



Updates to Short Start and Long Start Unit Definitions

February 17, 2022

Draft Final Proposal

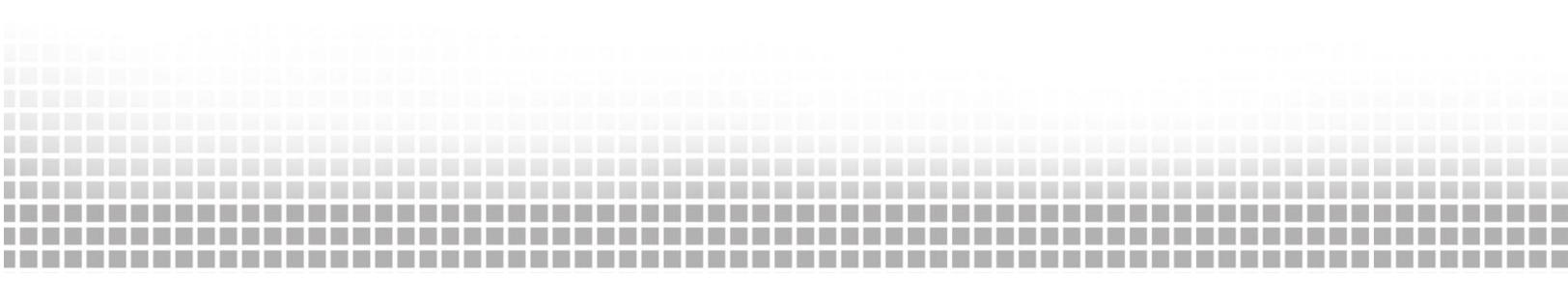
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Table of Contents

Introduction 3
Background 4
Issue Description 5
Stakeholder Comments 6
Proposed Solution 7
EIM Decisional Classification 8
Next Steps 9
ATTACHMENT A 10

Introduction

The CAISO initiated stakeholder discussions on three miscellaneous tariff revisions in the summer of 2021. The CAISO is now resuming discussion, and is in process of a initiative to stakeholder the proposed revision to the definitions in its tariff of a Short Start Unit and a Long Start Unit.¹ During the summer 2021 tariff clarification stakeholder process, the CAISO believed that it might be appropriate to make the tariff changes as tariff clarifications, without the need for CAISO Board of Governors or Governing Body consideration. On further consideration, however, the CAISO has concluded that such consideration is warranted and has pursued these changes through its stakeholder process. To date the CAISO has published an Issue Paper / Straw Proposal, held a public stakeholder call and has solicited written comments on its proposal.

In summary, the purpose of the tariff revisions discussed herein is to align the tariff definitions of generating units that can be committed in the real-time market and the day-ahead market to how the CAISO market software functions. This alignment will also address a gap in the application of resource adequacy availability incentive mechanism (RAAIM) penalties under the CAISO's resource adequacy program. The RAAIM penalty was designed based on the existing definitions. Because the definition of a Long Start Unit does not expressly reference cycle time (*i.e.*, the sum of a resource's start-up time and minimum run time), some resources that do not meet the definition of Short Start Unit also do not meet the definition of Long Start Unit. Resources falling into this definitional gap have had to submit real-time bids to avoid RAAIM penalties even though the market software will not commit the resources in the real-time market.² The new definitions proposed in this Issue Paper and Straw Proposal will address this issue by defining both Long Start and Short Start Units based on their respective cycle times.

¹ See [California ISO - Miscellaneous Stakeholder Meetings \(caiso.com\)](https://www.caiso.com/California-ISO-Miscellaneous-Stakeholder-Meetings). That stakeholder process also resulted in a tariff amendment the CAISO filed in Docket No. ER21-2854-000 to clarify the term "business day," which FERC accepted by letter order. The CAISO stated in the transmittal letter for the tariff amendment that the issues the CAISO discussed with stakeholders included not only the tariff clarification proposed in the tariff amendment but also two other tariff issues concerning intertie deviation settlements and short-start/long-start units. The CAISO stated that those two tariff issues require additional planning and stakeholder activities before they could be included in a filing for Federal Energy Regulatory Commission (FERC) acceptance.

² The CAISO described this RAAIM issue in greater detail at pp. 15-17 of the paper titled Summary of Issues and Draft Tariff Language (originally published on August 24, 2021) and now available at <https://stakeholdercenter.caiso.com/StakeholderInitiatives/Short-long-start-unit-definitions-update>.

The revisions to the existing definitions of both Long Start and Short Start Units will align those definitions with the market processes and timelines of the day-ahead and real-time market. In addition, the CAISO is proposing to eliminate the definition of a Fast Start Unit (which is committed in the real-time unit commitment (RTUC) process during the real-time market) and a Medium Start Unit (which is committed in the short-term unit commitment (STUC) process during the real-time market) as unnecessary. As a result, the definition of a Short Start Unit must specify the resource that can be started in either the RTUC or the STUC depending on the generating unit's actual start-up and minimum run time, which is the information the market processes obtain from the CAISO master file. This paper focuses on the STUC as the commitment process for determining the dividing line between Short Start Units and Long Start Units, which is the dividing line for what can be committed in the real-time market and the day-ahead market, respectively.

The definitions of a Short Start Unit and a Long Start Unit do not currently reflect the accurate maximum cycle time for an offline generating unit that could be started up in the STUC. The tariff definition of a Short Start Unit lists a five-hour (*i.e.*, 300-minute) cycle time, whereas the business practice manual for market operations specifies a 270-minute cycle time for Short Start Units and reflects actual implementation. The definition of a Long Start Unit specifies a time of between five and eighteen hours to start-up and synchronize to the grid and, as noted above, does not expressly reference cycle time.

Last summer the CAISO stated in the stakeholder process that it believed the definitions of a Short Start Unit and a Long Start Unit should be revised to specify a maximum cycle time of 240 minutes. The CAISO has further reconsidered its proposal and has determined that the more appropriate maximum cycle time should instead be 255 minutes for the reasons discussed below. To address this matter, the CAISO proposes to amend the two definitions to include the 255-minute maximum cycle time, and proposes other conforming revisions and clarifications to the tariff and the business practice manual. The revised maximum cycle time also aligns with the 255-minute time period within which the STUC commits units. The CAISO has verified that the revisions will not change the status that any generating unit currently has as a Short Start Unit or a Long Start Unit. This means that no existing Short Start Unit that participates in the CAISO market will be reclassified as a Long Start Unit.

Background

The CAISO real-time market software conducts a multi-interval optimization for each of the real-time market processes. The real-time market processes includes two commitment processes: the RTUC and the STUC. These two processes make commitment decisions and send out start up instructions to resources that can be started in the real-time market. These commitment processes also make decommitment decisions. The RTUC commits resources with relatively shorter cycle times and the STUC commits the resources with longer cycle times that can still be committed in the real-time market. Therefore, the definition of a Short Start Unit needs to be tied to what can be committed in the STUC.

The STUC runs once at the beginning of each hour and looks ahead eighteen 15-minute intervals, *i.e.*, has a time horizon of four hours and 30 minutes (*i.e.*, 270 minutes).³ However, only, 255 minutes are available to perform the unit commitment process.

The tariff defines a Short Start Unit as a generating unit that has a cycle time less than five hours (*i.e.*, 300 minutes), and that can be fully optimized with respect to this cycle time in the STUC. The CAISO's business practice manual states that the cycle time for a Short Start Unit is less than or equal to 270 minutes.⁴

The tariff also includes two more definitions of resources that can be started in the real-time market, namely Fast Start Unit and Medium Start Unit. These resources are either committed in the RTUC or the STUC depending on their start-up and minimum run time, *i.e.*, cycle time registered in the master file. Because Fast, Medium, and Short Start Units are all committed in the real-time market based on resource-specific start-up and minimum run time, the CAISO is proposing to eliminate the terms Fast Start Unit and Medium Start unit and to retain Short Start Unit as the term that defines resources that can be committed in the day ahead market. During the summer of 2021, as part of a tariff clarifications stakeholder process, the CAISO proposed to amend the definition of Short Start Unit to 240 minutes, which was selected to allow for 15 minutes of the available 255 minutes to account for decommitment decisions. By modifying its proposed definition to 255 minutes, to clarify that decommitment decisions need not be made within the same STUC time horizon.

The CAISO is also proposing to amend the definition of Long Start Unit. This definition signifies resources that are committed in the day-ahead market, but it is currently ill-defined because it only includes start-up time. Specifically the tariff defines a Long Start Unit as a generating unit that requires between five and eighteen hours to start-up and synchronize to the grid but does not include minimum run time. Lastly, the tariff defines an Extremely Long Start Resource as a generating unit that has a start-up time greater than 18 hours or a system resource that is either: (1) a non-resource-specific system resource with contractual limitations that require the energy be transacted (*i.e.*, committed) prior to the publishing time of the day-ahead market results (1300 hours on the day before the trading day); or (2) a resource-specific system resource that has a start-up time greater than 18 hours. The CAISO is not proposing any change to the definition of Extremely Long Start Resource.

Issue Description

As discussed above, the tariff currently defines a Short Start Unit as having a cycle time of less than five hours (*i.e.*, 300 minutes), and the business practice manual currently states that a Short Start Unit has a cycle time of less than or equal to 270

³ See Business Practice Manual for Market Operations, Section 7.3.3.

⁴ Business Practice Manual for Market Operations, Section 6.4.7.

minutes. Neither of these defined cycle times, however, aligns with how the real-time market software functions. As discussed above, only 255 minutes are available within STUC to commit resources in the real-time market and to establish the dividing line between resources that can be started in the real-time market and resources that must be started in the day-ahead market. The tariff and business practice manual should be revised to align the definition of Short Start Unit with the 255-minute cycle time. The CAISO had proposed 240 minutes in the summer tariff clarifications initiative to allow for a decommitment decision to be made within the same STUC time horizon. As discussed below, the CAISO is proposing additional tariff language to make it clear that the decommitment decisions need not be made within the same STUC time horizon.

Further, the tariff currently defines a Long Start Unit as requiring between five and eighteen hours to start-up and synchronize to the grid, and the definition does not reference the Long Start Unit's cycle time. Consequently, a generating unit with a start-up time of three hours and a minimum run time of three hours would not meet the definition of either a Short Start Unit or a Long Start Unit. From a software perspective, the market considers both start-up time and minimum run time along with other inputs, including commitment costs and energy bids, when making commitment decisions in the RTUC and STUC processes for Short Start Units, or in the IFM and RUC processes of the day-ahead market for Long Start Units. This means that Short Start and Long Start Units should both be defined in terms of cycle time, which is not the case under the existing tariff. As noted above, the absence of the use of cycle time in the definition of a Long Start Unit has become an issue for the application of RAIM penalties under the CAISO's resource adequacy program. Because the Short Start Unit definition is using 255 minutes cycle time, the definition of Long Start Unit must also be defined using 255 minutes cycle time to ensure that there is no gap between short and long start units.

Stakeholder Comments

The CAISO received comments on the Issue Paper / Straw proposal published January 25, 2022. Those comments support the CAISO's proposal to align the tariff and business practice manual with existing practices, but requested confirmation on the nature the propose change.

The CAISO reiterates that the short and long start definitions will be changed to reflect a maximum cycle time of 255-minutes for resources that can be started in the real-time market short-term unit commitment process. Cycle time includes both startup and minimum run times. This change reflects the optimization horizon of the market run, the run time of the application and the expected notification time of resources commitment results. For purposes of determining whether a resource falls under the Short Start or Long Start category, the markets will use the longest (cold) startup time registered in the master file. For MSG resources, the cycle time will be based on plant values, e.g. longest (cold) startup time and minimum run time values registered at the plant level in the master file. For multi-state generating resrouces transitioning between configurations the market will utlize the appropriate transition time; the real-time market may transition a resource between configurations if the bid in notification

time for that transition is 255 minutes or less. The transition functionality is explained here for information only, is not a part of this stakeholder process, and is not changing as part of this stakeholder process.

Proposed Solution

The CAISO proposes to revise the tariff definitions of a Short Start Unit and a Long Start Unit to reflect the maximum 255-minute cycle time of a Short Start Unit and to reference cycle time in both definitions. These revisions will ensure that the definition of a Short Start Unit includes resources that can be committed in the real-time market (RTUC or STUC) depending on the specific start-up and minimum run time (*i.e.*, cycle time) of each resource. The definition of a Long Start Unit by including cycle time will address the identified gap that a generating unit could fail to meet the Short Start Unit definition but also fail to meet the Long Start Unit definition in the event the start-up time was less than five hours but total cycle time was more than five hours, thereby failing to meet both tariff definitions. Using cycle time in both definitions will address this gap and result in appropriate RAAIM penalty alignment.

The CAISO has verified that the proposed 255-minute cycle time Short Start Unit definition will not result in any resource that is currently participating in the real-time market, being redefined as a Long Start Unit. Resources currently treated as long start resources in the market software, but fail to meet the definition of Long Start Unit, will now meet the definition of a Long Start Unit and will not need to submit real-time market bids to manage real-time RAAIM exposure.

Specifically, the CAISO proposes to revise the definitions of a Short Start Unit and a Long Start Unit as shown in the following underlined and struck-through language:

- Short Start Unit

A Generating Unit that has a cycle time less than or equal to 255 minutes~~five hours~~ (Start-Up Time plus Minimum Run Time is less than or equal to 255 minutes~~five hours~~), ~~has a Start-Up Time less than two hours,~~ and can be fully optimized with respect to this cycle time.

- Long Start Unit

A Generating Unit that has a cycle time of more than 255 minutes (Start-Up Time plus Minimum Run Time is more than 255 minutes) and ~~requires between five and~~ up to 18 hours to Start-Up and synchronize to the grid.

These two revised definitions will describe the cycle times of all generating units – those that have cycle times of 255 minutes or less (Short Start Units) and those that have cycle times of more than 255 minutes (Long Start Units). As a result of these revised definitions, the CAISO proposes to eliminate the definitions of a Fast Start Unit and a Medium Start Unit as unnecessary. Those definitions simply split the set of Short Start Units into subsets in an effort to align Fast Start Units with RTUC commitment and

Medium Start Units with STUC commitment. There is no need for this distinction in the tariff. The important distinction in the tariff and in CAISO operations is between real-time startable units and day-ahead startable units. The CAISO is not proposing to alter the definition or tariff provisions related to Extremely Long-Start Resources, because those types of resources require additional notice. Lastly, there is no gap between the definitions of Short Start Unit and Long Start Unit.

The CAISO also proposes to make conforming revisions in other sections of the tariff to eliminate references therein to Fast Start Units and Medium Start Units, and to correctly reference the 270-minute STUC time horizon to align with the 255-minute cycle time under the amended Short Start Unit definition. In addition, tariff section 34.6 currently states that the STUC will only decommit a resource to the extent the resource's physical characteristics allow it to be cycled in the same look-ahead time period for which it was previously committed. The CAISO proposes to revise that tariff provision to state that the STUC may, but is not required to, decommit a resource in the same look-ahead period for which it was previously committed. The CAISO is making this tariff revision to make it clear that the CAISO does not have to decommit a resource within the same STUC time horizon, which was the basis for the CAISO's summer 2021 proposal for a 240-minute cycle time under the Short Start Unit definition. All of these revisions are shown in Attachment A hereto.

EIM Decisional Classification

This Issue Paper and Straw Proposal proposes tariff changes that would go to the CAISO Governing Board (Board) for decision in March 2022. CAISO staff believes that the Energy Imbalance Market (EIM) Governing Body has joint authority with the CAISO Governing Board (Board) over the tariff rule changes proposed in the Issue Paper and Straw Proposal.

The role of the EIM Governing Body with respect to policy initiatives changed on September 23, 2021, when the Board adopted revisions to the corporate bylaws and the Charter for EIM Governance to implement the Governance Review Committee's Part Two Proposal. Under the new rules, the Board and the EIM Governing Body have joint authority over any

proposal to change or establish any CAISO tariff rule(s) applicable to the EIM Entity balancing authority areas, EIM Entities, or other market participants within the EIM Entity balancing authority areas, in their capacity as participants in EIM. This scope excludes from joint authority, without limitation, any proposals to change or establish tariff rule(s)

applicable only to the CAISO balancing authority area or to the CAISO-controlled grid.⁵

Stakeholders are encouraged to submit a response to the EIM classification described above in their written comments, particularly if they have concerns or questions.

Next Steps

Date	Milestone
Issue Paper / Straw Proposal	January 19, 2022
Stakeholder Meeting	January 26, 2022
Comments Due	February 9, 2022
Draft Final Proposal	February 17, 2022
Comments Due	March 3, 2022
CAISO Board of Governors and EIM Governing Body meeting	March 16, 2022
FERC Filing	March 21, 2022

⁵ Charter for EIM Governance, § 2.2.1.

ATTACHMENT A

Conforming Tariff Revisions

11.8.1.1 IFM Self-Commitment Period

An IFM Self-Commitment Period for a Bid Cost Recovery Eligible Resource shall consist of one or more sets of consecutive Trading Hours during which the relevant Bid Cost Recovery Eligible Resource has either a Self-Schedule or, except for Self-Provided Ancillary Services for Non-Spinning Reserve by a ~~Short~~Fast Start Unit, has a non-zero amount of Self-Provided Ancillary Services. An IFM Self-Commitment Period for a Bid Cost Recovery Eligible Resource may not be less than the relevant Minimum Run Time (MRT), rounded up to the next hour. Consequently, if a Bid Cost Recovery Eligible Resource first self-commits in hour h of the Trading Day, the self-commitment will be extended to hour $h + \text{MRT}$. Two IFM Self-Commitment Periods for a Bid Cost Recovery Eligible Resource may not be apart by less than the relevant Minimum Down Time (MDT) (rounded up to the next hour). Consequently, if a Bid Cost Recovery Eligible Resource has submitted a Self-Schedule or Submission to Self-Provide an Ancillary Service in hours h and $h + n$, and n is less than the MDT, the IFM Self-Commitment Period will be extended to the hours in between h and $h + n$ inclusive. The number of IFM Self-Commitment Periods for a Bid Cost Recovery Eligible Resource within a Trading Day cannot exceed the relevant Maximum Daily Start-Ups (MDS), or $\text{MDS} + 1$ if the first IFM Self-Commitment Period is the continuation of an IFM or RUC Commitment Period from the previous Trading Day. Consequently, if a Bid Cost Recovery Eligible Resource has submitted a Self-Schedule or Submission to Self-Provide an Ancillary Service, such that after applying the preceding two rules, the number of disjoint Self Commitment Periods for the Operating Day exceeds the Maximum Daily Start-Ups (MDS), or $\text{MDS} + 1$ if the first IFM Self-Commitment Period is the continuation of an IFM or RUC Commitment Period from the previous Trading Day, the disjoint Self-Commitment Periods with smallest time gap in between will be joined together to bring down the number of disjoint Self Commitment Periods to MDS or $\text{MDS} + 1$ as relevant. To determine whether an extension of the IFM Self-Commitment Period applies for Multi-Stage Generating Resources, the CAISO will ensure that the respective Minimum Run Time and Minimum Down Time for both the Generating Unit and MSG Configuration levels are simultaneously respected.

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11.8.1.2 Real-Time Self-Commitment Period

A Real-Time Market Self-Commitment Period for a Bid Cost Recovery Eligible Resource shall consist of all consecutive Dispatch Intervals not in an IFM Commitment Period or a RUC Commitment Period where the Bid Cost Recovery Eligible Resource has a Self-Schedule or, except for Self-Provided Ancillary Services for Non-Spinning Reserve by a

~~ShortFast~~ Start Unit, has a non-zero amount of Self-Provided Ancillary Services. A Real-Time Market Self-Commitment Period for a Bid Cost Recovery Eligible Resource may not be less than the relevant MUT (rounded up to the next 15-minute Commitment Interval) when considered jointly with any adjacent IFM Self-Commitment Period. For example, if a Bid Cost Recovery Eligible Resource self-commits at time h , the self-commitment will be extended to Commitment Interval $h + MUT$, unless an IFM or RUC Commitment Period exists starting after hour h , in which case the self-commitment will be extended to Commitment Interval $h + \min(MUT, t)$, where t represents the time interval between the Real-Time Market Self-Commitment Period and the IFM or RUC Commitment Period. A Real-Time Market Self-Commitment Period for a Bid Cost Recovery Eligible Resource may not be apart from an IFM or RUC Commitment Period by less than the relevant MDT (rounded up to the next 15-minute Commitment Interval). For example, if a Bid Cost Recovery Eligible Resource self-commits at time $T1$ and has a RUC Schedule at time $T2 < T1$, the Real-Time Market Self-Commitment Period will be extended to the interim Commitment Intervals if $T1 - T2 < MDT$. The number of Real-Time Market Self-Commitment Periods for a Bid Cost Recovery Eligible Resource within a Trading Day, when considered jointly with any adjacent IFM Self-Commitment Period, may not exceed the relevant MDS (or $MDS + 1$ if the first Real-Time Market Self-Commitment Period is the continuation of a Real-Time Market Commitment Period from the previous Trading Day). For example, if a Bid Cost Recovery Eligible Resource self-commits at time $T1$ and has a RUC Schedule at time $T2 > T1$, the Real-Time Market Self-Commitment Period will be extended to the interim Commitment Intervals if an additional Real-Time Market Start-Up at $T1$ would violate the MDS constraint. To determine whether an extension of the RTM Self-Commitment Period applies for Multi-Stage Generating Resources, the CAISO will ensure that the respective Minimum Run Time and Minimum Down Time for both the Generating Unit and MSG Configuration levels are simultaneously respected.

* * * * *

30.5.2.7 Ancillary Service Bids

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

addition to the common elements listed in Section 30.5.2.1, all Ancillary Services Bid components of a Supply Bid must contain the following: (1) the type of Ancillary Service for which a Bid is being submitted (2) Ramp Rate (Operating Reserve Ramp Rate and Regulation Ramp Rate, if applicable); and (3) Distribution Curve for Physical Scheduling Plant or System Unit. A Scheduling Coordinator may only submit an Ancillary Services Bid or Submission to Self-Provide an Ancillary Service for Multi-Stage Generating Resources for the Ancillary Service for which the specific MSG Configurations are certified. For any such certified MSG Configurations the Scheduling Coordinator may submit only one Operating Reserve Ramp Rate and Regulation Ramp Rate. An Ancillary Services Bid submitted to the Day-Ahead Market when submitted to the Day-Ahead Market may be, but is not required to be, accompanied by an Energy Bid that covers the capacity offered for the Ancillary Service. Submissions to Self-Provide an Ancillary Services submitted to the Day-Ahead Market when submitted to the Day-Ahead Market may be, but are not required to be, accompanied by an Energy Bid that covers the capacity to be self-provided. If a Scheduling Coordinator's Submission to Self-Provide an Ancillary Service is qualified as specified in Section 8.6, the Scheduling Coordinator must submit an Energy Bid that covers the self-provided capacity prior to the close of the Real-Time Market for the day immediately following the Day-Ahead Market in which the Ancillary Service Bid was submitted. Except as provided below, the Self-Schedule for Energy need not include a Self-Schedule for Energy from the resource that will be self-providing the Ancillary Service. If a Scheduling Coordinator is self-providing an Ancillary Service from a ~~ShortFast~~ Start Unit, no Self-Schedule for Energy for that resource is required. If a Scheduling Coordinator proposes to self-provide Spinning Reserve, the Scheduling Coordinator is obligated to submit a Self-Schedule for Energy for that particular resource, unless as discussed above the particular resource is a ~~ShortFast~~ Start Unit. When submitting Ancillary Service Bids in the Real-Time Market, Scheduling Coordinators for resources that either have been awarded or self-provide Spinning Reserve or Non-Spinning Reserve capacity in the Day-Ahead Market must submit an Energy Bid for at least the awarded or self-provided Spinning Reserve or Non-Spinning Reserve capacity, otherwise the CAISO will apply the Bid validation rules described in Section 30.7.6.1.

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

34.3.1 RTUC Optimization

The Real-Time Unit Commitment (RTUC) process uses SCUC and is run every fifteen (15) minutes to make commitment decisions for ~~Fast Start and~~ Short Start Units having Start-Up Times ~~within the applicable time periods described below in this section~~ for the next four to seven subsequent fifteen-minute intervals, depending on when during the hour the run occurs. For Multi-Stage Generating Resources the RTUC will issue a binding Transition Instruction separately from the binding Start-Up or Shut Down instructions. The RTUC can also be run with the Contingency Flag activated, in which case the RTUC can commit Contingency Only Operating Reserves. If RTUC is run without the Contingency Flag activated, it cannot commit Contingency Only Operating Reserves. RTUC is run at the following time intervals: (1) at approximately 7.5 minutes prior to the first Trading Hour, to serve as the HASP run, for T-45 minutes to T+60 minutes; (2) at approximately 7.5 minutes into the current hour for T-30 minutes to T+60 minutes; (3) at approximately 22.5 minutes into the current hour for T-15 minutes to T+60 minutes; and (4) at approximately 37.5 minutes into the current hour for T to T+60 minutes, where T is the beginning of the next Trading Hour. The HASP is a special RTUC run that is performed at approximately 67.5 minutes before each Trading Hour and has the additional responsibility of pre-dispatching Energy and awarding Ancillary Services for HASP Block Intertie Schedules. A Day-Ahead Schedule or RUC Schedule for an MSG Configuration that is later impacted by the resource's derate or outages, will be reconsidered in the RTUC and the FMM taking into consideration the impacts of the derate or outage on the available MSG Configurations. Not all resources identified as needed in a given RTUC run will necessarily receive CAISO commitment instructions immediately, because during the Trading Day the CAISO may issue a commitment instruction to a resource only at the latest possible time that allows the resource to be ready to provide Energy when it is expected to be needed.

34.3.2 Commitment Of ~~Fast Start And~~ Short Start Units

RTUC produces binding and advisory Start-Up and Shut-Down Dispatch Instructions for ~~Fast Start and~~ Short Start Units that have Start-Up Times that ~~can~~ would allow the resource to be committed prior to the end of the relevant time period of the RTUC run as described in Section 34.3.1. A Start-Up Dispatch Instruction is considered binding in any given RTUC run if ~~the Start-Up time of the resource is such that~~ there would not be sufficient time for a subsequent RTUC run to Start-Up the resource. A Start-Up Instruction is considered advisory if it is not binding, such that the resource could achieve its target Start-Up Time as determined in the current RTUC run in a subsequent RTUC run based on its Start-Up Time. A Shut-Down Instruction is considered binding if the resource could achieve the target Shut-Down Time as determined in the current RTUC run in a subsequent RTUC run. A Shut-Down Dispatch Instruction is considered advisory if the resource Shut-Down Instruction is not binding such that the resource could achieve its target Shut-Down time as determined in the current RTUC run in a

subsequent RTUC run. A binding Dispatch Instruction that results in a change in Commitment Status will be issued, in accordance with Section 6.3, after review and acceptance of the Start-Up Instruction by the CAISO Operator. An advisory Dispatch Instruction changing the Commitment Status of a resource may be modified by the CAISO Operator to a binding Dispatch Instruction and communicated in accordance with Section 6.3 after review and acceptance by the CAISO Operator. Only binding and not advisory Dispatch Instructions will be issued by the CAISO. For Multi-Stage Generating Resources the CAISO will also issue binding Transition Instructions when the Multi-Stage Generating Resource must change from one MSG Configuration to another. A Transition Instruction is considered binding in any given RTUC run if the Transition Time for the Multi-Stage Generating Resource is such that there would not be sufficient time for a subsequent RTUC run to transition the resource.

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34.6 Short-Term Unit Commitment

Once per hour, near the top of each Trading Hour, immediately after the FMM and the RTUC for the same interval is completed the CAISO performs ~~an approximately five (5) hour~~ Short-Term Unit Commitment (STUC) run using SCUC and the CAISO Forecast of CAISO Demand over a 270-minute time horizon to commit ~~Medium Start Units and~~ Short Start Units, with Start-Up Times greater than the time period covered by the RTUC described in Section 34.3. In any given Trading Hour, the STUC may commit resources for the third fifteen-minute interval of the current Trading Hour and extending into the next four (4) Trading Hours. The STUC looks ahead over a period of at least three (3) hours beyond the Trading Hour for which the RTUC optimization was run. STUC will utilize: (1) Bids previously submitted in the RTM by the Scheduling Coordinator for that Trading Hour; or (2) the Clean Bid from the Day-Ahead Market if the resource has a Day-Ahead Schedule or received a Start-Up Instruction in RUC for the Trading Hour; or (3) the Generated Bid if the resource has a Real-Time must-offer obligation for that Trading Hour and has not submitted a Bid in the RTM. The CAISO revises these replicated Bids each time the hourly STUC is run, to utilize the most recently available Bids. Not all resources identified for need as a given STUC run will necessarily receive CAISO commitment instructions immediately, because during the Trading Day the CAISO may issue a commitment instruction to a resource only at the latest possible time that allows the resource to be ready to provide Energy when it is expected to be needed. A Start-Up Instruction produced by STUC is considered binding if the resource could not achieve the target Start-Up Time as determined in the current STUC run in a subsequent RTUC or STUC run as a result of the Start-Up Time of the resource. A Start-Up Instruction produced by STUC is considered advisory if it is not binding, such that the resource could achieve its target start time as determined in the current RTUC run in a subsequent STUC or RTUC run based on its Start-Up Time. A binding Dispatch Instruction produced by STUC that results in a change in Commitment Status will be issued, in accordance with Section 6.3, after review and acceptance of the Start-Up Instruction by the CAISO

Operator. The STUC ~~may, but is not required to, will only~~ decommit a ~~resource to the extent that resource's physical characteristics allow it to be cycled~~ in the same ~~approximately 270-minute five (5) hour~~ look-ahead time period for which it was previously committed. STUC does not produce Locational Marginal Prices for Settlement. A Day-Ahead Schedule or RUC Schedule for an MSG Configuration that is later impacted by the resource's derate or outages, will be reconsidered in the STUC process taking into consideration the impacts of the derate or outage on the available MSG Configurations.

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40.6.2 Real-Time Availability

- (a) **General Requirement.** Resource Adequacy Resources that have received an IFM Schedule for Energy or Ancillary Services or a RUC Schedule for all or part of their Resource Adequacy Capacity must remain available to the CAISO through Real-Time for Trading Hours for which they receive an IFM or RUC Schedule, including any Resource Adequacy Capacity of such resources that is not included in an IFM Schedule or RUC Schedule, except for Resource Adequacy Capacity that is subject to Section 40.6.4.
- (b) **Short Start Units ~~or Medium Start Units~~.** Short Start Units ~~or Medium Start Units~~ that are Resource Adequacy Resources that do not have an IFM Schedule or a RUC Schedule for any of their Resource Adequacy Capacity for a given Trading Hour must be available to the CAISO through Real-Time. Resource Adequacy Resources with Resource Adequacy Capacity that is required to be available to the CAISO through Real-Time and does not have an IFM Schedule or a RUC Schedule for a given Trading Hour must submit to the RTM for that Trading hour: (a) Energy Bids and Self-Schedules for the full amount of the available Resource Adequacy Capacity, including capacity for which it has submitted Ancillary Services Bids or Submissions to Self-Provide Ancillary Services; and (b) Ancillary Services Bids and Submissions to Self-Provide Ancillary Services for the full amount of the available Ancillary Service-certified Resource Adequacy Capacity and for each Ancillary Service for which the resource is certified, including capacity for which it has submitted Energy Bids and Self-Schedules. The CAISO may waive these availability obligations for a resource that is not a Long Start Unit or an Extremely Long-Start Resource that does not have an IFM Schedule or a RUC Schedule based on a procedure to be published on the CAISO Website. The CAISO will insert Generated Bids in accordance with Section 40.6.8 for any Resource Adequacy Capacity subject to the above requirements for which the resource has failed to submit the appropriate bids to the RTM.
- (c) **Long Start Units.** Long Start Units not committed in the Day-Ahead Market will be released from any further obligation to submit Self-

Schedules or Bids for the relevant Operating Day. Scheduling Coordinators for Long Start Units are not precluded from self-committing the unit after the Day-Ahead Market and submitting a Self-Schedule or Wheeling-Out in the RTM, unless precluded by terms of their contracts.

- (d) **Extremely Long-Start Resources.** Once an Extremely Long-Start Resource providing Resource Adequacy Capacity is committed by the CAISO, it shall comply, for the Trading Days for it was committed, with the Real-Time availability provisions in sub-sections (a) and (b) of this Section 40.6.2, including those provisions that otherwise apply only to Short Start Units ~~or Medium-Start Units.~~
- (e) **Self-Schedules.** The CAISO will honor submitted Energy Self-Schedules of Resource Adequacy Capacity unless the CAISO is unable to satisfy one hundred (100) percent of its Ancillary Services requirements. In such cases, the CAISO may curtail all or a portion of a submitted Energy Self-Schedule to allow Ancillary Service-certified Resource Adequacy Capacity to be used to meet the Ancillary Service requirements, as long as such curtailment does not lead to a real-time shortfall in energy supply. If the CAISO reduces a submitted Real-Time Energy Self-Schedule for Resource Adequacy Capacity when that capacity is needed to meet an Ancillary Services requirement, the Ancillary Service Marginal Price for that capacity will be calculated in accordance with Sections 27.1.2 and 40.6.1.
- (f) **Distributed Generation Facilities.** Distributed Generation Facilities shall comply with the RTM bidding requirements that apply to the same technology type of resource connected to the CAISO Controlled Grid.
- (g) **Non-Generator Resources**
 - (1) Non-Generator Resources that do not use Regulation Energy Management shall submit –
 - (A) Economic Bids or Self-Schedules into the RTM for any remaining RA Capacity scheduled in the IFM or RUC; and
 - (B) Economic Bids or Self-Schedules into the RTM for all RA Capacity not scheduled in the IFM.
 - (2) Non-Generator Resources using Regulation Energy Management that are not Use-Limited Resources under Section 40.4.6.1 shall submit Economic Bids or Self-Schedules into the RTM for any remaining RA Capacity from resource scheduled in IFM or RUC.

40.6.4.4 Proxy Demand Resources

- (a) Short Start ~~and Medium-Start~~ Proxy Demand Resources that provide Resource Adequacy Capacity shall submit \$0/MW RUC Availability Bids

for all of their Resource Adequacy Capacity for all hours of the month the resource is physically available; however, any RUC schedule for these resources will not be binding.

- (b) Long Start Proxy Demand Resources are not required to submit Bids or Self Schedules in the RUC for their Resource Adequacy Capacity.

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40.10.6 Flexible RA Capacity Must-Offer Obligation

40.10.6.1 Day-Ahead and Real-Time Availability

- (a) **Must-Offer Obligation.** The Scheduling Coordinator for a resource supplying Flexible RA Capacity must submit Economic Bids for Energy for the full amount of the resource's Flexible RA Capacity, and Economic Bids for Ancillary Services that are not flagged as Contingency Only in the Day-Ahead Market for the full amount of the resource's Flexible RA Capacity that is certified to provide Ancillary Services, in the Day-Ahead Market and the Real-Time Market for the applicable Trading Hours that is capable of being economically dispatched as follows, except as provided in Section 40.10.6.1(e) through (h) –
 - (1) Flexible Capacity Category for base ramping resources - the 17-hour period from 5:00 a.m. to 10:00 p.m., seven days a week;
 - (2) Flexible Capacity Category for peak ramping resources - the five-hour period determined for each season by the CAISO's Flexible Capacity Needs Assessment, seven days a week; and
 - (3) Flexible Capacity Category for super-peak ramping resources – the five-hour period determined for each season by the CAISO's Flexible Capacity Needs Assessment, weekdays, except holidays and as provided in Section 40.10.6.1(h), until the resource receives during the five-hour period of the must offer obligation and responds to five CAISO dispatches for Start-Up during the month, after which the resource will not be subject to a must-offer obligation as a super-peak ramping resource for the remainder of that month; however, any other must-offer obligations for Resource Adequacy Capacity will still apply.
- (b) **Availability Requirement.** During the period of the applicable must-offer obligation, a Flexible RA Capacity Resource must be operationally available except for limitations specified in the Master File, legal or regulatory prohibitions or as otherwise required by this CAISO Tariff or by Good Utility Practice.

- (c) **Co-optimization.** Through the IFM co-optimization process, the CAISO will utilize available Flexible RA Capacity to provide Energy or Ancillary Services in the most efficient manner to clear the Energy market, manage congestion and procure required Ancillary Services.
- (d) **Participation in RUC.** A Flexible RA Capacity Resource must participate in the RUC to the extent that the resource has available Flexible RA Capacity that is not reflected in an IFM Schedule. Resource Adequacy Capacity participating in RUC will be optimized using a zero dollar (\$0/MW-hour) RUC Availability Bid. Flexible RA Capacity selected in RUC will not be eligible to receive a RUC Availability Payment.
- (e) **Use-Limited Resources.**
 - (1) A Use-Limited Resource providing Flexible RA Capacity must be capable of responding to Dispatch Instructions and, consistent with its use-limitations, must submit Economic Bids for Energy for the full amount of its Flexible RA Capacity in the Day-Ahead Market and the Real-Time Market for the Trading Hours applicable to the resource's Flexible Capacity Category for that month for the Trading Hours that it is capable of being economically dispatched.
 - (2) The Scheduling Coordinator for the Use-Limited Resources designated as a combined resource under Section 40.10.3.2(b), 40.10.3.3(b) or 40.10.3.4(b) must submit Economic Bids for Energy for either resource for the full amount of the Flexible RA Capacity required by the applicable must-offer obligation; however, Economic Bids for Energy must be submitted for only one resource in the combination per Trade Day.
- (f) **Short, ~~Medium~~ or Long Start Units.**
 - (1) Short Start Units ~~or Medium Start Units~~ providing Flexible RA Capacity that do not have an IFM Schedule or a RUC Schedule for any of their Resource Adequacy Capacity for a given Trading Hour are required to participate in the Real-Time Market consistent with the provisions in Section 40.6.2 that apply to Short Start Units providing RA Capacity.
 - (2) Long Start Units providing Flexible RA Capacity that do not have an IFM Schedule or a RUC Schedule for any of their Resource Adequacy Capacity for a given Trading Hour are required to participate in the Real-Time Market consistent with the provisions in Section 40.6.2 that apply to Long Start Units providing RA Capacity.

- (3) If availability is required under Section 40.6.2, the Scheduling Coordinator for the resource must submit to the RTM for that Trading hour for which the resource is capable of responding to Dispatch Instructions: (i) Economic Bids for Energy for the full amount of the available Flexible RA Capacity, including capacity for which it has submitted Economic Bids for Ancillary Services; and (ii) Economic Bids for Ancillary Services for the full amount of its Flexible RA Capacity that is certified to provide Ancillary Services and that did not receive a day-ahead award, and for each Ancillary Service for which the resource is certified, including capacity for which it has submitted Economic Bids for Energy.
- (g) **Extremely Long-Start Resources.** Flexible RA Capacity Resources that are Extremely Long-Start Resources must be available to the CAISO by complying with the Extremely Long-Start Commitment Process under Section 31.7 or otherwise committing the resource upon instruction from the CAISO, if physically capable. Once an Extremely Long-Start Resource is committed by the CAISO, it is subject to the provisions of Section 40.10.6 regarding Day-Ahead Availability and Real-Time Availability for the Trading Days for which it was committed.
- (h) **Non-Generator Resources, Regulation Energy Management.** Non-Generator Resources providing Flexible RA Capacity and Regulation Energy Management must submit Economic Bids for Regulation Up and Regulation Down for Trading Hours in the 17-hour period from 5:00 a.m. to 10:00 p.m., seven days a week and shall not submit Bids for Energy or other Ancillary Services.

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Appendix A

Master Definitions Supplement

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~~–Fast Start Unit~~

~~A Generating Unit that has a Start-Up Time less than two hours and can be committed in the FMM and STUC.~~

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- Long Start Unit

A Generating Unit that has a cycle time of more than 255 minutes (Start-Up Time plus Minimum Run Time is more than 255 minutes) and requires ~~between five and~~ up to 18 hours to Start-Up and synchronize to the grid.

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~~-Medium Start Unit~~

~~A Generating Unit that requires between two and five hours to Start-Up and synchronize to the grid.~~

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- Real-Time Unit Commitment (RTUC)

An application of the RTM that runs every 15 minutes and commits Short~~Fast~~ Start Units ~~and Medium Start Units~~ using the SCUC to adjust from Day-Ahead Schedules, EIM Base Schedules, and HASP Advisory Schedules.

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- Self-Commitment Period

The portion of a Commitment Period of a unit with an Energy Self-Schedule or a Submission to Self-Provide an Ancillary Service, except for Non-Spinning Reserve self-provision ~~by a Fast Start Unit~~. The Self-Commitment Period may include Time Periods without Energy Self-Schedules or AS self-provision if it is determined by inference that the unit must be on due to Minimum Run Time, Minimum Down Time, or Maximum Daily Start-Up constraints.

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- Short Start Unit

A Generating Unit that has a cycle time less than or equal to 255 minutes~~five hours~~ (Start-Up Time plus Minimum Run Time is less than or equal to 255 minutes~~five hours~~), ~~has a Start-Up Time less than two hours~~, and can be fully optimized with respect to this cycle time.

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- Short-Term Unit Commitment (STUC)

The Unit Commitment procedure run at approximately 52.5 minutes prior to the applicable Trading Hour to determine whether certain Short~~Medium~~ Start Units need to be started early to meet the Demand within the STUC forward-looking time period as described in Section 34.4 using the CAISO Forecast of CAISO Demand. The STUC

produces a Unit Commitment solution for every 15-minute interval within the STUC forward-looking time periods and issues binding Start-Up Instructions only as necessary.