Use-Limited Resources Additional Availability Requirements, 13.0.0
40.6.8, Use of Generated Bids, 17.0.0
Appendix A, Definitions, 0.0.0

- Minimum Load Opportunity Costs, 0.0.0
- Opportunity Costs, 0.0.0.
- Start-Up Opportunity Costs, 0.0.0
- Transition Cost, 4.0.0
- Use-Limited Resource, 3.0.0
- Variable Energy Opportunity Costs, 0.0.0

Tariff Records Rejected

4.6.4, Identification of Generating Units, 3.0.0
4.7, Relationship Between CAISO and Participating Loads, 3.0.0
4.8, Relationships Between CAISO and Intermittent Resources, 1.0.0
4.9.1, General Nature of Relationship Between CAISO and MSS, 1.0.0
4.12.2, Identification of Resource-Specific System Resources, 1.0.0
4.13.3, Identification of RDRRs and PDRs, 3.0.0
4.17.1, Relationship with Distributed Energy Resource Providers, 1.0.0
8.3.7, AS Bidding Requirements, 5.0.0
8.4.1, Operating Characteristics Required to Provide AS, 14.0.0
30.5.2, Supply Bids, 18.0.0
30.7.3, DAM Validation, 17.0.0
30.7.7, Format and Validation of Operational Ramp Rates, 2.0.0
34.17.1, Resource Constraints, 3.0.0
34.17.5, Inter-Hour Resources Dispatch Without Real-Time Energy Bids, 2.0.0
Appendix A, Definitions, 0.0.0

- Maximum Daily Start-Ups, 1.0.0
- Minimum Down Time (MDT), 1.0.0
- Minimum Run Time, 1.0.0
- Multi-Stage Generating Resources, 5.0.0
- Operating Reserve Ramp Rate, 1.0.0
- Operational Ramp Rates, 1.0.0

- Pump Ramping Conversion Factor, 1.0.0
- Ramp Rate, 4.0.0
- Regulation Ramp Rate, 1.0.0
- Security Constrained Unit Commitment (SCUC), 4.0.0