California Independent
System Operator Corporation

June 5, 2015

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

Re: California Independent System Operator Corporation
Docket No. ER15- ___-000

Tariff Amendment to Update Provisions on Transition Costs for Multi-Stage Generating Resources and Use-Limited Resources, and Request for Waiver of Notice Requirements

Dear Secretary Bose:

The California Independent System Operator Corporation ("CAISO") submits this tariff amendment as the latest in a series of improvements the CAISO has made to its "commitment cost" tariff mechanisms providing for the recovery of costs by generating resources participating in its markets. The purpose of this specific amendment is two-fold: (1) to simplify the provisions regarding the calculation and bidding of transition costs for multi-stage generating resources and align these provisions with other existing commitment cost mechanisms; and (2) to narrow and clarify the definition applicable to "use-limited" resources and modify and relocate the tariff provision addressing the registration process for resources with use-limited capacity.[1]

The CAISO requests that the Commission accept the proposed tariff revisions relating to transition costs effective as September 15, 2015, and respectfully requests that the Commission grant waiver of its notice requirements to accept the proposed tariff provisions relating to use-limited resources effective as of March 1, 2016. The CAISO also respectfully requests that the Commission issue an order on this filing by no later than September 5, 2015.

[1] The CAISO submits this filing pursuant to section 205 of the Federal Power Act, 16 U.S.C. § 824d. Capitalized terms not otherwise defined herein have the meanings set forth in the CAISO tariff. References to numbered sections are references to sections of the CAISO tariff unless otherwise indicated.

I. Executive Summary

During the past several years, the CAISO has engaged in a process of incrementally improving its commitment cost tariff mechanisms.[2] The purpose of this tariff amendment is: (1) to simplify and align with other commitment cost mechanisms the process for calculating and bidding transition costs, which are incurred by multi-stage generators when transitioning between configurations; and (2) to narrow and clarify the definition applicable to "use-limited" resources.

A multi-stage generating ("MSG") resource differs from other types of generating resources in that it can operate in various MSG configurations and incurs transition costs to move from one MSG configuration to a higher MSG configuration.[3] Fundamentally, transition costs are a type of start-up costs specific to MSG configurations. Under the current tariff, start-up costs are calculated and bid into the market depending on a resource's use of the proxy or registered cost methodology.[4] Transition costs, on the other hand, are calculated the same way for resources under both the proxy and registered cost methodologies, using a methodology that is different from either the proxy or registered cost methodology for start-up costs. The CAISO therefore proposes to align the calculation and bidding of transition costs with start-up costs to the extent possible, based on the existing proxy cost and registered cost

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[2] *See California Independent System Operator Corp.*, 128 FERC ¶ 61,282, at PP 26-30 (2009) (accepting various tariff revisions to "provide resource owners the needed flexibility to choose the option that best enables recovery of their start-up and minimum load costs"); *California Independent System Operator Corp.*, 134 FERC ¶ 61,257, at PP 4, 23-24, 26 (2011) (accepting tariff revisions to "further increase resource owners' flexibility in choosing between the options available to recover start-up and minimum load costs by allowing a resource to select a different recovery option for each type of cost and by introducing a daily bid option"); *California Independent System Operator Corp.*, 141 FERC ¶ 61,237 (2012) (conditionally accepting tariff revisions that allow resources to recover greenhouse gas compliance costs in their commitment costs, default energy bids, and generated bids); *California Independent System Operator Corp.*, 145 FERC ¶ 61,082 (2013) (accepting tariff revisions to include additional categories of costs eligible for inclusion in proxy cost calculations for start-up and minimum load costs, default energy bids, and generated bids); *California Independent System Operator Corp.*, 149 FERC ¶ 61,284 (2014) (discussed in footnote 5.).

[3] A "higher" MSG configuration is one that allows the generator to produce more electrical power.

[4] Under the proxy cost methodology, scheduling coordinators may submit daily start-up cost bids that are up to 125 percent of the CAISO's daily estimated start-up costs based on each generator's physical characteristics and a daily natural gas price index. Under the registered cost methodology, scheduling coordinators may submit start-up cost bids that are fixed for the month for up to 150 percent of the CAISO's estimated start-up costs based on each generator's physical characteristics and natural gas futures prices for the month.

methodologies and the cost caps that the Commission recently approved.[5] These tariff revisions will increase market efficiency because start-up and transition costs will be calculated in more similar manners, and will simplify the calculation and bidding of transition costs and provide more clarity for market participants.

The CAISO tariff currently defines a use-limited resource as a resource unable to operate continuously due to non-economic reasons.[6] Although it is proposing changes to the definition, the CAISO is not proposing any change to the fundamental core of the definition that use limits must be non-economic in nature. First, the CAISO proposes to change the name of the defined term from "Use-Limited Resource" to "Use-Limited *Capacity*" to recognize that a resource may not be use-limited at all times or that only some of its capacity may be use-limited. Second, the CAISO proposes to provide further clarifying details concerning the non-economic bases for qualifying capacity as use-limited. Third, the CAISO proposes to narrow the definition of use-limited capacity to include only capacity that cannot be optimized by the CAISO without considering opportunity costs. Wind and solar resources, for example, are limited in their fuel sources but have no opportunity costs, and thus will no longer be considered use-limited.[7] This change recognizes that if a resource has the ability to include an opportunity cost in its energy bid, then it should be able to bid in all hours. Fourth, the CAISO proposes to move the tariff provisions regarding registration of use-limited capacity from section 40 of the CAISO tariff, which is dedicated solely to resource adequacy, to a more appropriate location in the tariff that also addresses MSG and constrained output generator registration processes, and to streamline and clarify those provisions.

The CAISO Market Surveillance Committee and the Department of Market Monitoring both generally supported the revisions proposed in this tariff amendment. Stakeholders generally supported the tariff revisions or supported them with qualifications. Although the proposed definition of "use-limited"

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[5] *California Independent System Operator Corp.*, 149 FERC ¶ 61,284 (accepting tariff revisions to increase proxy cost bid cap, eliminate registered cost option for resources other than use-limited resources, and include in the tariff the use of updated natural gas price data in the event of a spike in natural gas prices).

[6] Use-limited resources are eligible for the registered cost option, which allows scheduling coordinators to register start-up and minimum load costs of up to 150 percent of projected proxy costs. Use-limited resources that are also resource adequacy resources have a must-offer obligation that takes into account their use limits and the CAISO does not generate must-offer bids for energy and ancillary services.

[7] These resources will continue to be exempted from the CAISO's resource adequacy bid insertion rules pursuant to the tariff amendment to implement phase 1A of the reliability services initiative ("RSI"), which the CAISO filed on May 29, 2015 in Docket No. ER15-1825-000 ("May 29 RSI Tariff Amendment").

narrows the categories of eligible capacity, some stakeholders expressed the position that contract limits should qualify as use-limited. As discussed below, the CAISO's existing definition of use-limited does not allow economic limitations, including contract-based limits, to qualify a resource for use-limited status. The CAISO is not proposing to change this longstanding result in the revised definition of use-limited. Therefore, this concern is beyond the scope of the CAISO's proposed changes. No stakeholder raised concerns about the tariff revisions regarding transition costs of MSG resources.

II. Background

A. CAISO Tariff

1. Multi-Stage Generating Resources and Transition Costs

An MSG resource differs from other types of generating resources in that it can operate in various MSG configurations, with only one MSG configuration operating in any given dispatch interval.[8] Each MSG configuration is a qualified and registered operating mode of an MSG resource with a distinct set of operating characteristics.[9] The operating characteristics include whether the MSG configuration can be directly started (*i.e.*, is "startable") or cannot be directly started (*i.e.*, can only be started by moving from another MSG configuration to the indirectly started MSG configuration). Each MSG configuration is treated as a distinct generating plant whose operation is mutually exclusive of the other MSG configurations.

The costs the CAISO market considers when making commitment decisions (*i.e.*, commitment costs) include the costs of starting up resources (start-up costs) and the costs of running resources at their minimum operating levels (minimum load costs).[10] Like other types of resources, MSG resources are subject to either the proxy cost methodology or the registered cost methodology for determining their start-up or minimum load costs. Each methodology includes a cap on such costs to mitigate potential market power concerns.

In addition to start-up and minimum load costs, MSG resources can also incur transition costs, which are the costs associated with moving to a higher MSG configuration. Transition costs are a type of start-up cost, in that transition

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[8] Tariff appendix A, definition of "Multi-Stage Generating Resource." The definition also sets forth technical characteristics that qualify a generating resource as an MSG resource.

[9] Tariff appendix A, definition of "MSG Configuration."

[10] Tariff sections 31.3; tariff appendix A, definitions of "Start-Up Cost" and "Minimum Load Costs."

costs are the costs incurred to "start" an MSG configuration, when moving to a higher configuration. A MSG resource does not incur transition costs when it moves to a lower MSG configuration, just as it does not incur plant-level start-up costs when the entire plant shuts down. The CAISO uses the term transition costs to indicate the costs associated with a change in MSG configuration when an MSG resource is already on, as opposed to the plant-level start-up costs an MSG resource incurs when the resource starts up after being off.

Despite the analogy between transition costs and start-up costs, under the existing tariff, transition costs are treated differently from start-up costs. Currently, scheduling coordinators for MSG resources register their transition costs and the CAISO validates those costs by applying rules specific to such costs in the bid validation process. The CAISO market then scales these transition costs each day based on a daily gas price index. Similar to the registered cost methodology, once accepted by the CAISO, the transition costs submitted by scheduling coordinators apply for a minimum of 30 days. Start-up costs, on the other hand, are calculated and bid based on whether a resource is under the proxy or registered cost methodology.

2. Use-Limited Resources

The CAISO tariff 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. 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.

Pursuant to the first sentence of this definition, a resource can achieve use-limited status only if it is unable to operate continuously due to non-economic reasons. For example, a resource subject to a contract that economically limits its participation in the CAISO markets is not within the definition of a use-limited resource, because the reason is economic, rather than non-economic. The last two sentences of the definition simply indicate that use-limited resources may or may not be resource adequacy resources. In other words, the concept of use-limited is independent of whether the resource is or is not a resource adequacy resource under the CAISO tariff.

The existing tariff provisions regarding resource adequacy also address registration of use-limited resources. Section 40.6.4.1 states that hydroelectric generating units, proxy demand resources, reliability demand response resources, and participating load, including pumping load, are deemed to be use-

limited resources and are not required to apply for use-limited status. Scheduling coordinators for other types of resources may request that the CAISO grant use-limited status for such resources pursuant to the application process set forth in the tariff provisions.

B. Stakeholder Process

In November 2014, the CAISO initiated the stakeholder process that resulted in this tariff amendment, called Commitment Cost Enhancements Phase 2.[11] The stakeholder process included:

- A series of three papers issued by the CAISO;
- The development of draft tariff provisions;
- Four stakeholder conference calls to discuss the CAISO papers and the draft tariff provisions; and
- Four opportunities for stakeholders to submit written comments on the CAISO papers and the draft tariff provisions.[12]

The CAISO Governing Board ("Board") authorized the preparation and filing of this tariff amendment at its March 26-27, 2015, meeting.[13]

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[11] The Commitment Costs Enhancements Phase 1 stakeholder initiative was completed earlier in 2014 and culminated in the Commission's acceptance of the tariff revisions coming out of that initiative. See *California Independent System Operator Corp.*, 149 FERC ¶ 61,284. A new stakeholder initiative, Commitment Costs Enhancements Phase 3, will begin later in 2015 to address the development of an opportunity cost model and additional, minor issues not addressed in Phase 2. The CAISO currently expects to file any tariff revisions coming out of Phase 3 in late 2015 or early 2016.

[12] Materials relating to this stakeholder process are available on the CAISO website at http://www.caiso.com/informed/Pages/StakeholderProcesses/CommitmentCostEnhancementsPhase2.aspx. The materials include the Commitment Cost Enhancements Phase 2 Draft Final Proposal (Feb. 9, 2015) ("Draft Final Proposal"), which is provided in attachment C to this filing. A list of key dates in the stakeholder process for this tariff amendment is provided in attachment G to this filing.

[13] Materials related to the Board's authorization to prepare and submit this filing are available on the CAISO website at http://www.caiso.com/informed/Pages/BoardCommittees/Default.aspx. The materials include a memorandum to the Board from Keith Casey, Vice President, Market and Infrastructure Development (Mar. 19, 2015) ("Board Memorandum"), which is provided in attachment D to this filing.

The CAISO's Market Surveillance Committee and the Department of Market Monitoring ("DMM") both generally supported the revisions proposed in this tariff amendment.[14] Stakeholders generally supported the tariff revisions or supported them with qualifications. The CAISO addresses the concerns raised by stakeholders with respect to the definition of use-limited capacity in Section III.B of this transmittal letter. No stakeholder raised an issue regarding the tariff revisions on the calculation and bidding of transition costs for MSG resources.

III. Proposed Tariff Revisions

A. Revisions Regarding Transition Costs of MSG Resources

In the Commitment Cost Enhancements Phase 2 initiative, the CAISO and stakeholders determined that the tariff should be revised to align the calculation and bidding of transition costs and start-up costs to the extent possible. These revisions will increase market efficiency because start-up and transition costs will be calculated in more similar manners, and will simplify the calculation of transition costs and provide more clarity for market participants. Moreover, as DMM notes, the revisions address recommendations that DMM has reiterated in each of its last three annual reports.[15]

To align the definition of transition cost with the CAISO's proposed changes as to how transition costs are actually calculated, the CAISO proposes to clarify that transition cost means the non-negative dollar cost per feasible transition from a given MSG configuration to a higher MSG configuration when the resource is already on.[16] The CAISO also proposes to revise its tariff to permit each MSG resource to bid transition costs pursuant to the methodology – proxy cost or registered cost – that applies to the start-up costs of the resource.[17]

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[14] *See* Department of Market Monitoring memorandum to the Board from Eric Hildebrandt, Direct, Market Monitoring (Mar. 19, 2015) ("DMM Memorandum"); Final Opinion on Reliability Services Phase 1 and Commitment Cost Enhancements Phase 2 issued by the Market Surveillance Committee (Mar. 23, 2015) ("MSC Final Opinion"). These documents are available on the CAISO website at http://www.caiso.com/informed/Pages/BoardCommittees/Default.aspx and are provided in attachments E and F, respectively, to this filing.

[15] DMM Memorandum at 3-4. *See, e.g.*, 2013 Annual Report on Market Issues & Performance at 262-63 (Apr. 2014) (recommending that the CAISO revise the caps for transition cost bids). The DMM's annual reports are available on the CAISO website at https://www.caiso.com/market/Pages/MarketMonitoring/MarketIssuesPerfomanceReports/Default.aspx.

[16] Tariff appendix A, revised definition of "Transition Cost." The revisions to the definition of transition cost consists of the underlined additions shown above.

[17] Revised tariff section 30.4. The scheduling coordinator for a use-limited MSG resource must make the same election (proxy cost methodology or registered cost methodology) for transition costs as it makes for start-up costs. *Id.*

As a result, transition costs will now be subject to tariff provisions comparable to the existing provisions used to calculate, validate, bid, and cap start-up costs under the proxy cost and registered cost methodologies. This means, however, that the scheduling coordinators for MSG resources must align their election of transition cost to match their election for start-up costs. That is, scheduling coordinators under the proxy methodology for start-up costs will be subject to the proxy methodology for transition costs and scheduling coordinators for use-limited resources that can elect either proxy or registered start-up costs will be subject to the same election for transition costs.

1. Transition Costs Under the Proxy Cost Methodology

For an MSG resource subject to the proxy cost methodology, the CAISO will calculate the transition costs used for each feasible transition from a given MSG configuration to a higher MSG configuration based on cost information provided by the scheduling coordinator and 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 calculation of start-up costs under the proxy cost methodology. If the result of this calculation is negative for any transition between MSG configurations, then the associated transition cost will be zero.[18] This simplified means of calculating transition costs reflects the revised definition of transition cost discussed above.[19] Due to these proposed changes for calculating transition costs under the proxy cost methodology and the proposed changes to transition costs for the registered cost methodology discussed below, the CAISO proposes to delete the existing tariff language regarding the calculation of transition costs.[20]

Similar to the existing tariff provisions regarding start-up costs, the CAISO will use the transition proxy costs it calculates in the CAISO markets processes unless the scheduling coordinator submits daily bids for transition costs that are less than or equal to 125 percent of the transition costs calculated by the CAISO and are not negative, in which case the CAISO will use those transition costs in the CAISO markets processes.[21]

As with start-up and minimum load costs generally, if a scheduling coordinator for an MSG resource does not provide sufficient data for the CAISO

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[18] New tariff section 30.4.1.1.5.

[19] Pages 22-27 of the Draft Final Proposal provide illustrative examples of the calculation of transition costs for gas-fired and non-gas-fired resources under the new calculation methodology.

[20] Deleted tariff section 30.4.2.

[21] New tariff sections 30.4.1.1.5 and 30.7.9(c).

to determine proxy start-up and minimum load costs, or the components of such costs, for the lowest startable configuration, the CAISO will assume that such costs are zero.[22] The CAISO also proposes to revise the tariff to state that if the scheduling coordinator for an MSG resource does not provide sufficient data for the CAISO to determine a component of the proxy costs for a particular MSG configuration other than in its lowest startable configuration, the CAISO will, if feasible, use the value for that component associated with the next-lowest MSG configuration.[23]

These tariff revisions are just and reasonable because they apply the existing cap to proxy bids that applies to start-up and minimum lost proxy bids. In this regard, the CAISO is simply extending the existing Commission approved policy to transition costs. In addition, if the proposed tariff revisions will allow the CAISO to use the component value from the next-lowest configuration if the scheduling coordinator failed to provide that information for the higher configuration, without requiring the CAISO to assume that the missing component value is zero.[24]

2. Transition Costs Under the Registered Cost Methodology

The CAISO proposes to revise its tariff to clarify that a scheduling coordinator for an MSG resource that has use-limited capacity registering a start-up costs under the registered cost methodology must also register transition costs for each feasible MSG transition, subject to the 150-percent cap discussed below.[25]

The CAISO's tariff revisions specify that the maximum start-up cost and minimum load cost values registered in the master file for capacity of an MSG resource will be limited to 150 percent of the projected proxy cost for each MSG configuration of the resource.[26] As explained above, each MSG configuration is

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[22] Revised tariff sections 30.4.1.1.1, 30.4.1.1.2. The CAISO will generally attempt to obtain additional information from a scheduling coordinator before assuming the relevant cost, or cost component, is zero.

[23] Revised tariff section 30.4.1.1.3.

[24] If the missing component value is for the lowest startable configuration, the CAISO will assume the value is zero, consistent with the existing language generally applicable to all resources, as set forth in sections 30.4.1.1.1 and 30.4.1.1.2.

[25] Revised tariff section 30.4.1.2(a). The CAISO also clarifies that the cap for each MSG configuration will be based on values that include those for each MSG configuration that cannot be directly started. *Id.*

[26] Revised tariff section 39.6.1.6.

treated as a distinct generating plant whose associated transition costs are a type of start-up costs. Therefore, it is just and reasonable to apply the existing 150-percent registered cost cap applicable to start-up costs to the transition costs for each MSG configuration.

Consistent with this approach, the CAISO also proposes to specify that a scheduling coordinator representing an MSG resource under the registered cost methodology must register with the CAISO transition costs for each feasible transition between a lower MSG configuration and a higher MSG configuration between zero and a maximum of 150 percent of the difference between the projected proxy cost for the start-up costs for the higher MSG configuration, minus the projected proxy cost for the start-up costs for the lower MSG configuration. If the result of this calculation is negative for any transition between two MSG configurations, the associated transition cost will be zero.[27]

Further, the CAISO will not make a separate determination for transition costs regarding whether a spike in natural gas prices triggers the calculation of an alternative natural gas price for a resource subject to the registered cost methodology, but if a gas price spike triggers a switch from registered to proxy based on start-up costs, the transition costs will also be switched to that methodology.[28]

B. Revisions Regarding Use-Limited Capacity

The CAISO proposes to modify the tariff definition of a use-limited resource in several respects, while still retaining the existing core concept of "use-limited" that has been in place for many years.[29]

First, the CAISO proposes to change the name of the defined term to "use-limited capacity." This definitional change recognizes that only a portion of a resource's capacity may be use-limited. For example, some air permits limit a resource's run time only during the summer months. Therefore, such a resource would have use-limited capacity during the summer but not during the other seasons.

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[27] New tariff section 39.6.1.7.

[28] Revised tariff section 30.4.1.2(b).

[29] In addition, as explained above, the Commitment Costs Enhancements Phase 3 will address the development of an opportunity cost model. Further, the May 29 RSI Tariff Amendment includes proposed tariff revisions regarding use-limited resources and an availability incentive mechanism.

The CAISO also proposes to add additional detail to the definition to clarify the definition of use-limited capacity:

> Capacity with limitations or restrictions on its operation established by statute, regulation, ordinance, court order, design considerations, or other non-economic reasons, that cannot be optimized by the appropriate CAISO commitment process without considering opportunity costs.

The first sentence of this revised definition clarifies the existing requirement that use-limited status cannot be based on limitations that are economic in nature, by stating that the limitations or restrictions on the operation of the capacity must be established by statute, regulation, ordinance, court order, design considerations, or other non-economic reasons. Moreover, the revised definition specifies that these limitations cannot be optimized by the appropriate CAISO commitment process without allowing for opportunity costs. Opportunity costs more accurately reflect the characteristics of use-limited capacity and justifies the right to bid up to 150% of projected proxy costs.

For example, an environmental restriction may limit a resource's run time over a single month to only 200 hours. However, the CAISO market optimization only considers a single day for economic commitment. Currently, the market optimization does not take into account that dispatching the capacity of a resource during the current day may restrict the resource's ability to run later in the month. So long as it is economically beneficial from a market-optimization standpoint to continue to dispatch the resource's capacity, the market optimization could potentially keep the resource on for 200 hours consecutively rather than dispatching it in the 200 hours during the month when prices and system need are the highest unless the resource's bids appropriately reflect the opportunity costs associated with dispatching it during particular times.

In contrast, variable energy resources (*e.g.*, wind-powered and solar-powered resources) do not have opportunity costs, although they are likely unable to operate continuously and should not be eligible to bid up to 150% of proxy costs. As a result, variable energy resources will no longer be considered use-limited capacity. Variable energy resources with their intermittent fuel (or energy) sources do not have opportunity costs because their ability to generate does not need to be, and cannot be, reserved for the most profitable hours. Likewise, regulatory must-take capacity will no longer be considered use-limited capacity because the availability of such capacity is dictated by contract obligations with its interconnected utility and/or commitments to its host utility, which cannot be quantified as opportunity costs in the CAISO optimization. However, the May 29 RSI Tariff Amendment will continue to exempt these

resources with resource adequacy capacity from the CAISO tariff's bid insertion rules even though these resources no longer qualify as use-limited.[30]

The CAISO is also proposing to delete the last two sentences of the definition. It is no longer necessary to explicitly clarify that use-limited capacity is not limited to resource adequacy capacity because the CAISO is moving the use-limited registration process from the resource adequacy section (section 40) to the more general CAISO markets and processes section (section 27) of the CAISO tariff.[31]

Some stakeholders stated that the CAISO should allow contractual limitations as a basis, at least for a limited "transition period," for obtaining use-limited status for certain resources because they have signed power purchase agreements with start-up limitations regarding those resources. These stakeholders have argued alternatively that contract limits should be eligible for opportunity costs, on the one hand, and that these limits justify being exempt from the must-offer bid-insertion rule applicable to non-use-limited resource adequacy resources, on the other hand. As the CAISO explained in the stakeholder process, the CAISO's current tariff definition of use-limited resource explicitly refers to "non-economic" reasons, and therefore does not permit economic reasons such as contract-based limitations to be used as the basis for obtaining use-limited status.[32] The CAISO has consistently applied this rule. The revised definition of use-limited capacity does not change this outcome or the CAISO's longstanding practice, but merely adds clarity as to what constitutes "non-economic reasons limitations". Therefore, this concern has no relevance to the CAISO's present proposal.[33] Further, the CAISO's definition prohibiting

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[30] Specifically, in the May 29 RSI Tariff Amendment, the CAISO proposes to revise tariff section 40.6.8, which addresses the use of generated bids, to state that the CAISO will not insert any bid in the day-ahead market or real-time market required under tariff section 40 for resource adequacy capacity of a use-limited resource, non-generator resource, variable energy resource, or resource providing regulatory must-take generation unless the resource submits an energy bid and fails to submit an ancillary service bid.

[31] *See* new tariff section 27.11. The CAISO has also revised several tariff sections in this filing to reflect the term use-limited capacity superseding the term use-limited resource. Following Commission acceptance of these tariff revisions to implement the term use-limited capacity, the CAISO may need to make conforming changes as part of a future separate tariff clarifications amendment, to the extent neither this tariff amendment nor the reliability services Initiative captures all the tariff references to this term.

[32] This result has also been stated explicitly in the CAISO's business practice manual for Reliability Requirements since 2009. *See* CAISO Business Practice Manual for Reliability Requirements, March 27, 2009, version 1, pages 41-42, available at http://bpmcm.caiso.com/Pages/BPMDetails.aspx?BPM=Reliability%20Requirements.

[33] Although the definition of "use-limited" always specified that economic limits would not qualify a resource as use-limited, two other factors are driving this concern. First, due to changes in California over the last few years, including loss of the San Onofre Nuclear Generating Station

economic limitations is consistent with how other Independent System Operators and Regional Transmission Organizations define use-limited resources.[34]

The contract-based limitations identified by stakeholders are contained in confidential power purchase agreements. However, the CAISO understands that each such agreement contains one of two types of contract-based limitations: (1) a limitation that precludes a resource from being available in the circumstances set forth in the agreement (*e.g.*, a contract provision that limits the resource to a specified number of starts each month), or (2) a limitation that may merely result in higher costs for the resource (*e.g.*, a contract provision stating that the resource must pay higher costs for each start it makes above a specified number of lower-cost starts during the month). Neither type of contract-based limitation should be included within the definition of use-limited capacity.

Allowing the first type of contract-based limitation described above to provide a basis for obtaining (or retaining) use-limited status would inappropriately increase the number of resources qualifying as use-limited, thereby decreasing the CAISO's flexibility in dispatching resources and hampering the CAISO's efforts to ensure reliability. The premise of the resource adequacy program is for the CAISO to have sufficient resources to operate the system, which necessitates a certain amount of base capacity that has a must-offer requirement to bid in 24 hours a day, 7 days a week.[35] Treating contract

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("SONGS") nuclear plant and increased participation of variable energy resources, contract limits that may not have been binding in the past are now binding. Second, pursuant to the Commitment Costs Enhancements Phase 1 initiative, the CAISO amended its tariff to limit the registered cost methodology to use-limited resources. Prior to that tariff change, a resource with contract limits that did not qualify for use-limited status could elect the registered cost methodology and effectively use this methodology as a means to implement its contractual limitations because the CAISO does not insert bids on behalf of use-limited resources. Today's amendment does nothing to change this situation.

[34] *See* Midcontinent Independent System Operator, Inc., ("MISO") Open Access Transmission Tariff ("OATT"), § 1.U (stating that the definition of a "Use Limited Resource" excludes resources that for "non economic reasons, are unable to operate continuously on a daily basis"); MISO Resource Adequacy Business Practice Manual, § 4.2.3.1 (Sept. 1, 2014) (stating that "[i]nternal purchase power agreements (PPAs)" will not qualify a resource as a Use Limited Resource in the MISO); New York Independent System Operator, Inc. Market Administration and Control Area Services Tariff, § 2.5 (stating that the definition of an "Energy Limited Resource" excludes resources that for "non-economic reasons, are unable to operate continuously on a daily basis"); PJM Interconnection, L.L.C. ("PJM") OATT, Attachment K – Appendix, Section 1.3.2B (stating that the definition of "Energy Market Opportunity Cost" includes costs due to "limitations imposed on the unit by Applicable Laws and Regulations"); PJM OATT, Attachment K – Appendix, Section 1.3.17A (stating that the definition of "Non-Regulatory Opportunity Cost" includes costs due to "physical equipment limitations of the unit, for up to one year, due to original equipment manufacturer limitations or insurance carrier restrictions" and a "fuel supply limitation, for up to one year, resulting from an event of force majeure").

[35] A resource's contract-based limitation is different from the CAISO's establishment of a

limits as use limits would undermine this premise and incentivize parties to enter into contracts with similar arrangements in the future to circumvent must-offer obligations and other obligations applicable to non-use-limited resources, causing both economic withholding through inflated opportunity costs and/or physical withholding by not bidding at all. Market participants should not be able to avoid compliance with CAISO tariff provisions by simply executing contracts with third parties that seek to eliminate any obligations to follow otherwise applicable market rules. That could lead to "gaming" types of opportunities and arbitrary, non-physical contract limitations, and deprive the CAISO of dependable capacity that it needs to maintain reliability.

Reducing the capacity available to the CAISO to meet reliability needs could also force the CAISO to rely on its backstop procurement authority under exceptional dispatch and the capacity procurement mechanism. That result would be inconsistent with both the CAISO's and the Commission's goal that the CAISO utilize its backstop authority less, not more. To the extent the CAISO must rely on backstop procurement under these circumstances, this will result in ratepayers paying twice for capacity to maintain reliability – once for a resource adequacy resource that is "use-limited" because of a contract limitation and then again for a resource that the CAISO has to exceptionally dispatch or designate as capacity subject to the capacity procurement mechanism. This would be particularly unfair to load-serving entitles who are procuring resource adequacy capacity that is not contract limited.

It would also be inappropriate to allow the second type of contract-based limitation described above to provide a basis for obtaining (or retaining) use-limited status. The fact that a resource may incur higher costs due to a provision in its agreement is not a limitation on the resource's availability for dispatch but instead is merely an additional cost the resource has agreed to pay whenever that provision is triggered. Further, although resources that fall outside the definition of use-limited capacity may incur higher costs as a result of being dispatched more frequently, the CAISO has filed and the Commission has accepted tariff amendments over the past few years to better ensure that resources can reflect additional costs in their commitment cost bids. In particular, the Commission recently approved the CAISO's proposal to increase the proxy cost bidding cap from 100 percent to 125 percent of a resource's proxy costs.[36] The CAISO had proposed eliminating the registered cost methodology

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daily start minimum for a resource adequacy resource based on the CAISO's analysis of operational need. A contract-based limitation is economic in nature and sets an upper limit, whereas the CAISO's analysis is operations-based and sets a minimum requirement. The CAISO already performs such an operational analysis for flexible resource adequacy capacity and may propose in the future to perform such an analysis for system capacity.

[36] *See supra* note 2.

due to the increased bidding headroom available under the proxy cost methodology but was persuaded that use-limited resources needed the additional flexibility available under the registered cost methodology to reflect their opportunity costs. Expanding the pool of use-limited resources undermines the CAISO's policies, which is moving in the direction of getting the opportunity cost calculation right so that resources can bid 24 hours a day, 7 days a week.

For these reasons, the CAISO does not agree with the request to permit purely contractual arrangements to qualify as a basis for resources to obtain use-limited status, either on a "transitional" or a permanent basis.

Some stakeholders expressed concerns that the CAISO's storage modeling capabilities may not appropriately capture the operating characteristics of non-pumping storage resources. These stakeholders requested that the CAISO grant these storage resources use-limited status. Similarly, some stakeholders requested that all storage resources receive an exemption from the CAISO's bid insertion requirements for resource adequacy capacity. In response, the CAISO explained that it understands that to effectively dispatch storage resources (including non-pumping resources), it must have models that can accurately account for their operational constraints, *i.e.,* the number of cycle times allowed in a given period. Simply deeming storage resources automatically to have use-limited status and, therefore, an exemption from the resource adequacy bid insertion rules, is no substitute for accurate modeling because use-limited status gives resources the ability to reflect opportunity costs that ensure they are dispatched within their use limitations; however, storage resources do not incur commitment costs. Therefore, having use-limited status would not address the operational constraints of storage resources. Moreover, although the tariff deems certain types of resources to be use-limited, resources that are not deemed use-limited can submit information to the CAISO to demonstrate that they are use-limited (*i.e.*, have non-economic limits that cannot be optimized without additional headroom to reflect opportunity costs in bids).

The CAISO notes that it has started a new stakeholder initiative to review what modeling and market functionality are currently available to reflect the operational constraints of storage resources.[37] If this review reveals a need to enhance the modeling or market functionality, the CAISO and stakeholders will address that matter in the stakeholder initiative. Storage resources can apply for use-limited status either now or after the CAISO makes any needed enhancements. Further, the May 29 RSI Tariff Amendment exempts use-limited resources, non-generator resources, variable energy resources, and resources providing regulatory must-take generation from the CAISO's bid insertion rules,

[37] Materials regarding this new stakeholder initiative are available on the CAISO website at http://www.caiso.com/informed/Pages/StakeholderProcesses/EnergyStorage_AggregatedDistributedEnergyResources.aspx.

and thus use-limited status is not necessary to exempt such resources from the bid insertion rules.

C. Other Clarifying Revisions

The CAISO proposes to make minor revisions to the tariff sections regarding the proxy cost methodology to more clearly state that the scheduling coordinator for a resource subject to that methodology can submit daily bids for start-up and minimum load costs only if the scheduling coordinator chooses not to recover such costs based on the resource's actual unit-specific performance parameters.[38]

The CAISO also proposes to make the following underlined clarification to state that the proxy costs for MSG resources will be calculated for each specific MSG configuration, including for each MSG configuration that cannot be directly started.[39] In addition, the CAISO proposes to clarify the definition of an MSG transition to state that it includes a feasible transition from one MSG configuration to another as registered in the transition matrix associated with a specific transition cost, if applicable.[40]

IV. Effective Date and Request for Waiver of Notice Requirements

The CAISO requests that the Commission accept the tariff revisions contained in this filing relating to transition costs and the clarifying changes discussed above effective as of September 15, 2015, and respectfully requests that the Commission grant waiver of its notice requirements to accept the proposed tariff provisions relating to use-limited resources effective as of March 1, 2016.[41]

Good cause exists to grant this waiver. The CAISO will be implementing the MSG transition costs and bidding rules as part of the 2015 fall release on September 15, 2015. The CAISO requests an effective date of March 1, 2016 for the tariff provisions relating to use-limited resources in order to give market participants sufficient time to align their contracting with those tariff provisions. March 1, 2016 is also the effective date the CAISO proposes for almost all of the

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[38] Revised tariff sections 30.4.1.1.1, 30.4.1.1.2.

[39] Revised tariff section 30.4.1.1.3.

[40] Tariff appendix A, revised definition of "MSG Transition." As discussed above, there is no transition cost associated with moving from an MSG configuration to a lower MSG configuration.

[41] Specifically, pursuant to Section 35.11 of the Commission's regulations (18 C.F.R. § 35.11), the CAISO requests that the Commission grant waiver of the notice requirements set forth in Section 35.3 of its regulations (18 C.F.R. § 35.3).

tariff revisions contained in the May 29 RSI Tariff Amendment.[42] The commitment cost provisions relating to use-limited resources need to go into effect at the same time as the reliability services revisions. In conjunction with the May 29 RSI Tariff Amendment, the CAISO will be implementing a significant number of revised resource adequacy and outage requirements that require substantial systems and process changes. The CAISO and market participants need adequate time to design, develop, implement, and test these changes. For these reasons, granting the requested waiver is appropriate.

The CAISO also respectfully requests that the Commission issue an order on this filing by no later than September 5, 2015. An order by September 5 will provide regulatory certainty and needed lead time for an orderly implementation of the MSG transition costs and bidding rules on September 15. Regulatory certainty by that date is necessary for the reasons set forth in the previous paragraph.

V. Communications

Correspondence and other communications regarding this filing should be directed to:

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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.

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[42] In the May 29 RSI Tariff Amendment, the CAISO requested an effective date of January 10, 2016 for a small subset of the tariff revisions that would require load-following metered subsystem load-serving entities to submit annual and monthly resource adequacy plans.

VII. Contents of this 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	Board Memorandum
Attachment E	DMM Memorandum
Attachment F	MSC Final Opinion
Attachment G	List of key dates in the stakeholder process

VIII. Conclusion

For the reasons set forth in this filing, the CAISO respectfully requests that the Commission accept the tariff changes contained in this filing effective as described above.

Respectfully submitted,

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Attachment A – Clean Tariff Records

Commitment Cost Enhancements Phase 2

California Independent System Operator Corporation

Att. A1 – Clean Tariff Records for Revisions Effective September 15, 2015

30.4 Proxy Cost and Registered Cost Methodologies

Scheduling Coordinators for Generating Units and Resource-Specific System Resources that are not Use-Limited Resources 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 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 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 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.

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 Start-Up as the product of the resource's fuel requirement at Minimum Load, 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; (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.

(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'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 Proxy Cost Bid, or (b) below:

(a) The relevant cost information of the particular resource, including fuel or fuel equivalent input costs, which will be provided to the CAISO by the Scheduling Coordinator and maintained in the Master File.

Start-Up Costs will also include: (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, 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.

Minimum Load Costs also include: (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; (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.

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.

(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.

30.4.1.1.3 Multi-Stage Generating Resources

The Proxy Cost methodology for calculating Start-Up Costs and Minimum Load Costs will apply to all the MSG Configurations for a Multi-Stage Generating Resource that is not a Use-Limited Resource and for a Multi-Stage Generating Resource that is a Use-Limited Resource and elects to use the Proxy Cost methodology. The Proxy Costs (Start-Up Cost, Transition Cost, and Minimum Load Cost) for Multi-Stage Generating Resources will be calculated for each specific MSG Configuration, including for each MSG Configuration that cannot be directly started. Notwithstanding the rules set forth in Sections 30.4.1.1.1(b) and 30.4.1.1.2(b), to the extent that a Scheduling Coordinator for a Multi-Stage Generating Resource, other than in its lowest startable configuration, does not provide sufficient data for the CAISO to determine a component of the Start-Up or Minimum Load Costs for a particular MSG Configuration, the CAISO will, if feasible, use the value for that component associated with the next-lowest MSG Configuration.

* * *

30.4.1.1.5 Proxy Transition Cost

For a 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 less than or equal to one hundred twenty-five (125) percent of the Transition Costs calculated by the CAISO and are not negative, in which case the Transition Costs submitted in the form of daily Bids will be utilized in the CAISO Markets Processes.

30.4.1.2 Registered Cost Methodology

(a) Under the Registered Cost methodology, the Scheduling Coordinator for a Use-Limited Resource 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.

(b) If the alternative natural gas price set forth in Section 39.7.1.1.1.3(b) is triggered, and a Use-Limited Resource's Start-Up Costs or Minimum Load Costs calculated pursuant to the Proxy Cost methodology using the alternative gas price exceeds the value registered in the Master File, then the CAISO will switch the Use-Limited Resource to the Proxy Cost methodology. Any Use-Limited Resource switched to the Proxy Cost methodology pursuant to this Section 30.4.1.2(b) will revert to the Registered Cost methodology when the Use-Limited Resource's alternative Proxy Cost calculation no longer exceeds the value registered using the Registered Cost methodology. These determinations will be made separately for both Start-Up Costs and Minimum Load Costs. The CAISO will not make a separate determination for Transition Costs but if a Start-Up Cost is switched to the Proxy Cost methodology, the Transition Costs of the Use-Limited Resource will also be switched to the Proxy Cost methodology.

* * *

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 one hundred twenty-five (125) percent of the Proxy Cost, 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 one hundred twenty-five (125) percent of the Start-Up Cost for the MSG Configuration. 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.

* * *

39.6.1.6 Maximum Start-Up Cost and Minimum Load Cost Registered Cost Values

The maximum Start-Up Cost and Minimum Load Cost values registered in the Master File by Scheduling Coordinators for capacity of non-Multi-Stage Generating Resources that are eligible and elect to use the Registered Cost methodology in accordance with Section 30.4 will be limited to 150 percent of the Projected Proxy Cost. The maximum Start-Up Cost and Minimum Load Cost values registered in the Master File by Scheduling Coordinators for capacity of Multi-Stage Generating Resources that are eligible and elect to use the Registered Cost methodology in accordance with Section 30.4 will be limited to 150 percent of the Projected Proxy Cost for each MSG Configuration of the resources. The Projected Proxy Cost for natural gas-fired resources will include a gas price component, a major maintenance expense component, if available, a volumetric Grid Management Charge component, and, if eligible, a projected Greenhouse Gas Allowance Price component calculated as set forth in this Section 39.6.1.6. The Projected Proxy Cost for non-natural gas-fired resources will be based on costs provided to the CAISO pursuant to Section 30.4.1.1.2, a major maintenance expense component, if available, a volumetric Grid Management Charge component, and, if eligible, a projected Greenhouse Gas Allowance Price component calculated as set forth in this Section 39.6.1.6.

* * *

39.6.1.7 Maximum Transition Cost Values

Scheduling Coordinators for capacity of Multi-Stage Generating Resources that are eligible and elect to use the Registered Cost methodology in accordance with Section 30.4 must register Transition Costs for each feasible transition between a lower MSG Configuration and a higher MSG Configuration, between zero and a maximum of 150 percent of the difference between the Projected Proxy Cost for the Start-Up Costs for the higher MSG Configuration, minus the Projected Proxy Cost for the Start-Up Costs for the lower MSG Configuration. If the result of this calculation is negative for any transition between two MSG Configurations, then the associated Transition Cost shall be zero.

* * *

Appendix A

Master Definition Supplement

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- MSG Transition

A feasible operation from one MSG Configuration to another as registered in the Transition Matrix associated with a specific Transition Time and a specific Transition Cost, if applicable.

* * *

- 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.

Att. A2 – Clean Tariff Records for Revisions Effective March 1, 2016

27.11 Registration of Use-Limited Capacity

A Scheduling Coordinator on behalf of capacity that meets the definition of Use-Limited Capacity must follow the registration and validation processes set forth in the Business Practice Manual. Capacity of Hydroelectric Generating Units, Proxy Demand Resources, Reliability Demand Response Resources and Participating Load, including Pumping Load, must be registered through this process even though such capacity is deemed to be Use-Limited Capacity. Within five (5) Business Days, the CAISO will provide the Scheduling Coordinator with information concerning the status of the CAISO's validation process.

* * *

30.4 Proxy Cost and Registered Cost Methodologies

Capacity of Generating Units and Resource-Specific System Resources that is not Use-Limited Capacity will be subject to the Proxy Cost methodology for 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 have Use-Limited Capacity may elect on a thirty (30) day basis to use either the Proxy Cost methodology or the Registered Cost methodology for specifying 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 a resource with Use-Limited Capacity 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 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.

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 Start-Up as the product of the resource's fuel requirement at Minimum Load, 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; (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.

(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'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 Proxy Cost Bid, or (b) below:

(a) The relevant cost information of the particular resource, including fuel or fuel equivalent input costs, which will be provided to the CAISO by the Scheduling Coordinator and maintained in the Master File.

Start-Up Costs will also include: (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, 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.

Minimum Load Costs also include: (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; (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.

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.

(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.

30.4.1.1.3 Multi-Stage Generating Resources

The Proxy Cost methodology for calculating Start-Up Costs and Minimum Load Costs will apply to all the MSG Configurations for a Multi-Stage Generating Resource that does not have Use-Limited Capacity and for a Multi-Stage Generating Resource that has Use-Limited Capacity and elects to use the Proxy Cost methodology. The Proxy Costs (Start-Up Cost, Transition Cost, and Minimum Load Cost) for Multi-Stage Generating Resources will be calculated for each specific MSG Configuration, including for each MSG Configuration that cannot be directly started. Notwithstanding the rules set forth in Sections

30.4.1.1.1(b) and 30.4.1.1.2(b), to the extent that a Scheduling Coordinator for a Multi-Stage Generating Resource, other than in its lowest startable configuration, does not provide sufficient data for the CAISO to determine a component of the Start-Up or Minimum Load Costs for a particular MSG Configuration, the CAISO will, if feasible, use the value for that component associated with the next-lowest MSG Configuration.

* * *

30.4.1.1.5 Proxy Transition Cost

For a 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 less than or equal to one hundred twenty-five (125) percent of the Transition Costs calculated by the CAISO and are not negative, in which case the Transition Costs submitted in the form of daily Bids will be utilized in the CAISO Markets Processes.

30.4.1.2 Registered Cost Methodology

(a) Under the Registered Cost methodology, the Scheduling Coordinator for a resource with Use-Limited Capacity may register values of its choosing for Start-Up Costs and/or Minimum Load Costs in the Master File for such Use-Limited Capacity subject to the maximum limit specified in Section 39.6.1.6. A Scheduling Coordinator for a Multi-Stage Generating Resource that has Use-Limited Capacity 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 Use-Limited Capacity 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.

(b) If the alternative natural gas price set forth in Section 39.7.1.1.1.3(b) is triggered, and the Start-Up Costs or Minimum Load Costs of Use-Limited Capacity calculated pursuant to the Proxy Cost methodology using the alternative gas price exceeds the value registered in the Master File, then the CAISO will switch the Use-Limited Capacity to the Proxy Cost methodology. Any Use-Limited Capacity switched to the Proxy Cost methodology pursuant to this Section 30.4.1.2(b) will revert to the Registered Cost methodology when the Use-Limited Capacity's alternative Proxy Cost calculation no longer exceeds the value registered using the Registered Cost methodology. These determinations will be made separately for both Start-Up Costs and Minimum Load Costs. The CAISO will not make a separate determination for Transition Costs but if a Start-Up Cost is switched to the Proxy Cost methodology, the Transition Costs of the Use-Limited Capacity will also be switched to the Proxy Cost methodology.

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Appendix A

Master Definition Supplement

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- Use-Limited Capacity

Capacity with limitations or restrictions on its operation established by statute, regulation, ordinance, court order, design considerations, or other non-economic reasons that cannot be optimized by the appropriate CAISO commitment process without considering opportunity costs.

Attachment B – Marked Tariff Records

Commitment Cost Enhancements Phase 2

California Independent System Operator Corporation

Att. B1 – Marked Tariff Records for Revisions Effective September 15, 2015

30.4 Proxy Cost and Registered Cost Methodologies

Scheduling Coordinators for Generating Units and Resource-Specific System Resources that are not Use-Limited Resources 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 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 a Use-Limited Resource may elect~~ing~~ 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. ~~Scheduling Coordinators for Multi-Stage Generating Resources may also register with the CAISO their Transition Costs on a thirty (30) day basis.~~

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 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.

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 Start-Up as the product of the resource's fuel requirement at Minimum Load, 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; (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.

(b) ~~Values~~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~~unit~~ does not provide sufficient data for the CAISO to determine the resource's~~unit's base~~ Start-Up or Minimum Load ~~Proxy~~ Costs or one or more ~~of the additional~~ components of the resource's~~unit's~~ Start-Up or Minimum

LoadProxy Costs, the CAISO will assume that the resource'sunit's base Start-Up Costs orand Minimum Load Costs, or the indeterminable additional component(s) of the resource'sunit'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 Proxy Cost Bid, or (b) below:

(a) The relevant cost information of the particular resource, including fuel or fuel equivalent input costs, which will be provided to the CAISO by the Scheduling Coordinator and maintained in the Master File.

Start-Up Costs will also include: (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, 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.

Minimum Load Costs also include: (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; (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.

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.

(b) ~~Values~~ 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 ~~unit~~ 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~~unit's~~ Start-Up or Minimum Load~~Proxy~~ Costs, the CAISO will assume that resource's Start-Up or Minimum Load Costs, or the indeterminable component(s) of the resource's~~unit'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.

30.4.1.1.3 Multi-Stage Generating Resources

The Proxy Cost methodology for calculating Start-Up Costs and Minimum Load Costs will apply to all the MSG Configurations for a Multi-Stage Generating Resource that is not a Use-Limited Resource and for a Multi-Stage Generating Resource that is a Use-Limited Resource and elects to use the Proxy Cost methodology. The Proxy Costs (Start-Up Cost, Transition Cost, and Minimum Load Cost) ~~values~~ for Multi-Stage Generating Resources will be calculated for each specific MSG Configuration, including for each MSG Configuration that cannot be directly started. Notwithstanding the rules set forth in Sections 30.4.1.1.1(b) and 30.4.1.1.2(b), to the extent that a Scheduling Coordinator for a Multi-Stage Generating Resource, other than in its lowest startable configuration, does not provide sufficient data for the CAISO to determine a component of the Start-Up or Minimum Load Costs for a particular MSG Configuration, the CAISO will, if feasible, use the value for that component associated with the next-lowest MSG Configuration.

* * *

30.4.1.1.5 Proxy Transition Cost

For a 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 less than or equal to one hundred twenty-five (125) percent of the Transition Costs calculated by the CAISO and are not negative, in which case the Transition Costs submitted in the form of daily Bids will be utilized in the CAISO Markets Processes.

30.4.1.2 Registered Cost Methodology

(a) Under the Registered Cost methodology, the Scheduling Coordinator for a Use-Limited Resource 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.

(b) If the alternative natural gas price set forth in Section 39.7.1.1.1.3(b) is triggered, and a Use-Limited Resource's Start-Up Costs or Minimum Load Costs calculated pursuant to the Proxy Cost methodology using the alternative gas price exceeds the value registered in the Master File, then the CAISO will switch the Use-Limited Resource to the Proxy Cost methodology. Any Use-Limited Resource switched to the Proxy Cost methodology pursuant to this Section 30.4.1.2(b) will revert to the Registered Cost methodology when the Use-Limited Resource's alternative Proxy Cost calculation no longer exceeds the value registered using the Registered Cost methodology. These determinations will be made separately for both Start-Up Costs and Minimum Load Costs. The CAISO will not make a separate determination for Transition Costs but if a Start-Up Cost is switched to the Proxy Cost methodology, the Transition Costs of the Use-Limited Resource will also be switched to the Proxy Cost methodology.

* * *

~~**30.4.2 Transition Costs**~~

~~Scheduling Coordinators may register and the CAISO will validate Transition Costs for Multi-Stage Generating Resources as described below. Once accepted by the CAISO, such Transition Costs will apply until modified and will apply for a minimum of thirty (30) days. Scheduling Coordinators may change their Transition Costs pursuant to the time line that applies to changes to the Master File. During the registration process, the Scheduling Coordinator shall submit a dollar value for each upward Transition Cost, including a Transition Costs multiplier which consists of the Transition Costs dollar value divided by the applicable monthly Thousand Thousand British Thermal Units (MMBtu) Gas Price Index on~~

~~the day that the Scheduling Coordinator is registering the Transition Costs value with the CAISO. At the time of registration, the CAISO will validate that the upward Transition Costs dollar value and the Transition Costs multiplier are consistent. The CAISO will further validate the upward Transition Costs dollar values using the two rules described below, and will include the validated values in the Master File. The Scheduling Coordinator shall also submit a fuel input value, which consists of a quantity of natural gas in MMBtu, for each downward MSG Transition such that the fuel input value accurately reflects the operating characteristics of the Multi-Stage Generating Resource, which the CAISO may reject if perceived to be inconsistent with such characteristics. Through the Bid validation process in the CAISO Markets, the CAISO will adjust both the downward and upward Transition Costs by the daily Gas Price Index when Scheduling Coordinators submit Bids into the CAISO Markets for Multi-Stage Generating Resources to calculate the Transition Costs per the submitted Bid.~~

~~**Rule 1:** The CAISO will constrain the Transition Costs along each of the feasible, unidirectional MSG Transition paths from Off to each MSG Configuration such that their sum is between one-hundred (100) percent and one-hundred twenty five (125) percent of the MSG Configuration's proxy Start-Up Cost value plus ten (10) percent; where the MSG Configuration's proxy Start-Up Cost value is determined using the same methodology provided in Section 30.4.1.1 except that the CAISO will use the monthly Gas Price Index and the monthly Greenhouse Gas Allowance Price as opposed to the daily values. If the Scheduling Coordinator flags an MSG Configuration as able to Start-Up as part of its registration requirements in Section 27.8, the CAISO will use a value of $0 as the lower bound for the MSG Transition paths up to the MSG Configuration flagged as able to Start-Up.~~

~~**Rule 2:** The CAISO will validate that the sum of Transition Costs for incremental MSG Transitions along a feasible, unidirectional path between two MSG Configurations is between one-hundred (100) percent and one-hundred twenty five (125) percent of the Transition Cost associated with the direct transition to the target MSG Configuration.~~

* * *

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 one hundred twenty-five (125) percent of the Proxy Cost, 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 one hundred twenty-five (125) percent of the Start-Up Cost for the MSG Configuration. 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.

* * *

39.6.1.6 Maximum Start-Up Cost and Minimum Load Cost Registered Cost Values

The maximum Start-Up Cost and Minimum Load Cost values registered in the Master File by Scheduling Coordinators for capacity of non-Multi-Stage Generating ~~r~~Resources that are eligible and elect to use the Registered Cost methodology in accordance with Section 30.4 will be limited to 150~~%~~ percent of the Projected Proxy Cost. The maximum Start-Up Cost and Minimum Load Cost values registered in the Master File by Scheduling Coordinators for capacity of Multi-Stage Generating Resources that are eligible and elect to use the Registered Cost methodology in accordance with Section 30.4 will be limited to 150 percent of the Projected Proxy Cost for each MSG Configuration of the resources. The Projected Proxy Cost for natural gas-fired resources will include a gas price component, a major maintenance expense component, if available, a volumetric Grid Management Charge component, and, if eligible, a projected Greenhouse Gas Allowance Price component calculated as set forth in this Section 39.6.1.6. The Projected Proxy Cost for non-natural gas-fired resources will be based on costs provided to the CAISO pursuant to Section 30.4.1.1.2, a major maintenance expense component, if available, a volumetric Grid Management Charge component, and, if eligible, a projected Greenhouse Gas Allowance Price component calculated as set forth in this Section 39.6.1.6.

* * *

39.6.1.7 Maximum Transition Cost Values

Scheduling Coordinators for capacity of Multi-Stage Generating Resources that are eligible and elect to use the Registered Cost methodology in accordance with Section 30.4 must register Transition Costs for each feasible transition between a lower MSG Configuration and a higher MSG Configuration, between zero and a maximum of 150 percent of the difference between the Projected Proxy Cost for the Start-Up Costs for the higher MSG Configuration, minus the Projected Proxy Cost for the Start-Up Costs for the

lower MSG Configuration. If the result of this calculation is negative for any transition between two MSG Configurations, then the associated Transition Cost shall be zero.

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Appendix A

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- MSG Transition

A feasible operation from one MSG Configuration to another as registered in the Transition Matrix associated with a specific Transition Time and a specific Transition Cost, if applicable.

* * *

- Transition Cost

For a Multi-Stage Generating Resource~~s~~, the dollar cost per feasible transition from~~associated with~~ a given MSG Configuration to a higher MSG Configuration when the resource is already On~~as registered in the Transition Matrix~~. Transition Cost must be non-negative.

Att. B2 – Marked Tariff Records for Revisions Effective March 1, 2016

27.11 Registration of Use-Limited Capacity

A Scheduling Coordinator on behalf of capacity that meets the definition of Use-Limited Capacity must follow the registration and validation processes set forth in the Business Practice Manual. Capacity of Hydroelectric Generating Units, Proxy Demand Resources, Reliability Demand Response Resources and Participating Load, including Pumping Load, must be registered through this process even though such capacity is deemed to be Use-Limited Capacity. Within five (5) Business Days, the CAISO will provide the Scheduling Coordinator with information concerning the status of the CAISO's validation process.

* * *

30.4 Proxy Cost and Registered Cost Methodologies

~~Scheduling Coordinators for~~ Capacity of Generating Units and Resource-Specific System Resources that ~~are~~is not Use-Limited Capacity~~Resources~~ 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~~have Use-Limited Capacity~~Resources~~ 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 a resource with ~~a~~ Use-Limited Capacity~~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 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.

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 Start-Up as the product of the resource's fuel requirement at Minimum Load, 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; (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.

(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'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 Proxy Cost Bid, or (b) below:

(a) The relevant cost information of the particular resource, including fuel or fuel equivalent input costs, which will be provided to the CAISO by the Scheduling Coordinator and maintained in the Master File.

Start-Up Costs will also include: (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, 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.

Minimum Load Costs also include: (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; (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.

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.

(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.

30.4.1.1.3 Multi-Stage Generating Resources

The Proxy Cost methodology for calculating Start-Up Costs and Minimum Load Costs will apply to all the

MSG Configurations for a Multi-Stage Generating Resource that ~~is~~does not ~~a~~ have Use-Limited Capacity~~Resource~~ and for a Multi-Stage Generating Resource that has ~~is a~~ Use-Limited Capacity~~Resource~~ and elects to use the Proxy Cost methodology. The Proxy Costs (Start-Up Cost, Transition Cost, and Minimum Load Cost) for Multi-Stage Generating Resources will be calculated for each specific MSG Configuration, including for each MSG Configuration that cannot be directly started. Notwithstanding the rules set forth in Sections 30.4.1.1.1(b) and 30.4.1.1.2(b), to the extent that a Scheduling Coordinator for a Multi-Stage Generating Resource, other than in its lowest startable configuration, does not provide sufficient data for the CAISO to determine a component of the Start-Up or Minimum Load Costs for a particular MSG Configuration, the CAISO will, if feasible, use the value for that component associated with the next-lowest MSG Configuration.

* * *

30.4.1.1.5 Proxy Transition Cost

For a 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 less than or equal to one hundred twenty-five (125) percent of the Transition Costs calculated by the CAISO and are not negative, in which case the Transition Costs submitted in the form of daily Bids will be utilized in the CAISO Markets Processes.

30.4.1.2 Registered Cost Methodology

(a) Under the Registered Cost methodology, the Scheduling Coordinator for a resource with ~~a~~ Use-Limited Capacity~~Resource~~ may register values of its choosing for Start-Up Costs and/or Minimum Load Costs in the Master File for such Use-Limited Capacity subject to the maximum limit specified in Section 39.6.1.6. A Scheduling Coordinator for a Multi-Stage Generating Resource

that has~~is a~~ Use-Limited Capacity~~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 Capacity~~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.

(b) If the alternative natural gas price set forth in Section 39.7.1.1.1.3(b) is triggered, and ~~a Use-Limited Resource's~~ the Start-Up Costs or Minimum Load Costs of Use-Limited Capacity calculated pursuant to the Proxy Cost methodology using the alternative gas price exceeds the value registered in the Master File, then the CAISO will switch the Use-Limited Capacity~~Resource~~ to the Proxy Cost methodology. Any Use-Limited Capacity~~Resource~~ switched to the Proxy Cost methodology pursuant to this Section 30.4.1.2(b) will revert to the Registered Cost methodology when the Use-Limited Capacity's~~Resource's~~ alternative Proxy Cost calculation no longer exceeds the value registered using the Registered Cost methodology. These determinations will be made separately for both Start-Up Costs and Minimum Load Costs. The CAISO will not make a separate determination for Transition Costs but if a Start-Up Cost is switched to the Proxy Cost

methodology, the Transition Costs of the Use-Limited Capacity~~Resource~~ will also be switched to the Proxy Cost methodology.

* * *

~~**40.6.4.1 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 NOx, SOx, 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.~~

* * *

Appendix A

Master Definition Supplement

* * *

- Use-Limited Capacity~~Resource~~

Capacity with limitations or restrictions on its operation established by statute, regulation, ordinance, court order, design considerations, or other non-economic reasons that cannot be optimized by the appropriate CAISO commitment process without considering opportunity costs. ~~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. 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.~~

Attachment C – Draft Final Proposal

Commitment Cost Enhancements Phase 2

California Independent System Operator Corporation

Commitment Cost Enhancements Phase 2

Draft Final Proposal

February 9, 2015

Table of Contents

1. Changes from the revised straw proposal

Section 6 – In response to stakeholder comments, the ISO reiterates that the tariff only recognizes non-economic use limitations. This would mean that contracts signed to economically limit a resource's participation in the ISO markets is not a recognized use limitation. This is a long-standing rule in the ISO tariff and has not been changed in this initiative. To maintain reliability, the ISO expects resources with resource adequacy capacity to be available 24 hours, seven days a week but for non-economic limitations.

The ISO has incorporated discussion on the commitment processes relevant for use limitations.

Section 7 - In response to stakeholder feedback and to allow more time for discussion, development of opportunity costs will be moved to a new initiative, *Commitment Cost Enhancements Phase 3*. In the meantime, use-limited capacity may remain on the registered cost option and use a new "short-term use-limit reached" outage without penalty to manage use limitations.

Section 8 – In response to stakeholder requests, the ISO provides more detailed examples of the proposed calculation of transition costs. The ISO clarifies that the proposed changes will allow for bidding of transition costs consistent with the registered or proxy cost option.

Section 9 – The ISO agrees with stakeholders that there is too much regulatory uncertainty at this time to propose any policy changes to the ISO's current practices. The ISO will continue to monitor the situation and can discuss this issue again with stakeholders when the situation changes.

Section 10 - The ISO agrees with stakeholders that the energy price index and the methodology used to calculate auxiliary start-up costs is not clear. Therefore, the ISO will clarify the existing methodology in a business practice manual as soon as possible. Additionally, the ISO will discuss any proposed changes to the inputs and methodology (inclusive of policy and business practice manual changes) in a stakeholder process, to be determined at a later date.

Section 11 – The ISO agrees with stakeholders that there is currently no need to review the default variable operation and maintenance costs. While the ISO agrees with stakeholders that establishing default major maintenance adders may be beneficial, we will need more time to explore this option. This topic is also delayed to *Commitment Cost Enhancements Phase 3*.

Some stakeholders have suggested improvements in how the ISO accounts for start types and gas transportation costs. The ISO agrees that these issues may need to be reviewed will address them in *Commitment Cost Enhancements Phase 3.* Additionally, the ISO proposes to address the use of the daily start limit field more closely under the *Bidding Rules Enhancements* initiative.

2. Background

Commitment Cost Enhancements (henceforth referred to as Phase 1) had proposed the calculation of opportunity costs for use-limited resources but there was insufficient time to vet the methodology and business rules. This follow-on stakeholder process, *Commitment Cost Enhancements Phase 2*, is narrowly scoped to continue that discussion and provide additional policy clarifications.

During the winter season of 2013-2014, the ISO energy market experienced abnormally volatile and high natural gas price spikes. The ISO was not able to reflect these price spikes in its resource commitment decisions, which led to inefficient resource dispatch. To address the potential for additional natural gas price spikes for the duration of the winter season, on March 6, 2014 the ISO filed with the Federal Energy Regulatory Commission (FERC) a proposed tariff waiver until April 30, 2014 to take remedial action. In the tariff waiver filing, the ISO also committed to commence a stakeholder process in April to address the issues raised by gas market conditions and to more comprehensively develop an interim solution that can be implemented in fall 2014 if such solutions do not require substantial system changes. FERC granted the ISO's tariff waiver on March 21, 2014.[1]

The ISO started a stakeholder process in April 2014, *Commitment Cost Enhancements Phase 1*, to develop an interim solution to enhance the current options for reflecting resource commitment costs for starting a resource and running at minimum load. The ISO provides two options: 1) the "proxy cost," which updates natural gas prices daily and allows daily bidding up to 100 percent of the calculated proxy cost; and 2) the "registered cost," which updates natural gas prices every 30 days but allows for a fixed, 30-day bid up to 150 percent of the calculated proxy cost. The interim solution modified the current rules by increasing the proxy cost bid cap to 125 percent and eliminating the registered cost option for all resources except those categorized as use-limited resources. The interim solution was approved by the ISO Board of Governors in September 2014 and has been filed at the FERC.[2] Once opportunity costs are implemented for use-limited resources, the registered cost option will be eliminated for all resources.

As Table 1 shows, the *Commitment Cost Enhancements stakeholder* processes are also coordinated with the *Reliability Services* initiative for the development of a more stringent must offer obligation for certain use-limited resources by 2016.

The ISO has added a new initiative, *Commitment Cost Enhancements Phase 3*, to discuss development of an opportunity cost model and additional issues that were not addressed in phase 2. In the meantime, use-limited capacity may continue to use the registered cost option.

[1] *California Indep. Sys. Operator Corp.*,146 FERC 61,218 (2014).
[2] *California Indep. Sys. Operator Corp.*, FERC docket no. ER15-15, October 1, 2014.

The ISO will also address broader market changes related to bidding rules for energy and commitment costs in the *Bidding Rules Enhancements* initiative. These are longer-term market changes that will require significant market design, settlements, and system changes.

Table 1
Commitment cost-related initiatives

Initiative	Description	Policy start	Status
Commitment Cost Enhancements Phase 1	Interim solution to address natural gas price spikes. Proxy cap increased to 125% and only use-limited on registered.	Q2 2014	Implemented
Commitment Cost Enhancements Phase 2	Clarify definition, qualifications, and requirements for use-limited resources with additional commitment cost improvements.	Q4 2014	Policy, coordinate implementation with Reliability Services
Commitment Cost Enhancements Phase 3	Develop opportunity cost adders for use-limited resources with additional commitment cost improvements	Q1 2015	Policy, targeted Q4 2015 Board
Reliability Services	Phase 1 focuses on resource adequacy rules and will develop more stringent must offer obligations for use-limited resources.	Q1 2014	Policy, targeted Q1 2016 implementation
Bidding Rules Enhancements	Longer-term changes to energy and commitment cost bidding.	Q4 2014	Policy

There are two additional processes that deserve mention here:

- First, a separate stakeholder initiative, *Natural Gas Pipeline Penalty Recovery*, created to address potential ISO bid cost recovery of operational flow order penalties under specific limited circumstances, has been closed. The ISO was not able to gain unanimous support from natural gas pipeline companies for this policy due to concerns that ISO cost recovery would undermine natural gas reliability. Therefore, the ISO decided not to pursue this policy change. This decision was presented to stakeholders and the Board of Governors at the December 2014 meeting as an informational item.

- Second, on March 20, 2014, the FERC released a notice of proposed rulemaking (NOPR) to address coordination and scheduling practices of the interstate natural gas pipeline companies and the electricity industry.[3] The NOPR provides the natural gas and electricity industries six months to reach a consensus. While the NOPR is not directly related to commitment cost pricing in the ISO market, issues discussed there may overlap with the ISO's commitment cost-related stakeholder initiatives.

[3] http://www.ferc.gov/whats-new/comm-meet/2014/032014/M-1.pdf

3. Schedule for policy stakeholder 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*.

Date	Event
Wed 10/29/14	Straw proposal posted
Wed 11/12/14	Stakeholder call
Wed 11/19/14	Stakeholder comments due
Mon 12/22/14	Revised straw proposal posted
Tue 1/6/15	Stakeholder call
Tue 1/13/15	Stakeholder comments due on revised straw proposal
Fri 2/6/15	Joint call with *Reliability Services* initiative to announce move of opportunity cost modeling to *Commitment Cost Enhancements Phase 3*
~~Tue 2/3/15~~ Mon 2/9/15	Draft final proposal posted
~~Tue 2/10/15~~ Thu 2/12/15	Stakeholder call
~~Tue 2/24/15~~ Mon 3/2/15	Stakeholder comments due on draft final proposal
Thu/Fri 3/26-3/27/15	Board of Governors meeting

4. Initiative scope

This initiative was created to develop a methodology and the business rules to calculate opportunity costs for use-limited resources. In doing so, it is necessary to first clarify the current use-limited definition, the process for submitting documentation and qualifying for use-limited status, and modeling those use limitations as opportunity costs.

This initiative also clarifies additional commitment cost-related issues such as transition costs, greenhouse gas costs, and related business practice manual changes. Transition costs are costs incurred by multi-stage generators when transitioning from one configuration to another. They can also be thought of as start-up costs when "starting" a new configuration. *Commitment Cost Enhancements Phase 1* did not make any changes to transitions costs. In this initiative we reevaluate the current calculation of transition costs and how they are similar to start-up costs for non-multi-stage generators.

The *Commitment Cost Refinements, 2012* stakeholder process[4] incorporated greenhouse gas costs into commitment costs for those resources subject to California's greenhouse gas program. This initiative considers additional greenhouse gas compliance on natural gas suppliers.

[4] http://www.caiso.com/informed/Pages/StakeholderProcesses/CommitmentCostsRefinement2012.aspx

Business practice manual changes will be necessary to clarify the current policy as well as support new policy developed in this initiative. Though changes to the business practice manuals do not require FERC approval and have a separate change process, this revised straw proposal discusses those changes to help stakeholders track closely related issues.

The remainder of this paper is divided into the following sections. Section 5 summarizes all of the proposals. Section 6 clarifies the definition of and process for qualifying for use-limited status. Section 7 notes that the opportunity cost discussion will be addressed under *Commitment Cost Enhancements Phase 3*, targeting a later Board approval date. The remainder of the *Commitment Cost Enhancements Phase 2* initiative will be presented at the March Board meeting for approval. Section 8 aligns the treatment of multi-stage generator transition costs with start-up costs. Section 9 considers extending the greenhouse gas costs to thermal resources not subject to California's greenhouse gas program. Section 10 discusses the business practice manual changes in progress and references additional changes that need to be made pursuant to policy developed in this stakeholder initiative. Section 11 discusses a potential review of default variable operation and maintenance costs and default major maintenance adders. Section 12 discusses next steps.

5. Summary of proposals

Table 2 summarizes the changes by topic, and whether it is new policy or clarifications to the existing business practice manuals (BPMs).

Table 2
Summary of proposals

Topic	Change	Type of change*
Use-limited definition	Revised definition and new flag	Policy
	Application process for use-limited status including documentation	Existing BPM clarifications
Transition costs	Clarify calculation used in start-up costs	Existing BPM clarifications
	New methodology to calculate transition costs and allow bidding	Policy
Greenhouse gas costs	Given the regulatory uncertainty, ISO proposes no changes at this time. The ISO will continue to monitor and propose changes as necessary in another stakeholder initiative	None
Costs for non-thermal resources	Clarify that non-thermal resources may use the "fuel cost" field to reflect certain costs	Existing BPM clarifications and implementation changes
Major maintenance adder	Clarify the documentation required for and methodology to calculate major maintenance adders and responsible	Existing BPM clarifications

	parties.	

*The *type of change* category only reflects whether the topic is new policy or only requires clarification to an existing business practice manual section. It does not determine whether the policy changes will be detailed in the tariff or in a business practice manual. Consistent with the existing FERC-approved ISO tariff, the ultimate tariff language may mention the new policy and provide relevant details in a business practice manual.

6. Use-limited definition

Use-limited resources cannot operate continuously because of environmental, operational, or other non-economic limits. Consequently, the ISO provides for a separate treatment of these resources in accordance with their approved limitations. *Commitment Cost Enhancements Phase 1* clarified that use-limited status is separate from resource adequacy as shown in the first column of Table 3.[5] Therefore, non-resource adequacy resources can also apply for use-limited status. While some resources are deemed use-limited under the tariff, all others must apply for use-limited status.[6]

The ISO proposes to further modify the use-limited definition to what is presented in the second column.[7] These clarifications will greatly benefit the subsequent calculation of opportunity costs. In addition, the ISO will separately identify resource adequacy capacity that will be exempt from the requirement to bid their capacity.

Table 3
Existing and proposed use-limited capacity definition

Existing	Proposed
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. 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.	Capacity with limitations or restrictions on its operation established by statute, regulation, ordinance, or court order that cannot be optimized by the appropriate ISO commitment process without allowance for opportunity costs.

[5] *California Indep. Sys. Operator Corp.*, FERC docket no. ER15-15, October 1, 2014.
[6] 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 deemed to be use-limited.
[7] Policy change.

First, the ISO proposes to refer to use-limited *capacity* rather than resources.[8] This more accurately reflects the fact that a single resource may have both use-limited and non-use-limited capacity or the resource may only be designated use-limited for certain parts of the year. For example, a combined heat and power resource may have use-limited capacity above its regulatory must-take capacity but not below it. Another resource may have an air permit limiting its capacity's run hours only during the summer months.

The limitations accepted by the ISO must be statutory, regulatory, based on an ordinance, due to a court order or operational in nature. They cannot be economic or contractual. The ISO cannot provide an exhaustive list of what the acceptable limitations are but Table 4 below provides illustrative examples.[9] The ISO is seeking feedback from stakeholders on whether the explanations below provide enough guidance.

Table 4
Sample of use limitation sources and examples

Acceptable?	Source	Non-exhaustive list of examples
Yes	Statutes, regulations, ordinances, or court order	• Such as from Air Quality Management Districts, California Energy Commission, Local Regulatory Authorities, etc. o 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, noise restrictions, etc.
	Operational	• Limited due to the actual design of the resource. o This limitation is largely applicable to hydro, pumped storage, participating load, and combined heat and power. For example, limited reservoir storage capacity or interruption of host functions for combined heat and power capacity above the regulatory must-take capacity, etc.
No	Contractual	• Limitations based on a power purchasing or tolling agreements
	Economic	• To reduce wear and tear • Staffing constraints or lack of investment • Avoid purchasing more credits, allowances, etc. to manage emissions (*e.g.*, South Coast Air Quality Management District allows purchase of additional permits rather than a strict limit) • Did not procure fuel (potentially because it was expensive)
	Fuel intermittency	• Variable energy resource o Such as wind and solar without storage, geothermal

[8] Policy change.
[9] Business practice manual change supporting new policy.

The limitations may be statutory, regulatory, based on an ordinance or court order (such as an air permit from a local regulatory authority) or operational (such as supporting a thermal host for combined heat and power resources) but must be non-economic (*i.e.*, not based on contractual obligations or other economic decisions such as staffing requirements).

Commitment processes and use-limitations

The next important change in the proposed definition explicitly points out the limitation in the ISO's commitment time horizon and why an opportunity cost should be calculated. As Table 5 shows, the ISO commits long-start resources in the day-ahead (integrated forward market or IFM) and medium- and short-start resources in the short-term unit commitment (STUC) and short- and fast-start resources in the real-time unit commitment (RTUC).[10] While all day-ahead awards are financially binding, only long-start resources have *operationally* binding commitments in the IFM. All other resources with shorter start-up times will have an operationally binding commitment in one of the real-time market processes. Short-start resources straddle both the STUC and RTUC processes but will be considered in RTUC for the purposes of analyzing use limitations.

Table 5
ISO commitment processes relevant for use limitations

Attribute	Fast-start	Short-start	Medium-start	Long-start	Extremely long-start
Start-up time	≤10 minutes	< 2 hours	2 to 5 hours	5 to 18 hours	>18 hours
Cycle time		≤ 270 minutes	≤ 270 minutes		
Day-ahead application					
IFM (24 hours)	Financial commitment	Financial commitment	Financial commitment	Financial and operationally binding commitment	No commitment
Real-time applications					
STUC (approx. 5 hours)	Advisory or operationally binding commitment	Advisory or operationally binding commitment	Operationally binding commitment	No commitment	No commitment
RTUC (~1 hour or 4 to 7 subsequent 15-min intervals)	Operationally binding commitment	Advisory or operationally binding commitment	No commitment	No commitment	No commitment

[10] Extremely long-start resources are committed separately in the Extremely Long-Start Commitment Process.

The ISO proposes to consider a use-limitation if the applicability[11] of the limitation is longer than the resource's appropriate commitment process. The appropriate commitment process for each type of resource's use-limitation consideration is highlighted in Table 5 above. Table 6 below provides examples of this proposal.

Resources A1 and A2 in Table 6 are both long-starts and therefore committed in the day-ahead, which currently has a time horizon of 24 hours. For resource A1, the permit has a daily start limitation that is applicable for 24 hours. Since this is equal or less than the commitment time horizon, A1 is not use-limited. On the other hand, A2 has an illustrative limit of 100 run hours per year. The limiting factor is the applicability of the permit, which is one year and is longer than the commitment process for this long-start. Notice that the 100 hour limitation is not relevant. A2 may be considered a use-limited resource in the ISO market.

Resources B1 and B2 are both medium-starts and therefore committed in STUC, which currently has a time horizon of approximately four hours. For both resources, the applicability of the limitation is longer than the commitment horizon. Therefore, both resources may be considered use-limited resources in the ISO market

Resources C1 and C2 are both short-starts and D1 and D2 are fast-starts and therefore committed in RTUC, which currently has a time horizon of approximately one hour. For all four of these illustrative resources, the applicability of the limitation is longer than the commitment horizon. Therefore, they may be considered use-limited resources in the ISO market

Table 6
Examples of ISO commitment processes and use limitations

	Resource type	Operationally binding commitment process	Commitment process time horizon	Limitation *(assume from air permit)*	Applicability of limitation	Is applicability > commitment process time?
A1	Long-start	IFM	24 hours	1 daily start	24 hours	No, not use-limited
A2				100 run hours per year	One year	Yes, use-limited
B1	Medium-start	STUC	4 hours	1 daily start	24 hours	Yes, use-limited
B2				100 run hours per year	One year	Yes, use-limited
C1	Short-start	RTUC	1 hour	1 daily start	24 hours	Yes, use-limited
C2				100 run hours per year	One year	Yes, use-limited
D1	Fast-start	RTUC	1 hour	1 daily start	24 hours	Yes, use-limited
D2				100 run hours per year	One year	Yes, use-limited

[11] 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.

This standard is applicable to Energy Imbalance Market (EIM) entities seeking use-limited status and intertie resources that are dynamic transfers. No other intertie resources can apply for use-limited status.

Intermittent resources

A use-limitation is different from an intermittent fuel source. 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. 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). Since the ISO commitment software cannot optimize the resource over the month without opportunity cost adders, we currently do not automatically generate bids for the resource but instead allow scheduling coordinators to bid in accordance with a submitted use plan.[12] Similarly, hydro resources may be limited by a combination of storage capacity and fish and wildlife restrictions.

On the other hand, wind, solar, and geothermal resources (all without storage) run only when the fuel (*i.e.*, energy source) is available. While these generators may have some level of control (*e.g.,* feathering blades) and can submit decremental bids, the fuel supply cannot be optimized by the scheduling coordinator (*e.g.,* wait to use the fuel at a later time in order to maximize profits and system benefit). Therefore, these resources do not inherently have opportunity costs.

Use limitation in other contexts

The ISO clarifies that designation of "use limited" in the ISO market is not a reflection on how this term is used in other forums (*e.g.*, California Public Utilities Commission) or a judgment on the actual statute, regulation, ordinance, court order, or operational characteristic. For example, if the California Public Utilities Commission uses its own definition of "use limited" to grant resource adequacy capacity, the ISO does not change this designation. The ISO respects the Commission's designation and then applies the ISO's rules applicable to resource adequacy capacity obligations (such as a must offer obligation) for participation in the ISO markets. The resource can additionally apply for use-limited status in the ISO market if it meets the criteria in the proposed definition. Therefore, the ISO can have the following four types of capacity: 1) resource adequacy and use-limited; 2) resource adequacy and not use-limited; 3) not resource adequacy and use-limited; and 4) not resource adequacy and not use-limited.

[12] Most resources with a resource adequacy designation have a must offer obligation to bid that capacity into the market or else the ISO automatically generates a bid. Use-limited resources are exempt from automatic bid insertion unless there is a residual unit commitment availability bid or residual unit commitment schedule for a resource without a corresponding economic bid or self-schedule. Changes under the *Reliability Services* initiative will address must offer obligations for use-limited resources. See: http://www.caiso.com/informed/Pages/StakeholderProcesses/ReliabilityServices.aspx

Similarly, if the resource has an air permit limiting its operation, the ISO does not question the premise or content of the air permit. However, the ISO will have requirements for providing documentation and validating that sufficient information is provided to the ISO. The ISO can deny use-limited status if the resource has not submitted the appropriate or complete documentation.

Table 7 below is partially reproduced from the *Reliability Requirements* business practice manual. Text copied from the manual is in black and bolded text in blue reflect changes to the use-limited categorization under the proposed definition. The table provides general non-binding guidelines regarding the scope of use-limited status.

The first two changes under **gas-fired resources** with limited fuel storage and environmental restrictions clarify that approval of use-limited status means the limitation cannot be modeled by the ISO optimization without opportunity cost adders because it runs over a single day.

Hydro resources and participating load (including pumping load) will all remain "deemed use-limited" capacity under the proposed definition.

As noted above, **wind and solar** generators will not be considered default use-limited capacity under the proposed definition. However, tariff section 40.6.4.3.4 exempts them from automatic bid insertion in the day-ahead and real-time markets. This section is currently in the use-limited discussion in the tariff. The ISO proposes to retain this exemption but move it to an appropriate section in the tariff so that it is not subsumed under the use-limited definition.[13] Impact on Resource Adequacy designation is discussed below in Section 6.1.

Qualifying facilities (QFs) with existing QF contracts (grandfathered Public Utility Regulatory Policies Act contracts) under the ISO tariff are categorized as regulatory must-take resources, a type of self-scheduling, and are exempt from the standard capacity product availability standard reporting requirements related to resource adequacy capacity. This largely negates the need for additional use-limited status. Since the resources are self-scheduled, there is no opportunity cost. Similarly, QFs that are 20 MW or less are also entitled to regulatory must-take status and would not qualify for use-limited status. QFs with amended QF contracts will be treated as non-use-limited capacity unless they qualify otherwise under the proposed definition. Qualifying facilities that have signed the Net Scheduled Participating Generator Agreement are discussed below in the combined heat and power description. Impact on resource adequacy designation is discussed below in Section 6.1 Regulatory must-take capacity that is also resource adequacy capacity will be exempt from the bidding obligation.

Proxy demand and reliability demand response resources are deemed use-limited by the tariff and the ISO does not propose any changes to this status. Reliability demand response resources do not have non-zero start-up or minimum load costs and therefore do not have commitment cost-related opportunity costs. Proxy demand resources may have shut-down costs and minimum load costs that the ISO may consider. However, both can have energy-

[13] Policy change.

based opportunity costs. The ISO would only calculate these costs to include in a default energy bid if these resources were mitigated as part of the market power mitigation process. But since demand response is not subject to mitigation, there is no need for the ISO to calculate these costs. Proxy demand resources can directly reflect opportunity cost in the energy bids up to the offer cap and reliability demand response resources are already required to bid in near the offer cap.

Combined heat and power resources that are not subject to an existing QF contract (grandfathered Public Utility Regulatory Policies Act contract) but have signed a Net Scheduled Participating Generator Agreement can have the capacity used to support a thermal host designed as regulatory must-take, which will be exempt from the offer obligation. Tariff section 4.6.10 determines the maximum regulatory must-take capacity. Above this amount, the resource can apply to be treated as use-limited capacity if it can demonstrate that the ISO's co-optimize of non-regulatory must-take capacity would unduly interfere with the operation of the thermal host or undermine regulatory policy objectives concerning efficiency or greenhouse gas emissions.[14] Impact on resource adequacy designation is discussed below in Section 6.1.

Nuclear resources under the ISO tariff are also categorized as regulatory must-take resources. Similar to QFs, the ISO proposes to remove nuclear units from the use-limited designation. Impact on resource adequacy designation is discussed below in Section 6.1. These resources will also be exempt from the must offer obligation.

The last four rows have been added to the original table and assumes none of the generation types are QFs subject to existing QF contracts. As noted above, **geothermal** resources' fuel source is limited in the same way that wind and solar are and do not qualify for default use-limited status. As circumstances change, these resources may apply for use-limited capacity designation via the same process as other resources.

If **storage** resources can be fully optimized by the ISO within the optimization time horizon, then they do not qualify as use-limited. This does not apply to storage resources such as participating load or pumped storage (and are already deemed use-limited). The ISO understands from the California Energy Storage Alliance (CESA) that modern storage devices (*e.g.,* fly wheels) are not yet large enough to charge or discharge beyond the current ISO optimization time horizon of a single trade date in the day-ahead. If this should change in the future, these storage resources may apply for use-limited status like any other resource with an acceptable limitation. Impact on resource adequacy designation is discussed below in Section 6.1

We seek stakeholder feedback on how to address potential limitations for **biomass, landfill gas, and other resources** not discussed. Thus far, stakeholders have not objected to the ISO's classifications. These resources will not be default use-limited but may apply for such status based on the acceptable limitations.

[14] Addendum to Draft Final Proposal, Regulatory Must-Take Generation stakeholder initiative, April 30 2012, California ISO. http://www.caiso.com/Documents/Addendum_DraftFinalProposal-RegulatoryMust-TakeGeneration.pdf

Lastly, only **dynamic transfers** are allowed to apply for use-limited status. All other intertie resources cannot be considered use-limited.

Table 7
Use-limited categorization changes under proposed definition

Resource type	Use-limited (Yes/No)	Proposed changes
Gas-Fired (Steam)	No	**None**
Gas-Fired (Combined Cycle)	No	**None**
Gas-Fired (GT with limited fuel storage)	Yes	**Not use-limited if can be optimized by ISO**
Gas-Fired (GT without limited fuel storage)	No	**None**
Gas-Fired with environmental restrictions that constraint its operation	Yes	**Not use-limited if can be optimized by ISO**
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 water flow and water-release needs and other environmental conditions may dictate output so as to warrant Use-Limited status	**None. This category should also include participating load, including pumping load.**
Hydro-Small Storage/Small Conduit	Yes	**None**
Hydro-Run of the River	Yes	**None.**
Wind	Yes	**Not default use-limited. Do not have to bid in DAM (40.6.4.3.4). Assume same treatment in RTM.**
Solar	Yes	**Not default use-limited. Do not have to bid in DAM (40.6.4.3.4). Assume same treatment in RTM.**
Nuclear	Yes	**Not use-limited – regulatory must-take.**
QF	Yes	1. **With existing QF contract** – not use-limited. Is already considered regulatory must-take. 2. **Is 20 MW or less** - not use-limited. Is already considered regulatory must-take. 3. **With amended QF contract** – not default use-limited. May apply based on proposed definition.

Resource type	Use-limited (Yes/No)	Proposed changes
Resource with Contractual Limitation that Limits Availability	No	4. **With Net Scheduled Participating Generator Agreement –** see discussion below on combined heat and power **This is an overarching requirement, not just under QFs.**
Clarification: Proxy demand and reliability demand response resources	**Yes, per current tariff section 40.6.4.1**	**No commitment-related opportunity cost for RDRR. Both may have energy-related opportunity costs but ISO may not calculate because these resource types are not currently mitigated.**
New: Combined heat and power	**n/a**	**Not use-limited for regulatory must-take capacity; may apply for use-limited status for capacity above regulatory must-take.**
New: Geothermal	**n/a**	**Not default use-limited.**
New: Storage	**n/a**	**Not default use-limited.**
New: Biomass, landfill gas, others	**n/a**	**Not default use-limited.**
Intertie resources	**n/a**	**Only dynamic transfers may apply for use-limited status.**

This proposal does not change the definition or use of the terms "dispatchable" and "non-dispatchable." Under the current paradigm, non-dispatchable use-limited resources include regulatory must-take, regulatory must-run and fuel limited resources such as wind, solar, and some combined heat and power, biomass, hydro, and geothermal units. However, this proposal may eliminate or vastly decrease resources considered non-dispatchable *use-limited* and instead categorize them as non-dispatchable only. As a consequence, resources that have been previously exempt from the residual unit commitment process per tariff section 40.6.4.3.2 may now be subject to it if they have resource adequacy capacity.[15]

In summary, use-limited capacity:

- Is limited by operational limitations or restrictions established by statue, regulation, ordinance, or court order that is not due to economic, contractual, or fuel limitations;
- 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.

[15] Policy change under the Reliability Services Initiative.

6.1. Use-limited designation and resource adequacy

As discussed in the tariff stakeholder process for *Commitment Cost Enhancements*, use-limited capacity need not be a resource adequacy resource. Consequently, the ISO proposes that two existing flags in the Master File be used as follows: 1) the use-limited flag may be used for use-limited capacity regardless of resource adequacy status and 2) the must-offer flag may be used more generically (and may be renamed) to indicate that the ISO does not insert a bid regardless of resource adequacy status.[16] The use-limited flag may be used to indicate that the resource has an opportunity cost (and may also be renamed to reflect this use). A single resource may have one, both or none of the flags selected. The *Reliability Services* initiative will establish the criteria for which the ISO uses the no bid insertion flag for both use-limited and non-use-limited resource adequacy capacity.[17]

The December 10, 2014 working group of the *Reliability Services* initiative has proposed the following changes to coordinate with the change in default use-limited status for certain resources.[18] Specifically:

- Continue to exempt use-limited resources, regulatory must-take, non-generator resources, and variable energy resources from generated bid rules;
- Continue to exempt hydro, pumping load, and non-dispatchable, use-limited resources, and qualifying facilities from residual unit commitment.
    - Wind and solar may need specific provisions that recognize that their residual unit commitment obligation is equal to their day-ahead schedule.

Currently two use-limited resources that do not individually meet the definition of a flexible resource can be combined to meet the flexible resource criteria (Section 40.10.3.2(b)(2)). The ISO does not propose to change this policy.

Lastly, the business practice manual discussion for use-limited resources will be moved out of the Reliability Requirements manual to the Market Operations manual.[19] The separately published Use-Limited Resource Guidebook will be subsumed into the use-limited discussion in the Market Operations manual.[20]

6.2. Current application process

The ISO has made corresponding business practice manual changes to clarify the current application process for use-limited resources. The ISO submitted changes to require an

[16] Policy change.
[17] See http://www.caiso.com/informed/Pages/StakeholderProcesses/ReliabilityServices.aspx
[18] Presentation available at: http://www.caiso.com/Documents/AgendaPresentation-ReliabilityServices-WorkingGroupDec122014.pdf
[19] Business practice manual change pursuant to policy change.
[20] The guidebook is currently available at: http://www.caiso.com/Documents/Use-LimitedResourceGuideBook.pdf

affidavit verifying that each resource categorized as use-limited continues to qualify as such the next calendar year.[21] In addition, the ISO clarifies that a use-limited resource will be considered available 24 hours a day, 7 days a week unless the ISO receives a valid annual or monthly plan.

Additional changes will be made in the Reliability Service Initiative to further refine the current application process.

7. Opportunity costs

In response to stakeholder feedback and to allow for more time for discussion, the ISO will not implement a model for calculating opportunity costs for use-limited resources by Fall 2015. While the remainder of this proposal will move to March Board, the opportunity cost model discussion will be split off into a new initiative, *Commitment Cost Enhancements Phase 3*, along with minor commitment cost items not addressed in this initiative. The ISO will target a later Board date for phase 3, likely in Q4 2015. The ISO still commits to work with stakeholders to provide a prototype and hold technical workshops as necessary. In the meantime, use-limited resources may continue to use the registered cost option to reflect opportunity costs and take advantage of a new "short-term use-limit reached" outage without penalty to manage use limitations. These changes were discussed at a joint call with the *Reliability Services* initiative on February 6, 2015. Stakeholders can also refer to the addendum to the draft final proposal for the *Reliability Services* initiative.[22]

8. Transition costs

This topic only applies to multi-stage generators.

Transition costs are a type of start-up cost specific to multi-stage generators. Transitions costs can be thought of as the costs to "start" a configuration (or conversely the cost savings to "shut down" a configuration). The ISO maintains the separate terminology to differentiate between changes in configuration when the resource is already on versus plant-level start-up, which turns the resource "On" or "Off" per the ISO tariff definitions. A plant-level start reflects an operational need to validate a physical start and adherence to certain physical parameters such as inter-temporal constraints for the plant, versus the configuration. Otherwise, they are the same.

8.1. Transition cost current business practice manual changes

The ISO currently does not allow scheduling coordinators to submit a major maintenance adder for non-start-upable configurations. However, the ISO has clarified that for resources with an

[21] Existing business practice manual clarifications. See PRR 787 available at: http://bpmcm.caiso.com/pages/default.aspx
[22] See http://www.caiso.com/informed/Pages/StakeholderProcesses/ReliabilityServices.aspx

approved major maintenance adder in a start-able configuration, the adder from the highest start-able configuration below the non-start-upable configuration, will be added to the non-start-up-able configuration for the purposes of calculating the transition cost. This process is needed to prevent negative calculations from missing data. The ISO has made this clarification in Attachment L of the Market Instruments business practice manual.[23] This can be accomplished without any policy changes and will largely preserve the current calculation of transition costs.

8.2. Transition cost policy changes

The ISO proposes to simplify the transition cost calculation by clarifying its definition and providing guidelines on how it will be calculated. As a consequence of these changes, scheduling coordinators will be able to bid transition costs under the proxy or registered cost options.

8.2.1. Transition cost current calculation

Table 8 below is reproduced from the sample transition cost calculation spreadsheet posted on the ISO website.[24] The figure shows a four configuration resource that can start directly into configurations 1 and 3 but not into 2 or 4. The fields in yellow are based on information provided by the scheduling coordinators (or otherwise stored in the Master File). The ISO expects the data provided for the heat input, configuration Pmin and configuration start-up time to reflect the resource's actual unit-specific performance parameters and may be different for each configuration. On the other hand, the monthly GPI (gas price index), GHG (greenhouse gas) price and emission rate and the GMC (grid management charge) are the same for all configurations. The 10 percent cost adder in the last column is a calculation embedded in the spreadsheet. Lastly, the major maintenance adder column should be populated based on costs submitted to and approved by the ISO pursuant to the processes and rules in Appendix L of the Market Instruments business practice manual (incorporating the recent changes to be made as discussed in Section 10). Once the major maintenance adders have been approved, they will be stored in the Master File.

[23] Existing business practice manual clarifications (completed). See PRR 782 available at: http://bpmcm.caiso.com/pages/default.aspx

[24] "See Multi Stage Generating Resource Transition Cost Validation Sample Spreadsheet v2" available at: http://www.caiso.com/market/Pages/NetworkandResourceModeling/Default.aspx

Table 8
Current sample start-up cost calculation for multi-stage generator

STEP 1:	Calculate proxy start-up values for each configuration, and apply a 10% adder											
	The values in cells highlighted in yellow are supplied by the SC.											
		Configuration Proxy Start-Up Costs – For validation of rule 1 ONLY										
	Enter Configuration IDs	Configuration	Start-able	Heat Input (MMBtu)	Monthly GPI ($/MMBtu)	Monthly GHG Price	GHG Emission Rate	Major Maint. Adder	Configuration Pmin	Config Startup Time	GMC	Cost + 10%
	Config 1	1 - Startable	Y								0.3626	$ -
	Config 2	2	N		$0.00	$0.00	0				0.3626	$ -
	Config 3	3 - Startable	Y		$0.00	$0.00	0				0.3626	$ -
	Config 4	4	N		$0.00	$0.00	0				0.3626	$ -

Eliminate cost boundary rules

Currently the ISO relies on two separate rules to bound transition costs:

> Rule 1: Constrains the transition costs along each feasible path from offline to each configuration such that their sum is between 100 percent and 125 percent of the cost (plus 10 percent) associated with starting up directly to that configuration.
>
> Rule 2: Limits transition costs between configurations such that the sum of nested transition costs is between 100 percent and 125 percent of the direct transition.

The ISO proposes to eliminate both rules and change how transition costs are calculated.[25]

8.2.2. Transition cost proposal

A transition cost is a type of start-up cost

The ISO will clarify that the transition cost is the cost to transition between multi-stage generator configurations when the resource is already "On." It is the ISO's understanding that the transition cost reflects the fuel input and major maintenance costs, as appropriate, to transition from one configuration to another. The fuel input is based on the resource's actual unit-specific performance parameters, as required in tariff section 30.4.1.1.1. Since the transition is a start-up, there is no transition cost when transitioning to a lower configuration just like there is no start-up cost when shutting down.[26]

[25] Policy change.
[26] However, there are resources that have explicit shut-down costs.

Start-up costs can reflect major maintenance adders

The ISO will allow major maintenance costs for each configuration to be reflected in the start-up cost for each configuration. The ISO can calculate a start-up cost for each configuration regardless if the resource can start directly into that configuration or not. However, the ISO expects scheduling coordinators to provide major maintenance costs for each configuration as part of the existing process to provide such costs as described in Attachment H of the Market Instruments business practice manual.[27] If the ISO does not receive or cannot calculate major maintenance costs for non-start-upable configurations, then the last the adder from the highest start-able configuration below the non-start-able configuration will be added to the non-start-able configuration for the purposes of calculating the transition cost. This clarification is needed to prevent negative calculations from missing data.

Transition cost calculation proposal

Transition and start-up costs will be calculated and treated as follows:[28]

- A start-up cost is incurred when a resource is turned "On." If a resource is already On but incrementing between configurations, it may incur a transition cost.
- The ISO will calculate a start-up or indicative start-up cost for each configuration based on quantifiable and verifiable costs, related to physical parameters of the resource. The start-up cost is the cost incurred when a resource is turned On and is for a configuration that the resource can directly start into. An *indicative* start-up cost[29] is only calculated for the purpose of calculating transition costs and will not be used when a resource is turned On (and is not a biddable parameter). Both the start-up cost and indicative start-up cost may include a major maintenance adder per configuration. If the scheduling coordinators cannot provide such information for a particular configuration, then that configuration will have the same costs and/or parameters as the next lowest configuration with the missing data.
- The ISO clarifies that even configurations that cannot be directly started (referred to as "non-start-upable" configurations) can have verifiable physical parameters and/or costs that are used to calculate the start-up or indicative start-up cost. Again, should the scheduling coordinator not (or cannot) provide such information, the parameters of the next lowest configuration with the data will be used.
- The ISO will calculate start-up or indicative start-up costs without considering any headroom.
- Transition costs will be calculated as the difference between the calculated "To" and "From" configuration start-up or indicative start-up costs when the resource is increasing

[27] Business practice manual change pursuant to policy change.
[28] Policy change.
[29] New term. This is a proposed term to distinguish these calculated costs from the current definition of start-up costs. The ISO may ultimately use a different term but the concept remains.

in configurations. Transition costs will only be calculated for possible transition paths. The ISO does not recognize a downward transition cost. At this point, the calculation of the transition cost does not consider any headroom. Transition costs must be either a zero or positive number and will default to zero if negative.

- Scheduling coordinators may bid start-up costs and transition costs according to the rules of the proxy or registered cost option. Under the proxy cost option, scheduling coordinators may bid up to 125 percent of the start-up or transition cost on a daily basis for each configuration. Under the registered cost option, scheduling coordinators may bid up to 150 percent of the start-up and transition cost every 30 days for each configuration. These changes will require new bidding and verification functionality for both registered and proxy cost options. The ISO will automate these processes.

8.2.3. Transition costs for natural gas-fired resources

The ISO reviewed a sample of multi-stage generator transition costs for natural gas-fired resources. The tables below reflect the two most common variations. Table 9 shows the proposed calculation for a resource with distinct peakers or steam turbines and Table 11 shows a resource with duct firing and distinct peakers or turbines. For both tables, the costs are calculated as such:

(Heat input x Gas price) + (Heat input x GHG price x GHG emission rate) + Major maintenance adder + (Config startup time / 2 x Config startup time /60 x GMC) + (Start-up energy x EPI)

Unit A in Table 9 has four configurations. Only configurations 1 and 3 are directly startable and all transition paths are possible except from 2 to 4. In this example, a new configuration entails starting a new peaker or steam turbine. Therefore, most of the costs and physical parameters approximately double as the configurations increase. The ISO expects that all the columns in yellow are verifiable costs and/or verifiable physical parameters of the resource. For example, the ISO should be able to verify the heat input, start-up energy, configuration Pmin, and start-up time for each configuration. The ISO clarifies that the heat input is the amount to reach the Pmin of the peaker or steam turbine. This is different than the transition heat input which is the difference in heat input between the configurations.[30]

Additionally through its existing process, the ISO expects to verify the major maintenance adder for each configuration. The non-highlighted columns are costs that remain the same for all configurations and are provided by the ISO, such as the daily gas price index. The last column in blue calculates the total start-up or indicative start-up cost.

[30] Business practice manual change supporting new policy.

Table 9
Proposed start-up and indicative start-up cost calculation: peaker or steam turbine

Config IDs	Configuration	Heat Input (MMBtu)	Gas price ($/MMBtu)	GHG Price	GHG Emission Rate	Major Maint. Adder	Config Pmin	Config Startup Time	GMC	Start-up energy (MWh)	Energy Price Index ($/MWh)	Cost
UnitA_1	1 - Startable	80	$4.00	$12.00	0.053963	$250	50	20	$0.38	20	$1.00	$645
UnitA_2	2 - NOT startable	160	$4.00	$12.00	0.053963	$550	100	20	$0.38	20	$1.00	$1,320
UnitA_3	3 - Startable	240	$4.00	$12.00	0.053963	$1,000	150	20	$0.38	20	$1.00	$2,145
UnitA_4	4 - NOT startable	320	$4.00	$12.00	0.053963	$1,500	200	20	$0.38	20	$1.00	$3,020

Table 10 shows the calculated transition costs based on the start-up and indicative start-up costs shown in Table 9. The calculated transition costs do not include headroom. All of the transition costs are calculated as the difference between the "To" configuration and "From" configuration start-up and indicative start-up costs. For example, the start-up cost for configuration 1 is $645 and for configuration 2 is $1,320 as shown in the last column of Table 9. If the resource transitions from configuration 1 to 2, it would incur an additional $675 in transition costs shown in the first row, second column of Table 10, which is the difference between the two configuration start-up costs.

Scheduling coordinators can bid up to 125 percent or 150 percent of the transition cost under proxy or registered cost, respectively. As noted above, the unit cannot transition from configuration 2 to 4 so that transition cost is not calculated. When the resource stays in configuration 1 it incurs only the start-up for configuration 1. After it transitions, it would only incrementally incur the transition cost to configuration 2. There are no transition costs from a higher to a lower configuration or if the resource stays in the same configuration.

Table 10
Proposed transition cost calculation: peaker or steam turbine

		"To" configuration			
		UnitA_1	UnitA_2	UnitA_3	UnitA_4
"From" configuration	UnitA_1		$675	$1,500	$2,375
	UnitA_2			$825	n/a
	UnitA_3				$875
	UnitA_4				

As part of this new policy, if information is not provided for each configuration (even if the configuration is not start-upable), then the ISO will use data from the last available configuration. Table 11 below provides an illustrative example where the non-start-upable configuration data is missing and highlighted in orange. For data missing for configuration 2, the ISO will use data from configuration 1 and for data missing for configuration 4 the ISO will use data from configuration 3.

Table 11
Proposed start-up and indicative start-up cost calculation for missing data: peaker or steam turbine

Config IDs	Configuration	Heat Input (MMBtu)	Gas price ($/MMBtu)	GHG Price	GHG Emission Rate	Major Maint. Adder	Config Pmin	Config Startup Time	GMC	Start-up energy (MWh)	Energy Price Index ($/MWh)	Cost
UnitA_1	1 - Startable	80	$4.00	$12.00	0.053963	$250	50	20	$0.38	20	$1.00	$645
UnitA_2	2 - NOT startable	80	$4.00	$12.00	0.053963	$250	50	20	$0.38	20	$1.00	$645
UnitA_3	3 - Startable	240	$4.00	$12.00	0.053963	$1,000	150	20	$0.38	20	$1.00	$2,145
UnitA_4	4 - NOT startable	240	$4.00	$12.00	0.053963	$1,000	150	20	$0.38	20	$1.00	$2,145

The consequence of not providing data for configurations 2 and 4 (and the ISO using information from configurations 1 and 3, respectively), is a zero transition cost calculated for transition paths C1 to C2 and C3 to C4, reduced transition cost from C1 to C4, and an increase in transition cost from C2 to C3 because the C2 cost is now lower. Transitioning from C2 to C4 is not possible for this resource.

Table 12
Proposed transition cost calculation for missing data: peaker or steam turbine

		"To" configuration			
		UnitA_1	UnitA_2	UnitA_3	UnitA_4
"From" configuration	UnitA_1		$0	$1,500	$1,500
	UnitA_2			$1,500	n/a
	UnitA_3				$0
	UnitA_4				

Unit B in Table 13 has four configurations and only the first and the third can be directly started. In this example, configurations 2 and 4 reflect duct firing. Therefore, the costs do not double from configuration 1 to 2 or from 3 to 4. Instead, there is an increase in fuel input to access the duct firing at the top of the combustion turbine configuration (*i.e.*, when the combustion turbine is operating at 85 percent of capacity) and small incremental increases in the costs due to the change in the configuration Pmin.[31] Unlike starting a new piece of equipment, it is the ISO's understanding that in order to access the duct firing capability, the resource needs to increase its energy output from the Pmin of configuration 1 (200 MW) through to the Pmin of configuration 2 (250 MW) and would be paid for the energy produced in the dispatchable portion

[31] Business practice manual change supporting new policy.

of configuration 1 (between 200 and 249 MW). In this way, there is a small amount of additional fuel input for reaching duct firing that has not been accounted for in the energy to ramp into the duct firing configuration. The ISO appreciates feedback provided by stakeholders in clarifying this point.

The ISO expects that all the columns in yellow are verifiable costs and/or verifiable physical parameters of the resource. For example, the ISO should be able to verify the heat input, start-up energy, configuration Pmin, and start-up time for each configuration. The ISO clarifies that the heat input is the amount to reach the Pmin of the combustion turbine or duct firing (assuming the combustion turbine supporting the duct firing is near maximum capacity). This is different than the transition heat input which is the difference in heat input between the configurations.[32]

Additionally through its existing process, the ISO expects to verify the major maintenance adder for each configuration. The non-highlighted columns are costs that remain the same for all configurations and are provided by the ISO such as the daily gas price index. The last column in blue calculates the total start-up or indicative start-up cost.

Table 13
Proposed start-up cost calculation: duct firing

Config IDs	Configuration	Heat Input (MMBtu)	Gas price ($/MMBtu)	GHG Price	GHG Emission Rate	Major Maint. Adder	Config Pmin	Config Startup Time	GMC	Start-up energy (MWh)	Energy Price Index ($/MWh)	Cost
UnitB_1X1	1 - Startable	1,500	$4.00	$12.00	0.053072	$11,590	200	60	$0.38	20	$1.00	$18,604
UnitB_1X1DF	2 - NOT startable	1,550	$4.00	$12.00	0.053072	$11,590	250	60	$0.38	20	$1.00	$18,845
UnitB_2X1	3 - Startable	2,500	$4.00	$12.00	0.053072	$23,180	400	60	$0.38	20	$1.00	$34,869
UnitB_2X1DF	4 - NOT startable	2,550	$4.00	$12.00	0.053072	$23,180	450	60	$0.38	20	$1.00	$35,110

Table 14 shows the calculated transition costs based on the start-up and indicative start-up costs shown in Table 13. The calculated transition costs do not include headroom. All of the transition costs are calculated as the difference between the "To" configuration and "From" configuration start-up and indicative start-up costs. For example, the start-up cost for configuration 1 is $18,604 and for configuration 2 is $18,845 as shown in the last column of Table 13. If the resource transitions from configuration 1 to 2, it would incur an additional $241 in transition costs shown in the first row, second column of Table 14, which is the difference between the two configuration start-up costs.

Scheduling coordinators can bid up to 125 percent or 150 percent of the transition cost under proxy or registered cost, respectively. The resource also cannot transition from configuration 2 to 4 so that transition cost is not calculated. When the resource stays in configuration 1 it incurs only the start-up for configuration 1. After it transitions, it would only incrementally incur the

[32] Business practice manual change supporting new policy.

transition cost to configuration 2. There are no transition costs from a higher to a lower configuration or if the resource stays in the same configuration.

Table 14
Proposed transition cost calculation: duct firing

		"To" configuration			
		UnitA_1	UnitA_2	UnitA_3	UnitA_4
"From" configuration	UnitA_1		$241	$16,265	$16,507
	UnitA_2			$16,024	n/a
	UnitA_3				$241
	UnitA_4				

8.2.4. Transition costs for non-natural gas-fired resources

For non-natural gas-fired resources (thermal and non-thermal), the ISO system currently uses a single cost amount (in dollars) or a single cost amount per configuration (in dollars) in start-up costs instead of a heat input multiplied by the gas price index. Other cost items remain largely the same except for different inputs used between the proxy and registered cost options.

Formula for non-natural gas thermal resource with greenhouse gas obligation under proxy cost option

(Non-natural gas start cost) + (Heat input x GHG price x GHG emission rate) + Major maintenance adder + (Config startup time / 2 x Config startup time /60 x GMC) + (Start-up energy x EPI)

Table 15
Proposed start-up cost calculation: non-natural gas thermal

Config IDs	Configuration	Non-nat gas start cost ($)	Heat Input (MMBtu)	GHG Price	GHG Emission Rate	Major Maint. Adder	Config Pmin	Config Startup Time	GMC	Start-up energy (MWh)	Energy Price Index ($/MWh)	Cost
UnitC_1	1 - Startable	$1,000	1,500	$12.00	0.053072	$10,000	200	60	$0.38	20	$1.00	$12,014
UnitC_2	2 - NOT startable	$2,000	2,300	$12.00	0.053072	$20,000	250	60	$0.38	20	$1.00	$23,533
UnitC_3	3 - NOT startable	$3,000	3,400	$12.00	0.053072	$35,000	400	60	$0.38	20	$1.00	$40,262
UnitC_4	4 - NOT startable	$4,000	4,400	$12.00	0.053072	$42,000	450	60	$0.38	20	$1.00	$48,908

The formula for a non-thermal resource is shown below. The only difference is the elimination of the greenhouse gas cost calculation. The formula would be the same for a non-natural gas thermal resource without a greenhouse gas obligation.

Formula for non-natural gas thermal resource with greenhouse gas obligation under proxy cost option

(Non-natural gas start cost) + Major maintenance adder + (Config startup time / 2 x Config startup time /60 x GMC) + (Start-up energy x EPI)

At this time the ISO cannot directly reflect multiple fuels for the same resource. Stakeholders should comment on whether this should be a future enhancement.

9. Greenhouse gas costs

In response to Assembly Bill 32, California's Air Resources Board established the state's market-based cap-and-trade program to reduce greenhouse gas emissions. "Covered entities," such as thermal generators, emitting more than 25,000 metric tons of carbon dioxide equivalents (MTCO2e) per year are required to comply. The program began on January 1, 2013 with phased compliance obligations for different parts of the economy. Thermal electric generating sources have already begun compliance.

Starting January 1, 2015, natural gas suppliers will also be considered covered entities for the amount of gas delivered to California end-users, net of the amount delivered to existing covered entities.[33]

The ISO currently allows covered entities to reflect greenhouse gas costs in commitment costs. Thermal resources that have not reached the 25,000 MTCO2e threshold cannot include a greenhouse gas cost or will have to voluntarily enroll in the cap-and-trade program. Depending on how the regulations are changed, the ISO has two main options in the future:

1) When natural gas suppliers become covered entities, the greenhouse gas costs incurred may be passed on to natural gas-fired generators that do not meet the emission threshold. Therefore, all natural gas-fired resources will have greenhouse gas costs. Correspondingly, the ISO proposes to allow all natural gas-fired resources to reflect greenhouse gas costs in commitment costs. This assumes that greenhouse gas costs are *not* reflected in the gas price indices used.[34]
2) On the other hand, if the cost of greenhouse gas is already reflected in the gas price indices, no generators will need an explicit adder for these costs. Instead, the ISO will simply reflect the natural gas costs.

[33] California Public Utilities Commission, *Scoping Memo and Ruling of the Assigned Commissioner and Administrative Law Judge*, Rulemaking 14-03-003, July 7, 2014, p. 3.
[34] Policy change.

The California Public Utilities Commission is currently assessing the impact of greenhouse gas compliance on natural gas suppliers.[35] On November 18, 2014 the Commission released a non-binding proposed decision that defers several key issues from the current Phase 1 process to Phase 2 of the proceeding.[36] The schedule for Phase 2 has not been released. It is also unclear whether the gas price indices in future will reflect greenhouse gas costs.

The outcome of this proposal will impact commitment cost and opportunity cost calculations and will need careful consideration of energy imbalance market resources. However, given the current regulatory uncertainty, the ISO proposes no policy changes until there is clearer direction from the Commission. The ISO needs more regulatory clarity in order to propose market design changes that will be acceptable to the Federal Energy Regulatory Commission.

10. Additional business practice manual clarifications

Costs for non-natural gas-fired resources

The FERC has approved the ISO's tariff amendment to allow reflection of fuel or fuel-equivalent costs for non-natural gas-fired resources.[37] The ISO will make a corresponding clarification in the Market Instruments manual that non-thermal resources will be allowed to use the "fuel cost" fields in the Master File to reflect non-fuel costs, such as pumping costs for pumped storage resources.[38] The ISO recognizes that much of the ISO's systems were created with natural gas-fired resources in mind and that some categories do not specifically meet non-gas or non-thermal resources' needs.

Specifically for start-up costs, non-natural gas-fired resources may include a single cost amount (in dollars) to reflect a fuel or fuel-equivalent cost. As discussed above in section 8.2.3, this can also be a per configuration cost for each start-up or indicative start-up.

Specifically for minimum load costs, non-natural gas-fired resources may include a single cost amount (in dollars) to reflect a fuel or fuel-equivalent cost. For resources selecting the multi-stage generator modeling, a single cost amount may be provided for each configuration.

For both start-up and minimum load costs, the ISO clarifies that these costs do not vary automatically (*e.g.,* based on an index or changing conditions). These costs are submitted by the scheduling coordinator and kept in the ISO's system. The ISO seeks stakeholder feedback on whether this is a sustainable solution for non-natural gas-fired resources and how stakeholders should submit supporting documentation for these costs.

[35] See California Public Utilities Commission, Rulemaking 14-03-003, filed March 13, 2014.
[36] California Public Utilities Commission, Proposed Decision, Decision Resolving Phase 1 Issues and Addressing the Motion for Adoption of Settlement Agreement, Rulemaking 14-03-003, November 18, 2014.
[37] *California Indep. Sys. Operator Corp.*, FERC docket no. ER15-15, October 1, 2014. Section 30.4.1.1.2 Non-Natural Gas-Fired Resources. FERC approved on December 31, 2014.
[38] Business practice manual change pursuant to tariff approved under ER15-15.

Major maintenance adders

The ISO has made a clarification in Appendix L of the Market Instruments manual outlining the documentation required and the methodology used to calculate major maintenance adders.[39]

Energy price index and auxiliary start-up cost calculation

The ISO agrees with stakeholders that the energy price index and the methodology used to calculate auxiliary start-up costs is not clear. Therefore, the ISO will clarify the existing methodology in a business practice manual as soon as possible.[40] As part of this documentation, the ISO may require the posting of certain information to stakeholders such as the specific and confidential energy price index used per resource. However, posting of information will need to follow the ISO's current implementation schedules and priority.

In addition to documenting the current process, the ISO will work with stakeholders to consider proposed changes, improvements, and clarifications to the inputs and methodology (inclusive of policy and business practice manual changes) in a stakeholder process. At this time the ISO is evaluating which stakeholder process will be the most appropriate venue (*i.e.*, *Commitment Cost Enhancements Phase 3* or *Bidding Rules*). The ISO will announce the final determination to stakeholders at a later date.

11. Other issues

Default variable operation and maintenance costs

The ISO is approaching the three year review period for default variable operation and maintenance costs, which became effective on April 1, 2012. We agree with stakeholders that current costs used are sufficient and there is currently no need for a review.

Default major maintenance adders

The ISO is contemplating ways to reduce the administrative burden on ISO and stakeholder resources by proposing to establish default values for major maintenance adders. Many scheduling coordinators only have access to contracts such as power purchase agreements as supporting documentation when applying for these adders. These costs may not necessarily reflect actual operational costs but rather a negotiated price. The ISO proposes to use default values when the scheduling coordinator cannot or does not provide supporting documentation for alternative values. The ISO would apply this to both non- and multi-stage generating

[39] Existing business practice manual clarifications (completed). See PRR 782 available at: http://bpmcm.caiso.com/pages/default.aspx
[40] Existing business practice manual change.

resources. While the ISO agrees with stakeholders that establishing default major maintenance adders may be beneficial, we will need more time to explore this option. This topic is also delayed to *Commitment Cost Enhancements Phase 3*.

Clarification on major maintenance adders

The ISO reiterates that if scheduling coordinators submit power purchase agreements, service agreements or other contractual arrangements as documentation for major maintenance adders, they must be based on estimates of reasonable actual major maintenance costs. This is already detailed in the tariff in section 30.4.1.1.4.

Future improvements to consider

Some stakeholders have suggested improvements in how the ISO accounts for start types and gas transportation costs. The ISO agrees that these issues may need to be reviewed will address them in *Commitment Cost Enhancements Phase 3.* Additionally, the ISO proposes to address the use of the daily start limit field more closely under the *Bidding Rules Enhancements* initiative.

12. Next Steps

The ISO will discuss this draft final proposal with stakeholders on a conference call on February 12, 2015. Stakeholders should submit written comments by March 2, 2015 to initiativecomments@caiso.com.

Attachment D – Board Memorandum

Commitment Cost Enhancements Phase 2

California Independent System Operator Corporation

Memorandum

To: ISO Board of Governors

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

Date: March 19, 2015

Re: Decision on commitment cost enhancements phase 2

This memorandum requires Board action.

EXECUTIVE SUMMARY

At their September 2014 meeting, the Board of Governors approved a set of targeted market rule changes for generator commitment costs to improve market efficiency and reliability during natural gas price spikes. The proposal included a provision to allow a subset of resources currently considered as use-limited to reflect opportunity costs in their start-up and minimum-load bids through the use of the registered cost option, which allows bids up to 150 percent of the resource's calculated start-up and minimum load costs.

In this proposal, Management seeks Board approval to narrow the scope of resources considered "use-limited" which are eligible to include an opportunity cost in their start-up and minimum load bids. Currently, the definition of use-limited resources includes all resources that are not able to participate in the ISO's market with a 24/7 must-offer obligation. This includes qualifying facilities and wind and solar resources for example. The reliability services initiative is creating categories of resources that will be exempt from the 24/7 must-offer obligation. Thus, as a result of these changes, the ISO proposes to clarify that only resources eligible for an opportunity cost will be provided use-limited status and to clarify that opportunity costs reflect the revenue that would be lost if the resource cannot be utilized in the market at the times it is most valuable. The substance of the definition is otherwise unchanged and the limitation, which provides the basis for an opportunity cost, must be based on environmental, design or other non-economic reasons. Finally, Management also proposes to simplify the calculation of multi-stage generator transition costs and treat these costs similar to generator start-up costs. Transition costs reflect the costs a multi-stage generator, such as a combined cycle generation plant that uses a combination of gas turbines and steam generators, incurs when moving from one configuration to another.

Management proposes the following motion:

> ***Moved, that the ISO Board of Governors approves phase 2 of the commitment cost enhancements proposal, as described in the memorandum dated March 19, 2015; 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

The tariff 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." Limitations cannot be economic in nature such as due to a contract provision. All hydro, participating load, and demand response resources are automatically "deemed" use-limited and qualifying facilities and wind and solar were generally considered use-limited.

The ISO originally developed the use-limited resource category to recognize that some resource adequacy resources have limitations that prevent them from being able to offer in the market as full must-offer resources. Full must-offer resources must bid into the market each day and hour of the week they have an offer obligation. In the event the resource fails to provide a bid, the ISO will automatically generate bids to meet their must-offer obligation. Use-limited resources, on the other hand, are not similarly available. Instead, their scheduling coordinators submit use-limitation plans and bid the resources accordingly. The ISO does not generate bids on behalf of such resources.

Although the ISO originally developed the use-limited resource category for resource adequacy purposes, the ISO modified this definition to also apply to non-resource adequacy resources. Use-limited resources have the right to bid up to 50 percent of their calculated startup-up and minimum load cost to reflect their opportunity costs. The ISO recognized that non-resource adequacy resources that otherwise meet the definition of a use-limited resource should also be eligible to bid their opportunity costs. If a use-limited resource has the ability to include its opportunity costs in its bids, then it should be able to bid in all hours.

During its September 2014 meeting, the Board approved market rule changes to allow only use-limited resources to remain on the "registered cost" commitment

cost bidding option to accommodate opportunity costs in their commitment cost bids. The registered cost option allows use-limited resources to bid up to 150 percent of calculated costs versus the lower 125 percent cap under the alternative "proxy cost" option. Under the proposal approved by the Board, the registered cost option is to be retained until the ISO can explicitly calculate opportunity costs for use-limited resources.
Although Management proposed a methodology for calculating opportunity costs for use-limited resources, stakeholders requested that Management take more time to finish developing the opportunity cost methodology. As a result, Management plans to propose an opportunity cost methodology to the Board in September. In the meantime, use-limited resources can continue to use the registered cost commitment cost bidding option to reflect opportunity costs – subject to the four proposed enhancements to the use-limited definition described below.

This proposal also addresses multi-stage generator transition costs. Multi-stage generators differ from typical generators because they have different configurations, each with different minimum and maximum output levels and operating characteristics. Like other generators, multi-stage generators incur start-up costs. But unlike typical generators, multi-stage generators can transition between configurations and also incur costs when transitioning into a configuration with a higher maximum capacity. Transition costs are very similar to start-up costs, but the ISO currently accounts for transition costs differently than start-up costs and does not allow resources to bid these costs in the same manner as start-up costs. The proposal described below outlines new provisions to calculate transition costs in a similar manner to start-up costs.

Proposed enhancements for the use-limited resource definition

Management proposes the following four modifications and clarifications to the use-limited resource definition.

- The term "use-limited resource" will change to "use-limited capacity," recognizing that a resource may not always be use-limited or may only have a portion of its capacity that is use-limited. For example, some air permits limit a resource's run time only during the summer months. Therefore, the resource would have use-limited capacity during the summer only.

- Clarify the existing limitation that use-limitation status may not be based on economic limitations by explicitly stating that limitations on the resource's operation must be derived from a statute, regulation, ordinance, court order, or the resource's design, and that the ISO market's optimization cannot automatically account for the opportunity costs.

For example, an environmental restriction may limit a resource's run time over a single month to only 200 hours. However, the ISO market's optimization only considers a single day at most. Currently, the ISO optimization does not take into account that dispatching a resource in the current day may restrict its ability to run later in the month. If the resource is economic, the market could potentially keep it on for 200 hours consecutively rather than dispatching it in the 200 hours during the month when prices and system need is the highest. When the resource runs in lower-priced hours, it incurs an opportunity cost. Therefore, use-limited resources, by definition, have opportunity costs.

Third, all regulatory must-take and qualifying facility capacity that is considered regulatory must-take will no longer be included in the definition of use-limited capacity. These resources are not eligible for an opportunity cost because, for example, the availability of the capacity is dictated by their PURPA contract obligations and their commitment to their host industrial processes. The Reliability Services initiative will continue to exempt these resources from bid insertion rules.

- Fourth, variable energy resources will no longer be considered use-limited capacity. A resource with an intermittent fuel source cannot be optimized to run only during the most profitable hours. It can only run when the energy source is available. Therefore, these resources do not inherently have opportunity costs that need to be accounted for under the use-limited category. The Reliability Services initiative will continue to exempt these resources from bid insertion rules.

Proposed enhancements for the calculation of transition costs

Management proposes the following two enhancements for the calculation of transition costs.

- First, the ISO will calculate transition costs in a similar manner as for start-up costs for typical generators. This includes consideration of certain costs such as major maintenance adders, as appropriate. By aligning the calculation of transition costs and start-up costs, Management recognizes that the transition cost is a form of start-up cost specific to multi-stage generators.

- Second, the ISO will allow scheduling coordinators to bid transition costs in the same manner that proxy and registered costs are currently bid into the market.

These two enhancements greatly simplify the current calculation of transition costs and provide more clarity for market participants.

POSITION OF THE PARTIES

Stakeholders generally support the enhancements to the use-limited resource definition and overwhelmingly support the proposed changes to the transition cost calculation. Certain stakeholders have concerns for specific resources currently designated as use-limited resources that may lose such status under the new definition.

The Market Surveillance Committee supports Management's proposal. The Market Surveillance Committee has provided a draft opinion on Management's proposal and will be voting on the opinion at its March 23, 2015 meeting.

The Department of Market Monitoring also supports Management's proposal. The DMM report is included with the March Board materials as an informational report. Both the MSC and DMM have encouraged the ISO to develop the opportunity cost adder as soon as possible.

The following addresses stakeholder positions raised during the stakeholder process. A detailed stakeholder comment matrix is attached.

Position 1: Some market participants would like to use contract limitations as a basis for obtaining (or retaining) use-limited resource status because they have signed power purchase agreements with start-up limitations. These market participants are asking to remain use-limited for a transition period. As stated below in more detail, economic reasons such as contract limitations have never been a basis for obtaining use-limited status.

Response: The ISO's practice of not allowing economic, including contract-based, limitations precedes the enhancements proposed today. This is a long-standing ISO tariff provision and practice detailed in the business practice manual since 2009.[1] Recently signed contracts that limit the operation of the resource adequacy resources in question have done so while the current tariff and business practice manuals have been in effect. Proposed changes to the use-limited resource definition do not change this specific provision. Therefore, Management does not see a need for a transition period for these contracts as a result of the proposed clarifications to the use-limited resource definition. In addition, Management notes that but for the contractual limitations, the resources of concern do not have any other operational limitations. The resources are physically capable of satisfying the default resource adequacy obligations. Although costs may increase for resources that are dispatched more frequently, the ISO and the Department of Market Monitoring have taken steps over the last year to ensure that the resources can reflect these costs in their commitment cost bids to improve cost recovery. This is particularly the case for major

[1] See Business Practice Manual for Reliability Requirements, March 27, 2009, version 1, pages 41-42. The manual is currently on version 24.

maintenance costs related to increased dispatch. Finally, allowing contractual limitations to dictate use limitations could erode the ISO's ability to ensure reliability, and encourage similar arrangements in the future.

Position 2: Some stakeholders have concerns that the ISO's storage modeling capabilities may not appropriately capture the operating characteristics of non-pumping storage resources. These stakeholders request default use-limited resource status. Similarly, some stakeholders have requested an exemption from bid insertion for all storage resources.

Response: Management understands that to effectively dispatch storage resources, the ISO must have models that can accurately account for their operational constraints (i.e., number of cycle times allowed in a given period). However, simply providing default use-limited resource status to storage resources will not resolve these issues. Use-limited resource status provides resources with the ability to provide commitment costs that ensure they are dispatched efficiently within their use limitations. Storage resources do not incur commitment costs. Therefore, the provisions provided to use-limited resources would not address the operational constraints of storage resources. To address storage resources' operational dispatch constraints, Management will be starting a new stakeholder initiative in April to clarify what modeling and market functionality is currently available to reflect storage resources' operational constraints. If this review reveals that enhancements to storage modeling or policy are needed, they will be addressed in this stakeholder initiative. This will ensure that storage resources can be effectively dispatched in the ISO market.

As this technology matures and as the ISO improves upon its storage modeling capability, non-pumping storage can apply for use-limited resource status in the future. However, there is no value in setting these resources as default use-limited today. The reliability services initiative will exempt non-generating resources, pumped hydro, and use-limited storage resources from bid insertion.

CONCLUSION

Management recommends the Board approve the commitment cost enhancements proposal described in this memorandum. The enhancements to the definition of use-limited resources provide clarity to existing rules, improve the ISO's processes, and support the reliability services initiative in enhancing reliability. The transition cost improvements will improve market efficiency by aligning costs more appropriately with start-up costs and providing greater transparency to market participants.

California ISO

Attachment A

Stakeholder Process: Commitment Cost Enhancements Phase 2

Summary of Submitted Comments

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

- Round One, 11/19/14
- Round Two, 1/13/15
- Round Three, 3/2/15

Stakeholder comments were received from: California Public Utilities Commission, Calpine Corporation, City of Pasadena, Department of Market Monitoring, NRG Energy, Pacific Gas & Electric Company, San Diego Gas and Electric, Shell Energy, Six Cities, and Southern California Edison.

Stakeholder comments are posted at:
http://www.caiso.com/informed/Pages/StakeholderProcesses/CommitmentCostEnhancementsPhase2.aspx

Other stakeholder efforts include:

- Stakeholder call, 11/12/14
- Stakeholder call, 1/6/15
- Stakeholder call with reliability services Initiative, 2/6/15
- Stakeholder call, 2/12/15
- Numerous outreach calls

Stakeholder	Management proposal: Clarify and improve use-limited definition, qualification criteria and application process	Management response
California Public Utilities Commission	Broadly supports but grandfather long-term resource adequacy contracts with contract-based limitations approved by the Commission.	The ISO's practice of not allowing economic, including contract-based, limitations precedes the enhancements proposed today. This is a long-standing ISO tariff provision and practice detailed in the business practice manual since 2009. Recently signed contracts that limit the operation of the resource adequacy resources in question have done so while the current tariff and business practice manuals have been in effect. Proposed changes to the use-limited definition do not change this specific provision. Therefore, there is no reason to grandfather these contracts. The ISO accepts documentation of underlying environmental restrictions, even if the restrictions are ultimately reflected in a contract. The current proposal allows for the continued use of the registered cost option until the ISO has developed and opportunity cost methodology. Therefore, stakeholders should continue to reflect opportunity costs under the registered cost option. Categorizing all storage resources as default use-limited out of a concern for the ISO's storage modeling capabilities misinterprets the intent of the use-limited category. Under the ISO's storage model, the non-generating resource, start-up and minimum load costs are zero. Therefore, the opportunity cost is also zero and there is no value in setting these resources as default use-limited today. Furthermore, the reliability services initiative will exempt non-generating resource, pumped hydro, and use-limited storage from bid insertion.
Calpine Corporation	Does not oppose.	
City of Pasadena	No comment.	
NRG Energy	Should consider if and what kinds of contractual limits might be acceptable use limits.	
Pacific Gas & Electric Company	Supports but ISO should outline how to translate environmental restrictions into use limitations that are reflected as contractual limitations. All storage should be exempt from bid insertion.	
San Diego Gas and Electric	Broadly supports but grandfather long-term resource adequacy contracts with contract-based limitations approved by the Commission. Tariff does not explicitly prohibit "non-contractual" limitations.	
Shell Energy	Broadly supports but grandfather long-term resource adequacy contracts with contract-based limitations approved by the Commission.	
Six Cities	Supports.	
Southern California Edison	Use limitations should include long-term resource adequacy contracts with contract-based limitations approved by the Commission. Storage resources should be considered use-limited.	

Stakeholder	Management proposal: Align the calculation of transition costs with start-up costs	Management response

Stakeholder	Management proposal: Align the calculation of transition costs with start-up costs	Management response
California Public Utilities Commission	No comment.	No stakeholders have indicated opposition to the transition cost proposal.
Calpine Corporation	Supports.	
City of Pasadena	No comment.	
NRG Energy	No comment.	
Pacific Gas & Electric Company	Supports.	
San Diego Gas and Electric	Supports.	
Shell Energy	No comment.	
Six Cities	Supports.	
Southern California Edison	Supports.	

Attachment E – DMM Memorandum

Commitment Cost Enhancements Phase 2

California Independent System Operator Corporation

Memorandum

To: ISO Board of Governors

From: Eric Hildebrandt, Director, Market Monitoring

Date: March 19, 2015

Re: **Department of Market Monitoring report**

This memorandum does not require Board action.

EXECUTIVE SUMMARY

This memo provides comments by the Department of Market Monitoring (DMM) on three Management proposals being presented to the Board:

- **Energy imbalance market year 1 enhancements.** DMM supports Management's proposed design changes to the energy imbalance market (EIM) scheduled for implementation when NV Energy joins the EIM in October 2015. DMM believes the most important element of Management's proposal involves how transfer limit constraints between EIM balancing authority areas will be modeled. The approach proposed by Management is designed to maximize the use of transmission rights made available in the EIM on different interties while avoiding any inappropriate impact this has on locational prices within EIM areas. DMM believes this approach can effectively balance these objectives, but recommends that the details of this approach be carefully tested and adjusted as necessary based on market simulation prior to implementation, as described in Management's memo.

- **Commitment cost enhancements phase 2.** DMM supports Management's proposal to clarify the current definition and qualification criteria for resources that are granted use-limited status. This has important implications since units deemed to be use-limited will continue to be exempted from some important bidding and availability standards established through other market initiatives to help ensure sufficient capacity is available for dispatch to meet the ISO's growing need for operational flexibility. However, DMM is concerned that the ISO's effort to develop a methodology and model for calculating opportunity costs that could be directly incorporated in bids for use-limited resources has again been deferred. DMM has provided detailed input on this project and will continue to work with the ISO and stakeholders on this important market enhancement.

- **Reliability services initiative.** DMM is supportive of Management's proposal under the first phase of this initiative as a step forward toward improving and streamlining resource adequacy requirements and processes to meet the need for increased operational flexibility to integrate new renewable energy resources. Under Management's proposal, until opportunity cost estimates can be implemented, use-limited resources can exempt themselves from the availability standards by submitting special outages. Therefore, DMM urges the ISO to commit the resources necessary to develop and implement the opportunity cost estimation method, as noted above. DMM also recommends that the ISO monitor whether the new level of the availability incentive established under this initiative is high enough to prevent suppliers from opting to pay a penalty rather than provide substitute capacity when supply conditions are relatively tight. If this occurs, the ISO will need to procure capacity through the capacity procurement mechanism.

ENERGY IMBALANCE MARKET YEAR 1 ENHANCEMENTS

EIM transfer limits constraints

DMM believes the most important element of Management's proposal involves how transfer limit constraints between EIM balancing authority areas will be modeled. As described in Management's memo, the approach proposed by the ISO is designed to maximize the use of contractual transmission rights made available in the EIM on different interties, while minimizing the impact these contractual considerations have on locational prices within EIM areas. DMM believes Management's proposed approach for modeling EIM transfer limit constraints should accomplish these objectives if carefully tested prior to implementation, as proposed by the ISO.

DMM has closely reviewed the proposed approach for modeling EIM transfer limit constraints based on the level of detail provided in the ISO's final proposal, and submitted a detailed summary of DMM's analysis.[1] Based on this analysis, DMM concurs with the ISO and the Market Surveillance Committee that if the transfer cost used in the market software is set at a relatively low value, the proposed approach should allow the ISO to efficiently make use of EIM transfer capacity while limiting the impact of the transfer cost on locational market prices.

The final proposal outlined in Management's memo specifies that the transfer cost used in the market software will be determined by the ISO. If an EIM entity has multiple EIM internal interties, the ISO will consult with the EIM entity to determine the appropriate

[1] The detailed summary of DMM's analysis can be found here: http://www.caiso.com/Documents/DMMComments_EnergyImbalanceMarketYear1Enhancements-DraftFinalProposal.pdf.

transfer costs to balance the goals of maximizing use of transmission made available in EIM while minimizing impacts of the transfer cost on locational market prices. This clarification addresses concerns that an EIM entity could be subject to scrutiny by DMM if the transfer cost was set by the EIM entity rather than by the ISO. DMM is prepared to work closely with the ISO and EIM entities to determine the level at which transfer costs should be set based on pre-implementation market simulation results and actual market results after implementation.

Greenhouse gas bidding rules

DMM supports proposed changes involving greenhouse gas bidding rules. These changes would implement recommendations made by DMM during the initial EIM design to encourage EIM participation and address stakeholder concerns. FERC's June 19 order on the initial EIM design directed the ISO to include these provisions in the future EIM design.

As noted in Management's memo, one detail involved in complying with FERC's June 19 order was the degree of flexibility that will be provided to participants in terms of "flagging" resources' bids that could be deemed delivered to the ISO versus being available only to meet demand within other EIM balancing authority areas not subject to California's cap and trade program compliance obligations. Management's proposal seeks to provide flexibility by allowing the portion of each resource's bid quantity eligible for delivery to the ISO to vary from hour to hour, rather than requiring each resource to "opt in or out" of being potentially subject to California's greenhouse gas program on a daily or longer term basis.

DMM appreciates that this flexibility is being provided in response to requests from some stakeholders and to encourage participation in EIM. Some stakeholders have expressed concerns about the need for this flexibility and requested that DMM review this market design feature for potential gaming or other detrimental market impacts. DMM has reviewed this issue, and while we see limited value or need for this additional flexibility, we also do not have any significant concerns about potential gaming or other detrimental impacts of this bidding flexibility. Nonetheless, DMM will monitor any bidding behavior that may indicate an attempt to detrimentally affect market outcomes by hourly changes in greenhouse gas bidding.

COMMITMENT COST ENHANCEMENTS PHASE 2

Transition costs

Management is proposing to simplify the calculation of multi-stage generating resource transition costs and treat these costs similar to generator start-up costs. Scheduling coordinators will be allowed to bid transition costs in the same manner that proxy and

registered costs are currently bid into the market, so that transitions cost bids may be submitted up to 125 to 150 percent of cost-based calculations.

DMM is highly supportive of these enhancements which address recommendations that have been reiterated by DMM in each of our last three annual reports. These two enhancements greatly simplify the current calculation of transition costs, provide more clarity for market participants, and provide a basis for the ISO to review and verify these costs.

Use-limited status

DMM also supports Management's proposal to clarify the current definition and qualification criteria for resources that are granted use-limited status. The proposal clarifies that under current market rules resources can only be deemed use-limited based on physical, environmental or regulatory limits, and that units cannot be eligible for use-limited status based on contract-based limitations or economic operating costs.

This has important implications since units deemed to be use-limited will continue to be exempted from key bidding limits and availability standards established through other market rules and initiatives aimed at making sure capacity is available for dispatch to meet the growing operational need for flexible capacity.

As noted by DMM in this stakeholder process, the ISO's efforts to limit the number of resources with exemptions due to actual physical or regulatory use limits may be undermined if scheduling coordinators can use other unit operating constraints in the market model to limit unit usage and flexibility. One key model input currently used by participants to limit unit operation is the limit on start-ups per day that can be entered into the ISO master file by each unit's scheduling coordinator.

DMM has expressed concerns that daily start limits entered by participants do not reflect the actual physical limits of generating units. In 2014, the ISO started a process to examine this issue. Under the flexible resource adequacy program requirements being implemented by the ISO and CPUC, units will be required to enter at least two start-ups per day in order to meet requirements for this most flexible category of resources. DMM encourages the ISO to continue to review and clarify rules regarding daily start limits and other unit operating constraints submitted by scheduling coordinators that can also have a major impact on unit availability and flexibility.

One common factor cited by participants for wanting to be deemed use-limited resources or limit their daily start-ups, is to limit the longer term maintenance costs ultimately incurred as a result of starting-up or running a unit. However, starting in 2014 resources are eligible to apply to have a major maintenance adder included in their start-up and minimum load bids. This adder is designed to cover the incremental maintenance costs incurred from major maintenance actions that periodically occur

based on the number of times a unit has started up and/or the number of hours it has run. Including these additional costs in start-up and minimum load bids can reduce the frequency that units get cycled on and off, and ensure that generators recover these costs whenever they are dispatched to operate.

Although the process for implementing major maintenance adders in 2014 was initially problematic, the ISO, in consultation with DMM, assumed responsibility for this process in mid-2014. Starting in 2015, fewer units were allowed to bid up to 150 percent of costs under the registered cost option as a result of changes made under the first phase of the commitment cost initiative. This led many units that had previously not applied for a major maintenance adder to avail themselves of this bidding option.

DMM believes further refinements to the tariff provisions regarding the major maintenance adder could be made. These changes would make this market feature even more effective at ensuring that unit commitments reflect actual marginal unit commitment costs and that resourced owners recover the additional costs associated with starting up and operating flexible generating units more frequently to meet the ISO's growing need for operational flexibility.

Opportunity cost bid adder

As noted in previous comments in the stakeholder process and to the Board, DMM is very supportive of the concept of including opportunity costs in start-up and minimum load bids, and is supportive of the ISO's general approach to calculating opportunity costs. We recommend that the ISO continue further refining and developing their current prototype spreadsheet model and continue to engage stakeholders in developing and refining the opportunity cost methodology and model.

DMM supported removing the opportunity cost adder from this initiative, given the lack of progress that has been made on developing a complete and well-designed model and process that would allow this option to be implemented. DMM is concerned that this important market enhancement has been deferred again, as this represents at least the fourth time this market enhancement has been dropped from a stakeholder initiative since 2010.

During the course of this initiative, the ISO has begun to implement a process to verify the actual use limits of various resources. This represents an important input to the process of establishing opportunity costs for various resources. However, DMM is concerned that given the current status and resources being applied to this project, it may be very difficult for the ISO to complete the development, testing and stakeholder review of an opportunity cost model and rules in time for consideration of this issue by the Board in September, as indicated in Management's memo.

Currently, this methodology has only been tested using a simple prototype spreadsheet model that can incorporate only one type of use-limit (e.g. a limit on start-ups or run

hours per month). The next step is to develop a software model that will allow inclusion of additional features including multiple usage constraints commonly included in air permits, such as simultaneous monthly and annual limits on both start-up and run hours.

For ISO staff to actually implement opportunity costs in the market, this software must also be highly automated and allow for opportunity cost to be updated as necessary based on changes in market prices or actual generating units. DMM has also recommended that a version of the model be made available to market participants so that they may perform their own analysis and request updates or modifications to their opportunity cost bids as appropriate.

DMM continues to look forward to working closely with the ISO and stakeholders on working out the details of this important market enhancement and implementing this functionality in the market.

RELIABILITY SERVICES INITATIVE

As described in Management's memo, changes being proposed under the first phase of the reliability services initiative include (1) enhancements to further integrate preferred resources into the grid; (2) a new availability incentive mechanism to assess resource adequacy resources including demand response and use-limited resources; and (3) revisions to resource adequacy outage rules to streamline ISO processes and provide a framework for flexible resource adequacy outage rules.

DMM is supportive of Management's recommendations as a step forward toward improving and streamlining resource adequacy requirements and processes to meet the need for increased operational flexibility to integrate new renewable energy resources. DMM has two recommendations concerning this initiative, as described below.

Exemption for use-limited resources

The new availability incentive mechanism to assess use-limited resource adequacy resources was designed on the assumption that the opportunity cost estimates for use-limited resources would be available before these changes were implemented. As noted above, the development of the method to estimate opportunity costs has been postponed yet again. Until these opportunity cost estimates can be implemented, use-limited resources can exempt themselves from the availability standards by submitting special outages. Therefore, DMM urges the ISO to commit the resources necessary to develop and implement the opportunity cost estimation method in a timely manner.

Penalty price

The ISO proposes to set the penalty price for not meeting availability standards at 60 percent of the soft offer cap for the capacity procurement mechanism that was approved at the February 5 Board meeting. DMM notes that if the cost of replacement capacity approaches the soft offer cap, it will be less costly for generating unit owners to pay the penalty rather than provide substitute capacity. DMM believes this scenario could occur precisely when supply conditions are tightest and options for capacity that can be procured bilaterally by participants or by the ISO through the capacity procurement mechanism is most limited and non-competitive.

DMM recommends that the ISO monitor this issue once the new incentive mechanism has been implemented. DMM has suggested that the ISO set the penalty price for not meeting availability standards higher than 60 percent of the soft offer cap for the capacity procurement mechanism. Setting the penalty price at 100 percent of this soft cap would appear to maintain a clear logic that exists in the current standard capacity procurement policy.

Attachment F – MSC Final Opinion

Commitment Cost Enhancements Phase 2

California Independent System Operator Corporation

Opinion on

Reliability Services Phase 1 and Commitment Costs Enhancements Phase 2

by

James Bushnell, Member
Benjamin F. Hobbs, Chair
Shmuel S. Oren, Member
Scott M. Harvey, Member

Members of the Market Surveillance Committee of the California ISO

Final Opinion
March 23, 2015

1. Introduction and Summary of Recommendations

With a goal of 33% renewable electricity production by 2020, the California power system will face increasing challenges to manage the variable output of wind and solar resources. Since the publication of the ISO's "20% Study" in 2010, it has been recognized that inadequate investment in flexible resources or a failure of those resources to offer flexibly into the ISO markets will increase the cost of integrating variable renewables and could result in difficulties in matching system supply and demand during periods of steep up- or down-ramps.[1] In response, the ISO has developed a series of initiatives designed to motivate flexible offers and, ultimately, to encourage appropriate investments in flexible resources. Some of these initiatives, such as the flexible ramping product, change the operation of the short-term dispatch and spot markets for energy and ancillary services. Others, in cooperation with the California Public Utilities Commission focus on resource adequacy (RA) mechanisms, including the definition of flexible RA requirements and the must-offer obligations (MOO) imposed upon capacity designated as flexible by RA mechanisms.

The Market Surveillance Committee (MSC) of the California Independent System Operator (CAISO) has been asked to comment on two related proposals that address implementation issues for the flexible RA requirements and rules governing their offers into the ISO day-ahead and real-time markets. These proposals are the Reliability Services Initiative Phase 1 (RSI)[2] and

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[1] CAISO, Operational Requirements and Generation Fleet Capability at 20% RPS, August 31, 2010, www.caiso.com/Documents/Integration-RenewableResources-OperationalRequirementsandGenerationFleetCapabilityAt20PercRPS.pdf

[2] CAISO, Reliability Services, Draft Final Proposal, Jan. 22, 2015, www.caiso.com/Documents/DraftFinalProposal-ReliabilityServices.pdf; Addendum, Feb. 27, 2015,

the Commitment Costs Enhancements Phase 2 Initiative (CCE2).[3] These will be considered by the Governing Board of the California ISO during their March 2015 meeting

The RSI initiative consists of two phases, the first of which we address in this opinion. The overall initiative is to address the ISO's RA rules and processes to ensure that the system's requirements for flexible resources, as well as local and system resources, will be met. As explained in the RSI draft final proposal, the first phase of the initiative focuses on RA rules and processes that must be updated for reliability or regulatory reasons. It is divided into three parts. The first part relates to enhancements to further integrate preferred resources into the grid and rules for integrating flexible RA resources into the energy market. The second part updates the RA availability incentive mechanism, most notably basing the incentive for flexible RA upon whether or not a flexible resource economically offers into the market, not just on whether it is on forced outage or not. The third part revises RA outage management rules, and is intended to serve as a platform to develop flexible RA outage rules in phase two of the RSI.

The second initiative, CCE2 is a continuation of the Commitment Cost Enhancements proposal[4] adopted by the Governing Board at its September 2014 meeting. The original (phase 1) CCE proposal addressed procedures used to calculate start-up and minimum-load costs for electricity generators. Under the CAISO's current market design, accurate estimation of these commitment costs by the CAISO is important to ensure efficiency of market operations. Caps upon offers for energy and for start-up and minimum run costs should be broadly reflective of actual costs in order to ensure that resources are incented to make offers without having an opportunity to exercise market power. The CCE Phase 1 proposal deferred the consideration of how opportunity costs, which can be a large component of marginal energy costs and of start-up and minimum load expenses for use-limited resources, can be estimated because of the need for further development of calculation procedures. Opportunity costs arise because of limitations upon the amount of energy production, number of starts, or number of operating hours during a time period; as a result, a generating unit should husband its limited energy, starts, or hours of operation for the times when its energy production and ancillary services are most valuable to the system.

The present CCE Phase 2 proposal again defers the opportunity cost calculation rules and procedures further to a later CCE Phase 3 proposal, which will also address some other unresolved issues concerning major maintenance adders, greenhouse gas costs, and accounting for gas transportation costs. CCE Phase 2 addresses two other sets of issues not fully addressed in Phase 1. The first is a clarification of the definition of use-limited resources, whose must-offer rules differ from those for non-use-limited resources. The issue of must-offer rules is where the CCE Phase 2 and RSI Phase 1 proposals intersect, and is the reason we are considering them together. After CCE Phase 3 is implemented, it is anticipated that many use-limited resources will be allowed to

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www.caiso.com/Documents/DraftFinalProposalAddendum-ReliabilityServices.pdf

[3] CAISO, Commitment Costs Enhancement Phase 2, Draft Final Proposal, Feb. 9, 2015, www.caiso.com/Documents/DraftFinalProposal_CommitmentCostEnhancementsPhase2.pdf

[4] CAISO, Commitment Costs Enhancement, Revised Draft Final Proposal, Aug. 21, 2014, www.caiso.com/Documents/RevisedDraftFinalProposalCommitmentCostEnhancements.pdf

bid their opportunity costs, but at the present time, most such resources manage their use limitations by withholding their capacity from the market when it is not expected to be needed, and are excused from must-offer obligations if they offer their output in accord with their approved use plans. Resources should not be allowed to claim use-limited status simply to be held to a more lenient performance standard. The second set of issues addressed is relatively minor, and concerns cost accounting and offers, such as the treatment of multistage generators. In this opinion, we comment of the first set of issues.

The MSC has addressed the RSI proposal in recent meetings, including March 11 and May 19, 2014 and Feb. 19, 2015. More generally, the MSC has been considering the design of resource adequacy mechanisms and short-term energy markets to encourage flexibility for several years. Since the publication of the ISO's "20% study" in 2010, the MSC has examined a range of issues and initiatives concerning incentives for provision of flexible resources. These have included our 2012 opinion on flexible capacity procurement and risk of retirement,[5] a 2014 opinion on must-offer obligations for flexible RA,[6] and several opinions addressing how the ISO's short-term energy markets should be designed to encourage efficient offers and dispatch of flexible capacity. The latter include opinions on how commitment costs should be estimated, bid, and compensated in the ISO markets; [7] on payments for capacity used to meet the flexiramp constraint in real-time markets;[8] and on the Renewable Integration: Market and Product Review, which addressed bid floors, bid cost recovery calculations, and revisions to the Participating Intermittent Resource Program (PIRP) designed to have contracting parties realize more directly the value of their real-time production so as to motivate them to bid more flexibly.[9]

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[5] Market Surveillance Committee of the California ISO, "Final Opinion on Flexible Capacity Procurement - Risk of Retirement," Sept. 2012, www.caiso.com/Documents/MSCFinalOpinion-FlexibleCapacityProcurementRisk-Retirement.pdf

[6] Market Surveillance Committee of the California ISO, "Final Opinion on Flexible Resource Adequacy Criteria Must Offer Obligation," March 11, 2014 http://www.caiso.com/Documents/FinalOpinion-FlexibleResourceAdequacyCriteriaMustOfferObligation.pdf

[7] Market Surveillance Committee of the California ISO, "Final MSC Opinion on Commitment Cost Enhancements," September 2014, www.caiso.com/Documents/MSC_FinalOpinionCommittmentCostEnhancements-Sept2014.pdf; Market Surveillance Committee of the California ISO, "Opinion on Bid Cost Recovery Mitigation Measures and Commitment Costs Refinement", May 7, 2012, www.caiso.com/Documents/MSCFinalOpinion-BidCostRecoveryMitigationMeasures_CommitmentCostsRefinement.pdf; Market Surveillance Committee of the California ISO, "Opinion on Changes to Bidding and Mitigation of Commitment Costs," June 4, 2010,www.caiso.com/Documents/FinalOpinionon Changes-BiddingandMitigation-CommitmentCosts.pdf; Market Surveillance Committee of the California ISO, "Comments on Changes to Bidding Start-Up and Minimum Load," July 16, 2009, www.caiso.com/Documents/FinalOpinionon Start-UpandMinimumLoadBiddingRules.pdf

[8] Market Surveillance Committee of the California ISO, "Final Opinion on Payment for Provision of Flexible Ramping," Aug. 16, www.caiso.com/Documents/FinalOpinion_Payment_Provision_FlexibleRamping.pdf

[9] Market Surveillance Committee of the California ISO, "Opinion on Renewable Integration: Market and Product Review, Phase 1," Dec. 8 2011,

More recently than these opinions, the MSC has considered the issues of flexible ramping product in public meetings of the MSC on August 22, October 15, and December 16, 2014, as well as the definition of future flexible capacity needs at the latter meeting.

Based on our review of the ISO proposal, stakeholder input, and our review of experience with similar problems in the eastern ISOs, we have reached the following conclusions about the elements of the ISO proposals:

- The first part of the RSI addresses the development of eligibility criteria and must-offer obligations for certain resource categories. We support treatment of distributed resources in the same manner as resources interconnected with the transmission system. Defining the default qualifying capacity of non-generator resources based on the output the resource can sustain over a 4 hour period is not unreasonable, but the choice of period is not a precise bright line driven by physics and economics. The need for this and other somewhat arbitrary bright lines is inevitable in resource adequacy markets. Thus, such lines will likely need to be adjusted with experience. We have discussed in prior opinions and meetings the difficulty of defining the default qualifying capacity requirements that will ensure that RA resources that are capable of providing flexible capacity will indeed offer their capacity in a manner that most effectively and efficiently contributes to meeting CAISO resource needs. We have also stressed the consequent importance of energy and ancillary service market mechanisms that will incent resources capable of providing flexible capacity to operate in that manner.

- The RAAIM is designed to split the difference between the view that the RA design needs to provide a strong incentive for RA suppliers to live up to the obligations undertaken when selling RA, and the view that the energy and ancillary service markets will generally provide adequate and efficient incentives. It reduces the per-MWh penalty for non-performance relative to the current design while also eliminating important exemptions to the non-performance penalties. An important example is including planned outages that are triggered in the wake of a forced outage in order to make the necessary repairs. In our opinion both steps are, in general, an improvement upon the previous mechanism as it has been applied to standard capacity resources. However, as we note below, higher, not lower, penalties could be more efficient during high demand periods, but this would entail a much more complex RAAIM design.

- Significantly, the RAAIM also expands the performance metrics to cover the additional obligations undertaken by units selling flexible capacity. This adds financial consequence to the expanded Must-offer Obligation that is applied to flexible capacity resources. We note the potential for the RAAIM penalties to be too high in some periods (when there is more than enough capacity) and, more importantly, to be too low during times of resource scarcity. Too low a penalty could provide an inadequate incentive for making the expenditures needed to reduce forced outage rates.

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www.caiso.com/Documents/MSC_Final_Opinion_RenewableIntegrationMarket-ProductReviewPhase1.pdf

- The choice of penalty is a difficult balance to achieve in any capacity based RA design and the CAISO will have to monitor how these penalties are affecting the propensity of units to bid their capacity flexibly, and to offer it as flexible capacity in the RA process. With regard to the structure of the proposed penalty, we support the CAISO proposal which opts for simplicity by having a single penalty which is applied whenever a resource fails to meet its Generic RA or Flexible RA must offer obligation rather than a more complex approach with different penalties for Generic and Flexible RA or a tiered structure of the must offer obligation with incremental penalties. While the single penalty approach is a blunt instrument, we are persuaded that in combination with the market based premium for Flexible RA (induced by the Flexible RA capacity requirement) and efficient spot market pricing of energy and ancillary services, it will be sufficient to induce a willingness to provide flexibility and compliance with the must offer obligation in the day-ahead and real time markets. We expect that the finer tuning of incentives will be accomplished through the short term energy and ancillary services markets.

- To better understand how to set the performance incentives we also recommend that the ISO continue to study the reasons apparently flexible resources do not bid flexibly, which we hope would provide guidance as to market rule changes that would incent greater flexibility in offers.

- Regarding the proposed adjustments to exceptions to the RAAIM, we support all of them as they, on balance, reduce exemptions and start to normalize the standards of performance across different technology types. However, we note that significant gaps remain. Renewable intermittent resources will continue to be exempt from the performance metrics. Units subject to verified use-limitations that extend beyond the daily scope of the ISO's market runs will continue to be able to use outages to manage these limits and will not be be subject to RAAIM penalties for these outages. Permitting opportunity cost-based bidding of start-up and minimum load costs, as is intended in the Commitment Cost Enhancements Part 3 initiative, would allow for more efficient utilization of these use limited resources and enable the ISO to apply performance metrics to a broader set of RA resources.

- Although it may be possible over time to tinker with the RAAIM penalties to better reflect the capacity contributions of different types of resources at different times, the potential for significant improvements will be limited by the RA mechanism's fundamental inflexibility to reflect rapidly changing system needs and the many attributes of a resource's design, operation and bidding strategy that impact the value of the capacity provided by the resource. For this reason, we reiterate our previous conclusion that a well-functioning spot market will in theory correctly value a resource's availability, flexibility, location, and other attributions, and incent the resource owner to offer and manage the resource in a manner that effectively utilizes the resource's flexibility. The ISO should therefore aim to enhance the efficiency of spot markets so that resource revenues will make up a material portion of the gross margin of resources. As a result, RA mechanisms (and RAAIM in particular) would become relatively unimportant in incenting the efficient operation of resources, while continuing to provide for the recovery of a portion of

investment and going forward costs, which means that the consequences of distortions in capacity credit/AIM penalty calculations will matter less. The proposed RAAIM system will, we believe, provide improved performance incentives, but they are not a substitute for a properly functioning set of ISO markets for energy and ancillary services.

- The changes that the RSI proposes in replacement rules are positive steps towards simplifying the process of replacing RA capacity that is not available due to planned or forced outages. They pave the way for expanding this process to accommodate Flexible Capacity in phase 2 of the RSI. The CAISO hopes that these changes would make it easier for unavailable resources to replace their RA obligation with other resources owned by other entities, and thereby avoid penalties under the incentive mechanism and contributing to improved system reliability. We note, however, that shifting the replacement process onto the resource will lead to increased communications among suppliers about outage plans, which might contribute to facilitating of coordinated exercise of market power (either tacit or explicit) if large market players routinely exchange information about capacity outages. This shifting might also make it more difficult for small suppliers to arrange for replacement capacity and avoid penalties at times when there is no actual shortage of capacity. In theory, such coordination would be more difficult if replacement transactions were made through an arms-length central market. Moving slow in implementing such changes is probably a good idea given all the moving parts that need to be coordinated between the ISO, market participants and the CPUC, and the need by participants to evaluate the impact of such changes.

- Regarding the Commitment Cost Enhancements Phase 2, we are disappointed that the opportunity cost calculation procedures are delayed again, although we appreciate the potential complexity of those procedures and the need for careful review. Because of this delay, use-limited resources with true opportunity costs for their energy production, start-up, and running hours will have to continue to use inherently inefficient use plans to manage those limitations. As we have stated in a previous opinion, we believe that the best way to manage these use-limitations is to allow opportunity costs be included in resource offers to the market so that the decision to dispatch or not right now balances the benefits of operation immediately against the benefits of instead using the resource later.

- We understand the need for the restrictions proposed by the CCE2 proposal to restrict use-limited designations to units with genuine physical or regulatory constraints that result in opportunity costs beyond the time horizons of the ISO market software. If contractual provisions rather than regulations or physical limitations were to be allowed to justify a use-limited status, this could conceivably weaken incentives to avoid signing contracts that limit output, starts, or operating hours and perhaps incent the use of contractual provisions to avoid performance penalties when there are no physical or regulatory reasons for those restrictions. However, these changes in use limited designations need to be accompanied by the changes in restrictions in commitment cost offers to be implemented as part of CCE Phase 3 that will allow resources to make offers that are reflective of their actual costs, including opportunity costs.

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2. RSI Part I: Enhancements to Resource Adequacy Criteria and Must Offer Obligation

The first part of the Reliability Services Initiative is the development of eligibility criteria, qualifying capacity criteria and must offer obligations for additional categories of resources (distributed generation and non-generator resources[10]) and adjustments to the existing rules for proxy demand response. [11]

The CAISO proposes that distributed generation resources qualifying as a resource adequacy resource must be visible to CAISO, so must be a participating generator or system resource. The resources must either be at least 0.5 megawatts in size or aggregated to 0.5 megawatts or more across resources of the same type, but potentially at different locations.[12] The CAISO proposes to apply the same availability, bidding and must offer obligations to distributed resources as would be applied to a similar resource on the transmission system.[13] We have not identified any valid reasons for applying different obligations to distributed resources.

The CAISO proposes that the default qualifying capacity of non-generator resources will be based on the output the resource can sustain over a 4 hour period.[14] This approach is reasonable, but it needs to be recognized that it is an approximation. There is no bright line between the value of resources that are available, say, 3.75 hours, 4 hours or 4.25 hours. Resources capable of longer sustained output are potentially more valuable at the margin, but whether this is the case in practice to any material degree will depend on the overall mix of resources available to the CAISO. The need for such bright line distinctions is unavoidable in a capacity-based RA mechanism. The CPUC's maximum cumulative capacity buckets serve to balance the overall resource mix between resources with shorter and longer availability, but again necessarily relies on bright line distinctions when the operational impacts are not that discrete in practice.

The CAISO has determined that the default energy bid, regardless of how it is established, is not appropriate for use with non-generation resources. The CAISO therefore proposes to exempt non-generation resources from the bid insertion provisions of the must offer requirement. Instead, the CAISO proposes to monitor non-generator resource performance and the need for bid insertion rules. [15]

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[10] NGR is "a resource that operate as either Generation or Load and that can be dispatched to any operating level within their entire capacity range but are also constrained by a MWH limit to (1) generate Energy, (2) curtail the consumption of Energy in the case of demand response, or (3) consume energy." Footnote 4 p. 17

[11] See Reliability Services, Addendum to the Draft Final Proposal, February 27, 2015 Part I, Sections 4 and 5.

[12] Ibid., Section 4.3.1, p. 13.

[13] Ibid., Section 4.3.1, p. 14.

[14] Ibid., Section 4.3.2, p. 14.

[15] Ibid., Section 5.4, p. 23

Finally, the CAISO proposes to change the qualifying capacity requirements for proxy demand resources to require that they are available to be dispatched at 24 hours a month, for at least 3 consecutive days and for at least 4 hours per dispatch event. [16] These bright line standards are again an approximation of more complex variations in the value of these resources but this is a necessary consequence of the capacity-based resource adequacy design. The proposed minimum dispatch duration is consistent with the requirement for other resources such as non-generator resources and is also consistent with the direction of changes in other ISO RTO markets, which are also tending to require longer and more frequent availability.

We have discussed in prior opinions and meetings the difficulty of defining requirements that will ensure that RA resources that are capable of providing flexible capacity will indeed offer their capacity in a manner that most effectively and efficiently contributes to meeting CAISO resource needs. We have also stressed the consequent importance of energy and ancillary service market mechanisms that will incent resources capable of providing flexible capacity to operate in that manner.[17]

3. RSI Part II. Resource Adequacy Availability Incentive Mechanism (RAAIM)

There have been different views about the need for and role of availability incentives as a feature of capacity-based products, such as California's resource adequacy framework. Although capacity and RA frameworks are designed to provide incentives primarily for the advanced procurement (and therefore construction) of generation capacity, such capacity is of no value when it fails to perform.

Of course, the prospect of revenues from sales of energy and ancillary services would be expected, absent market power, to provide incentives for generation owners to make their units available. Most stakeholders agree that the bulk of the performance incentive should and does come through these short-term market incentives. [18] However, a view that the short-term markets will generally provide efficient incentives for unit availability once the capacity is built must recognize that the energy market will not provide efficient incentives when the cost of being remaining available is high relative to real-time shortage prices, if such prices are lower than the actual value of power to the system at such times. Further, if unreliable capacity which suffers more frequent forced or requires more planned outages can claim the same capacity value as more reliable sources, unreliable capacity could crowd-out more reliable sources from the procurement process. This concern is exemplified by the fact that, under the previous resource adequacy availability paradigm, resources could receive capacity credit, go on a planned outage for an extended period of time (multiple months) and be counted as 100% available during the entire period. Because payments are paid from a penalty pool, a resource on an extended planned out-

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[16] Ibid., Section 4.4, p. 15.

[17] Market Surveillance Committee of the California ISO, "Final Opinion on Flexible Resource Adequacy Criteria Must Offer Obligation," op. cit.

[18] As we argue in ibid.

age would take away potential revenues to participating resources and potentially receive more availability payments than a resource adequacy resource that was actually participating in the energy markets.

The proposed resource adequacy availability incentive mechanism (RAAIM) is designed to split the difference between the view that firms need a strong incentive to live up to the obligations undertaken when selling RA, and the view that the energy and ancillary service markets will generally provide adequate and efficient incentives. It reduces the per-MWh penalty for non-performance while also eliminating important exemptions to the non-performance penalties, most notably including all forced outages in the incentive mechanism. In our opinion, both steps are an improvement upon the previous mechanism as it has been applied to standard capacity resources.

Significantly, the RAAIM also expands the performance metrics to cover the increased obligations undertaken by units selling flexible capacity. This adds financial consequence to expanded Must-offer Obligation that is applied to flexible capacity resources.

We address several aspects of the RAAIM design. These include the level of the RAAIM payment, the number of payment categories, and the remaining exemptions for resources in the following subsections.

3.1 RAAIM Incentive Price Level

The challenge in setting performance penalties is establishing a level that is high enough to incent generation units to be available when needed, but not so high that the potential penalties from under performance could exceed the revenues from selling capacity in the first place. Under the expiring Standardized Capacity Product (SCP) framework, availability incentive payments were based upon a price of $5.91/kW-month. One of the concerns with this level is that we understand that it is higher than some of the prices being paid for capacity in today's bilateral market. The new RAAIM framework would initially set this price to $3.79/kW-month.[19]

There are several potential concerns with the pricing level. Several could be construed as concerns that the price is too high. First, if the level is set considerably above the going bilateral price for RA capacity, the exposure to penalties could exceed the revenues from RA sales. This would put upward pressure on the RA price. This effect would also disproportionately impact units with higher outage rates, even if those units are available during periods of true system-wide scarcity. Last, as we discuss below, generation units owned by small firms may find it more difficult to find substitute capacity than larger firms that can substitute within their own generation portfolios.

Conversely, if the price level were too low, firms may find it preferable to simply under-perform and pay the penalty rather than undertake the expenditures necessary to maintain availability at the desired levels. One concern is that this effect would be strongest during periods when substi-

[19] See Reliability Services, Draft Final Proposal, op. cit., Section 6.8, p. 49.

tute capacity is scarce and expensive, or simply not available. In other words, the gap between the availability penalty and desired incentive level would be largest exactly when the system needs higher availability from units that have sold RA.

As it applies to standard capacity, we believe this reduction in the performance penalty to be a sensible change that appears to better align with the underlying price of capacity in the bilateral capacity market. However, if the bilateral market tightens and bilateral prices increase, there would be a significant lag before the incentive payment would also be increased to reflect the new reality. This is in part because there is not a transparent RA price in California that is generated by a liquid market, so it is difficult to have the incentive mirror conditions in the bilateral market.

As the performance penalty will apply to flexible resources, the issue of an appropriate incentive price is complicated by the lack of clarity as to why flexible resources are not already bidding in ways that would comply with the FRACMOO standards. In a previous opinion on this must-offer requirement,[20] we noted that:

> *(a)bsent knowing exactly what factors currently discourage resources from offering their output flexibly, it is impossible to assess how successful this must offer requirement will be in overcoming these factors.*

While it makes intuitive sense to link performance penalties for different types of RA to the different requirements faced by RA, the effects are difficult to predict in the case of flexible capacity. Previously we were concerned that the bidding requirements of FRACMOO might raise the cost of participation in RA, and therefore procurement of RA, in unforeseen ways. This concern extends to the impacts of availability penalties that are also applied, as proposed, when flexible RA units fail to bid flexibly as required. The CAISO will have to monitor closely how these penalties are affecting the propensity of units to bid their capacity flexibly, and to offer it as flexible capacity in the RA process. We also recommend that the ISO continue to study the reasons why apparently flexible resources do not bid flexibly, which we hope would provide guidance as to market rule changes that would incent greater flexibility in offers.

3.2 RAAIM Single Incentive Price

The compound nature of the FRACMOO obligation, which (1) requires that units not only be available but offer their capacity in a manner that meets rules defining flexibility and (2) co-exists with generic RA, raises some issues regarding the structure of the incentive mechanism. Specifically, generic RA capacity is only required to operate either by bidding into the CAISO markets or through self-scheduling, whereas Flexible RA is required to offer economic bids into the DA and RT markets. Requiring resources to be available in real-time whether or not the CAISO foresees a need for them will raise the cost of capacity. The hours of required performance also differ between the two types of capacity resources.

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[20] See "Opinion on Flexible Resource Adequacy Criteria and Must-Offer Obligation," Market Surveillance Committee of the California ISO, op. cit.

One of the questions that has been raised has been whether there should be two different penalties for nonperformance by generic RA and by flexible RA. Another question is whether those penalties should be tiered and compounded so that, for example, Flexible RA that ends up self-scheduling will be deemed as performing as generic RA and be penalized only for not meeting its must offer flexibility. Such a differentiated and tiered penalty scheme can be rationalized on the grounds that providing flexibility constitutes an incremental service relative to generic RA with additional opportunity cost relative to self-scheduling. However, a tiered scheme would also increase the complexity of the incentive mechanism. The CAISO opted for a simple approach consisting for a single penalty that will be imposed on a resource if it does not provide the type of RA it committed to. Thus a flexible RA resource performing as generic RA will be treated as if it did not perform at all, and will pay the same penalty as a generic resource that does not perform at all. The penalty, and incremental payment for flexibility must, of course, be designed so as to not discourage Flexible resources from offering Flexible RA. Likewise the penalty should be high enough relative to the Flexible RA premium so as to discourage non-flexible resources from posing as Flexible RA and then paying the penalty for non-performance.

In theory, if there were transparent prices for both generic and flexible RA from liquid markets that reveal how much load-serving entities pay for each type of RA, then the incentives could be based on those prices. However, such prices do not exist.

We support the single penalty approach for its simplicity if combined with reasonably efficient energy and ancillary service market incentives. Such an approach indeed can achieve the objective of both incentivizing truthful revelation of flexibility in the RA commitment as well as incenting performance to the level required by the must offer obligations in the energy markets. To do so we analyze the decision process faced by a resource owner at both stages, the RA contracting stage and the energy markets bidding stage. This is done in form of a decision tree illustrated in the Appendix.

One should recognize that the single penalty approach is a rather blunt mechanism that will not lead to perfect incentives for real-time operation absent adequate compensation for real time energy when needed. For example, consider a flexible unit suffering an operating problem that prevents it from ramping up and down but that can stay on line despite the problem and operate at a fixed output. Such a unit would not have any RA incentive to stay on line since it would lose its entire capacity payment for the period because of its inability to ramp. Hopefully these situations are rare enough so that they are not a critical consideration, and furthermore if the output of such a resource were needed, we also hope that energy market prices would be high enough to provide adequate incentives for the resource operator to incur the costs needed to keep it on line.

In light of the problems with CAISO bidding restrictions, there may be times when there are large benefits to self-scheduling that will swamp the penalty and the self-scheduling may even be beneficial. For example, this can occur when there are large gains from getting a unit on-line when it is needed, but ISO bidding rules are inflating its minimum load and/or start-up costs, so the resource owner self-schedules the resource's minimum load block.

We also need to keep in mind that there is another possible situation in which self-scheduling is efficient. This can occur when the penalty is less the relative inefficiency of self-scheduling the unit or achieving a similar outcome with bids that do not trigger penalties. For example, instead of self-scheduling a unit's minimum load block to get it on line, the penalty could cause a generator to bid in a range above minimum load at an artificially low price to compensate for an inflated minimum load and/or start-up bid and get the unit on line. However, that could result in not only the minimum load block being dispatched, but also the capacity above minimum load that was offered at a very low price below both the actual marginal cost and the market price. So getting energy market prices and bidding rules right is important.

3.3 RAAIM Exemptions

The wide variety and extensive application of exemptions has undercut the impact of previous availability mechanisms.[21] Exemptions fall under two categories: exempt classes of generation technologies and exempt actions taken by generation plants that reduce availability of those units. One of the positive elements of this initiative is that it reduces exemptions and tries to apply a more consistent standard of compliance to what a diverse set of obligations and unit capabilities.

Given the transition from an outage-based to a bidding-based availability metric, non-standard resources like participating demand resources can now be evaluated on the same basis as other resources.

The category of use-limited resources was a significant and growing concern under the previous SCP framework. Like other unconventional sources, it was difficult under the previous performance framework to measure the value of these resources in terms of availability, as the lack of a forced outage is only one factor determining the availability of a use-limited resource. The shift to a bid-based availability metric allows for some improvement in this regard. To the extent that the ISO's market optimization properly captures use-limitations and to the extent that bidders can reflect opportunity costs in their offers, bidding by these units is both appropriate and should be expected by units who have sold their capacity as RA. As with other generation, it would be a legitimate metric upon which to base performance penalties.

The CAISO proposal points out that while their day-ahead market runs can properly capture intra-day use limitations, any constraints on plant usage that tradeoff usage now against, for example, operation in a subsequent month, are more difficult to capture in the ISO's optimization. The ISO will continue to work to develop methods for incorporating these longer-term opportunity costs into the optimization, but in the meantime the proposal will not apply the bid-based availability metric to outages used to manage resource usage limitations that cannot be modeled in the software. It is crucial for the efficient operation of the ISO markets that, first, resources can reflect opportunity costs in their bids and, second, intraday unit commitments consider opportunity costs within the day since the intraday market runs' multi-hour time horizon does not consider the entire day. The CCE Phase 3 initiative is intended to address the former need, and

[21] See Reliability Services Issues Paper, January 28, 2014.

we urge its rapid development and implementation.

Another area in which the ISO will limit exemptions is by requiring verification of a real physical use limitation rather than allowing units to unilaterally declare themselves to be use-limited. This is being proposed as part of the CCE2 proposal discussed in Section 5, below. The present use-limitation rules have provided a significant loophole in the enforcement of availability metrics, as a firm could exempt their units from these metrics simply by declaring its capacity to be use-limited.

We support all of these adjustments as they, on balance, reduce exemptions and start to normalize the standards of performance across different technology types. However, we note that significant gaps remain. Renewable intermittent resources will continue to be exempt from the performance metrics, as will units subject to verified use-limitations that extend beyond the daily scope of the ISO's market runs. Allowing opportunity cost-based bidding of start-up and minimum load costs, as is intended in the Commitment Cost Enhancements Part 3 initiative, should allow the ISO to further restrict exemptions in the latter case.

In the future, one possible course is to make further adjustments toward metrics and penalty structures that could be applied fairly to a broad class of units, while still capturing the relative capacity resource values that those units provide. For example, variable resource penalties could be assessed based on average performance over a longer period, such as a month, in a manner similar to the PIRP program. A similar approach could be applied to use-limited resources, but it would require the relative capacity value be downscaled in some way that is proportionate to the use limitation. This would require more analysis and stakeholder consideration of how to value, for example, a reliable but more use-limited resource relative to one that is perhaps less reliable but also a less limited resource. For example, how should a 240 MW resource that is available only for a single hour of a day be compared to a 120 MW resource that is available for 2 hours of the day, or a 10 MW resource that is available 24 hours a day.

We encourage the ISO and stakeholders to continue to explore how the RAAIM framework could be elaborated in a way that could incorporate the broadest set of resources under a single performance framework in way that is consistent with the actual benefits that those resources provide to the system. However, as we concluded in our FRACMOO opinion, the RA construct is an awkward and inherently inaccurate way to value flexible capacity in a market with diverse flexible resources with many different restrictions and capabilities that will be used to backstop the output from an increasing amount of intermittent renewable generation. It is important to give appropriate credit to capacity of different types if market failures in the short term markets mean that capacity revenues turn out to be a significant portion of a resource's gross margin. The wrong credits can give the ISO too little or too much capacity, or the wrong mix. Engineering calculations, based on reliability theory, of the marginal capacity contribution of different resources are difficult and will yield fluctuating values over time as system conditions change, including loads, hydro availability, and the mix of resources.[22] Stakeholder processes without

[22] In theory, metrics could be based on the expected load carrying capability ELCC method developed by power engineers in which the marginal contribution of a resource to the ability of a system to meet an in-

careful analyses to back them up are unlikely to yield accurate assessments of the capacity value of different resources with dramatically different types of operating constraints and availability.

For this reason, we reiterate our previous conclusion[23] that a well-functioning spot market will in theory correctly value a resource's availability, flexibility, location, and other attributions, and incent the resource owner to offer and manage the resource in a manner that effectively utilizes the resource's flexibility. The ISO should therefore aim to enhance the efficiency of spot markets so that resource revenues will make up a material portion of the gross margin of resources. As a result, RA mechanisms (and RAAIM in particular) would become relatively unimportant in incenting the efficient operation of resources, while continuing to provide for the recovery of a portion of investment and going forward costs, which means that the consequences of distortions in capacity credit/AIM penalty calculations will matter less. The proposed RAAIM system will, we believe, provide improved incentives, but they are not a substitute for a properly functioning set of ISO markets for energy and ancillary services.

4. RSI Part III: Replacement and Substitution Rules

An important component of the CAISO RSI proposal is the set of rules for replacement and substitution of resources in case that resources that have a must-offer obligation as generic RA capacity or are Flexible RA capacity are unavailable due to planned or forced outages. Under current rules, the CAISO uses the term "replacement" for additional capacity provided during planned outages of RA capacity which is not accounted for in the planning reserve margin (PRM). In contrast, "substitution" refers to additional capacity provided during forced outages of the committed RA capacity which is partially accounted for in the PRM. Integration of Flexible RA necessitates significant changes to the current rule that would likely not be implemented until Fall 2016. Hence the CAISO proposes to delay until phase two of the RSI any changes concerning planned outages of flexible RA. It is proposed that such changes will be implemented for the 2017 RA year to allow for gradual adjustment by participants and for proper coordination with the CPUC.

In response to stakeholders' comments, the CAISO opted to delay all aspects related to flexible characteristics for planned outages until phase 2, although this delay leaves a time gap between the implementation of flexible RA requirements and the implementation of rules related to flexible RA planned outages. During this time gap the ISO may need to rely on the CPM to ensure

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creased road at a given reliability (e.g., LOLP = 1 day in 10 years) (L.L. Garver, "Effective Load Carrying Capability of Generating Units." IEEE Trans. on Power Apparatus and Systems, Vol. PAS-85, August 1966, pp. 910–919). But this is a difficult calculation for a system with hydro and other resources with complex constraints. ELCC calculations used to be against system peaks, but now they must account for ramps and possible occurrences of resource deficits off-peak, further increasing their complexity (See S. Madeani, R. Sioshansi, and P. Denholm, Comparison of Capacity Value Methods for Photovoltaics in the Western United States, NREL, July 2012, www.nrel.gov/docs/fy12osti/ 54704.pdf).

[23] "Opinion on Flexible Resource Adequacy Criteria and Must-Offer Obligation," Market Surveillance Committee of the California ISO, op. cit.

that the fleet can meet real time net load ramping needs.[24]

The CAISO proposal describes a variety of problems with the current replacement and substitution rules, some of which result from complexity due to timing and overlapping cure periods for LSE and supplier replacement requirements. The proposed rule changes are designed to address these shortcomings and streamline the cure processes for planned and forced outages of RA resources. The proposed rule changes eliminate the distinction between replacement and substitution, focusing instead on the outage type and whether or not substitute capacity is needed. The proposal also revises the monthly RA timeline so as to fully separate the monthly RA process from the planned outage analysis process.

The changes that the RSI proposes in replacement rules are positive steps towards simplifying the process of replacing RA capacity that is not available due to planned or forced outages. They pave the way for expanding this process to accommodate Flexible Capacity in phase 2 of the RSI. The CAISO hopes that these changes would make it easier for unavailable resources to replace their RA obligation with other resources owned by other entities, and thereby avoid penalties under the incentive mechanism, when there is adequate capacity, and contributing to improved system reliability by reducing outages and improving availability of supply when capacity supply would be tight. We note, however, that shifting the replacement process onto the resource could increase awareness among suppliers about outage plans, which might contribute to facilitating of coordinated exercise of market power (either tacit or explicit) if large market players routinely exchange information about capacity outages. This shift in responsibility might also make it more difficult for small suppliers to arrange for replacement capacity and avoid penalties at times when there is no actual shortage of capacity. In theory, such coordination would be more difficult if replacement transactions were made through an arms-length central market. Moving slow in implementing such changes is probably a good idea given all the moving parts that need to be coordinated between the ISO, market participants and the CPUC, and the need by participants to evaluate the impact of such changes.

5. Commitment Costs Enhancements Phase 2

The feature of the CCE2 proposal that we focus on in this opinion is the clarification of the definition of use-limited resources, whose must-offer rules differ from those for non-use-limited resources. It is important that resources claiming use-limited status be limited to those that actually have physical or regulatory limits in order to maximize the resources available to the market.

In general, a resource may face limitations to the number of hours and starts or the amount of energy it can provide over a given period of time. This limits can restrict when and how much a resource can provide, which means that a decision to dispatch a resource now must consider the benefits that may be foregone later ("opportunity costs") if the resource runs out of starts, hours, or energy and cannot be dispatched during a time of high energy prices. For instance, a hydropower plant's production is limited by the amount of water available, and so its production may

[24] See Section 8.3 of the RSI proposal, op. cit.

be rationed to peak periods during the day. Emissions limits can similarly restrict the output of a fossil fuel-fired resource, meaning that is owner should consider when its production would be most valuable. Maintenance needs or inherent resource limitations may limit number of starts per month or season or other period. As a result of these limits, there is an opportunity cost that could mean that even though the price of energy now might exceed out-of-pocket expenses for fuel or other short-run costs, the resource should still not be dispatched. The calculation of these opportunity costs and their inclusion in commitment cost calculations was discussed briefly in an earlier opinion of the MSC,[25] and is to be considered in the CCE Phase 3 initiative later this year.

As we have stated in that previous opinion, we believe that the best way to manage these use-limitations is to allow the opportunity costs be included in resource offers to the market so that the decision to dispatch or not right now balances the benefits of operation immediately against the benefits of instead using the resource later. However, present market rules for calculating commitment costs and default energy bids do not allow for explicit inclusion of opportunity costs, so instead resources must either submit a use-plan or bid higher commitment costs under the registered cost option. Also, under the RSI proposal, limited use resources will also be able to declare themselves on outage when in case the use limitation is reached; of course, this does not help ration starts, hours, or energy earlier when it might have been more optimal. For reasons we have explained in our previous commitment cost opinions, we believe that these approaches to managing opportunity costs are likely to be significantly less efficient than management based on bids that reflect opportunity costs.

Based on information provided to us by the ISO in August 2014, the following resources had a limited-use designation as of that time:

Biofuel 638 MW
Coal 118 MW
Gas 6476 MW
Geothermal 258 MW
Nuclear 2300 MW
Oil 45 MW
Other 2700 MW
Solar 3529 MW
Waste 103 MW
Hydro 10,731 MW
Wind 4198 MW
Total 31,098 MW

This is compared to the reported 2013 installed capacity of 78 GW in the state.[26] Thus the amount of capacity whose flexibility is limited due to declared use-limitations is about 40% of the total. This large percentage implies that it is important to carefully examine whether those

[25] "Final MSC Opinion on Commitment Cost Enhancements," September 2014, op. cit.

[26] www.energy.ca.gov/renewables/tracking_progress/documents/installed_capacity.pdf

limitations are due to physical or regulatory restrictions, or are due to economic factors that would be more appropriately reflected in offers and managed by the ISO market software.

The CCE2 proposal aims to remove the use-limited designation from resources that do not need the designation because they do not have a clear use-limitation per the ISO's tariff. The proposed change in the definition of use-limited resources has two parts. First, use limitations must be due to physical or regulatory restrictions, and not economic considerations such as cost of wear and tear or fuel supplies, or the terms of tolling agreements (unless those terms reflect underlying physical or regulatory restrictions). For instance, the ISO has clarified that natural gas unavailability or high costs are not a use limitation, and so under the new availability incentive mechanism, RA resources that do not meet their must-offer requirements for those reasons will be fully exposed to the availability incentive mechanism.

We agree with this part of the changed definition for two reasons. First, it is intended that changes in restrictions in commitment cost offers to be implemented as part of CCE Phase 3 will allow resources to make offers that are more reflective of their actual costs, including opportunity costs, than in the past. It is important for market efficiency that resources bid flexibly, but also in a way that reflects their costs. The past and likely future reforms to commitment cost calculation procedures still need to be worked out and will not be perfect. However, the goal is that they will improve upon past procedures and lessen the need for resources to self-schedule in order to either (1) avoid incurring costs that would not be compensated by the market or (2) bring a resource on line when its operation would be economic, but CAISO bidding rules preclude the submission of appropriate economic bids. Second, if contractual provisions rather than regulations or physical limitations were to be allowed to justify a use-limited status, this could conceivably weaken incentives to avoid signing contracts that limit output, starts, or operating hours and perhaps incent the use of contractual provisions to avoid performance penalties when there are no physical or regulatory reasons for those restrictions. Such contracts would lessen the amount of flexible resources available to the market and, in some circumstances, might abet the exercise of market power by providing an opportunity cost-based excuse to keep resources out of the market or raise bids.

We note, however, that in practice the distinction between contractual and physical or regulatory limitations can be difficult to draw. For instance, a resource may be able to choose to sign higher-cost maintenance contracts that would provide for more starts or operating hours between planned outages for major maintenance.[27] To build upon a point we made earlier (Section 3.3), if spot markets appropriately reward flexibility, then the correct incentives would be in place to motivate signing of an efficient contract.

The second part of the changed definition narrows the definition of use-limitation for the day-ahead, and short-term and real-time unit commitment processes, making clear that it must involve an opportunity cost. In particular, the applicability of start-up and hour use limitations

[27] However, increased starts would still raise the probability of forced outages later in the season, so increased starts when they are not needed can simultaneously raise contract costs and adversely impact reliability

would be restricted to those limitations whose relevant time horizon is longer than the time horizon considered in the particular unit commitment process. Only such limitations could have an opportunity cost. Thus, for instance, intermittent solar and wind resources do not have opportunity costs, and so will not qualify as use-limited. On the other hand, demand response resources with a limited number of calls per month would be use-limited. We agree with this part of the changed definition as well, and look forward to reviewing the ISO's proposals for opportunity cost calculations in the CCE Phase 3 initiative.

The proposal provides details on how the proposed definition would be applied to various categories of resources. One category of resource that the proposal says that use-limitations are proposed to not apply, but we believe could be applicable in the future is geothermal. It is possible for a given geothermal resource to have an energy limitation over a period of time because of limited heat transfer capability and storage in the tapped source of geothermal energy, which might imply that some husbanding of energy output for use in the highest price hours might be desirable. Such limits might be a contributing reason, for instance, for the Geysers plant and other US geothermal power plants to have a capacity factor of only about 70%.[28]

Appendix: Incentive Compatibility of Single Incentive Price

Following the decision tree in the figure below, a resource can either be flexible or not and in either case can sell generic RA or Flexible RA (if it can still sell flexible RA with the intention of not performing). Then in the energy market after various uncertainties have materialized, a resource that committed to provide flexible RA can choose to either (i) not be available at all, (ii) self-schedule or (iii) submit flexible economic bids. In contrast, a resource that is not flexible can either not be available or provide generic RA. The rewards resulting from the different combinations of capability and choices for different resources are indicated at the end points of the tree branches in the figure.

The objective of the RAAIM is to induce the decisions designated by the two paths denoted on the decision tree, i.e., to incentivize flexible resources to show Flexible RA and bid flexibly in the energy market while incentivizing nonflexible resources to show generic RA and be available in the energy market. For this choices to be consistent with economic behavior it is necessary that the nonperformance penalty is such that: **Penalty > FlexRAprem + Max [UnAvailGain, SelfSchGain]**, where

FlexRAPrem = Difference between Flexible RA and Generic RA payment for the period.

UnAvailGain = costs avoided if the unit is not available for the period

[28] Geothermal resources used to produce renewable electricity in western states, Today in Energy, USEIA, Sept. 8, 2014 http://www.eia.gov/todayinenergy/detail.cfm?id=17871; Capacity factors of geothermal plants, a global analysis by Bloomberg New Energy Finance, http://thinkgeoenergy.com/archives/9644

SelfSchGain = costs avoided if the unit self-schedules its output rather than being dispatched in the period

This will deter a nonflexible resource from contracting to provide Flexible RA and will induce a generic RA resource to be available in the energy market.

The above condition also implies that **Penalty > UnAvailGain** so a flexible resource offering generic RA will choose to be available. However, if **FlexRAprem > SelfSchGain** the option to show Flexible RA by a flexible resource dominates the option to show generic RA and realize any savings from self-scheduling. The latter condition will result naturally since the flexible RA premium will adjust to whatever the market will bear until the Flexible RA capacity needs are met. The conditions above on the penalty does not necessarily mean that it should be higher than the self-scheduling benefit or the unavailability benefit under any circumstance. By seting the penalty the CAISO, effectively sets, an upper bound on the level of self-scheduling benefits and unavailability benefits for which it wants to deter noncompliance. Under the penalty scheme if a resource's self-scheduling benefit exceeds the penalty it will choose to self-schedule and if that is a frequent occurrence that resource will be better off not offering its capacity as Flexible RA. Likewise a resource that frequently has unavailability benefits (or avoided cost) that exceed the penalty should not offer its capacity as RA. By selecting the proper penalty level the CAISO can control what resources should be available in real time and what resources offer flexible capacity and ensure that these resources have the incentives to reveal their intended behavior through their RA and Flexible RA commitments.

The above analysis demonstrates that a well calibrated single penalty will suffice to achieve the RAAIM goals. Such calibration may not be easy since, as shown above it will depend on estimates of gains and avoided costs that are not well understood. However, calibrating a more complex mechanism with two penalties and tiered compliance will most likely be even harder. If the required flexible RA premium is small because the energy market provides strong incentives for flexible resources to offer in a manner that enables them to be dispatched flexibly, then the required penalty for flexible resources would also be small. As we argue in the body of the opinion, and elsewhere,[29] this is the most desirable outcome, and spot market designs should be sought to achieve this outcome.

[29] See "Opinion on Flexible Resource Adequacy Criteria and Must-Offer Obligation," Market Surveillance Committee of the California ISO, op. cit.

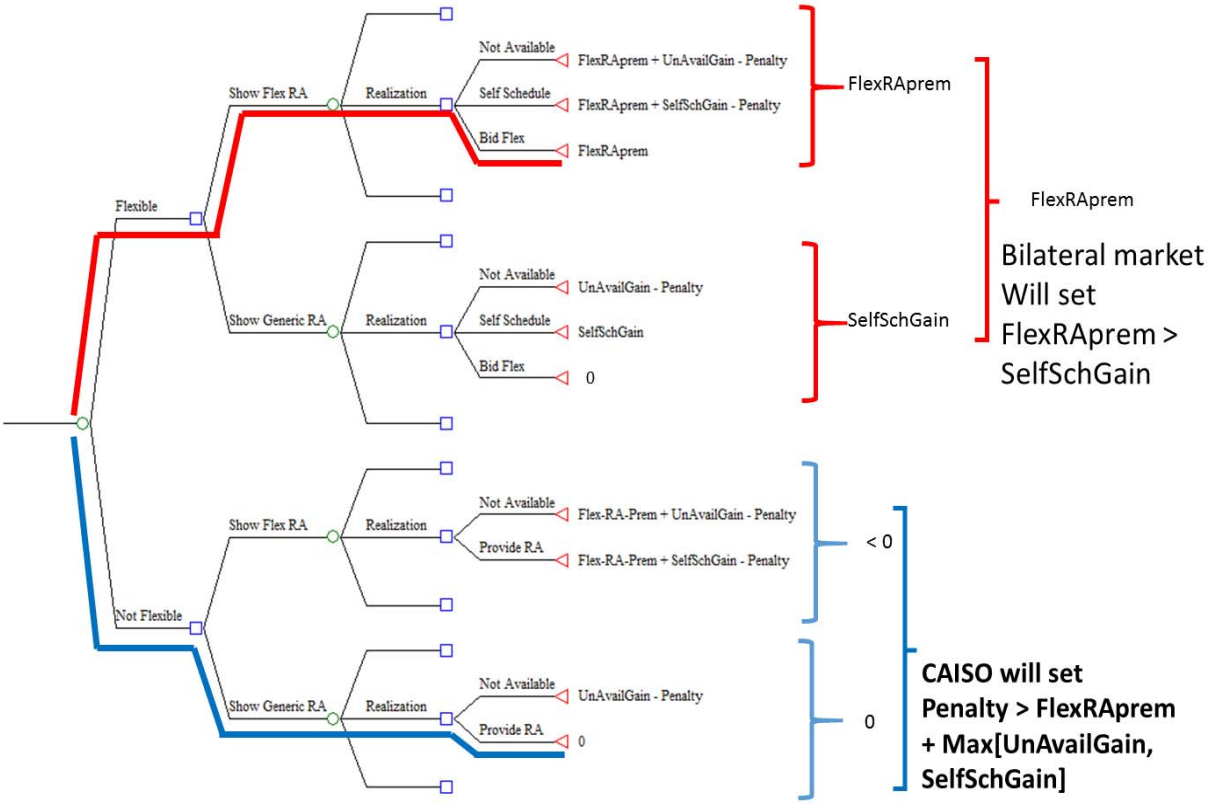

Figure 1: Decision tree for resource self-selection of RA category and performance

Attachment G – List of Key Dates in the Stakeholder Process

Commitment Cost Enhancements Phase 2

California Independent System Operator Corporation

List of Key Dates in the Stakeholder Process for this Tariff Amendment

Date	Event/Due Date
October 29, 2014	CAISO issues paper entitled "Commitment Cost Enhancements Phase 2 – Straw Proposal"
November 12, 2014	CAISO hosts stakeholder web conference that includes discussion of paper issued on October 29 and presentation entitled "Commitment Cost Enhancements Phase 2 – Straw Proposal Discussion"
November 19, 2014	Due date for written stakeholder comments on paper issued on October 29
December 22, 2014	CAISO issues paper entitled "Commitment Cost Enhancements Phase 2 – Revised Straw Proposal"
January 6, 2015	CAISO hosts stakeholder web conference that includes discussion of paper issued on December 22 and presentation entitled "Commitment Cost Enhancements Phase 2 – Revised Straw Proposal Discussion"
January 13, 2015	Due date for written stakeholder comments on paper issued on December 22
February 6, 2015	CAISO hosts joint stakeholder web conference regarding reliability services and commitment cost enhancements phase 2 initiatives that includes presentation entitled "Reliability Services Initiative and Commitment Costs Enhancements Phase 2 Policy Changes"
February 9, 2015	CAISO issues paper entitled "Commitment Cost Enhancements Phase 2 – Draft Final Proposal"
February 12, 2015	CAISO hosts stakeholder web conference that includes discussion of paper issued on February 9 and presentation entitled "Commitment Cost Enhancements Phase 2 – Draft Final Proposal Discussion"
March 2, 2015	Due date for written stakeholder comments on paper issued on February 9
April 16, 2015	CAISO issues draft tariff language to implement phase two of commitment cost enhancements proposal
April 24, 2015	Due date for written stakeholder comments on draft tariff language issued on April 16
April 30, 2015	CAISO hosts stakeholder conference call that includes discussion of draft tariff language issued on April 15
May 21, 2015	CAISO issues revised draft tariff language to implement phase two of commitment cost enhancements proposal