



California ISO

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

February 17, 2016

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

1.1. CHANGES MADE FROM REVISED STRAW PROPOSAL:

Section 5

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

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

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

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

Section 6

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

Section 7

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

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

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

Section 10

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

Section 11

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

Section 12

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

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

1.2. STAKEHOLDER COMMENTS AND REQUESTS NOT RESULTING IN CHANGES

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

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

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

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

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

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

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

2. SCHEDULE FOR STAKEHOLDER POLICY ENGAGEMENT

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

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

3. INTRODUCTION

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

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

This initiative will primarily culminate in implementing a process which will determine an opportunity cost for use-limited resources that reflect eligible limitations. The opportunity cost(s) will be reflected in default commitment cost bids and/or the resource's Default Energy Bids (DEBs). Reflecting the opportunity costs in the resource's commitment cost(s) will facilitate a more efficient market solution while respecting the limitations of these resources that cannot be optimized by the applicable market commitment process. Once opportunity costs are implemented for use-limited resources, the registered cost option will be eliminated, and all resources will be on the proxy cost option for commitment costs¹.

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

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

4. INITIATIVE SCOPE

This initiative was initially created to allow additional time for development and vetting of the business rules to determine opportunity costs for use-limited resources. During the stakeholder process, FERC issued an order issued in September 2015 rejecting the revised definition of use-limited as developed under Commitment Cost Enhancements Phase 2, therefore the scope of CCE3 expanded to include revisions to the definition of use-limited². Recently, there was concern expressed by stakeholders regarding the interdependency of three on-going initiatives, Commitment Cost Enhancements Phase 3, Bidding Rules, and Reliability Services 2. In response, the ISO migrated topics from Bidding Rules and Reliability Services 2 into Commitment Cost Enhancements Phase 3. Therefore, the scope of Commitment Cost Enhancements Phase

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

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

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

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

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

5. USE-LIMITED DEFINITION

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

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

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

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

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

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

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

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

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

Appendix G³ of the market protocols manual for SPP provides the following criteria for acceptable restrictions/limitations:

11.1 Basis for Opportunity Cost to be Included in Mitigated Offers

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

11.1.1 Environmental Run-hour Restriction

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

11.1.2 Physical Equipment Limitations

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

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

Section 12 in PJM's Manual 15: Cost development guide⁴ also provides the same three reasons under which a resource would be able to apply for an opportunity cost as SPP, almost verbatim.

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

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

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

5.2. REVISED USE-LIMITED DEFINITION

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

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

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

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

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

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

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

TABLE 1 NON-EXHAUSTIVE LIST OF ACCEPTABLE RESTRICTIONS

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

The next part of the proposed definition explicitly points out the limitation in the ISO’s commitment time horizon and why an opportunity cost should be calculated. The ISO proposed to consider a use-limitation if the applicability⁵ of the limitation is longer than the resource’s appropriate commitment process in the ISO market. For example, a long start resource with a daily limitation would not be considered use-limited because it is committed in the day-ahead market which optimizes over 24 hours; the applicability of the limitation is 24 hours which is not longer than the optimization horizon of the market which commits the resource. If the same resource has an acceptable monthly limitation, then it would be considered use-limited because the day-ahead

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

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

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

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

In summary, a use-limited resource:

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

5.2.1. DEFAULT USE-LIMITED STATUS

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

⁶ These resources would continue to be exempt from bid insertion rules.

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

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

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

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

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

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

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

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

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

TABLE 2 IMPACT OF REMOVING DEFAULT DESIGNATION

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

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

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

5.3. CONTRACTUAL LIMITATIONS

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

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

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

5.3.1. EXCEPTIONS FOR CERTAIN CONTRACTUAL LIMITATIONS

Several stakeholders have commented that they are not requesting the ISO recognize all contractual limitations, just those in long term contracts previously approved by the CPUC through LTPP. As discussed above, the ISO's primary concern with accepting contractual limitations is the ability to exercise market power through commitment cost bids while bypassing the current market power mitigation regime. However, the ISO understands that long term contracts that were approved through a robust regulatory process, prior to initial discussions of the ISO allowing opportunity costs for such limitations, would not reflect attempts of exercising market power. Therefore, the ISO is now proposing a limited exception of contractual limitations that meet the criteria for a transitional period. The CPUC, through written comments, suggested the ISO accept these contractual limitations for a three year period. The three year period would provide sufficient time for the CPUC and ISO to consider RA impact as well as allow time for LSEs to consider renegotiations of the long term contracts⁷. The ISO proposes the following exemption:

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

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

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

5.4. ISO'S RESPONSE TO FERC ORDER ON CCE2

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

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

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

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

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

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

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

⁸ September 9 Order at P 34.

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

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

6. USE-LIMITED REGISTRATION PROCESS

The ISO has made business practice manual changes to clarify the current application and use-plan submittal process for use-limited resources in accordance with Reliability Services initiative implementation in spring 2016⁹. This is the process that will apply once the BPM change are implemented. Pursuant to that process, scheduling coordinators will apply to register resources and then provide use-plan information as follows using a new user interface:

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

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

6.1. PROCESS FOR OPPORTUNITY COSTS

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

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

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

Supporting documentation

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

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

Below is a table include some examples, by resource type, some of the supporting documentation that would be required to validate use-limits and to calculate an opportunity cost¹⁰.

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

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

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

Documentation review

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

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

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

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

Maintaining opportunity costs and use-limited status

Use-limited resources are required to submit an annual use-plan to maintain use-limited status. In subsequent years following the establishment of the initial opportunity cost, if the limitations identified on the use-plan have not changed, and nothing has changed from the supporting documentation previously submitted and reviewed by the ISO, scheduling coordinators can submit an affidavit in lieu of re-submitting all supporting documentation already on file and reviewed by the ISO. The affidavit must attest that the use limitations, and all supporting documentation provided, continues to qualify the resource for use-limited status for the upcoming year, is accurate, and continues to be supported by previously submitted and ISO reviewed documentation. The affidavit will need to be submitted to allow for sufficient time for the ISO to update the negotiated values¹¹ or re-run the model to generate opportunity costs for the upcoming calendar year.

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

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

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

Use-limited registration of new resources

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

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

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

6.2. EVALUATING SUBMITTED LIMITATIONS

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

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

Modeled limitations

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

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

Negotiated limitations

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

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

Daily limitations

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

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

Resources that have daily limitations supported by acceptable documentation can be managed through tools currently available to scheduling coordinators and grid operators. Scheduling coordinators can use daily Masterfile fields, including max daily starts, max daily MWh¹², minimum up time, minimum down time, to ensure the resource does not exceed the daily limits. ISO grid operators can also ensure resources with daily limitations are available in real-time when most needed by

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

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

Multi-stage generating resources

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

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

7. OPPORTUNITY COST MODEL

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

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

¹³ http://www.caiso.com/Documents/MSCFinalOpinion-BidCostRecoveryMitigationMeasures_CommitmentCostsRefinement.pdf

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

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

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

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

7.1. OPPORTUNITY COST METHODOLOGY OVERVIEW

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

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

Table 4 Opportunity cost methodology overview

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

7.1.1.MODEL INPUTS

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

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

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

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

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

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

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

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

7.1.2. CALCULATING OPPORTUNITY COSTS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

7.1.2.1. NESTED LIMITATIONS

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

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

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

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

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

7.1.2.2. SCHEDULED MODEL RUNS

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

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

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

Frequency of scheduled model runs

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

Given stakeholder comments, at this time, the ISO proposes to run the model and update opportunity costs monthly¹⁵. Table 4 below illustrates 1) when the model will be run, 2) what calculated opportunity costs are generated in each model run, and 3) how previously calculated opportunity costs are updated during subsequent model runs.

Table 5 Schedule for calculating opportunity costs

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

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

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

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

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

Rolling 12-month limitations¹⁶: These limitations will be modeled each month as well but always include limitations for at least two 12 month periods. A model run for a rolling 12-month limitation will generate a binding opportunity cost for the upcoming month.

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

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

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

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

Updating limitations in model

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

¹⁶ RAIM calculations will be updated accordingly to accommodate newly identified limitation horizons.

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

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

7.1.3.OUTPUTS

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

Start limits will be reflected in an opportunity cost adder for start-up costs; run hour limits will be reflected in an opportunity cost adder for minimum load costs; energy limits will be reflected in an opportunity cost adder for DEBs¹⁷.

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

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

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

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

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

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

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

Dispute and resolution process

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

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

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

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

8. NEGOTIATED OPPORTUNITY COST AND REVISIONS TO NDEB PROCESS

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

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

For example, if a resource has a limitation of 100 hours per month, the market participant could estimate an opportunity cost by creating a price duration curve for each month and noting the profits, as opposed to revenues, earned in the 100th run hour of that month. The market participant would then ideally submit to the ISO the price duration curves for each month, costs of the resource to run each hour, and the resulting proposed opportunity cost for negotiations.

The ISO will then review the submitted negotiated opportunity costs and methodology. The ISO will either approve the submitted methodology and opportunity costs, or work with the market participants to reach an approved methodology and opportunity cost values. In the event the negotiation has not been finalized prior to the effective date(s) of the limitation(s), the ISO may propose a temporary opportunity cost value that the ISO finds reasonable while the negotiation process continues. The scheduling coordinator may accept or reject the proposed temporary value. If the scheduling coordinator rejects the proposed value, no opportunity cost will be included until a negotiation is reached.

The temporary value established by the ISO would be applicable only in the event that the CAISO determines that resource warrants establishing a non-zero temporary opportunity cost based on submitted documentation pending any agreement or resolution of a negotiated opportunity cost proposed by the SC. If a Scheduling Coordinator and the CAISO cannot reach mutual agreement on an opportunity cost to be used, the Scheduling Coordinator may file at FERC pursuant to Section 205 of the Federal Power Act for approval of a rate.

As discussed at the technical workshop, and reiterated through submitted comments, stakeholders requested resources with negotiated opportunity costs to also be eligible for updated values throughout the calendar year. The ISO agrees that these resources, while not modeled by the ISO, may encounter unanticipated events that result in running through their limitations faster, or slower, than initially estimated. Due to the potential complexity of updating negotiated opportunity costs as well as the unpredictability of when updates will be requested, the additional ISO resources required to support this process in a timely manner may become insufficient. To ensure updates to negotiated opportunity costs can be updated in a timely manner acceptable by the ISO and market participants, the frequency of updates will be part of the negotiation process. In addition to the approved methodology and opportunity costs determined through the negotiation process, the ISO will also negotiate with the market participants the frequency of updates. The ISO envisions the frequency of updates to be dependent on the transparency of the approved methodology; more formulaic methodologies are likely to be easier to update and therefore have more frequent updates compared to those that are less transparent.

Updates to negotiated opportunity costs will only include updates to the opportunity cost values, not the approved methodology used to determine the opportunity costs. To initiate an update, the market participant will need to provide the ISO the new value(s) along with an explanation of why the opportunity costs have changed. Market participants will need to identify the input variables or original assumptions from the approved methodology that changed in such a way to warrant an updated opportunity cost.

Finally, the ISO will propose a modification to the negotiated default energy bid process to allow the ISO the right to initiate the renegotiation of a negotiated default energy bid. Currently, although the ISO may request renegotiation, it cannot require it. The ISO has identified outdated and erroneous negotiated default energy bids or components thereof, including for example, opportunity costs adders that may no longer be appropriate or may need to be adjusted as a result of this initiative.

The ISO will be amending section 39.7.1.3 of the ISO tariff to allow the ISO to review and propose modifications to existing negotiated default energy bids and to require the scheduling coordinator to provide updated supporting information and cost justification.

9. MULTI-STAGE GENERATING RESOURCES

This section only applies to Multi-stage generating (MSG) resources.

It is the ISO's understanding that limitations on MSG resources may apply to either the collective resource, i.e. parent level, or on the individual configurations. Furthermore, each configuration has a biddable minimum load cost, biddable start-up cost (for startable configurations), and upon implementation of CCE2, biddable transition costs. Therefore, additional consideration to determine which commitment cost bids may reflect opportunity costs is warranted. The following discussion pertains to all opportunity costs for MSG resources, independent of if the opportunity cost was calculated by the ISO or negotiated. The overall methodology used to determine which commitment costs may reflect the opportunity costs is based on the concept that any commitment

type decision, i.e. transition or direct start, made by the market should reflect the appropriate opportunity cost.

Limitations that apply to the collective resource will have one opportunity cost for each limitation. Up to 100% of an opportunity cost due to a start limitation may be reflected in the start-up bid for each startable configuration. This ensures that when the market commits the resource from being “off” to “on”, the start-up cost incurred can reflect the opportunity cost associated with a limitation on starting the collective resource. Up to 100% of an opportunity cost due to a run-hour limitation may be reflected in the minimum load cost bid for each configuration. The opportunity cost due to an energy limitation will be added to the DEB of each configuration.

Limitations that apply to each configuration will have an opportunity cost for each limitation, for each configuration. Theoretically the opportunity cost for the same limitation may differ for each configuration. Up to 100% of an opportunity cost due to a run-hour limitation on a given configuration may be reflected in the minimum load cost bid for that configuration. Opportunity costs due to energy limitations on a given configuration will be added to the DEB of said configuration.

In cases where transitions between configurations is considered a start to which the limitation applies, transition costs can be considered another commitment type cost analogous to a start-up cost for that configuration. Essentially the configuration may be started by either 1) being started directly, if a startable configuration, or 2) being transitioned into that configuration. Upon implementation of *Commitment Cost Enhancements Phase 2*, transition costs will also be a biddable commitment cost. Therefore, where a limitation on starts is applied to the configuration level, an opportunity cost will be determined for each configuration. Up to 100% of the opportunity cost can be reflected in start-up cost bid for that configuration as well as the transition costs transitioning into that configuration.

The following tables illustrate how the transition cost bid caps will be determined in cases where the opportunity costs can be reflected in transition cost bids. The proposed method further expands upon the method developed in CCE2, which was accepted by FERC in the order released on September 9, 2015.

Table 1 shows the calculated start-up cost for each configuration of a four configuration MSG resource, which are used to determine the bid caps for transition costs. The bid cap for transition costs are shown in table 2. The transition cost bid cap is equal to the difference of 125% of start-up cost of the to-configuration and 125% of start-up cost of the from-configuration, as developed in CCE2.

The shaded blue columns in table 1 reflect the opportunity cost for each configuration due to a limitation on starts that considers transitions as a start. Assume each configuration has a different opportunity cost for a start limitation, as shown in Table 1. The ISO would then create a matrix of transition opportunity costs, shown in Table 3. The opportunity cost for each transition is the opportunity cost of the to-configuration. For example, the opportunity cost for transitioning from UnitA_2 to UnitA_3 is \$150, which is the opportunity cost of UnitA_3.

The bid cap for transition costs including the opportunity cost is shown in Table 4. These are determined by adding the transition opportunity costs in Table 3 to the transition cost bid caps in Table 2. This results in the opportunity cost associated with the to-configuration to be reflected in the transition cost bids for transitions going into that configuration.

Assume the start-up cost shown in table 1 is the daily calculated proxy start-up cost for these configurations. Currently, the start-up cost bid cap is set to 125% of the daily calculated proxy cost. With opportunity costs, the new start-up cost bid cap for each configuration is increased by the opportunity cost of that configuration, shown in the far right column of the first table below.

Configuration start-up costs

Config IDs	Config number	Start-up Cost	Cost x 125%	Opp Cost	Start-up cost bid cap
UnitA_1	1 - Startable	\$645	\$806	\$100	\$906
UnitA_2	2 - NOT startable	\$1,320	\$1,650	\$50	\$1,700
UnitA_3	3 - Startable	\$2,145	\$2,681	\$150	\$2,831
UnitA_4	4 - NOT startable	\$3,020	\$3,775	\$75	\$3,850

Transition costs bid caps

"From" Configuration	"To" configuration			
	UnitA_1	UnitA_2	UnitA_3	UnitA_4
UnitA_1		\$844	\$1,875	\$2,969
UnitA_2			\$1,031	n/a
UnitA_3				\$1,094
UnitA_4				

Transition opportunity costs

"From" Configuration	"To" configuration			
	UnitA_1	UnitA_2	UnitA_3	UnitA_4
UnitA_1		\$50	\$150	\$75
UnitA_2			\$150	n/a
UnitA_3				\$75
UnitA_4				

Transition cost bid caps with opportunity costs

"From" Configuration	"To" configuration			
	UnitA_1	UnitA_2	UnitA_3	UnitA_4
UnitA_1		\$894	\$2,025	\$3,044
UnitA_2			\$1,181	n/a
UnitA_3				\$1,169
UnitA_4				

Upon implementation, the ISO will be able to identify and track qualifying transitions and thus be accurately captured in the RAIM calculation for use-limited MSG resources.

10. OUTAGE CARDS

The Reliability Service initiative modified the must offer obligation for Resource Adequacy resources. Along with the modified must offer obligations, the initiative also implemented the Resource Adequacy Availability Incentive Mechanism (RAIM) intended to incentivize RA resource to adhere to their must offer obligations.

10.1. SHORT TERM USE-LIMITED REACHED OUTAGE CARD

Use-limited resources may or may not also be RA resources, subject to must offer obligations and RAIM. The Reliability Service initiative established the following outage card specific for use-limited RA resources. The card was created to use as an interim solution between when RAIM becomes effective and the ISO implements an economic tool, i.e. the opportunity cost, and can optimize the use-limited resource through the market. The card was intended to be retired upon implementation of an opportunity cost method.

Short-term use-limited reached: This card may be submitted for use-limited resources as a tool to manage the resource until the ISO implements opportunity costs. The resource can then stop bidding into the market and be exempt from RAIM.

The ISO is proposing the short-term use-limited reached outage card will be retained upon implementation of the opportunity cost methodology. This will allow time for the ISO and scheduling coordinators to become effective in using the opportunity costs in commitment cost bids and address any potential unforeseen issues that may arise. The outage card will serve as a safety net for scheduling coordinators during this period and will aid in a smooth transition away from the outage cards and towards an economic tool to optimize use-limited resources. Excessive use of the outage card will inhibit the ability for the ISO and market participants to ensure the opportunity cost methodology is an effective management tool. Therefore reasonable use of the outage card should primarily be limited to cases where the opportunity cost has been ineffective and the resource is at risk of reaching the limitation prematurely even with bids reflecting the opportunity cost. For example, if a resource adequacy resource is at risk of reaching the limitation

before the end of its RA obligation despite utilizing the opportunity cost in commitment cost bids, this card can be used to essentially reserve sufficient starts for the latter portion of the RA period.

The card will remain available to use-limited resources until the ISO deems the opportunity cost methodology an effective economic tool to manage use-limited resources. At that juncture, the ISO will seek to retire the short-term use-limited reached outage card through a tariff amendment filing.

As discussed in more detail below, a primary concern for stakeholders is when a use-limited RA resource reaches its limitation it will no longer be exempt from RAAIM, possibly due to a miscalculated opportunity cost. The ISO will commit to evaluating how well the opportunity cost model rations out the starts over the year, particularly for RA resources. In the event the ISO finds that for certain resources, the opportunity cost is not an effective management tool, the ISO will consider further enhancements to the model or possibly make the short term use-limited reached outage card a permanent tool for those resources.

10.2. USE-LIMITED REACHED OUTAGE CARD RAAIM TREATMENT

By allowing use-limited resources to reflect opportunity costs of the limitations through commitment cost bids, the resource can be more efficiently optimized over the limitation horizon. When use-limited resource adequacy and flexible resource adequacy resources reach their limitations, scheduling coordinators must submit an outage card indicating the resource has reached the limitation, and is no longer available for the remainder of the limitation horizon. Reliability Services initiative provided RAAIM exemption for use-limited resources that have reached the limitation and is no longer available.

Use-limited capacity that becomes unavailable may have been previously shown on annual or monthly resource adequacy showings. Currently, there are no rules disqualifying use-limited resources that are no longer available from continually being shown on RA plans. The ISO must ensure sufficient capacity to meet monthly requirements is available when needed. The ISO now proposes that when a resource reaches a limitation and submits a use-limited reached outage card, it will be exempt from RAAIM for the remainder of the month. Starting the first day of the subsequent month, the resource will be subject to RAAIM unless substitute capacity has been provided. Not exempting use-limited resources from RAAIM once they become unavailable beyond the current month is intended to provide an incentive for scheduling coordinators to show substitute capacity that is still available to the market.

Stakeholders have expressed concern regarding the non-exemption for use-limited resources. The concerns are based on the premise that use-limited resources will reach the limitation before the end of the year due to a miscalculated opportunity cost, and then be penalized under RAAIM. The ISO understands this concern and it is the primary justification for the ISO taking conservative policy approaches to mitigate the likelihood of this scenario occurring. First, as discussed in section 10.1, the ISO is retaining the short term use-limited reached outage card for a transition period during which this concern, if it materializes, can be addressed through

further enhancements as discussed in Section 12. Secondly, the ISO is using 90% of the resource's limitation in the model to account for any modeling errors that may result in an under calculated opportunity cost. This modification made in the revised straw proposal was in response to this concern when initially brought to the ISO's attention, the idea being modeling ten percent less of the limitation essentially preserves ten percent of starts, run-hours, and/or output for the last month of the limitation horizon. Lastly, the monthly model re-runs will reflect actual usage of the resource. Therefore in the event a resource is using up starts, run-hours, and/or output prematurely, the limitation used in monthly re-runs will reflect a lower limitation, and be reflected in updated opportunity costs.

The ISO would like to take this opportunity to also note a resource may run through a limitation before the end of the year under two other scenarios. First, the policy is not requiring the opportunity costs to be reflected in bids, it only increases the bid cap. Therefore if the opportunity costs are not being reflected in bids, a resource may reach its limitation before the end of the year. Second, if the opportunity cost is accurate and being reflecting in bids, the optimal time to use the resource may be before the end of the year. In either case, the ISO could still be in a situation where resources that are no longer available to the market are still being shown on monthly RA showings; monthly RA showings may appear to not be deficient but in reality the ISO is deficient.

Recent discussion at the February 11th Market Surveillance Committee brought to the table the concept of including an estimate of RA payments in the opportunity cost model to help ensure the resource remains available for the period of its RA obligation. While the ISO appreciates the robust discussion at the meeting, including capacity payments, which are resource specific bilateral contracts and are not public information, into the wholesale energy market - which is intended to reflect marginal energy costs - is a path the ISO does not want to pursue. In a bilateral RA world, the risk and exposure of non-availability, as it always has, should fall to the contracting parties, not the wholesale energy market.

Additionally, including estimated RA payments into the opportunity cost calculation may not have the desired outcome. If the opportunity cost included an estimated RA payment to ensure the resource is not exposed to RAAIM penalties, the application of adding an estimated RA payment to the LMPs used in the model would not necessarily result in a higher opportunity cost. It may result in a resource getting started up once and committed through the day as opposed to started up once, shut down, and started up again as would more likely be the case with the lower LMPs. The former scenario being that the resource uses up less starts in the model due to higher LMPs, which may result in the resource not reaching a start limitation. When a resource in the model does not reach the limitation, the resulting opportunity cost is zero. Lastly, the intent of including an RA payment in the model is to increase the opportunity cost and thus the effectiveness of the opportunity cost as a management tool; again, this was the justification for the current proposal of using 90% of the limitation in the model. Only experience will enable the ISO and market participants to make a more educated decision between various approaches.

10.3. DEMAND RESPONSE OUTAGE CARD

As previously noted, the ISO's intent of removing default use-limited designation is to signal the need for an opportunity cost, not to modify the treatment of previously default use-limited resources in the ISO markets. At this point, the ISO does not envision reliability demand response (RDRR) and proxy demand response (PDR) resources to qualify for use-limited status. However, through discussions with stakeholders, the ISO recognized the need for these resource to have access to outage cards similar to the short term use-limited reached and use-limited reached outage cards discussed above. RDRR and PDR resources, per demand response programs, are provided the ability to take "fatigue breaks" after being dispatched so many hours in so many consecutive days. For example, a PDR resource may be able to take a 48 hour fatigue break after being dispatched four hours a day for three consecutive days. In addition, the programs typically indicate the maximum hours per month the resource will be dispatched, after which the resource is no longer available to the market.

Access to the current outage cards is dependent on use-limited status. To ensure there is no impact on how RDRR and PDR resources participate in the ISO markets without use-limited status, the ISO is proposing a new "nature-of-work" outage card specific to demand response resources. The outage cards will be available for use in accordance with the demand response programs and provide RAIM exemption for the resources while on the outage.

11. MASTERFILE RESOURCE CHARACTERISTICS

Resource characteristics are submitted to the Master File based on the generator resource data template.¹⁸ Valid inter-temporal constraints, such as minimum up and down times, and other resource characteristics are the foundation for effective bidding rules. The ISO currently requires scheduling coordinators to provide information reflecting physical characteristics. Specifically, the tariff requires:

Each Participating Generator shall provide data identifying each of its Generating Units and such information regarding the capacity and the operating characteristics of the Generating Unit as may be reasonably requested from time to time by the CAISO. All information provided to the CAISO regarding the operational and technical constraints in the Master File shall be accurate and actually based on physical characteristics of the resources except for the Pump Ramping Conversion Factor, which is configurable.

Many of the constraints that participating generators provide to master file can be difficult for the ISO to validate because the value for the constraint may legitimately require some engineering and economic judgment to balance excessive wear and tear and the technical capabilities of the resource. At the same time, the vast majority of resource characteristics should be static over a period of time and reflect resource vintage and use.

¹⁸ See <http://www.caiso.com/market/Pages/NetworkandResourceModeling/Default.aspx> link to the excel file for the most recent Generator Resource Data Template.

The ISO proposes two sets of Master File values. The first set consists of all the existing resource characteristics and these must be based on the maximum (or minimum) design capabilities of the resource. These characteristics will be kept as validation data and for exceptional dispatch under stressed system conditions and will be referred to in this paper as “design capability” characteristics. EIM resources will also be subject to the following criteria set forth for market based and design capability values.

The second set is a subset of resource characteristics that will be used in the ISO market for normal operations to reflect preferred operating parameters. These values may be different than the first design capability set and will be referred to in this paper as “market” characteristics.

11.1. MARKET CHARACTERISTICS

The value each unit has registered for the vast majority of resource characteristics should remain static over time, but recognizes the need for some characteristics to reflect a balance between technical capabilities and economic trade-offs. At this time, the ISO proposes to allow generating resources to register market based values in market resource characteristic fields for maximum daily starts, maximum MSG transitions, and ramp rates. Subject to the proposed amendment to Tariff Section 4.6.4, the ISO does not propose other changes to the basic nature of how resource characteristics are registered. Outside of the maximum daily starts, maximum MSG transitions, and ramp rate market characteristics, all other resource characteristics will only provide design characteristic fields which values must reflect the unit’s design capability.

Maximum daily starts may warrant being more restrictive than the design capability values for a few reasons. It is the ISO’s understanding that a common trade-off is made between excessive wear and tear on a resource and the frequency of being started. While a resource may be able to start, for example, five times a day, starting it more than twice a day would drastically increase wear and tear on the resource and thus the probability of catastrophic failure. Tolling agreements or power purchasing agreements may impose restrictions on the use of the resource by limiting starts. While these restrictions would not generally qualify the resource for use-limited status and an opportunity cost adder, they can be reflected in the maximum daily starts field to help manage the resource within the contractual limitations.

The previous proposal stated the market based values, must at a minimum, support RA showings of the resource and adjust with changes made to those showings. This would translate to a minimum of two starts per day for Flexible Category 1 resources and a minimum of one start per day for all others. However, after further discussion, the ISO is concerned with potential gaming and exercise of market power that could arise with allowing one start per day. An overly restricted maximum daily start of one start per day provides a mechanism for resources to exercise market power. In addition, with one start per day, there are gaming concerns that arise due to the difference of optimization horizons between the day-ahead and real time markets. A resource with one start per day may be optimally committed in the day-ahead market for the evening peak. The real time market optimization does not optimize over the full 24 hour day, and thus may dispatch the resource to meet the morning peak instead. It may then be optimal for the real-time market to issue a shut down as solar peaks and net loads

reach a low in the middle of the day. In this case, a resource with a single daily start will not be able to meet its day-ahead schedule for the evening load peak. Under these circumstances, system operators may issue an exceptional dispatch to prevent the resource from shutting down, contributing to potential over-generation in the middle of the day. If, instead, the resource follows the real-time dispatch and shuts down, it will not be available to meet its day ahead schedule for the evening load ramp raising reliability concerns under conditions when system demand for both energy and flexibility are high. In addition to reliability implications, the buyback of the day-ahead schedules created by this situation can result in real-time bid cost recovery uplift.

Therefore the ISO is now proposing the market based maximum daily start values be, at a minimum, two starts per day except in the event the design capability value for maximum daily starts is one start per day or under the limited exception as noted below. If the design capability of the resource is one start per day, the market based value can then be one start per day.

The ISO understands resources nearing the end of its life cycle *may* warrant the resource only starting once per day despite its design capabilities allowing it to start more than once per day. The scheduling coordinator may request the ISO extend this exception of allowing one start per day in the market based max daily start field with sufficient justification. The request being made must include a detailed explanation of the mechanical justification for why the resource cannot start more than once per day, including the vintage of the resource. Per the ISO's discretion, upon receipt of such a request and review of documentation provided, the ISO may grant the exception. The scheduling coordinator must also provide additional explanation and/or documentation per ISO request if needed. Review of an ISO denial of an exception request would be subject to the ISO tariff alternative dispute provisions.

Maximum MSG transitions, similar to maximum daily starts, may warrant being more restrictive than the design capability of the resources. Based on discussion with stakeholders, oftentimes what the ISO considers a transition is actually a start of another resource which is part of the MSG pseudo-unit. For example, a MSG resource comprised of four identical CTs may have four configurations, where each consecutive configuration reflects the start of an additional CT.

The ISO is proposing to have a market based maximum MSG transition resource characteristic field held to the same minimum standards, minimum of 2, as the maximum daily start market based value. A minimum value of two transitions per day, is based on the ISO's need to be able to ramp twice per day and mitigate any potential gaming concerns that may arise through the ability to limit transitions to once per day.

The same exceptions to the minimum of two transitions per day will be extended to the market based maximum MSG transition field as well.

Ramp rates can currently be specified as a component of daily energy bids. The ISO has greatly enhanced the modeling capabilities of resources in the markets, such as multi-stage generating resources, reducing the need to accommodate daily bid-in ramp rates. Also, removing the daily bid-in ramp rate functionality minimizes potential adverse market impacts from resources changing ramp rates based on current system conditions while the ISO market is making awards

based on ramping capability under planned new market products i.e. flexible ramping product¹⁹ and corrective capacity²⁰.

The ISO proposes to remove the capability to specify ramp rates in daily energy bids. However, the ISO also recognizes the need to reflect preferred ramp rate capabilities used under normal operating conditions in contrast to those used under emergency conditions. The ISO is now proposing to allow resources to have a market based ramp rate to reflect the preferred operational ramp rate of the resource under normal system conditions. The market based ramp rate values, at a minimum, must support the resource's EFC value. For example, if the EFC value based on a 3 hour ramp period is 270MWs, the market based value cannot be less than 1.5MWs/min (270MWs/180 minutes).

11.2. DESIGN CAPABILITY CHARACTERISTICS

This set of Master File characteristic fields will consist of all the existing resource characteristics and its values must reflect the maximum, or minimum, design capability of the resource. For example, maximum daily starts must reflect the maximum starts the resource can endure under emergency conditions; minimum up time must reflect the shortest time period a resource necessarily has to be committed before shutting down.

For those characteristics which have both design capability and market fields, the ISO will model and ordinarily respect the market characteristics. However, where the ISO may need to issue an exceptional dispatch in response to stressed system conditions, the ISO proposes to make the design capability values available to operators.

The design capability characteristics shall be greater than or equal to the market based value for those resource characteristics with both a design and market based value. Due to the minimum requirements set on the market based maximum daily starts and maximum MSG transitions, minimum of two per day, it logically follows that the design capability value for maximum daily starts and maximum MSG transitions shall not be less than two per day. In the event the design capability value for either maximum daily starts or maximum MSG transitions is one per day, the market based value can also reflect one per day. Registration of one maximum daily start or maximum MSG transition for design and market based values in the Masterfile will be subject to ISO's confirmation this reflects the resource's design capability. As previously noted, the scheduling coordinator must submit to the ISO a detailed explanation of the design characteristics which restrict the resource to only start once per day. Review of an ISO denial of an exception request would be subject to the ISO tariff alternative dispute provisions.

The ISO also proposes to revise Tariff Section 4.6.4 and the Tariff definition of "Maximum Daily Starts" to refer to "design capability" rather than "physical characteristics," as a unit's design capability can be more objectively determined than its physical characteristics. For example,

¹⁹For more information on flexible ramping product, please see <http://www.caiso.com/informed/Pages/StakeholderProcesses/FlexibleRampingProduct.aspx>

²⁰ For more information on corrective capacity, please see <http://www.caiso.com/informed/Pages/StakeholderProcesses/ContingencyModelingEnhancements.aspx>

determination of a unit's physical characteristics arguably could include economic trade-offs involving wear and tear, whereas the design capability of the resource is the maximum (or minimum) ability of the resource.

11.3. CHANGES TO MASTERFILE RESOURCE CHARACTERISTICS

The Reliability Service Initiative Phase 2 previously discussed how the ISO would address changes to Masterfile resource characteristics for resource adequacy resources in such a way that would no longer support the RA showing for that resource. For example, if a Flexible Category 1 resource changes the maximum daily start value from two starts per day to one per day, it would no longer be supporting the requirements set forth to be a Flexible Category 1 resource. This discussion has been migrated to this initiative as it is directly link to the proposed changes for Masterfile resource characteristics. Qualification for generic and flexible resource adequacy showings are based on maximum daily starts, ramp rates, and minimum down time.

Based on the minimum requirements set forth above for the market based Masterfile maximum daily start parameter, this value can no longer be changed in a manner that does not support the RA showing. The minimum value of two starts per day is sufficient enough to support the highest category of flexible capacity. In the event a Resource Data Template (RDT) is submitted with a maximum daily start value less than 2, with the exception of those with a design capability value of one or granted exceptions, the RDT will be rejected and sent back to the scheduling coordinator for revision.

As noted in Section 11.1, the minimum requirement for the market based ramp rate value is that it at least supports the EFC value the resource is able to provide. In the event an RDT is submitted with a market based ramp rate value that does not support the EFC value of the resource, the RDT will be rejected and sent back to the scheduling coordinator for revisions.

Lastly, the minimum down time and dispatchability is also used to determine the category of flexible capacity a resource is qualified to provide. Any changes to either minimum down times or the dispatchability flag of the resource which would result in the resource no longer qualifying for the flexible capability category it is being shown as will be rejected when submitted as a change in Masterfile fields.

12. FUTHER ENHANCEMENTS OF THE OPPORTUNITY COST MODEL

The ISO recognizes that the opportunity cost modeling and implementation this is a new process for all involved. As with any new process, there is a learning curve which brings with it, gained experiences. Several of the policy elements, including monthly re-runs and modeling 90% of a resource's limitation, are viewed as a good step in the right direction; made to ensure perfection is not the enemy of good.

As the ISO and market participants gain experience with the opportunity cost model and using the opportunity cost as a management tool, the ISO will consider future enhancements to both the policy and model as warranted.

Potential future enhancements and considerations include

- re-evaluating the frequency of model re-runs based on the time needed for each updated,
- considering modifications to using 90% of a resource's limitation in the model, or other ways in which to further enhance the effectiveness of the opportunity cost as a management tool such as possibly including an estimated RA payment, and
- evaluate how well the opportunity cost model rations starts throughout the year, particularly for use-limited RA resources

13. NEXT STEPS

The ISO will discuss this draft final proposal with stakeholders on a conference call on February 25, 2016. Stakeholders should submit written comments by March 2, 2016 to initiativecomments@caiso.com.

The ISO will also post a technical appendix in March 2016 to provide transparency of the optimization based model as well as additional details and examples of how the model results will be used to determine the opportunity cost.