

March 23, 2018

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

**Re: California Independent System Operator Corporation  
ER18-\_\_\_\_\_-000**

**Filing to Implement Commitment Cost Enhancements Phase 3  
Initiative, Request for Timely Commission Order, and Request  
for Waiver of Notice Requirement**

Dear Secretary Bose:

The California Independent System Operator Corporation (CAISO) submits this tariff amendment to implement its commitment cost enhancements phase 3 (CCE3) initiative.<sup>1</sup> The CAISO proposes to: (1) implement a methodology to allow eligible resources to include opportunity cost adders to their commitment costs and energy bid costs; (2) limit the registered cost methodology to resources with fewer than 12 months of locational market pricing data that seek opportunity cost adders; (3) provide scheduling coordinators the flexibility to submit their preferred unit operating characteristics for use in CAISO markets for parameters, rather than the unit's design capability; (4) permit eligible resources to renegotiate outdated or erroneous negotiated values used for commitment cost and generated energy bids; and (5) clarify the definition of use-limited resources and make other tariff clarifications. These amendments will improve the economic efficiency of the CAISO's markets.

Stakeholders generally support the policies reflected in the tariff amendment. As discussed further below, a few stakeholders object to details concerning the scope of use limits that will be eligible for opportunity cost adders. However, the CAISO believes that it has struck the right balance in this proposal.

---

<sup>1</sup> The CAISO submits this filing pursuant to section 205 of the Federal Power Act (FPA), 16 U.S.C. § 824d. References in this transmittal letter to section numbers are references to sections of the CAISO tariff unless otherwise stated.

The CAISO respectfully requests that the Commission issue an order by May 23, 2018, 61 days from the date of this filing, accepting the tariff revisions contained in this filing effective November 1, 2018. Good cause exists for the Commission to waive its 120-day notice requirement to give the CAISO and market participants regulatory certainty and adequate time to perform the preparatory activities required to implement the tariff revisions. In particular, the CAISO and market participants need the entire period prior to November 1 to develop opportunity costs for all eligible resources.

## I. Executive Summary

During the past several years, the CAISO has conducted a series of stakeholder initiatives to incrementally improve its tariff mechanisms regarding the calculation of: (i) commitment costs, *i.e.*, costs to start up resources (start-up costs) and costs to keep resources running at a minimum operating level (minimum load costs); and (ii) energy bid components that are used in generated energy bids (bids generated when resource adequacy resources fail to submit required bids) and default energy bids (used in local market power mitigation).<sup>2</sup> The CAISO has implemented a series of tariff enhancements to reflect more accurate resource costs for purposes of conducting economically efficient least-cost dispatch.<sup>3</sup>

This tariff amendment, which was developed with stakeholder input over a period of more than two years, will further enhance the economic efficiency of the CAISO's markets. The primary improvement is a proposed methodology that will allow resources to reflect in the CAISO markets, through opportunity costs, eligible limitations on their use that span a time horizon longer than the CAISO's daily markets (*e.g.*, monthly limitations on run-hours due to environmental restrictions).

This filing uses the term opportunity cost in its ordinary economic sense as "the value of a forgone activity or alternative when another item or activity is

---

<sup>2</sup> Under the CAISO tariff, commitment costs are calculated using either a defined "proxy cost" methodology or "registered cost" methodology, the latter methodology being available only to those resources that are unable to operate continuously due to non-economic reasons (*i.e.*, use-limited resources). The proxy cost methodology uses flexible daily commitment cost values while the registered cost methodology uses commitment cost values that are fixed every 30 days and registered in the CAISO's Master File.

<sup>3</sup> See *Cal. Indep. Sys. Operator Corp.*, 128 FERC ¶ 61,282 (2009); *Cal. Indep. Sys. Operator Corp.*, 134 FERC ¶ 61,257 (2011); *Cal. Indep. Sys. Operator Corp.*, 141 FERC ¶ 61,237 (2012); *Cal. Indep. Sys. Operator Corp.*, 145 FERC ¶ 61,082 (2013); *Cal. Indep. Sys. Operator Corp.*, 149 FERC ¶ 61,284 (2014); *Cal. Indep. Sys. Operator Corp.*, 152 FERC ¶ 61,185 (2015). This last cited order is discussed further below.

chosen.”<sup>4</sup> In the electric utility context, an example of a resource with opportunity costs is a natural gas-fired resource with environmental limits on the amount of its emissions. These limits can be translated into a finite number of start-ups, run-hours, and megawatt-hours (MWh).

The CAISO’s current market design provides limited functionality for managing the commitment and dispatch of such resources because it restricts participants’ ability to reflect the opportunity costs associated with such limitations. Under the current CAISO tariff, use-limited resources often elect the registered cost methodology for reflecting their commitment costs because its cap provides greater headroom than the proxy cost option cap for resources to reflect opportunity costs regarding their monthly and annual use limitations. The cap under the registered cost methodology is set at 150 percent of projected proxy costs; whereas, the proxy cost methodology has a 125-percent bid cap. However, because the registered cost methodology is locked in 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 and daily adjustments to the bid cap to reflect gas price volatility. As a result, the CAISO’s commitment of use-limited resources subject to the registered cost methodology is often inefficient compared with the CAISO’s commitment of use-limited resources subject to the proxy cost methodology.

In addition, scheduling coordinators sometimes manage their resources’ use limitations by bidding the resources into the CAISO market for only a subset of hours. This allows them to manage their resources’ use limitations by preventing the CAISO market from dispatching the resources too often. This method of managing use limitations did not create operational issues for the CAISO historically because market participants could reliably predict when the grid needed their resources to meet peak load. Now, however, with the influx of variable energy resources on the system, the CAISO’s need for supply has become increasingly unpredictable, making use-limited resources potentially needed at any time. The negative impact of market inefficiencies associated with the current commitment cost methodologies and increased resource variability has been magnified by the growing number of variable energy resources and use-limited resources on the system. Use-limited resources have ballooned to about 35,000 megawatts of total capacity and represent more than 50 percent of

---

<sup>4</sup> See <https://www.encyclopedia.com/social-sciences-and-law/economics-business-and-labor/economics-terms-and-concepts/opportunity-cost>. The Commission and its Staff often use the term in the same sense. See, e.g., *Price Formation in Organized Wholesale Electricity Markets – Staff Analysis of Shortage Pricing in RTO and ISO Markets*, Docket No. AD14-14-000, at 5 (Oct. 21, 2014) (“The marginal cost of providing operating reserves is principally opportunity costs – the net revenue that the resource could have received by selling energy instead of providing reserves.”).

the capacity provided in the CAISO balancing authority area.

The CAISO proposes to address these issues by providing a mechanism to calculate resource-specific opportunity costs associated with eligible use limitations and to reflect those opportunity costs in its market processes. If a resource meets the requirements set forth in this filing to be a use-limited resource and has a sufficient energy price history, the resource will be eligible to submit a request to include an opportunity cost adder in its market bids for start-up cost and minimum load costs.<sup>5</sup> Opportunity costs for energy (MWh) limits will be reflected in generated energy bids, such as generated bids for resource adequacy resources, and default energy bids used in local market power mitigation.<sup>6</sup> Reflecting opportunity costs in such bids will enable the CAISO market to (1) optimize its use of use-limited resources by recognizing their limitations that extend beyond the market's daily horizon and (2) commit and run a resource at the times the resource is valued most. Introducing opportunity costs will facilitate a more efficient market-based solution because the CAISO will commit and dispatch use-limited resources during optimal periods after taking all of the resources' costs, including their opportunity costs, into account. This improvement in efficiency will benefit the markets and thus also benefit electricity customers.

The CAISO will implement two processes for developing opportunity costs: the calculated process and the negotiated process. The calculated process will use the results of an opportunity cost calculator that will be the preferred approach for resources with limits that can be easily translated into start-up, run-hour, or MWh limitations. The opportunity cost calculator was developed for natural gas-fired resources and must be used whenever feasible. When this approach is not feasible, the CAISO has a negotiated opportunity cost process. The CAISO proposes to file all opportunity cost component rates with the Commission as part of its existing monthly obligation under the tariff to file reference values.

---

<sup>5</sup> The CAISO's policy is that economic contractual limits do not make a resource use-limited and therefore, such resources are not eligible for opportunity costs. However, the CAISO is proposing one limited exception involving a small set of existing contracts and only for a period of three years after the tariff revisions go into effect. The CAISO's proposal strikes a reasonable ground between the position of some stakeholders that no contractual limitations should qualify for use-limited status and the position of other stakeholders that contractual limitations should qualify throughout the entire life of a contract.

<sup>6</sup> Use-limited resources that are eligible for opportunity costs and have not established 12 months of energy price history will continue to have the option to elect the registered cost methodology instead of the proxy cost methodology until sufficient data is available, in which case they must start the process for establishing eligibility for an opportunity cost adder or move to the proxy cost methodology.

The proposed tariff revisions will also allow for additional flexibility regarding certain characteristics of resources participating in the CAISO markets. The current tariff requires market participants to provide the CAISO with information regarding the operational and technical characteristics of resources registered in the CAISO database of resource information, known as the Master File. The CAISO proposes to clarify the information requirements applicable to those characteristics, which the CAISO will now call “design capability values.” The CAISO also proposes to give scheduling coordinators the new flexibility to register alternative “market values” meeting specified requirements for several operating characteristics in the Master File, in addition to the unit’s design capabilities. The CAISO will use these market values during market operations except as otherwise set forth in the tariff. Providing this flexibility will especially benefit market participants by allowing them to reflect contractual limitations for start-up costs that are not eligible for opportunity costs.

In addition, CAISO proposes that market participants have flexibility to register market value ramp rates (operational, operating reserve, and regulation ramp rates) in addition to design capability ramp rates. The CAISO is, however, eliminating the option for daily bidding of ramp rates, which, though available, has not been utilized by market participants.

Finally, the CAISO proposes other tariff modifications and clarifications to improve tariff administration in the area of negotiated cost values and to make certain ministerial clarifications.

## **II. Background**

### **A. Relevant CAISO Tariff Provisions**

#### **1. Commitment and Compensation of Generating Resources**

Pursuant to its tariff, the CAISO optimizes economic commitment and dispatch of generating resources in its markets based on resources’ energy bids and submitted commitment costs. Besides the market participant-submitted energy bids, the CAISO market also uses default energy bids for local market power mitigation and generated bids.

##### **a. Commitment Costs**

In the day-ahead market, (*i.e.*, the integrated forward market (IFM) and the residual unit commitment (RUC) process), the CAISO commits long-start units through the IFM and RUC and publishes a financially binding day-ahead

schedule for IFM awards.<sup>7</sup> In making commitment decisions, the market considers the costs of energy bids and the costs of starting up resources (start-up costs), the costs of running resources at their minimum operating levels (minimum load costs),<sup>8</sup> and transition costs for resources that can operate in different configurations.<sup>9</sup>

All resources, except use-limited resources whose scheduling coordinators elect the registered cost methodology described below, bid their start-up costs, minimum load costs, and transition costs pursuant to the proxy cost methodology. To the extent such resources do not recover the sum of their bid-in costs through the market, *i.e.*, commitment costs and energy, ancillary services, and residual unit commitment costs, they recover them through a bid cost recovery uplift payment.<sup>10</sup> Resources subject to the proxy cost methodology submit daily bids for their start-up costs, minimum load costs, and transition costs that are between zero and 125 percent of the calculated proxy cost (the proxy cost bid cap), which is largely based on daily natural gas prices.<sup>11</sup> Thus, the proxy cost methodology provides resources with daily bidding flexibility, and the CAISO adjusts the proxy cost bid cap each day to reflect gas price volatility.

Alternatively, scheduling coordinators for use-limited resources can elect the registered cost to register fixed commitment cost values of their choosing in the Master File for 30 days.<sup>12</sup> The registered costs are subject to a cap set at 150 percent of the calculated projected proxy cost (the registered cost cap), which includes monthly natural gas futures prices.<sup>13</sup> The registered cost methodology differs from the proxy cost methodology because registered cost resources have no bidding flexibility and cannot reflect daily gas price volatility for the 30-day period. As a result, CAISO commitment of use-limited resources

---

<sup>7</sup> The real-time market commits resources in the short-term unit commitment and the real-time unit commitment processes every 15 minutes.

<sup>8</sup> See existing tariff section 31.3; tariff appendix A, existing definitions of “Start-Up Cost” and “Minimum Load Costs”.

<sup>9</sup> The tariff refers to these resources as multi-stage generating (MSG) resources. See tariff appendix A, existing definitions of “Multi-Stage Generating Resources” and “Transition Cost”.

<sup>10</sup> Existing tariff sections 30.4.1.1.1(a), 30.4.1.1.2(a). Among these cost components are adders or interim adders for major maintenance expenses and custom operations and custom operation and maintenance adders, each of which the CAISO and the scheduling coordinator can negotiate. See existing tariff sections 30.4.1.1.4 and 39.7.1.1.2.

<sup>11</sup> Existing tariff sections 30.4.1.1.1(b), 30.4.1.1.2(b), 30.4.1.1.5, 30.7.9(c), and 30.7.10.

<sup>12</sup> Existing tariff section 30.4.1.2.

<sup>13</sup> Existing tariff section 39.6.1.6. Projected proxy cost is different from proxy cost and is determined using a different calculation. Both proxy cost and projected proxy cost are calculated using various inputs in addition to natural gas prices.

subject to the registered cost methodology is often inefficient compared with CAISO commitment of use-limited resources subject to the proxy cost methodology.

Although the CAISO tariff specifically provides for opportunity costs in other contexts,<sup>14</sup> the tariff does not expressly include opportunity costs as an adder to the commitment costs or mitigated energy bid costs of use-limited resources.<sup>15</sup> Instead, until the CAISO could develop and implement such an adder, the registered cost methodology would allow use-limited resources to reflect opportunity costs associated with their use limitations under the headroom afforded by the 150-percent cap.<sup>16</sup>

---

<sup>14</sup> See, e.g., existing tariff section 11.10.1.4 (“The total payments for each Scheduling Coordinator for Voltage Support in any Settlement Period shall be the sum of the opportunity costs of limiting Energy output to enable reactive energy production in response to a CAISO instruction. The opportunity cost shall be calculated based on the product of the Energy amount that would have cleared the market at the price of the Resource-Specific Settlement Interval LMP minus the higher of the Energy Bid price or the Default Energy Bid price.”); existing tariff section 27.1.2.2 (“The Ancillary Services Shadow Price . . . includes the foregone opportunity cost of the marginal resource, if any, for not providing Energy or other types of Ancillary Services the marginal resource is capable of providing in the relevant market. . . . The foregone opportunity cost of Energy for this purpose is measured as the positive difference between the IFM or FMM LMP at the resource’s Pricing Node and the resource’s Energy Bid price.”); existing tariff section 30.5.2.7.1 (“Scheduling Coordinators may include inter-temporal opportunity costs in their Regulation capacity bids, but these inter-temporal opportunity costs must be verifiable.”).

<sup>15</sup> The tariffs and business practice manuals of the other Independent System Operators (ISOs) and Regional Transmission Organizations (RTOs) include mechanisms permitting opportunity cost recovery as part of the mitigation procedures in their energy markets. See PJM Interconnection, L.L.C. (PJM) Operating Agreement, schedule 2, at section 1.1(a); PJM Manual 15: Cost Development Guidelines, at section 12 (Revision 29) (PJM Manual 15); New York Independent System Operator, Inc. (NYISO) Manual 34: Reference Level Manual, at section 9.1 (Feb. 2016) (referencing sections 23.3.1.4.1.3, 23.3.1.4.2.1, and 23.4.2.1 of attachment H to the NYISO Market Administration and Control Area Services Tariff); ISO New England Inc. Market Rule 1, at sections III.A.7.5 and III.A.7.5.1; Midcontinent Independent System Operator, Inc. Tariff, at section 64.1.4(a); Southwest Power Pool, Inc. (SPP) Open Access Transmission Tariff (OATT), attachment AF, at section 3.2(D); SPP Market Protocols, appendix G, at section G.11 (Feb. 8, 2018).

<sup>16</sup> See transmittal letter for CAISO tariff amendment, Docket No. ER15-15-000, at 13 (Oct. 1, 2014) *Cal. Indep. Sys. Operator Corp.*, 149 FERC ¶ 61,284, at P 10 (“CAISO explains that the opportunity cost for [use-limited resources] can be greater than the proposed 125 percent [proxy cost bid] cap. CAISO submits that it is therefore appropriate for use-limited resources to retain the registered cost methodology, with its existing 150 percent cap, until CAISO can implement new provisions to enable use-limited resources to bid their opportunity costs directly”).

## **b. Default Energy Bids**

The CAISO uses default energy bids to mitigate bids of resources subject to local market power mitigation.<sup>17</sup> When a resource's bid is mitigated, the CAISO systems substitute the default energy bid for the resource's bid in the market clearing process and use the default energy bid to determine the resource's bid cost recovery compensation.<sup>18</sup> Default energy bids also factor into the settlement of residual imbalance energy and exceptional dispatches in some circumstances.<sup>19</sup>

Each scheduling coordinator can choose one of three options as its preferred option for calculating default energy bids: (1) the variable cost option; (2) the negotiated rate option; or (3) the locational marginal price option.<sup>20</sup> Apart from potentially factoring opportunity costs into the values negotiated under the negotiated rate option, use-limited resources have no means of directly reflecting opportunity costs in their default energy bids.

## **c. Generated Bids**

The CAISO generates cost-based bids using the same cost components and resource specific information used in the variable cost default energy bid when a scheduling coordinator does not submit a bid for a resource adequacy resource subject to a must-offer requirement or pursuant to the generally applicable scheduling and bidding rules set forth in the CAISO tariff and the business practice manual.<sup>21</sup> Use-limited resource adequacy resources are exempt from the resource adequacy must-offer bid generation rules.<sup>22</sup>

---

<sup>17</sup> Existing tariff section 39.7.1, *et seq.*

<sup>18</sup> Existing tariff section 11.8, *et seq.*

<sup>19</sup> Existing tariff sections 11.5.5 and 11.5.6.

<sup>20</sup> Existing tariff sections 39.7.1 through 39.7.1.3. Further, a scheduling coordinator for a frequently mitigated unit has a fourth option for calculating default energy bids, the frequently mitigated unit option. Existing tariff section 39.7.1.4. The CAISO may also establish temporary default energy bids. Existing tariff section 39.7.1.5.

<sup>21</sup> Existing tariff sections 30.7.3.4 and 40.6.8; tariff appendix A, existing definition of "Generated Bid".

<sup>22</sup> Existing tariff section 40.6.8(e).



## 2. Use-Limited Resources

The 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.”<sup>23</sup> Qualifying use limitations are often a month or a year in duration.

An example of such a use limitation would be an environmental restriction that limits a resource’s run-hours over a single month to only 200 hours. The CAISO’s market commitment decisions do not explicitly recognize this monthly use limitation because the market optimization tool makes unit commitment decisions over its various horizons that look ahead one day at the most; they cannot take into account that dispatching the use-limited resource for a particular day may reduce or eliminate its ability to run later in the month, when its dispatch may be optimal for the market. For instance, if the use-limited resource in the example exhausted its monthly use limitation by running for a total of 200 hours on days with lower-priced hours during the first few weeks of the month, the resource would have an opportunity cost to the extent it had no run-hours remaining to operate on days with higher-priced hours occurring near the end of the month. The market would put the most economic value on dispatching the resource during those days at the end of the month, if it were available. However, the market cannot optimize the use of the resource over the horizon of the limitation because it cannot reserve run-hours for the times of greatest need. A way to address this issue is to include the opportunity cost for the foregone run-hours in the resource’s market bid.

Use-limited resource adequacy resources subject to must-offer requirements are obligated to bid into the CAISO market based on their availability and for specified availability assessment hours in accordance with those requirements.<sup>24</sup> To the extent use-limited resources fail to bid during the availability assessment hours, they are subject to penalties under the CAISO’s resource adequacy availability incentive mechanism (RAAIM).<sup>25</sup> Scheduling coordinators for such resources sometimes manage their use limitations by bidding the resources into the market only to the extent needed to avoid incurring RAAIM penalties (*i.e.*, only for the availability assessment hours), and the market then sub-optimally dispatches them as discussed above. Further, scheduling coordinators for use-limited resources that are not resource adequacy resources, and thus are not subject to must-offer requirements or RAAIM penalties, sometimes manage their use limitations by bidding them into the market for only

---

<sup>23</sup> Tariff appendix A, existing definition of “Use-Limited Resource”.

<sup>24</sup> Existing tariff section 40.6.4.3, *et seq.*

<sup>25</sup> Existing tariff section 40.9, *et seq.*

a subset of hours as discussed above, which has created operational issues for the CAISO now that the CAISO's need for supply is increasingly unpredictable.

The current definition of use-limited resources captures a broad range of resources, including variable energy resources, that essentially are not available 24 hours a day and, therefore, cannot be subject to the resource adequacy generated bidding rules. In addition, the tariff also provides that certain types of resources are deemed to be use-limited resources and not required to apply for use-limited status.<sup>26</sup> Scheduling coordinators for other types of resources may request that the CAISO grant use-limited status for such resources pursuant to an application process.<sup>27</sup> Although the CAISO will continue to exempt resources from generated bidding rules if they cannot provide 24-hour availability, the CAISO is proposing to modify the definition of a use-limited resource to include those resources that have limits that can be translated into opportunity costs.

In 2015, the CAISO filed a tariff amendment that included proposed revisions to the definition of, and application process to become, a use-limited resource. The CAISO proposed to change the name of the defined term to "use-limited capacity" and to state in the definition that the CAISO will consider opportunity costs for use-limited capacity. The CAISO stated that it would develop a methodology for determining opportunity costs in the then-upcoming CCE3 initiative.<sup>28</sup> Several parties submitted comments and protests of the tariff amendment asserting that the proposed definition of use-limited capacity was too narrow in that it could exclude design considerations, environmental restrictions, and contractual limitations that parties argued should qualify a resource for use-limited status and eligibility for opportunity costs.

The Commission rejected the tariff revisions regarding use-limited resources "without prejudice to CAISO submitting a new section 205 filing that provides a comprehensive explanation of what it is proposing to change, how the changes impact the various categories of market participants, and the impact on customers."<sup>29</sup> The Commission found that "there is a lack of clarity as to what capacity will be deemed use-limited under the proposed new definition" and that

---

<sup>26</sup> Existing tariff section 40.6.4.1. Pursuant to that section, hydroelectric generating units, proxy demand resources, reliability demand response resources, and participating load, including pumping load, are deemed to be use-limited resources. Thus, these types of resources are currently exempt from the generated bid rules described above by virtue of the exemption for use-limited resources contained in existing tariff section 40.6.8(e).

<sup>27</sup> Existing tariff section 40.6.4.1.

<sup>28</sup> Transmittal letter for CAISO tariff amendment, Docket No. ER15-1875-000, at 10-16 (June 5, 2015). This tariff amendment concerned tariff revisions proposed in the commitment cost enhancements phase 2 (or CCE2) initiative.

<sup>29</sup> *Cal. Indep. Sys. Operator Corp.*, 152 FERC ¶ 61,185, at P 39 (CCE2 Order).

the CAISO should “identify a list of limitations to be included in the tariff,” as well as “specific examples” of qualifying limitations.<sup>30</sup> The Commission also stated that “CAISO has failed to discuss in sufficient detail the interaction of contractual limitations with economic and non-economic limitations,” including discussing the effects of economic limitations on reliability.<sup>31</sup> The Commission found that “CAISO removed clarifying language from the tariff regarding the use-limited registration process without any justification.”<sup>32</sup> Further, the Commission stated that “it is unclear from the filing what the CAISO means when it states it will ‘consider opportunity costs’ in the proposed definition for use-limited resources.”<sup>33</sup> Finally, the Commission stated that it expected “that any such filing would include a detailed explanation of how it will implement the changes given the protests raised herein.”<sup>34</sup> The CAISO addresses each of these matters below.<sup>35</sup>

### 3. Data Required for Generating Resources

The existing tariff requires each generator participating in the CAISO markets to provide data identifying each of its resources and such information regarding the capacity and operating characteristics of the resources as the CAISO may request from time to time. The CAISO maintains its Master File as an electronic repository for such data. The tariff requires that all information provided to the CAISO regarding the operational and technical constraints of a resource registered in the Master File be accurate and based on the resource’s physical characteristics (except for the pump ramping conversion factor, which is configurable).<sup>36</sup>

---

<sup>30</sup> *Id.* at PP 34-35, 38.

<sup>31</sup> *Id.* at P 35.

<sup>32</sup> *Id.* at PP 34, 37. In addition, the Commission found that “CAISO has not sufficiently explained or justified the potential effect on market participants of changing from a definition of use-limited resource to use-limited capacity.” *Id.* at P 34.

<sup>33</sup> *Id.* at P 36.

<sup>34</sup> *Id.* at P 39; *see also id.* at PP 18-24 (summarizing the comments and protests). Further, the Commission found that some of the comments were beyond the scope of the CCE2 proceeding. *Id.* at PP 25-26, 40-41.

<sup>35</sup> *See infra* section III.A(3) of this transmittal letter.

<sup>36</sup> Existing tariff section 4.6.4; tariff appendix A, existing definition of “Master File”. For the sake of clarity, this transmittal letter distinguishes between existing tariff provisions (*i.e.*, provisions in the current CAISO tariff), new tariff provisions (*i.e.*, new provisions that the CAISO proposes to add to the tariff in this filing), revised tariff provisions (*i.e.*, existing tariff provisions that the CAISO proposes to revise in this filing), and deleted tariff provisions (*i.e.*, existing tariff provisions that the CAISO proposes to delete in this filing).

#### 4. Use of Ramp Rates in Daily Bids

Under the existing tariff, a resource can submit any of three types of daily bids: energy bids, ancillary services bids, and RUC availability bids.<sup>37</sup> A component of the daily bids is the ramp rate of the resource.<sup>38</sup> The ramp rate indicates the resource's operational ramp rate, operating reserve ramp rate, and regulation ramp rate.<sup>39</sup>

##### B. Stakeholder Process

The stakeholder process for the CCE3 initiative that resulted in this tariff amendment lasted more than two years. The CAISO and stakeholders were mindful throughout the process of the need to develop changes regarding use-limited resources and opportunity costs that addressed the concerns raised in the CCE2 Order. This extensive and robust stakeholder process included the following activities:

- A series of five policy papers issued by the CAISO;
- The development of draft tariff provisions and revised draft tariff provisions;
- Six conference calls with stakeholders to discuss the CAISO policy papers and the draft tariff provisions;
- Three technical workshops with stakeholders to address certain issues in the initiative; and
- Opportunities at each step of the initiative for stakeholders to submit written comments.<sup>40</sup>

---

<sup>37</sup> Existing tariff section 30.2.

<sup>38</sup> Existing tariff sections 30.5.2.2 through 30.5.2.4, 30.5.2.6, and 30.5.2.7.

<sup>39</sup> Tariff appendix A, existing definitions of "Ramp Rate", "Operational Ramp Rate", "Operating Reserve Ramp Rate", and "Regulation Ramp Rate".

<sup>40</sup> Materials related to this stakeholder process are available at <http://www.caiso.com/informed/Pages/StakeholderProcesses/CommitmentCostEnhancementsPhase3.aspx>. The materials include the Draft Final Proposal that the CAISO issued in the stakeholder process and the Final Opinion on Commitment Cost Bidding Improvements issued by the CAISO Market Surveillance Committee, which are provided in attachments C and D, respectively, to this filing. The CAISO also provides a list of key dates in the stakeholder process for this tariff amendment in attachment F to this filing.

The CAISO Governing Board (Board) authorized the preparation and filing of this tariff amendment at its March 25, 2016 meeting.<sup>41</sup>

Stakeholders for the most part agreed with the proposals reflected in the tariff amendment. The CAISO addresses specific issues raised by stakeholders in the relevant sections of this transmittal letter.<sup>42</sup>

### **III. Proposed Tariff Revisions**

#### **A. Revisions to Definition of Use-Limited Resource**

The CAISO's current market design provides only limited functionality to address the dispatch of use-limited resources. As explained above,<sup>43</sup> the CAISO's market commitment decisions cannot explicitly recognize use limitations extending beyond a day, which means the market optimization tool cannot optimally dispatch resources with use limitations lasting a month or a year. Thus, the market may dispatch use-limited resources at non-optimal times potentially resulting in the resources not being available for dispatch when the system most needs them. The sole means a use-limited resource has to manage its monthly or annual use limitations by including opportunity costs in bids is to elect the registered cost methodology with its 150-percent cap. But the registered cost methodology – in contrast with the proxy cost methodology – does not provide resources with bidding flexibility and cannot reflect gas price volatility. Therefore, CAISO commitment of use-limited resources subject to the registered cost

---

<sup>41</sup> Materials related to the Board's authorization are available at <http://www.caiso.com/informed/Pages/BoardCommittees/BoardGovernorsMeetings.aspx>. The materials include a memorandum to the Board (Board Memorandum), which is provided in attachment E to this filing.

<sup>42</sup> The stakeholder initiative also addressed changes to the current treatment of outage cards, which in specified circumstances may exempt use-limited resources from the CAISO's resource adequacy availability incentive mechanism as set forth in the business practice manual. See transmittal letter for tariff amendment to implement phase 1A of reliability services initiative, Docket No. ER15-1825-000, at 45-46 (May 25, 2015) (describing the current use of outage cards); Draft Final Proposal at 41-44 (describing changes to how outage cards are used). Because the treatment of outage cards is addressed solely in the business practice manual, no tariff revisions are required for the outage card changes. Also, at one time the CCE3 initiative was part of another CAISO initiative regarding bidding rules enhancements, which addressed issues pertaining to (1) the recovery of commitment costs that exceed the proxy cost bid cap, (2) bidding of real-time market commitment costs, and (3) changes to natural gas transportation rates and generator auxiliary energy electric prices. See Board Memorandum at 6-7. Subsequently the CAISO split off CCE3 to become a separate initiative, leaving the three issues listed above as part of the bidding rules enhancements initiative. See transmittal letter for tariff amendment to implement bidding rules enhancements initiative, Docket No. ER16-2445-000, at 8-16, and attachment C thereto at 17-21 (Aug. 19, 2016); *Cal. Indep. Sys. Operator Corp.*, 157 FERC ¶ 61,138 (2016) (accepting tariff revisions for bidding rules enhancements initiative).

<sup>43</sup> See *supra* sections II.A(1)-(2) of this transmittal letter.

methodology is often inefficient compared with CAISO commitment of resources subject to the proxy cost methodology. For example, daily gas price volatility up or down cannot be reflected under the registered cost methodology, resulting in under- or over-procurement of use-limited resources.

Also, scheduling coordinators sometimes manage their resources' use limitations by bidding the resources into the CAISO market for only a subset of hours so the CAISO market does not run their resources too often. This method of managing use limitations did not necessarily create operational issues for the CAISO in the past because market participants could reliably predict when the grid needed their resources to meet peak load. Traditionally, the highest prices and need predictably occurred during on-peak hours. However, the increasing number of variable energy resources on the system has made supply on the CAISO system increasingly unpredictable and resulted in use-limited resources potentially being needed at any time. The negative impact of these market inefficiencies has been magnified as the number of use-limited resources and the megawatts they provide continues to grow. Use-limited resources began as an exceptional and limited category of resource adequacy resources under the CAISO tariff but have since ballooned to about 35,000 megawatts of total capacity, which represents more than 50 percent of the capacity provided in the CAISO markets. Much of this increase is due to growing amounts of supply to meet Renewables Portfolio Standard (RPS), which currently require retail sellers and publicly owned utilities to procure 50 percent of their electricity from eligible renewable energy resources by 2030.<sup>44</sup>

The problems with the existing rules for use-limited resources can and should be addressed by a market-based solution that enables such resources to bid into the markets more frequently, while only being committed and dispatched when it is optimal. Therefore, the CAISO proposes to replace the existing process with a new registration and validation process that focuses on resources with use-limiting attributes that create opportunity costs that cannot be optimized by the CAISO's current market processes.<sup>45</sup> With an accurate opportunity cost

---

<sup>44</sup> See <http://www.energy.ca.gov/portfolio/>.

<sup>45</sup> New tariff sections 30.4.1.1.6 through 30.4.1.1.6.1.1; deleted tariff section 40.6.4.1; tariff appendix A, revised definition of "Use-Limited Resource". In tandem with the deletion of tariff section 40.6.4.1, the CAISO also proposes to revise existing tariff section 40.6.8(e), which specifies the types of resources that are exempt from CAISO insertion of a generated bid unless the resource submits an energy bid and fails to submit an ancillary service bid. The exemption in section 40.6.8(e) extends to use-limited resources, but with the deletion of section 40.6.4.1 that exemption will no longer apply to the types of resources that were deemed to be use-limited resources pursuant to section 40.6.4.1 (*i.e.*, hydroelectric generating units, proxy demand resources, reliability demand response resources, and participating load, including pumping load). Therefore, the CAISO proposes to revise section 40.6.8(e) to maintain the generated-bid exemption for those types of resources. The table shown on page 16 of the Draft Final Proposal

adder, use-limited resources will be able to submit bids for all hours.

If a resource demonstrates that it meets the revised definition of a use-limited resource, it will be eligible to demonstrate that it should receive an opportunity cost adder, over and above its other commitment costs and energy bid costs.<sup>46</sup> If the use-limited resource has a non-zero opportunity costs, the scheduling coordinator will have additional headroom to submit bids reflecting the opportunity costs, and the CAISO will include opportunity costs in generated bid components and default energy bids.

## 1. Implementation of Opportunity Cost Adders

As discussed above, the main feature of the CAISO's proposed changes to use-limited resource status is to permit more efficient management of non-economic use limitations by accounting for resources' opportunity costs. Use-limited resources currently have no direct means of reflecting use limitations that span time horizons longer than the CAISO market looks ahead (*i.e.*, a maximum of one day). To address this issue, the CAISO proposes to include in bids the opportunity costs related to resources' commitment costs and mitigated energy bid costs under the CAISO tariff.<sup>47</sup>

The CAISO will require all use-limited resources that have established a sufficient energy price history to be subject to the proxy cost methodology and, if they meet the requirements described below, they can receive opportunity cost adders associated with their monthly and yearly use limitations in the CAISO markets.<sup>48</sup> Determining an opportunity cost for each qualifying limitation that a use-limited resource has that can be reflected in market bids will facilitate a more efficient market-based solution for use-limited resources. The opportunity cost adder will capture the value of a use-limited resource's limited availability, so that the use limitations are not reached until the end of the monthly or annual use

---

compares the treatment of such resources currently with how they will be treated after they are no longer deemed to be use-limited.

<sup>46</sup> The next section of this transmittal letter describes how the CAISO will determine the opportunity cost adders.

<sup>47</sup> As explained above in section II.A(2) of this transmittal letter, the tariffs and business practice manuals of the other ISOs and RTOs include mechanisms permitting opportunity cost recovery.

<sup>48</sup> As discussed below, the CAISO does not propose to allow use-limited resources that are subject to the registered cost methodology to recover opportunity costs. However, the 150-percent registered cost cap will continue to provide sufficient headroom for a use-limited resource to reflect the opportunity costs under the cap until the resource develops a history of 15-minute LMPs for energy and thereby becomes subject to the proxy cost methodology under this tariff amendment. See *infra* section III.B of this transmittal letter.

limitation period and the resource is dispatched when it is valued most. Receiving an opportunity cost 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, which also provides daily bidding flexibility and a proxy cost bid cap that the CAISO adjusts each day to reflect gas price volatility.

Also, the opportunity cost adder will allow resource adequacy resources with use limits to submit bids in hours other than their availability assessment hours and will encourage bidding outside of a limited subset of hours by use-limited resources that are not resource adequacy resources.<sup>49</sup> As a result, the market will 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. Further, the opportunity cost adder will create an incentive for use-limited resources to reflect opportunity costs in bids so that the limitations are not prematurely reached, because it will allow the resources to receive higher revenues by reserving their use for when system needs and prices are expected to be the greatest. These benefits will only increase as California's RPS continues to incent more renewable resources to enter the CAISO markets. Dispatching use-limited resources when they are valued most and enabling them to bid continuously and flexibly will make the markets more efficient, benefiting both customers and suppliers.

A use-limited resource will be eligible for an opportunity cost adder for any or all of the following types of opportunity costs, provided the scheduling coordinator supplies adequate supporting documentation:

- Start-up opportunity costs, which consist of the estimated profits a use-limited resource with a limitation on its number of starts foregoes, if it had one less start in the applicable time period.<sup>50</sup> Use-limited resources will recover start-up opportunity costs as an adder to their start-up costs, and the adder will not be subject to the existing 125-percent proxy cost bid cap that applies to other types of start-up costs.<sup>51</sup> Transition costs for use-limited resources that are MSG resources will also include a start-up opportunity cost adder not subject to the proxy cost bid cap.<sup>52</sup>

---

<sup>49</sup> The CAISO will ensure that any resource that has exhausted its monthly or annual use limitations does not continue to be shown in the CAISO's systems as a resource adequacy resource.

<sup>50</sup> Tariff appendix A, definition of new term "Start-Up Opportunity Costs".

<sup>51</sup> Revised tariff sections 30.4.1.1.1(a), 30.4.1.1.2(a), and 30.7.9(c).

<sup>52</sup> Revised tariff section 30.4.1.1.5; tariff appendix A, revised definition of "Transition Cost".



- Minimum load opportunity costs, which consist of the estimated profits a use-limited resource with a limitation on its number of run-hours foregoes if it had one less run-hour in the applicable time period.<sup>53</sup> Use-limited resources will recover minimum load opportunity costs as an adder to their minimum load costs, with the adder not subject to the proxy cost bid cap.<sup>54</sup>
- Variable energy opportunity costs, which consist of the estimated profits a use-limited resource with a limitation on its energy output foregoes if it had one less megawatt-hour of energy output in the applicable time period.<sup>55</sup> Use-limited resources will recover variable energy opportunity costs as an adder to their default energy bids under the variable cost methodology.<sup>56</sup>

A scheduling coordinator for a use-limited resource may seek to establish such opportunity costs for any limitation(s) that satisfy the criteria for a use-limited resource, apply for period(s) longer than the daily time horizon considered by the day-ahead market,<sup>57</sup> and can be reflected in a monthly, annual, and/or rolling 12-month period. If a use-limited resource cannot satisfy all of these requirements, it will not be eligible for an opportunity costs adder.<sup>58</sup>

Opportunity costs adders will not be available to a use-limited resource that has only a daily limitation; although, the resource can still be considered use-limited. This applies to only a handful of the existing use-limited resources in the CAISO markets. The CAISO real-time market is currently unable to fully optimize resources over a day because it only looks out over four and a half hours. The CAISO is concerned that setting opportunity costs associated with daily limitations at the maximum daily opportunity cost from all days within a month could result in excessive headroom in some months, but in other months the headroom may not be high enough to be effective. In lieu of receiving opportunity costs, a resource can manage the daily limitations through tools

---

<sup>53</sup> Tariff appendix A, definition of new term “Minimum Load Opportunity Costs”.

<sup>54</sup> Revised tariff sections 30.4.1.1.1(a), 30.4.1.1.2(a), 30.7.10.1.

<sup>55</sup> Tariff appendix A, definition of new term “Variable Energy Opportunity Costs”. The CAISO also proposes to add to tariff appendix A the new term “Opportunity Costs,” defined as start-up opportunity costs, minimum load opportunity costs, or variable energy opportunity costs.

<sup>56</sup> Revised tariff section 39.7.1.1; new tariff section 39.7.1.1.3.

<sup>57</sup> For example, a long start unit with a monthly limitation would satisfy this requirement to recover opportunity costs, because the day-ahead market does not optimize over the month. But a long start unit with a daily limitation would not satisfy the requirement, because the time horizon of the day-ahead market is 24 hours, *i.e.*, the same length as (but not longer than) the daily limitation.

<sup>58</sup> New tariff section 30.4.1.1.6.1.2.

currently available to scheduling coordinators and CAISO grid operators. Scheduling coordinators can use daily values registered in the Master File (e.g., maximum daily starts, maximum daily megawatt-hours, minimum up time, and minimum down time) to ensure that use-limited resources do not exceed the daily limitations. Also, CAISO grid operators can ensure that use-limited resources with daily limitations are available later in the day when they are most needed by blocking sub-optimal commitment instructions that would ultimately make the resources unavailable when needed most, and by issuing exceptional dispatch instructions to the resources to remain on-line (if they have limits on their number of starts) to ensure they are still available to the market when they are most needed. Through these measures, scheduling coordinators and grid operators can manage the relatively small number of daily limitations of use-limited resources.

Based on the documentation submitted by the resource's scheduling coordinator, the CAISO will evaluate whether it can determine an opportunity cost using its opportunity cost calculator or whether the opportunity cost must instead be established for the limitation pursuant to the negotiation process as described below. The CAISO's opportunity cost calculator was developed to apply to natural gas-fired resources whose limits can be translated into start-ups (and transition costs for multi-stage generators), run-hours, or MWh limits. The CAISO will use the opportunity cost calculator rather than negotiate the opportunity cost whenever feasible. Once an opportunity cost is developed using either approach, it (and the resulting methodology for any negotiated opportunity cost) will remain in place unless and until the resource's scheduling coordinator submits updated documentation, either to establish a new limitation or to modify an existing limitation, in which case the scheduling coordinator can request reconsideration.<sup>59</sup>

The following types of use-limited resource capacity are not eligible for an opportunity cost adder under the new tariff provisions: the capacity of a condition 2 reliability must-run (RMR) unit; a reliability demand response resource; regulatory must-take capacity; and any other type of use-limited resource to the extent it has a limitation that satisfies the relevant requirements but applies for a period less than or equal to the time horizon considered in the day-ahead market.<sup>60</sup> Reliability demand response resources are not eligible because their capacity is required to bid at or near the CAISO's energy bid cap and, therefore, such bids implicitly reflect the resource's opportunity costs. In addition, the capacity of condition 2 RMR units is not eligible because these resources are

---

<sup>59</sup> New tariff section 30.4.1.1.6.1.2. Any opportunity costs reflected in generated bids for energy will be calculated or negotiated pursuant to the same tariff provisions described above. See revised tariff section 40.6.8(d).

<sup>60</sup> New tariff section 30.4.1.1.6.1.2.

dispatched for local reliability and non-competitive congestion based on RMR contract costs. Regulatory must-take capacity is self-scheduled to meet a host industrial process and, therefore, is not optimized in the CAISO markets.

For use limitations that the CAISO determines opportunity costs using the opportunity cost calculator, the CAISO will calculate and update its most recent opportunity cost calculations on a monthly basis, unless circumstances prevent it or suggest a basis to update the calculations more frequently. In those cases, the CAISO will prioritize the workload based on opportunity costs most likely to need updating based on market conditions. The CAISO will actually use such calculations, or updated calculations, to determine the adder for each validated limitation that can be reflected in a monthly or rolling 12-month period; the CAISO will use advisory calculations, or updated calculations, for each validated limitation that can be reflected in an annual period. The CAISO will provide the results of the calculations or updated calculations to the scheduling coordinator for the use-limited resource.<sup>61</sup>

Each calculation of 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, taking into account a margin set at a level appropriate to experience with the opportunity cost adder that will be set forth in the business practice manual.<sup>62</sup> This margin reduces the limitation that the CAISO will model. For example, if a resource is limited to 100 starts per year and the margin is ten percent, the CAISO would model the resources as having 90 starts per year as the base case and comparing with the case of 89 starts per year, calculating the resource's profits as the difference in overall profits between the two cases. Ninety starts reflects the margin, and 89 starts reflects one less unit of starts.

Utilizing a margin addresses stakeholder concerns that resources might otherwise use up all of 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. The CAISO will initially set the margin at ten percent and may subsequently adjust it, pursuant to the business practice

---

<sup>61</sup> New tariff sections 30.4.1.1.6.2 and 30.4.1.1.6.2.1. If the CAISO is unable to perform calculations or updated calculations for all use-limited resources, the CAISO will prioritize such calculations or updated calculations for those use-limited resources that are currently on pace to reach their maximum allowed numbers of starts, maximum allowed numbers of run-hours, or maximum allowed energy output more quickly than the most recent calculations of opportunity costs indicated. To the extent that the CAISO is unable to perform such calculations or updated calculations for a use-limited resource, the CAISO will utilize the most recently calculated or updated opportunity costs. *Id.*

<sup>62</sup> New tariff section 30.4.1.1.6.2.2.

manual change management process, if a change is needed based on the CAISO's actual experience with the level of the margin.<sup>63</sup> Specifying in the tariff that the opportunity cost calculation will take the margin into account and including the level of the margin in the business practice manual is just and reasonable in light of the CAISO's proposal to include calculated opportunity costs (in addition to the negotiated opportunity costs) in the CAISO monthly informational filing with the Commission of all negotiated bid components.<sup>64</sup>

The calculation will also take into account the effect of any validated limitation on a use-limited resource's number of starts, number of run-hours, or energy output in the monthly and annual and/or rolling 12-month periods. For MSG transitions, the opportunity cost for each transition will be derivative of the number of start-ups required for the MSG resource to achieve a specific MSG configuration.<sup>65</sup>

The CAISO will calculate the opportunity costs for each validated limitation based on the estimated market commitment of the resource using historical 15-minute LMPs that will be used to establish forecasted hourly LMPs. Today, 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,<sup>66</sup> and the CAISO expects that the same will be true for the vast majority of use-limited resources under the revised tariff provisions. Specifically, the CAISO will calculate the estimated profits for each validated limitation over the future time period of the limitation based on the following estimated inputs: (a) the forecasted hourly average of 15-minute LMPs for energy at the use-limited resource's pricing node or aggregated pricing node<sup>67</sup>

---

<sup>63</sup> See, e.g., *Cal. Indep. Sys. Operator Corp.*, 149 FERC ¶ 61,042, at P 49 (2014) ("We agree that the more detailed description of the processes CAISO will use for the calculation can be appropriately reflected in its business practice manuals."); *Cal. Indep. Sys. Operator Corp.*, 140 FERC ¶ 61,070, at P 47 (2012) ("The proposed GIDAP [generator interconnection and deliverability allocation procedure] specifies that the methodology for the [deliverability] assessment will be included in a business practice manual. Thus, we find that the proper forum for Wellhead's concerns and questions is CAISO's revision process of its business practice manual.").

<sup>64</sup> New tariff sections 30.4.1.1.6.1.2 and 39.7.1.3.2.2 (the latter formerly numbered as tariff section 39.7.1.3.2). The CAISO will add any calculated or negotiated opportunity costs to the existing set of items the CAISO already includes in the monthly informational filings it submits in Docket No. ER06-615-000. This filing includes all negotiated default energy bids, operations and maintenance adders and major maintenance adders.

<sup>65</sup> New tariff section 30.4.1.1.6.2.2.

<sup>66</sup> Currently there are only three gas-fired, long-start, use-limited resources that are committed and de-committed based on day-ahead prices.

<sup>67</sup> For a use-limited resource that has 12 or fewer months of LMP data at its pricing node or aggregated pricing node, the CAISO will calculate this input (a) using LMP data from a

multiplied by (b) the optimal hourly dispatch of the use-limited resource, minus (c) the estimated monthly start-up cost of the use-limited resource, minus (d) the estimated monthly minimum load cost of the use-limited resource, minus (e) the estimated monthly variable energy cost of the use-limited resource multiplied by the difference between (f) the optimal hourly commitment and dispatch of the use-limited resource and (g) the minimum operating level of the use-limited resource, minus (h) the estimated monthly transition cost of the use-limited resource.<sup>68</sup>

If the CAISO is unable to calculate opportunity costs, it will use the negotiation process to establish them. A negotiation process addresses concerns raised in the stakeholder process. Stakeholders explained that several hydroelectric, participating load, and pumped storage resources develop their opportunity costs based on sophisticated models that synthesize the impact of current and projected hydrology data, including snowpack levels, watershed topology and size, and various fish and wildlife restrictions. The CAISO will not be able to replicate those models in its opportunity cost calculation process. Instead, the CAISO will work with scheduling coordinators for such resources to establish an appropriate methodology and schedule for updating opportunity costs. The CAISO also expects that resources with more complicated environmental permits (e.g., Delta dispatch) and MSG resources with use limitations may also require negotiated opportunity costs.

The CAISO will request in the negotiation process that the scheduling coordinator provide the CAISO with a proposed opportunity cost methodology, documentation supporting the methodology, and a proposed schedule for the CAISO to update opportunity costs under the methodology. The CAISO will either approve the submitted methodology or enter into good-faith negotiations with the scheduling coordinator to establish an agreed-upon methodology and the schedule for updating the opportunity costs. The CAISO may propose interim opportunity cost values while the negotiations are ongoing. If the negotiation period ends without the CAISO and the scheduling coordinator agreeing on negotiated opportunity costs, the scheduling coordinator may file proposed opportunity costs and supporting documentation with the Commission.<sup>69</sup> This negotiation process is similar to the processes under the existing tariff for negotiating major maintenance expense adders and negotiated default energy bids for resources.<sup>70</sup>

---

comparable pricing node or aggregated pricing node. New tariff section 30.4.1.1.6.2.2.

<sup>68</sup> New tariff section 30.4.1.1.6.2.2.

<sup>69</sup> New tariff section 30.4.1.1.6.3.

<sup>70</sup> See existing tariff sections 30.4.1.1.4 and 39.7.1.3.1.

The CAISO's methodology for calculating opportunity costs for use-limited resources is comparable to the methodologies employed by PJM and SPP to determine opportunity costs for resources eligible to recover such costs as part of their mitigated energy offers, due to operational limitations on the resources' number of starts, run-hours caused by physical equipment restrictions, or by environmental restrictions resulting from applicable laws and regulations.<sup>71</sup> PJM and SPP also permit market participants to propose alternative (*i.e.*, negotiated) methods of determining opportunity costs that are specific to their resources, if the normal calculation method will not suffice.<sup>72</sup> PJM and SPP include methodologies in their tariffs to determine the opportunity costs for eligible resources and use manuals containing the calculation details to implement the methodologies.<sup>73</sup> The CAISO's proposal has comparable features.

Before the opportunity cost adders and tariff provisions go into effect on November 1, 2018, the CAISO will work with eligible use-limited resources to determine their opportunity cost adders. The CAISO expects that the opportunity cost calculator will be available in early May of 2018. During this approximately six-month period, the CAISO will determine the opportunity cost adders on a case-by-case basis for both the calculation process and the negotiation process. The CAISO expects this will be time-intensive work that will require the entire six months.<sup>74</sup>

## 2. Clarification of the Definition of Use-Limited Resources

The tariff currently defines a use-limited resource as a resource that, due to design considerations, environmental restrictions on operations, cyclical requirements, or other non-economic reasons, is unable to operate continuously.<sup>75</sup> The existing tariff also specifies the types of resources that are deemed to be use-limited resources by default and provides that scheduling coordinators for all other types of resources can submit applications that allow

---

<sup>71</sup> PJM Operating Agreement, schedule 2, at section 1.1(a); PJM Manual 15, at section 12; SPP OATT, attachment AF, at section 3.2(D); SPP Market Protocols, appendix G, at section G.11.

<sup>72</sup> See PJM Operating Agreement, schedule 2, at section 1.1(a); PJM Manual 15, at section 12 (May 15, 2017); SPP OATT, attachment AF, at section 3.2(D); SPP Market Protocols, at section G.11.

<sup>73</sup> "While relying on Manuals to develop implementation details and mechanics of implementation may be acceptable, the methodology to be applied in determining the relevant opportunity costs needs to be sufficiently described in the tariff." *PJM Interconnection, L.L.C.*, 130 FERC ¶ 61,230, at P 17 (2010).

<sup>74</sup> See *infra* section IV of this transmittal letter.

<sup>75</sup> Tariff appendix A, existing definition of "Use-Limited Resource".

the CAISO to determine whether they are use-limited resources.<sup>76</sup>

The CAISO proposes to clarify the existing tariff language so that resources that have limitations the CAISO market process can recognize (e.g., daily limitations) will not meet the new definition of use-limited resource; although, resources previously classified as use-limited that cannot have a must-offer obligation, e.g., variable energy resources, will continue to be exempt from the bid insertion rules under different tariff provisions.<sup>77</sup> Further, no resources will receive use-limited status by default pursuant to the proposed tariff revisions. Instead, a scheduling coordinator seeking to obtain use-limited status for any resource (including a resource currently deemed use-limited by default) must follow the registration and validation process set forth in the tariff and the business practice manual.<sup>78</sup>

Thus, the revised definition of use-limited resource will apply only to resources that have limitations on their overall use that span a period longer than the CAISO markets can recognize and will exclude resources that are not necessarily available all the time, such as wind-powered and solar-powered resources, but that do not have limitations on their overall use. The CAISO is excluding them from the definition because use-limited status previously only exempted them from CAISO bid insertion if they did not bid. Because the CAISO is changing the rules, there is no longer any benefit to them being classified as “use-limited”.

To be considered a use-limited resource, the scheduling coordinator 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, (b) environmental restrictions, or (c) qualifying contractual limitations that meet requirements set forth in the tariff;
- (2) The CAISO market process used to dispatch the resource cannot recognize the resource’s limitation(s); and

---

<sup>76</sup> Existing tariff section 40.6.4.1.

<sup>77</sup> See tariff section 40.6.8(e) as revised by this filing. The clarifications also do not impose any new must-offer obligation on any resource.

<sup>78</sup> New tariff section 30.4.1.1.6.1. This same registration and validation process will also allow each scheduling coordinator to seek to recover opportunity costs for use-limited resources by making the demonstration discussed below.

- (3) The resource's ability to select hours of operation is not dependent on any energy source outside of the resource's control being available during such hours.<sup>79</sup>

The tariff revisions specify the design considerations, environmental restrictions, and qualifying contractual limitations that satisfy requirement (1). The required design considerations (item (a) under requirement (1)) are those resulting from physical equipment limitations and from performance criteria for demand response resources established pursuant to programs or contracts approved by local regulatory authorities. The required environmental restrictions (item (b) under requirement (1)) are those imposed by regulatory bodies, legislation, or courts. The tariff provisions include non-exhaustive lists of examples for both requirements.<sup>80</sup> The qualifying contractual limitations (item (c) under requirement (1)) are discussed below. Thus, the tariff provisions augment the language in the current definition of a use-limited resource, which states without further detail that design considerations, environmental restrictions, or other non-economic reasons may qualify a resource for use-limited resource status.

Regarding requirement (2) of the criteria listed above, a resource can obtain use-limited status only if the applicable CAISO market process cannot recognize the resource's limitations. If the market process could recognize its limitations, the CAISO would be able to treat it like any other resource. Regarding requirement (3) of the criteria, a resource is eligible for use-limited status only if it can select hours of operation independent of an energy source outside of its control, such as the inability of a solar-powered resource to operate at night. A use limitation that precludes operation is different than the mere unavailability of a fuel source to enable the resource to operate.

Under these tariff revisions, the CAISO continues to exclude economic limitations established by contract as the basis for a resource to be considered use-limited and thus potentially to qualify for opportunity costs as discussed above. The CAISO maintains its longstanding position that economic limitations such as those originating from contracts, such as power purchase or tolling agreements, are not acceptable limitations for establishing an opportunity cost adder under the resource's bid cap. These limitations do not result from restrictions imposed by external statutes or regulations, but instead they reflect economic tradeoffs made by the contracting parties. Further, contrary to

---

<sup>79</sup> New tariff section 30.4.1.1.6.1.1. If the CAISO determines that a scheduling coordinator has not made the required demonstration, the scheduling coordinator may dispute that determination pursuant to the generally applicable CAISO alternative dispute resolution procedures, which apply except where a tariff provision expressly provides for a different means of resolving disputes. *Id.*

<sup>80</sup> New tariff section 30.4.1.1.6.1.1.



arguments made by some stakeholders, continuing to exclude economic limitations will not jeopardize reliability. To the extent any reliability issue arguably would arise, it would be solely due to contractual agreement to limit the availability of the resource. Also, the CAISO can address any reliability concerns that arise by issuing exceptional dispatch instructions or procuring backstop capacity under applicable capacity procurement mechanism procurement provisions. If the CAISO 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 both to physically and economically withhold resources from the market by simply contracting obligations away. This would also allow them to bypass the market power mitigation processes in place under the tariff. This in turn could lead to market inefficiencies and market power concerns that would go unmitigated.<sup>81</sup>

The CAISO recognizes, however, that long-term contracts approved through a robust regulatory process, before discussions even commenced regarding opportunity costs for qualifying use-limited resources that have contractual limitations, would not reflect attempts to exercise market power. Therefore, the CAISO proposes to allow a resource to qualify as a use-limited resource if it has contractual limitations that meet the rigorous tariff criteria described below.<sup>82</sup>

The proposed tariff revisions specify that qualifying contractual limitations (item (c) under requirement (1)) are those contained in long-term contracts that: (i) were reviewed and approved by a local regulatory authority on or before January 1, 2015 or were pending approval by a local regulatory authority on or before January 1, 2015 and were later approved; and (ii) were evaluated by the local regulatory authority for the cost implications of those contracts with regard to limitations on such resources' numbers of starts, numbers of run-hours, or energy output. Contract limits that provide for higher payments when start-up,

---

<sup>81</sup> For example, if two contracting parties negotiated a contract that limited a resource to 100 starts per year, the contract would in effect permit physical withholding of the resource from the CAISO markets. If the CAISO were to recognize the 100 starts per year as an acceptable limitation, the two contracting parties could continue to restrict the resource to progressively lower numbers of starts and increase any start-up opportunity cost the resource could receive. Because any start-up opportunity cost amount is added to the 125-percent proxy cost bid cap applicable to other types of start-up costs (see the discussion below on opportunity cost adders), and because the proxy cost bid cap is the market power mitigation method in place for commitment costs, the contracting parties could essentially negotiate the proxy cost bid cap for the resource applicable to start-ups. This would enable the contracting parties to increase the proxy cost bid cap, thereby subverting the existing market power mitigation procedures.

<sup>82</sup> All resources, including those that do meet the criteria for use-limited status, will have the flexibility to register market values in the Master File that are based on their contractual limitations. See *infra* section III.C of this transmittal letter.

run-hour, or energy output thresholds are exceeded cannot be qualifying contractual limitations. Effective three years after the tariff revisions go into effect, *i.e.*, November 1, 2021, no contractual limitations will constitute qualifying contractual limitations that satisfy requirement (1).<sup>83</sup>

These tariff revisions are just and reasonable because they will allow resources to qualify for use-limited status pursuant to contractual limitations that were approved through a robust regulatory process well over three years ago, and before the CAISO launched its stakeholder process regarding opportunity costs. Establishing the qualifying contractual limitations, with a defined cutoff period, strikes a reasonable balance between diametrically opposed positions put forward by some participants in the stakeholder process. One view was that no contractual limitations at all should qualify, and at the other pole was the view that contractual limitations should qualify throughout the entire life of a contract. The CAISO's proposal represents an appropriate middle ground that balances stakeholders' interests for the reasons explained below.<sup>84</sup>

The proposed three-year cutoff period will provide sufficient time for the CAISO and the local regulatory authority to consider the implications of the change for resource adequacy and provide time for market participants either to renegotiate their contracts or work with the CAISO's Department of Market Monitoring to obtain a more accurate major maintenance adder if applicable. In addition, as the percentage of variable energy resources in the generating fleet continues to grow, the CAISO will require additional flexibility to maintain system reliability. If the CAISO can utilize more flexibility from resources currently constrained by contractual limitations, it could diminish the need for new resources to be built.

Given the uncertainty regarding the quantity of capacity that will be covered by the tariff revisions, and increasing flexibility needs of the markets, the CAISO cannot at this time fully assess the market impacts of extending the provisions regarding qualifying contractual limitations beyond three years. However, the CAISO commits to evaluate, before the end of the three-year period, potential market and reliability impacts if the provisions were to be

---

<sup>83</sup> New tariff section 30.4.1.1.6.1.1.

<sup>84</sup> See, *e.g.*, *Cal. Indep. Sys. Operator Corp.*, 145 FERC ¶ 61,082, at P 23 (2013) (finding that CAISO tariff revisions strike "a reasonable balance between preventing the exercise of market power and enabling the recovery of costs"); *Cal. Indep. Sys. Operator Corp.*, 127 FERC ¶ 61,178, at P 27 (2009) (explaining that CAISO tariff revisions "strike a reasonable balance that addresses the barriers to development of location-constrained resources, while providing appropriate ratepayer protections to ensure that rates remain just and reasonable"); *ISO New Eng. Inc. and New Eng. Power Pool Participants Comm.*, 155 FERC ¶ 61,023, at P 36 (2016) (find that tariff revisions "struck an appropriate balance of competing interests").

extended at that time.

### 3. This Filing Satisfies the Directives in the CCE2 Order

The discussion above in this section III.A of the transmittal letter and the referenced tariff revisions address the concerns raised by the Commission in the CCE2 Order. The Commission directed the CAISO to explain in any new FPA section 205 filing what it is proposing to change, how the changes impact the various categories of market participants, and the impact on customers.<sup>85</sup> The discussion above explains the changes the CAISO proposes and how they will affect market participants that seek use-limited status and opportunity costs. All resources that can demonstrate that they meet the three use-limited resource requirements will receive use-limited status, and all use-limited resources (excluding the specified categories of ineligible resources) that meet the opportunity cost criteria will receive opportunity costs. As the CAISO explained, the tariff revisions will allow the CAISO to dispatch use-limited resources when they are valued most and enable them to bid continuously and flexibly, thus making the markets more efficient and thereby benefiting customers.

The Commission directed that the tariff language should describe clearly how the CAISO will determine what capacity is use-limited and should include a list of limitations.<sup>86</sup> Further, the Commission stated that the tariff language should include a non-exhaustive list of examples.<sup>87</sup> The tariff revisions contained in this filing clearly explain the criteria to be a use-limited resource, including the limitations that qualify (*i.e.*, limitations affecting the number of starts, number of run-hours, or energy output) and the qualifying reasons for those limitations (*i.e.*, due to the specified types of design considerations, environmental restrictions, or qualifying contractual limitations). Regarding those reasons, the tariff revisions provide a non-exhaustive list of examples of design considerations and environmental restrictions, and define the universe of qualifying contractual limitations. Moreover, the Commission directed the CAISO to explain how it will implement the changes given the protests raised in the CCE2 proceeding regarding the definition of use-limited capacity the CAISO had proposed.<sup>88</sup> The CAISO explained above exactly how it will implement the revised definition of a use-limited resource to include the specified qualifying limitations and qualifying

---

<sup>85</sup> CCE2 Order at P 39.

<sup>86</sup> *Id.* at PP 34-35. The Commission also stated that the CAISO had not sufficiently explained the potential effect on market participants of changing from a definition of use-limited resource to use-limited capacity. *Id.* at P 34. That concern is now moot because the CAISO has determined that changing the definition to use-limited capacity is unnecessary.

<sup>87</sup> *Id.* at P 38.

<sup>88</sup> *Id.* at P 39.

reasons.

The Commission also stated in the CCE2 Order that the CAISO should explain the interaction of contractual limitations with economic and non-economic limitations, including the effects of economic limitations on reliability.<sup>89</sup> The discussion above explains why the CAISO proposes that only certain contractual limitations can qualify a resource for use-limited status.

Further, the Commission found in the CCE2 Order that the CAISO must explain any deletion of the existing tariff language regarding the registration process for use-limited resources.<sup>90</sup> The CAISO explained above why it proposes the new registration process for resources seeking use-limited status.

The Commission also stated that the CAISO should explain how it will consider opportunity costs for use-limited resources.<sup>91</sup> The CAISO provides that explanation in the discussion above regarding its proposed tariff revisions to implement opportunity cost adders. In summary, the CAISO has addressed in this tariff amendment all of the concerns expressed in the CCE2 Order.

#### **B. Allow a Use-Limited Resource to Use the Registered Cost Methodology Until It Establishes an Energy Price History**

The tariff currently states that scheduling coordinators for resources that are not use-limited resources will be subject to the proxy cost methodology for their start-up costs, minimum load costs, and transition costs, while scheduling coordinators for use-limited resources can elect on a 30-day basis either the proxy cost methodology or the registered cost methodology for such costs.<sup>92</sup> The proxy cost methodology results in a more efficient resource commitment and better ensures cost recovery as compared with the registered cost methodology, because the proxy cost methodology more accurately reflects current (daily) natural gas prices. However, use-limited resources are permitted to elect the registered cost methodology because they do not operate continuously and usually only come online when demand on the system is greatest. Because such resources operate at limited intervals, the opportunity costs for their use can exceed the headroom provided by the 125-percent proxy cost bid cap.

---

<sup>89</sup> *Id.* at P 35.

<sup>90</sup> *Id.* at PP 34, 37.

<sup>91</sup> *Id.* at P 36. The Commission stated that to the extent certain resources are use-limited by default, it is unclear why they are not included in the definition of use-limited capacity. *Id.* This concern is now moot because the CAISO proposes to eliminate the category of default use-limited resources and instead to require all resources that seek use-limited status to apply for it.

<sup>92</sup> Existing tariff section 30.4.

Now that the CAISO will have the capability of reflecting opportunity costs in bids, the registered cost methodology will only be available to use-limited resources that do not have a sufficient price history to calculate opportunity costs and for a two-month period to allow the scheduling coordinator and the CAISO to engage in the process of developing an opportunity cost adder. Once completed, the use-limited resource will be on the proxy cost methodology even if the resource is determined not to have any opportunity costs because the eligible limits are not binding based on market conditions.<sup>93</sup>

### **C. Enhance Tariff Provisions on Resource Characteristics Registered in the Master File**

The existing tariff requires that all information provided to the CAISO regarding the operational and technical constraints of resources registered in the Master File be accurate and actually based on the physical characteristics of the resources.<sup>94</sup> The CAISO proposes to clarify this requirement and apply it to what the CAISO will now call “design capability values.”

The proposed revisions state that the information provided must be an accurate reflection of the design capabilities (rather than the physical characteristics, as under the current tariff) of a unit and its constituent equipment when operating at maximum sustainable performance over minimum run time, recognizing that resource performance may degrade over time. Information registered in the Master File must also conform to any additional and applicable definitional requirements set forth in appendix A to the tariff.<sup>95</sup> Further, a scheduling coordinator may not submit a bid for a generating unit or offer to provide any other service in the CAISO markets if that bid or offer could not be delivered feasibly based on the registered operational and technical constraints for that generating unit. All information registered in the Master File (except for certain information regarding the pump ramping conversion factor) must be consistent with the offers and services provided by the resources in the CAISO markets.<sup>96</sup>

---

<sup>93</sup> Revised tariff sections 30.4 and 30.4.1.2.

<sup>94</sup> Existing tariff section 4.6.4.

<sup>95</sup> Some design capability values, such as maximum daily start-ups and start-up times, have definitions specified in appendix A to the tariff.

<sup>96</sup> Revised tariff sections 4.6.4.1, 4.7, 4.8, 4.9.1.1, 4.12.2, 4.13.3, 4.17.1, and 30.7.3.5; tariff appendix A, revised definitions of “Maximum Daily Start-Ups”, “Minimum Down Time”, “Minimum Run Time”, “Multi-Stage Generating Resources”, “Pump Ramping Conversion Factor”, and “Security Constrained Unit Commitment”.

These clarifying changes will ensure that the Master File includes the most robust information possible and that the information aligns with resources' participation in the CAISO markets. For example, a resource's absolute maximum level of performance over a short increment of time would not reflect how that resource would perform in the CAISO market. Also, it is more feasible to determine objectively a resource's design capability than to determine objectively a resource's physical characteristics. For example, determining a resource's physical characteristics inherently includes some degree of economic tradeoffs involving wear and tear because a unit's capability when operated to its breaking point is different than when the unit is operated in light of its long-term interests. The design capability approach, in contrast, involves how the unit was initially designed to be used, subject only to the variability of its lifespan. Thus, the design capability approach has clear benefits over the current tariff provisions.

Following discussion with stakeholders, the CAISO determined that in some cases it would be beneficial to provide flexibility for the CAISO market optimization to consider values other than design capability. One such consideration is avoiding excessive wear and tear on the resource. It is the CAISO's understanding that a resource may be designed to start up five times a day, but starting up the resource more than twice a day could dramatically increase wear and tear and increase the possibility of catastrophic resource failure. Another consideration is contractual limitations. The CAISO understands that resources may be subject to tolling agreements or power purchase agreements that impose limitations such as the number of times a resource can start up in a year. The CAISO's proposal allows flexibility for scheduling coordinators to manage contract limits through the market values.<sup>97</sup> Providing the flexibility to consider values other than design capability values will be especially valuable to market participants to the extent their resources' contractual limitations either (1) do not meet the criteria to qualify as use-limited resources and possibly receive opportunity costs, or (2) meet the criteria, but the resource no longer can qualify as a use-limited resources because the three-year cutoff period has expired.<sup>98</sup> The Commission previously approved ISO New England's use of separate offer thresholds based on physical and on financial parameters for use in mitigating supply offers.<sup>99</sup> The CAISO should similarly be

---

<sup>97</sup> The contract limits will be registered in the Master File rather than being used to calculate proxy costs subject to the proxy cost bid cap. Thus, the contract limits will not qualify a resource to be a use-limited resource and thus to be eligible for opportunity costs. As explained above, the only contract limits that will qualify a resource to be a use-limited resource are qualifying contractual limitations for a period of three years after the effective date of the proposed tariff revisions.

<sup>98</sup> See *supra* section III.A(1) of this transmittal letter.

<sup>99</sup> See ISO New England Market Rule 1, at section III.A.6.

permitted to allow scheduling coordinators to register separate values in addition to design capability values based on differing parameters, subject to the caveat that the market values cannot be allowed to undermine CAISO system reliability.

For these reasons, the CAISO proposes to allow scheduling coordinators for participating generators to register market values in the Master File for certain resource characteristics.<sup>100</sup> With respect to 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, a scheduling coordinator for a participating generator may also register market values in the Master File that the CAISO will utilize during market operations except as otherwise set forth in the tariff. These market values need not reflect design capability, but they are subject to the following limitations:

- Maximum daily start-ups must be at least two start-ups per day. The CAISO permits only one start-up per day in the Master File due to the design capabilities or degradation in performance of a resource nearing the end of or operating beyond its useful life.
- The maximum daily number of MSG transitions must be at least two MSG transitions for every MSG transition registered in the transition matrix, unless the design capability is one MSG transition per day. The CAISO permits only one MSG transition per day in the Master File due to the design capabilities or degradation in performance of a resource nearing the end of or operating beyond its useful life.
- Operational ramp rate values must be sufficient to permit the resource to provide its flexible resource adequacy capacity obligation. If a scheduling coordinator for a participating generator registers market operational ramp rate values in the Master File, the market values must be values at which the resource is reasonably capable of operating.

The CAISO system faces a twice-daily peak, once in the morning and again in the afternoon. Requiring at least two start-ups or MSG transitions per day under the market values will mitigate the concern that a unit could exploit this aspect of CAISO load patterns by only starting or transitioning once per day and essentially forcing the CAISO to keep the unit on all day even if it is not needed during the middle of the day.

---

<sup>100</sup> New tariff section 4.6.4.2; tariff appendix A, revised definition of “Maximum Daily Start-Ups”. Scheduling coordinators will be allowed to register the market values using a new field to the Master File, in addition to the existing field in the Master File for the design characteristics of the resource.

Further, a resource with one start-up or MSG transition per day may be optimally committed in the day-ahead market for the evening load peak, but such a commitment may never happen because the real-time market optimization does not optimize over the full 24-hour day. Thus, it may dispatch the resource to meet the morning load peak instead. It may then be optimal for the real-time market to issue a dispatch instruction to shut down the resource as solar load peaks and net loads reach a low in the middle of the day. In that event, the resource would be unable to meet its day-ahead schedule for the evening load peak. Under these circumstances, CAISO system operators may issue an exceptional dispatch instruction to prevent the resource from shutting down, which would contribute to potential over-generation in the middle of the day. If, on the other hand, the resource were to follow the real-time dispatch and shut down, it would remain unavailable to meet its day-ahead schedule for the evening load peak. This potentially would raise reliability concerns under conditions where system demand for both energy and flexibility are high. Requiring at least two start-ups or MSG transitions per day under the market values will avoid these potential issues.

Some stakeholders contended that requiring at least two start-ups per day would create an inconsistency between provisions in the tariff that impose a must-offer obligation on flexible resource adequacy resources and tariff provisions that allow two types of flexible resource adequacy resources (peak ramping resources and super-peak ramping resources) to provide flexible resource adequacy capacity using just one start-up per day. The CAISO explained in response that there is no inconsistency. The must-offer obligation requires a flexible resource adequacy resource to offer all of its available capacity into the CAISO market.<sup>101</sup> Requiring at least two start-ups per day has nothing to do with the must-offer obligation. In the example above in which a resource has a day-ahead schedule in the afternoon, the CAISO is not proposing to impose a must-offer requirement on the resource in the morning. The resource must have at least two start-ups per day to avoid issues from arising if the resource submits an offer in the real-time market in the morning.

To provide clarity for market participants, the CAISO also proposes tariff revisions to specify what happens if the CAISO rejects a proposed or existing market value. The revised tariff provisions authorize the CAISO to reject a market value either proposed for registration or already registered in the Master File if that value is infeasible given the design capabilities of the resource or is inconsistent with a participating generator's commitment to provide resource adequacy capacity. If the CAISO rejects a market value, the CAISO will solely honor the design capability value.<sup>102</sup>

---

<sup>101</sup> Existing tariff section 40.10.6.

<sup>102</sup> Revised tariff section 4.6.4.



The tariff revisions state that the CAISO will utilize market Master File values in the CAISO markets and in automated exceptional dispatch tools. However, the CAISO may issue exceptional dispatch instructions pursuant to the tariff based on the design capability of a generating unit, regardless of whether the participating generator also provides a market value for use in the CAISO markets.<sup>103</sup> These tariff revisions are necessary to cover any situation that may arise in which the CAISO must rely on resource design capabilities rather than market values to fully address an exceptional dispatch issue.

#### **D. Remove Ramp Rates as a Component of Daily Bids**

Under the existing tariff, ramp rates are a component of daily bids for energy, ancillary services, and RUC availability.<sup>104</sup> However, it is no longer necessary for ramp rates to be a component of daily bids. Since the existing tariff provisions went into effect, the CAISO has greatly enhanced the modeling capabilities of resources in the CAISO markets (e.g., MSG resources), thus reducing the need to accommodate daily bid-in ramp rates. As discussed above, the CAISO also proposes to give scheduling coordinators the ability to register market ramp rate values in the Master File, which will further obviate the need for ramp rates to be a component of daily bids. Having all ramp rates in the Master File will provide scheduling coordinators the flexibility to register two Master File values (market values of their own choosing and design capability values), similar to the flexibility currently offered for the ramp rate component of bids. Further, retiring the daily bid-in ramp rate functionality will minimize potential adverse market impacts from resources changing ramp rates based on current system conditions while the CAISO market is making awards based on ramping capability under the CAISO's existing flexible ramping product and its planned corrective capacity market product.<sup>105</sup>

For these reasons, the CAISO proposes to revise the tariff to remove all ramp rates (*i.e.*, 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 the ramp rates that will be

---

<sup>103</sup> *Id.*

<sup>104</sup> Existing tariff sections 30.5.2.2 through 30.5.2.4, 30.5.2.6, and 30.5.2.7.

<sup>105</sup> See *Cal. Indep. Sys. Operator Corp.*, 156 FERC ¶ 61,226 (2016) (accepting tariff revisions to implement flexible ramping product). The CAISO is working with stakeholders in a separate stakeholder initiative to develop a corrective capacity market product that is expected to impact awards made by the CAISO market based on ramping capability. See Contingency Modeling Enhancements Draft Final Proposal Addendum (Aug. 29, 2017), available at <http://www.aiso.com/informed/Pages/StakeholderProcesses/ContingencyModelingEnhancements.aspx>.

solely registered in the Master File.<sup>106</sup>

#### **E. Provide for the Renegotiation of Outdated and Erroneous Values**

The existing tariff allows the CAISO and scheduling coordinators to negotiate adders or interim adders for major maintenance expenses under the proxy cost methodology,<sup>107</sup> negotiate default energy bids,<sup>108</sup> establish temporary default energy bids,<sup>109</sup> and negotiate custom operations and maintenance adders.<sup>110</sup> However, the tariff does not provide a means to renegotiate any such values that have become outdated, are erroneous, or for which the scheduling coordinator has changed.

To address this gap, the CAISO proposes to revise the tariff to allow it to require the renegotiation of any such values and the renegotiation of any negotiated opportunity costs. In the renegotiation process, the 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.<sup>111</sup>

#### **F. Make Minor Tariff Clarifications**

The CAISO proposes to make minor clarifications to its tariff to reflect the accurate use of defined terms, include more descriptive section titles, correct punctuation, grammatical, and typographical errors, and provide more specific cross-references.<sup>112</sup>

---

<sup>106</sup> Revised tariff sections 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), and 34.17.5; deleted tariff section 30.7.7; tariff appendix A, revised definitions of “Operating Reserve Ramp Rate”, “Operational Ramp Rates”, “Ramp Rate”, and “Regulation Ramp Rate”. The Draft Final Proposal referred to the elimination of ramp rate in “energy” bids rather than in bids generally, but that phrasing was unintentionally specific. As the CAISO explained in the stakeholder process, its intention was always for all ramp rates to be Master File values, because having all ramp rates in the Master File provides significant benefits. See pages 9-10 of its December 5, 2017 response to stakeholder comments on the draft tariff language to implement this tariff amendment, available at <http://www.caiso.com/Documents/StakeholderCommentMatrix-CommitmentCostEnhancementsPhase3.pdf>.

<sup>107</sup> Existing tariff sections 30.4.1.1.1, 30.4.1.1.2, and 30.4.1.1.4.

<sup>108</sup> Existing tariff sections 39.7.1 and 39.7.1.3

<sup>109</sup> Existing tariff section 39.7.1.5.

<sup>110</sup> Existing tariff section 39.7.1.1.2.

<sup>111</sup> Revised tariff section 39.7.1.3.2; new tariff section 39.7.1.3.2.1.

<sup>112</sup> Revised tariff sections 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,

The CAISO also clarifies that the scheduling coordinator for a non-natural gas-fired resource subject to the proxy cost methodology, rather than the CAISO, will provide the fuel or fuel-equivalent input costs that the CAISO will maintain in the Master File.<sup>113</sup> Further, the 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, just as it currently does for natural gas-fired resources.<sup>114</sup>

#### **IV. Effective Date, Request for Timely Commission Order, and Request for Waiver**

The CAISO respectfully requests that the Commission issue an order by May 23, 2018 accepting the tariff revisions contained in this filing effective November 1, 2018.<sup>115</sup>

Good cause exists for the Commission to issue an order by May 23 and grant this waiver. Implementation of the tariff revisions proposed herein requires substantial systems and business process changes. The CAISO and market participants require a significant lead time to perform the preparatory activities required to implement the tariff revisions, with early May being the target date for the CAISO to have the opportunity cost calculator available for use. During the approximately six-month period between early May and November 1, all scheduling coordinators that are eligible for an opportunity cost must work through the CAISO's calculated opportunity cost process, or, for resources that cannot be modelled using the opportunity cost calculator, through the negotiated opportunity cost process.

Due to the number of resources that potentially are eligible for opportunity costs, and due to the fact that the CAISO is implementing these new processes, the CAISO will require the entire period to prepare for the tariff revisions to become effective on November 1. Therefore, it is appropriate for the Commission to issue an order accepting the tariff revisions by May 23 and to grant the requested waiver.

---

40.6.8(d), and 40.6.8(e); tariff appendix A, revised definition of "Multi-Stage Generating Resources".

<sup>113</sup> Revised tariff sections 30.4.1.1.2 and 39.7.1.1.1.2.

<sup>114</sup> Revised tariff section 39.7.1.1.

<sup>115</sup> Pursuant to section 35.11 of the Commission's regulations, 18 C.F.R. § 35.11, the CAISO respectfully requests waiver of the notice requirement contained in section 35.3(a)(1) of the Commission's regulations, 18 C.F.R. § 35.3(a)(1), to allow the tariff revisions to go into effect more than 120 days after submittal of this filing.

## V. Communications

Pursuant to Rule 203(b)(3) of the Commission's Rules of Practice and Procedure,<sup>116</sup> the individuals listed below are to receive correspondence and other communications regarding this filing:

Roger E. Collanton  
General Counsel  
Sidney L. Mannheim  
Assistant General Counsel  
California Independent System  
Operator Corporation  
250 Outcropping Way  
Folsom, CA 95630  
Tel: (916) 608-7144  
Fax: (916) 608-7222  
E-mail: [smannheim@caiso.com](mailto:smannheim@caiso.com)

Michael Kunselman  
Bradley R. Miliauskas  
Alston & Bird LLP  
The Atlantic Building  
950 F Street, NW  
Washington, DC 20004  
Tel: (202) 239-3300  
Fax: (202) 654-4875  
E-mail:  
[michael.kunselman@alston.com](mailto:michael.kunselman@alston.com)  
[bradley.miliauskas@alston.com](mailto:bradley.miliauskas@alston.com)

## VI. Service

The CAISO has served copies of this filing on the California Public Utilities Commission, the California Energy Commission, and all parties with scheduling coordinator agreements under the CAISO tariff. In addition, the CAISO has posted a copy of the filing on the CAISO website.

## VII. Contents of Filing

In addition to this transmittal letter, this filing includes the following attachments:

Attachment A	Clean CAISO tariff sheets incorporating this tariff amendment
Attachment B	Red-lined document showing the revisions contained in this tariff amendment
Attachment C	Draft Final Proposal
Attachment D	Final Opinion on Commitment Cost Bidding Improvements issued by the CAISO Market Surveillance Committee

---

<sup>116</sup> 18 C.F.R. § 385.203(b)(3).

Attachment E      Board Memorandum

Attachment F      List of key stakeholder dates for the CCE3 initiative

### **VIII. Conclusion**

For the reasons set forth in this filing, the CAISO respectfully requests that the Commission issue an order by May 23, 2018 accepting the tariff revisions contained in this filing effective November 1, 2018.

Respectfully submitted,

Roger E. Collanton  
General Counsel  
Sidney L. Mannheim  
Assistant General Counsel  
California Independent System  
Operator Corporation  
250 Outcropping Way  
Folsom, CA 95630

Michael Kunselman  
Bradley R. Miliauskas  
Alston & Bird LLP  
The Atlantic Building  
950 F Street, NW  
Washington, DC 20004

Counsel for the California Independent System Operator Corporation

**Attachment A – Clean Tariff Records**  
**Commitment Cost Enhancements Phase 3**  
**California Independent System Operator Corporation**

#### **4.6.4 Identification of Generating Units**

##### **4.6.4.1 Design Capability Values**

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 must be an accurate reflection of the design capabilities of the resource and its constituent equipment when operating at maximum sustainable performance over Minimum Run Time, recognizing that resource performance may degrade over time. Information registered in the Master File by a Scheduling Coordinator must also conform to any additional definitional requirements in Appendix A as may exist as to that information. A Scheduling Coordinator may not submit a Bid for a Generating Unit or offer to provide any other service in the CAISO Markets if that Bid or offer could not be delivered feasibly based on the operational and technical constraints for that Generating Unit registered in the Master File. All information registered in the Master File shall be consistent with the offers and services provided by the resources in the CAISO Markets. The Pump Ramping Conversion Factor value is configurable and need not reflect a resource's design capabilities.

##### **4.6.4.2 Market Values**

With respect to Maximum Daily Start-Ups, maximum daily number of MSG Transitions, Operational Ramp Rate values, Operating Reserve Ramp Rate values, and Regulation Ramp Rate values, a Scheduling Coordinator for a Participating Generator may also register in the Master File market values that the CAISO will utilize during market operations except as otherwise set forth in this Section 4.6.4, and which need not reflect design capability recognizing that resource performance may degrade over time subject to the following limitations on such market values:

- (1) Maximum Daily Start-Ups must be at least two (2) Start-Ups per day unless the design capability is one (1) Start-Up per day. The CAISO permits only one (1) Start-Up per day in the Master File due to the design capabilities or degradation in performance of a resource nearing the end of or operating beyond its useful life.
- (2) The maximum daily number of MSG Transitions must be at least two (2) MSG Transitions for every MSG Transition registered in the Transition Matrix unless the design capability is one (1) MSG Transition per day. The CAISO permits only one (1) MSG Transition per day in the Master File due to the design capabilities or degradation in performance of a resource nearing the end of or operating beyond its useful life.
- (3) Operational Ramp-Rate values must be sufficient to permit a resource to provide its Flexible RA Capacity obligation. If a Scheduling Coordinator for a Participating Generator registers market values for Operational Ramp Rate in the Master File, the market values must be values at which the resource is reasonably capable of operating.

The CAISO has the authority to reject a market value either proposed for registration in the Master File or already registered in the Master File if that value is infeasible given the design capabilities of the resource or is inconsistent with a Participating Generator's commitment to provide Resource Adequacy Capacity.

If the CAISO rejects a market value, the CAISO will solely honor the design capability value.

The CAISO will utilize market value Master File values in the CAISO Markets and in automated Exceptional Dispatch tools. However, the CAISO may issue Exceptional Dispatch Instructions pursuant to Section 34.11 based on the design capability of a Generating Unit, regardless of whether the Participating Generator also provides a market value for use in the CAISO Markets.

\* \* \* \*

#### **4.7 Relationships Between CAISO and Participating Loads**

The CAISO shall only accept Bids for Supply of Energy or Ancillary Services or Submissions to Self-Provide Ancillary Services from Loads if such Loads are those of a Participating Load that has entered into a Participating Load Agreement with the CAISO and which meet standards adopted by the CAISO



and published on the CAISO Website. The CAISO shall not accept submitted Bids for Supply of Energy or Ancillary Services from a Participating Load other than through a Scheduling Coordinator. The CAISO shall not accept Bids from Scheduling Coordinators relating to Load from any Non-Generator Resource unless the resource owner or operator undertakes in writing, by entering into a Participating Load Agreement, to comply with all applicable provisions of this CAISO Tariff as they may be amended from time to time. A Participating Load shall provide any data or information consistent with the requirements set forth in Section 4.6.4.

\* \* \* \*

#### **4.8 Relationship Between CAISO and Intermittent Resources**

The CAISO shall not accept Bids for an Eligible Intermittent Resource other than through a Scheduling Coordinator. Any Eligible Intermittent Resource that is not a Participating Intermittent Resource, or any Participating Intermittent Resource for which Bids are submitted shall be bid and settled as a Generating Unit for the associated Settlement Periods (except that the Forecast Fee shall apply in such Settlement Periods). An Eligible Intermittent Resource shall provide any data or information consistent with the requirements set forth in Section 4.6.4.

\* \* \* \*

#### **4.9.1 General Nature of Relationship Between CAISO and MSS**

**4.9.1.1** An entity that is determined by the CAISO to qualify as a Metered Subsystem and that undertakes in writing, by entering into a Metered Subsystem Agreement with the CAISO, to comply with all applicable provisions of the CAISO Tariff as specified in that MSS Agreement as they may be amended from time to time, including, without limitation, the applicable provisions of this Section 4.9, shall be considered an MSS Operator and shall have the rights and obligations set forth in this Section 4.9. The CAISO shall not be obligated to accept Bids that would require Energy to be transmitted to or from a Metered Subsystem unless the MSS Agreement of the MSS Operator of the Metered Subsystem has become effective.

Metered Subsystem shall provide any data or information consistent with the requirements set forth in Section 4.6.4.

\* \* \* \*

#### **4.12.2 Identification of Resource-Specific System Resources**

Each Resource-Specific System Resource owner shall provide data identifying each of its Resource-Specific System Resources and such information regarding the capacity and the operating characteristics of the Resource-Specific System Resource as may be reasonably requested from time to time by the CAISO. Any such data or information shall be provided consistent with the requirements set forth in Section 4.6.4. Pursuant to Sections 8.9 and 8.10, the CAISO may verify, inspect and test the capacity and operating characteristics of the resource provided to the CAISO.

\* \* \* \*

#### **4.13.3 Identification of RDRRs and PDRs**

Each Demand Response Provider shall provide data, as described in the Business Practice Manual, identifying each of its Reliability Demand Response Resources or Proxy Demand Resources and such information regarding the capacity and the operating characteristics of the Reliability Demand Response Resource or Proxy Demand Resource as may be reasonably requested from time to time by the CAISO. Any such data or information shall be provided consistent with the requirements set forth in Section 4.6.4.

\* \* \* \*

#### **4.17.1 Relationship with Distributed Energy Resource Providers**

The CAISO will accept Bids for Energy or Ancillary Services from Distributed Energy Resource Aggregations or submissions of Energy Self-Schedules from Distributed Energy Resource Aggregations, only if such Distributed Energy Resource Aggregations are represented by a Distributed Energy Resource Provider that has entered into a Distributed Energy Resource Provider Agreement with the CAISO to

comply with all applicable provisions of the CAISO Tariff as they may be amended from time to time. The CAISO will not accept Bids for Energy or Ancillary Services from a Distributed Energy Resource Aggregation other than through a Scheduling Coordinator. The Scheduling Coordinator may be the Distributed Energy Resource Provider itself or another entity. A Distributed Energy Resource Aggregation shall provide any data or information consistent with the requirements set forth in Section 4.6.4.

\* \* \* \*

### **8.3.7 AS Bidding Requirements**

Scheduling Coordinators may submit Bids or Submissions to Self-Provide an Ancillary Service consistent with the rules specified in Section 30 and any further requirements in this Section 8.3.7. Scheduling Coordinators may (i) submit Bids or Submissions to Self-Provide an Ancillary Service from resources located within the CAISO Balancing Authority Area (which includes Pseudo-Ties of Generating Units to the CAISO Balancing Authority Area) or Dynamic System Resources certified to provide Ancillary Services, (ii) submit Submissions to Self-Provide an Ancillary Service from System Resources located outside the CAISO Balancing Authority Area if provided pursuant to ETCs, TORs, or Converted Rights, (iii) submit Bids for Ancillary Services from Dynamic and Non-Dynamic System Resources located outside the CAISO Balancing Authority Area certified to provide Ancillary Services, or (iv) submit Inter-SC Trades of Ancillary Services. Ancillary Services procured in the IFM and in the Real-Time Market are comprised of the following: Regulation Up, Regulation Down, Spinning Reserve, and Non-Spinning Reserve. Each resource for which a Scheduling Coordinator wishes to submit Ancillary Service Bids must meet the requirements set forth in this CAISO Tariff. The same resource capacity may be simultaneously offered to the same CAISO Market for multiple Ancillary Services types. Ancillary Services Bids and Submissions to Self-Provide an Ancillary Service can be submitted up to seven (7) days in advance. The CAISO will only use Operating Reserve Ramp Rates for procuring capacity associated with the specific Ancillary Services. The CAISO will issue Real-Time Dispatch Instructions in the Real-Time Market for the Energy associated with the awarded capacity based upon the applicable Operational Ramp Rate value registered

in the Master File in accordance with Section 4.6.4. There is no ability to procure Ancillary Services for export.

To the extent a Scheduling Coordinator has an on-demand obligation to serve loads outside the CAISO Balancing Authority Area, it can do so provided that (1) it is using export transmission capacity available in Real-Time, and (2) the resource capacity providing Energy to satisfy the on-demand obligation is not under an RMR Contract or Resource Adequacy Capacity obligation, and has not been paid a RUC Availability Payment for the Trading Hour. All resources subject to the Ancillary Services must offer requirements, as specified in Section 40.6, must submit Bids consistent with the requirements specified therein and in Section 30.

\* \* \* \*

#### **8.4.1.1 Regulation**

A resource offering Regulation must have the following operating characteristics and technical capabilities:

- (a) it must be capable of being controlled and monitored by the CAISO EMS by means of the installation and use of a standard CAISO direct communication and direct control system, a description of which and criteria for any temporary exemption from which, the CAISO shall publish on the CAISO Website;
- (b) it must be capable of achieving at least the Ramp Rates (increase and decrease in MW/minute) registered in the Master File for the full amount of Regulation capacity offered;
- (c) the Regulation capacity offered must not exceed the maximum Ramp Rate (MW/minute) of that resource times ten (10) minutes;
- (d) the resource to CAISO Control Center telemetry must, in a manner meeting CAISO standards, include indications of whether the resource is on or off CAISO EMS control at the resource terminal equipment;
- (e) the resource must be capable of the full range of movement within the amount of

Regulation capability offered without manual resource operator intervention of any kind;

- (f) each Ancillary Service Provider must ensure that its CAISO EMS control and related SCADA equipment for its resource are operational throughout the time period during which Regulation is required to be provided;
- (g) Regulation capacity offered must be dispatchable on a continuous basis for at least sixty (60) minutes in the Day-Ahead Market and at least thirty (30) minutes in the Real-Time Market after issuance of the Dispatch Instruction. The CAISO will measure continuous Energy from the time a resource reaches its award capacity. Scheduling Coordinators for Non-Generator Resources located within the CAISO Balancing Authority Area that require Energy from the Real-Time Market to offer their full capacity as Regulation may request the use of Regulation Energy Management as described in Section 8.4.1.2; and
- (h) Regulation capacity offered must meet or exceed the minimum performance threshold of twenty-five (25) percent measured accuracy as specified in Section 8.2.3.1.1.

\* \* \* \*

#### **30.4 Proxy Cost and Registered Cost Methodologies**

Scheduling Coordinators for Generating Units and Resource-Specific System Resources must use the Proxy Cost methodology for their Start-Up Costs and Minimum Load Costs, as well as for Transition Costs in the case of Multi-Stage Generating Resources unless the resource has fewer than twelve (12) consecutive months of fifteen-minute LMPs for Energy at the resource's PNode or Aggregated PNode and meets the definition of a Use-Limited Resource. Scheduling Coordinators on behalf of Use-Limited Resources with fewer than 12 months of data can elect to use the Registered Cost methodology and remain on that methodology for a two-month period once 12 months of pricing data is collected, while the Scheduling Coordinator and the CAISO are going through the process of determining what Opportunity

Costs, if any, apply to the Use-Limited Resource. Once this process concludes, all such Use-Limited Resources must be subject to the Proxy Cost methodology.

For Use-Limited Resources eligible for the Registered Cost methodology, Scheduling Coordinators may elect on a thirty (30) day basis to use either the Proxy Cost methodology or the Registered Cost methodology for specifying their Start-Up Costs and Minimum Load Costs to be used for those resources in the CAISO Markets Processes, as well as for Transition Costs in the case of Multi-Stage Generating Resources. The elections are independent as to Start-Up Costs and Minimum Load Costs; that is, a Scheduling Coordinator for such a Use-Limited Resource may elect to use either the Proxy Cost methodology or the Registered Cost methodology for Start-Up Costs and may make a different election for Minimum Load Costs. However, in the case of Multi-Stage Generating Resources, the Scheduling Coordinator must make the same election (Proxy Cost methodology or Registered Cost methodology) for Transition Costs as it makes for Start-Up Costs. If a Scheduling Coordinator has not made an election, the CAISO will assume the Proxy Cost methodology as the default.

\* \* \* \* \*

### **30.4.1 Start-Up and Minimum Load Costs**

#### **30.4.1.1 Proxy Cost Methodology**

##### **30.4.1.1.1 Natural Gas-Fired Resources**

For each natural gas-fired resource, the Proxy Cost methodology uses formulas for Start-Up Costs and Minimum Load Costs based on the resource's actual unit-specific performance parameters. The Start-Up Cost and Minimum Load Cost values utilized for each such resource in the CAISO Markets Processes will be either (a), if the Scheduling Coordinator does not submit a Start-Up or Minimum Load Cost Bid, or (b) below:

- (a) Formulaic natural gas cost values adjusted for fuel-cost variation on a daily basis using the natural gas price calculated pursuant to Section 39.7.1.1.1.3.  
Start-Up Costs also include: (i) the cost of auxiliary power calculated using the unit-specific MWh quantity of auxiliary power used for Start-Up multiplied by a resource-

specific electricity price; (ii) a greenhouse gas cost adder for each resource registered with the California Air Resources Board as having a greenhouse gas compliance obligation, which is calculated for each Start-Up as the product of the resource's fuel requirement per Start-Up, the greenhouse gas emissions rate authorized by the California Air Resources Board, and the applicable Greenhouse Gas Allowance Price; (iii) the rates for the Market Services Charge and System Operations Charge multiplied by the shortest Start-Up Time listed for the resource in the Master File, multiplied by the PMin of the resource, multiplied by 0.5; (iv) a resource-specific adder, if applicable, for major maintenance expenses (\$ per Start-Up) determined by the CAISO or Independent Entity selected by the CAISO to determine such major maintenance expenses; and (v) for a Use-Limited Resource, Start-Up Opportunity Costs determined pursuant to Section 30.4.1.1.6, if any.

Minimum Load Costs also include: (i) operation and maintenance costs as provided in Section 39.7.1.1.2; (ii) a greenhouse gas cost adder for each resource registered with the California Air Resources Board as having a greenhouse gas compliance obligation, which is calculated for each run-hour as the product of the resource's fuel requirement at Minimum Load as registered in the Master File, the greenhouse gas emissions rate authorized by the California Air Resources Board, and the applicable Greenhouse Gas Allowance Price; (iii) the rates for the Market Services Charge and System Operations Charge multiplied by the PMin of the resource as registered in the Master File; (iv) the Bid Segment Fee; (v) a resource-specific adder, if applicable, for major maintenance expenses (\$ per operating hour) determined pursuant to Section 30.4.1.1.4; and (vi) for a Use-Limited Resource, Minimum Load Opportunity Costs determined pursuant to Section 30.4.1.1.6, if any.

- (b) Start-Up or Minimum Load Cost Bids specified by Scheduling Coordinators pursuant to Sections 30.7.9 and 30.7.10, subject to the provisions applicable to Multi-Stage Generating Resources set forth in Section 30.4.1.1.3.

In the event that the Scheduling Coordinator for a resource other than a Multi-Stage Generating Resource or for a Multi-Stage Generating Resource in its lowest startable configuration does not provide sufficient data for the CAISO to determine the resource's Start-Up or Minimum Load Costs or one or more components of the resource's Start-Up or Minimum Load Costs, the CAISO will assume that the resource's Start-Up Costs or Minimum Load Costs, or the indeterminable component(s) of the resource's Start-Up Costs or Minimum Load Costs, are zero. In the event that the Scheduling Coordinator for a Multi-Stage Generating Resource does not provide such data for an MSG Configuration beyond its lowest startable configuration, Section 30.4.1.1.3 applies.

#### **30.4.1.1.2 Non-Natural Gas-Fired Resources**

For each non-natural gas-fired resource, Start-Up Cost and Minimum Load Cost values under the Proxy Cost methodology shall be based on either (a) if the Scheduling Coordinator does not submit a Start-Up or Minimum Load Cost Bid, or (b) below:

- (a) The Scheduling Coordinator for the resource will provide the fuel or fuel equivalent input costs, which the CAISO will maintain in the Master File.

For Start-Up Costs, the CAISO will also include, if applicable: (i) greenhouse gas allowance costs for each resource registered with the California Air Resources Board as having a greenhouse gas compliance obligation, as provided to the CAISO by the Scheduling Coordinator; (ii) the rates for the Market Services Charge and System Operations Charge multiplied by the shortest Start-Up Time listed for the resource in the Master File, multiplied by the PMin of the resource as registered in the Master File, multiplied by 0.5; (iii) a resource-specific adder, if applicable, for major maintenance expenses (\$ per Start-Up) determined by the CAISO or Independent Entity selected by the CAISO to determine such major maintenance expenses; and (iv) for a Use-Limited Resource, Start-Up Opportunity Costs determined pursuant to Section 30.4.1.1.6, if any. For Minimum Load Costs, the CAISO will also include, if applicable: (i) operation and maintenance costs as provided in Section 39.7.1.1.2; (ii) greenhouse gas allowance costs for each resource registered with the California Air Resources Board as having a greenhouse gas compliance obligation, as provided to the CAISO by the Scheduling



Coordinator; (iii) the rates for the Market Services Charge and System Operations Charge multiplied by the PMin of the resource as registered in the Master File; (iv) the Bid Segment Fee; (v) a resource-specific adder, if applicable, for major maintenance expenses (\$ per operating hour) determined by the CAISO or an Independent Entity selected by the CAISO; and (vi) for a Use-Limited Resource, Minimum Load Opportunity Costs determined pursuant to Section 30.4.1.1.6, if any.

For each resource registered with the California Air Resources Board as having a greenhouse gas compliance obligation, the information provided to the CAISO by the Scheduling Coordinator must be consistent with information submitted to the California Air Resources Board. Adders for major maintenance expenses will be determined pursuant to Section 30.4.1.1.4, if any.

- (b) Bids specified by Scheduling Coordinators pursuant to Sections 30.7.9 and 30.7.10, subject to the provisions applicable to Multi-Stage Generating Resources set forth in Section 30.4.1.1.3.

In the event that the Scheduling Coordinator for a resource other than a Multi-Stage Generating Resource or for a Multi-Stage Generating Resource in its lowest startable configuration does not provide sufficient data for the CAISO to determine the resource's Start-Up or Minimum Load Costs or one or more components of the resource Start-Up or Minimum Load Costs, the CAISO will assume that resource's Start-Up or Minimum Load Costs, or the indeterminable component(s) of the resource's Start-Up Costs or Minimum Load Costs, are zero. In the event that the Scheduling Coordinator for a Multi-Stage Generating Resource does not provide such data for an MSG Configuration beyond its lowest startable configuration, Section 30.4.1.1.3 applies.

\* \* \* \*

#### **30.4.1.1.5 Proxy Transition Cost**

For each Multi-Stage Generating Resource under the Proxy Cost methodology, the CAISO will calculate the Transition Costs utilized for each feasible transition from a given MSG Configuration to a higher MSG

Configuration based on the difference between the Start-Up Costs for the higher MSG Configuration, minus the Start-Up Costs for the lower MSG Configuration, as determined in accordance with the Start-Up Cost calculation methodology set forth in Section 30.4.1.1. If the result of this calculation is negative for any transition between two MSG Configurations, then the associated Transition Cost shall be zero. The Transition Costs calculated by the CAISO will be utilized in the CAISO Markets Processes unless the Scheduling Coordinator submits Transition Costs for the Multi-Stage Generating Resource in the form of daily Bids that are not negative and are less than or equal to the sum of (i) one hundred twenty-five (125) percent of the Transition Costs other than the portion of the Transition Costs that consist of Start-Up Opportunity Costs determined by the CAISO, if any; and (ii) one hundred (100) percent of the portion of the Transition Costs that consist of Start-Up Opportunity Costs determined by the CAISO, in which case the Transition Costs submitted in the form of daily Bids will be utilized in the CAISO Markets Processes.

#### **30.4.1.1.6 Use-Limited Resources**

##### **30.4.1.1.6.1 Registration and Validation Process**

A Scheduling Coordinator seeking to obtain Use-Limited Resource status for resource(s) will follow the registration and validation process set forth in this CAISO Tariff and the Business Practice Manual. The registration and validation process requires each Scheduling Coordinator to demonstrate that the resources meet the Use-Limited Resource criteria as set forth in Section 30.4.1.1.6.1.1, and allows each Scheduling Coordinator to seek to recover Opportunity Costs for Use-Limited Resources by making the demonstration set forth in Section 30.4.1.1.6.1.2.

##### **30.4.1.1.6.1.1 Use-Limited Resource Criteria**

In order for a resource to be considered a Use-Limited Resource, a Scheduling Coordinator must provide sufficient documentation demonstrating that the resource meets all three of the following criteria:

- (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, (b) environmental restrictions, or (c) qualifying contractual limitations;
- (2) The CAISO Market Process used to dispatch the resource cannot recognize the resource's limitation(s); and
- (3) The resource's ability to select hours of operation is not dependent on an energy source

outside of the resource's control being available during such hours.

Design considerations that satisfy the requirements of this Section are those resulting from physical equipment limitations. A non-exhaustive list of such physical equipment limitations includes restrictions documented in original equipment manufacturer recommendations or bulletins, or limiting equipment such as storage capability for hydroelectric generating resources. Other design considerations that satisfy the requirements of this Section are those resulting from performance criteria for Demand Response Resources established pursuant to programs or contracts approved by Local Regulatory Authorities. Environmental restrictions that satisfy the requirements of this Section are those imposed by regulatory bodies, legislation, or courts. A non-exhaustive list of such environmental restrictions includes limits on emissions, water use restrictions, run-hour limitations in operating permits or other environmental limits that directly or indirectly limit starts, run hours, or MWh limits, but excludes restrictions with soft caps that allow the resource to increase production above the soft caps through the purchase of additional compliance instruments. Qualifying contractual limitations that satisfy the requirements of this Section are those contained in long-term contracts that: (i) were reviewed and approved by a Local Regulatory Authority on or before January 1, 2015, or were pending approval by a Local Regulatory Authority on or before January 1, 2015 and were later approved; and (ii) were evaluated by the Local Regulatory Authority for the overall cost-benefit of those contracts taking into consideration the overall benefits and burdens, including the limitations on such resources' numbers of starts, numbers of run-hours, or Energy output. Contracts limits that provide for higher payments when start-up, run-hour, or Energy output thresholds are exceeded are not qualifying contractual limitations. Effective November 1, 2021, no contractual limitations will constitute qualifying contractual limitations that satisfy the requirements of this Section.

Pursuant to a process set forth in the Business Practice Manual, the CAISO will review the limits and the supporting documentation provided by the Scheduling Coordinator as well as any translation of indirect limits to determine whether the Scheduling Coordinator has made the required showing under this Section. Any dispute regarding the CAISO's determination will be subject to the generally applicable CAISO ADR Procedures set forth in Section 13, which apply except where a CAISO Tariff provision expressly provides for a different means of resolving disputes.

#### **30.4.1.1.6.1.2 Establishing Opportunity Cost Adders**

A Scheduling Coordinator for a Use-Limited Resource that elects the Proxy Cost methodology may seek to establish Opportunity Cost adders for any limitation(s) that meet all three (3) of the following criteria:

- (1) Satisfy the requirements of Section 30.4.1.1.6.1.1;
- (2) Apply for period(s) longer than the time horizon considered in the applicable Day-Ahead Market process; and
- (3) Can be reflected in a monthly, annual, and/or rolling twelve (12) month period.

The CAISO will review the documentation provided by the Scheduling Coordinator and determine whether the CAISO can calculate an Opportunity Cost pursuant to the methodology set forth in Section 30.4.1.1.6.2 using the Opportunity Cost calculator, or whether the Opportunity Cost for the limitation must instead be established pursuant to the negotiation process set forth in Section 30.4.1.1.6.3. Resources with limits that can be modelled using the Opportunity Cost calculator, are not eligible for a negotiated Opportunity Cost. Any Opportunity Cost that is determined either through the calculated or negotiated process, will remain in place unless and until the Scheduling Coordinator submits documentation, either to establish a new limitation or to modify an existing limitation, in which case the Scheduling Coordinator can request reconsideration. In accordance with Section 39.7.1.3.2.2, the CAISO will make informational filings with FERC of any Opportunity Costs calculated pursuant to Section 30.4.1.1.6.2 or negotiated pursuant to Section 30.4.1.1.6.3.

The following types of Use-Limited Resource capacity are not eligible for an Opportunity Cost adder: the capacity of a Condition 2 RMR Unit, a Reliability Demand Response Resource, Regulatory Must-Take capacity, and any other type of Use-Limited Resource to the extent it has a limitation that satisfies the requirements of Section 30.4.1.1.6.1 but applies for a period less than or equal to the time horizon considered in the Day-Ahead Market.

#### **30.4.1.1.6.2 Calculation of Opportunity Cost Adders**

##### **30.4.1.1.6.2.1 Calculation Schedule**

The CAISO will calculate, and will update the most recent calculations of, Start-Up Opportunity Costs for each validated limitation on a Use-Limited Resource's number of starts, Minimum Load Opportunity Costs for each validated limitation on a Use-Limited Resource's number of run-hours, and Variable Energy

Opportunity Costs for each validated limitation on a Use-Limited Resource's Energy output for which the Scheduling Coordinator has made the required showing under Section 30.4.1.1.6.1.2. Such calculations or updated calculations will actually be used to set the adder for each validated limitation that can be reflected in a monthly or a rolling twelve (12) month period and will be advisory for each validated limitation that can be reflected in an annual period. The CAISO plans to perform the calculations and updated calculations once a month. It is possible that circumstances may prevent the CAISO from performing the calculations on a monthly basis, in which case the CAISO will prioritize the workload based on Opportunity Costs most likely to need updating. Similarly, circumstances may suggest there is a basis to update calculations more frequently, in which case the CAISO will also prioritize the workload based on Opportunity Costs most likely to need updating. The CAISO will provide the results of the calculations or updated calculations for a Use-Limited Resource to its Scheduling Coordinator.

In the event that the CAISO is unable to perform such calculations or updated calculations for all Use-Limited Resources, the CAISO will give priority to performing such calculations or updated calculations for those Use-Limited Resources that are currently on pace to reach their maximum allowed numbers of starts, maximum allowed numbers of run-hours, or maximum allowed Energy output more quickly than the most recent calculations of Opportunity Costs indicated. To the extent that the CAISO is unable to perform such calculations or updated calculations for a Use-Limited Resource, the CAISO will utilize the most recently calculated or updated Opportunity Costs that have been set or are advisory for the Use-Limited Resource.

#### **30.4.1.1.6.2.2 Methodology for Opportunity Cost Calculator**

For the Opportunity Cost calculator developed by the CAISO, each calculation of Opportunity Costs will equal the estimated profits foregone if the Use-Limited Resource had one fewer unit of starts, run-hours, or Energy output, whichever is applicable, in the future time period of the validated limitation. With regard to each validated limitation of the Use-Limited Resource, the calculation will take into account a margin set forth in the Business Practice Manual. The calculation will also take into account the effect of any validated limitation on a Use-Limited Resource's number of starts, number of run-hours, or Energy output in the monthly and annual and/or rolling twelve month periods. For MSG Transitions, the Opportunity Cost for each transition will be derivative of the number of Start-Ups required for the MSG Resource to

achieve a specific MSG Configuration.

The CAISO will calculate the estimated profits for each validated limitation over the future time period of the limitation based on the following estimated inputs: (a) the forecasted hourly average of fifteen-minute LMPs for Energy at the Use-Limited Resource's PNode or Aggregated PNode multiplied by (b) the optimal hourly dispatch of the Use-Limited Resource, minus (c) the estimated monthly Start-Up Cost of the Use-Limited Resource, minus (d) the estimated monthly Minimum Load Cost of the Use-Limited Resource, minus (e) the estimated monthly variable Energy cost of the Use-Limited Resource multiplied by the difference between (f) the optimal hourly commitment and dispatch of the Use-Limited Resource and (g) the PMin of the Use-Limited Resource, minus (h) the estimated monthly Transition Cost of the Use-Limited Resource. For a Use-Limited Resource that has twelve (12) or fewer months of LMP data at its PNode or Aggregated PNode, the CAISO will calculate input (a) listed above using LMP data from a comparable PNode or Aggregated PNode.

Any dispute regarding the calculation of Opportunity Costs will be subject to the CAISO ADR Procedures set forth in Section 13.

#### **30.4.1.1.6.3 Negotiation of Opportunity Costs**

If, after receipt of the documentation required pursuant to Section 30.4.1.1.6.1.2, the CAISO determines that it cannot rely on the Opportunity Cost calculator to calculate Opportunity Costs for an eligible limitation pursuant to Section 30.4.1.1.6.2, the CAISO will establish the Opportunity Costs for the limitation pursuant to this Section. Upon making this determination, the CAISO will notify the Scheduling Coordinator for the resource and request that the Scheduling Coordinator provide the CAISO with a proposed methodology for determining Start-Up Opportunity Costs, Minimum Load Opportunity Costs, and/or Variable Energy Opportunity Costs for the limitation along with documentation supporting the methodology, and a proposed schedule for the CAISO to update such Opportunity Cost(s) under the methodology. The CAISO will either approve the submitted Opportunity Cost methodology or enter into good-faith negotiations with the Scheduling Coordinator to establish an agreed-upon Opportunity Cost methodology and the schedule for updating the Opportunity Costs under the methodology.

If the CAISO and the Scheduling Coordinator enter into good-faith negotiations, the negotiation period will be a minimum of sixty (60) days following the provision of all required documentation by the Scheduling

Coordinator. Following the 60-day period, the parties can agree to continue good-faith negotiations or the Scheduling Coordinator can exercise its right to file with FERC as described below. In the event that the CAISO and the Scheduling Coordinator are unable to agree upon negotiated Opportunity Costs before the negotiation period terminates, the CAISO may propose reasonable interim Opportunity Cost value(s) that will apply to the Use-Limited Resource until the CAISO and the Scheduling Coordinator agree upon negotiated Opportunity Costs. The Scheduling Coordinator may accept or reject the proposed interim Opportunity Cost value(s). If the Scheduling Coordinator rejects the proposed interim Opportunity Cost value(s), the Use-Limited Resource will not receive Opportunity Costs unless and until the CAISO and the Scheduling Coordinator agree upon negotiated Opportunity Costs, or such costs are established by an order issued by FERC. In the event that the negotiation period terminates without the CAISO and the Scheduling Coordinator reaching agreement upon negotiated Opportunity Costs, and the Scheduling Coordinator declines to continue negotiations, the Scheduling Coordinator may file proposed Opportunity Costs and supporting documentation with FERC pursuant to Section 205 of the Federal Power Act. Any updates to the negotiated Opportunity Costs adders established pursuant to this Section will consist solely of updates to the Opportunity Cost values themselves, and shall not affect the methodology for establishing those values. Any change in methodology would require the Scheduling Coordinator to initiate a new request pursuant to Section 30.4.1.1.6.1.2.

#### **30.4.1.2 Registered Cost Methodology**

Under the Registered Cost methodology, the Scheduling Coordinator for a Use-Limited Resource that is eligible for Opportunity Costs and either (i) does not have at least twelve (12) consecutive months of fifteen-minute LMPs for Energy at the Use-Limited Resource's PNode or Aggregated PNode; or (ii) has at least twelve (12) consecutive months of such LMPs but has not yet reached the start of the second month after the end of the twelfth consecutive month of having such LMPs, may register values of its choosing for Start-Up Costs and/or Minimum Load Costs in the Master File subject to the maximum limit specified in Section 39.6.1.6. A Scheduling Coordinator for a Multi-Stage Generating Resource that is a Use-Limited Resource registering a Start-Up Cost must also register Transition Costs for each feasible MSG Transition, subject to the maximum limit specified in Section 39.6.1.7. For a Use-Limited Resource to be eligible for the Registered Cost methodology there must be sufficient information in the Master File to

calculate the value pursuant to the Proxy Cost methodology, which will be used to validate the specific value registered using the Registered Cost methodology. Any such values will be fixed for a minimum of 30 days in the Master File unless: (a) the resource's costs for any such value, as calculated pursuant to the Proxy Cost methodology, exceed the value registered using the Registered Cost methodology, in which case the Scheduling Coordinator may elect to switch to the Proxy Cost methodology for the balance of any 30-day period, except as set forth in Section 30.4.1.2(b); or (b) any cost registered in the Master File exceeds the maximum limit specified in Section 39.6.1.6 or Section 39.6.1.7 after this minimum 30-day period, in which case the value will be lowered to the maximum limit specified in Section 39.6.1.6 or Section 39.6.1.7. If a Multi-Stage Generating Resource elects to use the Registered Cost methodology, that election will apply to all the MSG Configurations for that resource. The cap for the Registered Cost values for each MSG Configuration will be based on the Proxy Cost values calculated for each MSG Configuration, including for each MSG Configuration that cannot be directly started, which are also subject to the maximum limits specified in Sections 39.6.1.6 and 39.6.1.7.

\* \* \* \* \*

### **30.5.2.2 Supply Bids for Participating Generators**

In addition to the common elements listed in Section 30.5.2.1, Supply Bids for Participating Generators shall contain the following components as applicable: Start-Up Bid, Minimum Load Bid, Minimum and Maximum Operating Limits; Energy Limit, Regulatory Must-Take/Must-Run Generation; Contingency Flag; and Contract Reference Number (if any). Scheduling Coordinators submitting these Bid components for a Multi-Stage Generating Resource must do so for the submitted MSG Configuration. Scheduling quantities that a Scheduling Coordinator schedules as Regulatory Must-Take Generation for a CHP Resource shall be limited to the quantity necessary in any hour to meet the reasonably anticipated industrial host's thermal requirements and shall not exceed any established RMTMax values. The CHP Resource owner or operator shall provide its Scheduling Coordinator with the Regulatory Must-Take Generation values and is solely responsible for the accuracy of the information. The Scheduling Coordinator for the CHP Resource will schedule the quantities consistent with information provided



subject to any contract rights between the CHP Resource Generating Unit owner or operator and its counter-party to any power purchase agreement regarding curtailment or dispatchability of the CHP Resource. If the CHP Resource Generating Unit has a power purchase agreement and its counter-party is not the Scheduling Coordinator for the resource, the parties to the agreement share the responsibility for ensuring that the Scheduling Coordinator schedules the resource consistent with contractual rights of the counter-parties. A Scheduling Coordinator for a Physical Scheduling Plant or a System Unit may include Generation Distribution Factors as part of its Supply Bid. If the Scheduling Coordinator has not submitted the Generation Distribution Factors applicable for the Bid, the CAISO will use default Generation Distribution Factors stored in the Master File. All Generation Distribution Factors used by the CAISO will be normalized based on Outage data that is available to the automated market systems. A Multi-Stage Generating Resource and its MSG Configurations are registered under a single Resource ID and Scheduling Coordinator for the Multi-Stage Generating Resource must submit all Bids for the resource's MSG Configurations under the same Resource ID. For Multi-Stage Generating Resources, Scheduling Coordinators may submit bid curves for up to ten individual MSG Configurations of their Multi-Stage Generating Resources into the Day-Ahead Market and up to three individual MSG Configurations into the Real-Time Market. For Multi-Stage Generating Resources the Scheduling Coordinator may submit the Transition Times, which cannot be greater than the maximum Transition Time registered in the Master File. To the extent the Scheduling Coordinator does not submit the Transition Time that is a registered feasible transition the CAISO will use the registered maximum Transition Time for that MSG Transition for the specific Multi-Stage Generating Resource.

### **30.5.2.3 Supply Bids for Participating Loads, Including Pumped-Storage Hydro Units and Aggregated Participating Loads**

In addition to the common elements listed in Section 30.5.2.1, Scheduling Coordinators submitting Supply Bids for Participating Loads, which includes Pumping Load or Pumped-Storage Hydro Units, may include the following components: Pumping Level (MW), Minimum Load Bid (Generation mode only of a Pumped-Storage Hydro Unit), Load Distribution Factor, Energy Limit, Pumping Cost, and Pump Shut-Down Costs. If no values for Pumping Cost or Pump Shut-Down Costs are submitted, the CAISO will generate these Bid components based on values in the Master File. Scheduling Coordinators may only submit Supply Bids for Aggregated Participating Loads by using a Generating Unit or Physical Scheduling Plant

Resource ID for the Demand reduction capacity represented by the Aggregated Participating Load as set forth in a Business Practice Manual. The CAISO will use Generation Distribution Factors provided by the Scheduling Coordinator for the Aggregated Participating Load.

#### **30.5.2.4 Supply Bids for System Resources**

In addition to the common elements listed in Section 30.5.2.1, Supply Bids for System Resources shall also contain: Start-Up Costs; and Minimum Load Costs. Resource-Specific System Resources are subject to the Proxy Cost methodology or the Registered Cost methodology for Start-Up Costs and Minimum Load Costs as provided in Section 30.4, and Transaction ID as created by the CAISO. Other System Resources are not eligible to recover Start-Up Costs and Minimum Load Costs. Resource-Specific System Resources are eligible to participate in the Day-Ahead Market on an equivalent basis as Generating Units and are not obligated to participate in RUC or the RTM if the resource did not receive a Day-Ahead Schedule unless the resource is a Resource Adequacy Resource. If the Resource-Specific System Resource is a Resource Adequacy Resource, the Scheduling Coordinator for the resource is obligated to make it available to the CAISO Market as prescribed by Section 40.6. Dynamic Resource-Specific System Resources are also eligible to participate in the HASP and RTM on an equivalent basis as Generating Units. The quantity (in MWh) of Energy categorized as Interruptible Imports (non-firm imports) can only be submitted through Self-Schedules in the Day-Ahead Market and cannot be incrementally increased in the HASP or RTM. Bids submitted to the Day-Ahead Market for ELS Resources will be applicable for two days after they have been submitted and cannot be changed the day after they have been submitted.

\* \* \* \*

#### **30.5.2.6 Supply Bids for Distributed Energy Resource Aggregations**

In addition to the common elements listed in Section 30.5.2.1, Supply Bids for Distributed Energy Resource Aggregations will contain the following components as applicable: Generation Distribution Factors, Minimum and Maximum Operating Limits; Energy Limit, and Contingency Flag. If the Scheduling Coordinator does not submit the Generation Distribution Factors for the Bid, the CAISO will use default

Generation Distribution Factors registered in the Master File.

### **30.5.2.7 Ancillary Services Bids**

There are four distinct Ancillary Services: Regulation Up, Regulation Down, Spinning Reserve and Non-Spinning Reserve. A resource shall be eligible to provide Ancillary Service if it has complied with the CAISO's certification and testing requirements as contained in Appendix K and the CAISO's Operating Procedures. Scheduling Coordinators may use Dynamic System Resources to Self-Provide Ancillary Services as specified in Section 8. All System Resources, including Dynamic System Resources and Non-Dynamic System Resources, will be charged the Shadow Price as prescribed in Section 11.10, for any awarded Ancillary Services. A Scheduling Coordinator may submit Ancillary Services Bids for Regulation Up, Regulation Down, Spinning Reserve, and Non-Spinning Reserve for the same capacity by providing a separate price in \$/MW per hour as desired for each Ancillary Service. The Bid for each Ancillary Service is a single Bid segment. Only resources certified by the CAISO as capable of providing Ancillary Services are eligible to provide Ancillary Services and submit Ancillary Services Bids. In addition to the common elements listed in Section 30.5.2.1, all Ancillary Services Bid components of a Supply Bid must contain the following: (1) the type of Ancillary Service for which a Bid is being submitted; and (2) Distribution Curve for Physical Scheduling Plant or System Unit. A Scheduling Coordinator may only submit an Ancillary Services Bid or Submission to Self-Provide an Ancillary Service for Multi-Stage Generating Resources for the Ancillary Service for which the specific MSG Configurations are certified. An Ancillary Services Bid submitted to the Day-Ahead Market when submitted to the Day-Ahead Market may be, but is not required to be, accompanied by an Energy Bid that covers the capacity offered for the Ancillary Service. Submissions to Self-Provide an Ancillary Service submitted to the Day-Ahead Market when submitted to the Day-Ahead Market may be, but are not required to be, accompanied by an Energy Bid that covers the capacity to be self-provided. If a Scheduling Coordinator's Submission to Self-Provide an Ancillary Service is qualified as specified in Section 8.6, the Scheduling Coordinator must submit an Energy Bid that covers the self-provided capacity prior to the close of the Real-Time Market for the day immediately following the Day-Ahead Market in which the Ancillary Service Bid was submitted. Except as provided below, the Self-Schedule for Energy need not include a Self-Schedule for Energy from the resource that will be self-providing the Ancillary Service. If a Scheduling Coordinator is self-providing an

Ancillary Service from a Fast Start Unit, no Self-Schedule for Energy for that resource is required. If a Scheduling Coordinator proposes to self-provide Spinning Reserve, the Scheduling Coordinator is obligated to submit a Self-Schedule for Energy for that particular resource, unless as discussed above the particular resource is a Fast Start Unit. When submitting Ancillary Service Bids in the Real-Time Market, Scheduling Coordinators for resources that either have been awarded or self-provide Spinning Reserve or Non-Spinning Reserve capacity in the Day-Ahead Market must submit an Energy Bid for at least the awarded or self-provided Spinning Reserve or Non-Spinning Reserve capacity, otherwise the CAISO will apply the Bid validation rules described in Section 30.7.6.1.

As provided in Section 30.5.2.6.4, a Submission to Self-Provide an Ancillary Service shall contain all of the requirements of a Bid for Ancillary Services with the exception of Ancillary Service Bid price information. In addition, Scheduling Coordinators must comply with the Ancillary Services requirements of Section 8. Scheduling Coordinators submitting Self-Schedule Hourly Blocks for Ancillary Services Bids for the Real-Time Market must also submit an Energy Bid for the associated Ancillary Services Bid under the same Resource ID, otherwise the bid validation rules in Section 30.7.6.1 will apply to cover any portion of the Ancillary Services Bid not accompanied by an Energy Bid. As described in Section 34.2.3, if the resource submits a Self-Scheduled Hourly Block, the CAISO will only use the Ancillary Services Bid in the RTM optimization and will not use the associated Energy Bid for the same Resource ID to schedule Energy from the Non-Dynamic System Resource in the RTM. Scheduling Coordinators must also comply with the bidding rules associated with the must offer requirements for Ancillary Services specified in Section 40.6.

\* \* \* \*

### **30.7.3.5 Bid Validation Rules for Multi-Stage Generating Resources**

If a Scheduling Coordinator does not submit a Bid in the Day-Ahead Market or Real-Time Market for a Multi-Stage Generating Resource with a Resource Adequacy must-offer obligation at a MSG Configuration that can meet the applicable Resource Adequacy must-offer obligation, the CAISO will create a Generated Bid for the default Resource Adequacy MSG Configuration. If the Multi-Stage

Generating Resource is not capable of Start-Up in the default Resource Adequacy MSG Configuration, then the ISO will, based on feasibility of transitions, create a Generated Bid for every MSG Configuration that has a minimum output below the MW level of the Resource Adequacy must-offer obligation, which will cover the operating range from its minimum output to the minimum of its maximum output and the MW level of the Resource Adequacy must-offer obligation. In the event that the Scheduling Coordinator does not submit a Bid in compliance with section 30.5.1(p), the CAISO will create a Generated Bid for all of the capacity not bid into the CAISO Market between the maximum bid-in Energy MW and the higher of Self-Scheduled Energy MW and the Multi-Stage Generating Resource plant-level PMin. If the Scheduling Coordinator submits a Bid for the Multi-Stage Generating Resource, the CAISO will create this Generated Bid for the registered MSG Configurations before the Market Close, and if it does not submit such a Bid the CAISO will create this Generated Bid after the Market Close. Any Generated Bid created by the CAISO for the default Resource Adequacy MSG Configuration will be in addition to the MSG Configurations bid into the Real-Time Market by the responsible Scheduling Coordinator. If the Scheduling Coordinator submits a Bid in the Day-Ahead Market or Real-Time Market for a MSG Configuration that is not the default Resource Adequacy MSG Configuration and that does not cover the full amount of the resource's Resource Adequacy requirements, the CAISO will create a Generated Bid for the full Resource Adequacy Capacity. Before the market closes, if a Scheduling Coordinator submits a Bid in the Day-Ahead Market or Real-Time Market for the default Resource Adequacy MSG Configuration of a Multi-Stage Generating Resource that only meets part of the resource's Resource Adequacy must-offer obligation, the CAISO will extend the last segment of the Energy Bid curve in the submitted Bid for the Multi-Stage Generating Resource up to the Multi-Stage Generating Resource's Resource Adequacy must-offer obligation. After the market closes, to the extent that no Bid is submitted into the Real-Time Market for a Multi-Stage Generating Resource scheduled in the Integrated Forward Market as required in Section 30.5 the CAISO will create a Self-Schedule for MSG Configuration equal to the Day-Ahead Schedule for that resource for the MSG Configuration scheduled in the IFM. To the extent a Multi-Stage Generating Resource is awarded Operating Reserves in the Day-Ahead Market and no Economic Energy Bid is submitted for that resource in the Real-Time Market, the CAISO will insert Proxy Energy Bid in the MSG Configuration that was awarded in the Day-Ahead Market to cover the

awarded Operating Reserves. To the extent that a Multi-Stage Generating Resource's RUC Schedule is greater than its Day-Ahead Schedule, if the Scheduling Coordinator does not submit an Energy Bid in the RTM to cover the difference, then the CAISO will either create a Bid in the MSG Configuration awarded in RUC, or extend the Bid submitted by the Scheduling Coordinator before the Market Close. After the Market Close, the CAISO will create a Generated Bid if there is no Bid submitted for the resource for this difference. The CAISO will validate that the combination of the Day-Ahead Ancillary Services Awards and Submissions to Self-Provide Ancillary Services is feasible with respect to the operating characteristics of the applicable MSG Configuration registered in the Master File pursuant to Section 4.6.4. The CAISO will reject Ancillary Services Bids or Submissions to Self-Provide Ancillary Services for MSG Configurations that are not certified Ancillary Services. For any given Multi-Stage Generating Resource, for any given CAISO Market and Trading Hour if one MSG Configuration's Bid fails the bid validation process, all other Bids for all other MSG Configurations are also invalidated.

\* \* \* \*

### **30.7.7 [Not Used]**

\* \* \* \*

### **30.7.9 Format and Validation of Start-Up Costs and Shut-Down Costs**

For a Generating Unit or a Resource-Specific System Resource, the submitted Start-Up Cost expressed in dollars (\$) as a function of down time expressed in minutes must be a staircase function with up to three (3) segments defined by a set of 1 to 4 down time and Start-Up Cost pairs. The Start-Up Cost is the cost incurred to start the resource if it is offline longer than the corresponding down time. The last segment will represent the cost to start the resource from cold Start-Up and will extend to infinity. The submitted Start-Up Cost function shall be validated as follows:

- (a) The first down time must be zero (0) min.
- (b) The down time entries must match exactly (in number, sequence, and value) the corresponding down time breakpoints of the Start-Up Cost function, as registered in the

Master File for the relevant resource as either the Proxy Cost or Registered Cost.

- (c) The Start-Up Cost for each segment must not be negative and must be equal to the Start-Up Cost of the corresponding segment of the Start-Up Cost function, as registered in the Master File for the relevant resource. In addition, if the Proxy Cost methodology pursuant to Section 30.4 applies to the resource, the Scheduling Coordinator for that resource may submit a daily Bid for the Start-Up Cost that must not be negative but may be less than or equal to the sum of (i) one hundred twenty-five (125) percent of the Proxy Cost other than the portion of the Proxy Cost that consists of Start-Up Opportunity Costs, if any; and (ii) one hundred (100) percent of the portion of the Proxy Cost that consists of Start-Up Opportunity Costs; and if the resource is a Multi-Stage Generating Resource, the Scheduling Coordinator may submit a daily Bid for each MSG Configuration of the resource that must not be negative but may be less than or equal to the sum of (i) one hundred twenty-five (125) percent of the Start-Up Cost for the MSG Configuration other than the portion of the Start-Up Cost for the MSG Configuration that consists of Start-Up Opportunity Costs, if any; and (ii) one hundred (100) percent of the portion of the Start-Up Cost for the MSG Configuration that consists of Start-Up Opportunity Costs. For a resource that is eligible and has elected to use the Registered Cost methodology pursuant to Section 30.4, if a value is submitted in a Bid for the Start-Up Cost, it will be overwritten by the Registered Cost reflected in the Master File. If no value for Start-Up Cost is submitted in a Bid, the CAISO will insert the Master File value, as either the Proxy Cost or Registered Cost based on the methodology elected pursuant to Section 30.4.
- (d) The Start-Up Cost function must be strictly monotonically increasing, i.e., the Start-Up Cost must increase as down time increases.

The Start-Up Cost for a Reliability Demand Response Resource shall be zero (0). For Participating Loads and Proxy Demand Resources, a single Shut-Down Cost in dollars (\$) is the cost incurred to Shut-Down the resource after receiving a Dispatch Instruction. The submitted Shut-Down Cost must not be negative. For Multi-Stage Generating Resources, the Scheduling Coordinator must provide Start-Up Costs for each MSG Configuration into which the resource can be started.

### **30.7.10 Format and Validation of Minimum Load Costs**

#### **30.7.10.1 In General**

For a Generating Unit or a Resource-Specific System Resource, the submitted Minimum Load Cost expressed in dollars per hour (\$/hr) is the cost incurred for operating the unit at Minimum Load as registered in the Master File. The submitted Minimum Load Cost must not be negative. In addition, if the Proxy Cost methodology pursuant to Section 30.4 applies to the resource, the Scheduling Coordinator for that resource may submit a daily Bid for the Minimum Load Cost that must not be negative but may be less than or equal to the sum of (i) one hundred twenty-five (125) percent of the Proxy Cost value other than the portion of the Proxy Cost value that consists of Minimum Load Opportunity Costs, if any; and (ii) one hundred (100) percent of the portion of the Proxy Cost value that consists of Minimum Load Opportunity Costs. For a resource that is eligible and has elected to use the Registered Cost methodology pursuant to Section 30.4, any submitted Minimum Load Cost must be equal to the Minimum Load Cost as registered in the Master File.

\* \* \* \*

### **34.17.1 Resource Constraints**

The SCED shall enforce the following resource physical constraints:

- (a) Minimum and maximum operating resource limits. Outages and limitations due to transmission clearances shall be reflected in these limits. The more restrictive operating or regulating limit shall be used for resources providing Regulation so that the SCED shall not Dispatch them outside their Regulating Range.
- (b) Forbidden Operating Regions. When ramping in the Forbidden Operating Region, the implicit ramp rate will be used as determined based on the time it takes for the resource to cross its Forbidden Operating Region. A resource can only be ramped through a Forbidden Operating Region after being dispatched into a Forbidden Operation Region. The CAISO will not Dispatch a resource within its Forbidden Operating Regions in the Real-Time Market, except that the CAISO may Dispatch the resource through the



Forbidden Operating Region in the direction that the resource entered the Forbidden Operating Region at the maximum applicable Ramp Rate over consecutive Dispatch Intervals. A resource with a Forbidden Operating Region cannot provide Ancillary Services in a particular fifteen (15) minute Dispatch Interval unless that resource can complete its transit through the relevant Forbidden Operating Region within that particular Dispatch Interval.

- (c) Operational Ramp Rates and Start-Up Times. The Operational Ramp Rate for resources shall be used as the basis for all Dispatch Instructions, provided that the Dispatch Operating Point for resources that are providing Regulation remains within their applicable Regulating Range. The Regulating Range will limit the Ramping of Dispatch Instructions issued to resources that are providing Regulation. The Ramp Rate for Non-Dynamic System Resources cleared in the FMM will not be observed. Rather, the ramp of the Non-Dynamic System Resource will respect inter-Balancing Authority Area Ramping conventions established by WECC. Ramp Rates for Dynamic System Resources will be observed like Participating Generators in the RTD. Each Energy Bid shall be Dispatched only up to the amount of Imbalance Energy that can be provided within the Dispatch Interval based on the Operational Ramp Rate. The Dispatch Instruction shall consider the relevant Start-Up Time as, if the resource is off-line, the relevant Operational Ramp Rate function, and any other resource constraints or prior commitments such as Schedule changes across hours and previous Dispatch Instructions. The Start-Up Time shall be determined from the Start-Up Time function and when the resource was last shut down. The Start-Up Time shall not apply if the corresponding resource is on-line or expected to start.
- (d) Maximum number of daily Start-Ups. The SCED shall not cause a resource to exceed its daily maximum number of Start-Ups.
- (e) Minimum Run Time and Down Time. The SCED shall not start up off-line resources before their Minimum Down Time expires and shall not shut down on-line resources before their Minimum Run Time expires. For Multi-Stage Generating Resources these

requirements shall be observed both for the Generating Unit and MSG Configuration.

- (f) Operating (Spinning and Non-Spinning) Reserve. The SCED shall Dispatch Spinning and Non-Spinning Reserve subject to the limitations set forth in Section 34.18.3.
- (g) Non-Dynamic System Resources. If Dispatched, each Non-Dynamic System Resource flagged for hourly pre-dispatch in the next Trading Hour shall be Dispatched to operate at a constant level over the entire Trading Hour. The HASP shall perform the hourly pre-dispatch for each Trading Hour once prior to the Operating Hour. The hourly pre-dispatch shall not subsequently be revised by the SCED and the resulting HASP Block Intertie Schedules are financially binding and are settled pursuant to Section 11.4.
- (h) Daily Energy use limitation to the extent that Energy limitation is expressed in a resource's Bid. If the Energy Limits are violated for purposes of Exceptional Dispatches for System Reliability, the Bid will be settled as provided in Section 11.5.6.1.

\* \* \* \*

### **34.17.5 Inter-House Resource Dispatch Without Real-Time Energy**

Dispatch Instructions shall be issued for each Dispatch Interval as needed to prescribe the ramp between a resource's accepted Self-Schedule in one Trading Hour and its accepted Self-Schedule in the immediately succeeding Trading Hour. Such Dispatch Instructions shall be based on the lesser of: (1) the Operational Ramp Rate; and (2) the Ramp Rate associated with the Standard Ramp. The Dispatch Instructions for Ramping of Generating Units without Real-Time Energy Bids in both Operating Hours shall ramp the resource between hourly Schedules symmetrically to the extent possible subject to the Regulation Ramping limitations across hourly boundaries in twenty (20) to sixty (60) minutes assuming Congestion can be resolved utilizing Economic Bids. The minimum twenty (20)-minute ramp is required for smooth hourly Schedule changes and is consistent with Intertie scheduling agreements between Balancing Authority Areas. Energy resulting from the Standard Ramp shall be deemed Standard Ramping Energy and will be settled in accordance with Section 11.5.1. Energy resulting from any ramp extending beyond the Standard Ramp will be deemed Ramping Energy Deviation and will be settled in

accordance with Section 11.5.1.

\* \* \* \*

### **39.7.1.1 Variable Cost Option**

For natural gas-fueled units, the Variable Cost Option will calculate the Default Energy Bid by adding incremental cost (comprised of incremental fuel cost plus a volumetric Grid Management Charge adder plus a greenhouse gas cost adder if applicable) with variable operation and maintenance cost, adding ten percent (10%) to the sum, adding a Bid Adder if applicable for a Frequently Mitigated Unit, and adding Variable Energy Opportunity Costs, if any. For non-natural gas-fueled units, the Variable Cost Option will calculate the Default Energy Bid by summing incremental fuel or fuel-equivalent cost plus a volumetric Grid Management Charge plus a greenhouse gas cost adder if applicable, adding ten percent (10%) to the sum, adding a Bid Adder if applicable for a Frequently Mitigated Unit, and adding Variable Energy Opportunity Costs, if any.

\* \* \* \*

#### **39.7.1.1.1.2 Non-Natural Gas-Fired Resources**

For non-natural gas-fueled units, incremental fuel cost is calculated based on an average cost curve as described below.

Resource owners for non-natural gas-fueled units shall submit to the CAISO average fuel or fuel equivalent costs (\$/MW) measured for at least two (2) and up to eleven (11) generating operating points (MW), where the first and last operating points refer to the minimum and maximum operating levels (i.e., PMin and PMax), respectively. The average cost curve formed by the (\$/MWh, MW) pairs is a piece-wise linear curve between operating points, and two (2) average cost pairs yield one (1) incremental cost segment that spans two (2) consecutive operating points. For each segment representing operating levels below eighty (80) percent of the unit's PMax, the incremental cost rate is limited to the maximum of the average cost rates for the two (2) operating points used to calculate the incremental cost segment.

The unit's final incremental fuel cost curve is then adjusted, if necessary, applying a left-to-right adjustment to ensure that the final incremental cost curve is monotonically non-decreasing. The CAISO will include, if applicable: (i) greenhouse gas allowance costs for each non-natural gas-fired resource registered with the California Air Resources Board as having a greenhouse gas compliance obligation, as provided to the CAISO by the Scheduling Coordinator for the resource; and (ii) a volumetric Grid Management Charge adder that consists of: (i) the Market Services Charge; (ii) the System Operations Charge; and (iii) the Bid Segment Fee divided by the MW in the Bid segment. Cost curves shall be stored, updated, and validated in the Master File.

\* \* \* \*

#### **39.7.1.1.3 Variable Energy Opportunity Costs Under the Variable Cost Option**

The CAISO will determine eligibility for Variable Energy Opportunity Costs for Use-Limited Resources pursuant to Section 30.4.1.1.6.

\* \* \* \*

#### **39.7.1.3.2 Negotiated Values and Informational Filings**

##### **39.7.1.3.2.1 Renegotiation of Values**

The CAISO may require the renegotiation of any components including adders or interim adders for major maintenance expenses determined pursuant to Sections 30.4.1.1.1, 30.4.1.1.2, and 30.4.1.1.4, any Opportunity Costs negotiated pursuant to Section 30.4.1.1.6.3, any Default Energy Bids negotiated pursuant to this Section 39.7.1.3, any temporary Default Energy Bids established pursuant to Section 39.7.1.5, or any custom operation and maintenance adders negotiated pursuant to Section 39.7.1.1.2, that have become outdated, are possibly erroneous, or for which the Scheduling Coordinator has changed. In the renegotiation process, the CAISO may review and propose modifications to such values, and may require the Scheduling Coordinator to provide updated information to support continuation of such values.

#### **39.7.1.3.2.2 Informational Filings with FERC**

The CAISO shall make an informational filing with FERC of any adders or interim adders for major maintenance expenses determined pursuant to Sections 30.4.1.1.1, 30.4.1.1.2, and 30.4.1.1.4, any Opportunity Costs calculated pursuant to Section 30.4.1.1.6.2 or negotiated pursuant to Section 30.4.1.1.6.3, any Default Energy Bids negotiated pursuant to this Section 39.7.1.3, any temporary Default Energy Bids established pursuant to Section 39.7.1.5, or any custom operations and maintenance adders negotiated pursuant to Section 39.7.1.1.2, no later than seven (7) days after the end of the month in which the Default Energy or operations and maintenance values were established.

\* \* \* \*

#### **40.6.4 Use-Limited Resources Additional Availability Requirements**

##### **40.6.4.1 [Not Used]**

##### **40.6.4.2 Use Plan**

The Scheduling Coordinator shall provide for the following Resource Adequacy Compliance Year a proposed annual use plan for each Use-Limited Resource that is a Resource Adequacy Resource. For each Use-Limited Resource that is a Resource Adequacy Resource but is not a Reliability Demand Response Resource, the proposed annual use plan will provide the information described in the Business Practice Manual. The CAISO will have an opportunity to discuss the proposed annual use plan with the Scheduling Coordinator and suggest potential revisions to meet reliability needs of the system. The Scheduling Coordinator shall then submit its final annual use plan. Scheduling Coordinators for Use-Limited Resources must submit the proposed and final annual use plans, and any updates to those use plans, in accordance with the schedule set forth in the Business Practice Manual. The annual use plan must reflect the potential operation of the Use-Limited Resource at a level no less than the minimum criteria set forth by the Local Regulatory Authority for qualification of the resource.

\* \* \* \*

#### 40.6.8 Use of Generated Bids

- (a) **Day-Ahead Market.** Prior to completion of the Day-Ahead Market, the CAISO will determine if Resource Adequacy Capacity subject to the requirements of Section 40.6.1 and for which the CAISO has not received notification of an Outage has not been reflected in a Bid and will insert a Generated Bid for such capacity into the CAISO Day-Ahead Market.
- (b) **Real-Time Market.** Prior to running the Real-Time Market, the CAISO will determine if Resource Adequacy Capacity subject to the requirements of Section 40.6.2 and for which the CAISO has not received notification of an Outage has not been reflected in a Bid and will insert a Generated Bid for such capacity into the Real-Time Market.
- (c) **Partial Bids for RA Capacity.** If a Scheduling Coordinator for an RA Resource submits a partial bid for the resource's RA Capacity, the CAISO will insert a Generated Bid only for the remaining RA Capacity. In addition, the CAISO will determine if all dispatchable Resource Adequacy Capacity from Short Start Units, not otherwise selected in the IFM or RUC, is reflected in a Bid into the Real-Time Market and will insert a Generated Bid for any remaining dispatchable Resource Adequacy Capacity for which the CAISO has not received notification of an Outage.
- (d) **Calculation of Generated Bids.** A Generated Bid for Energy will be calculated pursuant to Sections 30.7.3.4 and 30.7.3.5. A Generated Bid for Ancillary Services will equal zero dollars (\$0/MW-hour).
- (e) **Exemptions.** Notwithstanding any of the provisions of Section 40.6.8, the CAISO will not insert any Bid in the Day-Ahead Market or Real-Time Market required under this Section 40 for Resource Adequacy Capacity of a Use-Limited Resource, Non-Generator Resource, Variable Energy Resource, Hydroelectric Generating Unit, Proxy Demand Resource, Reliability Demand Response Resource, Participating Load, including Pumping Load, or resource providing Regulatory Must-Take Generation unless the resource submits an Energy Bid and fails to submit an Ancillary Service Bid or unless the generally applicable bidding rules in Section 30 apply.

- (f) **NRS-RA Resources.** The CAISO will submit a Generated Bid in the Day-Ahead Market or Real-Time Market for a non-Resource Specific System Resource in each RAAIM assessment hour, to the extent that the resource provides Resource Adequacy Capacity subject to the requirements of Sections 40.6.1 or 40.6.2 and does not submit an outage request or Bid for the entire amount of that Resource Adequacy Capacity.

\* \* \* \*

## Appendix A

### Master Definition Supplement

\* \* \* \*

#### - Maximum Daily Start-Ups

The maximum number of times a Generating Unit can be started up within one day, due to environmental limitations that are not based solely on contractual considerations or operating constraints registered in the Master File pursuant to Section 4.6.4.

\* \* \* \*

#### - Minimum Down Time (MDT)

The minimum amount of time that a Generating Unit must stay off-line after being Shut-Down, due to operating constraints registered in the Master File pursuant to Section 4.6.4.

\* \* \* \*

#### - Minimum Load Opportunity Costs

An adder consisting of the estimated profits foregone by a Use-Limited Resource with a limitation on its number of run-hours that satisfies the definition of a Use-Limited Resource and applies for a time period that satisfies the requirements of Section 30.4.1.1.6.1, if the Use-Limited Resource had one less run-hour in the time period.

\* \* \* \*

### **- Minimum Run Time**

The minimum amount of time that a Generating Unit must stay on-line after being started-up prior to being Shut-Down, due to operating constraints registered in the Master File pursuant to Section 4.6.4.

\* \* \* \*

### **- Multi-Stage Generating Resource**

A Generating Unit that for reasons related to its technical characteristics can be operated in various MSG Configurations such that only one such MSG Configuration can be operated in any given Dispatch Interval. In addition, subject to the requirements in Section 27.8, the following technical characteristics qualify a Generating Unit as a Multi-Stage Generating Resource if the resource: (1) is a combined cycle resource, excluding those that are one-by-one combined cycle resources without bypassing, duct firing capability or power augmentation capability; (2) has more than one Forbidden Operating Region; (3) has multiple operating modes, including Regulating Ranges associated with different Ancillary Services capability; or (4) has hold times before or after a Transition through a Forbidden Operating Region. A hold time is an operational restriction that requires the resource to stay in or out of a specific operating mode for a given period of time, derived from the characteristics registered in the Master File for the resource pursuant to Section 4.6.4, which may be in the form of a requirement that the resource stay in a particular operating mode for a period of time once it is in, or that the resource must stay out of a particular operating mode for a period of time once it is out of that operating mode. Metered Subsystems, Pumped-Storage Hydro Units, and Pumping Loads, and System Resources do not qualify as Multi-Stage Generating Resources and therefore cannot register as such as provided in Section 27.8. Regulatory Must-Take Resources are not required to be registered as Multi-Stage Generating Resources. Dispatchable Qualifying Facilities that are not qualified as Regulatory Must-Take resources are required to register as Multi-Stage Generating Resources, provided they meet the qualifying technical characteristics described above.

\* \* \* \*

### **- Operating Reserve Ramp Rate**

A value registered in the Master File pursuant to Section 4.6.4 that represents the Ramp Rate of a resource used in the procurement of Operating Reserve capacity.



\* \* \* \*

**- Operational Ramp Rates**

A staircase function of up to 4 segments (in addition to Ramp Rate segments needed for modeling Forbidden Operating Regions). Operational Ramp Rate values are registered in the Master File pursuant to Section 4.6.4.

\* \* \* \*

**- Opportunity Costs**

Start-Up Opportunity Costs, Minimum Load Opportunity Costs, or Variable Opportunity Costs.

\* \* \* \*

**- Pump Ramping Conversion Factor**

A Master File entry submitted by Scheduling Coordinators that allows the Scheduling Coordinator to indicate the ratio of Energy expended to pump water into storage that can be used to produce Energy. A zero percent Pump Ramping Conversion Factor implies that no amount of Energy production capability is produced as a result of pumping water and the CAISO shall not use such unavailable Energy in its CAISO Markets optimization. A hundred percent Pump Ramping Conversion Factor indicates all the Energy expended to pump water is available for Generation and the CAISO shall use only the available portions in its CAISO Markets optimization. The Pump Ramping Conversion Factor submitted in the Master File need not be based on design capability characteristics of the resource and is adjustable by the Scheduling Coordinator.

\* \* \* \*

**- Ramp Rate**

A value registered in the Master File pursuant to Section 4.6.4 that indicates the Operational Ramp Rate, Regulation Ramp Rate, and Operating Reserve Ramp Rate for a Generating Unit, and the Load drop rate and Load pick-up rate for Participating Loads, Reliability Demand Response Resources, and Proxy Demand Resources, for which the Scheduling Coordinator is submitting Energy Bids or Ancillary Services Bids.

\* \* \* \*

**- Regulation Ramp Rate**

A value registered in the Master File pursuant to Section 4.6.4 that represents the Ramp Rate of a resource used in the procurement of Regulation capacity.

\* \* \* \*

**- Security Constrained Unit Commitment (SCUC)**

An algorithm performed by a computer program over multiple hours that determines the Commitment Status and Day-Ahead Schedules, AS Awards, RUC Awards, Hourly Intertie Block Schedules, FMM Schedules and Dispatch Instructions for selected resources and minimizes production costs (Start-Up, Minimum Load and Energy Bid Costs in IFM, and RTM; Start-Up, Minimum Load and RUC Availability Bid Costs) while respecting the operating characteristics of selected resources registered in the Master File pursuant to Section 4.6.4 and Transmission Constraints.

\* \* \* \*

**- Start-Up Opportunity Costs**

An adder consisting of the estimated profits foregone by a Use-Limited Resource with a limitation on its number of starts that satisfies the definition of a Use-Limited Resource and applies for a time period that satisfies the requirements of Section 30.4.1.1.6.1, if the Use-Limited Resource had one less start in the time period.

\* \* \* \*

**- Transition Cost**

For a Multi-Stage Generating Resource, the dollar cost per feasible transition from a given MSG Configuration to a higher MSG Configuration when the resource is already On. Transition Cost must be non-negative. For a Use-Limited Resource, Transition Cost can include Start-Up Opportunity Costs determined pursuant to Section 30.4.1.1.6.

\* \* \* \*

**- Use-Limited Resource**

A resource demonstrated to be a Use-Limited Resource pursuant to Section 30.4.1.1.6.1.1.

\* \* \* \*

**- Variable Energy Opportunity Costs**

An adder consisting of the estimated profits foregone by a Use-Limited Resource with a limitation on its Energy output that satisfies the definition of a Use-Limited Resource and applies for a time period that satisfies the requirements of Section 30.4.1.1.6.1, if the Use-Limited Resource had one less megawatt-hour of Energy output in the time period.

\* \* \* \*

**Attachment B – Marked Tariff Records**  
**Commitment Cost Enhancements Phase 3**  
**California Independent System Operator Corporation**

#### **4.6.4 Identification of Generating Units**

##### **4.6.4.1 Design Capability Values**

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~~ must be an accurate reflection of the design capabilities physical characteristics of the resources and its constituent equipment when operating at maximum sustainable performance over Minimum Run Time, recognizing that resource performance may degrade over time. Information registered in the Master File by a Scheduling Coordinator must also conform to any additional definitional requirements in Appendix A as may exist as to that information. A Scheduling Coordinator may not submit a Bid for a Generating Unit or offer to provide any other service in the CAISO Markets if that Bid or offer could not be delivered feasibly based on the operational and technical constraints for that Generating Unit registered in the Master File. All information registered in the Master File shall be consistent with the offers and services provided by the resources in the CAISO Markets. ~~except for~~ The Pump Ramping Conversion Factor value, which is configurable and need not reflect a resource's design capabilities.

##### **4.6.4.2 Market Values**

With respect to Maximum Daily Start-Ups, maximum daily number of MSG Transitions, Operational Ramp Rate values, Operating Reserve Ramp Rate values, and Regulation Ramp Rate values, a Scheduling Coordinator for a Participating Generator may also register in the Master File market values that the CAISO will utilize during market operations except as otherwise set forth in this Section 4.6.4, and which need not reflect design capability recognizing that resource performance may degrade over time subject

to the following limitations on such market values:

- (1) Maximum Daily Start-Ups must be at least two (2) Start-Ups per day unless the design capability is one (1) Start-Up per day. The CAISO permits only one (1) Start-Up per day in the Master File due to the design capabilities or degradation in performance of a resource nearing the end of or operating beyond its useful life.
- (2) The maximum daily number of MSG Transitions must be at least two (2) MSG Transitions for every MSG Transition registered in the Transition Matrix unless the design capability is one (1) MSG Transition per day. The CAISO permits only one (1) MSG Transition per day in the Master File due to the design capabilities or degradation in performance of a resource nearing the end of or operating beyond its useful life.
- (3) Operational Ramp-Rate values must be sufficient to permit a resource to provide its Flexible RA Capacity obligation. If a Scheduling Coordinator for a Participating Generator registers market values for Operational Ramp Rate in the Master File, the market values must be values at which the resource is reasonably capable of operating.

The CAISO has the authority to reject a market value either proposed for registration in the Master File or already registered in the Master File if that value is infeasible given the design capabilities of the resource or is inconsistent with a Participating Generator's commitment to provide Resource Adequacy Capacity. If the CAISO rejects a market value, the CAISO will solely honor the design capability value.

The CAISO will utilize market value Master File values in the CAISO Markets and in automated Exceptional Dispatch tools. However, the CAISO may issue Exceptional Dispatch Instructions pursuant to Section 34.11 based on the design capability of a Generating Unit, regardless of whether the Participating Generator also provides a market value for use in the CAISO Markets.

\* \* \* \*

#### **4.7 Relationships Between CAISO and Participating Loads**

The CAISO shall only accept Bids for Supply of Energy or Ancillary Services or Submissions to Self-Provide Ancillary Services from Loads if such Loads are those of a Participating Load that has entered

into a Participating Load Agreement with the CAISO and which meet standards adopted by the CAISO and published on the CAISO Website. The CAISO shall not accept submitted Bids for Supply of Energy or Ancillary Services from a Participating Load other than through a Scheduling Coordinator. The CAISO shall not accept Bids from Scheduling Coordinators relating to Load from any Non-Generator Resource unless the resource owner or operator undertakes in writing, by entering into a Participating Load Agreement, to comply with all applicable provisions of this CAISO Tariff as they may be amended from time to time. A Participating Load shall provide any data or information consistent with the requirements set forth in Section 4.6.4.

\* \* \* \*

#### **4.8 Relationship Between CAISO and Intermittent Resources**

The CAISO shall not accept Bids for an Eligible Intermittent Resource other than through a Scheduling Coordinator. Any Eligible Intermittent Resource that is not a Participating Intermittent Resource, or any Participating Intermittent Resource for which Bids are submitted shall be bid and settled as a Generating Unit for the associated Settlement Periods (except that the Forecast Fee shall apply in such Settlement Periods). An Eligible Intermittent Resource shall provide any data or information consistent with the requirements set forth in Section 4.6.4.

\* \* \* \*

#### **4.9.1 General Nature of Relationship Between CAISO and MSS**

**4.9.1.1** An entity that is determined by the CAISO to qualify as a Metered Subsystem and that undertakes in writing, by entering into a Metered Subsystem Agreement with the CAISO, to comply with all applicable provisions of the CAISO Tariff as specified in that MSS Agreement as they may be amended from time to time, including, without limitation, the applicable provisions of this Section 4.9, shall be considered an MSS Operator and shall have the rights and obligations set forth in this Section 4.9. The CAISO shall not be obligated to accept Bids that would require Energy to be transmitted to or from a Metered Subsystem

unless the MSS Agreement of the MSS Operator of the Metered Subsystem has become effective.  
Metered Subsystem shall provide any data or information consistent with the requirements set forth in Section 4.6.4.

\* \* \* \*

#### **4.12.2 Identification of Resource-Specific System Resources**

Each Resource-Specific System Resource owner shall provide data identifying each of its Resource-Specific System Resources and such information regarding the capacity and the operating characteristics of the Resource-Specific System Resource as may be reasonably requested from time to time by the CAISO. Any such data or information shall be provided consistent with the requirements set forth in Section 4.6.4.~~All information provided to the CAISO regarding the operation and technical constraints in the Master File shall be accurate and actually based on physical characteristics of the resource.~~  
Pursuant to Sections 8.9 and 8.10, the CAISO may verify, inspect and test the capacity and operating characteristics of the resource provided to the CAISO.

\* \* \* \*

#### **4.13.3 Identification of RDRRs and PDRs**

Each Demand Response Provider shall provide data, as described in the Business Practice Manual, identifying each of its Reliability Demand Response Resources or Proxy Demand Resources and such information regarding the capacity and the operating characteristics of the Reliability Demand Response Resource or Proxy Demand Resource as may be reasonably requested from time to time by the CAISO. Any such data or information shall be provided consistent with the requirements set forth in Section 4.6.4.~~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.~~

\* \* \* \*



#### **4.17.1 Relationship with Distributed Energy Resource Providers**

The CAISO will accept Bids for Energy or Ancillary Services from Distributed Energy Resource Aggregations or submissions of Energy Self-Schedules from Distributed Energy Resource Aggregations, only if such Distributed Energy Resource Aggregations are represented by a Distributed Energy Resource Provider that has entered into a Distributed Energy Resource Provider Agreement with the CAISO to comply with all applicable provisions of the CAISO Tariff as they may be amended from time to time. The CAISO will not accept Bids for Energy or Ancillary Services from a Distributed Energy Resource Aggregation other than through a Scheduling Coordinator. The Scheduling Coordinator may be the Distributed Energy Resource Provider itself or another entity. A Distributed Energy Resource Aggregation shall provide any data or information consistent with the requirements set forth in Section 4.6.4.

\* \* \* \*

#### **8.3.7 AS Bidding Requirements**

Scheduling Coordinators may submit Bids or Submissions to Self-Provide an Ancillary Service consistent with the rules specified in Section 30 and any further requirements in this Section 8.3.7. Scheduling Coordinators may (i) submit Bids or Submissions to Self-Provide an Ancillary Service from resources located within the CAISO Balancing Authority Area (which includes Pseudo-Ties of Generating Units to the CAISO Balancing Authority Area) or Dynamic System Resources certified to provide Ancillary Services, (ii) submit Submissions to Self-Provide an Ancillary Service from System Resources located outside the CAISO Balancing Authority Area if provided pursuant to ETCs, TORs, or Converted Rights, (iii) submit Bids for Ancillary Services from Dynamic and Non-Dynamic System Resources located outside the CAISO Balancing Authority Area certified to provide Ancillary Services, or (iv) submit Inter-SC Trades of Ancillary Services. Ancillary Services procured in the IFM and in the Real-Time Market are comprised of the following: Regulation Up, Regulation Down, Spinning Reserve, and Non-Spinning Reserve. Each resource for which a Scheduling Coordinator wishes to submit Ancillary Service Bids must meet the requirements set forth in this CAISO Tariff. The same resource capacity may be simultaneously offered

to the same CAISO Market for multiple Ancillary Services types. Ancillary Services Bids and Submissions to Self-Provide an Ancillary Service can be submitted up to seven (7) days in advance. The CAISO will only use Operating Reserve Ramp Rates for procuring capacity associated with the specific Ancillary Services. The CAISO will issue Real-Time Dispatch Instructions in the Real-Time Market for the Energy associated with the awarded capacity based upon the applicable Operational Ramp Rate value registered in the Master Files~~submitted with the single Energy Bid Curve~~ in accordance with Section ~~4.6.430.7.7~~.

There is no ability to procure Ancillary Services for export.

To the extent a Scheduling Coordinator has an on-demand obligation to serve loads outside the CAISO Balancing Authority Area, it can do so provided that (1) it is using export transmission capacity available in Real-Time, and (2) the resource capacity providing Energy to satisfy the on-demand obligation is not under an RMR Contract or Resource Adequacy Capacity obligation, and has not been paid a RUC Availability Payment for the Trading Hour. All resources subject to the Ancillary Services must offer requirements, as specified in Section 40.6, must submit Bids consistent with the requirements specified therein and in Section 30.

\* \* \* \*

#### **8.4.1.1 Regulation**

A resource offering Regulation must have the following operating characteristics and technical capabilities:

- (a) it must be capable of being controlled and monitored by the CAISO EMS by means of the installation and use of a standard CAISO direct communication and direct control system, a description of which and criteria for any temporary exemption from which, the CAISO shall publish on the CAISO Website;
- (b) it must be capable of achieving at least the Ramp Rates (increase and decrease in MW/minute) registered~~stated~~ in the Master Files~~its Bid~~ for the full amount of Regulation capacity offered;
- (c) the Regulation capacity offered must not exceed the maximum Ramp Rate

- (MW/minute) of that resource times ten (10) minutes;
- (d) the resource to CAISO Control Center telemetry must, in a manner meeting CAISO standards, include indications of whether the resource is on or off CAISO EMS control at the resource terminal equipment;
  - (e) the resource must be capable of the full range of movement within the amount of Regulation capability offered without manual resource operator intervention of any kind;
  - (f) each Ancillary Service Provider must ensure that its CAISO EMS control and related SCADA equipment for its resource are operational throughout the time period during which Regulation is required to be provided;
  - (g) Regulation capacity offered must be dispatchable on a continuous basis for at least sixty (60) minutes in the Day-Ahead Market and at least thirty (30) minutes in the Real-Time Market after issuance of the Dispatch Instruction. The CAISO will measure continuous Energy from the time a resource reaches its award capacity. Scheduling Coordinators for Non-Generator Resources located within the CAISO Balancing Authority Area that require Energy from the Real-Time Market to offer their full capacity as Regulation may request the use of Regulation Energy Management as described in Section 8.4.1.2; and
  - (h) Regulation capacity offered must meet or exceed the minimum performance threshold of twenty-five (25) percent measured accuracy as specified in Section 8.2.3.1.1.

\* \* \* \*

### **30.4 Proxy Cost and Registered Cost Methodologies**

Scheduling Coordinators for Generating Units and Resource-Specific System Resources must use the Proxy Cost methodology for their Start-Up Costs and Minimum Load Costs, as well as for Transition Costs in the case of Multi-Stage Generating Resources unless the resource has fewer than ~~that are not~~

~~Use-Limited Resources twelve (12) consecutive months of fifteen-minute LMPs for Energy at the resource's PNode or Aggregated PNode and meets the definition of a Use-Limited Resource. Scheduling Coordinators on behalf of Use-Limited Resources with fewer than 12 months of data can elect to use the Registered Cost methodology and remain on that methodology for a two-month period once 12 months of pricing data is collected, while the Scheduling Coordinator and the CAISO are going through the process of determining what Opportunity Costs, if any, apply to the Use-Limited Resource. Once this process concludes, all such Use-Limited Resources must be subject to the Proxy Cost methodology. will be subject to the Proxy Cost methodology for their Start-Up Costs and Minimum Load Costs, as well as for Transition Costs in the case of Multi-Stage Generating Resources.~~

~~Scheduling Coordinators for Generating Units and Resource-Specific System Resources that are Use-Limited Resources~~ For Use-Limited Resources eligible for the Registered Cost methodology, Scheduling Coordinators may elect on a thirty (30) day basis to use either the Proxy Cost methodology or the Registered Cost methodology for specifying their Start-Up Costs and Minimum Load Costs to be used for those resources in the CAISO Markets Processes, as well as for Transition Costs in the case of Multi-Stage Generating Resources. The elections are independent as to Start-Up Costs and Minimum Load Costs; that is, a Scheduling Coordinator for such a Use-Limited Resource may elect to use either the Proxy Cost methodology or the Registered Cost methodology for Start-Up Costs and may make a different election for Minimum Load Costs. However, in the case of Multi-Stage Generating Resources, the Scheduling Coordinator must make the same election (Proxy Cost methodology or Registered Cost methodology) for Transition Costs as it makes for Start-Up Costs. If a Scheduling Coordinator has not made an election, the CAISO will assume the Proxy Cost methodology as the default.

\* \* \* \*

### 30.4.1 Start-Up and Minimum Load Costs

#### 30.4.1.1 Proxy Cost Methodology

##### 30.4.1.1.1 Natural Gas-Fired Resources

For each natural gas-fired resource, the Proxy Cost methodology uses formulas for Start-Up Costs and Minimum Load Costs based on the resource's actual unit-specific performance parameters. The Start-Up Cost and Minimum Load Cost values utilized for each such resource in the CAISO Markets Processes will be either (a), if the Scheduling Coordinator does not submit a Start-Up or Minimum Load Proxy-Cost Bid, or (b) below:

- (a) Formulaic natural gas cost values adjusted for fuel-cost variation on a daily basis using the natural gas price calculated pursuant to Section 39.7.1.1.1.3.
- Start-Up Costs also include: (i) the cost of auxiliary power calculated using the unit-specific MWh quantity of auxiliary power used for Start-Up multiplied by a resource-specific electricity price; (ii) a greenhouse gas cost adder for each resource registered with the California Air Resources Board as having a greenhouse gas compliance obligation, which is calculated for each Start-Up as the product of the resource's fuel requirement per Start-Up, the greenhouse gas emissions rate authorized by the California Air Resources Board, and the applicable Greenhouse Gas Allowance Price; (iii) the rates for the Market Services Charge and System Operations Charge multiplied by the shortest Start-Up Time listed for the resource in the Master File, multiplied by the PMin of the resource, multiplied by 0.5; ~~and~~ (iv) a resource-specific adder, if applicable, for major maintenance expenses (\$ per Start-Up) determined by the CAISO or Independent Entity selected by the CAISO to determine such major maintenance expenses; and (v) for a Use-Limited Resource, Start-Up Opportunity Costs determined pursuant to Section 30.4.1.1.6, if any.

Minimum Load Costs also include: (i) operation and maintenance costs as provided in Section 39.7.1.1.2; (ii) a greenhouse gas cost adder for each resource registered with the California Air Resources Board as having a greenhouse gas compliance obligation, which is calculated for each run-hourStart-Up as the product of the resource's fuel requirement

at Minimum Load as registered in the Master File, the greenhouse gas emissions rate authorized by the California Air Resources Board, and the applicable Greenhouse Gas Allowance Price; (iii) the rates for the Market Services Charge and System Operations Charge multiplied by the PMin of the resource as registered in the Master File; (iv) the Bid Segment Fee; ~~and~~ (v) a resource-specific adder, if applicable, for major maintenance expenses (\$ per operating hour) determined pursuant to Section 30.4.1.1.4; and (vi) for a Use-Limited Resource, Minimum Load Opportunity Costs determined pursuant to Section 30.4.1.1.6, if any.

- (b) Start-Up or Minimum Load Cost Bids specified by Scheduling Coordinators pursuant to Sections 30.7.9 and 30.7.10, subject to the provisions applicable to Multi-Stage Generating Resources set forth in Section 30.4.1.1.3.

In the event that the Scheduling Coordinator for a resource other than a Multi-Stage Generating Resource or for a Multi-Stage Generating Resource in its lowest startable configuration does not provide sufficient data for the CAISO to determine the resource's Start-Up or Minimum Load Costs or one or more components of the resource's Start-Up or Minimum Load Costs, the CAISO will assume that the resource's Start-Up Costs or Minimum Load Costs, or the indeterminable component(s) of the resource's Start-Up Costs or Minimum Load Costs, are zero. In the event that the Scheduling Coordinator for a Multi-Stage Generating Resource does not provide such data for an MSG Configuration beyond its lowest startable configuration, Section 30.4.1.1.3 applies.

#### **30.4.1.1.2 Non-Natural Gas-Fired Resources**

For each non-natural gas-fired resource, Start-Up Cost and Minimum Load Cost values under the Proxy Cost methodology shall be based on either (a) if the Scheduling Coordinator does not submit a Start-Up or Minimum Load~~Proxy~~ Cost Bid, or (b) below:

- (a) The Scheduling Coordinator for the resource will provide the relevant cost information of the particular resource, including fuel or fuel equivalent input costs, which ~~will be provided to the CAISO~~ will by the Scheduling Coordinator and maintained in the Master File. For Start-Up Costs, the CAISO will also include, if applicable: (i) greenhouse gas allowance costs for each resource registered with the California Air Resources Board as

having a greenhouse gas compliance obligation, as provided to the CAISO by the Scheduling Coordinator; (ii) the rates for the Market Services Charge and System Operations Charge multiplied by the shortest Start-Up Time listed for the resource in the Master File, multiplied by the PMin of the resource as registered in the Master File, multiplied by 0.5; ~~and~~ (iii) a resource-specific adder, if applicable, for major maintenance expenses (\$ per Start-Up) determined by the CAISO or Independent Entity selected by the CAISO to determine such major maintenance expenses; and (iv) for a Use-Limited Resource, Start-Up Opportunity Costs determined pursuant to Section 30.4.1.1.6, if any. For Minimum Load Costs, the CAISO will also include, if applicable: (i) operation and maintenance costs as provided in Section 39.7.1.1.2; (ii) greenhouse gas allowance costs for each resource registered with the California Air Resources Board as having a greenhouse gas compliance obligation, as provided to the CAISO by the Scheduling Coordinator; (iii) the rates for the Market Services Charge and System Operations Charge multiplied by the PMin of the resource as registered in the Master File; (iv) the Bid Segment Fee; ~~and~~ (v) a resource-specific adder, if applicable, for major maintenance expenses (\$ per operating hour) determined by the CAISO or an Independent Entity selected by the CAISO; and (vi) for a Use-Limited Resource, Minimum Load Opportunity Costs determined pursuant to Section 30.4.1.1.6, if any.

For each resource registered with the California Air Resources Board as having a greenhouse gas compliance obligation, the information provided to the CAISO by the Scheduling Coordinator must be consistent with information submitted to the California Air Resources Board. Adders for major maintenance expenses will be determined pursuant to Section 30.4.1.1.4, if any.

- (b) Bids specified by Scheduling Coordinators pursuant to Sections 30.7.9 and 30.7.10, subject to the provisions applicable to Multi-Stage Generating Resources set forth in Section 30.4.1.1.3.

In the event that the Scheduling Coordinator for a resource other than a Multi-Stage Generating Resource or for a Multi-Stage Generating Resource in its lowest startable configuration does not provide sufficient

data for the CAISO to determine the resource's Start-Up or Minimum Load Costs or one or more components of the resource Start-Up or Minimum Load Costs, the CAISO will assume that resource's Start-Up or Minimum Load Costs, or the indeterminable component(s) of the resource's Start-Up Costs or Minimum Load Costs, are zero. In the event that the Scheduling Coordinator for a Multi-Stage Generating Resource does not provide such data for an MSG Configuration beyond its lowest startable configuration, Section 30.4.1.1.3 applies.

\* \* \* \*

#### **30.4.1.1.5 Proxy Transition Cost**

For each Multi-Stage Generating Resource under the Proxy Cost methodology, the CAISO will calculate the Transition Costs utilized for each feasible transition from a given MSG Configuration to a higher MSG Configuration based on the difference between the Start-Up Costs for the higher MSG Configuration, minus the Start-Up Costs for the lower MSG Configuration, as determined in accordance with the Start-Up Cost calculation methodology set forth in Section 30.4.1.1. If the result of this calculation is negative for any transition between two MSG Configurations, then the associated Transition Cost shall be zero. The Transition Costs calculated by the CAISO will be utilized in the CAISO Markets Processes unless the Scheduling Coordinator submits Transition Costs for the Multi-Stage Generating Resource in the form of daily Bids that are not negative and are less than or equal to the sum of (i) one hundred twenty-five (125) percent of the Transition Costs other than the portion of the Transition Costs that consist of Start-Up Opportunity Costs determined calculated by the CAISO, if any; and (ii) one hundred (100) percent of the portion of the Transition Costs that consist of Start-Up Opportunity Costs determined by the CAISO are not negative, in which case the Transition Costs submitted in the form of daily Bids will be utilized in the CAISO Markets Processes.

#### **30.4.1.1.6 Use-Limited Resources**

##### **30.4.1.1.6.1 Registration and Validation Process**

A Scheduling Coordinator seeking to obtain Use-Limited Resource status for resource(s) will follow the registration and validation process set forth in this CAISO Tariff and the Business Practice Manual. The



registration and validation process requires each Scheduling Coordinator to demonstrate that the resources meet the Use-Limited Resource criteria as set forth in Section 30.4.1.1.6.1.1, and allows each Scheduling Coordinator to seek to recover Opportunity Costs for Use-Limited Resources by making the demonstration set forth in Section 30.4.1.1.6.1.2.

#### **30.4.1.1.6.1.1 Use-Limited Resource Criteria**

In order for a resource to be considered a Use-Limited Resource, a Scheduling Coordinator must provide sufficient documentation demonstrating that the resource meets all three of the following criteria:

- (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, (b) environmental restrictions, or (c) qualifying contractual limitations;
- (2) The CAISO Market Process used to dispatch the resource cannot recognize the resource's limitation(s); and
- (3) The resource's ability to select hours of operation is not dependent on an energy source outside of the resource's control being available during such hours.

Design considerations that satisfy the requirements of this Section are those resulting from physical equipment limitations. A non-exhaustive list of such physical equipment limitations includes restrictions documented in original equipment manufacturer recommendations or bulletins, or limiting equipment such as storage capability for hydroelectric generating resources. Other design considerations that satisfy the requirements of this Section are those resulting from performance criteria for Demand Response Resources established pursuant to programs or contracts approved by Local Regulatory Authorities. Environmental restrictions that satisfy the requirements of this Section are those imposed by regulatory bodies, legislation, or courts. A non-exhaustive list of such environmental restrictions includes limits on emissions, water use restrictions, run-hour limitations in operating permits or other environmental limits that directly or indirectly limit starts, run hours, or MWh limits, but excludes restrictions with soft caps that allow the resource to increase production above the soft caps through the purchase of additional compliance instruments. Qualifying contractual limitations that satisfy the requirements of this Section are those contained in long-term contracts that: (i) were reviewed and approved by a Local Regulatory Authority on or before January 1, 2015, or were pending approval by a Local Regulatory Authority on or

before January 1, 2015 and were later approved; and (ii) were evaluated by the Local Regulatory Authority for the overall cost-benefit of those contracts taking into consideration the overall benefits and burdens, including the limitations on such resources' numbers of starts, numbers of run-hours, or Energy output. Contracts limits that provide for higher payments when start-up, run-hour, or Energy output thresholds are exceeded are not qualifying contractual limitations. Effective November 1, 2021, no contractual limitations will constitute qualifying contractual limitations that satisfy the requirements of this Section.

Pursuant to a process set forth in the Business Practice Manual, the CAISO will review the limits and the supporting documentation provided by the Scheduling Coordinator as well as any translation of indirect limits to determine whether the Scheduling Coordinator has made the required showing under this Section. Any dispute regarding the CAISO's determination will be subject to the generally applicable CAISO ADR Procedures set forth in Section 13, which apply except where a CAISO Tariff provision expressly provides for a different means of resolving disputes.

#### **30.4.1.1.6.1.2 Establishing Opportunity Cost Adders**

A Scheduling Coordinator for a Use-Limited Resource that elects the Proxy Cost methodology may seek to establish Opportunity Cost adders for any limitation(s) that meet all three (3) of the following criteria:

- (1) Satisfy the requirements of Section 30.4.1.1.6.1.1;
- (2) Apply for period(s) longer than the time horizon considered in the applicable Day-Ahead Market process; and
- (3) Can be reflected in a monthly, annual, and/or rolling twelve (12) month period.

The CAISO will review the documentation provided by the Scheduling Coordinator and determine whether the CAISO can calculate an Opportunity Cost pursuant to the methodology set forth in Section 30.4.1.1.6.2 using the Opportunity Cost calculator, or whether the Opportunity Cost for the limitation must instead be established pursuant to the negotiation process set forth in Section 30.4.1.1.6.3. Resources with limits that can be modelled using the Opportunity Cost calculator, are not eligible for a negotiated Opportunity Cost. Any Opportunity Cost that is determined either through the calculated or negotiated process, will remain in place unless and until the Scheduling Coordinator submits documentation, either to establish a new limitation or to modify an existing limitation, in which case the Scheduling Coordinator

can request reconsideration. In accordance with Section 39.7.1.3.2.2, the CAISO will make informational filings with FERC of any Opportunity Costs calculated pursuant to Section 30.4.1.1.6.2 or negotiated pursuant to Section 30.4.1.1.6.3.

The following types of Use-Limited Resource capacity are not eligible for an Opportunity Cost adder: the capacity of a Condition 2 RMR Unit, a Reliability Demand Response Resource, Regulatory Must-Take capacity, and any other type of Use-Limited Resource to the extent it has a limitation that satisfies the requirements of Section 30.4.1.1.6.1 but applies for a period less than or equal to the time horizon considered in the Day-Ahead Market.

### **30.4.1.1.6.2 Calculation of Opportunity Cost Adders**

#### **30.4.1.1.6.2.1 Calculation Schedule**

The CAISO will calculate, and will update the most recent calculations of, Start-Up Opportunity Costs for each validated limitation on a Use-Limited Resource's number of starts, Minimum Load Opportunity Costs for each validated limitation on a Use-Limited Resource's number of run-hours, and Variable Energy Opportunity Costs for each validated limitation on a Use-Limited Resource's Energy output for which the Scheduling Coordinator has made the required showing under Section 30.4.1.1.6.1.2. Such calculations or updated calculations will actually be used to set the adder for each validated limitation that can be reflected in a monthly or a rolling twelve (12) month period and will be advisory for each validated limitation that can be reflected in an annual period. The CAISO plans to perform the calculations and updated calculations once a month. It is possible that circumstances may prevent the CAISO from performing the calculations on a monthly basis, in which case the CAISO will prioritize the workload based on Opportunity Costs most likely to need updating. Similarly, circumstances may suggest there is a basis to update calculations more frequently, in which case the CAISO will also prioritize the workload based on Opportunity Costs most likely to need updating. The CAISO will provide the results of the calculations or updated calculations for a Use-Limited Resource to its Scheduling Coordinator.

In the event that the CAISO is unable to perform such calculations or updated calculations for all Use-Limited Resources, the CAISO will give priority to performing such calculations or updated calculations for those Use-Limited Resources that are currently on pace to reach their maximum allowed numbers of starts, maximum allowed numbers of run-hours, or maximum allowed Energy output more quickly than

the most recent calculations of Opportunity Costs indicated. To the extent that the CAISO is unable to perform such calculations or updated calculations for a Use-Limited Resource, the CAISO will utilize the most recently calculated or updated Opportunity Costs that have been set or are advisory for the Use-Limited Resource.

#### **30.4.1.1.6.2.2 Methodology for Opportunity Cost Calculator**

For the Opportunity Cost calculator developed by the CAISO, each calculation of Opportunity Costs will equal the estimated profits foregone if the Use-Limited Resource had one fewer unit of starts, run-hours, or Energy output, whichever is applicable, in the future time period of the validated limitation. With regard to each validated limitation of the Use-Limited Resource, the calculation will take into account a margin set forth in the Business Practice Manual. The calculation will also take into account the effect of any validated limitation on a Use-Limited Resource's number of starts, number of run-hours, or Energy output in the monthly and annual and/or rolling twelve month periods. For MSG Transitions, the Opportunity Cost for each transition will be derivative of the number of Start-Ups required for the MSG Resource to achieve a specific MSG Configuration.

The CAISO will calculate the estimated profits for each validated limitation over the future time period of the limitation based on the following estimated inputs: (a) the forecasted hourly average of fifteen-minute LMPs for Energy at the Use-Limited Resource's PNode or Aggregated PNode multiplied by (b) the optimal hourly dispatch of the Use-Limited Resource, minus (c) the estimated monthly Start-Up Cost of the Use-Limited Resource, minus (d) the estimated monthly Minimum Load Cost of the Use-Limited Resource, minus (e) the estimated monthly variable Energy cost of the Use-Limited Resource multiplied by the difference between (f) the optimal hourly commitment and dispatch of the Use-Limited Resource and (g) the PMin of the Use-Limited Resource, minus (h) the estimated monthly Transition Cost of the Use-Limited Resource. For a Use-Limited Resource that has twelve (12) or fewer months of LMP data at its PNode or Aggregated PNode, the CAISO will calculate input (a) listed above using LMP data from a comparable PNode or Aggregated PNode.

Any dispute regarding the calculation of Opportunity Costs will be subject to the CAISO ADR Procedures set forth in Section 13.

### **30.4.1.1.6.3 Negotiation of Opportunity Costs**

If, after receipt of the documentation required pursuant to Section 30.4.1.1.6.1.2, the CAISO determines that it cannot rely on the Opportunity Cost calculator to calculate Opportunity Costs for an eligible limitation pursuant to Section 30.4.1.1.6.2, the CAISO will establish the Opportunity Costs for the limitation pursuant to this Section. Upon making this determination, the CAISO will notify the Scheduling Coordinator for the resource and request that the Scheduling Coordinator provide the CAISO with a proposed methodology for determining Start-Up Opportunity Costs, Minimum Load Opportunity Costs, and/or Variable Energy Opportunity Costs for the limitation along with documentation supporting the methodology, and a proposed schedule for the CAISO to update such Opportunity Cost(s) under the methodology. The CAISO will either approve the submitted Opportunity Cost methodology or enter into good-faith negotiations with the Scheduling Coordinator to establish an agreed-upon Opportunity Cost methodology and the schedule for updating the Opportunity Costs under the methodology.

If the CAISO and the Scheduling Coordinator enter into good-faith negotiations, the negotiation period will be a minimum of sixty (60) days following the provision of all required documentation by the Scheduling Coordinator. Following the 60-day period, the parties can agree to continue good-faith negotiations or the Scheduling Coordinator can exercise its right to file with FERC as described below. In the event that the CAISO and the Scheduling Coordinator are unable to agree upon negotiated Opportunity Costs before the negotiation period terminates, the CAISO may propose reasonable interim Opportunity Cost value(s) that will apply to the Use-Limited Resource until the CAISO and the Scheduling Coordinator agree upon negotiated Opportunity Costs. The Scheduling Coordinator may accept or reject the proposed interim Opportunity Cost value(s). If the Scheduling Coordinator rejects the proposed interim Opportunity Cost value(s), the Use-Limited Resource will not receive Opportunity Costs unless and until the CAISO and the Scheduling Coordinator agree upon negotiated Opportunity Costs, or such costs are established by an order issued by FERC. In the event that the negotiation period terminates without the CAISO and the Scheduling Coordinator reaching agreement upon negotiated Opportunity Costs, and the Scheduling Coordinator declines to continue negotiations, the Scheduling Coordinator may file proposed Opportunity Costs and supporting documentation with FERC pursuant to Section 205 of the Federal Power Act. Any updates to the negotiated Opportunity Costs adders established pursuant to this Section will consist

solely of updates to the Opportunity Cost values themselves, and shall not affect the methodology for establishing those values. Any change in methodology would require the Scheduling Coordinator to initiate a new request pursuant to Section 30.4.1.1.6.1.2.

#### **30.4.1.2 Registered Cost Methodology**

Under the Registered Cost methodology, the Scheduling Coordinator for a Use-Limited Resource that is eligible for Opportunity Costs and either (i) does not have at least twelve (12) consecutive months of fifteen-minute LMPs for Energy at the Use-Limited Resource's PNode or Aggregated PNode; or (ii) has at least twelve (12) consecutive months of such LMPs but has not yet reached the start of the second month after the end of the twelfth consecutive month of having such LMPs, may register values of its choosing for Start-Up Costs and/or Minimum Load Costs in the Master File subject to the maximum limit specified in Section 39.6.1.6. A Scheduling Coordinator for a Multi-Stage Generating Resource that is a Use-Limited Resource registering a Start-Up Cost must also register Transition Costs for each feasible MSG Transition, subject to the maximum limit specified in Section 39.6.1.7. For a Use-Limited Resource to be eligible for the Registered Cost methodology there must be sufficient information in the Master File to calculate the value pursuant to the Proxy Cost methodology, which will be used to validate the specific value registered using the Registered Cost methodology. Any such values will be fixed for a minimum of 30 days in the Master File unless: (a) the resource's costs for any such value, as calculated pursuant to the Proxy Cost methodology, exceed the value registered using the Registered Cost methodology, in which case the Scheduling Coordinator may elect to switch to the Proxy Cost methodology for the balance of any 30-day period, except as set forth in Section 30.4.1.2(b); or (b) any cost registered in the Master File exceeds the maximum limit specified in Section 39.6.1.6 or Section 39.6.1.7 after this minimum 30-day period, in which case the value will be lowered to the maximum limit specified in Section 39.6.1.6 or Section 39.6.1.7. If a Multi-Stage Generating Resource elects to use the Registered Cost methodology, that election will apply to all the MSG Configurations for that resource. The cap for the Registered Cost values for each MSG Configuration will be based on the Proxy Cost values calculated for each MSG Configuration, including for each MSG Configuration that cannot be directly started, which are also subject to the maximum limits specified in Sections 39.6.1.6 and 39.6.1.7.

\* \* \* \*

### **30.5.2.2 Supply Bids for Participating Generators**

In addition to the common elements listed in Section 30.5.2.1, Supply Bids for Participating Generators shall contain the following components as applicable: Start-Up Bid, Minimum Load Bid, ~~Ramp Rate~~, Minimum and Maximum Operating Limits; Energy Limit, Regulatory Must-Take/Must-Run Generation; Contingency Flag; and Contract Reference Number (if any). Scheduling Coordinators submitting these Bid components for a Multi-Stage Generating Resource must do so for the submitted MSG Configuration. Scheduling quantities that a Scheduling Coordinator schedules as Regulatory Must-Take Generation for a CHP Resource shall be limited to the quantity necessary in any hour to meet the reasonably anticipated industrial host's thermal requirements and shall not exceed any established RMTMax values. The CHP Resource owner or operator shall provide its Scheduling Coordinator with the Regulatory Must-Take Generation values and is solely responsible for the accuracy of the information. The Scheduling Coordinator for the CHP Resource will schedule the quantities consistent with information provided subject to any contract rights between the CHP Resource Generating Unit owner or operator and its counter-party to any power purchase agreement regarding curtailment or dispatchability of the CHP Resource. If the CHP Resource Generating Unit has a power purchase agreement and its counter-party is not the Scheduling Coordinator for the resource, the parties to the agreement share the responsibility for ensuring that the Scheduling Coordinator schedules the resource consistent with contractual rights of the counter-parties. A Scheduling Coordinator for a Physical Scheduling Plant or a System Unit may include Generation Distribution Factors as part of its Supply Bid. If the Scheduling Coordinator has not submitted the Generation Distribution Factors applicable for the Bid, the CAISO will use default Generation Distribution Factors stored in the Master File. All Generation Distribution Factors used by the CAISO will be normalized based on Outage data that is available to the automated market systems. A Multi-Stage Generating Resource and its MSG Configurations are registered under a single Resource ID and Scheduling Coordinator for the Multi-Stage Generating Resource must submit all Bids for the resource's MSG Configurations under the same Resource ID. For ~~a~~-Multi-Stage Generating Resources, Scheduling Coordinators may submit bid curves for up to ten individual MSG Configurations of their Multi-

Stage Generating Resources into the Day-Ahead Market and up to three individual MSG Configurations into the Real-Time Market. ~~Scheduling Coordinators for Multi-Stage Generating Resources must submit a single Operational Ramp Rate for each MSG Configuration for which it submits a supply Bid either in the Day-Ahead Market or Real-Time Market.~~ For Multi-Stage Generating Resources the Scheduling Coordinator may submit the Transition Times, which cannot be greater than the maximum Transition Time registered in the Master File. To the extent the Scheduling Coordinator does not submit the Transition Time that is a registered feasible transition the CAISO will use the registered maximum Transition Time for that MSG Transition for the specific Multi-Stage Generating Resource.

### **30.5.2.3 Supply Bids for Participating Loads, Including Pumped-Storage Hydro Units and Aggregated Participating Loads**

In addition to the common elements listed in Section 30.5.2.1, Scheduling Coordinators submitting Supply Bids for Participating Loads, which includes Pumping Load or Pumped-Storage Hydro Units, may include the following components: Pumping Level (MW), Minimum Load Bid (Generation mode only of a Pumped-Storage Hydro Unit), Load Distribution Factor, ~~Ramp Rate~~, Energy Limit, Pumping Cost, and Pump Shut-Down Costs. If no values for Pumping Cost or Pump Shut-Down Costs are submitted, the CAISO will generate these Bid components based on values in the Master File. Scheduling Coordinators may only submit Supply Bids for Aggregated Participating Loads by using a Generating Unit or Physical Scheduling Plant Resource ID for the Demand reduction capacity represented by the Aggregated Participating Load as set forth in a Business Practice Manual. The CAISO will use Generation Distribution Factors provided by the Scheduling Coordinator for the Aggregated Participating Load.

### **30.5.2.4 Supply Bids for System Resources**

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



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

\* \* \* \*

#### **30.5.2.6 Supply Bids for Distributed Energy Resource Aggregations**

In addition to the common elements listed in Section 30.5.2.1, Supply Bids for Distributed Energy Resource Aggregations will contain the following components as applicable: Generation Distribution Factors, ~~Ramp Rate~~, Minimum and Maximum Operating Limits; Energy Limit, and Contingency Flag. If the Scheduling Coordinator does not submit the Generation Distribution Factors for the Bid, the CAISO will use default Generation Distribution Factors registered in [the](#) Master File.

#### **30.5.2.7 Ancillary Services Bids**

There are four distinct Ancillary Services: Regulation Up, Regulation Down, Spinning Reserve and Non-Spinning Reserve. A resource shall be eligible to provide Ancillary Service if it has complied with the CAISO's certification and testing requirements as contained in Appendix K and the CAISO's Operating Procedures. Scheduling Coordinators may use Dynamic System Resources to Self-Provide Ancillary Services as specified in Section 8. All System Resources, including Dynamic System Resources and Non-Dynamic System Resources, will be charged the Shadow Price as prescribed in Section 11.10, for any awarded Ancillary Services. A Scheduling Coordinator may submit Ancillary Services Bids for Regulation Up, Regulation Down, Spinning Reserve, and Non-Spinning Reserve for the same capacity by providing a separate price in \$/MW per hour as desired for each Ancillary Service. The Bid for each Ancillary Services is a single Bid segment. Only resources certified by the CAISO as capable of providing

Ancillary Services are eligible to provide Ancillary Services and submit Ancillary Services Bids. In addition to the common elements listed in Section 30.5.2.1, all Ancillary Services Bid components of a Supply Bid must contain the following: (1) the type of Ancillary Service for which a Bid is being submitted; ~~(2) Ramp Rate (Operating Reserve Ramp Rate and Regulation Ramp Rate, if applicable);~~ and ~~(23)~~ Distribution Curve for Physical Scheduling Plant or System Unit. A Scheduling Coordinator may only submit an Ancillary Services Bid or Submission to Self-Provide an Ancillary Service for Multi-Stage Generating Resources for the Ancillary Service for which the specific MSG Configurations are certified. ~~For any such certified MSG Configurations the Scheduling Coordinator may submit only one Operating Reserve Ramp Rate and Regulation Ramp Rate.~~ An Ancillary Services Bid submitted to the Day-Ahead Market when submitted to the Day-Ahead Market may be, but is not required to be, accompanied by an Energy Bid that covers the capacity offered for the Ancillary Service. Submissions to Self-Provide an Ancillary Services submitted to the Day-Ahead Market when submitted to the Day-Ahead Market may be, but are not required to be, accompanied by an Energy Bid that covers the capacity to be self-provided. If a Scheduling Coordinator's Submission to Self-Provide an Ancillary Service is qualified as specified in Section 8.6, the Scheduling Coordinator must submit an Energy Bid that covers the self-provided capacity prior to the close of the Real-Time Market for the day immediately following the Day-Ahead Market in which the Ancillary Service Bid was submitted. Except as provided below, the Self-Schedule for Energy need not include a Self-Schedule for Energy from the resource that will be self-providing the Ancillary Service. If a Scheduling Coordinator is self-providing an Ancillary Service from a Fast Start Unit, no Self-Schedule for Energy for that resource is required. If a Scheduling Coordinator proposes to self-provide Spinning Reserve, the Scheduling Coordinator is obligated to submit a Self-Schedule for Energy for that particular resource, unless as discussed above the particular resource is a Fast Start Unit. When submitting Ancillary Service Bids in the Real-Time Market, Scheduling Coordinators for resources that either have been awarded or self-provide Spinning Reserve or Non-Spinning Reserve capacity in the Day-Ahead Market must submit an Energy Bid for at least the awarded or self-provided Spinning Reserve or Non-Spinning Reserve capacity, otherwise the CAISO will apply the Bid validation rules described in Section 30.7.6.1.

As provided in Section 30.5.2.6.4, a Submission to Self-Provide an Ancillary Service shall contain all of the requirements of a Bid for Ancillary Services with the exception of Ancillary Service Bid price information. In addition, Scheduling Coordinators must comply with the Ancillary Services requirements of Section 8. Scheduling Coordinators submitting Self-Schedule Hourly Blocks for Ancillary Services Bids for the Real-Time Market must also submit an Energy Bid for the associated Ancillary Services Bid under the same Resource ID, otherwise the bid validation rules in Section 30.7.6.1 will apply to cover any portion of the Ancillary Services Bid not accompanied by an Energy Bid. As described in Section 34.2.3, if the resource submits a Self-Scheduled Hourly Block, the CAISO will only use the Ancillary Services Bid in the RTM optimization and will not use the associated Energy Bid for the same Resource ID to schedule Energy from the Non-Dynamic System Resource in the RTM. Scheduling Coordinators must also comply with the bidding rules associated with the must offer requirements for Ancillary Services specified in Section 40.6.

\* \* \* \*

### **30.7.3.5 Bid Validation Rules for Multi-Stage Generating Resources**

If a Scheduling Coordinator does not submit a Bid in the Day-Ahead Market or Real-Time Market for a Multi-Stage Generating Resource with a Resource Adequacy must-offer obligation at a MSG Configuration that can meet the applicable Resource Adequacy must-offer obligation, the CAISO will create a Generated Bid for the default Resource Adequacy MSG Configuration. If the Multi-Stage Generating Resource is not capable of Start-Up in the default Resource Adequacy MSG Configuration, then the ISO will, based on feasibility of transitions, create a Generated Bid for every MSG Configuration that has a minimum output below the MW level of the Resource Adequacy must-offer obligation, which will cover the operating range from its minimum output to the minimum of its maximum output and the MW level of the Resource Adequacy must-offer obligation. In the event that the Scheduling Coordinator does not submit a Bid in compliance with section 30.5.1(p), the CAISO will create a Generated Bid for all of the capacity not bid into the CAISO Market between the maximum bid-in Energy MW and the higher of Self-Scheduled Energy MW and the Multi-Stage Generating Resource plant-level PMin. If the Scheduling

Coordinator submits a Bid for the Multi-Stage Generating Resource, the CAISO will create this Generated Bid for the registered MSG Configurations before the Market Close, and if it does not submit such a Bid the CAISO will create this Generated Bid after the Market Close. Any Generated Bid created by the CAISO for the default Resource Adequacy MSG Configuration will be in addition to the MSG Configurations bid into the Real-Time Market by the responsible Scheduling Coordinator. If the Scheduling Coordinator submits a Bid in the Day-Ahead Market or Real-Time Market for a MSG Configuration that is not the default Resource Adequacy MSG Configuration and that does not cover the full amount of the resource's Resource Adequacy requirements, the CAISO will create a Generated Bid for the full Resource Adequacy Capacity. Before the market closes, if a Scheduling Coordinator submits a Bid in the Day-Ahead Market or Real-Time Market for the default Resource Adequacy MSG Configuration of a Multi-Stage Generating Resource that only meets part of the resource's Resource Adequacy must-offer obligation, the CAISO will extend the last segment of the Energy Bid curve in the submitted Bid for the Multi-Stage Generating Resource up to the Multi-Stage Generating Resource's Resource Adequacy must-offer obligation. After the market closes, to the extent that no Bid is submitted into the Real-Time Market for a Multi-Stage Generating Resource scheduled in the Integrated Forward Market as required in Section 30.5 the CAISO will create a Self-Schedule for MSG Configuration equal to the Day-Ahead Schedule for that resource for the MSG Configuration scheduled in the IFM. To the extent a Multi-Stage Generating Resource is awarded Operating Reserves in the Day-Ahead Market and no Economic Energy Bid is submitted for that resource in the Real-Time Market, the CAISO will insert Proxy Energy Bid in the MSG Configuration that was awarded in the Day-Ahead Market to cover the awarded Operating Reserves. To the extent that a Multi-Stage Generating Resource's RUC Schedule is greater than its Day-Ahead Schedule, if the Scheduling Coordinator does not submit an Energy Bid in the RTM to cover the difference, then the CAISO will either create a Bid in the MSG Configuration awarded in RUC, or extend the Bid submitted by the Scheduling Coordinator before the Market Close. After the Market Close, the CAISO will create a Generated Bid if there is no Bid submitted for the resource for this difference. The CAISO will validate that the combination of the Day-Ahead Ancillary Services Awards and Submissions to Self-Provide Ancillary Services ~~is~~ are feasible with respect to the ~~physical~~ operating characteristics of the applicable MSG Configuration registered in the Master File pursuant to Section

4.6.4. The CAISO will reject Ancillary Services Bids or Submissions to Self-Provide Ancillary Services for MSG Configurations that are not certified Ancillary Services. For any given Multi-Stage Generating Resource, for any given CAISO Market and Trading Hour if one MSG Configuration's Bid fails the bid validation process, all other Bids for all other MSG Configurations are also invalidated.

\* \* \* \*

### **30.7.7 ~~[Not Used] Format And Validation Of Operational Ramp Rates~~**

~~The submitted Operational Ramp Rate expressed in megawatts per minute (MW/min) as a function of the operating level, expressed in megawatts (MW), must be a staircase function with up to four segments. There is no monotonicity requirement for the Operational Ramp Rate. The submitted Operational Ramp Rate shall be validated as follows:~~

- ~~(a) — The range of the submitted Operational Ramp Rate must cover the entire capacity of the resource, from the minimum to the maximum operating capacity, as registered in the Master File for the relevant resource.~~
- ~~(b) — The operating level entries must match exactly (in number, sequence, and value) the corresponding minimum and maximum Operational Ramp Rate breakpoints, as registered in the Master File for the relevant resource.~~
- ~~(c) — If a Scheduling Coordinator does not submit an Operational Ramp Rate for a generating unit for a day, the CAISO shall use the maximum Ramp Rate for each operating range set forth in the Master File as the Ramp Rate for that unit for that same operating range for the Trading Day.~~
- ~~(d) — The last Ramp Rate entry shall be equal to the previous Ramp Rate entry and represent the maximum operating capacity of the resource as registered in the Master File. The resulting Operational Ramp Rate segments must lie between the minimum and maximum Operational Ramp Rates, as registered in the Master File.~~
- ~~(e) — The submitted Operational Ramp Rate must be the same for each hour of the Trading Day, i.e., the Operational Ramp Rate submitted for a given Trading Hour must be the~~

~~same with the one(s) submitted earlier for previous Trading Hours in the same Trading Day.~~

- ~~(f) Outages that affect the submitted Operational Ramp Rate must be due to physical constraints, reported in the CAISO's outage management system pursuant to Section 9 and are subject to CAISO approval. All approved changes to the submitted Operational Ramp Rate will be used in determination of Dispatch Instructions for the shorter period of the balance of the Trading Day or duration of reported Outage.~~
- ~~(g) Operational Ramp Rate derates in the CAISO's outage management system pursuant to Section 9 may be declared for any operational segment established in the Master File. Ramping capability through Forbidden Operating Regions are not affected by derates entered in the CAISO's outage management system pursuant to Section 9.~~
- ~~(h) The amount of change in Ramp Rates from one operating range to a subsequent operating range must not exceed a 10 to 1 ratio, and any Ramp Rate change in excess will be adjusted to achieve the 10 to 1 ratio. This adjustment will also include the implicit ramp rate in the Forbidden Operating Region.~~
- ~~(i) For all CAISO Dispatch Instructions of Reliability Must Run Units the Operational Ramp Rate will be the Ramp Rate declared in the Reliability Must Run Contract Schedule A.~~

\* \* \* \*

### **30.7.9 Format and Validation of Start-Up Costs and Shut-Down Costs**

For a Generating Unit or a Resource-Specific System Resource, the submitted Start-Up Cost expressed in dollars (\$) as a function of down time expressed in minutes must be a staircase function with up to three (3) segments defined by a set of 1 to 4 down time and Start-Up Cost pairs. The Start-Up Cost is the cost incurred to start the resource if it is offline longer than the corresponding down time. The last segment will represent the cost to start the resource from cold Start-Up and will extend to infinity. The submitted Start-Up Cost function shall be validated as follows:

- (a) The first down time must be zero (0) min.

- (b) The down time entries must match exactly (in number, sequence, and value) the corresponding down time breakpoints of the Start-Up Cost function, as registered in the Master File for the relevant resource as either the Proxy Cost or Registered Cost.
- (c) The Start-Up Cost for each segment must not be negative and must be equal to the Start-Up Cost of the corresponding segment of the Start-Up Cost function, as registered in the Master File for the relevant resource. In addition, if the Proxy Cost methodology pursuant to Section 30.4 applies to the resource, the Scheduling Coordinator for that resource may submit a daily Bid for the Start-Up Cost that must not be negative but may be less than or equal to the sum of (i) one hundred twenty-five (125) percent of the Proxy Cost other than the portion of the Proxy Cost that consists of Start-Up Opportunity Costs, if any; and (ii) one hundred (100) percent of the portion of the Proxy Cost that consists of Start-Up Opportunity Costs; and if the resource is a Multi-Stage Generating Resource, the Scheduling Coordinator may submit a daily Bid for each MSG Configuration of the resource that must not be negative but may be less than or equal to the sum of (i) one hundred twenty-five (125) percent of the Start-Up Cost for the MSG Configuration other than the portion of the Start-Up Cost for the MSG Configuration that consists of Start-Up Opportunity Costs, if any; and (ii) one hundred (100) percent of the portion of the Start-Up Cost for the MSG Configuration that consists of Start-Up Opportunity Costs. For a resource that is eligible and has elected to use the Registered Cost methodology pursuant to Section 30.4, if a value is submitted in a Bid for the Start-Up Cost, it will be overwritten by the Registered Cost reflected in the Master File. If no value for Start-Up Cost is submitted in a Bid, the CAISO will insert the Master File value, as either the Proxy Cost or Registered Cost based on the methodology elected pursuant to Section 30.4.
- (d) The Start-Up Cost function must be strictly monotonically increasing, i.e., the Start-Up Cost must increase as down time increases.

The Start-Up ~~e~~Cost for a Reliability Demand Response Resource shall be zero (0). For Participating Loads and Proxy Demand Resources, a single Shut-Down Cost in dollars (\$) is the cost incurred to Shut-Down the resource after receiving a Dispatch Instruction. The submitted Shut-Down Cost must not be

negative. For Multi-Stage Generating Resources, the Scheduling Coordinator must provide Start-Up Costs for each MSG Configuration into which the resource can be started.

### **30.7.10 Format and Validation of Minimum Load Costs**

#### **30.7.10.1 In General**

For a Generating Unit or a Resource-Specific System Resource, the submitted Minimum Load Cost expressed in dollars per hour (\$/hr) is the cost incurred for operating the unit at Minimum Load as registered in the Master File. The submitted Minimum Load Cost must not be negative. In addition, if the Proxy Cost methodology pursuant to Section 30.4 applies to the resource, the Scheduling Coordinator for that resource may submit a daily Bid for the Minimum Load Cost that must not be negative but may be less than or equal to the sum of (i) one hundred twenty-five (125) percent of the Proxy Cost value other than the portion of the Proxy Cost value that consists of Minimum Load Opportunity Costs, if any; and (ii) one hundred (100) percent of the portion of the Proxy Cost value that consists of Minimum Load Opportunity Costs. For a resource that is eligible and has elected to use the Registered Cost methodology pursuant to Section 30.4, any submitted Minimum Load Cost must be equal to the Minimum Load Cost as registered in the Master File.

\* \* \* \*

### **34.17.1 Resource Constraints**

The SCED shall enforce the following resource physical constraints:

- (a) Minimum and maximum operating resource limits. Outages and limitations due to transmission clearances shall be reflected in these limits. The more restrictive operating or regulating limit shall be used for resources providing Regulation so that the SCED shall not Dispatch them outside their Regulating Range.
- (b) Forbidden Operating Regions. When ramping in the Forbidden Operating Region, the implicit ramp rate will be used as determined based on the time it takes for the resource to cross its Forbidden Operating Region. A resource can only be ramped through a Forbidden Operating Region after being dispatched into a Forbidden Operation Region.



The CAISO will not Dispatch a resource within its Forbidden Operating Regions in the Real-Time Market, except that the CAISO may Dispatch the resource through the Forbidden Operating Region in the direction that the resource entered the Forbidden Operating Region at the maximum applicable Ramp Rate over consecutive Dispatch Intervals. A resource with a Forbidden Operating Region cannot provide Ancillary Services in a particular fifteen (15) minute Dispatch Interval unless that resource can complete its transit through the relevant Forbidden Operating Region within that particular Dispatch Interval.

- (c) Operational Ramp Rates and Start-Up Times. The ~~submitted~~ Operational Ramp Rate for resources shall be used as the basis for all Dispatch Instructions, provided that the Dispatch Operating Point for resources that are providing Regulation remains within their applicable Regulating Range. The Regulating Range will limit the Ramping of Dispatch Instructions issued to resources that are providing Regulation. The Ramp Rate for Non-Dynamic System Resources cleared in the FMM will not be observed. Rather, the ramp of the Non-Dynamic System Resource will respect inter-Balancing Authority Area Ramping conventions established by WECC. Ramp Rates for Dynamic System Resources will be observed like Participating Generators in the RTD. Each Energy Bid shall be Dispatched only up to the amount of Imbalance Energy that can be provided within the Dispatch Interval based on the ~~applicable~~ Operational Ramp Rate. The Dispatch Instruction shall consider the relevant Start-Up Time as, if the resource is off-line, the relevant Operational Ramp Rate function, and any other resource constraints or prior commitments such as Schedule changes across hours and previous Dispatch Instructions. The Start-Up Time shall be determined from the Start-Up Time function and when the resource was last shut down. The Start-Up Time shall not apply if the corresponding resource is on-line or expected to start.
- (d) Maximum number of daily Start-Ups. The SCED shall not cause a resource to exceed its daily maximum number of Start-Ups.

- (e) Minimum Run Time and Down Time. The SCED shall not start up off-line resources before their Minimum Down Time expires and shall not shut down on-line resources before their Minimum Run Time expires. For Multi-Stage Generating Resources these requirements shall be observed both for the Generating Unit and MSG Configuration.
- (f) Operating (Spinning and Non-Spinning) Reserve. The SCED shall Dispatch Spinning and Non-Spinning Reserve subject to the limitations set forth in Section 34.18.3.
- (g) Non-Dynamic System Resources. If Dispatched, each Non-Dynamic System Resource flagged for hourly pre-dispatch in the next Trading Hour shall be Dispatched to operate at a constant level over the entire Trading Hour. The HASP shall perform the hourly pre-dispatch for each Trading Hour once prior to the Operating Hour. The hourly pre-dispatch shall not subsequently be revised by the SCED and the resulting HASP Block Intertie Schedules are financially binding and are settled pursuant to Section 11.4.
- (h) Daily Energy use limitation to the extent that Energy limitation is expressed in a resource's Bid. If the Energy Limits are violated for purposes of Exceptional Dispatches for System Reliability, the Bid will be settled as provided in Section 11.5.6.1.

\* \* \* \*

#### **34.17.5 Inter-House Resource Dispatch Without Real-Time Energy**

Dispatch Instructions shall be issued for each Dispatch Interval as needed to prescribe the ramp between a resource's accepted Self-Schedule in one Trading Hour and its accepted Self-Schedule in the immediately succeeding Trading Hour. Such Dispatch Instructions shall be based on the lesser of: (1) the ~~applicable~~ Operational Ramp Rate; ~~as provided for in Section 30.7.7~~ and (2) the Ramp Rate associated with the Standard Ramp. The Dispatch Instructions for Ramping of Generating Units without Real-Time Energy Bids in both Operating Hours shall ramp the resource between hourly Schedules symmetrically to the extent possible subject to the Regulation Ramping limitations across hourly boundaries in twenty (20) to sixty (60) minutes assuming Congestion can be resolved utilizing Economic Bids. The minimum twenty (20)-minute ramp is required for smooth hourly Schedule changes and is consistent with Intertie

scheduling agreements between Balancing Authority Areas. Energy resulting from the Standard Ramp shall be deemed Standard Ramping Energy and will be settled in accordance with Section 11.5.1. Energy resulting from any ramp extending beyond the Standard Ramp will be deemed Ramping Energy Deviation and will be settled in accordance with Section 11.5.1.

\* \* \* \*

### 39.7.1.1 Variable Cost Option

For natural gas-fueled units, the Variable Cost Option will calculate the Default Energy Bid by adding incremental cost (comprised of incremental fuel cost plus a volumetric Grid Management Charge adder plus a greenhouse gas cost adder if applicable) with variable operation and maintenance cost, adding ten percent (10%) to the sum, ~~and~~ adding a Bid Adder if applicable for a Frequently Mitigated Unit, and adding Variable Energy Opportunity Costs, if any. For non-natural gas-fueled units, the Variable Cost Option will calculate the Default Energy Bid by summing incremental fuel or fuel-equivalent cost plus a volumetric Grid Management Charge plus a greenhouse gas cost adder if applicable, adding ten percent (10%) to the sum of fuel cost plus, adding a Bid Adder if applicable for a Frequently Mitigated Unit, and adding Variable Energy Opportunity Costs, if any.

\* \* \* \*

#### 39.7.1.1.1.2 Non-Natural Gas-Fired Resources

For non-natural gas-fueled units, incremental fuel cost is calculated based on an average cost curve as described below.

Resource owners for non-natural gas-fueled units shall submit to the CAISO average fuel or fuel equivalent costs (\$/MW) measured for at least two (2) and up to eleven (11) generating operating points (MW), where the first and last operating points refer to the minimum and maximum operating levels (i.e., PMin and PMax), respectively. The average cost curve formed by the (\$/MWh, MW) pairs is a piece-wise linear curve between operating points, and two (2) average cost pairs yield one (1) incremental cost

segment that spans two (2) consecutive operating points. For each segment representing operating levels below eighty (80) percent of the unit's PMax, the incremental cost rate is limited to the maximum of the average cost rates for the two (2) operating points used to calculate the incremental cost segment. The unit's final incremental fuel cost curve is then adjusted, if necessary, applying a left-to-right adjustment to ensure that the final incremental cost curve is monotonically non-decreasing. The CAISO Cost curves will include, if applicable: (i) greenhouse gas allowance costs for each non-natural gas-fired resource registered with the California Air Resources Board as having a greenhouse gas compliance obligation, as provided to the CAISO by the Scheduling Coordinator for the resource; and (ii) a volumetric Grid Management Charge adder that consists of: (i) the Market Services Charge; (ii) the System Operations Charge; and (iii) the Bid Segment Fee divided by the MW in the Bid segment. Cost curves shall be stored, updated, and validated in the Master File.

\* \* \* \*

### **39.7.1.1.3 Variable Energy Opportunity Costs Under the Variable Cost Option**

The CAISO will determine eligibility for Variable Energy Opportunity Costs for Use-Limited Resources pursuant to Section 30.4.1.1.6.

\* \* \* \*

### **39.7.1.3.2 Negotiated Values and Informational Filings**

#### **39.7.1.3.2.1 Renegotiation of Values**

The CAISO may require the renegotiation of any components including adders or interim adders for major maintenance expenses determined pursuant to Sections 30.4.1.1.1, 30.4.1.1.2, and 30.4.1.1.4, any Opportunity Costs negotiated pursuant to Section 30.4.1.1.6.3, any Default Energy Bids negotiated pursuant to this Section 39.7.1.3, any temporary Default Energy Bids established pursuant to Section 39.7.1.5, or any custom operation and maintenance adders negotiated pursuant to Section 39.7.1.1.2, that have become outdated, are possibly erroneous, or for which the Scheduling Coordinator has

changed. In the renegotiation process, the CAISO may review and propose modifications to such values, and may require the Scheduling Coordinator to provide updated information to support continuation of such values.

#### **39.7.1.3.2.2 Informational Filings with FERC**

The CAISO shall make an informational filing with FERC of any adders or interim adders for major maintenance expenses determined pursuant to Sections 30.4.1.1.1, 30.4.1.1.2, and 30.4.1.1.4, any Opportunity Costs calculated pursuant to Section 30.4.1.1.6.2 or negotiated pursuant to Section 30.4.1.1.6.3, any Default Energy Bids negotiated pursuant to this ~~s~~Section 39.7.1.3, any temporary Default Energy Bids established pursuant to Section 39.7.1.5, or any custom operations and maintenance adders negotiated pursuant to Section 39.7.1.1.2, no later than seven (7) days after the end of the month in which the Default Energy or operations and maintenance values were established.

\* \* \* \*

#### **40.6.4 Use-Limited Resources Additional Availability Requirements**

##### **40.6.4.1 ~~[Not Used]~~Registration of Use-Limited Resources**

~~Hydroelectric Generating Units, Proxy Demand Resources, Reliability Demand Response Resources, and Participating Load, including Pumping Load, are deemed to be Use-Limited Resources for purposes of this Section 40 and are not required to submit the application described in this Section 40.6.4.1.~~

~~Scheduling Coordinators for other Use-Limited Resources must provide the CAISO an application in the form specified on the CAISO Website requesting registration of a specifically identified resource as a Use-Limited Resource. This application shall include specific operating data and supporting documentation including, but not limited to:~~

- ~~(1) a detailed explanation of why the resource is subject to operating limitations;~~
- ~~(2) historical data to show attainable MWhs for each 24-hour period during the preceding year, including, as applicable, environmental restrictions for NO<sub>x</sub>, SO<sub>x</sub>, or other factors; and~~
- ~~(3) further data or other information as may be requested by the CAISO to~~

~~understand the operating characteristics of the unit.~~

~~Within five (5) Business Days after receipt of the application, the CAISO will respond to the Scheduling Coordinator as to whether or not the CAISO agrees that the facility is eligible to be a Use-Limited Resource. If the CAISO determines the facility is not a Use-Limited Resource, the Scheduling Coordinator may challenge that determination in accordance with the CAISO ADR Procedures.~~

\* \* \* \*

#### 40.6.8 Use of Generated Bids

- (a) **Day-Ahead Market.** Prior to completion of the Day-Ahead Market, the CAISO will determine if Resource Adequacy Capacity subject to the requirements of Section 40.6.1 and for which the CAISO has not received notification of an Outage has not been reflected in a Bid and will insert a Generated Bid for such capacity into the CAISO Day-Ahead Market.
- (b) **Real-Time Market.** Prior to running the Real-Time Market, the CAISO will determine if Resource Adequacy Capacity subject to the requirements of Section 40.6.2 and for which the CAISO has not received notification of an Outage has not been reflected in a Bid and will insert a Generated Bid for such capacity into the Real-Time Market.
- (c) **Partial Bids for RA Capacity.** If a Scheduling Coordinator for an RA Resource submits a partial bid for the resource's RA Capacity, the CAISO will insert a Generated Bid only for the remaining RA Capacity. In addition, the CAISO will determine if all dispatchable Resource Adequacy Capacity from Short Start Units, not otherwise selected in the IFM or RUC, is reflected in a Bid into the Real-Time Market and will insert a Generated Bid for any remaining dispatchable Resource Adequacy Capacity for which the CAISO has not received notification of an Outage.
- (d) **Calculation of Generated Bids.** ~~As provided in the Business Practice Manuals, a A~~ Generated Bid for Energy will be calculated pursuant to Sections 30.7.3.4 and 30.7.3.5 and will include: ~~(i) a greenhouse gas cost adder for a resource registered with~~

~~the California Air Resources Board as having a greenhouse gas compliance obligation; and (ii) a volumetric Grid Management Charge adder that consists of: (i) the Market Services Charge; (ii) the System Operations Charge; and (iii) the Bid Segment Fee divided by the MW in the Bid segment.~~ A Generated Bid for Ancillary Services will equal zero dollars (\$0/MW-hour).

- (e) **Exemptions.** Notwithstanding any of the provisions of Section 40.6.8, the CAISO will not insert any Bid in the Day-Ahead Market or Real-Time Market required under this Section 40 for Resource Adequacy Capacity of a Use-Limited Resource, Non-Generator Resource, Variable Energy Resource, Hydroelectric Generating Unit, Proxy Demand Resource, Reliability Demand Response Resource, Participating Load, including Pumping Load, or resource providing Regulatory Must-Take Generation unless the resource submits an Energy Bid and fails to submit an Ancillary Service Bid or unless the generally applicable bidding rules in Section 30 apply.
- (f) **NRS-RA Resources.** The CAISO will submit a Generated Bid in the Day-Ahead Market or Real-Time Market for a non-Resource Specific System Resource in each RAIM assessment hour, to the extent that the resource provides Resource Adequacy Capacity subject to the requirements of Sections 40.6.1 or 40.6.2 and does not submit an outage request or Bid for the entire amount of that Resource Adequacy Capacity.

\* \* \* \*

## Appendix A

### Master Definition Supplement

\* \* \* \*

#### - Maximum Daily Start-Ups

The maximum number of times a Generating Unit can be started up within one day, due to environmental limitations that are not based solely on contractual considerations or ~~physical~~ operating constraints registered in the Master File pursuant to Section 4.6.4.

\* \* \* \*

**- Minimum Down Time (MDT)**

The minimum amount of time that a Generating Unit must stay off-line after being Shut-Down, due to ~~physical~~ operating constraints registered in the Master File pursuant to Section 4.6.4.

\* \* \* \*

**- Minimum Load Opportunity Costs**

An adder consisting of the estimated profits foregone by a Use-Limited Resource with a limitation on its number of run-hours that satisfies the definition of a Use-Limited Resource and applies for a time period that satisfies the requirements of Section 30.4.1.1.6.1, if the Use-Limited Resource had one less run-hour in the time period.

\* \* \* \*

**- Minimum Run Time**

The minimum amount of time that a Generating Unit must stay on-line after being started-up prior to being Shut-Down, due to ~~physical~~ operating constraints registered in the Master File pursuant to Section 4.6.4.

\* \* \* \*

**- Multi-Stage Generating Resource**

A Generating Unit that for reasons related to its technical characteristics can be operated in various MSG Configurations such that only one such MSG Configuration can be operated in any given Dispatch Interval. In addition, subject to the requirements in Section 27.8, the following technical characteristics qualify a Generating Unit as a Multi-Stage Generating Resource if the resource: (1) is a combined cycle resource, excluding those that are one-by-one combined cycle resources without bypassing, duct firing capability or power augmentation capability; (2) has more than one Forbidden Operating Region; (3) has multiple operating modes, including Regulating Ranges associated with different Ancillary Services capability; or (4) has hold times before or after a Transition through a Forbidden Operating Region. A hold time is an operational restriction that requires the resource to stay in or out of a specific operating mode for a given period of time, derived from the ~~physical~~ characteristics registered in the Master File for the resource pursuant to Section 4.6.4, which may be in the form of a requirement that the resource stay in a particular operating mode for a period of time once it is in, or that the resource must stay out of a



particular operating mode for a period of time once it is out of that operating mode. Metered Subsystems, Pumped-Storage Hydro Units, and Pumping Loads, and System Resources do not qualify as Multi-Stage Generating Resources and therefore cannot register as such as provided in Section 27.8. Regulatory Must-Take Resources are not required to be registered as Multi-Stage Generating Resources. Dispatchable Qualifying Facilities that are not qualified as Regulatory Must-Take resources are required to register as Multi-Stage Generating Resources, provided they meet the qualifying technical characteristics described above.

\* \* \* \*

#### **- Operating Reserve Ramp Rate**

A ~~value single number included registered~~ in ~~the Master File pursuant to Section 4.6.4~~Ancillary Service Bids and Submissions to Self-Provide Ancillary Services for Spinning Reserve and Non-Spinning Reserve that represents the Ramp Rate of a resource used in the procurement of Operating Reserve capacity.

\* \* \* \*

#### **- Operational Ramp Rates**

A staircase function of up to 4 segments (in addition to Ramp Rate segments needed for modeling Forbidden Operating Regions). Operational Ramp Rate values are registered in the Master File pursuant to Section 4.6.4~~submitted with Energy Bid data.~~

\* \* \* \*

#### **- Opportunity Costs**

Start-Up Opportunity Costs, Minimum Load Opportunity Costs, or Variable Opportunity Costs.

\* \* \* \*

#### **- Pump Ramping Conversion Factor**

A Master File entry submitted by Scheduling Coordinators that allows the Scheduling Coordinator to indicate the ratio of Energy expended to pump water into storage that can be used to produce Energy. A zero percent Pump Ramping Conversion Factor implies that no amount of Energy production capability is produced as a result of pumping water and the CAISO shall not use such unavailable Energy in its CAISO Markets optimization. A hundred percent Pump Ramping Conversion Factor indicates all the Energy expended to pump water is available for Generation and the CAISO shall use only the available

portions in its CAISO Markets optimization. The Pump Ramping Conversion Factor submitted in the Master File need not be based on physical-design capability characteristics of the resource and is adjustable by the Scheduling Coordinator.

\* \* \* \*

#### **- Ramp Rate**

The valueBid registered in the Master File pursuant to Section 4.6.4~~component~~ that indicates the Operational Ramp Rate, Regulation Ramp Rate, and Operating Reserve Ramp Rate for a Generating Unit, and the Load drop rate and Load pick-up rate for Participating Loads, Reliability Demand Response Resources, and Proxy Demand Resources, for which the Scheduling Coordinator is submitting Energy Bids or Ancillary Services Bids.

\* \* \* \*

#### **- Regulation Ramp Rate**

A value registered single number included in the Master File pursuant to Section 4.6.4~~Ancillary Service Bids and Submissions to Self-Provide Ancillary Services for Regulation~~ that represents the Ramp Rate of a resource used in the procurement of Regulation capacity.

\* \* \* \*

#### **- Security Constrained Unit Commitment (SCUC)**

An algorithm performed by a computer program over multiple hours that determines the Commitment Status and Day-Ahead Schedules, AS Awards, RUC Awards, Hourly Intertie Block Schedules, FMM Schedules and Dispatch Instructions for selected resources and minimizes production costs (Start-Up, Minimum Load and Energy Bid Costs in IFM, and RTM; Start-Up, Minimum Load and RUC Availability Bid Costs) while respecting the physical-operating characteristics of selected resources registered in the Master File pursuant to Section 4.6.4 and Transmission Constraints.

\* \* \* \*

#### **- Start-Up Opportunity Costs**

An adder consisting of the estimated profits foregone by a Use-Limited Resource with a limitation on its number of starts that satisfies the definition of a Use-Limited Resource and applies for a time period that satisfies the requirements of Section 30.4.1.1.6.1, if the Use-Limited Resource had one less start in the

time period.

\* \* \* \*

#### **- Transition Cost**

For a Multi-Stage Generating Resource, the dollar cost per feasible transition from a given MSG Configuration to a higher MSG Configuration when the resource is already On. Transition Cost must be non-negative. For a Use-Limited Resource, Transition Cost can include Start-Up Opportunity Costs determined pursuant to Section 30.4.1.1.6.

\* \* \* \*

#### **- Use-Limited Resource**

~~A resource demonstrated to be a Use-Limited Resource pursuant to Section 30.4.1.1.6.1 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. This definition is not limited to Resource Adequacy Resources. A Use-Limited Resource that is a Resource Adequacy Resource must also meet the definition of a Resource Adequacy Resource.~~

\* \* \* \*

#### **- Variable Energy Opportunity Costs**

An adder consisting of the estimated profits foregone by a Use-Limited Resource with a limitation on its Energy output that satisfies the definition of a Use-Limited Resource and applies for a time period that satisfies the requirements of Section 30.4.1.1.6.1, if the Use-Limited Resource had one less megawatt-hour of Energy output in the time period.

\* \* \* \*

**Attachment C – Draft Final Proposal**  
**Commitment Cost Enhancements Phase 3**  
**California Independent System Operator Corporation**



# California ISO

**Commitment Cost Enhancements Phase 3  
Draft Final Proposal**

**February 17, 2016**

# TABLE OF CONTENTS

- 1. Changes from revised straw proposal and response to stakeholder comments..... 4
  - 1.1. Changes made from revised straw proposal: ..... 4
  - 1.2. Stakeholder comments and requests not resulting in changes ..... 5
- 2. Schedule for stakeholder policy engagement..... 7
- 3. Introduction..... 7
- 4. Initiative scope ..... 8
- 5. Use-limited definition ..... 9
  - 5.1. Other ISO's/RTO's opportunity cost criteria ..... 10
  - 5.2. Revised use-limited definition..... 12
    - 5.2.1. Default use-limited status..... 14
  - 5.3. Contractual limitations ..... 17
    - 5.3.1. Exceptions for certain contractual limitations..... 18
  - 5.4. ISO's response to FERC Order on CCE2 ..... 18
- 6. Use-limited registration process..... 21
  - 6.1. Process for opportunity costs ..... 21
  - 6.2. Evaluating submitted limitations..... 25
- 7. Opportunity Cost Model..... 27
  - 7.1. Opportunity cost methodology overview..... 28
    - 7.1.1. Model inputs ..... 29
    - 7.1.2. Calculating opportunity costs..... 30
      - 7.1.2.1. Nested limitations ..... 32
      - 7.1.2.2. Scheduled model runs..... 32
    - 7.1.3. Outputs..... 35
- 8. Negotiated opportunity cost AND REVISIONS TO ndeb PROCESS ..... 37
- 9. Multi-stage generating resources ..... 38
- 10. Outage cards..... 41
  - 10.1. Short term use-limited reached outage card..... 41

10.2. Use-limited reached outage card RAIM treatment ..... 42

10.3. Demand response outage card..... 44

11. Masterfile resource characteristics ..... 44

11.1. Market characteristics..... 45

11.2. Design capability characteristics..... 47

11.3. Changes to Masterfile resource characteristics..... 48

12. Futher enhancements of the opportunity cost model ..... 48

13. Next Steps ..... 49

# 1. CHANGES FROM REVISED STRAW PROPOSAL AND RESPONSE TO STAKEHOLDER COMMENTS

## 1.1. CHANGES MADE FROM REVISED STRAW PROPOSAL:

### Section 5

Section 5 discusses the ISO's proposed revisions to the definition to clarify the limits that are eligible for opportunity costs. This section also discusses the elimination of default designation. In addition, the ISO provided more information on how other ISOs/RTOs determine which resources are eligible to receive opportunity costs.

The ISO has provided more detailed discussion on the impact removing default use-limited designation will have on resources currently deemed use-limited to address stakeholder comments and questions.

In response to stakeholder comments, the ISO has included a more detailed description to provide justification for why, in general, contractual limitations that are purely economic in nature, that reflect a trade-off such as lower capacity costs for fewer start-ups or run ours are not qualifying limitations to receive an opportunity cost.

The ISO is now proposing an exemption provision for contractual limitations approved through a regulatory process that meets the provisional requirements to temporarily qualify for an opportunity cost.

### Section 6

The ISO has explained the documentation requirements for use-limited resources as established through the implementation of RSI1 to clarify questions posed by stakeholders regarding the current process. This section also discusses proposed changes to the tariff and BPM processes to implement the policies adopted in this initiative.

### Section 7

In response to stakeholder request, the ISO will be posting a technical appendix to provide more transparency. The technical appendix will include more detailed information regarding the estimated LMPs, optimization problem, and several examples of how the model will be used to determine opportunity costs for various limitations.

Several stakeholders commented on the model being re-run based on a trigger; when a resource used more of its limitation than the model initially anticipated by a given threshold, the ISO would update the opportunity cost. The ISO still proposes to update the opportunity costs monthly, but in the event the ISO cannot update all resources' opportunity costs, those resources running through the limitations faster than initially anticipated will have priority for updates.



In response to stakeholder concern regarding the limited circumstances under which a scheduling coordinator could dispute the ISO's calculated opportunity cost, the ISO is now proposing one addition situation related to resource adequacy resources at risk for not being available for the duration of the resource adequacy period.

### **Section 10**

In response to stakeholder comments, the use-limited reached outage card portion of Reliability Services Initiative phase 2 is now included in this policy. In addition, the ISO is proposing a new nature of work outage card specifically for demand response resources to ensure there is no adverse impact on the resources as they will not qualify for an opportunity cost.

### **Section 11**

In response to stakeholder comments, the ISO has migrated related topics from Bidding Rules initiative and Reliability Service Initiative phase 2. This policy now proposes to have two values for a subset of Masterfile resource characteristics; a market based and design value for maximum daily starts, maximum daily MSG transitions, and ramp rate. The ISO also considers how changes to Masterfile values which impact a resources' qualifications for resource adequacy products will be addressed.

### **Section 12**

The ISO has also provided a long term vision for the opportunity cost methodology, specifically what possible future enhancements may be considered after gained experience.

Stakeholders posed additional questions and asked for various clarifications in certain areas of the proposal. The ISO has added discussion and clarifications in this iteration of the policy proposal to address those concerns or questions raised by stakeholders.

## **1.2. STAKEHOLDER COMMENTS AND REQUESTS NOT RESULTING IN CHANGES**

Stakeholders requested the ISO to conduct additional testing of the models, conduct dry-runs of the opportunity cost model to gain insights, and run an offline six month simulation. Given the proposed optimization model, testing for comparison purposes is no longer needed. The preliminary testing that was presented at the technical workshop came from dry-runs of the model. It was intended to allow the ISO and stakeholders to understand the parameters of the model and identify areas that needed to be addressed. Conducting a six month offline simulation run is not generally ISO procedure; the preliminary testing already conducted illustrates the feasibility of the proposal and identified issues that were addressed through the policy development. The justification for retaining the short-term use-limited outage card is to provide a safety net in the event of unforeseen errors or issues with implementation.

Several stakeholders were concerned about the timing of implementation for CCE3. Particularly, there was some confusion around the registration required in March 2016 and how that relates to

the CCE3 policy. The use-limited registration process required in March 2016 is a result of the Reliability Services initiative phase 1, not due to this policy proposal, therefore the ISO is not requiring information from stakeholders that has not already been FERC approved. While the ISO understands the concern regarding a tight timeline between the March Board meeting for CCE3 approval and Fall 2016 implementation, the ISO is still targeting Fall 2016.

PG&E suggested an alternative approach whereby the ISO continue to define use-limited as currently in the tariff but define a subset of use-limited resources that would be eligible for an opportunity cost. While the ISO appreciates this suggestion, which was discussed internally, the ISO is going to continue to take this opportunity and define use-limited as resources that require an opportunity cost as discussed herein.

NRG asked the ISO to consider two scenarios which would warrant a resource with a calculated opportunity cost to dispute the value. The first being the scheduling coordinator has a differing view of the future gas prices than those used in the opportunity cost model. The methodology used to estimate the LMPs in the model take into account industry wide indices and reflect anticipated market conditions in both the energy and natural gas markets. Therefore the ISO does not see a need to allow scheduling coordinators to request a negotiated value under this scenario. If estimated LMPs are continuing to under or over-value actual LMPs, this would be a candidate area for potential future enhancements. The second scenario is where the scheduling coordinator has differing views on how the resource should be operated to reduce wear and tear. In Section 11, the ISO is proposing market based Masterfile resource characteristics which are intended to allow the scheduling coordinator to reflect preferred operating parameters of the resource. In addition, a scheduling coordinator may request a Major Maintenance Adder (MMA) in a resources' commitment costs to help manage the preferred operation of the resource to reduce wear and tear.

Separately under the *Bidding Rules Enhancements* stakeholder initiative, stakeholders submitted comments on the ISO's proposal for market based Masterfile resource characteristics discussed in Section 11. NCPA, Calpine, PG&E voiced concerns that there will not be a clear distinction between market and design characteristics as envisioned by the ISO's proposal. NPCA and Calpine requested the ISO acknowledge resource characteristics legitimately require some engineering and economic judgment to balance excessive wear and tear and the technical capabilities of the resource. Calpine requested ISO revise its tariff to recognize this operational judgment is necessary. Further, Calpine does not agree with the presumption that there is one, single set of "design" characteristics and proposed guidelines establishing design and market characteristics. Finally, SCE requested the ISO consider introducing market based Masterfile values for other resource characteristics such as runtime or energy limit restrictions over time horizons, number of cycles, Pmin, or Pmax values.

Through proposing an introduction of market based Masterfile characteristics, the ISO is acknowledging some resource characteristics require including economic judgements in its valuation. The ISO's review of Masterfile characteristics appropriate for market based values is an ongoing review and will consider expanding market based values to other characteristics if support is provided the modelled value should include economic judgments.

## 2. SCHEDULE FOR STAKEHOLDER POLICY ENGAGEMENT

The proposed schedule for the policy stakeholder process is listed below. We have omitted the issue paper since the issue was already discussed under Commitment Cost Enhancements Phase 1.

<i>Date</i>	<i>Event</i>
<i>July 15, 2015</i>	<i>Market Surveillance Committee Meeting</i>
<i>July 20, 2015</i>	<i>Technical Workshop</i>
<i>July 30, 2015</i>	<i>Stakeholder comments due</i>
<i>August 24, 2015</i>	<i>Straw proposal posted</i>
<i>August 31, 2015</i>	<i>Stakeholder call</i>
<i>September 8, 2015</i>	<i>Stakeholder comments due on straw proposal</i>
<i>November 3, 2015</i>	<i>Revised straw proposal posted</i>
<i>November 9, 2015</i>	<i>Stakeholder call</i>
<i>November 23, 2015</i>	<i>Stakeholder comments due on revised straw proposal</i>
<i>February 11, 2016</i>	<i>Market Surveillance Committee Meeting</i>
<i>February 17, 2016</i>	<i>Draft final proposal posted</i>
<i>February 25, 2016</i>	<i>Stakeholder call on Draft Final proposal</i>
<i>March 2, 2016</i>	<i>Stakeholder comments due on draft final proposal</i>
<i>March 2016</i>	<i>Post technical appendix</i>
<i>March 24-25, 2016</i>	<i>Board of Governors meeting for approval</i>

## 3. INTRODUCTION

*Commitment Cost Enhancements Phase 2* had proposed the calculation of opportunity costs but the ISO decided to take additional time to discuss this methodology with stakeholders. Thus the *Commitment Cost Enhancements Phase 3*, is scoped to continue that discussion and to address

concerns raised by FERC on how eligible limitations are defined. In addition to the opportunity cost methodology, this initiative proposes changes to a subset of Masterfile resource characteristics and modifications to outage cards that have been part of the ISO's Bidding Rules and Reliability Service initiatives respectively.

This initiative will primarily culminate in implementing a process which will determine an opportunity cost for use-limited resources that reflect eligible limitations. The opportunity cost(s) will be reflected in default commitment cost bids and/or the resource's Default Energy Bids (DEBs). Reflecting the opportunity costs in the resource's commitment cost(s) will facilitate a more efficient market solution while respecting the limitations of these resources that cannot be optimized by the applicable market commitment process. Once opportunity costs are implemented for use-limited resources, the registered cost option will be eliminated, and all resources will be on the proxy cost option for commitment costs<sup>1</sup>.

A technical workshop for *Commitment Cost Enhancements Phase 3* was held at the California ISO on July 20th, 2015. During the workshop, the ISO presented two potential prototype models that could be developed to calculate opportunity costs for use-limited resources along with preliminary test results. The ISO also discussed with stakeholders various issues that arose during the development of the models as well as additional processing and policy related questions that will be addressed during the policy development of this initiative. The input received during the workshop as well as through submitted written comments were taken into consideration to develop the methodology and business rules around the opportunity cost methodology.

This initiative will also implement a subset of market based resource characteristics to enable market participants to reflect the preferred operating parameter of the resource as opposed to only reflecting the physical capability of the resources. Existing nature of work outage cards for use-limited resources will be modified and a new nature of work outage card specific for demand response resources will be introduced.

## 4. INITIATIVE SCOPE

This initiative was initially created to allow additional time for development and vetting of the business rules to determine opportunity costs for use-limited resources. During the stakeholder process, FERC issued an order issued in September 2015 rejecting the revised definition of use-limited as developed under Commitment Cost Enhancements Phase 2, therefore the scope of CCE3 expanded to include revisions to the definition of use-limited<sup>2</sup>. Recently, there was concern expressed by stakeholders regarding the interdependency of three on-going initiatives, Commitment Cost Enhancements Phase 3, Bidding Rules, and Reliability Services 2. In response, the ISO migrated topics from Bidding Rules and Reliability Services 2 into Commitment Cost Enhancements Phase 3. Therefore, the scope of Commitment Cost Enhancements Phase

---

<sup>1</sup> As described in Section 6.1, new resources registering use-limited status will remain on registered cost option until sufficient historical data exists to facilitate the opportunity cost methodology.

<sup>2</sup> <http://www.ferc.gov/CalendarFiles/20150909162131-ER15-1875-000.pdf>

3 includes: use-limited definition, opportunity cost methodology, market based Masterfile resource characteristics, changes to Masterfile resource characteristics, and use-limited outage cards.

The remainder of this paper is divided into the following sections.

- Section 5 proposes a revised definition of “use-limited” to align with the reasoning of incorporating opportunity costs.
- Section 6 summarizes the current application and use-plan submittal process for use-limited resources, proposes some modifications to further streamline the processes, and discusses proposed changes to implement how use limits are evaluated modeled or negotiated.
- Section 7 describes the modeling process and how the calculated opportunity costs will be incorporated into commitment cost bids and default energy bids.
- Section 8 describes the negotiated opportunity cost method for those limitations that cannot be modeled.
- Section 9 proposes modifications to how opportunity costs will be incorporated into commitment cost bids for MSG resources.
- Section 10 proposes modifications to the use-limited outage card established through the Reliability Service initiative and introduces a new outage card for demand response resources.
- Section 11 proposes a new subset of Masterfile resource characteristics as well as the implications of changing Masterfile characteristics in such a manner that would no longer support the resource’s RA showing.
- Section 12 provides a discussion of considerations for potential future enhancements of the opportunity cost methodology.
- Section 13 provides the next steps for this initiative.

## 5. USE-LIMITED DEFINITION

Currently, use-limited resources are those that cannot operate continuously because of limitations set forth in regulations, statutes, ordinances, court orders, or due to design considerations. Consequently, the ISO provides for separate treatment of use-limited resources to accommodate their use limitations. *Commitment Cost Enhancements Phase 1* modified the definition of use-limited to clarify that use-limited status was not limited to RA resources.

Commitment Cost Enhancements Phase 2 (CCE2) proposed further revisions to the definition to narrow the scope by eliminating resources that would not have opportunity costs, such as wind and solar. The ISO filed the modified definition with FERC on June 5, 2015, which was rejected by FERC in the September 9th order. The ISO is proposing new clarifying revisions in response to the FERC order.

Historically, use-limited status has been provided to resources that, due to qualifying limitations, cannot be available twenty-four seven to meet their RA must offer obligation. These resources were exempt from bid insertion but they were required to bid as-available according to a use-plan submitted to the ISO annually. Thus the scheduling coordinator was left to determine the “optimal” times to use the resources within their limitations. As the quantity of use-limited resources, and megawatts represented by use-limited resources, continues to expand, the current market inefficiency due to managing the limitations of these resources out of the market is exacerbated. A market based solution which enables these resources to bid into the markets more frequently while only being committed and dispatched during the optimal periods will address the current market inefficiency.

The concept of determining an opportunity cost for each limitation, which can then be reflected in the market bids, will facilitate a more efficient market based solution for use-limited resources. An opportunity cost will enable use-limited resources to bid more frequently and, for resource adequacy resources, in accordance with must offer obligations, while allowing the market to determine the most optimal dispatch of the resource given the limitation which extends beyond the current market optimization horizon.

Consistent with its proposal in CCE2, the ISO is proposing to narrow the definition of use-limited resources to include only those resources that can be optimized with an opportunity cost based on eligible limits. Going forward, use-limited status will signal the need for a resource to have the ability to reflect an opportunity cost in its commitment cost bids due to qualifying limitations per the revised definition of use-limited proposed in this policy. As previously noted, use-limited status has been a “catch-all” category for resources that cannot be available twenty-four seven primarily to provide exemption from bid insertion. Therefore, not all resources currently use-limited necessitate having an opportunity cost in commitment costs and, going forward, will not have use-limited status.

Reliability Service initiative, which has been approved by FERC, continues to provide bid insertion exemption for resources that cannot offer their resources around the clock. For example, a wind resource will no longer qualify for use-limited status but will continue to be exempt from bid insertion because they cannot be optimized. Resource types currently deemed use-limited will also continue to be exempt from bid insertion independent of use-limited status. This policy is also not proposing to change any current bid mitigation or RAIM exemptions as developed under previously approved initiatives.

## 5.1. OTHER ISO'S/RTO'S OPPORTUNITY COST CRITERIA

During this policy development, the ISO has evaluated opportunity cost methodologies implemented in other ISOs/RTOs, specifically focusing on the qualification criteria for

opportunity costs. PJM and SPP have an opportunity cost methodology implemented for a subset of resources which meet the eligibility criteria to receive an opportunity cost. PJM and SPP define opportunity cost eligible resources, while the ISO is defining use-limited resources. Opportunity cost eligible resources under PJM and SPP are analogous to what the ISO is identifying as use-limited; resources which require an opportunity cost to be optimally dispatched over the limitation horizon, which extends beyond the market optimization horizon, are exogenously imposed on the resource, and do not reflect economic tradeoffs between buyer and seller that restrict resource availability.

Appendix G<sup>3</sup> of the market protocols manual for SPP provides the following criteria for acceptable restrictions/limitations:

#### *11.1 Basis for Opportunity Cost to be Included in Mitigated Offers*

*Opportunity Cost may be a component of mitigated offers under certain circumstances. There are two reasons for application of Opportunity Costs as contained in this section.*

##### *11.1.1 Environmental Run-hour Restriction*

*Opportunity costs associated with an externally imposed environmental run-hour restriction on a generation unit. Examples would include a limit on emissions for the unit imposed by a regulatory agency or legislation, a direct run hour restriction in the operating permit, or a heat input limitation defined by a regulatory decision or operating permit. Environmental run-hour restrictions must have suitable supporting documentation.*

##### *11.1.2 Physical Equipment Limitations*

*Physical equipment limitations that cause the unit to experience a restriction in the number of starts or run hours would be eligible for opportunity cost. Physical equipment limitations must have supporting evidence submitted by the Asset Owner. Documentation such as an OEM recommendation or bulletin and/or insurance carrier restrictions would meet this criterion.*

A force majeure provision, along with a definition of what constitutes force majeure, is included but restricted to being eligible for an opportunity cost up to one year.

Section 12 in PJM's Manual 15: Cost development guide<sup>4</sup> also provides the same three reasons under which a resource would be able to apply for an opportunity cost as SPP, almost verbatim.

PJM and SPP only provide opportunity costs for resources which have restrictions externally imposed on the resource due to environmental restrictions, physical (design) limitations, or under restricted conditions, events of force majeure. The ISO's currently proposed definition of use-limited is in line with what FERC has approved and found just and reasonable for both PJM and SPP to identify resources that would be eligible to reflect an opportunity cost in commitment cost bids.

---

<sup>3</sup> <http://www.spp.org/documents/32931/integrated%20marketplace%20protocols%2035.pdf>

<sup>4</sup> <http://www.pjm.com/~media/documents/manuals/m15.ashx>

## 5.2. REVISED USE-LIMITED DEFINITION

The ISO is proposing to define a use-limited resource as:

*“A resource with one or more limitation on starts, run-hours, and/or output due to environmental restrictions or design considerations, which cannot be optimally dispatched over the limitation horizon without consideration of opportunity costs.*

*Acceptable environmental restrictions are those that are imposed by regulatory bodies, legislation, or courts. A non-exhaustive list of acceptable environmental restrictions include: limits on emissions, water use restrictions, or run-hour limitations in operating permits. Restrictions with soft caps that allow the resource to increase production above the soft cap through purchasing additional compliance instruments are not acceptable restrictions.*

*Acceptable design considerations are those that are due to physical equipment limitations. A non-exhaustive list of acceptable design considerations include: restrictions documented in original equipment manufacturer recommendations or bulletins, or limiting equipment such as storage capability for hydroelectric generating resources.”*

The definition will retain the existing language defined in terms of a use-limited “resource” rather than use-limited “capacity.” The original intention of defining use-limited capacity in CCE2 was to accommodate resources that 1) may not be use-limited year round, or 2) only a portion of the capacity is use-limited. Examples include a resource with use-limited capacity above regulatory must take capacity or resources that are only restricted during a given season, such as those subject to Delta Dispatch. The use-limited status flag in Master File is set at the resource level, therefore defining a use-limited resource better aligns with the application of the status flag. The ISO does not anticipate any complications arising from defining use-limited resource rather than capacity.

The ISO is identifying acceptable limitations in the definition, consistent with FERC direction, as limitations on starts, run-hours, and/or output. The type of limitation will dictate which commitment cost component the opportunity cost can be reflected in, i.e., start-up or minimum load, or if the opportunity cost is included in the resource’s Default Energy Bid.

Limitations accepted by the ISO must originate from restrictions imposed by external regulatory bodies, legislation, or courts, or due to the design of the resource. They cannot be purely contractual, such as a monthly start limitation that is well below any binding environmental limit, based on economic decisions such as staffing requirements or maintenance cost tradeoffs (e.g., to avoid catastrophic maintenance events), or due to fuel intermittency (e.g., wind and solar without storage). The following table includes a non-exhaustive list of acceptable and unacceptable examples, as requested by FERC.



TABLE 1 NON-EXHAUSTIVE LIST OF ACCEPTABLE RESTRICTIONS

Acceptable?	Source	Non-exhaustive list of examples
Yes	Statutes, regulations, other ordinances, or court order	<ul style="list-style-type: none"> <li>• Such as from Air Quality Management Districts, California Energy Commission, Local Regulatory Authorities, etc.                             <ul style="list-style-type: none"> <li>○ This limitation is largely environmental and most commonly in the form of an air permit. For example, emissions limitations with an absolute limit (cannot pay to emit more and would incur a penalty), wildlife/natural resource management, etc.</li> </ul> </li> </ul>
	Design	<ul style="list-style-type: none"> <li>• Limited due to the actual design of the resource.                             <ul style="list-style-type: none"> <li>○ This limitation is largely applicable to hydro, pumped storage, and in some cases CHP. For example, limited reservoir storage capacity or restrictions documented in OEM recommendations, etc.</li> </ul> </li> </ul>
Yes – limited	Contractual	<ul style="list-style-type: none"> <li>• Limitations temporarily approved through a regulatory process which meets the criteria set forth in the provisions.                             <ul style="list-style-type: none"> <li>○ Additional documentation requirements will be applied</li> <li>○ Accepted for up to three years following first year of effective opportunity costs.</li> </ul> </li> </ul>
No	Contractual	<ul style="list-style-type: none"> <li>• Limitations based on a power purchasing or tolling agreements that do not meet the provisional grandfathering criteria</li> </ul>
	Economic	<ul style="list-style-type: none"> <li>• To reduce wear and tear</li> <li>• Staffing constraints or lack of investment</li> <li>• Avoid purchasing more compliance instruments (credits, allowances, etc). to manage emissions (e.g., South Coast Air Quality Management District allows purchase of additional permits rather than a strict limit)</li> </ul>
	Fuel intermittency	<ul style="list-style-type: none"> <li>• Variable energy resource                             <ul style="list-style-type: none"> <li>○ Such as wind and solar without storage, geothermal</li> <li>○ Non-linked run-of-river hydro resources</li> </ul> </li> </ul>

The next part of the proposed definition explicitly points out the limitation in the ISO’s commitment time horizon and why an opportunity cost should be calculated. The ISO proposed to consider a use-limitation if the applicability<sup>5</sup> of the limitation is longer than the resource’s appropriate commitment process in the ISO market. For example, a long start resource with a daily limitation would not be considered use-limited because it is committed in the day-ahead market which optimizes over 24 hours; the applicability of the limitation is 24 hours which is not longer than the optimization horizon of the market which commits the resource. If the same resource has an acceptable monthly limitation, then it would be considered use-limited because the day-ahead

<sup>5</sup> The ISO is using the term “applicability” to mean the time frame for which the limitation applies and not the run time limitation. For example, a long-start resource has an air permit that limits its operation to 200 hours per month. The applicability is the month whereas the run time limitation is 200 hours. Since a month is clearly greater than the 24 hours of the day-ahead commitment process, this resource may apply for use-limited status.

market does not optimize over the month. Resources that receive operationally binding commitment instructions in the real-time market with daily limitations, under the revised definition, will still qualify for use-limited status. However, the ISO will not be determining an opportunity cost for the daily limitations through this methodology as a more efficient and accurate method for managing these limitations is obtainable through real-time market enhancements, as further discussed in Section 6.2.

Lastly, there must be an opportunity cost associated with the limitation. A use-limitation is different from a limitation based on intermittency such as is the case with wind and solar resources. For example, a gas-fired resource with an air permit limiting run hours to 200 per month could physically continue to run more than this limit. Since the run hours are restricted, it is most optimal to only run the resource during the most profitable 200 hours per month. These are the hours in which energy is most valuable. The use-limited capacity has an opportunity cost if it is run in less profitable hours reflecting the foregone profits (*i.e.*, forgone greater benefit to the ISO system).

On the other hand, wind, solar, and geothermal resources (all without storage) run only when available based on the energy source. While these generators may have some level of control (*e.g.*, feathering blades) and can submit decremental bids, the availability cannot be optimized by the scheduling coordinator (*e.g.*, wait to use the resource at a later time in order to maximize profits and system benefit). Therefore, these resources do not inherently have opportunity costs. The proposed definition of “use-limited” would no longer include these resources.<sup>6</sup>

In summary, a use-limited resource:

- Is limited by restrictions set forth by regulatory bodies, legislation, court, or due to design elements of the resource. Limitations cannot be based on contractually negotiated limits.
- Cannot be optimized per their limitations because of the ISO’s commitment horizon as appropriate for the resource without an opportunity cost adder; and
- Has an opportunity cost.

### 5.2.1. DEFAULT USE-LIMITED STATUS

The ISO’s policy is to align the definition of use-limited with the need for an opportunity cost to be optimally dispatched in the markets due to acceptable restrictions, similar to the construct of opportunity cost eligible in PJM and SPP. To ensure all resources with use-limited status are only those which need an opportunity cost in accordance to the policy herein, the ISO is proposing to modify the tariff to eliminate default use-limited designation. Based on tariff section 40.6.4.1, hydroelectric generating units, proxy demand resources, reliability demand response resources, and participating load, including pumping load, are currently deemed to be use-limited. As discussed in more detail below, most of the resources currently default use-limited do not require

---

<sup>6</sup> These resources would continue to be exempt from bid insertion rules.

an opportunity cost; those resources that may require an opportunity cost can go through the registration process along with all the other resources to obtain use-limited status.

Historically use-limited status was provided to resources that could not be available twenty four seven and exempted those resource types from bid insertion. The Reliability Service initiative phase 1 policy continued to provide exemption from bid insertion by technology type, and the ISO is not proposing to change that exemption, even without use-limited status.

**Hydro-resources** will no longer be deemed use-limited per the tariff but may register and qualify for use-limited status and be eligible for an opportunity cost, provided sufficient documentation is provided to the ISO in accordance with the definition of use-limited and policy described herein. As described in Table 1, the ISO envisions hydro resources with limited storage capability or linked run-of-river systems to qualify for use-limited status under the revised definition. Per RS11 implementation, hydro resources will likely already be providing sufficient documentation for the registration process, thus minimal additional efforts will be required. Hydro resources that do not qualify for use-limited status will continue to be exempt from bid insertion.

**Participating load (including pumping load)**, based on discussion with stakeholders, likely will not need an opportunity cost. However, this does not exclude participating load going through the registration process and making a case to the ISO as to why it would need an opportunity cost. As noted in Table 2 below, even without use limited status, participating load will continue to be exempt from bid insertion, bid mitigation, and RAIM.

**Reliability demand response** or **participating demand response** resources would not qualify for use-limited status as there is no need, at this time, for these resources to reflect an opportunity cost in commitment costs or Default Energy Bids. Reliability demand response resources (RDRR) per the ISO tariff, have no commitment costs and therefore do not require any commitment cost related opportunity costs; energy related opportunity costs are also not warranted given RDRR are required to bid in at or near the energy price bid cap. The ISO is not proposing to change bid insertion exemption for RDRR. To date, proxy demand resources (PDR) have had zero commitment costs, therefore would not warrant an opportunity cost related to start-up or run-hours limitations. In addition, PDRs are not subject to energy bid mitigation, therefore energy related opportunity costs are not warranted. PDR owners can incorporate energy related opportunity costs in energy bids without risk of bid mitigation. The ISO is not proposing changes to the current treatment of RDRR or PDR in terms of bid insertion and bid mitigation exemptions.

As previously noted, the intent of removing default use-limited designation is not to have any impact on how current default use-limited resources are treated in the ISO markets. Through discussions with stakeholders, the ISO did recognize the need for PDR and RDRR to continue to have access to outage cards without being penalized through RAIM. The ISO is proposing to create new demand response specific outages cards exempting the resources from RAIM under pre-defined conditions. More detailed discussion is provided in Section 10.3. The end result is to ensure there is no change in treatment of demand response resources without use-limited status.

Several stakeholders submitted comments and questions regarding the impact this proposed change would have on resources currently default use-limited. In addition to bid insertion

exemption, addressed above, stakeholders also asked for clarification on how removing use-limited status from these resource types will impact bid mitigation and RAIM treatment. Table 2 below shows how removing use-limited status will impact these resources in terms of bid insertion, bid mitigation, and RAIM treatment by resource type. The changes in treatment between RS11 implementation and CCE3 implementation are indicated by the bolded text.

The only changes noted in this table are related to the outage cards for use-limited resources, and is discussed in more detail in Section 10. It is important to note at this point that the change in outage cards for PDR and RDRR are to ensure no impact on those resources once they are no longer use-limited. The change in RAIM exemption for hydro is not a result of removing default designations but rather a change being proposed generally to all use-limited resources that are not already explicitly exempt from RAIM by technology type.

TABLE 2 IMPACT OF REMOVING DEFAULT DESIGNATION

Resource Type	Default use-limited under RS11			Not default use-limited under CCE3		
	Bid insertion	Bid mitigation	RAAIM Treatment	Bid insertion	Bid mitigation	RAAIM Treatment
Hydro	Exempt per Tariff section 40.6.8(e)	Subject to mitigation	Exempt from RAIM when short-term use-limited reached or use-limited reached outage card submitted.	Continue to be exempt per section 5, page 12 of the Revised straw proposal.	Subject to mitigation	<b>Exempt from RAIM for remainder of month when a use-limited reached outage card submitted. Non-exempt from RAIM starting the first day of the subsequent month.</b>
Participating load		Exempt per Tariff section 31.2 and 34.1.5	Exempt from RAIM		Exempt per Tariff section 31.2 and 34.1.5	Exempt from RAIM.
PDR		Required to be at or near energy bid cap.	Exempt from RAIM when short-term use-limited reached or use-limited reached outage card submitted.		Required to be at or near energy bid cap.	<b>New outage card exempting DR from RAIM once the resource has been dispatched 3 consecutive days for 4 hours each or 24 hours in a month.</b>
RDRR						

Storage resources, while currently not default use-limited, are included in this section and the table below to address concerns and questions raised by stakeholders. Based on discussion with stakeholders, the ISO does not envision the need for storage resources at this point to reflect an opportunity cost in commitment costs. Storage resources, to date, have not had commitment costs in the market, nor has there been sufficient discussion around what cost components comprise a minimum load or startup cost for storage resources. Furthermore, the ISO and market participants are still gaining experience on the most efficient way to model and have storage resources participate in the ISO markets. The ISO recently has, and will continue to make, as

necessary, adjustments to the NGR model. All resource characteristics for storage resources are included in the NGR model and are within the market horizon, therefore those limitations would not need an opportunity cost. The topic of how to model or manage limitations of storage resources which extend beyond the market horizon has been teed up as a potential topic for ESDER Phase 2. Under CCE3, the ISO is not explicitly excluding storage resources from registering and potentially qualifying for an opportunity cost after the needed discussions have been concluded; the ISO is stating that at this time, due to the points noted above, storage resources would not need an opportunity cost reflected in commitment cost bids.

### 5.3. CONTRACTUAL LIMITATIONS

Generally, the ISO maintains its longstanding position that economic limits like limitations originating from contracts such as power purchasing or tolling agreements are not acceptable limitations for establishing an opportunity cost added to a resource's commitment cost bid cap. These limitations exist not as a result of restrictions imposed by external statutes or regulations, but rather reflect economic trade-offs made by the contracting parties. This does not prohibit limitations that originate from acceptable restrictions, such as environmental permits, which are also included in a contract, to qualify a resource for use-limited status and an opportunity cost. The ISO would require the permit from which the limitation originated and translation documentation, if applicable, to be provided through the registration process.

Stakeholders with contract limits argue that not reflecting such limits in opportunity costs may jeopardize reliability. The ISO disagrees. First, to the extent there is an arguable reliability issue it is only because of contractual agreement to limit the availability of the resource. Second, the ISO can address reliability concerns through exceptional dispatches in the event of a reliability issue. Thus, if the ISO were to accept contractual limitations to deem a resource eligible for an opportunity cost, it would provide market participants the ability to both physically and economically withhold resources from the market while bypassing the market power mitigation processes in place. This in turn could lead to market inefficiencies and market power concerns that would go unmitigated.

For example, if two contracting parties negotiated a contract limiting a resource to 100 starts per year, this contract would essentially physically withhold the resource from the ISO markets. If the ISO were to recognize the 100 starts per year as an acceptable limitation which would qualify the resource for an opportunity cost added to the start-up cost bid cap, the two contracting parties could continue to restrict the resource to progressively lower number of starts and further increase the start-up opportunity cost. Since the opportunity cost is added to the bid cap for start-up costs, which is the market power mitigation method in place for commitment costs, the contracting parties could essentially negotiate the start-up cost bid cap of the resource. This would provide the contracting parties the ability to increase the resource's commitment cost bid caps, subverting existing market power mitigation procedures.

### 5.3.1. EXCEPTIONS FOR CERTAIN CONTRACTUAL LIMITATIONS

Several stakeholders have commented that they are not requesting the ISO recognize all contractual limitations, just those in long term contracts previously approved by the CPUC through LTPP. As discussed above, the ISO's primary concern with accepting contractual limitations is the ability to exercise market power through commitment cost bids while bypassing the current market power mitigation regime. However, the ISO understands that long term contracts that were approved through a robust regulatory process, prior to initial discussions of the ISO allowing opportunity costs for such limitations, would not reflect attempts of exercising market power. Therefore, the ISO is now proposing a limited exception of contractual limitations that meet the criteria for a transitional period. The CPUC, through written comments, suggested the ISO accept these contractual limitations for a three year period. The three year period would provide sufficient time for the CPUC and ISO to consider RA impact as well as allow time for LSEs to consider renegotiations of the long term contracts<sup>7</sup>. The ISO proposes the following exemption:

*Conventional resources that, as of January 1, 2015, are on an original long-term contract individually reviewed and approved through a comprehensive regulatory process as a new build which evaluated cost implications on rate payers with a limitation on starts, run-hours, or output, will be eligible for an opportunity cost reflective of such limitation, provided sufficient supporting documentation is provided, for up to three years following the effectiveness date of opportunity costs as determined through CCE3.*

Scheduling Coordinators will have to provide copies of the contracts under a non-disclosure agreement, if it is non-public, and the order approving the contract to allow the ISO to validate the contract limits. Contracts that provide for higher payments when start-up thresholds or run hour thresholds are exceeded are not considered contract limitations that would justify an opportunity costs.

The ISO is viewing this as a transitional provision for three years, after which the ISO will no longer accept contractual limitations reflecting economic trade-offs for an opportunity cost. The transitional period of three years, as recommended by the CPUC, serves as time for the ISO and CPUC to consider RA implications, as well as provide time for market participants to either renegotiate the contracts and/or work with the Department of Market Monitoring to obtain a more accurate Major Maintenance Adder if applicable. In addition, as the percentage of intermittent resources in the fleet continues to grow, the ISO will require additional flexibility to maintain system reliability. If the ISO can utilize more flexibility from these resources currently constrained by contractual limitations, it could diminish the need for new resources to be built.

### 5.4. ISO'S RESPONSE TO FERC ORDER ON CCE2

Several stakeholders expressed concern through written comments as well as discussion on the November 8<sup>th</sup> stakeholder call regarding the ISO's response to the FERC order on CCE2. SCE,

---

<sup>7</sup> <http://www.caiso.com/Documents/CPUCComments-CommitmentCostEnhancementsPhase3-RevisedStrawProposal.pdf>

SDG&E, and the CPUC commented that the ISO must provide additional discussion and justification for its earlier position in CCE2 that accepting contractual or economic limitations would reduce reliability; SDG&E also stated that the ISO must define the term economic or non-economic to comply with FERC, not simply remove the term from the definition. SDG&E also commented the ISO must also address the requirements set forth in paragraph 39 of the order on CCE2, which stated:

“the Commission rejects the revisions related to use-limited resources, without prejudice to CAISO submitting a new section 205 filing that provides a comprehensive explanation of what it is proposing to change, how the changes impact the various categories of market participants, and the impact on customers. We further expect that any such filing would include a detailed explanation of how it will implement the changes given the protests raised herein. Given our rejection of these proposed revisions, the Commission dismisses as moot CAISO’s request for waiver of the Commission’s prior notice requirements to make the proposed tariff revisions related to use-limited resources effective March 1, 2016.”

In its September 9<sup>th</sup> order on CCE2, FERC rejected the proposed use-limited revisions they were “not sufficiently transparent in describing how CAISO will determine what capacity is use limited.”<sup>8</sup> The order also rejected the ISO’s proposal to modify the definition from “use-limited resource” to “use-limited capacity and use-limited registration process proposed deletion of details regarding the use-limited registration process. With respect to the former, the ISO has decided to retain the term “use-limited resource” and to address changes in the use-limited registration process in the Reliability Services Initiative.

The ISO is addressing FERC’s concerns regarding transparency and the justification for the policy on contract limits. The ISO does not interpret the FERC order as requiring the ISO to include or even consider including contract limits.

Table 1 below summarizes FERCs’ concerns, along with a response from the ISO and how that concern is being addressed through this policy process. As previously discussed, the revisions to the definition proposed in CCE2 were not substantive; the ISO had merely attempted to narrow the definition to remove resources that would have no basis for calculation of an opportunity cost. The parties comments concerned a pre-existing term: non-economic, which the ISO has long interpreted as excluding purely contractual limits. Similarly, the ISO is not proposing any substantive change. Rather the ISO is proposing revisions to clarify the term as well as examples of use-limits that will qualify for opportunity cost consideration. The ISO believes this stakeholder process addresses all concerns raised by FERC and welcomes stakeholder feedback in this regard.

---

<sup>8</sup> September 9 Order at P 34.

TABLE 3 FERCS’ CONCERNS ON CCE2 USE-LIMITED DEFINITION AND ISO RESPONSE

FERC order	ISO’s response
<p>“ . . . not sufficiently explained or justified the potential effect on market participants of changing from a definition of use-limited resource to use-limited capacity.” Paragraph 36</p>	<p>Changing the definition from “resource” to “capacity” was to accommodate resources that may not be use-limited year round or only have a portion of the capacity use-limited. After further reflection, the reference to “capacity” is not necessary. This initiative will retain the original language that defined resources as use-limited.</p>
<p>“ . . . should be able to identify a list of limitations to be included in the tariff, and it must do so in order for the Commission to understand how such a revision to the definition of use-limited resources impacts the market participants. . . .” Paragraph 35</p>	<p>The revised definition identifies limitations as limits on starts, run-hours, and/or output.</p>
<p>“CAISO fails to include in its proposed definition any specific examples of the statutes, regulations, or ordinances it will honor or the criteria it will use in making such determinations. Although an exhaustive list of specific regulations in the tariff may not be feasible, these examples are necessary” Paragraph 38</p>	<p>The definition now includes a non –exhaustive list of specific examples which, to the ISO’s understanding, captures the majority of acceptable restrictions.</p>
<p>“ . . . to the extent certain resources are use-limited by default, it is unclear why they are not included in the definition.” Paragraph 36</p>	<p>All resources will be required to register for use-limited status and there will no longer be a subset receiving default designation.</p>
<p>“ . . . failed to discuss in sufficient detail the interaction of contractual limitations with economic and non-economic limitations , and has not supported its position that allowing economic limitations could unnecessarily reduce CAISO’s flexibility in ensuring reliability.” Paragraph 35</p>	<p>Additional discussion in regards to contractual limitations will be included in the stakeholder process as will be discussed in the transmittal letter in support of the revised definition.</p> <p>The ISO will also be replacing the term “non-economic” from the definition of use-limited with specific examples to provide more clarity as to what would qualify for use-limited status.</p> <p>The ISO’s earlier position in CCE2 was that accepting contractual limitations would reduce reliability. While that concern is still plausible, the primary justification for not accepting contractual limitations is the market inefficiencies and potential market power implications it could cause.</p>
<p>“ . . .removed clarifying language from the tariff regarding the use-limited registration process without any justification. . . .”</p>	<p>FERC approved RSI1 tariff language included details regarding the registration process as will the tariff filing for CCE3.</p>



## 6. USE-LIMITED REGISTRATION PROCESS

The ISO has made business practice manual changes to clarify the current application and use-plan submittal process for use-limited resources in accordance with Reliability Services initiative implementation in spring 2016<sup>9</sup>. This is the process that will apply once the BPM change are implemented. Pursuant to that process, scheduling coordinators will apply to register resources and then provide use-plan information as follows using a new user interface:

- Register resources seeking use-limited status and upload any required information to meet the application requirements.
- On the use-limited plan data template, provide the limitations in terms of starts, run-hours, output, or other and the applicability of those limitations, e.g., monthly, annual, and rolling annual.

As part of the CCE3 initiative, the ISO will be proposing additional tariff and BPM changes. First, as noted above, the ISO is proposing to eliminate any default use-limited status. Second, the ISO will again be proposing to eliminate unnecessary tariff detail and move the use-limited process to section 27. As summarized above, the ISO tariff and BPM provides a two-step process. The ISO will be proposing an initial process and an annual process for updating information on applicable limits or confirming that no change has occurred. The ISO has identified that some information currently required by the tariff is no longer needed. Thus the ISO is proposing to eliminate the requirement to provide historical information. Specifically, the ISO will be eliminating the requirement to show attainable MWhs for each 24-hour period during the preceding year set forth in ISO tariff section 40.6.4.1(2). The ISO will continue to require documentation of the eligible limits. Because scheduling coordinators will get prompt feedback on whether the resource is use-limited or not, the ISO will be eliminating the five- business day response time. Consistent with the current tariff, use plan review and future review of proposed limits and resulting opportunity costs will not be subject to this time limit. Finally, the ISO will also be proposing to include tariff provisions relating to the use-limited process to section 27 as the ISO previously proposed in CCE2 because the status is not tied to resource adequacy status.

### 6.1. PROCESS FOR OPPORTUNITY COSTS

Given a targeted implementation date of Fall 2016, the ISO anticipates to implement opportunity costs in the market effective date of January 1, 2017. Therefore the registration process, information, documentation, model development, calculations, and negotiations will need to be finalized prior to January 1, 2017. Scheduling coordinators that are interested in obtaining an opportunity cost as of January 1 2017, must submit necessary information in sufficient time to

---

<sup>9</sup> Existing business practice manual clarifications. See PRR 787 available at: <http://bpmcm.aiso.com/pages/default.aspx> and see PRR 868 available at <http://bpmcm.aiso.com/Pages/ViewPRR.aspx?PRRID=868&IsDlg=0>

allow for document review, negotiation process, model development, and opportunity cost calculations.

**Supporting documentation**

To validate proposed use limits, for each resource applying for use-limited status, the scheduling coordinator must submit to the ISO copies of original documentation stating the resources’ limitations or restrictions imposed by regulatory agencies such as air quality management districts, due to environmental considerations such as air pollutants or wild life preservation. Resources seeking use-limited status due to design considerations will have to submit documentation proving to the ISO why the design of the resource limits the resource in such a way to qualify for an opportunity cost. Examples include OEM recommendation or bulletin or a summary of the portion of an ERRA filing related to the use-limited resource.

In some instances, the scheduling coordinator may translate the limitation as stated in the original documentation to a limit which can be modeled by the ISO, which is described below. If the limitation has been translated, the scheduling coordinator must document the methodology used to translate the limitations as stated in the original documentation to what was submitted in the registration process will be required.

Below is a table include some examples, by resource type, some of the supporting documentation that would be required to validate use-limits and to calculate an opportunity cost<sup>10</sup>.

Resource-Type	Use-Limited (Yes/No)	Supporting Documentation Requirement in CIDI for registration
Gas-Fired with environmental restrictions that constrain its operation	Yes	Limitation -Air Permit Translation/Formula - As Required
Gas-Fired with design limitations, such as limited fuel storage)	Yes	Limitation -Air Permit Translation/Formula - As Required
Hydro-Large Storage	Yes/No - although Hydro with large amount of storage may have more flexibility to generate on demand and thus may not be use-limited in a manner similar to a run-of-the river, downstream	Limitation - Storage Translation/Formula - ERRA Summary

<sup>10</sup> The tariff requires additional information as part of the registration process that is not included in this table.

	water flow and water-release needs and other environmental conditions may dictate output so as to warrant Use-Limited status	
Hydro-Small Storage/Small Conduit	Yes	Limitation - Storage Translation/Formula - ERRA Summary
Hydro-Run of the River	Yes/No – a run-of-river linked system with downstream water flow and water release needs dictating output warrant use-limited status where as a pure run-of-river system is similar to wind and solar in that there is no ability to store the water and create the ability to optimally chose when to generate.	Limitation - Storage Translation/Formula - ERRA Summary
Wind	No	No
QF Resource and Must Take	No	No
QF Resource and not Must Take	Yes/No – QF resources with capacity above the regulatory must take capacity may qualify for use-limited status if that capacity has an acceptable limitation applied.	Limitation -Air Permit Translation/Formula - As Required

**Documentation review**

Once the scheduling coordinator has provided all supporting documentation, the ISO will verify and validate that 1) the resource meets the definition of use-limited and is eligible for an opportunity cost, and 2) the limitations identified in the use-plan, which qualifies the resource for use-limited status, are supported by the documentation provided.

Some limitations may not explicitly be a limit on the quantity of starts, run-hours, and/or output but rather in terms of emissions, fuel usage, etc. It is the ISOs understanding that some of these limitations can be translated into a limit on starts, run-hours, and/or output, but may not be a simple translation. For example, emissions may differ at start-up and vary across the operating range of the resource. Scheduling coordinators of these resources have the expertise and knowledge on how they operate most efficiently within their current limitations. Therefore the ISO proposes that market participants translate such limitations into a limit on starts, run-hours, and/or output if possible, and submit the translated limitations to the ISO on the use-plan. When a limitation is translated into a limit on starts, run-hours, and/or output, the market participant will also provide the ISO documentation summarizing the methodology used to translate the limitations. The ISO will verify the methodology used to translate the limitations from those stated in the supporting documentation is reasonable and results in the limitations identified.

The ISO reserves the right to revoke use-limited status if, upon review of the documentation, finds either 1) the restrictions or design elements do not meet the definition of use-limited, or 2) the limitations identified are not reasonably supported to qualify as use-limited and receive an opportunity cost.

If during the documentation review process, the ISO requires additional information and/or clarification from the scheduling coordinator, the scheduling coordinator will be contacted by the ISO. In the event the additional documentation and/or clarification are not provided in a timely manner, the scheduling coordinator risks not having an opportunity cost in place prior to the limitation horizon or the ISO may revoke use-limited status.

### **Maintaining opportunity costs and use-limited status**

Use-limited resources are required to submit an annual use-plan to maintain use-limited status. In subsequent years following the establishment of the initial opportunity cost, if the limitations identified on the use-plan have not changed, and nothing has changed from the supporting documentation previously submitted and reviewed by the ISO, scheduling coordinators can submit an affidavit in lieu of re-submitting all supporting documentation already on file and reviewed by the ISO. The affidavit must attest that the use limitations, and all supporting documentation provided, continues to qualify the resource for use-limited status for the upcoming year, is accurate, and continues to be supported by previously submitted and ISO reviewed documentation. The affidavit will need to be submitted to allow for sufficient time for the ISO to update the negotiated values<sup>11</sup> or re-run the model to generate opportunity costs for the upcoming calendar year.

If there have been changes to any documentation previously submitted, the scheduling coordinator will need to submit updated supporting documentation. If documents are not received allowing for sufficient time to validate the updated documentation and incorporate any changes

---

<sup>11</sup> Resources with negotiated opportunity costs with no changes would trigger an expedited negotiation process where they can update the inputs used in the previously approved methodology for the upcoming calendar year without re-registering.

into the negotiation or modeling process, the ISO cannot guarantee an opportunity cost prior to the start of the limitation horizon.

### **Use-limited registration of new resources**

This section only applies to resources seeking an opportunity cost to be implemented after January 2017.

Scheduling coordinators seeking an opportunity cost for existing or new resources for the first time must complete the registration process and provide all required documentation in sufficient time to allow for the ISO to review documentation and complete the negotiation process or model and calculate an opportunity cost prior to the first effective date of the limitation. Failure to allow for sufficient time, could result in the resource not having an opportunity cost effective at the start of the limitation time horizon.

Sufficient data is necessary for the ISO to model and calculate opportunity costs or have a basis for the negotiation process. This would be, at a minimum, one year's worth of historical nodal LMPs from the fifteen minute market. New resources seeking use-limited status prior to having one year of historical LMPs can complete the registration process, be approved by the ISO as use-limited, and remain on the registered cost option until the minimum data requirement has been met. At that time, the ISO will commence with the negotiation or modeling process to determine the first set of opportunity costs for the resource. The scheduling coordinator will also be required to maintain use-limited status for the resource.

## **6.2. EVALUATING SUBMITTED LIMITATIONS**

All use-limited resources will be evaluated to determine if their limitation results in a non-zero opportunity cost. The ISO will not be able to model every type of limitation but will determine if modeling is possible based on reviews of documents submitted as part of the use-limited registration process. The ISO will either calculate opportunity costs or work with market participants to develop negotiated opportunity costs after the ISO has received the documentation needed to evaluate use limitations and has approved the resource's use limited status.

The ISO will evaluate each submission on a case-by-case basis and determine whether the ISO can model the resource and limitations to calculate opportunity costs. The ISO expects that its calculated methodology will largely be used by gas-fired resources with clearly defined limitations based on starts, run hours, and output.

### **Modeled limitations**

The proposed opportunity cost model will be able to model limitations on the number of starts, run hours, and/or output. Limitations may be applicable for a month, year, or rolling 12 month period. A resource with more than one limitation which can be modeled will have a calculated opportunity cost for each limitation. For purposes of this initiative, each modeled limitation has two components:

- Operating characteristic: this refers to the operating component which is limited, i.e. starts, run-hours, or output.
- Applicability: this refers to the time frame for which the limitation is applied, e.g., monthly, annual, etc.

### **Negotiated limitations**

Limitations that the ISO determines cannot be modeled will be eligible to request a negotiated opportunity cost. Based on conversations with scheduling coordinators, many hydro, participating load, and pumped storage resources develop costs based on sophisticated models that synthesize the impact of current and projected hydrology data, including snowpack levels, watershed topology and size, and various fish and wildlife restrictions. The ISO will not be able to replicate such a model. Instead, the ISO expects the scheduling coordinator to provide the opportunity cost(s) and documentation of the modeling methodology for calculating the opportunity cost(s). The resource will then use negotiated opportunity cost adders as approved by the ISO based on the submitted methodology. The ISO expects that more complicated environmental permits (e.g., Delta Dispatch), as well as multi-stage generators with use limitations, may also require negotiated opportunity costs.

Scheduling Coordinators will be required to provide documentation describing the methodology used to determine the submitted opportunity cost for each negotiated limitation. The methodology will be subject to ISO review. More detail on the process for negotiated opportunity costs is provided in Section 8.

### **Daily limitations**

The ISO is no longer proposing to provide opportunity costs, calculated or negotiated, for daily limitations. There was concern that setting the calculated opportunity costs due to daily limitations at the maximum daily opportunity cost from all days within the given month could result in excessive headroom; in other months it may not be high enough to be effective. The potential inaccuracy could worsen, rather than improve, the status quo. Discussion at the most recent MSC meeting determined that daily limitations are more effectively and accurately addressed through real-time market enhancements. For example, extending the real-time optimization horizon or utilizing IFM solutions to determine a daily opportunity cost are two potential solutions. Therefore, the opportunity cost for daily limitations will be addressed through real-time market enhancements.

It is the ISO's understanding that daily limitations as stated in current Master File fields are not a result of imposed daily restrictions but rather reflect imposed monthly or annual limitations, which would receive an opportunity cost. Given the current use-limited resources and supporting documentation available to the ISO, there are only a limited number of resources with daily limitations. All but three of those resources have the same limitation type, e.g, limit on starts, over a longer horizon, e.g., annual. Therefore the resource would still receive an opportunity cost associated with a limitation on starts, in this example, that can be reflected in start-up cost bids to optimally use the daily and annual starts.

Resources that have daily limitations supported by acceptable documentation can be managed through tools currently available to scheduling coordinators and grid operators. Scheduling coordinators can use daily Masterfile fields, including max daily starts, max daily MWh<sup>12</sup>, minimum up time, minimum down time, to ensure the resource does not exceed the daily limits. ISO grid operators can also ensure resources with daily limitations are available in real-time when most needed by

- blocking sub-optimal commitment instructions that would ultimately make the resource unavailable when needed most, or
- issuing bridging exceptional dispatches the resource to remain on such that it is still available to the market when needed most.

The ISO anticipates this change in the policy from the straw proposal to have minimal impact on resources with daily limitations given the limited number of resources this change would affect, and the current tools available to help manage daily limitations in the market.

### **Multi-stage generating resources**

Use-limited multi-stage generating resources (MSGs) may be use-limited if they meet the criteria set forth in the modified definition of use-limited and are approved such status through the registration process. Based on conversations with scheduling coordinators some limitations on MSG resources apply to the resource in its entirety, i.e. at the parent resource level, while others apply to the configurations and transitions between configurations. The ISO intends to calculate opportunity costs for limitations the model can accurately reflect. Therefore, the ISO will determine through the use-limited application process MSG limitations it can model and calculate an opportunity cost, and those it cannot model and consequently would be subject to a negotiated opportunity cost.

In some cases, transition costs for MSG resources with limitations on the configuration level become another commitment type cost. Therefore additional consideration as to which commitment costs for MSG resources is warranted and is discussed in Section 10.

## **7. OPPORTUNITY COST MODEL**

The Market Surveillance Committee opinion on the *Commitment Cost Refinements 2012* initiative noted the committee members' concern that relying on use plans (i.e., limiting the hours a resource is bid into the market to avoid over-use) could result in inefficient use of a unit's limited starts, run-hours, and energy output.<sup>13</sup> Traditionally, the highest prices and need predictably occurred during on-peak hours. With increasing renewable penetration and the need for flexibility

---

<sup>12</sup> This field is only available to use-limited resources, therefore it is essential for resources with daily limitations that want to utilize this field to register as use-limited with the ISO.

<sup>13</sup> [http://www.caiso.com/Documents/MSCFinalOpinion-BidCostRecoveryMitigationMeasures\\_CommitmentCostsRefinement.pdf](http://www.caiso.com/Documents/MSCFinalOpinion-BidCostRecoveryMitigationMeasures_CommitmentCostsRefinement.pdf)

and ramping capability, high prices may occur more frequently during off-peak periods that cannot be anticipated by a use plan.

The Committee concluded that it would be more efficient to allow high start-up and minimum load bids that reflect opportunity costs of operation, which then gives flexibility to the market software to determine if the resource is economic. The ISO will implement an optimization model capable of frequent model runs that provides market participants an effective tool to manage use-limited resources through the market while accurately reflecting opportunity costs. The model will use an algorithm to estimate commitment and dispatch of a resource and the foregone profits of having one less start, run-hour, or MWh to generate. The opportunity costs for each limitation will then be determined by the estimated foregone profits.

The ISO proposes to implement an optimization software model to estimate the opportunity costs. An optimization model can simultaneously enforce multiple limitations, thus resulting in more accurate opportunity costs. In addition, it is the more adaptable approach which would lend itself to more cleanly implementing potential future enhancements.

Several stakeholders requested the ISO provide more transparency into how the optimization model will be specified, along with additional estimated LMPs including the conversion factor. The ISO does see value in providing more technical information to stakeholders. In an effort to keep the policy papers within a reasonable length for all, the ISO will be posting a technical appendix in March 2016. The technical appendix will likely include all formulas used to calculate input values used in the model, estimated LMPs, the optimization formulation, as well as several examples of how the optimization model will be used to calculate the opportunity costs.

## 7.1. OPPORTUNITY COST METHODOLOGY OVERVIEW

Table 1 below provides an overview of the major components needed to calculate and utilize the opportunity cost estimates, including the inputs, calculation procedures, outputs, and the usage of the outputs. Under the “inputs” column, the optimization model will rely on limitations provided to the ISO through the registration process, Master File characteristics,<sup>14</sup> and applicable commitment and variable energy costs to provide a resource- and limitation-specific opportunity cost. This cost is based on calculating the profit (or gross margin) that is foregone in some future interval if one less start, one less operating hour, and/or one less MWh is available, as appropriate. In order for the model to calculate the profit, we will use historical implied heat rates, natural gas future prices, recent gas transportation and greenhouse gas prices, and an inflator based on future power prices to simulate a distribution of the node-specific LMPs for the resource. As noted under the “outputs” column, the model will provide for each resource a specific opportunity cost for each limitation it has over a specific period of time (e.g., month or year). Lastly, the opportunity cost will be reflected in commitment cost bids or added to the resource’s DEB.

---

<sup>14</sup> The model accounts for each resource’s minimum run time and minimum down time. It does not consider maximum daily starts in Master File.



**Table 4 Opportunity cost methodology overview**

Model inputs	Opportunity cost calculation	Model outputs
<ul style="list-style-type: none"> <li>• Use plan limitations</li> <li>• Unit characteristics</li> <li>• Commitment costs</li> <li>• Historical implied heat rate</li> <li>• Natural gas futures</li> <li>• Greenhouse gas prices</li> <li>• Gas transportation costs</li> <li>• Future power price conversion factor</li> </ul>	Unit commitment model over future time period (e.g., month) based on simulated node-specific LMPs.	Separate resource specific opportunity costs for start-up, minimum load, and energy, as appropriate. Can be reflected in commitment cost bids or resource’s DEB.

### 7.1.1.MODEL INPUTS

This section discusses resource characteristics and market inputs to the optimization model.

The ISO will rely on submitted use plans to determine the resource’s limitation(s). The ISO will also use Master File characteristics such as the minimum load and maximum capacity of the resource. The variable energy cost will be based on the megawatt weighted average heat rate, forward gas prices, recent gas transportation and greenhouse gas costs, and the O&M adder. For commitment costs, the ISO will calculate proxy start-up and minimum load costs based on the recent heat rates, gas transportation and greenhouse gas costs, O&M and major maintenance adders, GMC, and forward gas prices.

Scheduling coordinators will need to know their resource-specific opportunity costs for the month or year prior to the start of that period in order to reflect the costs in their bidding. Therefore the opportunity cost of each limitation will have to be calculated in advance of the time period based on simulated future prices. The ISO intends to make the opportunity costs and a summary of model results available to the scheduling coordinators prior to the month for which they become effective.

Most use-limited resources are committed and de-committed based on the 15-minute real time prices; there are three gas-fired long-start use-limited resources that are committed and de-committed based on day-ahead prices. On average, 15-minute real-time prices have been slightly lower than day-ahead prices by \$1-\$2/MWh, but are more volatile. Price volatility in the real-time market can result in use-limited resources cycling through starts and run hours, thus making them more likely to expend the limitations. Furthermore, the higher volatility of real-time prices is likely to result in higher opportunity costs, especially for infrequently used resources. The ISO recognized these pricing trends may not persist as the resource fleet and system conditions evolve. However, based on stakeholder feedback and discussion at a Market Surveillance Committee meeting, the ISO proposes to estimate 15-minute real-time prices to use in the opportunity cost model.

The ISO will simulate real-time prices by calculating an implied marginal heat rate at each use-limited resource’s pricing node (Pnode) based on fifteen minute real-time energy prices from the

same time period the previous year. Each interval's and location's LMP is assumed to reflect the heat rate of a marginal unit, and that heat rate can be inferred from the prices of gas and emissions allowances at that time and place. This procedure will allow the implied heat rate to inherently capture real-time price volatility which will then be used to forecast future prices. For example, if the ISO is estimating November 2016 prices, we will use November 2015 15-minute real-time energy prices, greenhouse gas costs, daily gas prices, and gas transportation costs. This will generate an implied heat rate for every 15-minute real-time interval, which will then be used to forecast November 2016 real-time energy prices for a given resource.

The ISO proposes to simulate the energy prices by first scaling the implied heat rate by a conversion factor based on future power prices and then multiplying the scaled implied heat rate by the sum of: (1) the most recent natural gas future prices for the applicable month; (2) the most recent gas transportation costs; and (3) the most recent greenhouse gas costs multiplied by the standard emissions rate. Using an implied heat rate from the previous time period scaled by a conversion factor based on power prices to simulate energy prices assumes that (1) real time volatility and congestion patterns from the previous year will materialize in the modeled year, and (2) the average nodal LMPs, adjusted for gas and GHG costs, will remain consistent year over year while capturing anticipated changes in both natural gas and energy market conditions. .

The end result is a set of node specific forecasted 15-minute real-time energy prices for each use-limited resource with a limitation that can be modeled. These forecasted prices will be used in the opportunity cost model, along with the estimated resource costs and characteristics, to estimate the dispatch of the resource over the modeled time period.

### 7.1.2. CALCULATING OPPORTUNITY COSTS

The ISO will develop an optimization model which estimates a resource's 15 minute interval dispatch, over a given time period, using estimated resource specific costs and characteristics against the forecasted 15-minute real-time energy prices. The ISO will have to run the model, and calculate opportunity costs, prior to the time period for which the limitations are applicable. An opportunity cost will be calculated for each limitation a use-limited resource has that can be modeled.

The opportunity cost will be based on the estimated profits foregone if the resource has one less start, run-hour, or MWh to generate. The foregone profits are based on the difference between estimated profits of the relevant time period from a model run with all limitations set at 90% of the limitation and the estimated profits from the same time period from a model run with the limitation reduced by one, i.e., 90% of actual, or remaining limitation, minus one start, run-hour, or MWh. For example, if a resource has 400 starts per year but by the end of September only has 100 starts, the model run for October through December will set the limitation to 90% of 100, or 90, in one model run and 89 in the second model run. In the case of a limitation being one, the opportunity cost will be based on the difference of estimated profits from a model run with the limitation set at two and estimated profits from a model run with the limitation set at one.

In response to stakeholder comments, the limitation used in the base run model will be reduced by a reserve margin. The ISO is proposing the reserve margin to be ten percent; the limitation in the base model run will be set at 90% of the actual, or remaining, limitation. There was concern that without a reserve margin, resources may not be available at the end of the year in December, which currently has the highest flexible capacity requirement. Running the base model with the limitation set at 90% of the actual limitation will ultimately achieve a higher opportunity cost, and will determine a more appropriate error term based on a sensitivity analysis as opposed to a fixed percent adder to the opportunity cost.

For illustrative purposes, assume a resource has an annual limitation of 300 starts and we are estimating the opportunity cost. The opportunity cost will be the difference in estimated profits from the two model runs.

Model Run #1 (base run): Run the model with start limitation set to 270 ( $.9 \times 300$ ) for January through December.

Model Run #2: Run the model with start limitation set to 269 for January through December.

**Start-up limitations:** The calculated opportunity cost for a limitation on the number of start-ups will be determined by the estimated profits foregone if the resource had one less start in the relevant time period. This will be a \$/start-up value.

**Run-hour limitations:** The calculated opportunity cost for a limitation on the number of run-hours will be determined by the estimated profits foregone if the resource had one less run hour in the relevant time period. This will be a \$/hour value.

**Energy limitations:** The calculated opportunity cost for a limitation on the output of the resource will be determined by the estimated profits foregone if the resource had MWh to generate in the relevant time period. This will be a \$/MWh value.

As previously noted, another element of a resource's limitation is applicability: the time period for which the limitation is applied. The ISO anticipates these to primarily be, monthly, calendar year, or rolling 12-month limitations. All opportunity costs will be calculated prior to the start of the applicable month, year, or 12-month period. In addition to the initial model run for the upcoming applicable time period, the ISO intends to run the model and update opportunity costs throughout the time period. More detailed information on scheduled runs, and how the opportunity costs are updated, is provided in Section 8.1.2.2. The following describes how opportunity costs for different applicable time horizons will be determined.

**Calendar year** limitations will have an opportunity cost valid for that calendar year, subject to updated values as a result of scheduled runs within the calendar year.

**Rolling 12-month** limitations (or other rolling limitations) will have an opportunity cost valid for the applicable period, subject to updated values as a result of scheduled runs that contain months within the previously modeled time horizon. As discussed at the MSC meeting, opportunity costs today due to rolling limitations are impacted by an infinite number of rolling 12-month time horizons. To estimate opportunity costs for rolling limitations, the model will enforce at least two

rolling time horizons: M-11 to M and M to M+11 where M is the last and first month of the rolling time horizon respectively.

**Monthly** limitations will have an opportunity cost for each month, subject to updated values as a result of scheduled runs before the month.

**Daily** limitations will no longer have an opportunity cost determined through either the model or negotiated process.

### 7.1.2.1. NESTED LIMITATIONS

A resource may have more than one limitation of the same type, i.e. limitation on starts, with different applicability, i.e. monthly and annual. The estimated opportunity costs due to these two limitations need to be combined into one value such that it can be reflected in the bid cap of the appropriate commitment cost or DEB. The straw proposal used an example to illustrate the issue and proposed a solution. Using an optimization that includes multiple resource constraints simultaneously would allow the ISO to solve the nested limitation problem discussed in the straw proposal without adding additional post processing steps. Therefore, the issue has become a non-issue with an optimization based modeling approach.

For resources with nested limitations, the opportunity cost will be based on the difference of estimated profits from the following two model runs. For illustrative purposes, assume a resource has monthly and annual limitation on starts of 20 and 140 respectively and we are estimating the opportunity cost for January.

Model Run #1: Run the model with monthly and annual limitations set at 18 ( $18 = .90 * 20$ ) and 126 ( $126 = .90 * 140$ ) respectively, for the full calendar year. Note the January profits.

Model Run #2: Run the model with the annual limitation set at 125 and the January limitation at 17. Leave the remaining monthly limitations set at 18. Note the January profits.

The estimated opportunity cost for January that can be reflected in the start-up cost bid is the difference of the January profits from the two model runs.

### 7.1.2.2. SCHEDULED MODEL RUNS

The opportunity cost model will be run prior to the time period for which the limitation is applicable. Most limitations are based on a calendar year, therefore the model will need to be initially run in Q4 of the year prior, to calculate opportunity costs for the year the limitation is applicable. As the year progresses, any re-runs of the model will model the months remaining in the calendar year and update previously calculated opportunity costs. Table 4 illustrates how scheduled runs throughout the year will update previously calculated opportunity costs.

Rolling 12-month limitations include the current month and either the preceding or upcoming 11 months. Theoretically, the opportunity cost today is based on energy prices in infinitely continuous 12-month rolling periods. For such limitations, the ISO will model limitations for at least two rolling

12-month periods; the preceding eleven months plus the current month, and the current month plus the subsequent eleven months. Based on stakeholder discussion and input from the Market Surveillance Committee, this is a reasonable way to approximate opportunity costs for rolling 12-month limitations.

*Frequency of scheduled model runs*

The closer the model is run to the actual time period for which the limitation is applied, the more accurate the opportunity costs, and more effective the tool is for the market to optimize the use of these resources. Therefore the frequency of scheduled runs is a significant factor in developing opportunity costs through this initiative. At the technical workshop, and through submitted comments, stakeholders have encouraged the ISO to update opportunity costs throughout the year as frequently as possible; the effectiveness of the model as a tool is strongly related to the frequency of updates. Some stakeholders mentioned their willingness to forego model accuracy that would not enable more frequent updates, for a model that would enable frequent updates.

Given stakeholder comments, at this time, the ISO proposes to run the model and update opportunity costs monthly<sup>15</sup>. Table 4 below illustrates 1) when the model will be run, 2) what calculated opportunity costs are generated in each model run, and 3) how previously calculated opportunity costs are updated during subsequent model runs.

**Table 5 Schedule for calculating opportunity costs**

Limit applicability	Current year	Calendar year limitations are applicable				
	Dec	Jan	Feb	Mar	Apr	May . . . Dec
Monthly	Model Jan - Dec					
		Model Feb - Dec				
			Model Mar - Dec			
Annual	Model Jan -Dec					
		Model Feb - Dec				
			Model Mar - Dec			
Rolling 12-months	Model Feb <sub>t-1</sub> -Jan; Jan -Dec					
		Model Mar <sub>t-1</sub> -Feb; Feb -Jan <sub>t+1</sub>				
			Model Apr <sub>t-1</sub> -Mar; Mar -Feb <sub>t+1</sub>			
Where		Binding		Binding, subject to updates		Advisory

**Monthly limitations:** The December model run will model January through December and generate monthly opportunity costs for monthly limitations. January opportunity costs will be binding; opportunity costs generated for February through December are advisory. The model run in January will model February through December, and produce binding opportunity costs for February and advisory opportunity costs for March through December. This will continue for each month through November where the November run will only model December and produce the

<sup>15</sup> The software platform that will be used to develop the model and calculate opportunity costs will be determined in implementation. Processing speeding of the software and required CAISO resource time will both determine how frequently the model can be run.

final binding opportunity cost for that calendar year; the December run will then model January through December of the next year.

**Annual limitations:** The December model run will generate one opportunity cost for January through December. That cost will be binding for January but subject to updates from the monthly model runs for the opportunity costs used February through December. Each monthly model run will model the remaining months of the year.

**Rolling 12-month limitations<sup>16</sup>:** These limitations will be modeled each month as well but always include limitations for at least two 12 month periods. A model run for a rolling 12-month limitation will generate a binding opportunity cost for the upcoming month.

Model runs that update a previously calculated opportunity cost, whether it was binding subject to updates or advisory, will supersede any prior value. Model updates are intended to more accurately capture changes in gas price futures and how the resource has been used in the market, both of which impact opportunity costs. This will enable uneconomic commitment of the resources, testing, and/or failed starts, to be reflected in the next model run. If those changes result in the limitations being less/more binding due to either lower/higher future gas prices or being committed less/more in the market than anticipated, the opportunity costs need to reflect the changes. Therefore opportunity costs can increase and decrease month to month.

The ISO is proposing to re-run the model and update calculated opportunity costs monthly. As with any new process, unforeseen circumstances may arise that result in the ISO unable to update the opportunity costs monthly. In the event the ISO cannot re-run the model for all resources in a timely manner such that the scheduling coordinators have an updated opportunity cost value for the upcoming month, the ISO will:

- Re-run models for resources that are using more starts, run-hours, or generating than the model most recently estimated.
- For resources that the ISO is unable to re-run, the most recent advisory calculated opportunity cost for the relevant time period will become binding. Limitations based on rolling time periods will continue to use the most recent calculated opportunity cost.

Impromptu re-runs were discussed at the technical workshop as well as through submitted comments. Most stakeholders felt that some method of impromptu re-runs be made available to scheduling coordinators. Given the ISO current proposed monthly scheduled model runs, along with incorporating a conversion factor based on future power prices, the need to have impromptu re-runs has diminished. Therefore, the ISO is not proposing to have impromptu re-runs within a month.

#### *Updating limitations in model*

As the year progresses and the model is run to update opportunity costs, the limits used in the model also need to be updated. The ISO presented three options at both the August Market

---

<sup>16</sup> RAAIM calculations will be updated accordingly to accommodate newly identified limitation horizons.

Surveillance Committee Meeting and the recent technical workshop on this initiative. During both discussions, and through stakeholder comments, one option was preferred by all whom commented on the issue. Therefore the ISO proposes to update the limits used in the model runs throughout the calendar year based on actual commitment and dispatch of the resource in the market. The ISO anticipates using settlement data in combination with scheduling coordinator input, as discussed below, to update the limits used in the model. For example, the model run for March through December will use 90% of an annual limitation on starts reduced by the number of starts the resource incurred in January and February. This will enable the opportunity cost model to accurately reflect unanticipated pricing events, failed starts, testing, or uneconomic commitment, that resulted in a resource using more of its limitation than initially estimated by the model.

Based on discussion with stakeholders, there are some instances where a resource may incur a start or run hour that counts towards its limitation but that the ISO market data does not reflect. The ISO considers a resource start when it reaches minimum load. These are primarily failed starts or testing. When a resource has a failed start, testing, or any other even that leads to a reduction in remaining starts, run hours, and/or output that is not reflected in the ISO market data, the scheduling coordinator will communicate that to the ISO such that it can be reflected in the remaining model runs for that calendar year.

### 7.1.3.OUTPUTS

Each model run will produce a calculated opportunity cost for each limitation type.

Start limits will be reflected in an opportunity cost adder for start-up costs; run hour limits will be reflected in an opportunity cost adder for minimum load costs; energy limits will be reflected in an opportunity cost adder for DEBs<sup>17</sup>.

Presently, the bid cap for start-up and minimum load costs is determined by 125% of the daily calculated proxy cost. The ISO is proposing commitment cost bids can reflect up to 100% of the opportunity cost for the corresponding commitment cost. For example, if a resource has a \$100/start opportunity cost, and the maximum start-up cost bid, excluding the opportunity cost component, is \$5,000, the scheduling coordinator can submit a start-up cost bid up to \$5,100. Opportunity costs associated with output limitations will be added to the resource's DEB. For example, if a resource has a DEB segment of \$50/MWh and an opportunity cost due to an output limitation of \$5/MWh, when the resource is mitigated, the DEB for that segment will be \$55/MWh. The opportunity cost will be added to all segments in a resource's DEB. Therefore:

- Start-up cost bids can reflect up to 100% of the opportunity cost due to a limitation on starts.

---

<sup>17</sup> Opportunity costs due to energy related limitations are not included in generated bids as use-limited resources are exempt from bid insertion.

- Minimum load cost bids can reflect up to 100% of the opportunity cost due to a limitation on run hours.
- Opportunity costs due to a limitation on output will be added to all segments of the resource's Default Energy Bid.

Upon completion of each model run, the ISO will provide each scheduling coordinator a summary of the model outputs for each use-limited resource modeled. The summary will include:

- Estimated usage of each limitation, i.e. starts, run-hours, and/or output, by applicability, i.e. month, year, etc.
- Binding and advisory opportunity cost adder for each limitation type, i.e. start, run hour, and/or output.

This will enable scheduling coordinators to track actual usage to how the model estimated the resource to be committed and dispatched. This will be significantly useful in the first year or so of implementation to aid in identifying any modeling enhancements that may increase the effectiveness of the tool. Furthermore, it will provide some transparency to how the final opportunity cost adders are determined.

### **Dispute and resolution process**

In the event a scheduling coordinator with a resource identified as having limitations that can be modeled does not agree with the ISO's calculated opportunity cost, the scheduling coordinator can submit a request to the ISO to obtain a negotiated opportunity cost. The ISO will work with the market participant to reach a negotiated contract if there is sufficient justification for why the calculated opportunity cost is not effective. Sufficient justifications include:

- a significant factor not accounted for in the model that cannot be reasonably modeled, and significantly impacts the calculated opportunity cost.
- a RA resource is at risk of not being available for the entirety of its RA showing despite the commitment cost bids reflecting the calculated opportunity cost.

The ISO will then work with the scheduling coordinator to negotiate an appropriate opportunity cost with sufficient justification and supporting documentation from the scheduling coordinator as requested by the ISO.

Similar to the process for a negotiated default energy bid or a negotiated major maintenance adder, if a scheduling coordinator and the CAISO cannot reach mutual agreement on an opportunity cost to be used, the scheduling coordinator may file at FERC pursuant to Section 205 of the Federal Power Act for approval of a rate.



## 8. NEGOTIATED OPPORTUNITY COST AND REVISIONS TO NDEB PROCESS

Upon receipt of all required documentation through the registration process, the ISO will review the limitations and identify those that cannot be modeled and notify scheduling coordinators of those resources. The notification to the scheduling coordinators will initiate the negotiation process. The ISO anticipates it will not be able to model and calculate opportunity costs for hydro resources and resources with complex limitations that cannot be translated into a limit on the number of starts, run-hours, and/or output. These limitations will have a negotiated opportunity cost. The ISO is proposing a negotiation process analogous to the negotiated default energy bid process and the major maintenance process as outlined below, will culminate with an approved methodology used to determine the opportunity cost for each limitation, an opportunity cost for each limitation, and the frequency of which the approved opportunity cost can be updated throughout the limitation's applicable time horizon.

As discussed in Section 7, resources with negotiated opportunity costs will provide additional documentation to the ISO. The documentation will include an opportunity cost for each limitation that cannot be modeled by the ISO that can be reflected in start-up cost bids, minimum load cost bids, or included in the Default Energy Bid. Documentation describing the methodology used to determine the submitted opportunity cost values will also be required and a proposed frequency of updates for the calendar year. The methodology should include details such as input variables, values used, values that may vary throughout the year, and/or process(es) used to arrive as the submitted values (i.e. formulas, simulation models, historical analysis, etc).

For example, if a resource has a limitation of 100 hours per month, the market participant could estimate an opportunity cost by creating a price duration curve for each month and noting the profits, as opposed to revenues, earned in the 100<sup>th</sup> run hour of that month. The market participant would then ideally submit to the ISO the price duration curves for each month, costs of the resource to run each hour, and the resulting proposed opportunity cost for negotiations.

The ISO will then review the submitted negotiated opportunity costs and methodology. The ISO will either approve the submitted methodology and opportunity costs, or work with the market participants to reach an approved methodology and opportunity cost values. In the event the negotiation has not been finalized prior to the effective date(s) of the limitation(s), the ISO may propose a temporary opportunity cost value that the ISO finds reasonable while the negotiation process continues. The scheduling coordinator may accept or reject the proposed temporary value. If the scheduling coordinator rejects the proposed value, no opportunity cost will be included until a negotiation is reached.

The temporary value established by the ISO would be applicable only in the event that the CAISO determines that resource warrants establishing a non-zero temporary opportunity cost based on submitted documentation pending any agreement or resolution of a negotiated opportunity cost proposed by the SC. If a Scheduling Coordinator and the CAISO cannot reach mutual agreement on an opportunity cost to be used, the Scheduling Coordinator may file at FERC pursuant to Section 205 of the Federal Power Act for approval of a rate.

As discussed at the technical workshop, and reiterated through submitted comments, stakeholders requested resources with negotiated opportunity costs to also be eligible for updated values throughout the calendar year. The ISO agrees that these resources, while not modeled by the ISO, may encounter unanticipated events that result in running through their limitations faster, or slower, than initially estimated. Due to the potential complexity of updating negotiated opportunity costs as well as the unpredictability of when updates will be requested, the additional ISO resources required to support this process in a timely manner may become insufficient. To ensure updates to negotiated opportunity costs can be updated in a timely manner acceptable by the ISO and market participants, the frequency of updates will be part of the negotiation process. In addition to the approved methodology and opportunity costs determined through the negotiation process, the ISO will also negotiate with the market participants the frequency of updates. The ISO envisions the frequency of updates to be dependent on the transparency of the approved methodology; more formulaic methodologies are likely to be easier to update and therefore have more frequent updates compared to those that are less transparent.

Updates to negotiated opportunity costs will only include updates to the opportunity cost values, not the approved methodology used to determine the opportunity costs. To initiate an update, the market participant will need to provide the ISO the new value(s) along with an explanation of why the opportunity costs have changed. Market participants will need to identify the input variables or original assumptions from the approved methodology that changed in such a way to warrant an updated opportunity cost.

Finally, the ISO will propose a modification to the negotiated default energy bid process to allow the ISO the right to initiate the renegotiation of a negotiated default energy bid. Currently, although the ISO may request renegotiation, it cannot require it. The ISO has identified outdated and erroneous negotiated default energy bids or components thereof, including for example, opportunity costs adders that may no longer be appropriate or may need to be adjusted as a result of this initiative.

The ISO will be amending section 39.7.1.3 of the ISO tariff to allow the ISO to review and propose modifications to existing negotiated default energy bids and to require the scheduling coordinator to provide updated supporting information and cost justification.

## 9. MULTI-STAGE GENERATING RESOURCES

This section only applies to Multi-stage generating (MSG) resources.

It is the ISO's understanding that limitations on MSG resources may apply to either the collective resource, i.e. parent level, or on the individual configurations. Furthermore, each configuration has a biddable minimum load cost, biddable start-up cost (for startable configurations), and upon implementation of CCE2, biddable transition costs. Therefore, additional consideration to determine which commitment cost bids may reflect opportunity costs is warranted. The following discussion pertains to all opportunity costs for MSG resources, independent of if the opportunity cost was calculated by the ISO or negotiated. The overall methodology used to determine which commitment costs may reflect the opportunity costs is based on the concept that any commitment

type decision, i.e. transition or direct start, made by the market should reflect the appropriate opportunity cost.

Limitations that apply to the collective resource will have one opportunity cost for each limitation. Up to 100% of an opportunity cost due to a start limitation may be reflected in the start-up bid for each startable configuration. This ensures that when the market commits the resource from being “off” to “on”, the start-up cost incurred can reflect the opportunity cost associated with a limitation on starting the collective resource. Up to 100% of an opportunity cost due to a run-hour limitation may be reflected in the minimum load cost bid for each configuration. The opportunity cost due to an energy limitation will be added to the DEB of each configuration.

Limitations that apply to each configuration will have an opportunity cost for each limitation, for each configuration. Theoretically the opportunity cost for the same limitation may differ for each configuration. Up to 100% of an opportunity cost due to a run-hour limitation on a given configuration may be reflected in the minimum load cost bid for that configuration. Opportunity costs due to energy limitations on a given configuration will be added to the DEB of said configuration.

In cases where transitions between configurations is considered a start to which the limitation applies, transition costs can be considered another commitment type cost analogous to a start-up cost for that configuration. Essentially the configuration may be started by either 1) being started directly, if a startable configuration, or 2) being transitioned into that configuration. Upon implementation of *Commitment Cost Enhancements Phase 2*, transition costs will also be a biddable commitment cost. Therefore, where a limitation on starts is applied to the configuration level, an opportunity cost will be determined for each configuration. Up to 100% of the opportunity cost can be reflected in start-up cost bid for that configuration as well as the transition costs transitioning into that configuration.

The following tables illustrate how the transition cost bid caps will be determined in cases where the opportunity costs can be reflected in transition cost bids. The proposed method further expands upon the method developed in CCE2, which was accepted by FERC in the order released on September 9, 2015.

Table 1 shows the calculated start-up cost for each configuration of a four configuration MSG resource, which are used to determine the bid caps for transition costs. The bid cap for transition costs are shown in table 2. The transition cost bid cap is equal to the difference of 125% of start-up cost of the to-configuration and 125% of start-up cost of the from-configuration, as developed in CCE2.

The shaded blue columns in table 1 reflect the opportunity cost for each configuration due to a limitation on starts that considers transitions as a start. Assume each configuration has a different opportunity cost for a start limitation, as shown in Table 1. The ISO would then create a matrix of transition opportunity costs, shown in Table 3. The opportunity cost for each transition is the opportunity cost of the to-configuration. For example, the opportunity cost for transitioning from UnitA\_2 to UnitA\_3 is \$150, which is the opportunity cost of UnitA\_3.

The bid cap for transition costs including the opportunity cost is shown in Table 4. These are determined by adding the transition opportunity costs in Table 3 to the transition cost bid caps in Table 2. This results in the opportunity cost associated with the to-configuration to be reflected in the transition cost bids for transitions going into that configuration.

Assume the start-up cost shown in table 1 is the daily calculated proxy start-up cost for these configurations. Currently, the start-up cost bid cap is set to 125% of the daily calculated proxy cost. With opportunity costs, the new start-up cost bid cap for each configuration is increased by the opportunity cost of that configuration, shown in the far right column of the first table below.

Configuration start-up costs

Config IDs	Config number	Start-up Cost	Cost x 125%	Opp Cost	Start-up cost bid cap
UnitA_1	1 - Startable	\$645	\$806	\$100	\$906
UnitA_2	2 - NOT startable	\$1,320	\$1,650	\$50	\$1,700
UnitA_3	3 - Startable	\$2,145	\$2,681	\$150	\$2,831
UnitA_4	4 - NOT startable	\$3,020	\$3,775	\$75	\$3,850

Transition costs bid caps

"From" Configuration	"To" configuration			
	UnitA_1	UnitA_2	UnitA_3	UnitA_4
UnitA_1		\$844	\$1,875	\$2,969
UnitA_2			\$1,031	n/a
UnitA_3				\$1,094
UnitA_4				

Transition opportunity costs

"From" Configuration	"To" configuration			
	UnitA_1	UnitA_2	UnitA_3	UnitA_4
UnitA_1		\$50	\$150	\$75
UnitA_2			\$150	n/a
UnitA_3				\$75
UnitA_4				

## Transition cost bid caps with opportunity costs

"From" Configuration	"To" configuration			
	UnitA_1	UnitA_2	UnitA_3	UnitA_4
UnitA_1		\$894	\$2,025	\$3,044
UnitA_2			\$1,181	n/a
UnitA_3				\$1,169
UnitA_4				

Upon implementation, the ISO will be able to identify and track qualifying transitions and thus be accurately captured in the RAIM calculation for use-limited MSG resources.

## 10. OUTAGE CARDS

The Reliability Service initiative modified the must offer obligation for Resource Adequacy resources. Along with the modified must offer obligations, the initiative also implemented the Resource Adequacy Availability Incentive Mechanism (RAIM) intended to incentivize RA resource to adhere to their must offer obligations.

### 10.1. SHORT TERM USE-LIMITED REACHED OUTAGE CARD

Use-limited resources may or may not also be RA resources, subject to must offer obligations and RAIM. The Reliability Service initiative established the following outage card specific for use-limited RA resources. The card was created to use as an interim solution between when RAIM becomes effective and the ISO implements an economic tool, i.e. the opportunity cost, and can optimize the use-limited resource through the market. The card was intended to be retired upon implementation of an opportunity cost method.

**Short-term use-limited reached:** This card may be submitted for use-limited resources as a tool to manage the resource until the ISO implements opportunity costs. The resource can then stop bidding into the market and be exempt from RAIM.

The ISO is proposing the short-term use-limited reached outage card will be retained upon implementation of the opportunity cost methodology. This will allow time for the ISO and scheduling coordinators to become effective in using the opportunity costs in commitment cost bids and address any potential unforeseen issues that may arise. The outage card will serve as a safety net for scheduling coordinators during this period and will aid in a smooth transition away from the outage cards and towards an economic tool to optimize use-limited resources. Excessive use of the outage card will inhibit the ability for the ISO and market participants to ensure the opportunity cost methodology is an effective management tool. Therefore reasonable use of the outage card should primarily be limited to cases where the opportunity cost has been ineffective and the resource is at risk of reaching the limitation prematurely even with bids reflecting the opportunity cost. For example, if a resource adequacy resource is at risk of reaching the limitation

before the end of its RA obligation despite utilizing the opportunity cost in commitment cost bids, this card can be used to essentially reserve sufficient starts for the latter portion of the RA period.

The card will remain available to use-limited resources until the ISO deems the opportunity cost methodology an effective economic tool to manage use-limited resources. At that juncture, the ISO will seek to retire the short-term use-limited reached outage card through a tariff amendment filing.

As discussed in more detail below, a primary concern for stakeholders is when a use-limited RA resource reaches its limitation it will no longer be exempt from RAAIM, possibly due to a miscalculated opportunity cost. The ISO will commit to evaluating how well the opportunity cost model rations out the starts over the year, particularly for RA resources. In the event the ISO finds that for certain resources, the opportunity cost is not an effective management tool, the ISO will consider further enhancements to the model or possibly make the short term use-limited reached outage card a permanent tool for those resources.

## 10.2. USE-LIMITED REACHED OUTAGE CARD RAAIM TREATMENT

By allowing use-limited resources to reflect opportunity costs of the limitations through commitment cost bids, the resource can be more efficiently optimized over the limitation horizon. When use-limited resource adequacy and flexible resource adequacy resources reach their limitations, scheduling coordinators must submit an outage card indicating the resource has reached the limitation, and is no longer available for the remainder of the limitation horizon. Reliability Services initiative provided RAAIM exemption for use-limited resources that have reached the limitation and is no longer available.

Use-limited capacity that becomes unavailable may have been previously shown on annual or monthly resource adequacy showings. Currently, there are no rules disqualifying use-limited resources that are no longer available from continually being shown on RA plans. The ISO must ensure sufficient capacity to meet monthly requirements is available when needed. The ISO now proposes that when a resource reaches a limitation and submits a use-limited reached outage card, it will be exempt from RAAIM for the remainder of the month. Starting the first day of the subsequent month, the resource will be subject to RAAIM unless substitute capacity has been provided. Not exempting use-limited resources from RAAIM once they become unavailable beyond the current month is intended to provide an incentive for scheduling coordinators to show substitute capacity that is still available to the market.

Stakeholders have expressed concern regarding the non-exemption for use-limited resources. The concerns are based on the premise that use-limited resources will reach the limitation before the end of the year due to a miscalculated opportunity cost, and then be penalized under RAAIM. The ISO understands this concern and it is the primary justification for the ISO taking conservative policy approaches to mitigate the likelihood of this scenario occurring. First, as discussed in section 10.1, the ISO is retaining the short term use-limited reached outage card for a transition period during which this concern, if it materializes, can be addressed through

further enhancements as discussed in Section 12. Secondly, the ISO is using 90% of the resource's limitation in the model to account for any modeling errors that may result in an under calculated opportunity cost. This modification made in the revised straw proposal was in response to this concern when initially brought to the ISO's attention, the idea being modeling ten percent less of the limitation essentially preserves ten percent of starts, run-hours, and/or output for the last month of the limitation horizon. Lastly, the monthly model re-runs will reflect actual usage of the resource. Therefore in the event a resource is using up starts, run-hours, and/or output prematurely, the limitation used in monthly re-runs will reflect a lower limitation, and be reflected in updated opportunity costs.

The ISO would like to take this opportunity to also note a resource may run through a limitation before the end of the year under two other scenarios. First, the policy is not requiring the opportunity costs to be reflected in bids, it only increases the bid cap. Therefore if the opportunity costs are not being reflected in bids, a resource may reach its limitation before the end of the year. Second, if the opportunity cost is accurate and being reflecting in bids, the optimal time to use the resource may be before the end of the year. In either case, the ISO could still be in a situation where resources that are no longer available to the market are still being shown on monthly RA showings; monthly RA showings may appear to not be deficient but in reality the ISO is deficient.

Recent discussion at the February 11<sup>th</sup> Market Surveillance Committee brought to the table the concept of including an estimate of RA payments in the opportunity cost model to help ensure the resource remains available for the period of its RA obligation. While the ISO appreciates the robust discussion at the meeting, including capacity payments, which are resource specific bilateral contracts and are not public information, into the wholesale energy market - which is intended to reflect marginal energy costs - is a path the ISO does not want to pursue. In a bilateral RA world, the risk and exposure of non-availability, as it always has, should fall to the contracting parties, not the wholesale energy market.

Additionally, including estimated RA payments into the opportunity cost calculation may not have the desired outcome. If the opportunity cost included an estimated RA payment to ensure the resource is not exposed to RAAIM penalties, the application of adding an estimated RA payment to the LMPs used in the model would not necessarily result in a higher opportunity cost. It may result in a resource getting started up once and committed through the day as opposed to started up once, shut down, and started up again as would more likely be the case with the lower LMPs. The former scenario being that the resource uses up less starts in the model due to higher LMPs, which may result in the resource not reaching a start limitation. When a resource in the model does not reach the limitation, the resulting opportunity cost is zero. Lastly, the intent of including an RA payment in the model is to increase the opportunity cost and thus the effectiveness of the opportunity cost as a management tool; again, this was the justification for the current proposal of using 90% of the limitation in the model. Only experience will enable the ISO and market participants to make a more educated decision between various approaches.

### 10.3. DEMAND RESPONSE OUTAGE CARD

As previously noted, the ISO's intent of removing default use-limited designation is to signal the need for an opportunity cost, not to modify the treatment of previously default use-limited resources in the ISO markets. At this point, the ISO does not envision reliability demand response (RDRR) and proxy demand response (PDR) resources to qualify for use-limited status. However, through discussions with stakeholders, the ISO recognized the need for these resource to have access to outage cards similar to the short term use-limited reached and use-limited reached outage cards discussed above. RDRR and PDR resources, per demand response programs, are provided the ability to take "fatigue breaks" after being dispatched so many hours in so many consecutive days. For example, a PDR resource may be able to take a 48 hour fatigue break after being dispatched four hours a day for three consecutive days. In addition, the programs typically indicate the maximum hours per month the resource will be dispatched, after which the resource is no longer available to the market.

Access to the current outage cards is dependent on use-limited status. To ensure there is no impact on how RDRR and PDR resources participate in the ISO markets without use-limited status, the ISO is proposing a new "nature-of-work" outage card specific to demand response resources. The outage cards will be available for use in accordance with the demand response programs and provide RAIM exemption for the resources while on the outage.

## 11. MASTERFILE RESOURCE CHARACTERISTICS

Resource characteristics are submitted to the Master File based on the generator resource data template.<sup>18</sup> Valid inter-temporal constraints, such as minimum up and down times, and other resource characteristics are the foundation for effective bidding rules. The ISO currently requires scheduling coordinators to provide information reflecting physical characteristics. Specifically, the tariff requires:

*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. 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.*

Many of the constraints that participating generators provide to master file can be difficult for the ISO to validate because the value for the constraint may legitimately require some engineering and economic judgment to balance excessive wear and tear and the technical capabilities of the resource. At the same time, the vast majority of resource characteristics should be static over a period of time and reflect resource vintage and use.

---

<sup>18</sup> See <http://www.caiso.com/market/Pages/NetworkandResourceModeling/Default.aspx> link to the excel file for the most recent Generator Resource Data Template.



The ISO proposes two sets of Master File values. The first set consists of all the existing resource characteristics and these must be based on the maximum (or minimum) design capabilities of the resource. These characteristics will be kept as validation data and for exceptional dispatch under stressed system conditions and will be referred to in this paper as “design capability” characteristics. EIM resources will also be subject to the following criteria set forth for market based and design capability values.

The second set is a subset of resource characteristics that will be used in the ISO market for normal operations to reflect preferred operating parameters. These values may be different than the first design capability set and will be referred to in this paper as “market” characteristics.

## 11.1. MARKET CHARACTERISTICS

The value each unit has registered for the vast majority of resource characteristics should remain static over time, but recognizes the need for some characteristics to reflect a balance between technical capabilities and economic trade-offs. At this time, the ISO proposes to allow generating resources to register market based values in market resource characteristic fields for maximum daily starts, maximum MSG transitions, and ramp rates. Subject to the proposed amendment to Tariff Section 4.6.4, the ISO does not propose other changes to the basic nature of how resource characteristics are registered. Outside of the maximum daily starts, maximum MSG transitions, and ramp rate market characteristics, all other resource characteristics will only provide design characteristic fields which values must reflect the unit’s design capability.

**Maximum daily starts** may warrant being more restrictive than the design capability values for a few reasons. It is the ISO’s understanding that a common trade-off is made between excessive wear and tear on a resource and the frequency of being started. While a resource may be able to start, for example, five times a day, starting it more than twice a day would drastically increase wear and tear on the resource and thus the probability of catastrophic failure. Tolling agreements or power purchasing agreements may impose restrictions on the use of the resource by limiting starts. While these restrictions would not generally qualify the resource for use-limited status and an opportunity cost adder, they can be reflected in the maximum daily starts field to help manage the resource within the contractual limitations.

The previous proposal stated the market based values, must at a minimum, support RA showings of the resource and adjust with changes made to those showings. This would translate to a minimum of two starts per day for Flexible Category 1 resources and a minimum of one start per day for all others. However, after further discussion, the ISO is concerned with potential gaming and exercise of market power that could arise with allowing one start per day. An overly restricted maximum daily start of one start per day provides a mechanism for resources to exercise market power. In addition, with one start per day, there are gaming concerns that arise due to the difference of optimization horizons between the day-ahead and real time markets. A resource with one start per day may be optimally committed in the day-ahead market for the evening peak. The real time market optimization does not optimize over the full 24 hour day, and thus may dispatch the resource to meet the morning peak instead. It may then be optimal for the real-time market to issue a shut down as solar peaks and net loads

reach a low in the middle of the day. In this case, a resource with a single daily start will not be able to meet its day-ahead schedule for the evening load peak. Under these circumstances, system operators may issue an exceptional dispatch to prevent the resource from shutting down, contributing to potential over-generation in the middle of the day. If, instead, the resource follows the real-time dispatch and shuts down, it will not be available to meet its day ahead schedule for the evening load ramp raising reliability concerns under conditions when system demand for both energy and flexibility are high. In addition to reliability implications, the buyback of the day-ahead schedules created by this situation can result in real-time bid cost recovery uplift.

Therefore the ISO is now proposing the market based maximum daily start values be, at a minimum, two starts per day except in the event the design capability value for maximum daily starts is one start per day or under the limited exception as noted below. If the design capability of the resource is one start per day, the market based value can then be one start per day.

The ISO understands resources nearing the end of its life cycle *may* warrant the resource only starting once per day despite its design capabilities allowing it to start more than once per day. The scheduling coordinator may request the ISO extend this exception of allowing one start per day in the market based max daily start field with sufficient justification. The request being made must include a detailed explanation of the mechanical justification for why the resource cannot start more than once per day, including the vintage of the resource. Per the ISO's discretion, upon receipt of such a request and review of documentation provided, the ISO may grant the exception. The scheduling coordinator must also provide additional explanation and/or documentation per ISO request if needed. Review of an ISO denial of an exception request would be subject to the ISO tariff alternative dispute provisions.

**Maximum MSG transitions**, similar to maximum daily starts, may warrant being more restrictive than the design capability of the resources. Based on discussion with stakeholders, oftentimes what the ISO considers a transition is actually a start of another resource which is part of the MSG pseudo-unit. For example, a MSG resource comprised of four identical CTs may have four configurations, where each consecutive configuration reflects the start of an additional CT.

The ISO is proposing to have a market based maximum MSG transition resource characteristic field held to the same minimum standards, minimum of 2, as the maximum daily start market based value. A minimum value of two transitions per day, is based on the ISO's need to be able to ramp twice per day and mitigate any potential gaming concerns that may arise through the ability to limit transitions to once per day.

The same exceptions to the minimum of two transitions per day will be extended to the market based maximum MSG transition field as well.

**Ramp rates** can currently be specified as a component of daily energy bids. The ISO has greatly enhanced the modeling capabilities of resources in the markets, such as multi-stage generating resources, reducing the need to accommodate daily bid-in ramp rates. Also, removing the daily bid-in ramp rate functionality minimizes potential adverse market impacts from resources changing ramp rates based on current system conditions while the ISO market is making awards

based on ramping capability under planned new market products i.e. flexible ramping product<sup>19</sup> and corrective capacity<sup>20</sup>.

The ISO proposes to remove the capability to specify ramp rates in daily energy bids. However, the ISO also recognizes the need to reflect preferred ramp rate capabilities used under normal operating conditions in contrast to those used under emergency conditions. The ISO is now proposing to allow resources to have a market based ramp rate to reflect the preferred operational ramp rate of the resource under normal system conditions. The market based ramp rate values, at a minimum, must support the resource's EFC value. For example, if the EFC value based on a 3 hour ramp period is 270MWs, the market based value cannot be less than 1.5MWs/min (270MWs/180 minutes).

## 11.2. DESIGN CAPABILITY CHARACTERISTICS

This set of Master File characteristic fields will consist of all the existing resource characteristics and its values must reflect the maximum, or minimum, design capability of the resource. For example, maximum daily starts must reflect the maximum starts the resource can endure under emergency conditions; minimum up time must reflect the shortest time period a resource necessarily has to be committed before shutting down.

For those characteristics which have both design capability and market fields, the ISO will model and ordinarily respect the market characteristics. However, where the ISO may need to issue an exceptional dispatch in response to stressed system conditions, the ISO proposes to make the design capability values available to operators.

The design capability characteristics shall be greater than or equal to the market based value for those resource characteristics with both a design and market based value. Due to the minimum requirements set on the market based maximum daily starts and maximum MSG transitions, minimum of two per day, it logically follows that the design capability value for maximum daily starts and maximum MSG transitions shall not be less than two per day. In the event the design capability value for either maximum daily starts or maximum MSG transitions is one per day, the market based value can also reflect one per day. Registration of one maximum daily start or maximum MSG transition for design and market based values in the Masterfile will be subject to ISO's confirmation this reflects the resource's design capability. As previously noted, the scheduling coordinator must submit to the ISO a detailed explanation of the design characteristics which restrict the resource to only start once per day. Review of an ISO denial of an exception request would be subject to the ISO tariff alternative dispute provisions.

The ISO also proposes to revise Tariff Section 4.6.4 and the Tariff definition of "Maximum Daily Starts" to refer to "design capability" rather than "physical characteristics," as a unit's design capability can be more objectively determined than its physical characteristics. For example,

---

<sup>19</sup>For more information on flexible ramping product, please see <http://www.caiso.com/informed/Pages/StakeholderProcesses/FlexibleRampingProduct.aspx>

<sup>20</sup> For more information on corrective capacity, please see <http://www.caiso.com/informed/Pages/StakeholderProcesses/ContingencyModelingEnhancements.aspx>

determination of a unit's physical characteristics arguably could include economic trade-offs involving wear and tear, whereas the design capability of the resource is the maximum (or minimum) ability of the resource.

### 11.3. CHANGES TO MASTERFILE RESOURCE CHARACTERISTICS

The Reliability Service Initiative Phase 2 previously discussed how the ISO would address changes to Masterfile resource characteristics for resource adequacy resources in such a way that would no longer support the RA showing for that resource. For example, if a Flexible Category 1 resource changes the maximum daily start value from two starts per day to one per day, it would no longer be supporting the requirements set forth to be a Flexible Category 1 resource. This discussion has been migrated to this initiative as it is directly link to the proposed changes for Masterfile resource characteristics. Qualification for generic and flexible resource adequacy showings are based on maximum daily starts, ramp rates, and minimum down time.

Based on the minimum requirements set forth above for the market based Masterfile maximum daily start parameter, this value can no longer be changed in a manner that does not support the RA showing. The minimum value of two starts per day is sufficient enough to support the highest category of flexible capacity. In the event a Resource Data Template (RDT) is submitted with a maximum daily start value less than 2, with the exception of those with a design capability value of one or granted exceptions, the RDT will be rejected and sent back to the scheduling coordinator for revision.

As noted in Section 11.1, the minimum requirement for the market based ramp rate value is that it at least supports the EFC value the resource is able to provide. In the event an RDT is submitted with a market based ramp rate value that does not support the EFC value of the resource, the RDT will be rejected and sent back to the scheduling coordinator for revisions.

Lastly, the minimum down time and dispatchability is also used to determine the category of flexible capacity a resource is qualified to provide. Any changes to either minimum down times or the dispatchability flag of the resource which would result in the resource no longer qualifying for the flexible capability category it is being shown as will be rejected when submitted as a change in Masterfile fields.

## 12. FUTHER ENHANCEMENTS OF THE OPPORTUNITY COST MODEL

The ISO recognizes that the opportunity cost modeling and implementation this is a new process for all involved. As with any new process, there is a learning curve which brings with it, gained experiences. Several of the policy elements, including monthly re-runs and modeling 90% of a resource's limitation, are viewed as a good step in the right direction; made to ensure perfection is not the enemy of good.

As the ISO and market participants gain experience with the opportunity cost model and using the opportunity cost as a management tool, the ISO will consider future enhancements to both the policy and model as warranted.

Potential future enhancements and considerations include

- re-evaluating the frequency of model re-runs based on the time needed for each updated,
- considering modifications to using 90% of a resource's limitation in the model, or other ways in which to further enhance the effectiveness of the opportunity cost as a management tool such as possibly including an estimated RA payment, and
- evaluate how well the opportunity cost model rations starts throughout the year, particularly for use-limited RA resources

## 13. NEXT STEPS

The ISO will discuss this draft final proposal with stakeholders on a conference call on February 25, 2016. Stakeholders should submit written comments by March 2, 2016 to [initiativecomments@caiso.com](mailto:initiativecomments@caiso.com).

The ISO will also post a technical appendix in March 2016 to provide transparency of the optimization based model as well as additional details and examples of how the model results will be used to determine the opportunity cost.

**Attachment D – Market Surveillance Committee Final Opinion**  
**Commitment Cost Enhancements Phase 3**  
**California Independent System Operator Corporation**

**Opinion on  
Commitment Costs and Default Energy Bid Enhancements (CCDEBE)**

by

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

Members of the Market Surveillance Committee of the California ISO

March 5, 2018

**1. Introduction and Summary of Recommendations**

The collection of costs associated with starting a generation unit and positioning it to provide at least its minimum amount of electrical energy are known as commitment costs. There is a potential for the exercise of market power through inflated commitment cost offers. Inflated commitment cost offers have the potential to impact the market in two ways. First, they can serve to economically withhold capacity, driving up energy prices when transmission constraints bind and the high cost of committing a resource causes a resource to not be committed and in turn causing energy prices to be set by high cost incremental energy offers of another resource. Besides higher prices, the result can be unnecessarily high resource costs in meeting load because load would not be met by the least-cost set of resources. Second, inflated commitment cost offers can also raise consumer costs through high bid-cost recovery (BCR) or exceptional dispatch (ED) payments required to cover inflated as-bid costs that are incurred when a resource must be committed to relieve a transmission constraint.

The California ISO (CAISO) has addressed these possibilities by either of two ways. Either resources could be scheduled based on commitment costs calculated by the CAISO, rather than using offer prices submitted by the resource operator, or commitment costs are submitted by the market participant, with the allowed offers being subject to caps calculated by the CAISO based on the CAISO's cost estimates.

The CAISO's commitment cost mitigation approach relies upon an assumption that the CAISO can estimate the true costs of most or all resources with reasonable accuracy. In particular, such approaches rely upon the availability of accurate *ex ante* measures of the natural gas costs that would be incurred by generators in order to generate incremental power. As CAISO markets have expanded to regions in which not all gas-fired generation is located at liquid trading points for gas with published indexes and may in the future include more unconventional generation, the assumption about the visibility of marginal costs to the CAISO is becoming less reliable.

The current CAISO design for mitigation of commitment costs has contributed to market problems as the western gas market has become more volatile and as the need has grown for the CAISO to improve its utilization of use-limited resources to balance short-term variations in net load. This design has also become less workable because of the expansion of the CAISO real-time market to include the EIM region. This expansion has taken the CAISO market design into

regions dominated by vertically integrated, regulated, utilities and with a wide diversity of supply situations for gas fired generation. The challenge is that the CAISO now needs to estimate commitment costs for an expanded set of gas-fired resources with a greater diversity of supply alternatives.

The CAISO has therefore proposed a comprehensive reform of its rules considering commitment cost offers and how the CAISO mitigates potential market power in those offers.<sup>1</sup> The Market Surveillance Committee (MSC) has been asked to prepare this Opinion on this proposed reform, which is called the Commitment Costs and Default Energy Bid Enhancements (CCDEBE). The MSC has participated extensively in the CCDEBE development process, including discussions addressing principles and detailed implementation issues that have taken place at several MSC public meetings over the past two years.<sup>2</sup> Moreover, this is not the first time that the MSC has considered the issues involved in designing a commitment cost bidding system that is both cost-reflective and safe from the exercise of market power. The MSC has written over 10 opinions since 2007 (summarized in Section 2) addressing those issues in response to the initial MRTU design as well as subsequent proposed changes.

In general, the CCDEBE proposal attempts to focus mitigation of commitment costs on a subset of units deemed to possess local market power using a dynamic test, and to allow more flexibility for market offers of these costs to other units. This philosophy closely mirrors that applied by CAISO in the mitigation of energy cost bids. For reasons discussed below, the implementation of this approach is more complicated with commitment costs than it is with energy bids. However, we agree that this is an important and necessary initiative to undertake. In brief, we agree that the volatility of gas prices and the need to encourage resources to make flexible offers into the market mean that it is desirable that the CAISO implement a more flexible system that allows resources to offer commitment costs that better reflect recent and anticipated costs particularly during periods of gas price volatility. Further, we agree, and have previously recommended, that dynamic market power tests be implemented that would give resources without market power more flexibility to bid their costs during periods while protecting consumers against the exercise of market power in those locations and at those times that there is a significant risk of that exercise. We believe the proposal will also enable the CAISO to coordinate a more efficient market across the broader EIM region and better accommodate the diverse gas supply situations of utility generation across the west.

Therefore, we recommend that the CAISO move forward with the development, testing and implementation of its design for dynamic mitigation of commitment costs as proposed. We also make the two additional recommendations for alternative implementations that may have some advantages, and should be considered if computational performance of the market software or the frequency of “false positives” becomes an issue. One is to combine market power tests on binding non-competitive constraints for energy and commitment cost offers; this would be more efficient computationally, and could reduce false positives. The second is to use after-the-fact

---

<sup>1</sup> California ISO, Commitment Cost and Default Energy Bid Enhancements, Revised Draft Final Proposal, January 31, 2018, [www.caiso.com/Documents/RevisedDraftFinalProposal-CommitmentCosts-DefaultEnergyBidEnhancements.pdf](http://www.caiso.com/Documents/RevisedDraftFinalProposal-CommitmentCosts-DefaultEnergyBidEnhancements.pdf)

<sup>2</sup> Presentations and discussions on CCDEBE occurred in MSC meetings held June 17 and Nov. 18, 2016; and May 5, July 10, Sept. 8, and Dec. 1, 2017.



mitigation of commitment cost offers if a resource that is not committed in the market power run also does not impact binding noncompetitive constraints, but would significantly affect nonbinding critical constraints.

Additional conclusions include the following. Overall, we support the transition to commitment cost reference levels that can be based on negotiated values or supplier updated cost information, consistent with the changes that have been introduced in the overall market power mitigation design of other ISOs over the past 5-7 years. With the greater ability of suppliers to reflect their actual costs in reference prices, it is appropriate to reduce the general mitigation threshold for commitment costs from 125% to the same 110% used for other resources. Finally, we continue to support the efforts by the CAISO and its Department of Market Monitoring (DMM) to base offer price mitigation on updated gas price information when available and sufficiently reliable.

We note that this is a very complex proposal with many features that stakeholders have commented extensively on. We have not expressed views on every issue raised; we instead emphasize the MSC's long-standing support for the general ideas of dynamic mitigation tests for commitment cost offers, and address a subset of particular implementation issues for which our views may offer a distinctive perspective. We have focused on evaluating whether the CCDEBE proposal addresses the major problems with the current design. We do not discuss other possible designs, such as a conduct-and-impact paradigm that might have some advantages but would entail much larger changes relative to the current design. Such more radical reforms of the commitment cost bidding and mitigation system might be worth considering in the future should the CCDEBE reforms turn out to be less effective than intended in adding flexibility while protecting against the exercise of market power.

This Opinion is organized as follows. In the following section, we provide background on the proposal by reviewing past market issues that motivated previous revisions of the CAISO procedures for making and mitigating commitment cost offers, and recent developments that have led the ISO to revisit those procedures. We also summarize the recommendations of previous MSC opinions on commitment cost costs and mitigation; the principles underlying the CCDEBE proposal are broadly consistent with those recommendations. Then in Section 3, we summarize the CAISO's general goals in designing this initiative. In Sections 4-6, we discuss issues associated with three core elements of the CCDEBE proposal:

- market-based offers for commitment costs (Section 4),
- dynamic mitigation of commitment cost offers (Section 5), and
- revised definition procedures for reference prices (Section 6).

## **2. Background and Previous MSC Opinions**

### **2.1. Past Market and Operational Problems**

The cost of supplying electric power is characterized by non-convexities, such as prohibited zones of operation and the expense of starting up or operating at minimum load. As a result, a fundamental issue in designing power markets is that it may not be possible to calculate a price that clears the market. That is, there may be no price that results in supply equaling demand, while supporting the overall least-cost solution (i.e., resulting in the social least-cost schedule being the same as the profit-maximizing schedule for each resource, given the prices). This results

in a fundamental difficulty, which is that clearing prices in the CAISO markets do not always fully cover the as-bid costs of all generators, even when they are selected as part of the least-cost market solution. To address this problem, in the CAISO's market design, as well as all other organized U.S. markets, generators can submit offers that include commitment costs and prohibited zones, and the market operator makes side-payments if clearing prices would not cover the as-bid costs of accepted supply offers, called bid cost recovery. This leads to several conceptual and practical challenges, such as how to allocate the resulting uplift as well as concerns that the market price may not adequately incent investment.

The concern addressed in this proposal is the potential for market power in commitment cost offers, in which resources would be able to increase their revenues by submitting commitment cost offers that materially exceed their costs. Such inflated offers might be able to increase net revenues by raising local marginal prices (LMPs), either for the resource making the offer or for other resources in a supplier's portfolio, or by increasing BCR payments to the resource. This increase in commitment cost offers can directly increase costs to consumers by raising their energy prices or allocated uplift, and also can inflate the resource cost of meeting load by shifting dispatch and commitments away from the least-cost schedule.

The risk of these cost shifts and distortions has been a central concern in the Market Redesign and Technology Upgrade (MRTU) from the very beginning of its design process after the 2000-01 crisis. There were several objectives in designing market rules that govern bidding of commitment costs. One is that bids must be able to fully reflect all the costs faced by resources so that suppliers can be assured that their costs will be covered; to do otherwise provides incentives to offer inflexibly ("self-schedule") or to not offer at all, which reduces the ability of the operator to reach a reliable and economic market solution and increases consumer costs. The second objective is to avoid exercise of market power to the detriment of market efficiency and consumers. Other objectives include transparency and simplicity of administration, avoiding slowing down the market clearing process, and minimizing the total amount of uplift so that market value and costs are reflected in market prices as much as possible.

A central tradeoff in applying market power mitigation to commitment cost bidding systems is between the risks of false negatives versus false positives. False negatives occur when bids should have been mitigated, but weren't, and the result is the exercise of market power and its attendant distortions. In contrast, false positives occur when bids were mitigated, but didn't need to be because the resource owner did not exercise market power. If the CAISO can confidently and accurately estimate the actual commitment costs of all resources, then market inefficiencies are unlikely to result from over-mitigation. This has heretofore been the philosophy of the CAISO's commitment cost bidding system. Its key feature has been that *all* commitment cost bids are subject to a bid cap determined by the ISO, without regard to the application of a market power test (which bore similarities to the design in PJM at the time the MRTU market power mitigation design was developed). The approach was simple, and provided strong assurance that the exercise of market power would be avoided.

Since the design and implementation of MRTU, the CAISO has revisited and adjusted its commitment cost bidding procedures multiple times. Table 1, below, summarizes in reverse chronological order twelve MSC opinions that address fundamental issues and/or details of implementation of those procedures.

**Table 1: Summary of MSC Opinions Addressing Commitment Costs (Left Column), Their Mitigation (Right Column), or Both**

Commitment Cost Offers and Cost Calculations	Mitigation of Commitment Cost Offers
<i>Bidding Rules &amp; Commitment Cost Bidding Enhancements (2016):</i> <sup>3</sup> The purpose of the Commitment Cost Enhancements 3 and BRE initiatives was to improve the CAISO’s calculation of commitment costs so that commitment cost bids will better reflect actual resource costs, including opportunity costs, while still effectively mitigating the potential for the exercise of market power. The MSC strongly supported calculation and inclusion of opportunity costs. The proposal also provided a safety valve in case commitment cost bid caps do not fully cover incurred fuel costs, by giving resources a right to file at FERC for recovery of those costs, which the MSC supported if used rarely. The MSC repeated earlier recommendations that a dynamic local market power test be used to limit mitigation of commitment cost offers to units possessing such market power.	
<i>Reliability Services Phase 1 &amp; Commitment Costs Enhancements Phase 2 (2015):</i> <sup>4</sup> The MSC recommended that opportunity costs implemented in commitment cost calculations in the near future. In the interim, it supported restricting use-limited designations to resources with physical or regulatory constraints.	<i>LMPM Implementation in EIM (2014):</i> <sup>5</sup> The MSC supported modification of the LMPM framework to deal with market structures that are quite different than inside the CAISO balancing authority. Among other differences are the degree concentration and the lack of a must-offer obligation in these other markets.
<i>Commitment Cost Enhancements (2014):</i> <sup>6</sup> The volatile 2013-14 natural gas market exposed limitations in procedures for adapting the CAISO’s commitment cost estimates to changing conditions. Lags in updating costs resulted in underestimation of minimum run costs, and ensuing distortions in dispatch. The MSC agreed with the CAISO proposal to increase the cap on start-up and minimum load offers to 125% of the calculated cost, because it will reduce mitigation of offer prices of suppliers lacking market power. The MSC reiterated the urgency of including opportunity costs in cost estimates, which was not part of this proposal.	<i>Appropriateness of the 3 Pivotal Supplier Test &amp; Other Competitive Screens (2013):</i> <sup>7</sup> In response to a FERC request, the MSC analyzed CAISO data, and concluded that there is no compelling justification for changing the three pivotal supplier screen in the LMPM competitive path assessment. Potential ways were identified for improving the definition of path competitiveness and the determination of DEBs in order to decrease the likelihood of false negatives and false positives.
	<i>Mitigation Measures for Bid Cost Recovery (2012):</i> <sup>8</sup> The MSC supported a simple and transparent approach to monitoring persistent real-time deviations from dispatch instructions.

<sup>3</sup> J. Bushnell, S. Harvey and B. Hobbs, Opinion on Commitment Cost Bidding Improvements,” March 10, 2016, [www.aiso.com/Documents/MSO\\_Opinion\\_CommitmentCostBiddingImprovements-Mar10\\_2016.pdf](http://www.aiso.com/Documents/MSO_Opinion_CommitmentCostBiddingImprovements-Mar10_2016.pdf)

<sup>4</sup> J. Bushnell, S. Harvey, B. Hobbs, and S. Oren, Opinion on Reliability Services Phase 1 and Commitment Costs Enhancements Phase 2, March 23, 2015, [www.aiso.com/Documents/Decision\\_ReliabilityServicesPhase1-MSO\\_Opinion-Mar2015.pdf](http://www.aiso.com/Documents/Decision_ReliabilityServicesPhase1-MSO_Opinion-Mar2015.pdf)

<sup>5</sup> J. Bushnell, S. Harvey, B. Hobbs, and S. Oren, "Opinion on LMPM Implementation in the Energy Imbalance Market," July 7, 2014, [www.aiso.com/Documents/FinalOpinion-LocalMarketPowerMitigation-Implementation-EnergyImbalanceMarket-July7\\_2014.pdf](http://www.aiso.com/Documents/FinalOpinion-LocalMarketPowerMitigation-Implementation-EnergyImbalanceMarket-July7_2014.pdf)

<sup>6</sup> J. Bushnell, S. Harvey, B. Hobbs, and S. Oren, "Opinion on Commitment Cost Enhancements," Sept. 8, 2014, [www.aiso.com/Documents/MSO\\_FinalOpinionCommitmentCostEnhancements-Sept2014.pdf](http://www.aiso.com/Documents/MSO_FinalOpinionCommitmentCostEnhancements-Sept2014.pdf)

<sup>7</sup> J. Bushnell, S. Harvey, B.F. Hobbs, and S. Oren, Report on the Appropriateness of the Three Pivotal Supplier Test and Alternative Competitive Screens, June 27, 2013, [www.aiso.com/Documents/Report-Appropriateness-ThreePivotalSupplierTest-AlternativeCompetitiveScreens.pdf](http://www.aiso.com/Documents/Report-Appropriateness-ThreePivotalSupplierTest-AlternativeCompetitiveScreens.pdf)

<sup>8</sup> J. Bushnell, S. Harvey, B.F. Hobbs, and S. Oren, “Opinion on Mitigation Measures for Bid Cost Recovery,” Dec. 5, 2012, [www.aiso.com/Documents/FinalOpinionBidCostRecoveryMitigationMeasures.pdf](http://www.aiso.com/Documents/FinalOpinionBidCostRecoveryMitigationMeasures.pdf)

<b>TABLE 1, Continued</b> <b>Commitment Cost Offers and Cost Calculations</b>	<b>Mitigation of Commitment Cost Offers</b>
<i>BCR Mitigation Measures and Commitment Costs Refinement (2012):</i> <sup>9</sup> The MSC supported its major features, including the modified day-ahead metered energy adjustment factor; the real-time performance metric; and the persistent uninstructed energy (PUIE) check, subject to careful monitoring and tuning. It also supported inclusion of several categories of costs, and <i>ex post</i> recovery of operational flow order-related costs	
<i>Renewable Integration, Final Product Review (2011):</i> <sup>10</sup> The MSC supported these proposals, which lowered of the bid floor in two stages, quantified additional categories of costs, and revised the bid cost recovery mechanism (BCR) to allow for separate calculation of BCR in the day-ahead and real-time markets. The MSC recommended that opportunity costs be considered, and careful review of the persistent uninstructed energy (PUIE) check.	
<i>Changes to Bidding and Mitigation of Commitment Costs (2010):</i> <sup>11</sup> This opinion expressed support for most of the elements of the ISO’s proposal to change start-up, minimum load, and transition costs for multistage generators (MSGs). The MSC supported the ISO’s recommendations not to consider opportunity cost bidding at that time, and to retain a 30 day minimum time period between changes in registered costs.	
<i>Changes to Bidding Start-Up and Minimum Load (2009):</i> <sup>12</sup> The MSC supported removal of barriers to reflecting verifiable commitment costs in offers. These costs could include opportunity costs. The MSC recommended that the ISO proceed with more frequent bidding only if improved mitigation procedures were put in place.	<i>LMPM &amp; Dynamic Competitive Path Assessment (2011):</i> <sup>13</sup> The MSC endorsed the proposal because it would allow the LMPM process to consider all demand and supply bid into the day-ahead market (including virtual bids); eliminate the potential for anomalous outcomes arising from the two-pass approach; and speed up the process, potentially allowing on-line (dynamic) competitive path analysis.
	<i>Start-Up &amp; Minimum Load Bid Caps Under MRTU (2007):</i> <sup>14</sup> The MSC concluded that, in the long run, the most suitable approach for mitigating SU/ML bids would be an extension of the MRTU LMPM mechanism to encompass all bids submitted by generators, not just energy bids.

<sup>9</sup> J. Bushnell, S. Harvey, B.F. Hobbs, and S. Oren, “Opinion on Bid Cost Recovery Mitigation Measures and Commitment Costs Refinement,” May 7, 2012, [www.caiso.com/Documents/MSCFinalOpinion-Bid-CostRecoveryMitigationMeasures\\_CommitmentCostsRefinement.pdf](http://www.caiso.com/Documents/MSCFinalOpinion-Bid-CostRecoveryMitigationMeasures_CommitmentCostsRefinement.pdf)

<sup>10</sup> J. Bushnell, S. Harvey, B.F. Hobbs, “Final Opinion on Renewable Integration: Market Product Review, Phase 1,” Dec. 11, 2011, [www.caiso.com/Documents/MSCFinalOpinionRenewableIntegrationMarket-ProductReviewPhase1.pdf](http://www.caiso.com/Documents/MSCFinalOpinionRenewableIntegrationMarket-ProductReviewPhase1.pdf)

<sup>11</sup> F. Wolak, J. Bushnell, B. Hobbs, "Opinion on Changes to Bidding and Mitigation of Commitment Costs", June 4, 2010, [www.caiso.com/Documents/FinalOpiniononChanges-BiddingandMitigation-CommitmentCosts.pdf](http://www.caiso.com/Documents/FinalOpiniononChanges-BiddingandMitigation-CommitmentCosts.pdf)

<sup>12</sup> F. Wolak, J. Bushnell, B. Hobbs, "Comments on Changes to Bidding Start-Up and Minimum Load," July 9, 2009, [www.caiso.com/Documents/DraftOpiniononStart-UpandMinimumLoadBiddingRules.pdf](http://www.caiso.com/Documents/DraftOpiniononStart-UpandMinimumLoadBiddingRules.pdf)

<sup>13</sup> J. Bushnell, S. Harvey, and B. Hobbs, “Opinion on Local Market Power Mitigation and Dynamic Competitive Path Assessment,” July 1, 2011, [www.caiso.com/Documents/110713Decision\\_LocalMarket-PowerMitigationEnhancements-MSCFinalOpinion.pdf](http://www.caiso.com/Documents/110713Decision_LocalMarket-PowerMitigationEnhancements-MSCFinalOpinion.pdf)

<sup>14</sup> F. Wolak, J. Bushnell, B. Hobbs, "Opinion on Start-Up and Minimum Load Bid Caps Under MRTU," Aug. 2007, [www.caiso.com/Documents/FinalOpiniononStart-upandMinimumLoadBidCapsUnderMRTU.pdf](http://www.caiso.com/Documents/FinalOpiniononStart-upandMinimumLoadBidCapsUnderMRTU.pdf)

Four of these principles, most of which have been discussed in several of the previous opinions as well as opinions concerning other aspects of the CAISO market design, include the following:

1. *ISO markets need to reward flexibility, preferably through spot market revenues.* This principle has been promoted by the MSC in its discussion of other market issues such as the energy bid floor, flexible ramp product, regulation pay-for-performance, and flexible resource adequacy requirements. The markets need to ensure that generators will have incentive to offer flexibly, which means that BCR and bid mitigation systems must allow recovery of all variable costs.
2. *There is a tradeoff between needs for cost recovery and to prevent market power.* The MSC has often discussed the frequency and consequences of false positives vs. false negatives. For this reason, the MSC has argued for dynamic market competitiveness tests that reflect up-to-date costs and market conditions that determine whether or not a particular resource has market power, and that give flexibility to resources lacking such market power to bid their costs as they see them. The CCDEBE proposal would implement such a test.
3. *Start-up and minimum-load (SU/ML) bid caps are needed, but tight caps should be imposed only where the market is insufficiently competitive to prevent exercise of market power.* For instance, in 2007 (Table 1, above), the MSC recommended that a variant of LMPM be used to identify market power in commitment cost bids, based on pivotal-type tests on supply to relieve congestion. Then, loose constraints on allowable bid levels and frequency of changes could be allowed where markets were likely to be competitive. On the other hand, tighter constraints on bids would then be imposed where exceptional dispatch, load pocket conditions, or other constraints limit contestability. The MSC recognized that dynamic tests are harder to define and implement for SU/ML bids due to lumpiness, and it suggested using results of transmission constraint generation in market software to identify paths of interest
4. *SU/ML bid caps should reflect all variable costs.* This means that when cost estimates are used to define mitigation thresholds and default bids, they should include all significant categories of costs, such as wear-and-tear, opportunity costs, fuel costs, operational flow orders (OFO). The MSC recognized that these can be very hard to estimate reliably. Examples of difficult-to-estimate costs include: the relevance of resource adequacy revenues to opportunity costs; intra-day gas prices, gas imbalance penalties; and expected OFO costs, gas prices for resources remote from liquid gas trading hubs, and the opportunity costs of start or emission limited resources. So, the MSC guardedly supported negotiated caps on bids, and after-the-fact review and recovery of costs that were unrecovered. Significant attention was paid to updating cost estimates as gas prices fluctuated, and the MSC proposed an approach based on daily gas indices for fuel cost-dominated components of costs, and slower changes for other cost components.

Based on these principles, the MSC has made a number of specific recommendations over the years for improving the commitment cost bidding and mitigation system, and has made note of emerging issues. Examples of recommendations and new issues include the following, as well as others in Table 1:

1. Adjustments to BCR calculation procedures in order to improve incentives to bid, and protect against market power. For instance, the separation of BCR for the day-ahead and real-time

markets; the calculation of opportunity costs of starts, energy, and operating hours based on multiweek or longer look-aheads; and design of “Performance Measure and Persistent Uninstructed Energy Check” procedures to discourage strategic behavior aimed at increasing BCR without greatly penalizing normal deviations.

2. In response to a charge from the Federal Energy Regulatory Commission to the MSC in FERC’s MRTU Order, the MSC assessed and recommended retaining the three pivotal supplier test.
3. High gas price volatility will often mean that commitment cost estimates used in the CAISO market power mitigation system become rapidly outdated. This directly led to the Winter 2013-14 difficulties, where the commitment costs estimated by the CAISO were grossly understated relative to energy price bids submitted by market participants, since the latter could be updated to reflect more current market conditions. This in turn caused the market software to inefficiently operate many generators at their minimum output levels, inflating actual system costs, inflating gas demand for power generation on a winter day with high gas demand, thereby endangering both gas and electric system reliability.<sup>15</sup>
4. Generator use plans have become a highly inefficient way of managing opportunity costs of units that have limited numbers of starts or operating hours, or limited energy availability. Because such plans give the operator little flexibility to change their usage in response to changing conditions they are no longer suited to the CAISO’s needs for balancing load and generation, given its current and prospective resource mix. A much better way is to quantify opportunity costs and allow their inclusion in SU/ML and energy offers. This is now being implemented by the CAISO.
5. Market power mitigation in the Energy Imbalance Market (EIM) is challenging because participation is voluntary, non-CAISO balancing authorities have high concentrations of suppliers, and gas-fired generation is often not located at liquid gas trading points with published indexes. The application of market power mitigation in the EIM is also more challenging because there is a greater diversity of gas supply situations, differing abilities to use storage, and a greater variety of supply constraints and options than in the CAISO footprint.

## **2.2. Emerging Problems**

Questions concerning how to respond to gas price volatility, and how to mitigate market power in the EIM are examples of issues concerning mitigation of commitment costs that have become more urgent recently. An example of the challenges for the current mitigation design is provided by the Aliso Canyon situation, in which the limited operability of a gas storage facility in southern California has tightened gas imbalance requirements and has increased price volatility for Southern California gas-fired generation.

Another increasingly important issue is the use of gas price indices for mitigating market power for Monday bids. Mitigation of Monday offer prices is based on the Weekend/Monday gas in-

---

<sup>15</sup> See CAISO, Commitment Costs Enhancement, Revised Draft Final Proposal, Aug. 21, 2014, p. 3, [www.caiso.com/Documents/RevisedDraftFinalProposalCommitmentCostEnhancements.pdf](http://www.caiso.com/Documents/RevisedDraftFinalProposalCommitmentCostEnhancements.pdf)

dex, which can provide a poor measure of the cost of buying gas for Monday because gas demand is lower over the weekend. Moreover, neither the weekend index for trades on Friday nor an index based on prior week Monday-only ICE trades would reflect changes in gas market conditions over the weekend as can be the case with changing weather forecasts. The California ISO DMM has conducted an analysis that has shown that understated gas prices on the first work day of the week has become fairly frequent over the past few years.<sup>16</sup> Similar issues with the accuracy of gas price indices exist around holidays, when the transactions used to compute the index can occur several days prior to the flow date for the gas, creating the potential for a significant difference between the gas price index and the cost of buying gas on the holiday for delivery on the day following the holiday,

The final issue of increasing importance is the prospect of increased natural gas price volatility. The exit of coal generation and a resulting increased reliance on gas fired generation to meet load appears to be increasing gas price volatility.<sup>17</sup> This trend of coal generation being replaced with gas and intermittent resources could continue, which could lead to further increases in gas price volatility in both day-ahead and intra-day gas markets.

The increasing risks posed to market efficiency and reliability by these emerging issues indicate that the present commitment cost mitigation system, in which all offers are mitigated, needs to be replaced by a more flexible bidding system. Such a system would dynamically identify and mitigate market power and allow bids to quickly reflect changes in gas prices. The CAISO has responded by developing the CCDEBE proposal, whose goals we discuss next.

---

<sup>16</sup> Figure 3.11 in the CAISO DMM's 2016 "Annual Report on Market Issues and Performance" compares the same day trade prices to next day index over the period June –December 2016. It shows that the proportion of trades at prices in excess of 110% of the next day index was much higher on the first trade day of the week. The same pattern is portrayed in Figure 3.2 of DMM's 3Q 2017 "Report on Market Issues and Performance," which compares same day trade prices to an updated same day average.

<sup>17</sup> An apparent increase in gas price volatility can be seen in successive CAISO DMM reports. Figure 3.12 in the 2016 "Annual Report on Market Issues and Performance" compares the next-day trade price to the next day index from the prior day for the SoCal City gate over the period June –December 2016. It shows that there were no trades at more than 125% of the prior day's next day index. The similar Figure 3.2 for the third quarter of 2017 in DMM's Q3 "Report on Market Issues and Performance" shows a few trades at more than 125% of the prior next day price, and it appears to show many more at more than 110% of the prior next day price than had been the case in 2016. Figure 3.8 in DMM's recently released 4Q Report on Market Issues and Performance not only shows an apparent increase in trades at slightly more than 125% of the prior day's next day index, but shows a distribution of next day trade prices extending up to several hundred percent of the prior next day price.

### 3. CCDEBE Goals and Summary of Mitigation Procedures

#### 3.1. Overall Market Design Goal

In summary, the CAISO seeks to develop a market design that will allow market-based bidding of commitment costs while applying market power mitigation to prevent the exercise of locational market power that can decrease market efficiency and raise consumer costs by either materially raising market prices above the competitive level or inflating BCR payments.

#### 3.2. Practical Complications

The application of market power mitigation to commitment costs is more complicated than the mitigation of energy offers because it needs to consider the impact of inflated commitment costs on BCR and ED payments as well as on market clearing energy prices.

Another complication is the lumpiness of commitment decisions. Unlike the dispatch of energy, which can be done in small increments, the commitment of a unit adds discrete blocks of energy to the market to accommodate the minimum operating level of that unit. As a result, a resource could be committed to solve a constraint that would have bound had the resource not been committed, but is non-binding in the dispatch with the resource on-line. Such a resource could submit inflated offers that would entitle it to large BCR or ED payments if the only way to avoid overloading a particular transmission constraint was to commit that resource. Therefore, a constraint may have bestowed locational market power on a resource, even if it is non-binding after the market solution is resolved.<sup>18</sup>

A third complication is the expansion of CAISO dispatch to EIM, which has introduced many additional gas procurement situations that need to be addressed in determining reference prices for mitigation. The increased potential for calculating erroneous reference prices increases the importance of limiting application of mitigation to situations in which there is a potential for significant exercise of locational market power. Not only does the EIM expansion make the likelihood of a false positive finding of inflated costs higher, but the consequences of the ensuing mitigation for market efficiency are greater when gas prices are opaque. The negative impact of “over-mitigation” is limited if the CAISO has highly accurate information about the marginal costs of the plants it is mitigating. The stakes are greater when the cost data available to the CAISO may not accurately reflect supplier costs.

---

<sup>18</sup> Such outcomes reflect the lumpiness of the unit commitment decision due to the minimum load block of the resource, whether or not commitment cost offers equal actual costs. As a trivial example, there may be several costly 25 MW units in a load pocket, each of which has a 18 MW minimum operating level (P<sub>min</sub>). If the load in the pocket is 80 MW and the transfer capability into that load pocket is 50 MW, then it is necessary to have at least 30 MW of local generation, which might be most cheaply achieved by committing two local units and operating them at their minimum levels. This implies 36 MW of local generation, so that 44 MW more needs to be imported; consequently, the 50 MW transfer limit is slack. The resulting LMP in the load pocket may be the system price, and those two units will require bid cost recovery.

However, market participants might deliberately structure offer prices to achieve such an outcome, perhaps in an attempt to evade triggering a pivotal supplier test on a constraint. That possibility motivates the first and second features of the proposed CCDEBE mitigation process (Sections 5.1 and 5.2, *infra.*).



### 3.3. CCDEBE Mitigation Procedure: Summary

As background, we provide here a brief synopsis of the CCDEBE mitigation procedure. Then in the next three sections (Sections 4-6), we summarize some issues associated with three core elements of the CCDEBE proposal (market-based commitment cost offers, commitment cost offer mitigation, and reference price modifications).

We start our synopsis by first noting that there are three basic steps for checking for market power and in defining market schedules and prices when the running the CAISO day-ahead and 15 minute real-time markets:

- Step 1: Using the unmitigated energy and commitment cost offers for all resources, execute the "Market Power Mitigation" (MPM) run, and determine which noncompetitive constraints are binding or, alternatively, sufficiently close to binding to be considered "critical constraints".
- Step 2: All resources, whether committed or not in the MPM run, are then subjected to various tests to determine whether they should be mitigated. In the case of commitment cost bids, the tests are summarized below, and result in each resource being placed in one of six categories; for three of those categories, the resource's start-up, transition, and minimum load bids are mitigated to the reference level. These categories include resources that affect congestion on noncompetitive binding constraints or that could provide significant relief to near-binding ("critical") constraints, as defined by the new CCDEBE tests, as well as resources that could potentially affect minimum on-line constraint congestion. On the other hand, if the resource is placed in one of the other three categories, then its commitment cost offers are not mitigated.
- Step 3: Market runs (scheduling and pricing) are executed using mitigated energy and commitment cost bids.

We now summarize the logic of the procedure for determining whether commitment cost offers are mitigated or not, which results in classifying each resource into one of six categories.<sup>19</sup> If the resource winds up in categories (1)(A) ("**MOC+**"), (2)(A) ("**Binding+**"), or (3)(A)(i)(a) ("**Non-binding/Committed/DispatchExcess+**"), then the commitment cost offers are mitigated. On the other hand, a resource that winds up in the other possible categories (3)(A)(i)(b), (3)(A)(ii), or (3)(B) is not mitigated.

*Procedure:*

(1) *Start:* Does the resource in question contribute to meeting any minimum on-line constraint (which is automatically deemed noncompetitive)?

(A) If yes, then mitigate commitment cost offers ("**MOC+**"). *Stop.*

(B) If no, then go to (2)

---

<sup>19</sup> This summary is based on our interpretation of information in the CCDEBE proposal (op. cit.) and other information provided by ISO staff. However, the responsibility for any errors is ours.

(2) Does the resource affect any noncompetitive constraint that is binding in the MPM run by the new CCDEBE pivotal supplier test? (In particular, does a resource have negative shift factor for any non-competitive binding constraint?)

(A) If yes, then mitigate commitment cost offers (“**Binding+**”). *Stop.*

(B) If no, then go to (3)

(3) Does the resource affect any critical noncompetitive nonbinding constraints by the new CCDEBE pivotal supplier test? (In particular, does a resource have negative shift factor for any non-competitive non-binding constraint?) (Given that the resource doesn't fall under categories (1) or (2), above, a "yes" here implies that energy prices aren't affected (*i.e.*, the local LMP equals system price, plus any adjustments for binding competitive constraints), but its bid cost recovery or exceptional dispatch payments might be.) Possible outcomes include:

(A) If yes, then check whether the resource committed in the MPM run? Possible outcomes:

(i) If committed, then check if the resource's dispatch in the MPM run is equal to or in excess of the unloaded capacity of the critical noncompetitive nonbinding constraint. Possible outcomes of this check:

(a) If yes, then mitigate commitment cost offers because its output is needed to satisfy that constraint (“**Nonbinding/Committed/DispatchExcess+**”). *Stop.*

(b) If no, then do not mitigate, since it is assumed that its dispatch is a result of it being competitive relative to system resources. *Stop.*

(ii) If not committed, then do not mitigate. (Note that it is possible that in the subsequent Step 3 market runs, the resource might be committed.<sup>20</sup> If it turns out that its scheduled dispatch is greater than the unloaded capacity of a critical nonbinding noncompetitive constraint, then a false negative has occurred; the resource should have been mitigated when it wasn't.) *Stop.*

(B) If the answer is no to (3) (the resource doesn't affect a critical noncompetitive nonbinding constraint by the CCDEBE test), then do not mitigate. *Stop.*

We now turn to a discussion of issues associated with the three core elements of the proposal.

---

<sup>20</sup> If the MPM and market dispatch are carried out in the same software run, such an outcome should be very rare with minor impacts, as the offer prices of other resources in the market run should be less than or equal to the offer prices in the MPM run. Such an outcome is possible as a result of solution differences due to MIP gap or changes in congestion when lower cost resources are committed due to mitigation in the market pass.

## 4. Market-Based Commitment Cost Design Issues

There are three core elements to the CCDEBE proposal, and we discuss several of their features in this and the following two sections. The first element is to allow market-based offers for commitment costs. We address issues concerning two features of this element in the following subsections. One is the proposed transition of the commitment cost bid cap from 200% to 300% if no problems emerge. The other is whether start-up cost offers should be allowed to vary within a day, consistent with the ISO's proposal for minimum load cost offers. In Section 5, we consider issues associated with the second core element, which is the proposed dynamic mitigation of commitment cost offers. Section 6 considers the third element, which is the revised definition procedures for reference prices. At the close of each section, we summarize our conclusions.

### 4.1. Transitional Cap on Commitment Cost Offers

The CAISO proposes to gradually shift to market-based bidding of commitment costs.<sup>21</sup> Even when not mitigated for local market power, commitment costs bids will be limited by a “damage control” cap. Market-based commitment cost bids will initially be capped at no more than 200% of the estimated reference level costs, with this cap rising to 300% after 18 months if there are no material unanticipated problems arising from the increased offer price flexibility.<sup>22</sup> The damage control cap on commitment costs could presumably be adjusted further in the future, but the proposal does not address this.

There are at least two rationales for the transitional cap on commitment cost offers. First, the 200% cap provides a limit on offer prices and market impacts in the event some element of the market power mitigation design that is implemented does not operate as intended. Second, the cap will limit offer prices and market impacts in the event that there are flaws in other elements of the CAISO market design that have been masked by the current bid constraints and which therefore will need to be modified to accommodate market-based commitment cost offers.

The DMM, on the other hand, recommends that the CAISO continue to cap all market participant commitment cost offers at 200% of the CAISO's estimated commitment costs until another stakeholder process is conducted to consider this issue.<sup>23</sup> The DMM's rationale for this recommendation is that

*“(t)his would allow stakeholders to demonstrate and justify the parameters for a reasonable level after they have some experience with the design of these new market features. A new stakeholder process is also more likely to result in a thorough evaluation of the functioning of the mitigation design.”<sup>24</sup>*

Some of the considerations that are relevant to whether or not the cap should be raised automatically if no problems occur include the following:

---

<sup>21</sup> See CCDEBE Revised Draft Final Proposal, *op. cit.*, Section 5, p. 15.

<sup>22</sup> *Ibid.*, Section 5.1.1, pp. 17-18.

<sup>23</sup> See California ISO, Department of Market Monitoring, Comments on CC DEB Initiative December 21, 2017 Stakeholder Call, January 11, 2018, p. 4.

<sup>24</sup> *Ibid.*, p. 4.

1. While DMM and the CAISO support the pivotal supplier test, it may turn out to not be a very good method for testing the application of market power involving commitment costs. If so, this would require changes in the limits on offers submitted by resources that are able to relieve a potentially binding transmission constraint.
2. Even if the pivotal supplier test is found to have weaknesses that require changes in the test design together with retention of or lowering of the 200% cap on the commitment cost offers of resources able to relieve a potentially binding transmission constraint, this would not warrant retaining that cap for resources whose output does not relieve any binding or potentially binding transmission constraint.
3. Unlike mitigation designs in other ISOs, the 200% and 300% caps would apply to any level of commitment costs; that is, there is no lower bound on dollar per megawatt hour or dollar per start offers to which the cap or mitigation would apply.

The CAISO proposes that the default caps on commitment cost offers would rise from 200% to 300% of the cost estimated by the CAISO after 18 months unless the CAISO files with FERC to defer this increase. We support this design as it allows the CAISO to defer the change in caps if market issues are identified during the first 12 months that provide reason for delay. The alternative of requiring a new stakeholder process before implementing the second increase would delay the increase in the cap regardless of whether there are any performance issues warranting such a delay. This alternative would also require that the CAISO and stakeholders devote resources to an unnecessary stakeholder process during a period when the CAISO and stakeholders will likely have a number of other complex initiatives that will need to be discussed.

#### **4.2. Within-Day Variation of Commitment Cost Offers**

Another issue with the commitment cost caps proposed by the CAISO is that while the CAISO proposes to allow market-based minimum load costs to vary by hour, market-based start-up and transition costs offers would be daily values.<sup>25</sup> While some market participants have pointed out the desirability of being able to vary start-up and transition cost offers over the day in response to changes in fuel prices or other factors impacting these costs,<sup>26</sup> it is our understanding that the current CAISO market software lacks the ability to readily accommodate start-up cost offers that vary over the day within a single software run.

Earlier CAISO proposals outlined work-arounds that would enable the submission of hourly start-up and transition cost offers, but the CAISO DMM has pointed out potential unintended consequences that could arise with implementation of those workarounds.<sup>27</sup> It appears to us that these concerns have likely been addressed by design in the Revised Draft Final Proposal which provides for a single start-up cost value to be used in the day-ahead market and a single value to be in effect in real-time.<sup>28</sup>

---

<sup>25</sup> See CCDEBE Revised Draft Final Proposal, Section 5.1, pp. 16-22.

<sup>26</sup> See Comments of NV Energy, January 11, 2018.

<sup>27</sup> CAISO DMM, Comments on CC DEB Initiative December 21, 2017 Stakeholder Call, *op. cit.*, p. 4.

<sup>28</sup> See CCDEBE Revised Draft Final Proposal, p. 16.

While this may not be an ideal resolution, market participants will be able to resubmit updated start costs each hour, which would be sufficient to reflect changes in gas costs over the day.

### 4.3. Conclusion

As stated above, we support the CAISO’s design for a gradual transition to market-based commitment cost offers.

## 5. Local Market Power Mitigation (LMPM) Commitment Cost Design Issues

The second core element of the CAISO design is the implementation of a local market power mitigation design that would be applied to test for the need to apply market power mitigation to commitment cost offers.<sup>29</sup> The CAISO market power mitigation design has several significant features that have been a source of discussion among market participants, DMM, and CAISO staff. We review four of these features and their current status below.

### 5.1. Identification of Transmission Constraints Potentially Causing Unit Commitments

The starting point in the application of the CAISO’s design for mitigating locational market power is identification of the transmission constraints that could potentially facilitate the exercise of locational market power. The CAISO has for several years applied a process for identifying binding transmission constraints as part of its LMPM design for energy offers. However, as discussed above, the complication that will be introduced with the application of LMPM to commitment costs is the potential for transmission constraints to bind in the unit commitment process and cause a resource to be committed, yet the transmission constraint might not bind in the dispatch schedule that the market software reports.

Hence, a resource could have been committed in order to solve a constraint that became non-binding with the resource committed. It is necessary to identify such constraints because although they do not directly affect energy market prices in the final market solution (because they are not binding), such constraints could have caused a resource to be committed even if it submitted non-competitive commitment cost offers that would entitle the resource to large BCR or ED payments. Further, such commitments are likely to affect market prices, meaning that non-binding constraints can indirectly affect energy prices.

While such a constraint would not be a binding constraint in the *final* dispatch solution, the iterative nature of the market model solution process means that any transmission constraint that impacts the commitment would be identified in an *earlier* pass and would remain in the constraint set of the final iteration of the process.<sup>30</sup> In the Siemens software these are referred to as “critical

---

<sup>29</sup> *Ibid.*, Section 5.2, pp. 24-31.

<sup>30</sup> That is, in a given iteration, a generation schedule is yielded by the optimizer, which has only included the subset of constraints included in the critical constraint set. A load flow model is then run in which the flows implied by the schedule are then checked against all constraints, including those not explicitly enforced in the market optimizer. If any omitted constraints are violated or have a flow that is within a given threshold of the flow limit, they are added to the critical set in the market optimization model, and it is run again. This process of “constraint generation” is repeated several times until all violated constraints are included or an iteration limit is reached.

constraints.” Importantly, once an iteration identifies a constraint, and it is included in the set of critical constraints, it remains in the critical constraint set in all subsequent dispatch passes. This software structure is not an accident, as it is necessary to avoid cycling in the software due to a constraint dropping in and out of the critical set from iteration to iteration.

The critical constraint set is also defined to include all constraints with flows on the monitored element or elements that are within a specified threshold of the limit. This structure in which constraints enter the critical set without an actual overload is designed to improve solution efficiency by including potentially binding constraints in the optimization at an earlier iteration than they would be if they were only included after they were violated.

Because a resource could not have been committed to solve a transmission constraint unless the transmission constraint was included in the critical constraint set, the CAISO can determine whether a resource might have been committed in order to solve a non-binding constraint on which it had market power by assessing whether the resource had negative shift factors on any non-binding transmission constraint in the critical set.<sup>31</sup> In other words, the test looks at units that provide counterflow to critical constraints, binding or not. The CAISO design will use this information to identify transmission constraints that could potentially have allowed the exercise of locational market power by resources potentially eligible for BCR payments. If a resource would not relieve any of the binding or non-binding constraints in the critical set, there is no need for the application of market power mitigation to its commitment cost bids.

The CAISO’s approach based on the critical constraint set is conservative and avoids the uncertainties and potential mitigation gaps associated with other approaches the CAISO considered.

## **5.2. Application of the Pivotal Supplier Test to Commitment Costs**

The CAISO will continue to apply pivotal supplier tests to binding transmission constraints. Separate tests are proposed to be applied for energy bids (the existing local market power mitigation system) and commitment cost bids (the new CCDEBE procedures). If the test is failed, the CAISO should mitigate the offers of resources relieving the constraint. A market design question is whether separate tests are necessary and useful.<sup>32</sup>

The new feature of the CAISO design considered here is its proposal to apply a pivotal supplier test to constraints that are included in the critical constraints but are not binding in the final dis-

---

<sup>31</sup> The reference bus used to define shift factors will have to be appropriately defined for this test to ensure that this test operates as intended.

<sup>32</sup> The CAISO proposes to apply separate and slightly different pivotal supplier tests for incremental energy and commitment cost offers to test for the presence of locational market power and trigger the possible application of mitigation. It is likely that the tests will both trigger mitigation when there is a potential for the exercise of locational market power, but there is no need to apply two versions of the pivotal supply test in order to trigger potential mitigation of resources whose output would relieve binding transmission constraints. If a supplier has locational market power on a binding transmission constraint, we recommend that all of its offer prices should be evaluated for mitigation.

The CAISO also proposes to implement a variety of minor improvements in the current 3 pivotal supplier test that we do not discuss in this opinion.

patch, as well as to binding constraints. The application of the pivotal supplier test to non-binding constraints included in the critical constraint set requires that the CAISO account for the unloaded capacity on the non-binding constraint. The reason for this is to avoid mitigating relatively small units for providing counterflow to a constraint with more unloaded capacity than the mitigated unit is providing counterflow for. This accounting will necessarily be a rough calculation in the CAISO mitigation design, which does not redispatch the system without the capacity being tested for pivotality and instead relies on *ad hoc* rules to calculate the flows and use of otherwise unloaded capacity on the non-binding constraint that result from dispatching up of identified resources.

The design needs to identify and test all resources able to relieve a non-binding critical constraint because the level of uplift payments is not necessarily related to the congestion component at locations impacted by non-binding constraints. Hence the CAISO design will not apply the competitive constraint congestion component decomposition that is utilized by the present mitigation system in applying mitigation to resources able to relieve congestion on binding constraints. Instead, the CAISO design will test for the potential ability to exercise locational market power by all resources able to relieve congestion on any constraint in the critical set.<sup>33</sup>

### 5.3. Application of Mitigation to BCR or Exceptional Dispatch Payments

The market power testing and mitigation procedure for commitment costs summarized in Section 3.3 involves entirely “before-the-fact” tests.<sup>34</sup> As described in the previous section, market

---

<sup>33</sup> It is unclear how useful and accurate the application of the pivotal supplier test proposed by the CAISO will be when applied to non-binding constraints for the purpose of commitment cost mitigation. The proposed test would almost always indicate a potential for the exercise of market power because it would compare (1) the sum of fringe capacity and potentially pivotal supplier capacity that cannot be physically withheld that would be available for dispatch to (2) the market power mitigation run’s dispatch of capacity providing counterflow on the constraint; it then compares the output of the individual resource relative to the unloaded transmission capacity to which BCR mitigation would be applied. The pivotal supplier test may introduce so many false positives that it does little to limit the inappropriate application of mitigation [Note – the design performs the resource test of  $DOP \geq \text{unloaded capacity}$  to address the potential for false positives of the PST so that the output is compared relative to unloaded trans capacity. We thought that mitigated false negatives based on our earlier discussions.], while weaknesses in the pivotal supplier test could fail to indicate the need for mitigation in some circumstances. The CAISO may find after implementing this design that it would be preferable to simply assume that resources able to relieve a non-binding constraint should be tested for whether commitment could have caused the constraint to become non-binding regardless of the amount of capacity available to commit, without applying a pivotal supplier test.

<sup>34</sup> An “after-the-fact” mitigation is in principle possible for BCR payments which are calculated after the fact depending on overall “as-bid costs” and revenues, and if that mitigation does not impact market clearing energy or reserve prices, which would be the case if the constraint does not bind in the dispatch or if the resource being tested was committed based on its unmitigated offer prices. (This is Section 3.3’s mitigation category (3)(A)(i)(a) “*Nonbinding/Committed/DispatchExcess+*”.)

There are several potential advantages to using such after-the-fact mitigation. First, it could simplify and speed execution of the market scheduling and pricing software by delaying some operations until later. Second, it could lessen the risk of “false negatives”. As mentioned in Section 3.3, there is a risk of

power mitigation would need to be applied before-the-fact (prior to the final market scheduling and pricing runs) to commitment cost offers of resources whose output would relieve binding constraints and which would not be committed based on their uncommitted offer prices. Then if mitigation results in the resource being committed, any BCR that is required would be based on mitigated bids, as just described.

Therefore, as summarized in Section 3.3, the test for BCR mitigation would need to be applied to resources that: (1) were committed, (2) whose output relieved a transmission constraint, and (3) had commitment cost offers that exceeded the reference levels. The purpose in applying the test to these resources would be to assess whether there is a significant potential for the exercise of locational market power by these resources. The test would be to assess whether any of the critical constraints relieved by the resource being tested could have required the commitment of the resource. This would necessarily be the case for resources relieving binding constraints. In the case of constraints that did not bind in the dispatch, this conceptually requires testing of whether there is sufficient unloaded capacity on the constraint in the dispatch solution such that the transmission constraint would not have bound even if the resource being tested had not been committed. If this is the case, the constraint could not have required commitment of the resource. On the other hand, if the constraint would have bound had the resource not been committed, then mitigation would be applied to the energy and commitment costs used to calculate BCR and ED payments. Then BCR and ED payments will be determined based on those mitigated bids.

A practical complication in applying this test to non-binding constraints is that whether the constraint would have been binding had the resource not been committed depends not only on the shift factor of the resource being tested on the constraint, but also on the shift factors of the resources that would have been dispatched up or committed to replace the resource's output if it had not been committed. For such non-binding constraints, the CAISO proposes to apply a simple test of whether the total output of the resource being tested exceeds the unloaded capacity on

---

a false negative if the market power mitigation run (Step 1 of the market model) does not commit a resource and if the test does not find it is needed to satisfy a nonbinding critical constraint, but then the actual market scheduling run (Step 3) commits the resource (category (3)(A)(ii) in Section 3.3). If that resource inflated its commitment cost bid, then it could receive more BCR than it should be entitled to. After-the-fact mitigation could detect and mitigate such instances. Third, if a resource is not committed but doesn't impact noncompetitive binding constraints, there will be no BCR payments to mitigate, and no adverse market impacts from the application of mitigation based on inaccurate reference prices. Market prices for energy would not be affected because of the fact that the resource faces competitive energy prices. Fourth, after-the-fact mitigation of BCR payments also allows the CAISO to make use of market data that was not available in the timeframe of the day-ahead market or real-time dispatch, such as additional gas price transaction data. Finally, it will likely also reduce the need to apply the tests as there is no need to apply the test to resources that are not entitled to BCR if it turns out that they recover their commitment costs in their energy market margins.

We have been informed by ISO staff that after-the-fact alternative was considered but not adopted due to settlement complications and some stakeholder desires for all mitigation to take place prior to the market run. However, we suggest that it be considered in the future if either execution times or such false negatives become an issue.



the transmission constraint being evaluated.<sup>35</sup> Any resource that is committed would fail this test in the case of a binding constraint, so the test is only meaningful in the case of critical constraints that do not bind in the dispatch. A more complex test would be to rerun the dispatch step without the resource's output and test if the constraint would have bound. However, this would increase solution times and latency. Therefore, we support the CAISO's application of a simple test, as long as its performance is monitored carefully after implementation.

#### **5.4. Application to Load Serving Entities**

Another difference relative to the present system of energy market price mitigation is that mitigation of BCR payments needs to be applied to offers by LSEs who can be net buyers of energy. This is because even if the LSE would be adversely impacted by increases in energy market prices, it could also benefit from the receipt of additional BCR payments.<sup>36</sup> The CAISO proposes to apply commitment cost mitigation to the commitment cost offers of all resources able to relieve a potentially binding constraint, regardless of whether the resource is owned by a load serving entity that is a net buyer in the energy market. We support this element of the CAISO's design.

The test for the exercise of market power by net energy buyers (i.e., LSEs) only needs to be applied, however, to the impact of commitment cost offers on BCR and exceptional dispatch payments, not their impact on energy market prices. This is the approach taken by the CAISO's proposed design.

#### **5.5. Conclusion**

Overall, we support these elements of the CAISOs dynamic market power design and believe it will both enable the CAISO to provide more offer price flexibility to gas-fired resources within the CAISO during periods of gas price volatility and will also enable the CAISO to coordinate a more efficient market across the broader EIM region and better accommodate the diverse gas supply situations of utility generation across the west.

We have made two general suggestions for alternative implementations that may have some advantages, and should be considered if computational performance of the market software or the frequency of "false positives" becomes an issue. One is to combine market power tests on binding non-competitive constraints for energy and commitment cost offers; this would be more efficient computationally, and could conceivably avoid false negatives in which the energy offer prices is mitigated but commitment cost offers are not. The second would be to apply mitigation to BCR payments in an after-the-fact process if a resource that is not committed in the market power run also does not impact binding noncompetitive constraints, but is committed in the market run and would significantly affect nonbinding critical constraints.

---

<sup>35</sup> See CCDEBE Revised Draft Final Proposal, Section 5.2.1, Table 2, pp. 25-26 and Appendix E, Section 7.2, p. 71.

<sup>36</sup> *Ibid.*, p. 25.

## 6. Mitigation Threshold and Reference Price Issues

In this section, we address three sets of issues associated with the definition of reference prices and thresholds for mitigation, which represent the third core element of the CCDEBE proposal. These three issues include: the consistency of thresholds for incremental energy and commitment costs (as a multiple of estimated costs); adjustment by offerors of reference cost values if the 110% threshold is insufficient, and procedures for reimbursement of those costs; and use of gas prices indices in reference price calculations. We support the ISO's proposed approaches to these issues, although we note some specific potential issues that should be monitored during implementation.

### 6.1. Thresholds for Mitigation

The CAISO currently allows market participants to submit incremental energy offers up to 110% of the cost calculated by the CAISO without triggering mitigation. For commitment cost offers, however, the threshold is presently 125% of the cost calculated by the CAISO that is allowed without triggering mitigation. The CCDEBE initiative proposes as part of these changes to adopt a common 110% threshold for both incremental energy and commitment cost offers. The reduction in the mitigation threshold for commitment cost offers would not be implemented initially but will be phased in with other adjustments after the new design has been in operation for 18 months.<sup>37</sup>

Part of the reason for the reduction in the mitigation threshold for commitment costs is that the CAISO will modify the calculation of commitment costs to include costs currently not included in commitment costs. These include minimum load costs for run hours not associated with energy output and the inclusion of eligible opportunity costs.<sup>38</sup> In addition, the tighter threshold would only be applied to resources whose output relieved a critical constraint.

### 6.2. Reference Level Adjustments

In addition to modifying the current default threshold for commitment cost offers in excess of the calculated costs, the CAISO proposes several mechanisms that would allow offers that exceed the calculated costs by more than the 10% threshold when a resource's commitment cost bids would otherwise be subject to mitigation (Section 3.3), when such offers are necessary to reflect actual costs. These will be implemented by adjusting the reference price for a resource to include:

- extending the option for negotiated reference levels that is currently available for incremental energy offers to allow negotiated reference levels for commitment cost offers,<sup>39</sup> and

---

<sup>37</sup> *Ibid.*, pp. 33-34.

<sup>38</sup> *Ibid.*, pp. 34-35.

<sup>39</sup> *Ibid.*, pp. 35-36.

- supplier-submitted adjustments to reference levels based on cost changes not reflected in the CAISO’s cost calculation.<sup>40</sup>

Supplier-submitted reference level adjustments that are within a specified volatility threshold of the CAISO’s cost calculation will be reflected in the unit commitment, impacting market clearing prices, and will also be reflected in BCR and exceptional dispatch payment calculations.<sup>41</sup> These thresholds are *ad hoc* simple percentage thresholds based on the CAISO and CAISO Department of Market Monitoring’s comparison of gas trade prices on electronic exchanges to various types of gas price indexes for the same location. It is possible that it will be found over time that the CAISO will need to establish wider thresholds for resources not located close to liquid gas trading locations, that the width of thresholds will need to be increased or could be reduced because of changes in gas market price volatility, and/or that the width of the threshold could be conditioned on pipeline or other conditions that the CAISO can observe. The CAISO proposal also provides for resource-specific feedback loops.<sup>42</sup> The volatility thresholds proposed by the CAISO are a reasonable starting point given the data on current gas market volatility relied upon by the CAISO.

Supplier-submitted reference level adjustments in excess of this threshold will be eligible for after-the-fact recovery of incorrectly mitigated actual costs.<sup>43</sup> This design is consistent with the practice of other ISOs that apply market power mitigation to market-based commitment costs.<sup>44</sup> These supplier-submitted adjustments are not simply an increase in the 10% default threshold. They must reflect actual costs and are subject to verification.<sup>45</sup> The DMM has stated a concern that suppliers that have been “determined to have market power” (as determined by a three pivotal supplier test) should not be “automatically” compensated for costs in excess of threshold.<sup>46</sup>

Our understanding of the CAISO’s provisions for *ex post* recovery of as-bid costs that were not recovered in market prices as a result of incorrectly mitigated offer prices is that the market participant will request this *ex post* recovery and the CAISO will make a determination of whether it will be provided. If the CAISO does not provide the make whole payment, the market participant will be able to make a FERC filing seeking recovery.<sup>47</sup> This does not describe a process for “automatic recovery” of as-bid costs in excess of the various thresholds, but rather provides for appropriate recovery of as-bid costs in excess of a threshold. Moreover, we do not agree that suppliers that fail the 3 pivotal supplier test have been determined to have market power. The 3

---

<sup>40</sup> *Ibid.*, pp. 33-43.

<sup>41</sup> *Ibid.*, p. 33.

<sup>42</sup> *Ibid.*, p. 40

<sup>43</sup> *Ibid.*, pp. 42-43.

<sup>44</sup> See MISO Tariff, Module D, Section 67; NYISO Market Services Tariff, Attachment H Sections 23.3.3.3.1, 23.3.3.3.2, and 23.6.

<sup>45</sup> See CCDEBE Revised Draft Final Proposal, *op. cit.*, Section 5.4.1, pp. 37-38.

<sup>46</sup> See CAISO DMM, Comments on CC DEB Initiative December 21, 2017 Stakeholder Call, *op. cit.*, p. 2

<sup>47</sup> See CCDEBE Revised Draft Final Proposal, *op. cit.*, Section 5.4.3, pp. 42-43.

pivotal supplier test is by design a very conservative test of competition, reflecting the many approximations in its application that could result in false negatives. The impact of this conservatism, however, is that it can produce many false positives. Rather than reflecting a finding that a market participant possesses market power, a failure to pass the three pivotal supplier test reflects a possibility that the supplier would possess market power.<sup>48</sup> In our opinion, there is no basis for the apparent position of DMM that costs above the threshold should never be recovered by suppliers that have otherwise been determined to have market power, even if the offers are clearly consistent with market conditions and other arms-length transaction prices. It is doubtful that such a policy will be acceptable to regulators in other states when applied to their utilities.

Another feature of the proposed reference price determination process is that the volatility threshold for gas fired resources will initially be set at 110% of the reference gas price for weekends and weekdays other than Monday's or weekdays following holidays. The threshold for the Mondays or weekdays following holidays will initially be set at 125%. These supplier-submitted cost adjustments would be used as the reference levels and the 110% (or, until changed, 125%) default threshold would be applied to cap offer prices.

An important rationale for this more relaxed threshold for the start of the work week is as follows. In assessing the need for suppliers to be able to make use of the volatility adjustment, it is important to recognize that the most often-used approach to comparing trade prices to an index is a comparison of transactions on the ICE to the index being used for the comparison at the same location. This calculation does not reflect the difference between the cost of purchasing gas over the weekend (most of which is purchased off-ICE) to the Friday gas price index. This calculation also does not reflect the difference between the gas index at a particular trading hub and the cost of acquiring gas delivered to gas fired generation not located at or near a reported gas trading point.

### **6.3. Gas Prices and Reference Price Calculations**

The CAISO also proposes to continue making use of the best available data to estimate the gas prices that would be the starting point for the application of energy and commitment cost mitigation in the day-ahead market.<sup>49</sup>

This updating of the gas price indexes used for mitigation in the day-ahead and real-time markets based on transaction prices on electronic exchanges has been consistently recommended by the CAISO Department of Market Monitoring.<sup>50</sup> This updating is an important component of an improved bidding and market power mitigation design. This updating, however, is not a substitute for the elements of the CCDEB design which will enable gas fired generators to submit their own

---

<sup>48</sup> See J. Bushnell, S. Harvey, B.F. Hobbs, and S. Oren, Report on the Appropriateness of the Three Pivotal Supplier Test and Alternative Competitive Screens, June 27, 2013, [www.caiso.com/Documents/Report-Appropriateness-ThreePivotalSupplierTest-AlternativeCompetitiveScreens.pdf](http://www.caiso.com/Documents/Report-Appropriateness-ThreePivotalSupplierTest-AlternativeCompetitiveScreens.pdf)

<sup>49</sup> Ibid., Section 5.3.1, p. 22.

<sup>50</sup> See CAISO DMM, Comments on CC DEB Initiative December 21, 2017 Stakeholder Call, *op. cit.*, p. 1.

offer prices when they lack market power. There are no gas price data on electronic exchanges—updated or otherwise—for gas purchased for delivery at locations that are not trading points on the electronic exchanges or for transactions carried out on the phone on weekends when there is little trading activity on electronic exchanges.<sup>51</sup>

#### **6.4. Conclusions**

Overall, we support the transition to commitment cost reference levels that can be based on negotiated values or supplier updated cost information, consistent with the changes that have been introduced in the overall market power mitigation design of other ISOs over the past 5-7 years. With the greater ability of suppliers to reflect their actual costs in reference prices, it is appropriate to reduce the general mitigation threshold for commitment costs from 125% to the same 110% used for other resources. Finally, we continue to support the efforts by the CAISO and DMM to base offer price mitigation on updated gas price information where this is available and sufficiently reliable.

---

<sup>51</sup> Monday-only transaction prices from the prior week will not reflect gas market conditions over the weekend when the weather forecast is changing.

**Attachment E – Board of Governors Memorandum**  
**Commitment Cost Enhancements Phase 3**  
**California Independent System Operator Corporation**



# Memorandum

**To:** ISO Board of Governors

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

**Date:** March 17, 2016

**Re:** **Decision on commitment cost bidding improvements proposal**

---

*This memorandum requires Board action.*

## EXECUTIVE SUMMARY

Resource commitment costs include the costs of starting up a resource and the costs of running a resource at its minimum operating level so that it is available for dispatch. Efficient resource commitment by the ISO market relies on the ability of market participants to submit bids that reflect accurate commitment costs which, in turn, also ensures market participants recover these costs. In 2014 and 2015, the Board approved Management proposals to improve the accuracy of commitment costs used in the ISO market.

The ISO has continued to identify enhancements to further improve market participants' ability to accurately reflect commitment costs in the ISO market and to manage the market's use of their resources. At the same time the ISO has seen a proliferation of resources registering as "use-limited," currently representing 35,000 MW. The current market rules for submitting bids into the market for use-limited resources, including for their commitment costs, are different than for other resources to reflect their use limitations.

In this proposal, Management asks the Board to approve a set of market enhancements that improve market participants' ability to more accurately reflect resources' commitment costs, better ensure recovery of actual costs, and better manage their use by the market. Specifically, the enhancements in this proposal include:

- Use-limited resources will be eligible for a calculated opportunity cost to include in their daily commitment cost bids, which will allow the market to recognize their use limitations that extend over a longer period of time than the daily markets, such as annual limitations. This will allow the ISO to eliminate the "registered cost" option for bidding resource commitment costs, which is a less efficient means of reflecting these costs in the market.

In connection with this enhancement, Management proposes to revise the definition of “use-limited” resource to align it with resources that need an opportunity cost included in their commitment costs to be efficiently dispatched throughout the year. Management also proposes corresponding changes to the resource adequacy availability incentive mechanisms to address when use-limited resources reach their use limitations, as well as revising the process for registering use-limited resources and the annual process for evaluating use limits.

- Market participants will have greater flexibility to reflect preferred operating values in the ISO’s master file, including maximum daily starts, maximum daily multi-stage generator transitions, and ramp rates. Currently, these values must reflect only physical characteristics.
- Market participants will have the ability to re-bid commitment costs in the real-time market when a resource has not been committed in the day-ahead market. Currently, resources are locked into using their day-ahead bid in the real-time market even if the resource had not received a day-ahead schedule. In addition, the ISO will no longer automatically insert bids into the real-time market’s short-term unit commitment process for non-resource adequacy resources in the event a market participant submits bids for a resource into the day-ahead market but not the real-time market.
- Market participants will have the opportunity to file with the Federal Energy Regulatory Commission to recover commitment costs that exceed the commitment cost bid cap and result in a net revenue shortfall over the day considering all market revenue.
- The ISO will make various changes to natural gas transportation rates and to the electricity price used to calculate resources’ costs used in commitment cost caps and default energy bids used by the market.

Management proposes the following motion:

***Moved, that the ISO Board of Governors approves the commitment cost bidding improvements 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**

Market participants can currently select between two options for bidding a resource's start-up, multi-stage generator transition costs, and minimum operating level costs (collectively referred to as "commitment costs"):

- The "registered cost option" allows market participants to bid up to 150 percent of a projected cost calculated by the ISO and is fixed for 30 days. The ISO bases the projected price based on monthly natural gas futures prices. To mitigate market power, this relatively high 150 percent bid cap is balanced with a requirement that the bids are fixed for 30 days. The ISO market rules currently allow only use-limited resources to be under the registered cost option. As discussed in more detail below, the higher cap allows them to include opportunity costs reflecting their limited starts or run hours. However, this option does not provide the ability to reflect current daily natural gas prices in commitment cost bids which can result in the inefficient commitment of resources.
- The "proxy cost option" allows market participants to submit daily bids up to 125 percent of costs calculated by the ISO using a daily gas price index. This option results in a more efficient resource commitment, and better ensures cost recovery, because it more accurately reflects current natural gas costs.

### **Proposed changes**

Management proposes several market enhancements to ensure both the ISO and market participants have the ability to accurately reflect costs in the market. These enhancements will improve efficient resource commitments, optimally commit use-limited resources, and provide more effective risk management tools while maintaining reliability.

#### ***Use-limited resources***

Management proposes that use-limited resources will be eligible for a calculated opportunity cost to include in their daily commitment cost bids, which will allow the market to recognize their use limitations that extend over a longer period of time than the daily markets, such as annual limitations. This will allow the ISO to eliminate the "registered cost" option for bidding resource commitment costs, which is an inefficient means of reflecting these costs in the market.

Use-limited resources have start and run limitations due to environmental or other operational restrictions. These restrictions extend beyond a one-day period, and therefore cannot be explicitly recognized in the ISO market commitment decision. For example, an environmental restriction may limit a resource's run time over a single month to only 200

hours. However, the ISO's day-ahead market only considers a single day. The ISO's optimization does not currently take into account that dispatching a resource in the current day may restrict its ability to run later in the month. When the resource runs in lower-priced hours, it incurs an opportunity cost to the extent it is not available in higher priced hours.

Including opportunity costs in commitment costs, however, can allow the ISO market to optimally commit these resources by considering the limitations that extend beyond a single day, such as over a month or a year. The ISO will determine resource-specific opportunity costs for limitations of use-limited resources by modelling the market commitment of these resources based on projected locational marginal prices. The ISO will update these opportunity costs monthly throughout the year to reflect the each resource's actual commitment by the market.

In conjunction with this enhancement, Management proposes to change the definition of "use-limited resource" to specify that these are resources that need an opportunity cost to have their commitment optimized through the market. Other resource types that in the past were considered "use-limited" but are not fully available at all times, such as variable energy resources and demand response resources, will continue to be exempt from the ISO's automatic bid insertion that use-limited status previously provided them.

The Board approved similar revisions to the "use-limited resource" definition last year. At that time, Management clarified that the proposed and existing interpretation of the "non-economic" limitations that would qualify a resource to be use-limited did not include purely contractual limitations. Notwithstanding, Management also committed to exploring appropriate solutions for market participants to manage resources' contractual limitations. However, FERC rejected the ISO's proposed revised definition of "use-limited resource" primarily on the basis that there was a lack of clarity concerning the term "non-economic" as it applies to limitations, a term in the existing definition. Management worked with stakeholders to further clarify the "use-limited resource" definition for this proposal.

The revised definition continues to exclude contractual limitations as the basis for a resource to be considered use limited and qualify for opportunity costs in their commitment cost bid cap. Management maintains its longstanding position that economic limits like those originating from contracts, such as power purchasing or tolling agreements, are not acceptable limitations for establishing an opportunity cost adder to a resource's commitment cost bid cap. These limitations exist not as a result of restrictions imposed by external statutes or regulations, but rather reflect economic trade-offs made by the contracting parties. If the ISO were to accept contractual limitations to deem a resource eligible for an opportunity cost, it would provide market participants the ability to both physically and economically withhold resources from the market while bypassing the market power mitigation processes in place. This in turn could lead to market inefficiencies and market power concerns that would go unmitigated.

However, Management recognizes that long-term contracts that were approved through a robust regulatory process, prior to initial discussions of the ISO allowing opportunity costs for

such limitations, would not reflect attempts to exercise market power. Management proposes a limited exception of contractual limitations that meet specified criteria for a three-year transitional period. Management proposes limitations in long-term contracts that have been approved by a local regulatory authority, such as the California Public Utilities Commission, and were entered into prior to January 1, 2015, can qualify for the temporary exemption. Given the uncertainty of the quantity of capacity that will be captured by the provision, and increasing flexibility needs of the markets, Management cannot fully assess the market impacts of extending the provision beyond three years at this time. However, Management does commit to evaluate, prior to the end of the three year period, potential market and reliability impacts if the provision were to be extended at that time. Moreover, as discussed further below, Management's proposal to allow market participants to reflect preferred operating values for certain resource characteristics, instead of mandating that they reflect physical operating limits, will allow market participants to manage contractual limitations that do not fall under this exception.

Finally, the proposed changes related to use-limited resources and demand response resources will consider these resources under the resource adequacy availability incentive mechanism starting the beginning of the subsequent month after reaching a use limitation.<sup>1</sup> This enhancement will help to ensure that all resources offered as resource adequacy resources are available for dispatch.

### ***Resource characteristics***

The tariff currently requires resource characteristics submitted to the ISO's master file used by the market to reflect only actual physical limitations. However, Management realizes that market participants may want the market optimizations to consider resource characteristics that are based on other considerations such as avoiding excessive wear and tear of the resource or operating within contractual limitations.

Management proposes to provide generators flexibility to reflect these preferred resource characteristic values by adding an additional market field in the master file for certain characteristics, in addition to the existing field that will continue to reflect purely physical characteristics. These resource characteristics include maximum daily starts, maximum multi-stage generator daily transitions, and ramp rates. In conjunction with this change, market participants will no longer be able to specify ramp rates in energy bids.

The preferred operating values will be used in the market under normal system conditions while the purely physical capability limits will only be accessed by operations manually under stressed system conditions for an exceptional dispatch.

Finally, to address concerns regarding potential market power and anomalous effects in the real-time market, resources will be restricted from submitting less than two starts per day as

---

<sup>1</sup> The resource adequacy availability incentive mechanism penalizes or rewards resources based on their performance in meeting their resource adequacy must offer obligations.

a preferred resource characteristic unless the resource is only physically capable of one start per day. There will be an exception process for resources nearing the end of their life for which limiting starts to once per day is reasonable. It is desirable for the real-time market to be able to start resources twice a day because the real-time market optimization only looks out four and a half hours and may start a resource for the morning peak that is also needed for the evening peak.

### ***Recovery of commitment costs that exceed the commitment cost bid cap***

Market participants have pointed out that, although very infrequent, sometimes actual natural gas prices exceed the ISO's calculated commitment cost bid cap. To address this issue, Management proposes to add tariff provisions that will allow market participants to seek after-the-fact FERC approval of actually incurred commitment costs that exceed the bid cap. The ISO would then reimburse the FERC-approved costs through its bid cost recovery mechanism. As a result, the market participant would only be reimbursed for these costs to the extent the resource had a net revenue shortfall over the day, considering its total market revenue.

FERC would apply its just and reasonable standard to determine whether the market participant reasonably incurred commitment costs that exceeded the bid cap to meet an ISO dispatch instruction. Management proposes that FERC conduct this review because having the ISO perform this function is not practical, as it would require establishing specific, objective criteria for such a reimbursement, for which it is not reasonable to enumerate all potential situations before-the-fact. Also, determining incurred costs would require visibility to a market participant's full portfolio of natural gas transactions and hedging mechanisms that FERC has a greater ability to obtain.

### ***Real-time market commitment cost bidding***

Currently, market participants don't have the ability to reflect the most recent natural gas prices in the real-time market if they bid the resource into the day-ahead market. Resources are locked into their day-ahead commitment cost bids when bidding in the day-ahead market even if the resource had not received a day-ahead schedule. Management proposes to allow resources without a day-ahead schedule to update their commitment cost bids for use in the real-time market to better reflect current costs.

Management also proposes to clarify the tariff so the real-time market's short-term unit commitment process no longer automatically uses day-ahead commitment cost bids in the real-time market for non-resource adequacy resources or resource adequacy resources without a real-time market offer obligation.

### ***Changes to natural gas transportation rates and auxiliary energy electricity price***

Finally, Management proposes various changes to improve the accuracy of natural gas transportation rates and generator auxiliary energy electrical processes used to calculate

resources' costs used in commitment cost caps and default energy bids used by the market. This includes creating a process for market participants to request an additional fuel region to include a gas transportation rate, including costs and credits, more representative of expected resource-specific costs based on the geographic location of the resource and whether the resource has a greenhouse gas compliance obligation. These changes will also introduce a process for estimating resource-specific start-up auxiliary power costs.

## **POSITIONS OF THE PARTIES**

Management has worked with stakeholders to develop the opportunity cost methodology over the past three years. Although most stakeholders support the opportunity cost concept, several concerns remain regarding the details of its implementation and the "use-limited resource" definition. Of particular concern is Management's position that the proposed "use-limited resource" definition does not include contractual limitations. In addition, a number of stakeholders oppose Management's proposal to require market participants to list at least two maximum daily starts for a resource in the master file preferred operating characteristics field unless the resource physically is only capable of one daily start.

Concerns regarding the opportunity cost implementation details mostly revolve around whether the modeled opportunity costs will be correct and not lead to a resource's maximum starts or run hours being used up before the end of the year. Management has responded to this concern by incorporating a "buffer" in the way the opportunity cost model will model resources. Also, Management added provisions that allow a market participant to temporarily declare a resource unavailable without incurring penalties under the resource adequacy availability incentive mechanism in the event the market is using a resource more frequently than anticipated by the opportunity cost model. Management believes that these provisions provide significant safeguards to ensure the opportunity cost is implemented in a way that will effectively manage resource use limitations.

Some stakeholders are concerned about the "use-limited resource" definition because it would not provide default use-limited status to storage, demand response, and hydro resources. Stakeholders expressed similar concerns when the Board approved changes to the definition last year. Management has explained that resources no longer deemed use limited by default can still qualify to be use limited if they meet the revised criteria. Management has also explained that the new definition for use-limited resources will not impact these resources, as they have other tools to reflect their use limitations and furthermore do not have start-up and minimum load commitment costs that could potentially need an opportunity cost adder.

Some stakeholders contend that Management's proposal to restrict resources from submitting less than two starts per day as a preferred resource characteristic conflicts with the resource adequacy flexible capacity requirements that allow a portion of the flexible

capacity requirement to be met by resources with one start per day. First, Management does not believe this is inconsistent with the flexible capacity requirements that were designed to accommodate resources with a physical start limitation of one per day. Under the current market provisions, resources are required to accurately submit their full physical start limitations regardless of the resource adequacy product they are shown to provide. Therefore, Management's proposal provides increased flexibility in reflecting start limitations. Next, the flexible resource adequacy requirements do not consider market power impacts or the potential interaction with the real-time market outlined earlier in this memorandum in which the real-time market's four and a half hour look ahead may start a resource for the morning peak that is also needed for the evening peak.

Some stakeholders are concerned that Management's proposal for a limited exception for contractual limitations does not go far enough. They would like to see the exception cover the full term of the contract. Management believes that the three year transition period, which was originally proposed by the California Public Utilities Commission, is appropriate as it provides stakeholders time to modify the contractual terms to better align with the ISO's market design and the flexibility needs of the system.

A stakeholder comment matrix is included as Attachment A. The Market Surveillance Committee provided a formal opinion on Management's proposals and is included as Attachment B. The Department of Market Monitoring provided comments in their Market Monitoring Report which is included in the informational reports of the March Board materials.

## **CONCLUSION**

Management requests Board approval of the proposal discussed above. The proposed changes will result in more efficient resource commitments, ensure generators are adequately compensated for their commitment costs, and enable more frequent, consistent participation from resources with external limitations all while improving system reliability.

**Attachment F – List of Key Stakeholder Dates**  
**Commitment Cost Enhancements Phase 3**  
**California Independent System Operator Corporation**

**List of Key Dates in the Stakeholder Process for this Tariff Amendment**

<b>Date</b>	<b>Event/Due Date</b>
July 20, 2015	CAISO hosts stakeholder technical workshop that includes presentation entitled “Commitment Cost Enhancements Phase 3 (CCE3)”
July 30	Due date for written stakeholder comments on July 20 technical workshop
August 24	CAISO issues paper entitled “Commitment Cost Enhancements Phase 3 – Straw Proposal”
August 31	CAISO hosts stakeholder conference call that includes discussion of paper issued on August 24 and presentation entitled “Commitment Cost Enhancements Phase 3 (CCE3) – Straw Proposal”
September 8	Due date for written stakeholder comments on paper issued on August 24
November 3	CAISO issues paper entitled “Commitment Cost Enhancements Phase 3 – Revised Straw Proposal”
November 9	CAISO hosts stakeholder conference call that includes discussion of paper issued on November 3 and presentation entitled “Commitment Cost Enhancements Phase 3 – Revised Straw Proposal”
November 23	Due date for written stakeholder comments on paper issued on November 3
February 17, 2016	CAISO issues paper entitled “Commitment Cost Enhancements Phase 3 – Draft Final Proposal”
February 25	CAISO hosts stakeholder conference call that includes discussion of paper issued on February 17 and presentation entitled “Commitment Cost Enhancements Phase 3 (CCE3) – Draft Straw Proposal”
March 2	Due date for written stakeholder comments on paper issued on February 17
April 22	CAISO issues paper entitled “Commitment Cost Enhancements Phase 3 Opportunity Cost Methodology – Technical Appendix”
May 13	Due date for written stakeholder comments on paper issued on April 22
June 15	CAISO hosts stakeholder technical workshop that includes presentation entitled “Commitment Cost Enhancements Phase 3 Board Follow-Up Workshop”
June 24	CAISO issues paper entitled “CCE3 Workshop – Issues Matrix and Next Steps”
July 6	Due date for written stakeholder comments on June 15 technical workshop and paper issued on June 24



<b>Date</b>	<b>Event/Due Date</b>
July 27	CAISO hosts stakeholder technical workshop that includes presentation entitled “Commitment Cost Enhancements Phase 3 Board Follow-Up Workshop”
August 5	CAISO issues paper entitled “CCE3 July 27 <sup>th</sup> Workshop – Issues Matrix and Next Steps”
August 10	Due date for written stakeholder comments on June 15 and July 27 technical workshops and paper issued on August 5
November 11	CAISO issues paper entitled “Commitment Cost Enhancements Phase 3 – Action Plan”
November 17	CAISO hosts stakeholder conference call that includes discussion of paper issued on November 11
November 18	CAISO issues paper entitled “Commitment Cost Enhancements Phase 3 – Action Plan Version 2”
November 29	Due date for written stakeholder comments on paper issued on November 18
July 31, 2017	CAISO issues draft tariff revisions to implement commitment cost enhancements phase 3 changes, and paper entitled “Summary of Topics Addressed in Draft Commitment Cost Enhancements Phase 3 Tariff Changes”
August 10	Due date for written stakeholder comments on draft tariff revisions issued on July 31
August 17	CAISO hosts stakeholder conference call that includes discussion of draft tariff revisions issued on July 31
December 5	CAISO issues modified version of draft tariff revisions
December 19	Due date for written stakeholder comments on modified draft tariff revisions issued on December 5
January 3, 2018	CAISO hosts stakeholder conference call that includes discussion of modified draft tariff revisions issued on December 5
March 7	CAISO issues further modified version of draft tariff revisions
March 17	CAISO hosts stakeholder conference call that includes discussion of further modified draft tariff revisions issued on March 7