California Independent
System Operator Corporation

May 27, 2010

DELIVERED BY FEDEX

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

Re: California Independent System Operator Corporation
Docket No. ER10-____- 000

Amendments to California ISO FERC Electric Tariff to Include Multi-Stage Generating Resource Modeling

Dear Secretary Bose:

Pursuant to Section 205 of the Federal Power Act (FPA),[1] 16 U.S.C. § 824d, and Section 35.13 of the regulations of the Federal Energy Regulatory Commission (FERC or the Commission), 18 C.F.R. § 35.13 (2009), the California Independent System Operator Corporation (ISO) respectfully submits for filing an original and five copies of an amendment to the ISO's FERC Electric Tariff. As directed in prior Commission orders, the ISO is filing this amendment to incorporate new ways for certain resources, like combined cycle generation resources, to participate in the ISO markets.

One extra copy of this filing is also enclosed. Please stamp these copies with the date and time filed and return them to the messenger.

I. EXECUTIVE SUMMARY

When the ISO's new market system went live on April 1, 2009, it included a range of design elements that have improved the ISO's market and system operations significantly. One important design element missing from the new market has been the ability to accurately model the unique operational and

1 Capitalized terms not otherwise defined herein have the meanings set forth in the Master Definitions Supplement, Appendix A to the ISO Tariff, and the proposed amendments to Appendix A as provided in Attachments A & B of this transmittal letter.

economic parameters of combined cycle generating units and other resources that have multiple operating or regulating ranges that limit the resource to operate in only one of those ranges at any particular point in time. Such a modeling concept can be referred to generally as a multi-stage modeling approach. Through the instant filing, the ISO proposes new market rules that support the implementation of a multi-stage modeling approach for generators. The ISO is proposing these new market rules in response to Commission directives issued prior to the start of the new market design in April of 2009. The specific proposal is the result of an extensive collaborative process with the ISO and its stakeholders.

As previously noted by the Commission, the lack of a functionality in the current market design to model combined cycle units and other units with multiple operating modes results in infeasible schedules and dispatches that result in the inefficient use of resources with such characteristics. This proposal will reduce the current use of exceptional dispatch by the ISO to prevent infeasible dispatches. This proposal will also enable Scheduling Coordinators to reduce the use of the ISO's outage reporting procedures to manage the operation of the multiple operating modes of such resources. These combined improvements will result in the more efficient and economic use of such resources in the ISO markets.

The core of the ISO's proposal involves modeling the distinct operating modes, or configurations, of generating units with multiple configurations as if each configuration were a distinct unit. This will enable Scheduling Coordinators to offer a unit's multiple configurations into the ISO markets and for the markets to consider each of these configurations in its optimization process. The optimization will be designed to only dispatch one configuration at a time and to consider and honor the resource's complete set of operating constraints. The proposed multi-stage modeling approach will apply to resources that register and qualify with the ISO as Multi-Stage Generating Resources. With additional market rules and software development, the modeling approach underlying the Multi-Stage Generating Resource functionality may be extended in the future to other types of resources, such as pumped storage hydro and other storage facilities.

The proposal requires Scheduling Coordinators intending to participate as Multi-Stage Generating Resources to submit detailed information regarding the operating characteristics of available configurations and the feasible transitions between the various configurations. Scheduling Coordinators will be compensated for their submitted transition costs if committed and transitioned from one configuration to another, similar to how the ISO currently compensates resources for their start-up and minimum load costs. Pursuant to their detailed registered resource data, Multi-Stage Generating Resources will be able to participate in the ISO markets to provide energy, residual unit commitment capacity, and ancillary services. The ISO proposes to modify its bid validation rules to ensure that Scheduling Coordinators submit bid sets that contain feasible transitions. Scheduling Coordinators will be permitted to submit up to ten registered configurations in the day-ahead market and three, four, or five configurations in the real-time market, depending on how many configurations were committed by the ISO in the day-ahead market.

The Multi-Stage Generating Resource functionality is scheduled to go live for the trading day of October 1, 2010. In preparation for a smooth transition to market operations with this new modeling approach, the ISO is requesting authority to implement early registration rules well in advance of that date. Such early registration will give the ISO the time necessary to ensure that all resources that wish to participate at go live and that successfully register and qualify as Multi-Stage Generating Resources will be able to utilize the functionality successfully.

II. BACKGROUND

Since April 1, 2009, the ISO has successfully operated its energy and ancillary services markets under its new locational marginal pricing-based market design. As anticipated, this new market design has provided the ISO with a more effective congestion management system, a robust day-ahead market for trading and scheduling energy, system improvements to increase operational efficiency and enhance reliability, a more transparent pricing system, improved market power mitigation measures, greater opportunities for participation of demand resources, and a process that respects the resource adequacy requirements established by the California Public Utilities Commission and Local Regulatory Authorities.

Absent from this list of attributes is the ability for the ISO to model resources with multiple operating modes in its market software and procedures. Multiple operating modes can be due to forbidden operating regions or to other characteristics of a resource that naturally segment its operating ranges. This results in ranges between the overall minimum and maximum operating levels of the resource through which the resource cannot operate and must be transitioned. Often these prohibited operating regions result from the fact that the resource, or plant, is comprised of multiple generating units. When such a resource places a constituent generator or additional auxiliary equipment, such as a feed water pump, on-line or takes it off-line the resource moves to a higher or lower operating range. Each distinct operating range is referred to as a configuration. The maximum output of one configuration often is below the minimum output of the next-highest configuration. Consequently, while the resource can feasibly produce energy over a range of operating capacity as a totality, there are output ranges within which the resource cannot be dispatched.[2] Examples of such resources are combined-cycle units which are comprised of multiple generation resources, large thermal generators that require the operation of auxiliary equipment (*e.g.*, feed water pumps or additional boilers), and certain types of hydro-electric generation plants. Under the ISO proposal as discussed more fully in this transmittal letter and accompanying testimony, such resources would be modeled more optimally using the Multi-Stage Generating Resource functionality.

Prior to the start of the new market design, the ISO modeled combined-cycle units as a composite resource across various sequential combined-cycle configurations. This was because the modeling technology the ISO had access to prior to the start of the ISO's new market only allowed for the consideration of one generator and could not fully consider the different operating constraints of the other generators that are in operation behind the single meter. This treatment of such resources had several drawbacks. Based on the then-existing optimization algorithms and techniques, the ISO required that resources submit a continuously increasing incremental heat rate because costs were required to be continuous and monotonically increasing. Consequently, resource owners are required to submit monotonically non-decreasing incremental bid cost curves.[3] The monotonically non-decreasing cost curve beyond minimum load is necessary to ensure a well-behaved economic dispatch solution such that as the load increases, the dispatch of resources continues to moves in an upward direction with increasing costs, as compared to an undesirable dispatch outcome that results in resources being dispatched down as the load increases. Consequently, resource owners were required to submit incremental bid cost curves for the plant as a whole, rather than for the individual configurations and thus that bid cost information is not accurate for any individual configuration though it is accurate at the resource level. However, using the composite (*i.e.*, resource-level) bid cost rather than the specific heat rate for the configuration that is implicitly being committed or dispatched has the potential to result in suboptimal commitments or dispatches of resources. Another drawback from treating combined-cycle units as a composite resource is that composite resources have two or more generators, with different operating characteristics, located behind one meter. These limitations are problematic because they can result in inaccurate settlements for start-up and minimum load costs that pertain to the individual configurations of the resource.

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2 To some extent, these problems are addressed through the forbidden operating region functionality. However, for reasons explained below and in Ms. Biedler's testimony (Exhibit No. ISO-1), the forbidden region functionality represents an incomplete solution to these problems.

3 Typically a resource would submit an incremental bid cost curve. However, the ISO uses incremental heat rate data that it has on file for generating default or proxy energy bids in cases where a resource is obligated to bid but does not.

The ISO explored changes to this modeling approach prior to filing its tariff in support of its new market design that would allow combined-cycle units to be modeled as a separate generation resource for each configuration. Unfortunately, due to the complexities associated with modeling such resources, the ISO was not able to successfully adopt an adequate modeling approach. The ISO's ability to develop and adopt an enhanced modeling functionality quickly was further limited by the fact that at the time none of the other independent system operator or regional transmission organizations (ISO/RTOs) had software in place that allowed them to model each configuration as a separate generating unit.

Consequently, rather than rushing an untried software revision into development for the start of the new market, the ISO proposed to continue modeling resources with multiple operating modes as composite resources with a single resource identification number registered for the composite resource. In addition, resources with these prohibited operating ranges have been able to register and incorporate into their bids intermediate dead bands (or forbidden operating regions) and complicated multiple ramp rates across the operational range of a resource for a single given configuration of the combined cycle facility. In addition, market participants can modify the operational ramp rates for combined-cycle facilities to reflect changes in operating configurations during the operating day.

The Commission authorized the ISO to commence operations with the first release of its new market design without inclusion of the enhanced capability, but found that more comprehensive modeling software was necessary to accurately reflect the operating characteristics of combined-cycle units.[4] The Commission recognized that significant market benefits can be realized by developing models that accurately consider the ramp rates, and start-up and minimum load costs of the different generators that make up these composite resources. The Commission further found that the ISO's hesitation to rush into the implementation of an untested model was prudent and acceptable. However, the Commission directed the ISO to continue working with software vendors to develop an application that would accurately detail the constraints of combined cycle units and to file tariff language for implementation of such improvements no later than Release 2 of its new market.[5]

The ISO's need to consider implementing the multi-stage generating resource functionality was heightened by the ISO's need to defer the forbidden operating region functionality for the real-time market prior to the start of the

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4 *Cal. Indep. Sys. Operator Corp.*, 116 FERC ¶ 61,274, P 573 (2006) [hereinafter *September 21 MRTU Order*].

5 *Id.* at P 33 (noting the ISO's commitment to launch Release 2 within three years of implementing Release 1).

ISO's new market on April 1, 2009. As originally filed, the ISO tariff containing the new market provisions provided that the real-time market software would not dispatch a generating unit within its forbidden operating region, except for ramping through the forbidden operating region. This software feature was included in the new market design to ensure that a generation resource would not be dispatched up or down by the ISO within an operating range prior to transiting all the way through the forbidden operating region. However, during the market simulations taking place prior to the start of operations under the new market design the ISO concluded that the inclusion of this software feature in the real-time market was causing performance and stability issues. The performance issues were caused by the optimization software in the real-time market sometimes creating infeasible optimization solutions due to the interaction of the forbidden operating region information provided by operators of generating units with additional constraints inherited by the real-time market (such as ancillary service awards in the day-ahead market, initial conditions produced by the day-ahead market results, etc.). As a result, the ISO proposed to defer the implementation of this software feature, or an alternative feature that would accomplish the same intended policy, in the real-time market until a later date.[6]

The Commission accepted the deferral of the real-time forbidden operating region functionality recognizing that operation of this feature during market simulations resulted in infeasible schedules. The Commission also recognized that one potential solution was to implement multi-stage modeling of forbidden operating regions, which even prior to go live was something the ISO already had begun developing.[7] Therefore, in accepting the ISO's deferral of the real-time forbidden operating region functionality, the Commission also accepted the ISO's commitment to develop the multi-stage modeling functionality within six to nine months following the start of its new market design. The Commission strongly encouraged the ISO to work to meet that target, because the Commission recognized that the adoption of multi-stage modeling would enable the ISO to reduce its use of exceptional dispatch.

At the time the ISO requested deferral of the real-time forbidden operating region functionality, the ISO had already commenced its stakeholder process to develop multi-stage generating modeling. The ISO had anticipated that the multi-stage modeling functionality would be ready for implementation approximately six to nine months after the start of its new market design. In the months following go live, the ISO worked with its vendor and stakeholders to develop and implement multi-stage generating resource modeling. However, in the latter part of 2009, the ISO began experiencing project schedule challenges with multi-stage generating unit modeling that resulted from the significant and complex changes to the market optimization software, as well as related downstream

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6 *See Cal. Indep. Sys. Operator Corp.*, 126 FERC ¶ 61,081 (2009) [hereinafter *Deferral Order*].

7 *Id.* at PP 29-30.

process modifications, that multi-stage generating unit modeling required. As a result, the ISO determined that the planned April 1, 2010, implementation date could not be met.

The ISO's day-ahead and real-time market software is designed to account for the registered forbidden operating regions constraints so that multi-stage generating units are not unfeasibly scheduled or dispatched.[8] It is important to note, however, that while the enforcement of the forbidden operating region constraints keeps units from being dispatched at infeasible output levels, it does not economically optimize the dispatch of such Multi-Stage Generating Resources. In other words, while the current functionality can avoid dispatching a unit between the registered ranges for specific units, it is not capable of ensuring that these resources are optimally committed and dispatched to respect their costs, the various operating configurations, and other resources available to the market. The forbidden operating region functionality further does not enforce constraints such as minimum hold times after transiting through a forbidden operating region. Lastly, the forbidden operating region does not address a resource's ability to provide or not provide ancillary services in a specific configuration. The Multi-Stage Generating Resource functionality will allow the responsible Scheduling Coordinator to better reflect the ranges of ancillary service that can be provided.

Recognizing the delay in the implementation of the multi-stage modeling approach, the ISO pursued the possibility of implementing the deferred forbidden operating region functionality prior to the implementation of the multi-stage generating resource functionality. While the ISO expedited the design and implementation of the multi-stage generating resource modeling, it determined it was still necessary to include the real-time forbidden operating region functionality even with the adoption of multi-stage generating resource functionality. The ISO had determined that there are resources within its fleet for which the forbidden operating region modeling approach better captures their operating constraints. Specifically, units with operating ranges through which they can ramp up or down, but in which they cannot be dispatched.[9] As discussed in Mr. Zhou's testimony, there is a tradeoff between administrative complexity and the benefit of Multi-Stage Generating Resources modeling for a particular unit.[10] In other words, some units do not benefit from Multi-Stage

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8 At the start of the ISO market, due to performance issues observed during market simulation, the ISO was forced to defer the implementation of the full scope of this forbidden operating region functionality. The real-time component that enabled the ISO to avoid dispatching such resources within their forbidden operating regions was not performing optimally. *See Deferral Order*. However, since April 15, 2010, the ISO has operated with this functionality in place.

9 CAL. INDEP. SYS. OPERATOR CORP., MODELING OF MULTI-STAGE GENERATING UNITS at p. 3, (2009), *available at* http://www.caiso.com/23a8/23a8e0d123ea0.pdf. (draft final proposal prepared for decision by the CAISO Board of Governors Meeting – May 18-19, 2009).

10 *See* Exhibit No. ISO-2 at 8-9.

Generating modeling sufficiently to justify the administrative expenses of participating as a Multi-Stage Generating Resource.

The ISO sought Commission-approval to introduce the previously deferred real-time forbidden operating region functionality. The Commission approved the ISO's application and due, in part, to the general performance improvements in the ISO real-time market and, in larger part, to software enhancements developed as part of its efforts to develop the Multi-Stage Generating Resource functionality, the ISO was able to implement the forbidden operating functionality on April 15, 2010.[11]

The ISO's inability to model these resource constraints more effectively means that the ISO's optimization software cannot take advantage of the inherent flexibility of resources that can function in multiple operating modes. The result is suboptimal dispatch. The inclusion of a functionality to model these constraints creates an opportunity to lower system energy costs by more accurately modeling their flexibility. Another consequence of the inability to model these resource constraints is that operators of such resources limit the flexibility they offer into the market in order to protect against uneconomic or infeasible dispatches. Specifically, operators of such resources face difficulties in protecting infeasible operating ranges. This risk of such uneconomic or infeasible dispatches are increased by the current limitations on ramp rates and at the start of the new market design the suspended functionality of forbidden operating regions in the real-time market. The adoption of the real-time forbidden operating region functionality has ameliorated these constraints somewhat, but such resources are at times still forced to avoid dispatches that are infeasible through the use of the ISO outage reporting tools or will be required to deviate from such dispatches or only offer into the market their preferred configurations. Once in the preferred and stable operating configuration, the owner of a multi-stage generating unit will need to manually adjust the unit's dispatch range (via unit de-rates, for example) in order to eliminate the possibility that the ISO would dispatch the unit between configurations. This poses an operational burden in that more operator management of the resource is required.

The adoption of the forbidden operating region functionality, while beneficial, is insufficient, by itself, to eliminate these inefficiencies because it does not allow the ISO to model such resources to enable the market software tools to recognize and adequately consider the costs and physical limitations involved with transitioning from one operating mode to another. The forbidden operating region functionality will ensure that the market software will dispatch

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11 FERC Doc. No. ER10-775-000, (2010), *available at* http://www.caiso.com/2772/2772c73d392c0.pdf. (letter order accepting amendment to the ISO's FERC tariff to reinstitute the forbidden operating region functionality in the real-time market).

resources through these regions, but it cannot accomplish the more sophisticated task of considering in the optimal dispatch the multiple possible operating modes. For example, it does not model the different minimum run time requirements on different operating ranges that these resources have due to manufacturers' warranty and/or environmental control requirements. Consequently, scheduling coordinators for multi-stage generation resources continue to have to make use of the ISO's outage reporting process to ensure that the dispatch of such resources respects the constraints posed in having to transition from one configuration to another. The ISO also has to rely on the exceptional dispatch mechanism to hold the resources within certain operating range because of the lack of a multi-stage modeling approach.

As discussed more fully below, in this filing the ISO proposes to amend its tariff to incorporate the Multi-Stage Generating Resource functionality developed with market participants over the past year and which the ISO is now preparing to be able to implement on October 1, 2010. The proposal has strong stakeholder support, and the ISO respectfully requests that the Commission promptly approve this proposal.

II. DESCRIPTION OF THE MULTI-STAGE GENERATING RESOURCE MODELING APPROACH

A. Overall Multi-Stage Generating Resource Functionality

The ISO proposes a modeling and processing approach that will: 1) enable scheduling coordinators to offer output from generating resources with multiple operating modes into the ISO markets in a manner that reflects the operational and financial constraints of operating in the multiple modes; 2) allow the ISO to consider these constraints in the security constrained unit commitment and economic dispatch of its fleet to ensure optimal and feasible use of the expanded range of flexibility offered by such resources; and 3) compensate such resources fairly for the costs incurred for the transition from one operating mode to another. The proposal was designed in close collaboration with stakeholders, who have expressed significant support for the adoption of a functionality that allows for better modeling of multi-stage generating resources, and in particular the proposal presented in this tariff amendment. The proposal was also carefully developed in close consultation with the ISO's software vendor to ensure feasibility of the design features. The approval of the proposed tariff changes will enable the ISO to better account for the full range of operational capabilities offered by the ISO's generation fleet. As suggested in Ms. Biedler's testimony, this enhancement will reduce the need for out-of market interventions such as exceptional dispatch to move these resources out of their forbidden operating regions.[12] In addition, this will reduce the use of the outage reporting service

[12] Exhibit No. ISO-1 at 6.

used today by Scheduling Coordinators to avoid being dispatched into unfavorable configurations. Finally, the proposal will lead to a more efficient dispatch of resources. Multi-Stage Generating Resources currently tend to rely on self-scheduling, as opposed to a relying on a market dispatch, because the market optimization does not respect their true operating characteristics. Being able to employ the inherent flexibility of these resources will help the ISO efficiently balance the grid, especially as maintaining that balance becomes more difficult with the increase in intermittent generating resources.

This proposal is designed for generation resources that have multiple operating modes or configurations, such as combined cycle units, any other resources with multiple operating or regulating ranges that limit the resource to operate in only one of these ranges at any given time, or resources that have at least one forbidden operating region. The proposal will enable Scheduling Coordinators to offer resources that successfully register and qualify as Multi-Stage Generating Resources the ability to participate in the ISO markets more effectively by offering the specific configurations in any market interval and avoiding the dispatch of such resources in operating modes that are not feasible. Similarly, the proposal is designed to enable the ISO to consider the constraints and characteristics submitted by the resources' Scheduling Coordinators.

At this time, the ISO's proposal is designed for generation resources only because when the ISO began designing this modeling approach in 2008, the ISO was seeking to comply with the Commission's requirements in the *September 21 MRTU Order* and the *Deferral Order*, that the ISO develop a methodology to better model combined cycle units. This filing satisfies the relevant compliance obligations. The proposed modeling approach accommodates all generating resources with multiple operating modes, as well as external generating resources that are dynamically scheduled into the ISO balancing authority area and that are modeled as resource-specific system resources, *i.e.,* are capable of submitting the three part bids that include bid-in commitment costs in addition to the energy bid curve.[13] As explained further below and in Mr. Alarian's testimony, based on recent interest in the use of a similar modeling approach by other resources, the ISO believes this modeling approach can be further adapted in the future to enable better modeling of aggregated pumped storage hydro resources, aggregated pump resources, and other storage resources.[14] The ISO will continue to pursue these possible enhancements with stakeholders and will seek Commission approval of such amendments once the approach has been fully explored with stakeholders and the ISO's software vendors.

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[13] Dynamic resource-specific system resources are treated like internal resources in many respects under the current ISO market design and are therefore naturally included in the set of resources for which this modeling functionality is tailored.

[14] Exhibit No. ISO-3 at 20-21.

Accordingly, the ISO proposes that eligibility for the multi-stage generating resource modeling approach proposed in this tariff amendment be open to all Generating Units or Dynamic Resource-Specific System Resources[15] that for reasons related to their technical characteristics can be operated in multiple operating modes (or configurations), but for any given five-minute dispatch interval are either operating in one such configuration or in transition from one to the other. The ISO also specifies that, provided resources successfully register and qualify as Multi-Stage Generating Resources pursuant to the procedures proposed in Section 27.8, the generating resources with the following technical characteristics will qualify as multi-stage generating resources and be permitted to participate in the ISO markets as such: 1) a combined cycle gas turbine resource; 2) a generating unit (*i.e.*, internal generator) or dynamic resource-specific system resources (*i.e.*, specific generating resources located outside of the ISO that can be dynamically scheduled and are registered resource-specific system resources) with multiple operating or regulating ranges that limit the resource to operate in only one of these ranges at any given time; or 3) a generating resource that has one or more than one forbidden operating region.[16] As reflected in the proposed definition for Multi-Stage Generating Resources to be included in Appendix A of the ISO Tariff, Metered Subsystems, Pumped-Storage Hydro Units, and Pumping Loads, and System Resources that are not Dynamic Resource-Specific System Resources are explicitly excluded from qualification as Multi-Stage Generating Resources.[17]

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[15] The ISO proposes that only resources that are already qualified as Generating Units and Dynamic Resource-Specific System Resources can participate in the ISO markets as Multi-Stage Generating Resources. The reason for this requirement is to ensure that the generating resources already have a legal relationship with the ISO under the ISO tariff. Both Generating Units and Dynamic Resource-Specific System Resources are already required to have with the ISO either a Participating Generator Agreement or Dynamic System Resource Agreement, respectively. (*See* Sections 4.6 and 4.5.4.3 of the ISO Tariff). This eliminates the need to establish an additional pro-forma contract for the registration of such resources.

[16] *See* proposed definition in Appendix A for Multi-Stage Generating Resources in Attachment B ("[a] Generating Unit or Dynamic Resource-Specific System Resource that for reasons related to its technical characteristics can be operated in various MSG Configurations such that only one such MSG Configuration can be operated in any given Dispatch Interval. In addition, subject to the requirements in Section 27.8, the following technical characteristics qualify a Generating Unit or Dynamic Resource-Specific System Resource as a Multi-Stage Generating Resource if the resource: (1) is a combined cycle gas turbine resource; (2) is a Generating Unit or Dynamic Resource-Specific System Resources with multiple operating or regulating ranges but which can operate in only one of these ranges at any given time; or (3) has one or more Forbidden Operating Regions. Metered Subsystems, Pumped-Storage Hydro Units, and Pumping Loads, and System Resources that are not Dynamic Resource-Specific System Resources do not qualify as Multi-Stage Generating Resources.")

[17] A "Metered Subsystem" is defined in Appendix A as "[a] geographically contiguous system located within a single zone which has been operating as an electric utility for a number of years prior to the CAISO Operations Date as a municipal utility, water district, irrigation district, state agency or federal power marketing authority subsumed within the CAISO Balancing Authority Area and encompassed by CAISO certified revenue quality meters at each interface point with the CAISO Controlled Grid and CAISO certified revenue quality meters on all Generating Units or,

The proposed multi-stage generating resource modeling design is based on the pseudo-plant model, which models each configuration as if it were a distinct generating plant. As such, Scheduling Coordinators will submit operating parameters and costs associated with configurations of their multi-stage generating resource at the plant level, as reflected in the single resource ID assigned to each generating plant to which all submitted bids submitted for each of the registered configurations will be associated. Scheduling Coordinators will then be able to offer the specific configurations through bids and associated parameters specified at the configuration level and associated with a specific configuration identification number. Scheduling Coordinators will also be able to define the transition matrix which describes the feasible transitions between the configurations with their transition time and cost. The various ISO market software tools will use these configuration-based or "sub-resource" bids to determine the optimal dispatch for a given hour with the transition matrix included in the consideration.

As explained in Ms. Biedler's testimony, the pseudo-plant modeling approach treats various configurations of a multi-stage generating resource as generation resources themselves, thereby allowing the resource owner to bid these configurations, or pseudo-plants, into the market independently.[18] The market optimization chooses which configuration, if any, is part of the optimal solution. Under this modeling approach, the configurations are mutually exclusive, which means that only one configuration can be chosen by the optimization. This pseudo-plant model is employed in the market being developed by ERCOT.

The alternative to this approach is the pseudo-unit model, which divides resources into mutually exclusive aggregations that may include portions of an

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if aggregated, each individual resource and Participating Load internal to the system, which is operated in accordance with a MSS Agreement described in Section 4.9.1."

"Pumped-Storage Hydro Units" are defined in Appendix A as "[a] hydroelectric dam with the capability to produce electricity and the ability to pump water between reservoirs at different elevations to store such water for the production of electricity."

"Pumping Loads" are defined in Appendix A as "[a] hydro pumping resource that is capable of responding to Dispatch Instructions by ceasing to pump."

"System Resources" are defined in Appendix A as "[a] group of resources, single resource, or a portion of a resource located outside of the CAISO Balancing Authority Area, or an allocated portion of a Balancing Authority Area's portfolio of generating resources that are either a static Interchange schedule or directly responsive to that Balancing Authority Area's Automatic Generation Control (AGC) capable of providing Energy and/or Ancillary Services to the CAISO Balancing Authority Area, provided that if the System Resource is providing Regulation to the CAISO it is directly responsive to AGC."

[18] Exhibit No. ISO-1 at 14.

embedded unit. With this modeling approach, a combined cycle generating unit with three gas turbine units and a steam turbine would be modeled as three separate pseudo-units, where each of the three pseudo-units would be modeled as an individual gas turbine plus one third of a steam turbine. This is similar to the way the NYISO and PJM approximate the modeling of different configurations of multi-stage generators. As discussed in Ms. Biedler's testimony, early on in the stakeholder process the ISO discussed both of these approaches with stakeholders and its software vendor and concluded that the pseudo-plant modeling approach was better.[19] In particular, the pseudo-unit modeling approach is less than ideal because such a model requires market participants to assign costs and operating parameters to pseudo-units, which is not necessarily intuitive or accurate. Another drawback of the pseudo-unit modeling approach is that it does not accurately model the resources that have a single physical unit, but have multiple operating or regulating modes. However, from an implementation and market performance perspective, the pseudo-unit model is much simpler from an implementation standpoint. Despite the fact that it is more difficult to implement the pseudo-plant approach, the ISO opted to pursue this after considering stakeholder input because the pseudo-unit modeling approach would not appreciably improve the ability of market participants to offer the inherent flexibility of multi-stage units into the market.

B. Registration and Qualification of Multi-Stage Generating Resource

i. Information Requirements

An important element of this proposal is the need for the ISO to collect and manage detailed information regarding the constraints and characteristics of the multiple configurations that the resources' Scheduling Coordinators intend to have modeled and considered in the ISO markets. The ability to model the flexibility offered by the multi-stage generating resources depends significantly on the quality and accuracy of the information regarding the resources characteristics registered with the ISO in its Master File.[20] These information requirements arise out of the pseudo-plant modeling approach adopted by the ISO. Therefore, the ISO is proposing a registration, qualification, and data management process as reflected in proposed Section 27.8.

A Scheduling Coordinator that intends to have its resources modeled and considered in the ISO markets as a multi-stage generating resource will be required to submit detailed information on their resources and follow the registration and qualification process described in Section 27.8. In particular,

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[19] Exhibit No. ISO-1 at 14-15.

[20] The Master File is a comprehensive database maintained by the ISO that contains information regarding generating units, loads and other resources.

information will be required for each configuration and will include the same specificity as is required for other generators in general. Attributes such as operating minimum and maximum values, minimum run times, minimum down times, a ramp rate, ancillary services certifications, and heat rates will be registered and stored at the configuration level. The information pertaining to the characteristics of multi-stage generating resources will reside in the ISO's Master File and will be accessed in every market interval as appropriate to accurately consider the resource as the market software and processes seek to arrive to an optimal market solution in each market run of the day-ahead market and the real-time market.

The responsible Scheduling Coordinator will be required to submit for each of the applicable MSG Configurations a single segment Operational Ramp Rate, and as applicable based on the certification of the MSG Configuration for the provision of ancillary services as discussed below, an Operating Reserves ramp rate and Regulating Reserves ramp rate.[21] Scheduling Coordinators will be required to submit to the ISO a Transition Matrix, which will contain the Transition Costs and operating constraints associated with the transition from one registered configuration to another.[22] For each transition between configurations that is feasible, the ISO will require transition time and cost information.[23] This is akin to the start-up and shut-down related data provided for single stage generators since each transition between the configurations of multi-stage units is like a shut-down of one configuration and a start up of another.

In addition, the Scheduling Coordinator must establish the default MSG Configuration and its associated Default Resource Adequacy Path that apply to Multi-Stage Generating Resources that are subject to Resource Adequacy must-offer obligations. This information is necessary for the enforcement of the resource adequacy requirements as discussed further below.

Finally, the Scheduling Coordinators may register the number of MSG Configurations as are reasonably appropriate for the resource based on the technical and operating characteristics of the resource. However, the Scheduling

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[21] *See* Proposed Section 27.8.2.

[22] A more complete description of the transition matrix is provided in Mr. Zhou's testimony. Exhibit No. ISO-2 at 11-12.

[23] In the initial stages of the stakeholder process, the ISO also intended to enable participants to specify the the number of times in an operating day that this transition can be made. The ISO was informed that this feature could not be implemented and did not pursue it. However, as explained in Mr. Zhou's testimony, at this time it is not apparent that this feature can be readily implemented because enforcing a daily maximum number of transitions between different configurations appears to be creating additional complexity to the design. However, permitting a Multi-Stage Generating Resource to specify a minimum up time and down time for each configuration will also keep a Multi-Stage Generating Resource from being transitioned between configurations more often than is permissible. Exhibit No. ISO-2 at 24.

Coordinator will not be able to register more than a total of ten MSG Configurations and cannot register fewer than two. These registered configurations will also be stored in the Master File.

ii. Registration and Qualification Process

Similar to other resources in its system, the ISO proposes a registration and qualification process that balances the ISO's need for detailed and accurate information with the burden imposed on Scheduling Coordinators in offering their resources into the ISO markets. The ISO proposes a registration timeline that is closely linked to the existing process for registering and modifying resource information contained in the Master File. Accordingly, as reflected in Section 27.8.1, a Scheduling Coordinator that intends to register and qualify their resource as a Multi-Stage Generating Resource must submit all the necessary registration information to the ISO no less than sixteen (16) business days prior to the date that Scheduling Coordinator seeks to have the resource participate in the ISO markets as a Multi-Stage Generating Resource. The necessary registration materials and directions to be submitted are available on the ISO website.[24] After the Scheduling Coordinator submits a request to register their resource as a Multi-Stage Generating Resource, the ISO will coordinate with that Scheduling Coordinator to validate that the resource qualifies for the requested status and that all the requisite information has been successfully provided to the ISO. This will consist of a series of consultations with the Scheduling Coordinators to ensure that the information captured by the ISO is correct and accurately reflects the resource's characteristics. In addition, based on information available to the ISO regarding the resources, the ISO will be able to validate that the information provided is correct and may accordingly request corrections, as necessary.

The resource will be successfully registered and qualified as a Multi-Stage Generating Resource once the ISO has notified the Scheduling Coordinator that they have been successfully registered and qualified. As is the case today regarding master file changes, this normally occurs no later than three business days before the intended effectiveness date. The ISO is not recommending a cut-off point for this final qualification step because it is possible that in the days prior to the effective date, depending on circumstances, the ISO can accommodate the integration of such resources by the requested effective date. However, the ISO has estimated that if the required registration data is not submitted at least 16 business days prior to the intended effective date, the ISO

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[24] The ISO's registration documentation and data requirements can be found at: http://www.caiso.com/2078/2078908392d0.html. Early in the stakeholder process preceding this filing, the ISO also shared with stakeholders the form used by ERCOT for the capture of this information was included as Appendix B to the Straw Proposal posted on February 17, 2009. This document and the glossary that accompanies it are available at the following link: http://www.caiso.com/2078/2078908392d0.html.

cannot ensure the resources will be fully qualified and registered in time. It is possible during this time, depending on the nature of the information provided either because of insufficiencies, errors, or the complexity of the modeling information provided, that the ISO will not be able to ensure completion of this process for the requested effective date. If the ISO has reason to believe that the resource's operating and technical characteristics are not consistent with the registered and qualified attributes, the ISO may request that the Scheduling Coordinator provide additional information necessary to support their registered status. Where appropriate, the ISO may require that the resource's configurations and their related parameters be registered and qualified to better reflect the resource's operating and technical characteristics. Where the additional information does not support the resource's status as a Multi-Stage Generating Resource, that status may be revoked. The ISO will work with Scheduling Coordinators to ensure that the Scheduling Coordinator is aware of any deficiencies in this regard.

Once the ISO has issued its notification that the resource is registered and qualified as a Multi-Stage Generating Resource, changes to the registered attributes will be subject to timing requirements discussed below in part II.B.iii below. The reason for this limitation is to ensure that these changes are adequately validated by the Scheduling Coordinator and the ISO so that these fundamental attributes are correctly reflected in the ISO's Master File.

The proposed tariff language provides the flexibility needed to ensure adequate registration and qualification of the resources' characteristics but puts Scheduling Coordinators on notice that if the required information is not submitted at least 16 days before the requested effective date, this process cannot be accomplished. In addition, the proposed tariff provisions provide sufficient detail regarding the registration and qualification terms and conditions of the registration process. Following its standard practice, the ISO will also make available business practice manuals, forms and information on its website that assist and guide market participants. While this information will be consistent with the terms and conditions outlined in this tariff, the inclusion of such business tools in the tariff is not consistent with the rule of reason.[25]

iii. Changes to Multi-Stage Generating Resources Attributes

The ISO is proposing certain rules and timing requirements above and beyond the existing timing requirements for changes to the Master File[26] to guide

[25] The Commission's "rule of reason" allows that only those practices that significantly affect rates, terms, and conditions fall within the requirement that public utilities shall file with the Commission all rate schedules for any transmission or sale subject to the jurisdiction of the Commission. *Cal. Indep. Sys. Operator Corp.*, 116 FERC ¶ 61,274, P 1369 (2006).

[26] Information regarding the Master File change process can be found at: http://www.caiso.com/1f94/1f94cd5447620.html.

the changes Scheduling Coordinators can make to their resources' registered attributes once the ISO has registered and qualified resources as Multi-Stage Generating Resources. These rules are necessary to ensure that the ISO markets can adequately model the attributes of Multi-Stage Generating Resources and that frequent and unnecessary changes to the salient attributes do not result in market performance issues. In developing these rules, the ISO also sought to accommodate the need for participants to be able to adjust attributes as more understanding is gained regarding how their resources' characteristics perform in the market. As discussed in Mr. Alarian's testimony, the modeling of such resources' multiple constraints poses additional computational challenges for the ISO.[27] To avoid random and unnecessary changes that stress the system, the ISO proposes to permit changes to certain salient attributes as discussed below.

Once resources are qualified as Multi-Stage Generating Resources, the Scheduling Coordinator will be permitted to make the changes to the following attributes only at certain time intervals:

(1) The registration and qualification of a Generating Unit or Dynamic Resource-Specific System Resource as a Multi-Stage Generating Resource.

(2) Changes to the MSG Configurations attributes, which include:
   a. addition of new MSG Configurations;
   b. removal of an existing MSG Configuration;
   c. a change in the physical units supporting the MSG Configuration;
   d. a change to the MSG Configuration Start Up and Shut Down flags;
   e. adding or removing an MSG Transition to the Transition Matrix;
   f. a material change in the Transition Times contained in the Master File, which consists of a change that more than doubles the Transition Times or reduces it to less than half; and
   g. a material change to the maximum Ramp Rate of the MSG Configuration(s) contained in the Master File, which consists of a change that more than doubles the maximum Ramp Rate or reduces it to less than half.

As explained further in III.A. below, for the start of this new modeling approach, the ISO is proposing a pre-go live process to ensure that Scheduling Coordinators that intend to have their resources participate in the ISO markets as multi-stage generating resources will be able to do so. After the start of this new market feature Scheduling Coordinators will again be able to modify the features listed above at given intervals. For the first forty-five (45) days after the multi-stage generating resource functionality becomes effective, Scheduling

[27] Exhibit No. ISO-3 at 6-7.

Coordinators may not change any of Multi-Stage Generating Resource attributes listed above and listed in Section 27.8.3. On the forty-sixth (46) day, changes to these attributes may take effect, including the registration of new Multi-Stage Generating Resources, provided Scheduling Coordinators have previously followed the registration and qualification process requirements listed in Section 27.8.1 and described above. Subsequently, further changes to these attributes listed above and in Section 27.8.3 may not take effect until after the one hundred-tenth (110) day following the day on which the multi-stage generating resource functionality takes effect, subject to the procedures described in Section 27.8.1. After that, the Scheduling Coordinators will be permitted to make changes to these attributes every sixty (60) days after the day on which any such changes have taken effect.

Changes to all other registered attributes such as the minimum up times, minimum down times and maximum daily startups will be permitted pursuant to the regular timing requirements for making such changes. For example, a change in the default resource adequacy configuration can be modified consistent with the Master File change process. In addition, Scheduling Coordinators may unregister a Generating Unit or Dynamic Resource-Specific System Resource from its Multi-Stage Generating Resource subject to the timing requirements for Master File changes, and such changes are not subject to the timing requirements in Section 27.8.3.

The ISO has sought to balance its need to restrict changes to the salient features of a multi-stage generating resource with the needs for Scheduling Coordinators to modify certain registered attributes so that they are able to make better use of their resources. In response to stakeholder comments, the ISO modified the list of restricted changes to exclude the default resource adequacy configuration. The rationale was that restricting the ability of Scheduling Coordinators to change the default resource adequacy configuration could force sub-optimal operation of resources subject to the must offer requirement during the time in which such features could not change. In addition, the ISO modified the restrictive changes so that if necessary resources can withdraw their status of a multi-stage generating resource at any time, subject to the timing requirements for making master file changes. However, once the resource’s status as a Multi-Stage Resource Generating Resource has been withdrawn, the re-entry as a Multi-Stage Resource Generating Resource is subject to the timing requirements described above and must be accomplished within the time periods described above and in proposed Section 27.8.3.

C. Bidding and Self-Scheduling Requirements

With the few modifications discussed in this Transmittal Letter, Multi-Stage Generating Resources will be able to participate in the ISO markets in the same manner as do all other Generating Units or Dynamic Resource-Specific System

Resources. Once fully qualified and registered as a Multi-Stage Generating Resource, Scheduling Coordinators will be able to submit bids for energy and ancillary services for each registered and qualified MSG Configuration.[28]

i. Bid Component Requirements

With respect to the general rules that govern the required components for bids and self-schedules, because all the essential elements of the bid components already incorporated in the ISO Tariff in Sections 30.5 remain the same, some changes are required to include the additional requirements for Multi-Stage Resource Generating Resources. The notable changes in the bid and self-schedule components involve the need to submit the individual bidding components for each MSG Configuration identification number along with the MSG Resource identification number (MSG Configuration ID and MSG Resource ID). Similar to the use of the Resource ID in the ISO markets, the MSG Configuration ID will enable the ISO to associate and process all bids and self-schedules with the specific MSG Configuration submitted to participate in the ISO Market.

Accordingly, the ISO proposes to modify Section 30.5.2.1 to require that Scheduling Coordinators submit the applicable supply bids, including self-schedules and components for the submitted MSG Configurations not just at the plant level.[29] The ISO also proposes to include the requirement that for Multi-Stage Generating Units Scheduling Coordinators must submit the bidding components using the MSG Configuration ID. Similar changes are proposed to Section 30.5.2.2, where the ISO specifies that Scheduling Coordinators must submit the Bid components for Multi-Stage Generating Resources at the MSG Configuration level. This does not eliminate the need to associate the supply bids with the entire plant being offered because each MSG Configuration will be linked to the single Resource ID designated for each resource. Therefore, the ISO proposes to specify in Section 30.5.2.2 that Scheduling Coordinators must submit all MSG bids for the MSG Configurations under the same Resource ID. The ISO also proposes similar changes to Section 30.5.2.6 that pertains to Ancillary Services Bids and Section 30.5.2.7 that pertains to RUC Availability Bids. In Section 30.5.2.6 the ISO proposes to specify that the Ancillary Services

[28] The ISO proposes to define MSG Configurations as: "[a] qualified and registered operating mode of a Multi-Stage Generating Resource, with a distinct set of operating characteristics. All MSG Configurations for Multi-Stage Generating Resources are operable on-line modes."

[29] As discussed further in this transmittal letter, certain rules for Multi-Stage Generating Resources will apply at the physical plant level and certain other rules will apply at the MSG Configuration level. In the proposed ISO Tariff language, for the purposes of referring to the plan-level requirements, the ISO has adopted the practice of referring to the Generating Unit or Dynamic Resource Specific System Resources. For the purposes of referring to requirements that apply to the configuration level, the ISO has adopted the practice of using the proposed defined term MSG Configuration.

Bids can only be submitted for the MSG Configuration certified to provide the specific Ancillary Service, which is discussed further in II.E below. This is necessary because Multi-Stage Generating Resources will be participating based on their specific configuration. If a generator is tested and certified at the plant level and that certification is based on the operating capability in a particular configuration, if the resource then gets awarded Ancillary Services and does not happen to be in the configuration that it qualified for, the ISO's procurement would be without value. Nor would the ISO be able to ensure that the resource is awarded the Ancillary Service in a configuration that is capable of actually providing the service.

ii. General Bidding Rules

Based on input received during the stakeholder process the ISO created a series of rules that govern bidding practices for Multi-Stage Generating Resources. These rules are designed to support the policy developed for such resources, as well as to ensure that the market optimization software can consider these resources adequately whilst minimizing performance challenges.

Scheduling Coordinators will be permitted to submit economic bids or self-schedules for up to ten (but only one self-schedule per configuration per interval) different MSG Configurations in the day-ahead market, which includes the Integrated Forward Market and the Residual Unit Commitment process. This will require the IFM and RUC to optimize up to ten MSG Configurations for each Multi-Stage Generating Resource that is offered in any IFM or RUC market interval. By design, each of the MSG Configurations offered into the IFM will be optimized as mutually exclusive Multi-Stage Generating Resources. As a result, the IFM will produce a day-ahead schedule for at most one configuration per multi-stage unit. As explained in Mr. Zhou's testimony, the limitation on the number of configurations submitted in the IFM was found to be feasible from a software performance perspective and was found to be acceptable by stakeholders.[30] This limitation thus strikes a balance between extending flexibility to Scheduling Coordinators while safeguarding the performance of the market software. Accordingly, the ISO is proposing amendments to Sections 30.5.1, 30.5.2.1, and 30.5.2.2 that reflect this requirement.

In the real-time market, Scheduling Coordinators will be permitted to bid up to three MSG Configurations.[31] This limit is in addition to any configurations

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[30] Exhibit No. ISO-2 at 27-29.

[31] Under the current design, Multi-Stage Generating Resources will only be permitted to participate in the day-ahead market and real-time market. While Dynamic Resource-Specific System Resources are located outside the ISO Balancing Authority Area, these resources are dynamically scheduled and under the existing market design and ISO tariff are considered and settled in the real-time market and not the hour-ahead scheduling process where non-dynamic external resources are considered.

that may have been committed in IFM or RUC. Again, this limitation was selected to provide sufficient flexibility to Scheduling Coordinators, whilst not compromising market software performance. As explained in Mr. Zhou's testimony, the real-time market cannot support as many MSG Configurations as the day-ahead market because in the real-time the market software is expected to optimize over a greater number of variables within a much smaller time frame.[32] A larger number of permissible configurations would compromise the ability to optimize over the fifteen-minute and five-minute dispatch intervals for RTUC and RTD, respectively, and reach a feasible solution. At the same time, based on stakeholder input the ISO determined that the limitation of three MSG Configurations in the real-time market still enables Multi-Stage Generating Resources to fully participate in the market. Accordingly, the ISO proposes amendments to Section 30.5.1 and 30.5.2.2 that reflect this requirement.

In addition, the ISO proposes that, to the extent that a Multi-Stage Generating Resource is selected in the IFM and receives a day-ahead schedule or is awarded RUC Capacity, the Scheduling Coordinator must then submit either the MSG Configuration or one that can support the day-ahead schedule for energy and RUC Awards must be bid into the real-time market for that same hour. Similarly, the ISO proposes that all MSG Configurations bid into the real-time market must be able to support a reservation of capacity in the amount and for the product of any day-ahead ancillary services award. These requirements are reflected in the amendments proposed for Section 30.5.1 (g). As discussed in Mr. Zhou's testimony, this requirement is necessary to ensure that Multi-Stage Generating Resources that are available and capable of performing are not withheld from the real-time market.[33] Since Multi-Stage Generating Resources can have different certified capacities for different MSG configurations, a day-ahead awarded Ancillary Service or RUC capacity on a given configuration may not be available if there are no real-time bids to support them. This treatment ensures that the day-ahead ancillary service capacity and the RUC capacity are warranted. However, as reflected in proposed Section 30.5.1 (h), to the extent that a Multi-Stage Generating Resource is not scheduled energy or awarded capacity in the day-ahead market, the Scheduling Coordinator can only bid in up to three MSG Configurations in the real-time market.

As reflected in proposed Section 30.5.1. (g), in addition to the two MSG Configurations that are reserved for the purpose of the day-ahead awards and schedules, three additional MSG Configurations may also be bid into the real-time market, provided that transitions within those three MSG Configurations are feasible and that the transition from the MSG Configuration in the previous trading hour is also feasible. At the conclusion of the stakeholder process to develop the Multi-Stage Generating Resource policy in 2009, the ISO concluded

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[32] Exhibit No. ISO-2 at 27-28.

[33] Exhibit No. ISO-2 at 41.

that the MSG Configurations submitted in the real-time market for the purpose of reserving the day-ahead awards and schedules would be included in the three permissible MSG Configurations for the real-time market. However, during the tariff stakeholder process conducted just prior to filing this amendment, the ISO learned that this limitation was unacceptable to stakeholders. Stakeholders argued that in the real-time market the MSG Configurations that the Scheduling Coordinator may submit may be further limited by the fact that SIBR currently cannot account for generation outages. As discussed in Mr. Zhou's testimony, this restriction would result in the inability for a resource to participate in the event that a particular MSG Configuration is subject to an outage after the real-time market bid submission and validation processes are over.[34]

Based on stakeholder feedback regarding the prior limitation, the ISO requested its vendor to determine the feasibility of relaxing this limitation so that the ISO could permit Scheduling Coordinators to submit three MSG Configurations in addition to the one or two others that would be reserved for the day-ahead schedules, awards and RUC schedule. Stakeholders supported this modification, which is now reflected in the proposed amendment in the sections discussed above. In addition, the ISO bid validation software will validate real-time market configuration-level bids to ensure that these stipulations are met, and that the transitions between bid-in MSG Configurations are feasible according to the information registered in the ISO Master File data.

Proposed Section 30.5.1 (i), further notifies Scheduling Coordinators that they cannot bid in a MSG Configuration to which a Multi-Stage Generating Resource cannot transition due lack of bids for the specific resource in other MSG Configurations that are necessary for the requisite MSG Transition. These requirements are necessary to avoid situations in which a resource cannot be utilized by the market because it cannot be feasibly transitioned from the MSG Configuration in which it is operating to the ones it has bid into the market for the subsequent interval.

In addition, because Multi-Stage Generating Resources may be subject to must-offer requirements under the existing ISO market design and as provided in Section 40 of the ISO Tariff, the ISO proposes certain bidding rules to ensure the Scheduling Coordinator submits a MSG Configuration that meets the resource's must-offer obligation. Specifically, in proposed Section 30.5.1 (j) the ISO provides that the Scheduling Coordinator must submit either an Economic Bid or Self-Schedule for at least one MSG Configuration into the day-ahead and real-time markets that is capable of fulfilling the resource adequacy obligations, as feasible.

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[34] Exhibit No. ISO-2 at 28-29.

The ISO also proposes specific bidding rules that apply for Trading Hours in which the Scheduling Coordinator submits a Self-Schedule and/or a Submission to Self-Provide Ancillary Service. First, in any given Trading Hour, the Scheduling Coordinator may submit Self-Schedules and/or Submissions to Self-Provide Ancillary Services in only one MSG Configuration for each Generating Unit or Dynamic Resource-Specific System Resource. This rule specifically references the Generating Unit or Dynamic-Specific System Resource because the rule applies to the entire plant and not just the MSG Configuration. Therefore, there cannot be more than one MSG Configuration self-scheduled for a Multi-Stage Generating Resource. As discussed in Mr. Zhou's testimony, this limitation is necessary because the ISO commits resources for an entire Trading Hour.[35] As the pseudo-plant modeling approach treats each configuration as a resource, this restriction is necessary to maintain consistency between Multi-Stage Resource Generating Resources and non-Multi-Stage Resource Generating Resources.

Second, in any given Trading Hour in which a Scheduling Coordinator has submitted a Self-Schedule for a Multi-Stage Generating Resource, the Scheduling Coordinator may also submit Bids for other MSG Configurations provided that they concurrently submit Bids that enable the ISO Market optimization to commit and/or transition the Multi-Stage Generating Resource to other MSG Configurations. This is necessary to ensure that the resources are offered into the market in a manner that ensures that they can be feasibly transitioned from one MSG Configuration to another.

The ISO also proposes to require that in any given trading hour in which the Multi-Stage Generating Resource was awarded Regulation or Operating Reserves in the IFM, any Self-Schedules or Submissions to Self-Provide Ancillary Services the Scheduling Coordinator submits for that Multi-Stage Generating Resource in the real-time market must be for the same MSG Configuration for which Regulation or Operating Reserve is Awarded in IFM for that Multi-Stage Generating Resource in that given Trading Hour. Similarly, if a Multi-Stage Generating Resource has received a binding RUC Start-Up Instruction as provided in Section 31, any Self-Schedule or Submission to Self-Provide Ancillary Services in the real-time market must be in the same MSG Configuration committed in RUC. As explained in Mr. Zhou's testimony, this rule is necessary, *inter alia*, because if the resource is awarded Regulation in the IFM, the ISO must be able to use the Regulation in real-time.[36] This rule ensures that the the awarded regulation from Multi-Stage Generating Resources is actually usable.

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[35] Exhibit No. ISO-2 at 32-33.

[36] Exhibit No. ISO-2 at 32 & 42.

Finally, the ISO proposes that Scheduling Coordinators for Multi-Stage Generating Resources must submit a single Operational Ramp Rate for each MSG Configuration for which it submits a supply bid either in the day-ahead market or real-time market. For Multi-Stage Generating Resources the Scheduling Coordinator may submit the Transition Times, which cannot be greater than the maximum Transition Time registered in the Master File. To the extent the Scheduling Coordinator does not submit the Transition Time for a registered feasible transition, the ISO will use the registered maximum transition time for that MSG Transition for the specific Multi-Stage Generating Resource. This rule extends the logic of an existing rule for non-Multi-Stage Generating Resources. Under this current rule, the ISO permits a generation unit to submit a startup time curve in day-ahead or real-time so long as it is lower than the startup time curve registered in the Master File.

iii. Bid Validation Rules

The integration of Multi-Stage Generating Resources into the ISO markets requires modifications to the bid validation rules to ensure that the bids submitted for the Multi-Stage Generating Resources as a whole fulfill the feasibility requirements, Resource Adequacy requirements, and the bidding rules discussed above. For the most part, the bid validation rules apply to bids by Multi-Stage Generating Resources as they do to all other Generating Units or Dynamic Resource-Specific System Resources. However, because of the new layer of attributes to be considered with offerings by resources with multiple operating modes, the ISO has created specific rules that apply only to Multi-Stage Generating Resources. Accordingly, the ISO is proposing the addition of a new Section 30.7.3.5 to reflect the bid validation rules that apply to bids submitted by Multi-Stage Generating Resources.

First, the ISO specifies the bid validation rules in the event that a Scheduling Coordinator does not submit a bid in the day-ahead market or real-time market for a Multi-Stage Generating Resource with a Resource Adequacy must-offer obligation at a MSG Configuration that can meet the applicable Resource Adequacy must-offer obligation. As is the case for all other Generating Resources and Dynamic Resource-Specific System resources subject to Resource-Adequacy must-offer obligations, the ISO will generate bids under such circumstances. The distinguishing feature for Multi-Stage Generating Resources is that the Generated Bid will be specifically for the default Resource Adequacy MSG Configuration that the resource must register with the ISO. Similarly, if in the given interval the Multi-Stage Generating Resource is not capable of Start-Up into the default Resource Adequacy MSG Configuration due to an infeasible transition from the prior interval’s configuration, the ISO will create a Generated Bid for every MSG Configuration in the registered Default Resource Adequacy Path if those configurations do not have bids submitted in them. The ISO also proposes that any Generated Bid created by the ISO for the default Resource Adequacy MSG Configuration will be *in addition* to the three MSG Configurations the Scheduling Coordinator can bid into the real-time market under the recently expanded functionality as discussed above. Further, as is the case with all other Generating Units and Dynamic Resource-Specific System Resources, if the Scheduling Coordinator submits a Bid in the day-ahead or real-time market for a MSG Configuration that is not the default Resource Adequacy MSG Configuration and that does not cover the full amount of the resource's Resource Adequacy requirements, the ISO will create a Generated Bid for the full Resource Adequacy Capacity. Before the market closes, if a Scheduling Coordinator submits a bid in the day-ahead or real-time market for the default resource adequacy MSG Configuration of a Multi-Stage Generating Resource that only meets part of the resource's Resource Adequacy must-offer obligation, the ISO will extend the last segment of the energy bid curve in the submitted bid for the Multi-Stage Generating Resource up to the Multi-Stage Generating Resource's resource adequacy must-offer obligation. After the market closes, to the extent that no bid is submitted into the real-time market for a Multi-Stage Generating Resource scheduled in the Integrated Forward Market as required in Section 30.5 the ISO will create a Self-Schedule for MSG Configuration equal to the day-ahead schedule for that resource for the MSG Configuration scheduled in the IFM.

The ISO is also proposing modifications to its bid validation rules to support the bidding requirements discussed above. For example, if a Multi-Stage Generating Resource is awarded operating reserves in the day-ahead market and no economic energy bids is submitted for that resource in the real-time market, the ISO will insert a proxy energy bid in the MSG Configuration that was awarded in the day-ahead market to cover the awarded operating reserves. Also, to the extent that a Multi-Stage Generating Resources RUC schedule is greater than its day-ahead schedule, if the Scheduling Coordinator does not submit an energy bid in the real-time market to cover the difference, then the ISO will either create a Bid in the MSG Configuration awarded in RUC, or extend the Bid submitted by the Scheduling Coordinator before the Market Close. After the Market Close, the ISO will create a Generated Bid if there is no Bid submitted for the resource for this difference.

The ISO will also validate that the combination of the Day-Ahead Ancillary Services Awards and Submissions to Self-Provide Ancillary Services are feasible with respect to the physical operating characteristics of the applicable MSG Configuration. The ISO will reject Ancillary Services Bids or Submissions to Self-Provide Ancillary Services for MSG Configurations that are not certified Ancillary Services. Finally, for any given Multi-Stage Generating Resource, for any given ISO Market and Trading Hour if one MSG Configuration's Bid fails the bid validation process, all other Bids for all other MSG Configurations are also invalidated.

These bid validation rules for Multi-Stage Generating Resources are necessary to ensure that such resources are fully integrated for the various multiple configurations that the resource can offer into the market. As discussed in Mr. Zhou's testimony, these requirements are a consequence of the pseudo-plant approach.[37] Because bids are submitted at a configuration level, bid validation must be conducted at that level.

D. Market Power Mitigation of Multi-Stage Generating Resources

Similar to all other Generating Units and Dynamic Resource-Specific System Resources in the ISO markets, Multi-Stage Generating Resources will be subject to the local market power mitigation procedures reflected in Section 31.2 of the ISO Tariff. The only change to this process the ISO proposes to make is that the ISO will perform the automated local market power mitigation process on a MSG Configuration basis as opposed to the plant level overall. Since the automated local market power mitigation process is performed on all clean bids submitted for use in the day-ahead market and real-time market, individual MSG Configurations' bids may be flagged for mitigation. This will be accomplished by mitigating all MSG Configurations that are incremented up in the All Constraints Run. Accordingly, Default Energy Bids for Multi-Stage Generating Resources will be calculated by the Independent Entity at the MSG Configuration level. In addition, if a Multi-Stage Generating Resource has a MSG Configuration committed in the Competitive Constraints Run, and the same or another committed in the All Constraints Run with the schedule from the All Constraints Run higher than the schedule from the Competitive Constraints Run, all configurations with bids higher than the schedule in the Competitive Constraints Run will be subject to mitigation. Furthermore, each configuration's bids subject to mitigation will be mitigated using its own default energy bid.

The ISO proposes that the Independent Entity will calculate Default Energy Bids for Multi-Stage Generating Resources (whether cost-based or negotiated) on a configuration-by-configuration basis. Furthermore, because at the start of market operations with the new Multi-Stage Generating Resource functionality there will be a lack of data on which the Independent Entity does not have data available to calculate LMP option for the specific resource, the Default Energy Bid for the first ninety days after go live or after the resource becomes an MSG for the first time, the Default Energy Bid is limited to the Negotiated Rate Option or Variable Cost Option. As discussed in Mr. Zhou's testimony, the LMP default energy bid calculation on each MSG configuration requires the ninety days' historical data of the schedule from All Constraints Run at the configuration level which will not be available until the first ninety days after go live or after the resource becomes an MSG for the first time.[38]

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[37] Exhibit No. ISO-2 at 29-30.

[38] Exhibit No. ISO-2 at 34.

E. Ancillary Services Provision

The adoption of the pseudo-plant modeling approach for Multi-Stage Generating Resources also requires that resources' provision of Ancillary Services be considered on the basis of the specific MSG Configurations. Therefore, the ISO proposes that Multi-Stage Generating Resources that intend to provide Ancillary Services[39] must be certified to provide Ancillary Services at the MSG Configuration level. This means that the specific certification requirements for each of the Ancillary Services offered will be geared to test and validate their ability to provide the specific Ancillary Service at the configuration level. Once the MSG Configuration is certified to provide an Ancillary Service, the Scheduling Coordinator can offer that specifically certified MSG Configuration into the ISO market for ancillary services. A Multi-Stage Generating Resource can have some configurations capable of providing ancillary services with others not capable. The ancillary service bids will then be treated through the market as are any ancillary service bids from Generating Units or Dynamic Resource-Specific System Resources.

Furthermore, as is the case for all Generating Units and Dynamic Resource-Specific System Resources, any Ancillary Services awards from the Integrated Forward Market will carry through to the real-time market. Therefore, for the specific MSG Configuration awarded ancillary services capacity, as discussed above in the bidding rules section, the Scheduling Coordinator must reserve the awarded Ancillary Services capacity through the submission of an economic bid. As discussed above in part II.C.iii above, the bid validation system will generate the real-time market bids on the IFM awarded configuration using the Proxy bids if these requirements are not met.

F. Resource Adequacy Requirements

The ISO Tariff includes a number of requirements that enable the ISO to implement must-offer obligations for resources that are contractually bound for resource adequacy requirements either under the CPUC program or specific LRAs. The resource adequacy rules in Section 40 of the ISO Tariff are not impacted by the integration of Multi-Stage Generating Resources. Therefore, the ISO is not proposing to modify any of the resource adequacy program rules. However, the ISO is proposing certain modifications to its existing market rules to ensure that Multi-Stage Generating Resources that are subject to such contractual resource adequacy requirements meet their offer obligations through their participation in the ISO markets.

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[39] Section 8.1 specifies that the ISO procures the five following categories of ancillary services: "(i) Regulation Up and Regulation Down, (ii) Spinning Reserve, (iii) Non-Spinning Reserve, (iv) Voltage Support, and (v) Black Start capability."

The ISO proposes that in order to meet their must-offer obligations as required for all Generating Units and Dynamic Resource-Specific System Resources under Section 40 of the ISO Tariff, Scheduling Coordinators for Multi-Stage Generating Resources must offer at least one MSG Configuration into each the day-ahead and real-time markets. If a Multi-Stage Generating Resource with a must-offer obligation does not offer in a configuration that can fulfill the offer obligation, or only submits a bid that partially meets their offer obligation the ISO will insert a Default Energy Bid and $0 Ancillary Services Bid for the Default MSG Configuration designated by the Scheduling Coordinator, as discussed above. The process for validating the Scheduling Coordinator's fulfillment of the Resource Adequacy must-offer obligation will be based on the generation capacity bid in for a specific MSG Configuration. The validation will not be based on the increment of generating capacity that can be provided by an MSG Configuration.

G. Settlements and Cost Recovery for Multi-Stage Generating Resources

The introduction of the Multi-Stage Generating Resource modeling approach does not require any changes to the way energy is settled for any resource supplying power or any other service supply resources provide the ISO market. Scheduling Coordinators for Multi-Stage Generating Resources providing energy at specific locations will be paid for their energy schedules in the day-ahead market and the energy the produce in response to dispatches in the real-time through the Locational Marginal Price at their respective pricing nodes. Similarly, Scheduling Coordinators will be compensated in exactly the same way they are compensated for any Ancillary Service provided by any other Generating Unit or Dynamic Resource-Specific System Resource through the Ancillary Services Marginal Price at their respective locations. Therefore, the ISO proposes no changes to the energy and ancillary services market settlement provisions reflected in Sections 11.2 and 11.5.

In addition to compensation for the energy and ancillary services provided, if committed by the ISO in any of the market runs, supply resources are also compensated for their commitment costs, which include start-up and minimum load costs, and if they the ISO's schedules or dispatches takes the supply resource off their submitted energy bid curve, the bid cost recovery mechanism also ensures such resources are kept whole by guaranteeing their submitted energy bid price. Under the ISO Tariff, both the energy bid price guarantee and the commitment cost recovery mechanism is accomplished through the bid cost recovery mechanism provided in Section 11.8 of the ISO Tariff. The introduction of Multi-Stage Generating Resources into the ISO markets requires modifications to the Bid Cost Recovery mechanism to account for the possible commitment of

Multi-Stage Generating Resources in multiple MSG Configurations in the various markets.

i. Determination of ISO Market Commitment Periods To Determine The Applicable Commitment Costs

Under the current market design, the commitment and bid costs are recovered through the bid cost recovery mechanism. The bid cost recovery mechanism reflected in Section 11.8 performs several calculations in order to determine how the commitment and bid costs are recovered by the responsible Scheduling Coordinator and then to determine to whom these commitment and bid costs are allocated. With respect to how the commitment and bid costs are determined, the ISO applies a series of rules that determine for any given market interval whether the commitment costs for the IFM/RUC or real-time market apply. This determination is necessary because in any given trading hour, the resource may be committed in part by the IFM, RUC or the real-time market. Scheduling Coordinators are permitted to submit separate commitment costs for the various markets. But because Scheduling Coordinators should only recover one set of commitment costs for a given trading hour, the first task is to determine which commitment period (*i.e.*, IFM/RUC or real-time market Commitment Period) the ISO will select, which carries with it the commitment costs that will be applied. It is important to note also that if a resource is self-committed, *i.e.,* the Scheduling Coordinator submitted a self-schedule in the applicable trading hour, the resource is not eligible for commitment cost recovery. How these commitment periods are determined for all Generating Units and Dynamic Resource-Specific System Resources are reflected in Section 11.8.1 of the ISO Tariff.

The introduction of the Multi-Stage Generating Resource functionality requires that these rules be further supplemented to account for the fact that in any given Trading Hour not only can a given Multi-Stage Generating Resource have commitments from the various ISO markets, but also they may be committed in different MSG Configurations as they are processed through the various markets. Scheduling Coordinators will be permitted to submit start-up and minimum load costs by MSG Configuration. In addition, as explained further below, Scheduling Coordinators will be permitted to submit Transitions Costs, which are intended to enable the Scheduling Coordinator to recover the costs of transitioning from one MSG Configuration to another.

Therefore, the ISO developed a series of rules that enables the ISO to determine which ISO commitment period will apply and accordingly, which commitment costs will be paid for in a given trading hour. Because the MSG Configurations are essentially modeled as individual generators in the market optimization, and re-aggregated for the purpose of settlements, it is essential to alter the bid cost recovery calculation methodology for Multi-Stage Generating

Resources. Otherwise, it is possible that an MSG Configuration for a given Multi-Stage Generating Resource recovers one set of commitment costs and then, because of a commitment by the ISO in a different MSG Configuration in a subsequent interval, the resource recovers the set of commitment costs associated with the different MSG Configuration. If the standard BCR calculation methodology were not modified and the ISO ignores the MSG Configuration commitments in calculating the commitment costs, there would be significant over-payment of eligible commitment costs to resources.

Accordingly, in new Section 11.8.1.3, the ISO proposes a series of rules to determine the applicable commitment period and Start-Up, Minimum Load and Transitions Costs. First, in any given Settlement Interval, the ISO will determine the applicable Start-Up Cost, Minimum Load Cost, and Transition Cost as between the IFM/RUC and the real-time market for the Multi-Stage Generating Resources. The ISO will determine which Commitment Period applies for the given interval. This determination is important in considering both which commitment costs apply and to which commitment period the costs will be assigned so that they are applied to the appropriate market for purposes of allocating the cost of paying these commitment costs. The ISO proposes the following rules for determining whether the IFM/RUC commitment period applies (*i.e.*, the commitment costs are assigned to the IFM/RUC allocation buckets) or the real-time market commitment period applies (*i.e.*, the commitment costs are assigned to the real-time market allocation bucket.[40]

(a) If the Multi-Stage Generating Resource is either self-committed or committed by the ISO in the IFM and/or RUC in MSG Configuration(s) that are different than the MSG Configuration committed by the ISO in the RTM, then the ISO will apply the RTM CAISO Commitment Period and the RTM Start-Up Cost, Minimum Load Cost, and Transition Cost.

(b) If the Multi-Stage Generating Resource is committed by the ISO in the IFM and/or RUC and subsequently the resource is self-committed in the RTM in any MSG Configuration, the ISO will apply the IFM CAISO Commitment Period and/or RUC CAISO Commitment Period MSG Configuration(s) and the IFM/RUC Start-Up Cost, Minimum Load Cost, and Transition Cost.

(c) If the Multi-Stage Generating Resource is committed by the ISO in the IFM and/or RUC in an MSG Configuration that is the same as the MSG Configuration committed by the ISO in the RTM, the ISO will apply the IFM/RUC

[40] The only proposed changes that impact the existing bid cost recovery uplift allocation rules proposed in this filing are in these upstream rules to determine in which bucket these MSG Configuration costs will be assigned. Once the ISO has assigned the costs to the appropriate commitment periods, the uplift calculations and the allocation provisions in Section 11.8.6 are unaffected by the introduction of the Multi-Stage Generating Resource functionality.

Commitment Period and the IFM/RUC Start-Up Cost, Minimum Load Cost, and Transition Cost.

(d) If the Multi-Stage Generating Resource is self-committed in the IFM and RUC in the same MSG Configuration(s) as it is then committed by the ISO in the RTM, then the ISO will apply the RTM CAISO Commitment Period and the RTM Start-Up Cost, Minimum Load Cost, and Transition Cost.

Subsequently, if there is only an IFM and RUC commitment (self-commitment or committed by the ISO), the ISO will then apply the following rules to determine whether the IFM or RUC commitment period applies and which commitment commitment cots apply.

(a) If the resource is either self-committed or committed by the ISO in the IFM in an MSG Configuration that is different than the MSG Configuration committed by the ISO in RUC, then the ISO will apply the RUC CAISO Commitment Period and the RUC Start-Up, Minimum Load Costs.

(b) If the resource is committed by the ISO in the IFM in an MSG Configuration that is the same as the MSG Configuration either self-committed or committed by the ISO in RUC, then the ISO will apply the IFM CAISO Commitment Period and the IFM MSG Configuration Start-Up, Minimum Load, and Transition Costs.

These rules reflect the ISO's policy established with stakeholders that the ISO only pay commitment costs (including transition costs) associated with the Real-Time Market except if: a resource self-schedules energy and/or self-provides ancillary services in the real time, then IFM commitment costs (including transition costs) would be recovered; or if a unit is not taken in the real-time market, then day-ahead commitment costs would be used for the commitment cost calculation for that hour.[41] As discussed in Mr. Zhou's testimony, these rules ensure that the settlement of a Multi-Stage Generating Resource's commitment costs are settled and allocated to reflect the fact that consistent with the pseudo-plant modeling approach these costs are settled per the resource's configurations committed by the ISO market.

ii. Commitment Costs for Multi-Stage Generating Resources

Under the current market design, resources committed by the ISO that are not under a Resource Adequacy requirement, recover their commitment costs

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[41] *See* CAL. INDEP. SYS. OPERATOR CORP., MODELING OF MULTI-STAGE GENERATING UNITS at 6, (2009), *available at* http://www.caiso.com/23a8/23a8e0d123ea0.pdf. (draft final proposal prepared for decision by the CAISO Board of Governors Meeting – May 18-19, 2009).

based on their bid-in start-up and minimum load costs.[42] In the case of Multi-Stage Generating Resources, the ISO proposes to continue to apply the same recovery mechanisms for start-up and minimum load and provide the opportunity to now recover the costs associated with transitioning from one MSG Configuration to another.[43] In operating the ISO markets, the ISO will consider the cost of transitioning from one MSG Configuration to another in its market optimization. These same costs submitted in the Multi-Stage Generating Resource's four part bids will be used for settlement purposes. Therefore, the ISO proposes to include in Section 11.8.1.3 the ability to recover transition costs.

In addition, the ISO proposes certain specific rules that will apply in the calculation of the start-up and minimum load costs for Multi-Stage Generating Resources. In the case of start-up costs, the ISO proposes that these costs apply on the basis of the MSG Configuration committed by the ISO. Because of the pseudo-plant modeling approach, the start-up costs for each MSG Configuration are modeled as individual plant start-up costs. Therefore, each MSG Configuration is afforded a specific start-up cost. Without this modification, one start-up cost would apply to all the MSG Configurations, which would eliminate the level of granularity in the optimization sought by the modeling approach adopted for Multi-Stage Generating Resources.

In addition, in arriving to the minimum load energy necessary to determine when the start-up actually occurs within an interval for all Generating Resources or Dynamic Resource-Specific System Resources, the ISO verifies in what interval in any given trading hour the actual metered energy from the generator increases from below the minimum load energy level to above. In any given trading hour, the generating unit is paid the start-up costs from that interval on. In the case of Multi-Stage Generating Resources, the ISO proposes to make this determination based on the minimum load energy for the ISO committed MSG Configuration. This is because Multi-Stage Generating Resources can have different minimum load energy and startup cost for different configurations. In a typical scenario, a higher minimum load energy and higher startup cost is associated with a higher configuration. Evaluation based on the minimum load energy of a given configuration for that configuration's startup will give the appropriate treatment for the MSG resource. Accordingly, the ISO proposed amendments to Section 11.8.2.1.1, 11.8.3.1.1, and 11.8.4.1.1 to reflect these

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[42] Start-Up and Minimum Load costs can be bid-into the ISO markets in the three part bids based on the registered costs which can be either based on the registered or proxy-cost option. The commitment cost options is not affected by the introduction of the Multi-Stage Generating resources. Therefore, no changes are proposed for sections 30.4.

[43] As discussed below, in this filing the ISO is not proposing modifications to its tariff to provide for how the transition costs will be calculated because at the time of this filing the ISO has not yet completed the stakeholder process to develop this policy. However, in this filing the ISO proposes to include in the bid-cost recovery mechanism the ability to recover the transitions costs, no matter how ultimately they will be determined.

specific rules that apply for start-up costs in the IFM, RUC and real-time market, respectively.

Similarly, in the case of minimum load energy, the ISO also proposes to apply all the same rules it applies to all generating units to determine the minimum load costs in any given interval with the one modification for Multi-Stage Generating Units to specify that their minimum load costs will be based on the ISO committed MSG Configuration minimum load costs.

iii. Recovery of Energy, Residual Unit Commitment, and Ancillary Services Bid Costs

Under the current market design, resources that submit economic bids are guaranteed their energy bid price in the event that the LMP cleared through the market for the interval in which they are dispatched or committed is not adequate to cover their bid price. Similarly, Scheduling Coordinators are guaranteed their Ancillary Services bid price and the RUC Availability Bid price in the event that that the Ancillary Services Marginal Price and RUC Price cleared through the markets does not cover these respective bid prices. All of these bid costs are also recovered through the bid cost recovery mechanism reflected in Sections 11.8.2.1.5, 11.8.2.1.6, 11.8.3.1.3, 11.8.4.1.5 and 11.8.4.1.6 of the ISO Tariff. These same principles will apply for Multi-Stage Generating Resources and the only requirement for Multi-Stage Generating Resources

iv. Market Revenues Calculation

Once the ISO has calculated the total commitment and bid costs for each of the markets, the ISO nets out the commitment and bid costs shortfalls to the market revenues obtained by the Scheduling Coordinator in each market based on the total revenue collected. This is done to ensure that to the extent the Scheduling Coordinator's market revenues cover their bid costs and commitment costs, the Scheduling Coordinator is not again compensated for the same costs for which it has already recovered.[44] This market revenue netting process will also apply to Multi-Stage Generating Resources. Because the total bid cost recovery mechanism applies to the individual Multi-Stage Generating Resource, it is necessary that the net revenue calculation for a Multi-Stage Generating Resource for any given trading hour be performed at the plant-level. The plant-level market revenues are themselves informed by the configuration-level costs for the Multi-Stage Generating Resource.

H. Rescission of Payments for AS and RUC

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[44] *See* Sections 11.8.2.2, 11.8.3.2 and 11.8.4.2 of the ISO Tariff.

Under the current market design, supply resources that are awarded ancillary services or RUC capacity shall actually be able to provide energy from the procured ancillary service. If the ISO determines that the resource is not capable of fulfilling its awarded ancillary services or RUC because based on its metered energy it is ultimately not able to actually provide the energy if required, the ISO will rescind any payment owed to the affected resource for the awarded service. This mechanism is necessary to ensure Scheduling Coordinators are paid for the ancillary services or RUC capacity actually provided consistent with their award. The ISO conducts this verification for whether the energy is undeliverable, undispatchable or unavailable for ancillary services and for RUC capacity whether it is undispatchable and undeliverable for RUC capacity.[45] As discussed further below, the ISO proposes to continue to apply the same rules to Multi-Stage Generating Resources, but with some modifications to account for the fact that these resources can be awarded ancillary services or RUC for a given MSG Configuration.

For the purposes of determining whether the ancillary services capacity is undispatchable, *i.e.*, the resource's awarded capacity cannot be dispatched for energy, the ISO determines the resource's ability in the real-time to deliver energy from the awarded Ancillary Services capacity or Self-Provided Ancillary Services capacity based on the resource's maximum operating capability, actual telemetered output, and Operational Ramp Rate.[46] This determination will remain essentially the same, except that the ISO will make this determination for Multi-Stage Generating Resources based on the MSG Configuration-specific maximum operating capability and the Operational Ramp Rate. This change is reflected in the proposed changes to Section 8.10.8.1. Similarly, for the purposes of determining whether the resource's awarded spinning and non-spinning reserve capacity is unavailable, the ISO determines whether the Scheduling Coordinator has supplied Uninstructed Imbalance Energy to the ISO during the applicable interval. This same rule will apply for Multi-Stage Generating Resources with the qualification that the ISO will determine whether the resource supplied Uninstructed Imbalance Energy using the MSG Configuration-specific maximum operating capability. This is reflected to the proposed changes to Section 8.10.8.2. With respect to the method for determining whether the resource is undelivered, the ISO simply looks at whether the resource fails to supply Energy from the ancillary services spinning reserve or non-spinning reserve capacity in accordance with a Dispatch Instruction. This will remain the same for Multi-Stage Generating Resources and therefore no changes are proposed to Section 8.10.8.3.

The ISO also validates whether the RUC capacity is undelivered or undisptachable using these same methods. The ISO again proposes minor

[45] *See* Sections 31.5.7.1 and 31.5.7.2 of the ISO Tariff, respectively.

[46] *See* Section 8.10.8.1 of the ISO Tariff.

modification to this method to reflect that for the Multi-Stage Generating Resources awarded RUC capacity, the ISO will evaluate whether they are undelivered or undispatchable based on the MSG Configuration. These changes are reflected in the proposed changes to Sections 31.5.7.1 and 31.5.7.2.

i. Outages

In this filing the ISO does not propose any changes in the outages reporting requirements, but does propose that the outages reporting requirements for Multi-Stage Generating Resources apply at the configuration level for each Multi-Stage Generating Resource. The ISO proposes to add this additional requirement in Section 9.7.

III. IMPLEMENTATION DEPENDENCIES

A. Earlier Implementation of Registration and Qualification Process

For the purposes of ensuring Generating Units and Dynamic Resource-Specific System Resources if they so intend are ready to reliably participate in the ISO markets as Multi-Stage Generating Resources when this proposal becomes effective, it is necessary to begin registration and qualification process no later than August 2, 2010. These provisions are necessary to ensure that the ISO and Scheduling Coordinators are prepared to successfully begin market operations as Multi-Stage Generating Resources in October. As discussed in Mr. Alarian's testimony, to ensure that the ISO market software and processes are prepared to support the Multi-Stage Generating Resources at go live, it is important to determine the number of resources that will be participating prior to go live and ensure that all the resources are adequately and accurately registered.[47] A last minute rush of requests to register resources as Multi-Stage Generating Resources just prior to go live could jeopardize as successful launch for all resources that intend to operate as Multi-Stage Generating Resources as of the start. In addition, during the months of August and September the ISO will be conducting market simulation activities to test the performance of the necessary enhancements to software and its procedures to accommodate Multi-Stage Generating Resources. These market simulation opportunities will provide market participants and the ISO an opportunity to test their performance using the new functionality. The ISO believes the early registration process will ensure that participants test their ability to participate as Multi-Stage Generating Resources. Accordingly, the ISO proposes that the provisions in Appendix AA containing the same registration and qualification requirements reflected in proposed Section 27.8.3 are made effective as of August 2, 2010, to require and enable Scheduling Coordinators and the ISO to undertake the necessary steps towards go live.

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[47] Exhibit No. ISO-3 at 17.

Proposed Appendix AA contains the same registration and qualification requirements for Generating Units and Dynamic Resource-Specific System Resources that intend to qualify and participate in the ISO Markets as Multi-Stage Generating Resources as are reflected in Section 27.8.3 as described above in II.B.iii above. The ISO proposes that no later than fifty eight days prior to go live, Scheduling Coordinators that intend to register and qualify Generating Units or Dynamic Resource-Specific System Resources as Multi-Stage Generating Resources as of the start of the new functionality must commence the registration process for their resources. The registration process commences with the submission by the responsible Scheduling Coordinator of the completed MSG registration form and the resource data template for Generating Unit or Dynamic Resource Specific System Resource, which the ISO provides as part of the registration process and are available on the ISO website. The registration and qualification process will be as described above and also reflected in Section 27.8.3.

To ensure that there is sufficient certainty regarding the nature of resources that will go live as Multi-Stage Generating Resources the ISO proposes to freeze any changes to any of the Multi-Stage Generating Resource's attributes thirty days before the start of market operations with Multi-Stage Generating Resources functionality, except that the resources can drop out Multi-Stage Generating Resource status. In addition, the ISO proposes that resources that are not registered and qualified as Multi-Stage Generating Resources cannot register as such until after forty-five days after go live. The ISO proposes that resources that are registered as Multi-Stage Generating Resources may withdraw from their Multi-Stage Generating Resource status and may modify the non-salient Multi-Stage Generating Resource attributes at any time, as described in proposed Appendix CC and in proposed Section 27.8.3. However, the ISO proposes to prohibit the changes to the fundamental attributes also listed in proposed Section 27.8.3 until after the 45th day after the start of this new market functionality.

Finally, as reflected in the modifications proposed for Section 9.7, Multi-Stage Generating Resources must submit outages information taking into consideration the MSG Configurations. Therefore, it is important that prior to the start of market operations with the Multi-Stage Generating Resource functionality that the ISO receive any outages information consistent with the registered MSG Configurations for such resources. The ISO proposes that this information be provided no later than forty-eight hours prior to the start of the first hour of the effective date market operations with this new functionality.

B. Determination of Transition Costs

As discussed above, the current proposal includes the opportunity for Scheduling Coordinators to recover costs associated with the Multi-Stage Generating Resource transitioning from one configuration to another but does not yet include a complete proposal for determining how the transition costs will be formulated. As discussed in Ms. Biedler's testimony, the transition costs principle has been an element of the Multi-Stage Generating Resource proposal from the early stages of the policy development and was widely supported by stakeholders.[48] Like other commitment costs, the right to recover transition costs is tied to the ISO's commitment of resources as are start-up and minimum load costs. In other words, resources that self-commit do not recover their commitment costs through the market because for whatever reason, they have made a decision not to submit economic bids and rely on an ISO commitment. In addition, as discussed above the Multi-Stage Generating Resource functionality will enable Scheduling Coordinators to bid in the various MSG Configurations separately. Therefore, the ISO market will determine the optimal MSG Configuration in which the resource should operate, and will optimize the transitions between MSG Configurations. Each transition has an associated transition cost which market optimization will consider when determining whether or not to move a Multi-Stage Generating Resource from one configuration to another. If left unbounded, just as high start-up and minimum load costs could be used to economically withhold from the market, a Scheduling Coordinator for a Multi-Stage Generating Resource could economically withhold one or more of the resource's configurations by simply specifying high transition costs for the transition from one configuration to another.

Because the ISO has not yet completed the stakeholder process to determine how transition costs will be determined, the ISO is not proposing any changes at this time for that purpose. As discussed in Ms. Biedler's testimony, this stakeholder process is scheduled to complete in July, at which time the ISO plans to take its final proposal to its Board of Governors for approval.[49] Shortly after that, the ISO will file any necessary tariff amendments to incorporate those elements. However, the Commission can rule on the proposed amendments contained in this filing without those changes because the policy being developed in that proceeding will not impact any of the elements of the proposal filed today. The only elements of Transition Costs for which the ISO seeks Commission-approval in this filing pertain to the policy items:

- The ISO has established through the stakeholder process that the Transition Costs will be included as other commitment costs such as start-up and minimum load costs and that for the purpose of determining eligibility for for such costs, that the ISO will use the Bid Cost Recovery

[48] Exhibit No. ISO-1 at 18-20.

[49] Exhibit No. ISO-1 at 20.

mechanism reflected in Section 11.8 as it does for start-up and minimum load costs; and

- The ISO will consider Transition Costs in the clearing of the IFM, RUC and real-time market as reflected in Sections 31.3, 31.5, 34.

As explained in Ms. Biedler's testimony, the changes arising out of the pending stakeholder process are not likely impact these provisions.[50]

The ISO has also extracted certain elements of the transition costs methodology that, while they have been developed and are ripe for Commission's consideration, are too closely intertwined with the overall methodology for determining the transitions costs are better addressed when the Commission considers the final proposal on the determination of transitions costs. The ISO has also established that within the eligible commitment period defined as the ISO commitment period related to the MSG Configuration *into* which the Multi-Stage Generating Resource is transitioning, only the settlement intervals into which the resource reached the Pmin of the target MSG Configuration will be eligible for recovery of the Transition Costs. In calculating this eligibility, the ISO proposes to apply a three-percent (or 5 MW, whichever is greater) tolerance band around the resource's operating level when determining whether or not the resource has achieved the Pmin of the target MSG Configuration.[51] However, the ISO does not seek approval of this element of the proposal at this time because it is closely related to the formulation transitions costs. The ISO will include these features in its upcoming filing in July seeking approval of any necessary tariff changes for the determination of transition costs.

The ISO recognizes that this filing could have been delayed until the ISO had completed the pending transition costs stakeholder process and filed the two proposals together. But the need for early effectiveness of the registration and qualification rules discussed above makes it necessary for the ISO to request approval of the Multi-Stage Proposal at this time. Had the ISO delayed the filing further it would become necessary to request a waiver of the sixty day notice requirements for early effectiveness of the registration requirements. Because as discussed in Ms. Biedler's testimony, the elements of Transitions Costs that are currently under consideration in the pending stakeholder process are not

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[50] Exhibit No. ISO-1 at 21.

[51] The tolerance band will be determined at the resource level, *i.e.*, it will be based on the resource's Pmax. Without this tolerance band, a unit that transitions from one configuration up to the Pmin of another configuration could otherwise end up not being paid at all for intervals in which it was running slightly under the target MSG Configuration's Pmin. Note that energy not delivered will not be paid; the tolerance band merely ensures that MSG units are not unduly penalized for small variations in metered values on the edges of their configurations' operating ranges.

expected to alter the transition costs elements the ISO is seeking approval in this filing, delaying the filing to obtain the final package is not necessary.[52]

C. Use Of Multi-Stage Modeling Approach In Future Enhancements

The proposed application of the multi-stage modeling approach to model generating resources fulfills the Commission's directive in the September 21, 2006 order accepting the ISO's new LMP-based market design. Moreover, the ISO submits that software enhancements necessary to adopt the new functionality for generating units will better position the ISO as it seeks to enhance the participation of other non-generation resources in its markets. The Multi-Stage Generating Resource functionality is implemented by adopting a modeling approach that provides the ability to inform the market optimization of the multiple variables associated with resources that can operate in multiple operating modes. As explained in Mr. Alarian's testimony, this modeling approach can be expanded to be applied to non-generation resources such as pumped storage hydro-resources and other energy storage facilities.[53] For example, it will be feasible to expand the multi-stage modeling approach to enable the ISO market processes to consider the multiple pumping configurations of pumped storage hydro facilities. Similar to generation resources such as combined-cycle resources, pumped storage facilities can pump in different load operating modes. The model proposed herein for generating units can be adapted to reflect the the discrete load operating modes in pumping for aggregated pumped storage hydro resources and aggregated pump resources. Such resources consist of both generation resources that can supply energy as well as demand resources that can be curtailed for service. As such, the multi-stage modeling approach would enable the ISO to model the generating configurations and pumping configurations as one for the same resource. Now that the ISO has complied with the Commission's order to make this functionality available for generation resources, the ISO is exploring this possibility with stakeholders through a new stakeholder process to determine the interest in, and feasibility of, adapting the multi-stage modeling approach for the modeling of pumped storage hydro facilities. However, the actual adoption of the multi-stage modeling approach or pumped storage hydro will require further stakeholder discussions to ensure its feasibility and develop the proper market procedures to support such an application.

IV. STAKEHOLDER PROCESS

The stakeholder process used in developing the Multi-Stage Generating Resource functionality proceeded in three parts: (1) policy development; (2) implementation planning; and (3) tariff drafting.

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[52] Exhibit No. ISO-1 at 21.

[53] Exhibit No. ISO-3 at 20-21.

The policy development stakeholder process began in November 2008, with the posting of an initial issue paper. This issue paper discussed the challenges posed by Multi-Stage Generating Resources and the potential methods of addressing those challenges. That initial issue paper was followed by a stakeholder conference call and written comments from stakeholders. In February 2009, the ISO released a straw proposal, which was again followed by a stakeholder call and written comments. Based on stakeholder feedback, the ISO released a revised straw paper in April 2009, with the customary stakeholder conference call and written comments following. The stakeholder policy development process concluded in May 2009, when the ISO's Governing Board approved the policy for the Multi-Stage Generating Resource functionality.

Since receiving Board approval, the ISO has held even more extensive post-policy development meetings to discuss implementation details. Most recently, on April 20, 2010, the ISO held an implementation meeting. At this meeting, no major stakeholder concerns were raised. This phase of stakeholder engagement is ongoing, as the ISO continues to be in contact with stakeholders regarding implementation details.

The tariff stakeholder process began in March 2010, when the ISO released a first draft of the tariff amendments needed to implement the Multi-Stage Generating Resource functionality. The ISO solicited written comments and held a stakeholder conference call on April 9, 2010 to discuss the proposed tariff language. Towards the end of April, the ISO posted a second draft of the proposed tariff language and again solicited stakeholder comment. Based on stakeholder feedback, the ISO released a third draft of the proposed tariff language on May 6, 2010, followed by a second tariff conference call on May 14, 2010.[54]

The stakeholder process has proceeded remarkably smoothly, with stakeholders offering strong support for the ISO's decision to implement a multi-stage modeling approach, while also offering significant constructive feedback on policy design and implementation details. The ISO believes that the strength of the instant proposal is due, in large part, to its robust process of stakeholder engagement.

V. DESCRIPTION OF TARIFF CHANGES

Included with this filing in Attachment C is a table listing the proposed amendments as further discussed in this Transmittal Letter. These proposed changes were reviewed with stakeholders prior to this filing as discussed above.

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[54] All tariff comments submitted to the ISO with the ISO's answers can be found at: http://www.caiso.com/2796/2796a0e214c80.pdf.

The ISO also includes in Attachment C a column describing any incremental changes made to the proposed tariff sheets after the last posting. These incremental changes were made to clarify the language, conform the usage of terms, and eliminate unnecessary redundancy. However, the ISO's incremental proposed changes after the proposed tariff sheets were last reviewed with stakeholders do not material alter the agreed upon tariff language to support the implementation of the Multi-Stage Generating Resource proposal.

VI. EFFECTIVE DATES

The ISO respectfully requests that the tariff amendments, contained in the instant filing, except for those in proposed Appendix AA, be made effective as of October 1, 2010. Accordingly, on September 30, 2010 will operate the day-ahead market for the October 1, 2010, trading day with the Multi-Stage Generating Resource functionality. On October 1, 2010, the ISO will conduct the real-time market for that same day with the Multi-Stage Generating Resource in place.

The ISO also requests that the tariff amendments contained in proposes Appendix AA be made effective as of August 2, 2010. As of that date, Scheduling Coordinators will have had to commenced the Multi-Stage Generating Resource registration process. However, the ISO will be accepting registration applications prior to August 2, 2010. This effectiveness date for their registration requirements will ensure the market's readiness for implementation of the Multi-Stage Generating Resources functionality.

VII. COMMUNICATIONS

Communications regarding this filing should be addressed to the following individuals. The individuals identified with an asterisk are the persons whose names should be placed on the official service list established by the Secretary with respect to this submittal:

Anthony Ivancovich*
Assistant General Counsel - Regulatory
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VIII. SERVICE

The ISO has served copies of this transmittal letter, and all attachments, on the California Public Utilities Commission and the California Energy Commission, and all parties with effective Scheduling Coordinator Service Agreements under the ISO Tariff, and all parties in Docket No. ER06-615. In addition, the ISO is posting this transmittal letter and all attachments on the ISO website.

IX. ATTACHMENTS

The following documents, in addition to this transmittal letter, support the instant filing:

Exhibit ISO-1 Prepared Direct Testimony of Gillian Biedler

Exhibit ISO-2 Prepared Direct Testimony of Li Zhou

Exhibit ISO-3 Prepared Direct Testimony of Hani Alarian

Attachment A Revised ISO Tariff Sheets – Clean

Attachment B Revised ISO Tariff Sheets – Blackline

Attachment C Table of proposed tariff changes and a description of changes to the Revised ISO Tariff Sheets since the last version posted for stakeholder review.

Attachment D Final Stakeholder Proposal for Multi-Stage Generating Resources

Attachment E California Board of Governors Memo on Multi-Stage Generating Resources

X. CONCLUSION

For the foregoing reasons, the ISO respectfully requests that the Commission approve this tariff revision as filed. Please contact the undersigned if you have any questions concerning this matter.

Respectfully submitted,

Anthony Ivancovich
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Attorneys for the California Independent System Operator Corporation

Exhibit ISO-1 Prepared Direct Testimony of Gillian Biedler

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

California Independent System Operator Corporation	**)** **)**	**Docket Nos. ER10-____-___**

PREPARED DIRECT TESTIMONY
OF
GILLIAN BIEDLER

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

California Independent System) **Docket No. ER10-____-___**
Operator Corporation)

PREPARED DIRECT TESTIMONY
OF
GILLIAN BIEDLER

I. INTRODUCTION

Q. Please state your name and business address.

A. My name is Gillian Biedler. My business address is 151 Blue Ravine Road, Folsom, California 95630.

Q. By whom and in what capacity are you employed?

A. I am employed as Senior Market Design & Policy Specialist in the Market & Infrastructure Development Department of the California Independent System Operator Corporation (ISO). As Senior Market Design & Policy Specialist, I am responsible for the development of market enhancements from a policy perspective. In this position, I have direct and recurring contact with stakeholders, and routinely make presentations at ISO stakeholder meetings on ISO policy and market design matters.

Q. Please describe your professional and educational background.

A. I joined the ISO in 2006 as a Market Monitoring Analyst. In this position, I worked to detect and analyze potential market manipulation. In 2007, I moved into my current position as Senior Market Design & Policy

Specialist. In this capacity, I design market enhancements and work through formal stakeholder processes to vet and refine those policies.

I received a Bachelor of Arts degree in Economics, with departmental honors, and a minor in Mathematics from the University of California, Irvine. I also received a Master of Science degree in Agricultural and Resource Economics from the University of California, Davis. In addition, I have completed all coursework and passed all qualifying exams for the Ph.D. program in Agricultural and Resource Economics at the University of California, Davis. My fields of concentration are Industrial Organization and Econometrics.

I have spent 15 years as an economist, during which time my work has focused primarily on the optimal use of renewable and non-renewable resources energy, transportation and land-use planning, and on electricity markets.

Q. Have you previously testified before the Commission?

A. No.

Q. What is the purpose of your testimony in this proceeding?

A. My testimony will focus on the following topics related to the development of the Multi-Stage Generating Resource functionality:

1. The impetus for developing the Multi-Stage Generating Resource functionality, including consideration of relevant Commission directives.

2. How Commission directives guided the substance of the Multi-Stage Generating Resource functionality.
3. The key design criteria that guided the Multi-Stage Generating Resource functionality stakeholder process.
4. The major design issues resolved in the initial stages of the stakeholder process that were outcome-determinative for later Multi-Stage Generating Resource functionality issues.
5. The issues and concerns stakeholders raised during the policy development and tariff stakeholder processes, along with how the ISO's proposal addresses those concerns.
6. The outstanding Multi-Stage Generating Resource functionality design issues and how the ISO plans to address them in the future.
7. The overall level of stakeholder support for the ISO's proposal.
8. How the proposal filed today, in particular the treatment of transition costs, relates to the pending ISO stakeholder process involving the bidding and mitigation of commitment costs.

Through this testimony, the most important point I would like to convey is that the final proposal is the product of significant stakeholder involvement and feedback. For this reason, I believe that the proposal the ISO is submitting to the Commission enjoys broad stakeholder support.

Q. What is the basis of your testimony?

A. In the fall of 2008, the ISO sought Commission approval to defer the implementation of the forbidden operating region functionality in the real-time market upon the launch of its new market design. Since that time, I have been the ISO lead on developing a market enhancement that enables better modeling of resources with forbidden regions and multiple operating modes. This has entailed researching possible solutions, preparing white papers describing those possibilities, leading stakeholders through discussions regarding those options, and the continuing refinement of the policy design based on the feedback of stakeholders. The research has been informed by Commission orders, the continual involvement of stakeholders, and by benchmarking against practices at other independent system operators and regional transmission organizations (ISO/RTOs).

II. THE IMPETUS FOR DEVELOPING THE MULTI-STAGE GENERATING RESOURCE FUNCTIONALITY

Q. Why is the ISO proposing a method for modeling Multi-Stage Generating Resources?

A. The immediate impetus was a Commission order from 2006 which mandated that the ISO implement combined cycle generating resource modeling within the first three years of operating its new market.[1]

[1] *Cal. Indep. Sys. Operator Corp.*, 116 FERC ¶ 61,274, P 573 (2006).

Aside from the Commission's directive, the ISO independently recognizes that the absence of a method for modeling combined cycles, and other units that are Multi-Stage Generating Resources, has some notable drawbacks. The inability to recognize the limitations on Multi-Stage Generating Resources creates a sub-optimal dispatch of resources and requires manual interventions, such as exceptional dispatch, to manage the resources. Those manual interventions often are undertaken to guard the resource from being dispatched in a manner that will damage the physical plant. For combined cycle gas turbine resources, the Multi-Stage Generating Resource functionality will allow much more accurate modeling by defining the different operating status of the gas turbines and steam turbines that compose the resource (*i.e.*, 1X1, 2X1, 2X2), and the feasible startup, shutdown and transition possibilities between those configurations. This reflects the natural operational flexibility of the combined cycle gas turbine resources. For other generating units with multiple operating ranges, which are usually large thermal generators that require the operation of auxiliary equipment, *e.g.*, feed water pumps or additional boilers, the Multi-Stage Generating Resource functionality will more accurately reflect the constraints imposed by the auxiliary equipment. Again, in order to protect these units from damaging, infeasible, or uneconomic dispatches, they are often self-scheduled, which means that the inherent flexibility of the resources has been lost to the ISO and the market as a whole.

In light of these issues, and given the Commission order mandating eventual implementation of combined cycle generating resource modeling, the ISO made the decision to pursue the “first best” solution to the problem rather than trying to refine an instrument which was not suited to the complexity of multi-stage resources.

Q. What positive consequences does the ISO expect to enjoy from successful implementation of the Multi-Stage Generating Resource functionality?

A**.** The ISO anticipates that the Multi-Stage Generating Resource functionality will create improvements for: (1) the market overall; (2) the ISO from a system operations perspective; and (3) owners and operators of the Multi-Stage Generating Resources.

Q. What advantages will the Multi-Stage Generating Resource functionality create for the market overall?

A. The ISO markets as a whole will benefit from the accurate modeling of Multi-Stage Generating Resources. Having flexible, often fast-ramping resources available to the market optimization will lower the need to commit and dispatch costlier resources.

Q. What advantages will the Multi-Stage Generating Resource functionality create from a systems operation perspective?

A. By instituting Multi-Stage Generating Resource functionality, the ISO market optimization will accurately dispatch these resources, which will help the ISO from a system operation perspective. Obviously infeasible dispatches are problematic. Extensive self-scheduling can also be problematic because it holds the output of the self-scheduled resource constant, which does not enable the ISO to dispatch the self-scheduled resource up or down in response to changing system conditions. Especially given the current and expected future increases in highly variable generation sources coming onto the grid, the ISO values the ability to accurately dispatch flexible Multi-Stage Generating Resources.

Q. What advantages will the Multi-Stage Generating Resource functionality create for the owners and operators of Multi-Stage Generating Resources?

A. The owners and operators of Multi-Stage Generating Resources currently have to manage the dispatch of their resources by re-rating the available output of their resources to keep the optimization from moving them back and forth across forbidden operating regions or between operating modes. Such switching can damage the physical plant. Since this is onerous and imperfect, many Multi-Stage Generating Resources are simply self-scheduled into the ISO markets at fixed output. This deprives the ISO and the market of their flexibility, and it means that Multi-Stage Generating Resources are not eligible for bid cost recovery nor can they set the locational marginal price. Enabling Multi-Stage Generating Resources to shift away from self-scheduling (and thus being price-takers) will also provide their owners and operators with the opportunity to be compensated appropriately for the responsiveness and flexibility their units provide to the market.

Q. Can you describe how the Multi-Stage Generating Resource functionality improves upon the forbidden operating region functionality?

A. The forbidden operating region functionality, which some may view as a partial solution to the complications posed by Multi-Stage Generating Resources, is a blunt instrument for incorporating Multi-Stage Generating Resources into the ISO's markets. Multi-Stage Generating Resources have more complex operating parameters than can be accounted for through the forbidden operating region functionality. For example, these units have minimum run times and minimum down times on either side of a forbidden range. These constraints exist because there is typically additional or different equipment and/or generating units that are involved in the various output ranges. In short, these different ranges are better treated by the market software as "logical generators" rather than treating the entire generating resource as a whole. The forbidden region functionality is such an incomplete solution that some operators of Multi-Stage Generating Resources rely on self-scheduling their units, rather than submitting economic bids. As a result, the ISO has lost the inherent flexibility that these resources can offer.

Q. Why is eligibility for the Multi-Stage Generating Resource functionality being limited to generators?

A. As discussed in the Mr. Zhou's testimony, eligibility for participating in Multi-Stage Generating Resource functionality initially will be limited to generators. Because the initial order mandating combined-cycle modeling, along with the 2009 order granting deferral of the forbidden operating region functionality for the real-time market,[2] discusses a multi-stage modeling approach in the context of its application to traditional thermal generating units, the ISO's effort from the start was on generation resources. As explained by Mr. Alarian in his testimony, it is possible to extend this modeling approach to other resources, such as pumped storage hydro-resources. Upon successful implementation of the Multi-Stage Generating Resource functionality, the ISO will consider how eligibility might be extended to those other resources.

Q. Why is the ISO choosing to implement the Multi-Stage Generating Resource functionality now when the compliance obligation was to do so within three years?

A. Several factors have resulted in Multi-Stage Generating Resource functionality implementation receiving a higher priority from the ISO:

1. A multi-stage modeling approach was identified by stakeholders as a high priority initiative in the 2008 market initiatives roadmap process.

[2] *Cal. Indep. Sys. Operator Corp.*, 126 FERC ¶ 61,081 (2009).

2. When the ISO's new market began, the forbidden operating region functionality for the real-time market was suspended due to system performance concerns. This suspension prompted consideration of accelerating Multi-Stage Generating Resource functionality, which was thought at the time to alleviate concerns with the absence of forbidden operating region functionality for the real-time market.

III. THE MULTI-STAGE GENERATING RESOURCE POLICY STAKEHOLDER PROCESS

Q. What process did the ISO follow in developing the Multi-Stage Generating Resource functionality?

A. Policy development began in November 2008 and proceeded through April 2009. The development process included:

1. Benchmarking analysis of other ISOs and RTOs, including ERCOT, PJM, and NYISO;
2. Extensive discussions with generation unit owners and other stakeholders in public stakeholder meetings and conference calls, along with individual conversations as follow-up to issues raised in stakeholder meetings; and
3. Coordination with software vendors and internal stakeholders to balance policy and implementation constraints.

The ISO's Governing Board approved Multi-Stage Generating Resource functionality at its May 2009 meeting. Since receiving Board approval, the

ISO has held even more extensive post-policy development meetings to discuss implementation details. Most recently, on April 20, 2010, the ISO held an implementation meeting. At this meeting, no major stakeholder concerns were raised.

Q. What were the key events in the policy stakeholder process?

A.

DATE	EVENT
November 7, 2008	Issues paper posted
November 14, 2008	Stakeholder conference call
November 21, 2008	Stakeholder comments due
February 17, 2009	Straw Proposal posted
February 25, 2009	Stakeholder conference call
March 4, 2009	Stakeholder comments due
April 13, 2009	Revised Straw Proposal posted
April 17, 2009	Stakeholder conference call
April 24, 2009	Stakeholder comments due

Q. What key design criteria guided the Multi-Stage Generating Resource functionality stakeholder process?

A. The ISO's initial issue paper, [3] the release of which initiated the stakeholder process, identified what the ISO saw as three key design principles. They were that Multi-Stage Generating Resource functionality should:

[3] CAL. INDEP. SYS. OPERATOR CORP., MODELING OF MULTI-STAGE GENERATING UNITS, (2008), *available at* http://www.caiso.com/2078/2078fe23684e0.pdf (issue paper prepared for decision on a stakeholder call – November 14, 2008).

1. Achieve the goal of more accurately modeling the operating parameters of Multi-Stage Generating Resources so that resources will be economically and feasibly dispatched and so that the market can benefit from their increased participation in the market.
2. Address the unique bid cost recovery issues posed by Multi-Stage Generating Resources' various operating configurations, including the costs associated with transitioning from one configuration to another.
3. Balance implementation feasibility and costs for stakeholders and the ISO, keeping in mind the magnitude of the potential issue and the Multi-Stage Generating Resource functionality work already completed by other ISOs and RTOs.

Stakeholders largely agreed with these design principles, which have been carried through policy development, implementation planning, and tariff drafting.

Q. Along with these design principles, were any other major modeling design issues resolved in the initial stages of the stakeholder process that were outcome-determinative for later Multi-Stage Generating Resource functionality development and implementation?

A. The most important initial policy decision resolved through the stakeholder process was the determination that the ISO would implement a pseudo-plant, as opposed to a pseudo-unit, modeling approach. Related to this decision was the determination that Multi-Stage Generating Resources would be permitted to bid in multiple configurations.

Q. Can you explain the difference between the pseudo-plant and the pseudo-unit modeling approaches?

A. A pseudo-plant approach treats various configurations of a Multi-Stage Generating Resource as distinct units, allowing the Scheduling Coordinator to bid these configurations, or pseudo-plants, into the market independently. The market optimization chooses which configuration, if any, is part of the optimal solution. In this type of model, the configurations are mutually exclusive, which means that only one configuration can be chosen by the optimization. This is the modeling approach ERCOT will use once it implements its nodal market design.

A pseudo-unit approach divides resources into mutually exclusive aggregations that may include portions of an embedded unit. For example, a 3 x 1 combined cycle generating unit would be modeled as three separate pseudo-units. Each of the three pseudo-units would be one gas turbine plus one third of a steam turbine. The pseudo-unit approach has been adopted by PJM and NYISO.

Q. Why did the ISO choose the pseudo-plant approach?

A. The pseudo-unit approach is less than ideal because such a model requires market participants to assign costs and operating parameters to pseudo-units, which is not necessarily intuitive or accurate. In addition to assigning costs to such a pseudo-unit, resource owners would need to provide operating constraints for them. No stakeholder comments reflected a preference for the pseudo-unit model. Rather, they expressed a clear preference for the pseudo-plant model since it offers a more flexible and realistic method of reflecting a Multi-Stage Generating Resources' operating characteristics.

Q. What were the consequences from selecting the pseudo-plant approach?

A. This was a fundamental policy decision and influences the whole of the Multi-Stage Generating Resource functionality's design and implementation. As explained in the Mr. Zhou's testimony, this decision is key both to how Multi-Stage Generating Resources bid into the ISO's markets and to how the ISO considers those bids in the market optimization.

Q. What does it mean to say that the ISO determined that Multi-Stage Generating Resources would be permitted to bid in multiple configurations?

A. Once the ISO determined that it would follow the configuration-based pseudo-plant approach, it then had to determine whether Multi-Stage Generating Resources would be able to bid in multiple configurations per market interval or be limited to bidding only one configuration.

The ISO initially proposed to limit each Multi-Stage Generating Resource to bidding only one configuration for each market interval. However, stakeholders raised the objection that limiting Multi-Stage Generating Resources' participation in this way would not permit the ISO markets to fully utilize the flexibility of such units. Together with its vendor, the ISO determined that a looser restriction on the number of configurations that can be bid into the real-time market would be feasible and would better achieve the intended benefits of the initiative.

Q. What are the consequences of this decision?

A. For Multi-Stage Generating Resources, the consequence is that they have significantly more flexibility in terms of how they can bid into the ISO's markets. As a result of this decision, the bidding rules applicable to Multi-Stage Generating Resources are significantly more complex than they otherwise would have been.

Q. Aside from the issues already discussed, what other major concerns and issues did stakeholders raise during the policy development process and how does the ISO's proposal respond to those concerns?

A. Stakeholders expressed the desire to specify a self-schedule in one configuration and still submit economic bids in additional configurations, and the ISO did not believe that this could be accommodated during the policy development. During the implementation phase, however, that flexibility turned out to be feasible and the ISO has adopted it.

Stakeholders also felt that the ability to bid more than three configurations into the real-time market was warranted. Again, this was at first thought infeasible, but upon further exploration, the ISO and its software vendor have determined that it is feasible to accommodate additional bids for configurations in the real-time market in the event that one or more of the resource's three real-time bids are taken up by IFM and/or RUC schedules. Overall, the stakeholder process was collaborative and did not involve any highly contentious issues. The technical nature of the subject, however, made discussion and examples of great importance to stakeholders. In particular, the topics of bid cost recovery, local market power mitigation, and outage reporting, required the ISO to provide examples to incite productive dialogue and provide clarity to stakeholders. Examples were provided as appendices to the various white papers, and/or were given in presentations. The stakeholder process included many discussions on the Multi-Stage Generating Resource functionality's implications for topics such as resource adequacy must-offer obligations, rules for self-schedules, the need to honor day-ahead schedules going into the real-time market, and the certification to provide ancillary services. Again, these discussions were collaborative and productive since the ISO and market participants alike were seeking a final policy design that would provide maximum functionality while being mindful of implementation challenges.

IV. ASSESSMENT OF STAKEHOLDER SUPPORT FOR THE ISO'S PROPOSAL

Q. What has been the stakeholder response to the ISO's proposed Multi-Stage Generating Resource functionality?

A. The response from stakeholders has been overwhelmingly positive, with stakeholders offering significant constructive feedback.

Q. In your opinion, to what can this general stakeholder response be attributed?

A. The ISO has solicited stakeholder input from the outset and has reflected that feedback in the policy design, implementation, and tariff drafting process associated with today's proposal. Additionally, more accurate modeling of combined cycle generating units, and other units qualifying as Multi-Stage Generating Resources, will not only provide benefits to the operators of such resources, but is also likely to create market-wide benefits. For this reason, the ISO believes that stakeholders have no reason to oppose the principles behind the Multi-Stage Generating Resource functionality.

V. <u>RELATIONSHIP OF THE MULTI-STAGE GENERATING RESOURCE FUNCTIONALITY TO THE ISO'S PENDING STAKEHOLDER PROCESS REGARDING FORMULATION AND MITIGATION OF COMMITMENT COSTS</u>

Q. Will Multi-Stage Generating Resources be eligible to recover costs incurred as a result of transitioning from one configuration to another?

A. Yes. The current proposal requests Commission approval of the general principle that such costs are recoverable through bid cost recovery and considered as part of the market optimization. The notion that Multi-Stage Generating Resources would recover their relevant commitment costs has been accepted as a key design parameter from the outset of the stakeholder process.

Q. Does the ISO's proposal include a complete description of how those costs will be determined?

A. No. This level of detail will be addressed in a later filing.

Q. Why is the ISO not addressing this issue now?

A. The ISO is currently engaged in a stakeholder process to address the manner in which commitment costs for all generating units are formulated and mitigated. The market software considers commitment costs as one of the parameters for which it optimizes. Mitigating such costs is important because if Scheduling Coordinators were free to submit unbounded costs, they could use such costs as a means of economically withholding a unit.

Transition costs are analogous to commitment costs in that the cost of transitioning from one configuration to another could be viewed as the costs of committing the configuration to which the unit transitions. Because transition costs are so similar to commitment costs, the ISO believes that it is appropriate to address the details of formulating transition costs as part of the current commitment costs stakeholder process.

Q. What is the current status of the commitment costs stakeholder process?

A. This stakeholder process is scheduled for completion in July. At that time, the ISO plans to take its final proposal to its Board of Governors for approval. Assuming that the Board approves the final policy proposal, the ISO will soon after file whatever tariff amendments will be necessary to implement the final policy outcome.

Q. Why did the ISO not delay the Multi-Stage Generating Resource functionality filing until the commitment costs stakeholder process was completed?

A. The ISO recognized that its Multi-Stage Generating Resource functionality filing could have been delayed until the completion of the commitment costs stakeholder process. However, the need for early effectiveness of the rules pertaining to Multi-Stage Generating Resource registration and qualification would have made a delay imprudent. This is especially so, considering that the results of the commitment costs stakeholder process should not impact the core substance of today's proposal.

VI. Conclusion

Q. Does this conclude your declaration?

A. Yes, it does.

G. Biedler

Gillian Biedler

State of California)
)
County of Sacramento)

Subscribed and sworn to (or affirmed) before me on this 27th day of May, 2010, by Gillian Biedler, proved to me on the basis of satisfactory evidence to be the person who appeared before me.

Martha M. Sedgley

Notary Public

MARTHA M. SEDGLEY
COMM. #1690762
Notary Public-California
PLACER COUNTY
My Comm. Exp. Sep. 27, 2010

Exhibit ISO-2 Prepared Direct Testimony of Li Zhou

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

California Independent System Operator Corporation	**)** **)**	**Docket No. ER10-____-___**

PREPARED DIRECT TESTIMONY
OF
LI ZHOU

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

California Independent System) Docket No. ER10-____-___
Operator Corporation)

PREPARED DIRECT TESTIMONY
OF
Li Zhou

I. INTRODUCTION

Q. Please state your name and business address.

A. My name is Li Zhou. My business address is 151 Blue Ravine Road, Folsom, California 95630.

Q. By whom and in what capacity are you employed?

A. I am employed as Senior Advisor in the Program Management Office of the California Independent System Operator Corporation (ISO). As Senior Advisor, I am responsible for overseeing the overall implementation of market enhancements from a technical business perspective. In this position, I have direct and recurring contact with stakeholders, and routinely make presentations at ISO stakeholder meetings on ISO policy and market design matters.

Q. Please describe your professional and educational background.

A. I joined the ISO in 2008 in my current position as Senior Advisor. In this position, I have worked extensively in the technical management and implementation of new market initiatives.

I received my Bachelor of Science degree in Computer Science from Zhong Shan University in Guang Zhou, P.R. China, and a Master of Science degree in Computer Science from State University of New York, Institute of Technology at Utica/Rome, New York. I have spent over 20 years as a software developer, consultant, software development manager, and director of engineering. The main focus of my work has been in the domain of energy related software development. For the four years before I joined the ISO, I was a consultant to the ISO on its Market Redesign and Technology Upgrade program. Before that, I was the director of engineering for energy operation software development at Henwood Energy Services.

Q. Have you previously testified before the Commission?

A. No.

Q. What is the purpose of your testimony in this proceeding?

A. I will discuss several topics related to the development, design, and implementation of the proposed Multi-Stage Generating Resource functionality. Some of the major topics I will address include:

1. How resources will register as Multi-Stage Generating Resources.
2. How Multi-Stage Generating Resources will bid into the ISO's markets, including the use of self-schedules and the imposition of local market power mitigation.

3. The rules governing Multi-Stage Generating Resources' eligibility for bid cost recovery.
4. How resources with a resource adequacy designation can utilize the Multi-Stage Generating Resource functionality.
5. How Multi-Stage Generating Resources will be able to provide ancillary services.

Through my testimony, I will explain how the proposal offers an approach for modeling and processing resources with multiple operating modes in the ISO markets effectively, and in a manner that is easily integrated into the existing ISO systems and processes. This is accomplished through detailed but straightforward rules for the participation and management of Multi-Stage Generating Resources, which I will explain in my testimony. Many of the rules and requirements I discuss here are driven by the fundamental decision made early on in the policy development process to pursue the pseudo-plant modeling approach, which is explained in greater detail in Ms. Biedler's testimony. This modeling approach enables the ISO to model and consider resources with multiple operating modes more accurately, but requires a greater level of detail for the integration of such resources than is required under alternative modeling approaches.

Q. On a conceptual level, what is a Multi-Stage Generating Resource?

A. At a general level, a Multi-Stage Generating Resource is the defined term used by the ISO to refer to a generator that can operate in one of several mutually exclusive operating modes, or "configurations." Each configuration has its own megawatt range and can have its own unique operating parameters distinct from the other configurations. One of the main constraints for Multi-Stage Generating Resources is that they operate in different configurations without an explicit transition from one to the other. Instead, a transition from one configuration to another will typically take time and have costs associated with it. These configurations and their unique operating constraints are defined based on the physical characteristics of the generating resources.

Q. Do you have any personal knowledge about the unique operational constraints facing Multi-Stage Generating Resources?

A. In my prior employment at Henwood Energy Services, I was responsible for the design, development, and maintenance of operational software that was used to manage combined cycle generating resources for various plant operators.

Q. Do you have any personal knowledge about the process the ISO has undergone in developing the Multi-Stage Generating Resource modeling functionality?

A. Yes. I have been involved with the ISO's efforts to create the Multi-Stage Generating Resource functionality from their inception. This has included involvement with the stakeholder process, business requirements development, and software design.

II. OVERVIEW OF MULTI-STAGE GENERATING PROPOSAL

Q. Can you please provide an overview of the proposal contained in this filing?

A. In this filing, the ISO proposes to adopt a multi-stage modeling approach that enables the ISO to model resources that have multiple operating modes such as combined cycle units. Under this modeling approach, the ISO will be able to consider in its markets the multiple operating modes of such resources as pseudo or logical individual plants as possible configurations of a single generating resource. Scheduling Coordinators will be able to offer the individual configurations into the ISO markets and in turn the ISO markets will optimize each of these configurations while honoring the resource's complete set of operating constraints. In addition to other start-up and minimum load costs, Scheduling Coordinators will be compensated for their submitted transition costs if committed and transitioned from one configuration to another. Pursuant to their detailed registered resource data, Multi-Stage Generating Resources will be able to participate in the ISO markets to provide energy, residual unit commitment capacity, and ancillary services for their registered configurations. Scheduling Coordinators will be permitted to submit up to ten registered configurations to the day-ahead market and three configurations to the real-time market. Resource adequacy requirements will be considered by configuration and will require the registration of a default configuration and path to guide the generation of bids to enforce the resource adequacy must-offer requirements.

III. REGISTRATION OF MULTI-STAGE GENERATING RESOURCES

A. Determining Eligible and Ineligible Resources

Q. What characteristics must a generating unit have to register as a Multi-Stage Generating Resource?

A. In the first instance, any Generating Unit or Dynamic Resource-Specific System Resource can apply to register as a Multi-Stage Generating Resource. Generating Units are internal generating resources that have already established a participating generator agreement with the ISO. Dynamic Resource-Specific System Resources are externally located generators that are already obligated under the ISO tariff under a dynamic scheduling agreement and a resource-specific system resource agreement. These external resources are treated similar to internal generating resources in that they are able to submit three-part bids that include start-up and minimum load costs, as well as the energy bid. To register as a Multi-Stage Generating Resource, a Generating Unit or Dynamic Resource-Specific System Resource must either:

1. Be a combined cycle gas turbine resource;
2. Have multiple operating or regulating ranges that limit the resource to operate in only one of these ranges at any given time; or

3. Have ranges of megawatt output through which the resource may transition but within which it cannot be operated reliably (*i.e.*, the resource has a forbidden operating region).

Q. If all Generating Units with a forbidden operating region are eligible to register as Multi-Stage Generating Resources, does that mean that the ISO will eliminate the forbidden operating region functionality?

A. As discussed by in Ms. Biedler's testimony, the ISO will not eliminate the forbidden operating region functionality, as some units may still prefer to rely on that functionality rather than to utilize the Multi-Stage Generating Resource functionality. The decision to register as a Multi-Stage Generating Resource or continue to rely on the forbidden operating region functionality is a decision made at the discretion of individual Scheduling Coordinators.

Q. Why would a unit with forbidden operating regions not want to use the Multi-Stage Generating Resource functionality?

A. The requirements to register a forbidden operating region are less complex than for Multi-Stage Generating Resources. Also, participating as a Multi-Stage Generating Resource requires compliance with special bidding rules that are necessary for modeling Multi-Stage Generating Resources, which I discuss further below. In contrast, once a unit registers a forbidden operating region, there are no special bidding requirements. The ISO's market software simply accounts for the forbidden operating region. For units with small forbidden operating regions and fast crossing times, it is possible that the owners or operators may conclude that given the added complexity, the Multi-Stage Generating Resource option does not offer them sufficient additional benefits to justify the higher administrative complexities of participating as a Multi-Stage Generating Resource.

Q. Will units with Multi-Stage Generating Resource status tend to be one type of generating unit?

A. The ISO expects that the majority of units initially registering as Multi-Stage Generating Resources will be combined cycle generating resources. However, Multi-Stage Generating Resource status is not limited to combined cycle resources. Some generating units besides combined cycles have multiple operating ranges. These are usually large thermal generators that require the operation of auxiliary equipment (*e.g.*, feed water pumps or additional boilers) to transition from a lower to a higher operating range.

Q. Are any types of resources specifically excluded from registering as Multi-Stage Generating Resources?

A. Yes. The current design does not accommodate metered subsystems, pumped-storage hydro units, pumping loads, and external resources that are not Dynamic Resource-Specific System Resources. As explained by Ms. Biedler's testimony, the current design and policy was developed based on the need to provide a method for modeling combined cycle units as required by the Commission. The multi-stage modeling approach poses a number of complexities that could not be resolved immediately for all resources. Therefore, the ISO focused on generation units and cannot expand the application to other classes of resources without jeopardizing the initial implementation of the Multi-Stage Generating Resource functionality. As discussed in Mr. Alarian's testimony, the modeling approach can be applied to other resources and can be extended with process, rule, and software improvements to permit these classes of resources to participate under a multi-stage modeling approach.

B. Required Information to Register as a Multi-Stage Generating Resource

Q. Will Participating Generators or Scheduling Coordinators be responsible for registering Multi-Stage Generating Resources?

A. Scheduling Coordinators will hold the responsibility to register Generating Units or Dynamic Resource-Specific System Resource as Multi-Stage Generating Resources.

Q. What process must be followed for a Multi-Stage Generating Resource unit to register as a Multi-Stage Generating Resource?

A. Registration will involve submitting two separate documents. The first is the registration form and the second is the resource data template.

Q. Can you describe what the Multi-Stage Generating Resource registration form will consist of?

The form will require the responsible Scheduling Coordinator to provide several pieces of information, including a:

1. Requested effective date, which must permit a minimum of 16 business days for ISO processing.
2. List of all configuration IDs (at least 2, no more than 10).
3. List of the constituent physical units making up a Multi-Stage Generating Resource along with which physical units comprise which configuration.
4. Transition matrix, listing all feasible transitions.

Q. Will the registration form only be required for initial resource registration?

A. No. The registration form will also be used for the following purposes.

1. Changing, adding, or removing a configuration ID.
2. Changing the constituent physical units mapped to a particular configuration ID.
3. Adding or removing a transition.

Q. Can you describe what the resource data template will consist of?

A. The resource data template is an Excel spreadsheet. This will provide the data parameters for the requested configuration IDs and provide transition matrix details such as cost, fuel, and transition times.

Q. What will the transition matrix contain?

A. The transition matrix will contain the transition costs and transition times associated with each feasible transition between the Multi-Stage Generating Resource configurations. For Multi-Stage Generating Resources that hold a contractual resource adequacy obligation, the

Scheduling Coordinator must also identify the default resource adequacy configuration and the default resource adequacy path. The default configuration and path are necessary to ensure that Multi-Stage Generating Resources holding resource adequacy obligations will meet those obligations.

Q. What is the registration timeline?

A. A Multi-Stage Generating Resource unit must complete the resource data template at least 16 days before it wishes to utilize the Multi-Stage Generating Resource functionality. These sixteen days are tied to the current Master File changes timeline, which requires that Scheduling Coordinators submit changes from 5 to 11 business days prior to the date on which they expect the changes to take effect. In the case of Multi-Stage Generating Resources, the ISO will require additional time to ensure that the more detailed data provided can be adequately verified and registered. In turn, the ISO intends to notify the relevant Scheduling Coordinator of the outcome of the registration process at least three days before the requested effective date. However, this may vary from case to case. Where the ISO has a need to verify additional data, it might not be able to complete the certification process at least three days in advance but could nevertheless complete the process before the requested effective date. A firm notice obligation would require that the ISO reject the Multi-Stage Generating Resource application since the ISO could not verify the application in time. However, without a notice obligation, the

ISO would be able to permit the resource to be approved for Multi-Stage Generating Resource status in time for the requested effective date. Therefore, the ISO proposes no specific cut-off date for when the ISO must respond to an application for Multi-Stage Generating Resource status.

Q. Can units switch back and forth between utilizing the forbidden operating region functionality and the Multi-Stage Generating Resource functionality?

A. Yes. The only limitation will be the registration timeline associated with Multi-Stage Generating Resources. Scheduling Coordinators can always drop their Multi-Stage Generating Resource status subject to the Master File changes timeline. With respect to becoming a Multi-Stage Generating Resource after they have dropped off, or if they want to become a Multi-Stage Generating resource for the first time, Scheduling Coordinators can only do so within the permissible timeline for such changes I discuss below.

C. <u>Registering Configurations</u>

Q. How many different configurations can a Multi-Stage Generating Resource register?

A. A Multi-Stage Generating Resource may register up to 10 configurations, and must register at least two configurations.

Q. Why is the total number of configurations limited to 10?

A. This limitation is based on implementation concerns related to system performance. Early in the policy development process, the ISO, along with its software vendor, was concerned that permitting more than 10 configurations would create too many complexities for the market optimization software to solve. Therefore, the ISO adopted this limitation in an effort to continue developing a proposal that it knew could be more readily implemented. As the multi-stage modeling approach develops further, it is possible to consider expanding these requirements subject to further evaluation of the market software performance.

Q. Do any Multi-Stage Generating Resources have greater than 10 configurations?

A. It is possible that some Multi-Stage Generating Resources have more operating modes than can be registered with the ISO as a configuration. However, the ISO will only recognize a maximum of 10 registered configurations for initial implementation. Based on feedback we have received from stakeholders over the past year, stakeholders do not object to this restriction and have not raised concerns that the limitation unduly limits flexibility.

Q. What verification procedures will the ISO have to confirm that the submitted configurations accurately reflect the operating characteristics of the unit?

A. If the ISO believes that a unit's operating and technical characteristics are not consistent with the registered Multi-Stage Generating Resource attributes, the ISO may request that the Scheduling Coordinator provide additional information necessary to justify the unit's registered status. This is particularly important during the initial registration process to ensure that the ISO captures the configuration attributes correctly, as this information will impact how the resources are ultimately modeled into the system. It may be necessary for the ISO to request that the resource be registered and qualified more consistent with its characteristics. The ISO may also find it necessary to revoke the unit's status as a Multi-Stage Generating Resource either because the resource does not meet the requirements specified in the tariff or the Scheduling Coordinator has not provided sufficient data to confirm that the resource qualifies. In addition, it may be necessary to revoke a resource's status as a Multi-Stage Generating Resource if the Scheduling Coordinator refuses to provide the ISO with the information it needs to verify that the resource is adequately registered. The reason for these rules is that the ISO cannot permit resources to be erroneously registered as Multi-Stage Generating Resources and risk issuing infeasible schedules, or causing the market software to fail. Therefore, it is crucial for the registration of such resources to be done in a manner that properly reflects the resources' true characteristics.

Q. How many ramp rates can be included for each configuration?

A. The ISO will permit Multi-Stage Generating Resources to register one segment ramp rate per configuration per service. Again, this limitation was adopted based on implementation and performance concerns. Permitting Multi-Stage Generating Resources to submit multiple ramp rates for individual configurations would create too many variables for the market optimization software to solve and could detrimentally impact system performance.

D. Changing Configurations

Q. How often can Multi-Stage Generating Resources change the registered values relating to the configurations?

A. Fundamental changes to a Multi-Stage Generating Resource's registered attributes must be made with at least 16 days of notice. As explained in Mr. Alarian's Testimony, changes to certain fundamental attributes can only be made at certain intervals after the start of the market operations with the new market design. First, the ISO will provide the ability to change fundamental attributes of a Multi-State Generating Resource discussed below only after the forty-fifth day after go-live. After that, the ISO will permit changes 110 days after the go-live. After that, Scheduling Coordinators will be able to make changes to these fundamental attributes only every 60 days after such a change has occurred. Non-fundamental changes can be made through the Master File change process, which requires 5-11 days of advance notice. Mr. Alarian explains in his testimony why these restrictions in changes are necessary.

Q. How will the ISO distinguish between fundamental and non-fundamental changes to a Multi-Stage Generating Resource's parameters?

A. Fundamental changes will be defined as the following:

1. Registering a new Multi-Stage Generating Resource unit.
2. Adding or removing a configuration.
3. Adding or removing a registered transition.
4. Changing configuration "Startup" or "Shutdown" flags.
5. Changing the physical units within a configuration.
6. Changing transition times materially.
7. Changing configuration ramp rates materially.

Q. How will the ISO determine whether a transition time or configuration ramp rate has been changed materially?

A. A change in transition time or configuration ramp rate will be deemed material if it consists of a change that more than doubles the prior value or reduces it to less than half of the prior value.

Q. How will the ISO treat a change to one of the above-mentioned fundamental Multi-Stage Generating Resource attributes where that Multi-Stage Generating Resource is committed across the midnight hour?

A. Whenever any one of these changes takes place, it is important to carefully manage the transition in the real-time market from one status to another over the midnight hour when the resource transitions from one state to another. Recall that the ISO conducts a two-settlement market where it conducts a day-ahead market in which resources are scheduled for energy and awarded ancillary services for each hour of the next day. Subsequently, on the next day, the ISO conducts a real-time market in which it clears energy on a five minute basis in the real-time dispatch process and procures ancillary services in the fifteen minute real-time unit commitment process. This may result in imbalance energy or incremental ancillary services procured between the day-ahead and real-time market which the ISO must settle for each resource. The introduction of the Multi-Stage Generating Resource functionality poses an additional issue because for any given real-time market, when a transition to a fundamental attribute is made, the ISO will be required to transition the resource in a manner that reflects the schedules and energy based one configuration or another. There are different ways to accomplish this transition. For example, if a generation resource changes from utilizing the forbidden operating region functionality to using the Multi-Stage

Generating Resource functionality, there can be multiple real-time unit commitment or real-time dispatch runs with time horizons across the midnight hour that will have submitted real-time bids from the configurations within the forward intervals passing the midnight hour, but only have real-time bids for the forbidden operating region resource within the intervals before midnight. The main difficulty here is to maintain a single resource definition within the time horizon of a particular real-time unit commitment or real-time dispatch run. In this case, it is either the forbidden region definition or the configuration definition that will apply but it is difficult to determine ahead of time because it depends on real-time conditions and the submitted bid sets. The ISO proposes that during the time horizon of the real-time market procedure when the transition takes effect, the ISO will schedule, dispatch, or award resources consistent with either the prior or new status, as appropriate and required by any real-time conditions regardless of the resource's schedule or award in the immediately preceding day-ahead market. Using the example above, for any real-time unit commitment or real-time dispatch run that has the time horizon crossing midnight (with a binding interval in the day prior to conversion), the ISO will use the following logic: 1) for the intervals including the binding interval within the day prior to conversion, it uses the bids and relevant data on the forbidden region resource since it is still a forbidden operating resource; and 2) for runs with binding intervals falling into the first day of conversion, since there can be day-ahead schedules or capacities awarded already on the new configurations and ISO has to protect those day-ahead decisions, ISO will use the configuration level day-ahead schedules/capacities and convert them into the bids/self schedules on the forbidden operating region resource. This is to allow the affected real-time unit commitment or real-time dispatch runs to make decisions based on the forbidden operating region definition but nevertheless take into account the fact that there can be day-ahead decisions made on the same power plant with the new configuration definition. This is only necessary in the transitioning time period over the midnight hour because that is the only time that the time horizon of a real-time unit commitment or real-time dispatch will have different intervals with different resource definitions and bids on those definitions.

IV. BIDDING AND PARTICIPATING IN THE MARKET

A. General Bidding Issues

Q. Will the Scheduling Coordinator or the Participating Generator be responsible for submitting bids?

A. As is the case with all other resources, the Scheduling Coordinator will be responsible for submitting bids in the ISO markets.

Q. Will bids be submitted at the plant level or the configuration level?

A. Bids will be submitted at the configuration level. That is, the Scheduling Coordinator must submit a separate set of bids for each registered configuration.

Q. Do the fundamental bidding requirements change dramatically for Multi-Stage Generating Resources?

A. The basic requirements will change, but not dramatically. Because of the decision to pursue the pseudo-plant approach, the bids submitted for Multi-Stage Generating Resources must be based on the configuration submitted to the market but must also be linked to the underlying plant or resource. This will be managed through the single resource identification number assigned to a specific Generating Unit or Dynamic Resource-Specific System Resource and the single configuration identification number assigned to each configuration for each resource.

B. <u>Principles of Unit Commitment for Multi-Stage Generating Resources</u>

Q. Will the resource characteristics the ISO considers in dispatching a unit be different for Multi-Stage Generating Resources than for regular units?

A. Yes. For resources that are not modeled as the Multi-Stage Generating Resources, the main characteristics the ISO must optimize are start-up costs, minimum load costs, and the energy bid. For Multi-Stage Generating Resources, consistent with the pseudo-plant modeling approach, the ISO market systems must consider these as well as a variety of additional characteristics at the configuration level, and restrictions relating to transitions between configurations.

Q. Are there any intertemporal constraints for Multi-Stage Generating Resource that the ISO will consider at the plant level?

A. Yes. Even with the ability to implement a configuration-based multi-stage modeling approach, certain characteristics must remain at the plant level because those constraints by nature are applicable to the power plant as a whole. These are characteristics that the ISO currently enforces for all resources at the plant level. Therefore, the following intertemporal constraints will remain at the plant level (*i.e.*, the Generating Unit or Dynamic Resource-Specific System Resource):

1. Daily maximum energy limit.
2. Daily maximum number of start-ups.
3. Plant minimum up time.
4. Plant minimum down time.

Q. What intertemporal constraints for Multi-Stage Generating Resources will be considered at the configuration level?

A. The following intertemporal constraints exist at the configuration level:

1. Configuration minimum up time.
2. Configuration minimum down time.
3. Ramp rate.
4. Start-up notification time.
5. Start-up ramp time.

These elements would be considered at the configuration level because different configurations are expected to have different constraints. For example, given a 2X1 combined cycle unit, a 1X1 configuration will likely have a shorter startup time than a 2X1 configuration. In addition, the ISO will consider at the configuration level the following intertemporal constraints related to transitions from one configuration to another:

1. Transition notification time.
2. Transition ramping time.

Q. What is the difference between transition notification time and transition ramp time?

A. The transition notification time is the total amount of time it takes a plant to transition to a new configuration, from the time a transition is first ordered to the time the new configuration is producing energy at or above the configuration's PMin or minimum load. The transition ramp time is the amount of time it takes to transition out of the "from" configuration and into the "to" configuration. The ramp time does not begin until the Multi-Stage Generating Resource begins generating energy from the equipment that constitutes part of the new configuration and does not end until the new configuration is producing energy at or above the configuration's PMin. The transition notification time is inclusive of the transition ramp time.

Q. How will the ISO consider these characteristics?

A. As is the case with the current market, the ISO's security constrained unit commitment and the security constrained economic dispatch algorithms will use these parameters to set a least-cost dispatch of units.

Q. Did the ISO consider permitting Multi-Stage Generating Resource to specify a daily maximum number of transitions between different configurations?

A. The ISO considered this and at one point proposed it as part of the Multi-Stage Generating Resource modeling design. The purpose of this restriction was to keep a resource from having the ISO's market software constantly dispatch a resource back and forth between different configurations in a manner that would be detrimental to the resource's operation. At this time it is not apparent that this feature can be readily implemented because enforcing a daily maximum number of transitions between different configurations appears to be creating additional complexity to the design. However, the ISO also determined that permitting a Multi-Stage Generating Resource to specify a minimum up time and down time for each configuration will also keep a Multi-Stage Generating Resource from being transitioned between configurations more often than is permissible.

Q. How will time spent in a transition be considered for purposes of enforcing the minimum up time and down time?

A. A Multi-Stage Generating Resource is considered to be in the "from" configuration until its transition is complete. For this reason, the time spent in transition will be allocated to meeting the minimum constraints for the "from" configuration, rather than the "to" configuration. This is important to keep a Multi-Stage Generating Resource from being transitioned between configurations more than is permissible if the enforcement of the daily maximum number of transitions cannot be readily implemented.

C. <u>Participating in the IFM</u>

Q. How many configurations can be bid in by a Multi-Stage Generating Resource in the IFM?

A. Scheduling Coordinators can submit, and the IFM will optimize, up to ten configurations as mutually exclusive resources. Because the bid submission is the same for the IFM and RUC, ten configurations can also be submitted into the RUC.

Q. Why is the IFM limited to ten configurations?

A. For reasons described above, Multi-Stage Generating Resources are permitted to register a maximum of 10 configurations. Thus, in the IFM, Multi-Stage Generating Resources are permitted to bid all of their configurations into the market.

D. <u>Participating in RUC</u>

Q. What restrictions will the ISO face in committing a Multi-Stage Generating Resource in RUC?

A. The ISO may use RUC to commit a Multi-Stage Generating Resource above the IFM commitment but only at a higher output. Thus, RUC can commit a Multi-Stage Generating Resource unit at a higher megawatt output in the same configuration as was committed in the IFM or can commit to Multi-Stage Generating Resource to a higher configuration and was committed in the IFM.

Q. Will RUC payments for undelivered energy from Multi-Stage Generating Resource be rescinded?

A. Consistent with current practice for other classes of Generating Units, RUC payments for undelivered energy will be rescinded for Multi-Stage Generating Resources. The extent of the deficiency between the RUC award and the undelivered energy is evaluated at the resource level, rather than the configuration level. This calculation is not made at the configuration level because the meter exists at the resource level. As there are not separate meters for each configuration, this calculation must be made at the resource level.

E. <u>Participating in the Real-Time Market</u>

Q. What responsibility does a Multi-Stage Generating Resource hold to bid into the real-time market?

A. Like all other resources, unless the resource is subject to a contractual resource adequacy must-offer obligation, there will be no requirement for a resource to bid into the real-time market. Also similar to other resources, where a Multi-Stage Generating Resource has an IFM energy schedule or RUC schedule, in the real-time market the Multi-Stage Generating Resource must bid in the configurations that were awarded in the IFM and RUC. If the IFM schedule and RUC schedule are for two different configurations, then both configurations must be bid into the real-time market. This is similar to the current rule dictating that if a resource receives a day-ahead schedule and does not submit bids or self-schedules in the real-time market, then the ISO will generate a self-schedule up to the quantity of the day-ahead schedule. This is necessary to ensure that the capacity in the day-ahead schedule or award is reserved. In the case of Multi-Stage Generating Resources, the rule is enhanced to ensure that the real-time requirement is met by the proper configuration.

Q. How many configurations may a Multi-Stage Generating Resource bid into the real-time market?

A. A Multi-Stage Generating Resource may bid three configurations into the real-time market, in addition to the configurations (if any) that were awarded in the IFM and RUC. Thus, depending on a Multi-Stage Generating Resource's IFM and RUC awards, a Multi-Stage Generating Resource can bid a maximum of three, four, or five configurations into the real-time market.

Q. Why does the ISO limit Multi-Stage Generating Resources to bid in fewer configurations to the real-time market than to the day-ahead market?

A. The real-time market cannot support as many configurations as the day-ahead market because in the real-time market the market software is expected to optimize over a greater number of variables than in the day-ahead market. Additionally, the market software has more time to generate a solution for the day-ahead market than it does for the real-time market, which must reach a feasible solution for every five-minute dispatch interval in real-time dispatch and every 15-minute interval in real-time unit commitment. A larger number of permissible configurations for the real-time market would compromise the system's ability to consistently generate a feasible solution within the real-time market timeline.

Q. Has the number of configurations permitted in the real-time market changed over the course of the Multi-Stage Generating Resource development process?

A. Yes. Initially, the limit on real-time market bidding was three configurations, irrespective of any awards in the IFM or RUC. However, some stakeholders expressed concern that such an approach would be overly restrictive for units that received both IFM and RUC awards. Such units would have only had the ability to bid one new configuration into the real-time market. The ISO, in consultation with its software vendor, determined that this restriction could be relaxed without detrimentally impacting system performance. Another reason for this change is that stakeholders argued that in the real-time market the configurations that the Scheduling Coordinator may submit may be further limited by the fact that the ISO's Scheduling Infrastructure and Bidding Rules (SIBR) currently cannot account for outages entered into the outage scheduling interface. If Multi-Stage Generating Resources are committed in IFM with a configuration that is in outage in real-time, then the earlier proposed rule would have limited their ability to bid in other configurations not in outage.

F. Bid Validation

Q. What factors unique to Multi-Stage Generating Resources will the bid validation process consider?

A. For Multi-Stage Generating Resources, the bid validation process will be altered such that all of the relevant Multi-Stage Generating Resource bidding rules and feasibility restrictions will be enforced. For example, the bid validation software will analyze whether transitions between bid-in Multi-Stage Generating Resource Configurations are feasible according to the information registered in the ISO Master File data. Similarly, the bid validation software will analyze whether a Multi-Stage Generating Resource has submitted bids for more configurations in the real-time market than are permissible. If the bid validation process were not configured to analyze all of the relevant bidding and feasibility restrictions, then those rules would not be enforced and the successful implementation of the Multi-Stage Generating Resource functionality would be seriously jeopardized.

Q. Does bid validation occur at the resource or configuration level?

A. Under the pseudo-plant modeling approach, each Multi-Stage Generating Resource configuration is treated as if it were a separate unit. As a result, the bidding rules apply at a configuration level. Were the ISO not to apply bid validation at the configuration level, it would be virtually impossible to ensure that Scheduling Coordinators were respecting those configuration-specific bidding rules.

Q. What happens if, in a given trading hour, one of the bids for a Multi-Stage Generating Resource's configurations fails the bid validation process?

A. The bids for that configuration will be invalidated, along with the bids for all of the other configurations will also be invalidated.

Q. Will the bid validation process for Multi-Stage Generating Resources only involve invalidating bids?

A. Part of the bid validation process will also involve the ISO's insertion of Generated Bids or Proxy bids. For example, where a Multi-Stage Generating Resource is scheduled in the IFM but does not submit any bids into the real-time market, the bid validation process will create a self-schedule for that resource equal to its day-ahead schedule. Similarly, if a Multi-Stage Generating Resource is awarded operating reserves in the day-ahead market and no economic energy bid is submitted for that resource in the real-time market, the ISO will insert a proxy energy bid in the configuration that was awarded in the day-ahead market to cover the awarded operating reserves. Additionally, as will be discussed more fully below, where a Multi-Stage Generating Resource's bids do not satisfy its resource adequacy obligations, the ISO will insert generated bids or extend a Multi-Stage Generating Resource's energy bid curve as necessary to comply with the resource adequacy rules unique to Multi-Stage Generating Resources.

V. SELF-SCHEDULES

Q. Will Multi-Stage Generating Resources be permitted to self-schedule their output?

A. Yes. To self-schedule, a Multi-Stage Generating Resource must submit a self-schedule under the normal process except that they must identify the configuration. For a given trading hour, there can be only one configuration bid in with a self-schedule. For consecutive hours with self-schedules that involve different configurations, the transition must be feasible based on the transition matrix.

Q. In a given trading hour, if a Multi-Stage Generating Resource has submitted a self-schedule for part of its capacity within a configuration, what restrictions are there on the ability to submit economic bids?

A. The Multi-Stage Generating Resource can still submit economic bids, but only for quantities above the self-schedule. Where the economic bids involve a configuration other than the configuration that was self-scheduled, there must be a feasible transition between the self-scheduled configuration and the bid-in configuration.

Q. When a Multi-Stage Generating Resource receives a binding RUC start-up instruction, what restrictions does the Multi-Stage Generating Resource face in self-scheduling that unit in the real-time market?

A. The self-schedule must be in the same configuration that was committed in RUC. This restriction is necessary because a binding RUC start-up instruction for a particular configuration reflects that the ISO needs that Multi-Stage Generating Resource to be on-line in that configuration. Allowing a self-schedule in a different configuration would potentially violate the RUC binding commitment decision. If a Multi-Stage Generating Resource wishes to provide energy based on a higher configuration than is committed from RUC, it may submit an economic bid rather than a self-schedule.

Q. How many self-schedules can be submitted in a trading hour?

A. For any given trading hour, a Multi-Stage Generating Resource may submit self-schedules in only one configuration.

Q. Why has the ISO limited Multi-Stage Generating Resources to self-scheduling only one configuration in a given Trading Hour?

A. This is a consequence of the pseudo-plant modeling approach. When the ISO commits a resource in a trading hour, it commits the resource for the entire hour. This is the case whether the unit has been committed by the ISO or has been self-scheduled. Because each Multi-Stage Generating Resource configuration is treated as if it were a distinct Generating Unit, allowing a Multi-Stage Generating Resource to submit self-schedules for more than one configuration in a given trading hour would be the equivalent to allowing a resource to be committed for only part of a trading hour.

VI. MARKET POWER MITIGATION

Q. Will Local Market Power Mitigation (LMPM) be applied for Multi-Stage Generating Resources?

A. Yes, Multi-Stage Generating Resources will be subject to LMPM. LMPM procedures will be analyzed for each configuration bid into the market.

Q. Why are the LMPM procedures applied configuration-by-configuration?

A. The ISO ordinarily applies LMPM to each individual resource. Under the pseudo-plant approach, a Scheduling Coordinator submits distinct bids for each of a Multi-Stage Generating Resource's configurations and each configuration is treated by the ISO's market optimization as if it were a distinct resource. For this reason, it would be more consistent with the pseudo-plant approach to apply LMPM procedures configuration-by-configuration, rather than according to an alternative approach.

Q. If LMPM mitigates a configuration above a certain MW level, what happens to other configurations that include that MW level?

A. If, for some reason, a Multi-Stage Generating Resource operates in a configuration other than the one that was subject to LMPM, the price at which the unit is mitigated will apply for all quantity levels above the mitigation threshold irrespective of the configuration.

Q. Why does the ISO propose to extend the mitigation across all configurations?

A. Where a unit is subject to mitigation it is because that unit is deemed to have market power in the relevant interval. That market power is not erased by virtue of the Multi-Stage Generating Resource operating in a higher configuration. Therefore, the ISO believes that it is appropriate to extend mitigation across all configurations.

Q. How will default energy bids be developed?

A. Default energy bids will be calculated separately for each configuration.

Q. Will Multi-Stage Generating Resources face any restriction on their choice of default energy bids?

A. For the first 90 days a resource participates in Multi-Stage Generating Resource modeling, its default energy bid options will be limited to the negotiated rate option or the variable cost option. The LMP option will not be available.

Q. Why is there such a restriction?

A. The LMP option is not available because it requires 90 days of historical information for a unit. To properly apply the LMP option, the ISO will require 90 days of data from a unit while it has participated in the markets as a Multi-Stage Generating Resource.

VII. OUTAGE AND DE-RATE REPORTING

Q. How will Multi-Stage Generating Resources report their maintenance outages?

A. Multi-Stage Generating Resources will report maintenance outages by configuration and at the plant level.

Q. How does the ISO's outage reporting interface handle outages that impact multiple configurations?

A. Users will have to input derate data for each configuration impacted by a derate, as well as for the plant as a whole.

VIII. BID COST RECOVERY

Q. Is bid cost recovery calculated at the resource or configuration level?

A. Some elements of bid cost recovery are calculated at the resource level and some at the configuration level. Commitment costs will be calculated at the configuration level. Those bid cost recovery elements that are transition-based will be calculated based on the configurations involved. The bid cost recovery calculations for each market and trade day will still be performed at the resource or plant level.

Q. What commitment costs are available for Multi-Stage Generating Resources?

A. The commitment costs depend on which configuration the ISO commits in the IFM, RUC, or real-time market. The commitment costs for Multi-Stage

Generating Resource resources can include startup cost, minimum load cost and transition cost.

Q. Upon what configuration will the relevant commitment costs be calculated?

A. The startup cost, minimum load cost and transition cost will be based on the configuration that the ISO commits in the relevant market. The startup cost will be allocated to the ISO commitment period for that configuration. The transition cost will be allocated to the ISO commitment period of the “to” configuration. Generally, no commitment costs will be considered for a given configuration if a Multi-Stage Generating Resource has a self-schedule or ancillary service self-provision on that configuration.

Q. If Multi-Stage Generating Resources will have different commitment costs registered for different markets, which commitment costs will govern?

A. The ISO will apply the following rules to determine which commitment costs will apply:

1. If the ISO commits a resource in different configurations between IFM/RUC and real-time market, then the real-time market commitment costs are used and those costs are assigned to the real-time market;
2. If the ISO commits a resource in the IFM/RUC but not in the real-time market, then the IFM/RUC commitment costs will be

evaluated and those costs are assigned to the IFM or RUC accordingly.

Q. If the ISO commits a Multi-Stage Generating Resource in IFM or RUC and the Multi-Stage Generating Resource self-commits in the real-time market for the remainder of the output of that configuration, which commitment costs will apply?

A. IFM or RUC commitment costs will apply, depending on the market in which the Multi-Stage Generating Resource was committed.

Q. What happens to start-up costs if a Multi-Stage Generating Resource unit starts in a configuration other than the configuration into which the ISO committed the unit?

A. If the unit starts in a higher configuration than was committed, it will receive bid cost recovery based on the committed configuration. If the unit starts in a lower configuration than was committed, it will ineligible for bid cost recovery.

Q. Will any bid cost recovery c**osts be calculated at the resource level?**

A. Yes. Energy bid cost, ancillary services bid cost, and market revenue will be calculated at the resource level.

Q. Which configuration will the transition costs be based on?

A. The configuration from which the Multi-Stage Generating Resource transitions, *i.e.*, the "to" configuration.

IX. RESOURCE ADEQUACY AND RELIABILITY MUST RUN

Q. May units holding resource adequacy commitments register as Multi-Stage Generating Resource?

A. Yes.

Q. What responsibilities during Multi-Stage Generating Resource registration does a resource adequacy resource hold?

A. The Scheduling Coordinator must:

1. Identify a default resource adequacy configuration.
2. Identify a default resource adequacy path.

The default resource adequacy configuration is the configuration used to meet the unit's resource adequacy obligation. This can be any configuration that can generate at or above the unit's resource adequacy obligation. The default resource adequacy path is the sequence of configurations through which the unit must transition to reach the default resource adequacy configuration. The default resource adequacy path is only applicable where the Multi-Stage Generating Resource cannot startup directly into the default resource adequacy configuration.

Q. What bidding responsibilities do resource adequacy Multi-Stage Generating Resources hold?

A. In both the day-ahead and real-time market, at least one configuration must be bid in that will fulfill the unit's resource adequacy RA commitment.

Q. What are the consequences if a resource adequacy Multi-Stage Generating Resource does not bid in at least one configuration to support its resource adequacy obligation?

A. For both the day-ahead and real-time market, the ISO will create a generated bid for the default resource adequacy configuration. For the real-time market, this generated bid will not count against the limit on the maximum number of allowable configurations bid into the real-time market.

Q. What happens if the default resource adequacy configuration is not capable of start-up because of infeasible transitions?

A. The ISO will create a generated bid for every configuration in the default resource adequacy path to allow a feasible transition to the default resource adequacy.

Q. What will the ISO do if a Multi-Stage Generating Resource submits a bid in the default resource adequacy configuration but for a quantity below the Multi-Stage Generating Resource's resource adequacy obligation?

A. The ISO will extend the last segment of the energy bid curve up to the must-offer obligation. Through this approach, the Multi-Stage Generating Resource will meet the minimum quantity of its resource adequacy obligation.

Q. Does a resource adequacy Multi-Stage Generating Resource have an obligation to participate in RUC if it does not receive an IFM schedule?

A. As is the case with resource adequacy units that are not Multi-Stage Generating Resources, the must-offer obligation continues to RUC even if it does not receive an IFM schedule.

Q. What if a Multi-Stage Generating Resource RA resource receives a RUC award?

A. At least one configuration bid into real-time market must support the RUC award.

Q. How will units holding a reliability must run designation be handled under the Multi-Stage Generating Resource functionality?

A. Thus far, no reliability must run units have expressed interest in participating as Multi-Stage Generating Resources. However, units holding a RMR designation may register as Multi-Stage Generating Resources and participate so long as they honor the obligations imposed by their reliability must run contract.

X. ANCILLARY SERVICES

Q. Can Multi-Stage Generating Resource units be awarded ancillary services?

A. Multi-Stage Generating Resources may provide ancillary services. However, only configurations that are certified to provide ancillary services can be awarded ancillary services. A Multi-Stage Generating Resource may have some configurations that are eligible to provide Ancillary Services and others that are not.

Q. Why is ancillary services eligibility by configuration and not based on the resource level?

A. Again, this requirement is a result of the pseudo-plant modeling approach. The ISO must ensure that each configuration is capable of fulfilling any ancillary services awards it is given.

Q. What information is required for a configuration to be certified to provide ancillary services?

A. For a Multi-Stage Generating Resource to register a configuration, it must meet the registration rules created in Section 8 of the ISO Tariff, Appendix K of the ISO Tariff, as well as the applicable Business Practice Manual.

Q. What bidding obligations in the real-time market accompany an award of ancillary services in the IFM?

A. There shall be at least one configuration bid in real-time that can support the ancillary service obligation from the IFM. Again, this is similar to the requirements discussed above to ensure that the day-ahead awarded capacity is reserved for the specific configuration in the real-time market.

Q. When a Multi-Stage Generating Resource receives a binding RUC start-up instruction, what restrictions does the Multi-Stage Generating Resource face in self-providing ancillary service for that unit in the real-time market?

A. As is the case with a self-schedule in the Real-Time Market where a Multi-Stage Generating Resource receives a binding RUC Start-Up Instruction, the self-provision of Ancillary Services must be in the same configuration that was committed in RUC. The rationale for this restriction is the same as well.

Q. What will SIBR do if ancillary services awarded for the IFM plus bids for ancillary services in the real-time market exceed the upper limit of the ancillary services available in the configuration that was awarded ancillary services in the IFM?

A. In such circumstances, SIBR will reject the real-time market bids to provide ancillary services.

Q. What will happen if a real-time market bid does not support the DA Ancillary Services award?

A. In such circumstances, SIBR will generate an energy bid on the IFM ancillary services awarded configuration using the configuration based default energy bid.

Q. How will rescission of payments work for a Multi-Stage Generating Resource that cannot meet its ancillary services award?

A. There will be no special rules for Multi-Stage Generating Resource units. Multi-Stage Generating Resource units that fail to meet their ancillary services awards will have their payments rescinded in the same fashion as any other resource.

Q. If a unit is awarded operating reserves in the day-ahead and does not submit an economic energy bid in the real-time market, what are the consequences?

A. The ISO will insert a proxy energy bid for the configuration that was awarded operating reserves.

Q. In the IFM, what ability does a Multi-Stage Generating Resource have to provide ancillary services in a trading hour in which it is transitioning from one configuration to another?

A. The IFM will not award ancillary services in such circumstances and any offers to self-provide ancillary services will be disqualified when the market interval is completely within the transition period. The reason for this is that when the resource is transitioning from one configuration to another, it is not possible for the ISO to convert the capacity to energy. Therefore, the ISO cannot award it the requisite ancillary services capacity.

Q. What rules will govern the disqualification of ancillary services that are awarded in the IFM that are unavailable due to a transition ordered in real-time?

A. Where a resource is awarded ancillary services in the IFM but is ordered to transition during that interval in real time, the ancillary services payment is disqualified during the intervals in which the resource is in transition. As with non-Multi-Stage Generating Resources, the disqualified ancillary services will be used to increase the real-time ancillary services obligation and thus increase the share of the ancillary services cost.

Q. How will incremental ancillary services be awarded in 15-minute real-time unit commitment intervals for Multi-Stage Generating Resources in transition between configurations during that interval?

A. In such circumstances, ancillary services will not be awarded. This is because a Multi-Stage Generating Resource cannot effectively provide operating reserve or regulation services when it is transitioning from one configuration to the other. It cannot effectively respond to a Spinning or Non-Spinning energy dispatch or respond to an AGC signal.

Q. May Multi-Stage Generating Resource resources self-provide ancillary services?

A. Yes. For both the IFM and real-time market, there can be only one self provision per trading hour per ancillary services product. Additionally, all self provisions of ancillary services must be provided on the same configuration as the energy self-schedule, if any, on an hourly basis.

Multi-Stage Generating Resources may transition to a higher configuration so long as they can still meet their self-scheduled ancillary services obligations.

Q. If a Multi-Stage Generating Resource is awarded regulation or operating reserves in the IFM, may it still self-provide ancillary services in the real-time market?

A. Yes, but only in the same configuration for which the award was given in the IFM. The Multi-Stage Generating Resource may not self-provide additional ancillary services in a higher configuration than was awarded in the IFM.

Q. What restrictions on self-providing ancillary services does a Multi-Stage Generating Resource have if it has a binding start-up instruction from RUC.

A. Any ancillary services self-provision must be in the same configuration that was committed in RUC. If a Multi-Stage Generating Resource wishes to provide ancillary services based on a higher configuration than is committed from RUC, it may submit an economic bid.

XI. <u>Conclusion</u>

Q. Does this conclude your declaration?

A. Yes, it does.

____

Mr. Li Zhou

State of California)
)
County of Sacramento)

Subscribed and sworn to (or affirmed) before me on this 27th day of May, 2010, by Li Zhou, proved to me on the basis of satisfactory evidence to be the person who appeared before me.

Martha M. Sedgley
Notary Public

MARTHA M. SEDGLEY
COMM. #1690762
Notary Public-California
PLACER COUNTY
My Comm. Exp. Sep. 27, 2010

Exhibit ISO-3 Prepared Direct Testimony of Hani Alarian

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

California Independent System Operator Corporation	**)** **)**	**Docket No. ER10-____-___**

PREPARED DIRECT TESTIMONY OF HANI ALARIAN

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

California Independent System) Docket No. ER10-____-___
Operator Corporation)

PREPARED DIRECT TESTIMONY
OF
Hani Alarian

I. INTRODUCTION

Q. Please state your name and business address.

A. My name is Hani Alarian. My business address is 151 Blue Ravine Road, Folsom, California 95630.

Q. By whom and in what capacity are you employed?

A. I am employed as Director, Advanced Power Network Technology at the California Independent System Operator Corporation (ISO). As Director, Advanced Power Network Technology, I am responsible for implementing advanced applications to improve the reliability of operations. I am also responsible for the soundness of technical design and operation of enhancements implemented by our market software vendor and market related procedures adopted by the ISO.

Q. Please describe your professional and educational background.

A. I joined the ISO on April 27, 2009 as Principal, and on December 14, 2009 became Director responsible for Advanced Power Network Application, the position I currently hold. In this position, I have worked on the design and implementation for many of the new market systems since the start of the ISO's new market design on April 1, 2010. From October 2003 to joining the ISO in 2009, I was an independent contractor for the ISO directly or indirectly through Siemens. During that time, I worked on developing many aspects of the ISO's current market design, including writing initialization, workarounds, and validation scripts. Prior to working for the ISO in this capacity, I spent almost 19 years working for Illinois Power Company, where my last two positions were Senior Manager for the Energy Management System (EMS) and Director of Generation Control. I received my Bachelor of Science degree in Electrical Engineering from Southern Illinois State University in Carbondale in December 1984, and my Master in Business Administration from Illinois State University in Bloomington in May 1997.

I have spent over 25 years in the energy industry supporting, designing, and building systems ranging from EMS to market system implementation: nineteen years in the EMS and six years in the market system areas.

Q. Have you previously testified before the Commission?

A. No.

Q. What is the purpose of your testimony in this proceeding?

A. My testimony is focused on several topics related to the overall system impact of the implementation of the Multi-Stage Generating Resource functionality. My testimony will focus on: 1) the software enhancements offered by the integration of the new multi-stage modeling approach as well as the complexities it adds and how those complexities affect the performance of the market systems overall; 2) the necessary measures to ensure a successful launch of this new functionality given these complexities; 3) the necessary measures to manage the introduction of new generating resources to be modeled as Multi-Stage Generating Resources after the launch of this new functionality; 4) the dependencies that exist in the software enhancements that follow the drop of the Multi-Stage Generating Resource functionality; and 5) the possibility of future application of this modeling approach to better model and integrate other non-generation resources into the ISO markets.

II. <u>ENHANCEMENTS PROVIDED THROUGH THE MULTI-STAGE MODELING APPROACH</u>

Q. Please provide a brief description of the proposal.

A. The implementation of the proposed changes in this filing will expand the existing market functionality to include the ability to model generating resources, such as combined cycle units, in a manner that better reflects the operating characteristics of such units. The current market software and related processes do not reflect that some of these resources are capable of operating in certain modes. Therefore, the ISO is not capable of fully capturing the market benefits that can be provided by such resources. The ISO has developed a modeling approach and a set of market rules and processes that enable the ISO to model the full scope of capability of such resources and enables owners or operators of such resources to be compensated appropriately for the services they provide. The proposal currently only applies to generating resources and those resources that will be modeled under this approach are referred to as Multi-Stage Generating Resources.

Q. Describe how this will be accomplished.

A. Based on the policy developed with stakeholders over the 2008-2009 time period, the ISO has requested and obtained from its market software vendor market optimization software enhancements that modify the ISO's modeling capability. These software enhancements create the ability for Scheduling Coordinators to input additional data regarding the multiple operational modes and for the ISO to consider separately the bids or self-schedules submitted by Scheduling Coordinators for each specific operating mode. The functionality will be expanded to include not only the ability to consider the range of operable capacity for a given resource, but also the costs and times associated with moving from one operable state to another. This is accomplished through enhancements to the optimization software itself and also through changes to information regarding a generating resource's characteristics that the ISO collects, stores, and utilizes in operating the market systems.

Q. Please describe the modeling approach developed by the ISO.

A. As explained by Ms. Biedler in her testimony (Exhibit ISO-1), through the stakeholder process that preceded this filing, the ISO and stakeholders decided that the best approach to integrating resources with multiple operating modes is a methodology that enables the ISO system to model more specifically the operating modes, referred to as "configurations," in which certain resources could be operated. Further, under the adopted modeling approach, the configurations are treated as individual resources that are linked to a single plant through the resource identification for that particular plant.

Q. Does this modeling approach pose any specific implementation challenges?

A. While this approach is the preferred approach and, as explained by Ms. Biedler, was the modeling approach supported by the stakeholders, this approach adds a significant level of complexity because it requires modeling all of a resource's multiple operating ranges. Alternative modeling approaches that do not require the integration of the multiple possible configurations would pose fewer complications because it would require the market software to optimize over fewer variables. However, as discussed by Ms. Biedler, more simplistic approaches would not adequately model and consider the full scope of flexibility offered by these resources and would prevent the ISO from providing the full scope of the potential benefits of resources that can be operated in multiple modes, provided they are moved reliably through the various configurations. That would essentially defeat the purpose of trying to model these resources more effectively. However, the more accurate modeling is not possible without the input of more granular data to the market systems that reflect the costs and constraints of operating in the various modes. This, in particular, poses significant data management challenges for the ISO's market processes.

Q. Describe the data management challenges you describe above.

A. This more complete modeling option is not possible without the collection and verification of more detailed data regarding the resources' operating characteristics. As such, we have had to enhance our registration, validation, and data management systems that are crucial both for the ability to submit bids that reflect the multiple variables associated with the optimization of the Multi-Stage Generating Resources and, in turn, for the ISO systems to use this information effectively through the market optimization process. In the first instance, if a Scheduling Coordinator wishes to have their resource participate as a Multi-Stage Generating Resource, Scheduling Coordinators register their data to accurately reflect the resource's characteristics and the ISO must ensure the data is registered correctly and is feasible for the market processes to use. Once the data is collected, the ISO has to ensure that the data is accurately stored and managed in the ISO's systems so that it is accurately running in the markets. The need for such resource data handling in turn required enhanced methods for holding a generating resource's data in the Master File, which houses all the resource-specific data used in the ISO markets. Currently, the ISO requires 5 to 11 days to process resource data in the Master File. The ISO believes it can continue to process Master File changes within this time frame for certain features, but as I explain further below, for some Multi-Stage Generating Resources' attributes that are also ultimately stored in the Master File, the ISO requires some additional time to ensure that the data provided is not erroneous and will not cause market run failures or infeasibilities due to data input issues. Subsequently, enabling the resources to submit bids at the configuration level for these resources requires that the ISO validate the bids to ensure that the bids accurately reflect the registered elements and do not pose an infeasibility problem in the market optimization process.

Q. Can you please explain how the ISO will ensure that the resources are registered accurately and do not pose infeasibility issues?

A. First, the ISO has created a set of new data templates to collect the requisite data from Scheduling Coordinators. These templates will capture the necessary data elements regarding the multiple operating modes or configurations in which these resources can be operated. As discussed in Mr. Zhou's testimony (Exhibit ISO-2), these data templates will include the transition matrix which will reflect the operating ranges of the feasible configurations and the times and costs associated with the transition between configurations, including the transition path that may be necessary to move from one configuration to another. Much as it does today, working together with the Scheduling Coordinator, the ISO will ensure that the data is submitted in a manner that accurately reflects the resources' characteristics and also will review and verify that the transition matrix information presents a feasible set of data. Once this step has been accomplished, only then can the ISO begin processing the data through the Master File and preparing the data for market operations.

Q. Describe the enhancements the multi-stage modeling approach required for the market optimization software.

A. From a market optimization perspective, the multi-stage modeling approach adds an order of magnitude to the number of commitment decisions that must be evaluated. In the optimization technique implemented by the ISO in its new market design adopted on April 1, 2009, changes that involve adding more commitment decisions to be evaluated creates an exponential, rather than linear, increase in the level of complexity. The proposed Multi-Stage Generating Resource functionality is based on a design that permits the commitment of up to 10 configurations (*i.e.*, sub-plants); however, only one configuration is "on" at any moment in time. Also, there are limitations on transitioning from any configuration to another. These limitations have the potential of creating infeasibilities in optimizations because their combined requirements may result in the optimizations' inability to arrive to a solution. Also, every one of the current resources that will be converting to be modeled as a Multi-Stage Generating Resource will change the internal number of resources the optimization has to consider from one resource up to as many as 10 resources for each plant. These additional variables, therefore, are causing exponential additions of complexity that must be carefully managed to ensure that the ISO is able to achieve a feasible solution in each market run. In addition, the vendor software will be tuned for optimum performance based on the definition of those participating Multi-Stage Generating Resources and their mixed configurations to assure reliable runs without timeout or infeasibilities.

Q. Please describe the modifications required to the bidding and bid validation functionality as a result of adopting the Multi-Stage Generating Resource functionality.

A. The bidding rules and validation requirements are described more fully in Mr. Zhou's Testimony. I summarize here the essential changes to the bidding and bid validation rules to explain the modifications required to the ISO's bidding infrastructure and business rules (SIBR). In essence, with this enhancement Scheduling Coordinators will be able to submit bids separately for each configuration in each of the ISO markets, *e.g.*, the day-ahead market (which includes the IFM and RUC process) along with the real-time market. As also described in Mr. Zhou's Testimony, Multi-Stage Generating Resources will be able to provide ancillary services in the individual configurations and therefore, the ISO will receive their bids and submissions to self-provide ancillary services at the configuration level. Multi-Stage Generating Resources will continue to be subject to resource-adequacy must-offer requirements if they are under contract for such service, but the ISO must validate the bids for such resources at the configuration level and must ensure that any generated bids for the must-offer requirements are created for a specific configuration. In addition, the ISO must verify that the bids are submitted in a manner that the resources can feasibly transition from one configuration to another and do not result in infeasible bid sets that prevent the ISO from considering the resource in the markets. Moreover, as discussed in Mr. Zhou's Testimony, different bid validation rules are required in the various markets. All of these requirements resulted in the need to enhance the SIBR rules so that the ISO can validate these parameters upfront and bids are processed through the ISO market without issue. However, with all the validation in SIBR, not all permutations can be accounted for and the possibility still exists for a set of bids and configuration parameters that can create an infeasibility for the resource in the real-time market where the Scheduling Coordinator is permitted to bid in fewer configurations than the day-ahead market.

Q. Please describe what the ISO and Scheduling Coordinators will do in the event of such infeasibilities for the real-time market.

A. The system will respect the defined operational rules for Multi-Stage Generating Resources. However, because the real-time market system dispatches resources from their initial conditions based on the State Estimator values or telemetry values, it is possible that under certain conditions it is infeasible to reach the next configuration from the current configuration. In the event that a Multi-Stage Generating Resource receives a dispatch from the ISO that is infeasible from an operational perspective, which can result if the current configuration in the EMS does not match the configuration in the field, then the resource may have to be exceptionally dispatched through an out-of-market action to a feasible dispatch operation point. Alternatively, the resource would be required to deviate from its dispatch and would be subject to uninstructed imbalance energy charges. Under the current structure the ISO does not have uninstructed deviation penalties. Therefore, they would not be subject to such penalties. In the event that the combination of variables results in an infeasible solution for the real-time market as a whole, the ISO will resort to the same market disruption procedures it currently has pursuant to Section 7.7.15, where the ISO essentially fills in the failed run with the last best run.

Q. Please describe the impact this new functionality has had on the settlements systems.

A. This enhancement has had less of an impact on the settlement system because ultimately, the energy schedules and dispatches, or the capacity and ancillary services awards, are settled at the resource level. However, as described in Mr. Zhou's Testimony, the recovery of commitment costs, *i.e.*, start-up, minimum load costs, and transitions costs, has been enhanced to ensure the recovery of these costs factors in the configurations in which the ISO commits these units.

Q. Do any of these enhancements pose market performance issues?

A. At this time we do not believe that any of these enhancements pose any performance issues. We have been working closely with our software vendor to ensure that in developing the multi-stage modeling approach and the rules to support this functionality we have not posed any performance issues. However, we recognize that this is a substantial addition of complexity to our market systems. Therefore, we are taking several actions to ensure that the transition to the new software in the ISO markets is without issue.

III. <u>NECESSARY MEASURES TO ENSURE A SUCCESSFUL LAUNCH OF THIS NEW FUNCTIONALITY GIVEN THESE COMPLEXITIES</u>

Q. Can you describe the actions taken to ensure a feasible transition?

A. As is customary with all software enhancements, the ISO is undergoing factory testing of the software, on-site testing soon, and then integration testing. Once this is completed, the ISO will conduct a series of market simulations to demonstrate the Multi-Stage Generating Resource functionality, provide market participants with an opportunity to become familiar with this functionality, and perform any of their associated internal processes and procedures under simulated market conditions prior to the introduction of Multi-Stage Generating Resource functionality into production. The Multi-Stage Generating Resource market simulations are scheduled to take place over an eight week period between July 6, 2010 and August 27, 2010. Simulations during the first four weeks will provide market participants with an opportunity to bid Multi-Stage Generating Resources into the simulated market and observe how the market systems and markets respond to these bids. During the final four weeks a set of structured simulations will be conducted in order to demonstrate functionality under various specific scenarios. During this time market participants will also have the opportunity to submit bids for any resources that are not being used to conduct the structured scenarios. Throughout the market simulation the ISO plans to introduce production market input data for non-Multi-Stage Generating Resources into the market simulation environment, as appropriate, in order to create a highly realistic simulated market in which Multi-Stage Generating Resources can participate. The production market input data, such as bids and load forecasts, may be modified to create the conditions specified in the scenario definitions. As I stated previously, the multi-stage modeling approach requires additional information on the operational characteristics of the resources. Therefore, the ISO has already begun a registration process whereby participants may elect to register a Multi-Stage Generating Resource for market simulation and submit a resource data template form to provide the requisite modeling data.

Q. How many resources have registered as multi-stage generating resources?

A. We are pleased to report that at this time there are 45 resources registered as multi-stage generating resources for the purposes of participating in the upcoming market simulation.

Q. Are these resources successfully registered for the launch of the market with this new functionality?

A. Not yet. While the ISO has used the same procedures it anticipates to use in registering Multi-Stage Generating Resources when live, these resources are only registered and qualified for the purposes of participating in the upcoming market simulations. The reason for this is that there is a need to test and validate these mechanisms and ensure that all the details are adequately captured. Therefore, the ISO is permitting Scheduling Coordinators to participate in market simulations for some time to practice and verify that their resources are adequately registered. Prior to the start of market operations with the new functionality, the ISO will begin its official registration process of such resources to ensure readiness.

Q. Please describe the pre-go live registration process.

A. Approximately two months before go live, it is crucial that the ISO have a firm understanding of what resources plan to participate as Multi-Stage Generating Resources at the start of the market operations with the new functionality. Therefore, the ISO is requesting that all Scheduling Coordinators, that intend to go live with their resources registered as Multi-Stage Generating Resources, commence their registration process no later than August 2, 2010. Scheduling Coordinators that have already submitted their information and registered as Multi-Stage Generating Resources for market simulation, must also indicate that they intend to make their registered information official by August 2, 2010. After August 2, 2010, the ISO will begin its final registration and validation process for the already-registered resources in preparation for go live. The ISO anticipates that, given the number of resources that have already begun registering their information for the purposes of market simulation, there should not be a rush to have resources registered at that time. However, the finalization and first registration process will require the processing and validation of a number of resources. It would be imprudent to leave this registration process close to go live as the ISO would not be able to guarantee full readiness of the resources that intend to go live as Multi-Stage Generating Resources nor will it be able to fine tune performance for the mix of Multi-Stage Generating Resources and their unique configurations.

Q. Will resources have had an opportunity to validate their participation in the ISO markets as a Multi-Stage Generating Resources by then?

A. By that time the ISO anticipates to have completed market simulations. This will have enabled Scheduling Coordinators to have practiced with their registered configurations and reformulate their registered information prior to go live, if necessary.

Q. Why does the ISO need to know two months before how many resources will be participating as Multi-Stage Generating Resources?

A. It is important for the ISO to know approximately two months before to ensure a successful launch. Because of the complexities discussed above, the greater the number of resources participating as Multi-Stage Generating Resources, the more pressure there will be on the market systems. During the two months prior to go live, the ISO will be able to validate the market software and processes to ensure that there will be no problems accommodating the fleet of Multi-Stage Generating Resources.

Q. Will Scheduling Coordinators be able to change their registered attributes before go live?

A. After August 2, 2010, the ISO will work with Scheduling Coordinators to ensure that the registered data is accurate and the resources can feasibly participate in the ISO markets. However, one month before go live, *i.e.*, September 1, 2010, the ISO will freeze the ability to change any of the Multi-Stage Generating Resources' characteristics. Prior to that time, Scheduling Coordinators can modify their registered information so long as they provide the ISO at least 16 days for processing. The ISO will endeavor to accommodate changes even if they are requested with less than sixteen days notice. However, the ISO cannot guarantee that the changes can be processed in time for the thirty-day freeze unless the ISO is given at least sixteen days notice. Therefore, by approximately August

14, Scheduling Coordinators should be finalizing any changes to their registered data. After that time, the only changes permitted would be the ability to revert back to their previous status as a non-Multi-Stage Generating Resources. In addition, that must be accomplished within the time frame of the last Master File drop before go live. The ISO will issue notices of these deadlines to ensure Scheduling Coordinators are fully apprised.

IV. MANAGING THE INTRODUCTION OF NEW RESOURCES TO BE MODELED AS MULTI-STAGE GENERATING RESOURCES AFTER THE LAUNCH OF THIS NEW FUNCTIONALITY

Q. Please describe the process for making changes to the Multi-Stage Generating Resources registered attributes after go live.

A. After the start of market operations with this new functionality, Scheduling Coordinators will be able to modify, pursuant to the existing timeline for modifications to the Master File data, all of their registered attributes. For a number of critical attributes, however, they will not be able to change until the 45th day after the start of market operations with this new functionality. The reason for this is that some of a resource's attributes require special management to ensure that the resources are not registered and managed in an infeasible manner. This consists of: 1) the registration of a new Multi-Stage Generating Resources; and 2) a change in the registered configurations, which would include the addition or removal of a configuration, or a change in the definition of the configuration. A change in the definition of the configuration includes a change in the physical units supporting the configuration, a change to the configuration start-up and shut-down flags, and adding or removing a transition to the transition matrix. Additionally, the ISO will not allow the following changes before the 45th day after go live: material changes in the transition times contained in the master file, which consists of a change that more than doubles a transition time or reduces it to less than half; and a material change to the maximum ramp rate of the configuration(s) contained in the Master File, which consists of a change that more than doubles the maximum ramp rate or reduces it to less than half. After the 45th day changes, changes to such attributes will again be prohibited until 110 days after go live.

Q. Should these restrictions pose a problem for the participation of resources?

A. I do not believe they will. Many of the resources that will participate as Multi-Stage Generating Resources will do so because of the physical operating characteristics of the units. The number of operating modes for these resources are already known and the resource operators or owners should already be familiar with the market performance of their resources without the multi-stage modeling approach. In addition, the configuration attributes are tightly linked to the physical characteristics of the units and that information does not change per Multi-Stage Generating Resource plant. The attributes that do change, like transition costs, are not subject to this lockdown and are instead going to be subject to the same time period that start-up and minimum load costs are subject to under the existing tariff structure.

V. DEPENDENCIES THAT EXIST IN THE SOFTWARE ENHANCEMENTS

Q. What kind of future enhancements rely on the implementation of the Multi-Stage Generating Resource functionality?

A. From a design and policy perspective, there is no pending future enhancement that is dependent on the implementation of this new functionality. However, from a software development and implementation perspective, the major subsequent software enhancements scheduled for 2011 are all developed on the presumption that the Multi-Stage Generating Resource functionality will be in place. For example, the convergence bidding software enhancements have been developing based on the presumption that the Multi-Stage Generating Resource functionality would be in place by the time the convergence bidding software is dropped.

VI. FUTURE APPLICATION OF MULTI-STAGE MODELING APPROACH

Q. Can this modeling approach be applied to other resources in the future?

A. Yes. In developing this modeling approach, the ISO and its vendor have also enhanced their functionality and know-how for modeling other non-generating resources in the ISO markets. In particular the multi-stage modeling approach is particularly helpful for modeling storage facilities, including both energy storage and pumped storage hydro-resources. These resources at times act as load and at other times as generation. The ability to model the various operating modes using a similar functionality would enhance their participation in the ISO markets. Without a multi-stage modeling approach it is difficult to model one resource that has two different characteristics regarding its physical parameters or bid structure. The multi-stage modeling approach in the Multi-Stage Generating Resource functionality provides the ability to have one resource at the plant level with different physical parameters and bid structure on the configuration level. However, the multi-stage modeling approach would have to be expanded to accommodate a configuration that is considered a “load” and not a “generating” resource. The “load” is represented as negative megawatts in the modeling, which requires modifications to the structure to accommodate the bids and megawatts output/awards along with distribution factors to fully support the network model. However, crucial to these future applications is the need to ensure that the current Multi-Stage Generating Resource application of this modeling approach is tuned and fully functional in production so that these additional functionalities can be built on top the Multi-Stage Generating Resource functionality based on the experience and knowledge gained from running it and understanding the performance and limitations of this implementation.

VII. CONCLUSION

Q. Does this conclude your declaration?

A. Yes, it does.

Hani Alarian

Mr. Hani Alarian

State of California)
)
County of Sacramento)

Subscribed and sworn to (or affirmed) before me on this 27th day of May, 2010, by Hani Alarian, proved to me on the basis of satisfactory evidence to be the person who appeared before me.

Martha M. Sedgley

Notary Public

MARTHA M. SEDGLEY
COMM. #1690762
Notary Public-California
PLACER COUNTY
My Comm. Exp. Sep. 27, 2010

Attachment A – Clean Sheets

Multi-Stage Generating Resource Amendment

ER10-___-000

Fourth Replacement CAISO Tariff

May 28, 2010

8.4 Technical Requirements for Providing Ancillary Services.

All Generating Units, System Units, Participating Loads and System Resources providing Ancillary Services shall comply with the technical requirements set out in Sections 8.4.1 to 8.4.3 below relating to their operating capabilities, communication capabilities and metering infrastructure. No Scheduling Coordinator shall be permitted to submit a Bid to the CAISO for the provision of an Ancillary Service from a Generating Unit, System Unit, Participating Load or System Resource, or to provide a Submission to Self-Provide an Ancillary Service from a Generating Unit, System Unit, Participating Load, or Dynamic System Resource, unless the Scheduling Coordinator is in possession of a current certificate issued by the CAISO confirming that the Generating Unit, System Unit, Participating Load or System Resource complies with the CAISO's technical requirements for providing the Ancillary Service concerned. Scheduling Coordinators can apply for Ancillary Services certificates in accordance with the requirements for considering and processing such applications in Appendix K and the CAISO's Operating Procedures. The CAISO shall have the right to inspect Generating Units, Participating Loads or the individual resources comprising System Units and other equipment for the purposes of the issue of a certificate and periodically thereafter to satisfy itself that its technical requirements continue to be met. If at any time the CAISO's technical requirements are not being met, the CAISO may withdraw the certificate for the Generating Unit, System Unit, Participating Load or System Resource concerned.

8.4.1 Operating Characteristics Required to Provide Ancillary Services.

Each Generating Unit, System Unit, Participating Load or System Resource for which a Scheduling Coordinator wishes to submit a Bid to provide Ancillary Services must comply with the requirements for the specific Ancillary Service as set forth in Appendix K and the Business Practice Manual. The certification requirements in Section 8, Appendix K of the CAISO Tariff, and the Business Practice Manuals shall apply to Multi-Stage Generating Resources based on the MSG Configurations. Scheduling Coordinators shall submit Ancillary Services Bids or Submissions to Self-Provide Ancillary Services to the CAISO Markets only for MSG Configurations that are certified consistent with these requirements. In addition, to the extent the CAISO requires specific operating characteristics for Ancillary Services certification of Multi-Stage Generating Resources the responsible Scheduling Coordinator shall submit to the CAISO such specific operating characteristics at the MSG Configuration level. The

System Units or System Resources, owners or operators of reactive devices and Scheduling Coordinators shall notify the CAISO immediately whenever they become aware that an Ancillary Service or RUC Capacity is not available in any way. All Participating Generators, owners or operators of Loads, operators of System Units or System Resources and owners or operators of reactive devices shall check, monitor and/or test their system and related equipment routinely to assure availability of the committed Ancillary Services and RUC Capacity. These requirements apply to Ancillary Services whether the Ancillary Services are contracted or self-provided. For a duration specified by the CAISO, the CAISO may suspend the technical eligibility certificate of a Scheduling Coordinator for a Generating Unit, System Unit, Load or System Resource, which repeatedly fails to perform. The CAISO shall develop measures to discourage repeated non-performance on the part of both bidders and self-providers. Further, all of these requirements apply to each MSG Configuration.

8.9.1 Compliance Testing for Spinning Reserve.

Compliance testing for Spinning Reserve is addressed in Section 8.10.2.

8.9.2 Compliance Testing for Regulation.

The CAISO may test the capability of any Generating Unit or System Resource providing Regulation by using the CAISO EMS to move that Generating Unit's or System Resource's output over the full range of its Regulation capacity within a ten-minute period. For a Multi-Stage Generating Resource the full range of Regulation capacity is evaluated at the applicable MSG Configuration.

measure the response of the Generating Unit, System Unit or external import of a System Resource to determine compliance with its stated capabilities. For a Multi-Stage Generating Resource the full range of Non-Spinning capacity is evaluated at the applicable MSG Configuration.

8.9.3.2 Compliance Testing of Curtailable Demand.

The CAISO may test the Non-Spinning Reserve capability of a Load providing Curtailable Demand by issuing unannounced Dispatch Instructions requiring the operator of the Load to report the Curtailable Demand of that Load actually being served by the operator at the time of the instruction. No Load will be disconnected as part of the test.

8.9.4 Compliance Testing for Voltage Support.

8.9.4.1 Compliance Testing of a Generating Unit.

The CAISO may test the Voltage Support capability of a Generating Unit by issuing unannounced Dispatch Instructions requiring the Generating Unit to adjust its power factor outside the specified power factor band of 0.90 lag to 0.95 lead, but within the limits of the Generating Unit capability curve.

8.9.4.2 Compliance Testing of Other Reactive Devices.

The CAISO may test the Voltage Support capability of other reactive devices (shunt capacitors, static var compensators, and synchronous condensers) by issuing unannounced Dispatch Instructions requiring operation of such devices.

8.9.5 Compliance Testing for Black Start.

The CAISO may test the Black Start capability of a Generating Unit by unannounced tests, which may include issuing Dispatch Instructions to start and synchronize the resource, testing of all communications circuits, simulating switching needed to connect the Black Start Generating Unit to the transmission system, and testing the features unique to each facility that relate to Black Start service.

8.9.6 Compliance Testing for RUC Capacity.

The CAISO may test the capability of a Generating Unit, System Unit or an external import of a System Resource to provide RUC Capacity by issuing unannounced Dispatch Instructions requiring the Generating Unit or System Unit to come on line and ramp up or, in the case of a System Resource, to affirmatively respond to a Real-Time Interchange Schedule adjustment; all in accordance with the Scheduling Coordinator's Bid. Such tests may not necessarily occur on the hour. The CAISO shall measure the response of the Generating Unit, System Unit or external import of a System Resource to determine compliance with its stated capabilities. For a Multi-Stage Generating Resource the range of RUC Capacity evaluated is the range for the applicable MSG Configuration.

8.9.7 Consequences of Failure to Pass Compliance Testing.

8.9.7.1 Notification of Compliance Testing Results.

If a Generating Unit, Load, or System Resource fails a compliance test, the CAISO shall notify the Scheduling Coordinator whose resource was the subject of the test and the provider or owner or operator of the Generating Unit, Participating Load, or System Resource providing Ancillary Services or RUC Capacity of such failure by any means as soon as reasonably practicable after the completion of the test. In addition, regardless of the outcome of the test, the CAISO shall provide the Scheduling Coordinator whose resource was subject to a compliance test written notice of the results of such test. The CAISO shall at the same time send a copy of the notice to the provider or owner or operator of the Generating Unit, Load, or System Resource providing Ancillary Services or RUC Capacity. For any Resource Adequacy Resource failing a compliance test, the CAISO also will provide notification of the failure to the California Public Utilities Commission, Local Regulatory Authority, or federal agency with jurisdiction over the Load Serving Entity that listed the Resource Adequacy Resource on its Resource Adequacy Plan, and FERC.

8.9.7.2 Penalties for Failure to Pass Compliance Testing.

The Scheduling Coordinator whose resource fails a compliance test shall be subject to the financial penalties provided for in the CAISO Tariff. In addition, the CAISO shall institute the sanctions described in Section 8.9.16.

8.9.8 Performance Audits for Standard Compliance.

In addition to testing under Section 8.10, the CAISO will periodically audit the performance of resources providing RUC Capacity or Ancillary Services to confirm the ability of such resources to provide the RUC Capacity or to meet the applicable Ancillary Service standard for performance and control.

8.9.9 Performance Audit for Regulation.

The CAISO will audit the performance of a Generating Unit providing Regulation by monitoring its response to CAISO EMS control or, in the case of an external import of a System Resource providing Regulation, by monitoring the dynamic Interchange response to CAISO EMS control around its Set Point within its rated MW/minute capability over the range of Regulation capacity scheduled for the current Settlement Period. For a Multi-Stage Generating Resource the range of Regulation capacity evaluated is the range for the applicable MSG Configuration.

8.9.10 Performance Audit for Spinning Reserve.

The CAISO will audit the performance of a Generating Unit or external import of a System Resource providing Spinning Reserve by auditing its response to Dispatch Instructions and by analysis of Meter Data associated with the Generating Unit. Such audits may not necessarily occur on the hour. A Generating Unit providing Spinning Reserve shall be evaluated on its ability to respond to a Dispatch Instruction, move at the MW/minute capability stated in its Bid, reach the amount of Spinning Reserve capacity scheduled for the current Settlement Period within ten (10) minutes of issue of the Dispatch Instruction by the CAISO, and respond to system frequency deviations outside the allowed frequency deadband. An external import of a System Resource providing Spinning Reserve shall be evaluated on its ability to respond to a Dispatch Instruction, move at the MW/minute capability stated in its Bid, reach the amount of Spinning Reserve capacity scheduled for the current Settlement Period within ten (10) minutes of issue of the Dispatch Instruction by the CAISO. For a Multi-Stage Generating Resource the range of Spinning Reserve capacity evaluated is the range for the applicable MSG Configuration.

8.9.11 Performance Audit for Non-Spinning Reserve.

The CAISO will audit the performance of a Generating Unit, Load, or System Resource providing Non-Spinning Reserve by auditing its response to Dispatch Instructions, and by analysis of Meter Data associated with the resource. Such audits may not necessarily occur on the hour. A Generating Unit providing Non-Spinning Reserve shall be evaluated on its ability to respond to a Dispatch Instruction, move in accordance with the time delay and MW/minute capability stated in its Bid, and reach the amount of Non-Spinning Reserve capacity under the control of the CAISO scheduled for the current Settlement Period within ten (10) minutes of issue of the Dispatch Instruction by the CAISO. An external import of a System Resource providing Non-Spinning Reserve shall be evaluated on its ability to respond to a Dispatch Instruction, move in accordance with the time delay and MW/minute capability stated in its Bid, and reach the amount of Non-Spinning Reserve capacity scheduled for the current Settlement Period within ten (10) minutes of issue of the Dispatch Instruction by the CAISO. A Load providing Non-Spinning Reserve from Curtailable Demand shall be evaluated on its ability to respond to a Dispatch Instruction, move in accordance with the time delay and MW/minute capability stated in its Bid, and reach the amount of Non-Spinning Reserve capacity scheduled for the current Settlement Period within ten (10) minutes of issue of the Dispatch Instruction by the CAISO. For a Multi-Stage Generating Resource the range of Non-Spinning capacity evaluated is the range for the applicable MSG Configuration.

8.9.12 Performance Audit for Voltage Support.

The CAISO will audit the performance of a resource providing Voltage Support by auditing of its response to Dispatch Instructions, and by analysis of Meter Data associated with the resource. A resource providing Voltage Support shall be evaluated on its ability to provide reactive support over the stated power factor range of the resource, provide reactive support within the prescribed time periods, and demonstrate the effective function of automatic voltage control equipment for the amount of Voltage Support under the control of the CAISO for the current Settlement Period.

8.9.13 Performance Audit for Black Start.

The CAISO will audit the performance of a Black Start Generating Unit by analysis of Meter Data and other records to determine that the performance criteria relating to the Black Start from that Black Start Generating Unit were met when required.

8.9.14 Performance Audit for RUC Capacity.

The CAISO will audit the performance of a Generating Unit, Participating Load, or System Resource providing RUC Capacity by auditing its response to Dispatch Instructions, and by analysis of Meter Data associated with the resource. Such audits may not necessarily occur on the hour. A Generating Unit providing RUC Capacity shall be evaluated on its ability to respond to a Dispatch Instruction, start within the designated time delay, move at the MW/minute capability stated in its Bid, reach the amount of RUC Capacity scheduled for the Settlement Period concerned and sustain operation at this level for a sufficient time to assure availability over the specified period. An external import of a System Resource providing RUC Capacity shall be evaluated on its ability to respond to a Dispatch Instruction, start within the designated time delay, move at the MW/minute capability stated in its Bid, reach the amount of RUC Capacity scheduled for the Settlement Period concerned and sustain operation at this level for a sufficient time to assure availability over the specified period. For a Multi-Stage Generating Resource range of RUC Capacity evaluated is the range for the applicable MSG Configuration.

8.10.2 Spinning Reserve.

The CAISO shall test the Spinning Reserve capability of a Generating Unit, System Unit or System Resource by issuing unannounced Dispatch Instructions requiring the Generating Unit, System Unit or System Resource to ramp up to its ten (10) minute capability. The CAISO shall measure the response of the Generating Unit, System Unit or System Resource to determine compliance with requirements. Such tests may not necessarily occur on the hour. The Scheduling Coordinator for the Generating Unit, System Unit or System Resource shall be paid pursuant to Section 11.5.6. For a Multi-Stage Generating Resource the range of Spinning capacity evaluated is the range for the applicable MSG Configuration.

8.10.3 Non-Spinning Reserve.

The CAISO may test the Non-Spinning Reserve capability of a Generating Unit, Load, System Unit or System Resource by issuing unannounced Dispatch Instructions requiring the Generating Unit, Load, System Unit or System Resource to come on line and ramp up or to reduce Demand to its ten (10) minute capability. The CAISO shall measure the response of the Generating Unit, System Unit, System Resource or Load to determine compliance with requirements. The Scheduling Coordinator for the Generating Unit, System Unit, Load or System Resource shall be paid pursuant to Section 11.5.6. For a Multi-Stage Generating Resource the range of Non-Spinning capacity evaluated is the range at the applicable MSG Configuration.

8.10.4 Voltage Support.

The CAISO shall monitor a Generating Unit's response to Voltage Support instructions in order to determine compliance with Dispatch Instructions.

8.10.5 Black Start.

The CAISO may test the Black Start capability of a Generating Unit by issuing unannounced Dispatch Instructions requiring the Generating Unit to start on a Black Start basis. The CAISO shall measure the response of the Generating Unit to determine compliance with the terms of the Black Start contract. The Scheduling Coordinator or Black Start Generator as stated in Section 11.10.1.5 for the Generating Unit shall be paid the Generating Unit's contract price for the output under the Black Start test.

8.10.8.1 Rescission of Payments for Undispatchable Ancillary Service Capacity.

The CAISO shall calculate the Real-Time ability of each Generating Unit, Participating Load, System Unit or System Resource to deliver Energy from Ancillary Services capacity or Self-Provided Ancillary Services capacity for each Settlement Interval based on its maximum operating capability, actual telemetered output, and Operational Ramp Rate as described in Section 30.10. To make this determination for Multi-Stage Generating Resources the CAISO shall use the MSG-Configuration-specific Maximum Operating Limit and Operational Ramp Rate. System Resources that are awarded Ancillary Services capacity in the Day-Ahead Market are required to electronically tag (E-Tag as prescribed by the WECC) the Ancillary Services capacity. If the amounts of Ancillary Services capacity in an electronic tag differ from the amounts of Ancillary Services capacity for the System Resource, the Undispatchable Capacity will equal the amount of the difference, and will be settled in accordance with the provisions of Section 11.10.9.1.

8.10.8.2 Rescission of Payments for Unavailable Ancillary Service Capacity.

If the CAISO determines that a Scheduling Coordinator has supplied Uninstructed Imbalance Energy to the CAISO during a Settlement Interval from the capacity of a Generating Unit, Participating Load, System Unit or System Resource that is obligated to supply Spinning Reserve or Non-Spinning Reserve to the CAISO, payments to the Scheduling Coordinator for the Ancillary Service capacity used to supply Uninstructed Imbalance Energy shall be eliminated to the extent of the deficiency, in accordance with the provisions of Section 11.10.9.2. For Multi-Stage Generating Resources that have supplied Uninstructed Imbalance Energy from capacity obligated to supply Spinning or Non-Spinning Reserves, the CAISO shall calculate the capacity for which payments will be rescinded at the Generating Unit or Dynamic Resource-Specific System Resource level, as applicable, and will use the MSG Configuration-specific Maximum Operating Limit.

8.10.8.3 Rescission of Payments for Undelivered Ancillary Service Capacity.

For each Settlement Interval in which a Generating Unit, Participating Load, System Unit or System Resource fails to supply Energy from Spinning Reserve or Non-Spinning Reserve capacity in accordance with a Dispatch Instruction, or supplies only a portion of the Energy specified in the Dispatch Instruction, the capacity payment will be reduced to the extent of the deficiency, in accordance with the provisions of Section 11.10.9.3.

9.5 Records.

The CAISO and all Operators shall develop procedures to keep a record of Approved Maintenance Outages as they are implemented and to report the completion of Approved Maintenance Outages. Such records are available for inspection by Operators and Connected Entities at the CAISO Outage Coordination Office. Only those records pertaining to the equipment or facilities owned by the relevant Operator or Connected Entity will be made available for inspection at the CAISO Outage Coordination Office, and such records will only be made available provided notice is given in writing to the CAISO fifteen (15) days in advance of the requested inspection date.

9.6 Facility Owner.

The facility owner shall remain solely and directly responsible for the performance of all maintenance work, whether on energized or de-energized facilities, including all activities related to providing a safe working environment.

9.7 Multi-Stage Generating Resources Outages

Participating Generators of Multi-Stage Generating Resources shall report Outages in accordance with the Outage reporting requirements in Section 9 for the Generating Unit and for each MSG Configuration, as applicable. In addition, to the extent that the responsible Scheduling Coordinator modifies the registered Multi-Stage Generating Resource's characteristics as provided in Section 27.8.3, the Participating Generator for the Multi-Stage Generating Resource shall modify any information or reports previously submitted pursuant to this Section 9 to account for any registered status and characteristic changes as soon as possible after receiving notice from the CAISO acceptance of the registered status or characteristics changes and no later than two (2) business days prior to the date on which the Section 27.8.3 changes are expected to be in effect.

11.8 Bid Cost Recovery.

For purposes of determining the Unrecovered Bid Cost Uplift Payments for each Bid Cost Recovery Eligible Resource as determined in Section 11.8.5 and the allocation of Unrecovered Bid Cost Uplift Payments for each Settlement Interval, the CAISO shall sequentially calculate the Bid Costs, which can be positive (IFM, RUC or RTM Bid Cost Shortfall) or negative (IFM, RUC or RTM Bid Cost Surplus) in the IFM, RUC and the Real-Time Market, as the algebraic difference between the respective IFM, RUC or RTM Bid Cost and the IFM, RUC or RTM Market Revenues, which is netted across the CAISO Markets. In any Settlement Interval a resource is eligible for Bid Cost Recovery payments only if it is On, or in the case of a Participating Load, only if the resource has actually stopped or started consuming pursuant to the Dispatch Instruction. BCR Eligible Resources for different MSS Operators are supply resources listed in the applicable MSS Agreement. All Bid Costs shall be based on mitigated Bids as specified in Section 39.7. In order to be eligible for Bid Cost Recovery, Non-Dynamic Resource-Specific System Resources must provide to the CAISO SCADA data by telemetry to the CAISO's EMS in accordance with Section 4.12.3 demonstrating that they have performed in accordance with their CAISO commitments.

11.8.1 CAISO Determination of Self-Commitment Periods.

For the purposes of identifying the periods during which a Bid Cost Recovery Eligible Resource is deemed self-committed and thus ineligible for Start-Up Costs, Transition Costs, Minimum Load Costs, IFM Pump Shut-Down Costs and IFM Pumping Costs, the CAISO derives the Self-Commitment Periods as described below. The CAISO will determine the Self-Commitment Periods for Multi-Stage Generating Resources based on the applicable MSG Configuration. MSS resources designated for Load following are considered to be self-committed if they have been scheduled with non-zero Load following capacity, or are otherwise used to follow Load in the Real-Time. The IFM and RUC Self-Commitment Periods will be available as part of the Day-Ahead Market results provided to the applicable Scheduling Coordinator. The interim RTM Self-Commitment Periods as reflected in the HASP will be available as part of the HASP results for the relevant Trading Hour as provided to the applicable Scheduling Coordinator. The final RTM Self-Commitment Period is determined ex-post for Settlements purposes. ELS Resources committed through the ELC Process described in

Section 31.7 are considered to have been committed in the IFM Commitment Period for the applicable Trading Day for the purposes of determining BCR settlement in this section 11.8.

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 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 + 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 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 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 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 or Dynamic Resource-Specific System Resource and MSG Configuration levels are simultaneously respected.

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 Fast 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 or Dynamic Resource-Specific System Resource and MSG Configuration levels are simultaneously respected.

11.8.1.3 Multi-Stage Generating Resource Start-Up, Minimum Load, or Transition Costs

For the settlement of the Multi-Stage Generating Resource Start-Up Cost, Minimum Load Cost, and Transition Cost in the IFM, RUC, and RTM, the CAISO will determine the applicable Commitment Period and select the applicable Start-Up Cost, Minimum Load Cost, and Transition Cost based on the following rules.

(1) In any given Settlement Interval, the CAISO will first apply the following rules to determine the applicable Start-Up Cost, Minimum Load Cost, and Transition Cost for the Multi-Stage Generating Resources. For a Commitment Period in which the:

(a) IFM Commitment Period and/or RUC Commitment Period MSG Configuration(s) are different than the RTM CAISO Commitment Period MSG Configuration, the Multi-Stage Generating Resource's Start-Up Cost, Minimum Load Cost, and Transition Cost will be settled based on the RTM CAISO Commitment Period MSG Configuration Start-Up Cost, Minimum Load Cost, and Transition Cost, as described in Section 11.8.4.1.

(b) IFM CAISO Commitment Period and/or RUC CAISO Commitment Period MSG Configuration(s) and there is a RTM Self-Commitment Period in any MSG Configuration, the Multi-Stage Generating Resource's Start-Up Cost, Minimum Load Cost, and Transition Cost will be settled based on the IFM CAISO Commitment Period and/or RUC CAISO Commitment Period MSG Configuration(s) Start-Up Cost, Minimum Load Cost, and Transition Cost, as described in Sections 11.8.2.1 and 11.8.3.1, and further determined pursuant to part (2) of this Section below.

(c) IFM CAISO Commitment Period and/or RUC CAISO Commitment Period MSG Configuration is the same as the RTM CAISO Commitment Period MSG Configuration, the Multi-Stage Generating Resource's Start-Up Cost, Minimum Load Cost, and Transition Cost will be settled based on the IFM CAISO Commitment Period and/or RUC CAISO Commitment Period MSG Configuration(s) Start-Up Cost, Minimum Load Cost, and Transition Cost described in Sections 11.8.2.1 and 11.8.3.1, and further determined pursuant to part (2) of this Section below.

(d) IFM and RUC Self-Commitment Period MSG Configuration(s) are the same as the RTM CAISO Commitment Period MSG Configuration, then the Multi-Stage Generating Resource's Start-Up Cost, Minimum Load Cost, and Transition Cost will be settled based on the RTM CAISO Commitment Period MSG Configuration Start-Up Cost, Minimum Load Cost, and Transition Cost as described in Section 11.8.4.1.

(2) In any given Settlement Interval, after the rules specified in part (1) above of this Section have been executed, the ISO will apply the following rules to determine whether the IFM or RUC Start-Up Cost, Minimum Load Cost, and Transition Cost apply for Multi-Stage Generating Resources. For a Commitment Period in which the:

(a) IFM Commitment Period MSG Configuration is different than the RUC CAISO Commitment Period MSG Configuration the Multi-Stage Generating Resource's Start-Up Cost, Minimum Load Cost, and Transition Cost will be settled based on the RUC CAISO Commitment Period MSG Configuration Start-Up Cost, Minimum Load Cost, and Transition Cost as described in Section 11.8.3.1.

(b) IFM CAISO Commitment Period MSG Configuration is the same as the RUC Commitment Period MSG Configuration, the Multi-Stage Generating Resource's Start-Up Cost, Minimum Load Cost, and Transition Cost will be based on the IFM CAISO Commitment Period MSG Configuration Start-Up Cost, Minimum Load Cost, and Transition Cost as described in Section 11.8.2.1.

11.8.2 IFM Bid Cost Recovery Amount.

For purposes of determining the IFM Unrecovered Bid Cost Uplift Payments as determined in Section 11.8.5, and the purposes of allocating Net IFM Bid Cost Uplift as described in Section 11.8.6.4 the CAISO shall calculate the IFM Bid Cost Shortfall or the IFM Bid Cost Surplus as the algebraic difference between the IFM Bid Cost and the IFM Market Revenues for each Settlement Interval. The IFM Bid Costs shall be calculated pursuant to Section 11.8.2.1 and the IFM Market Revenues shall be calculated pursuant to Section 11.8.2.2. The Energy subject to IFM Bid Cost Recovery is the actual Energy delivered in the Real-Time that is within the Day-Ahead Schedule for each eligible resource.

11.8.2.1 IFM Bid Cost Calculation.

For each Settlement Interval, the CAISO shall calculate IFM Bid Cost for each Bid Cost Recovery Eligible Resource as the algebraic sum of the IFM Start-Up Cost, IFM Transition Cost, IFM Minimum Load Cost, IFM Pump Shut-Down Cost, IFM Energy Bid Cost, IFM Pumping Cost, and IFM AS Bid Cost. For Multi-Stage Generating Resources, in addition to the specific IFM Bid Cost rules described in Section 11.8.2.1, the CAISO will apply the rules described in Section 11.8.1.3 to further determine the applicable MSG Configuration-based CAISO Market Start-Up Cost, Transition Cost and Minimum Load Cost in any given Settlement Interval. For Multi-Stage Generating Resources, the incremental IFM Start-Up, Minimum Load, and Transition Costs to provide Energy Scheduled in the Day-Ahead Schedule or awarded RUC or Ancillary Service capacity for an MSG Configuration other than the self-scheduled MSG Configuration are determined by the IFM rules specified in Section 31.3.

11.8.2.1.1 IFM Start-Up Cost.

The IFM Start-Up Cost for any IFM Commitment Period shall equal to the Start-Up Costs submitted by the Scheduling Coordinator to the CAISO for the IFM divided by the number of Settlement Intervals within the applicable IFM Commitment Period. For each Settlement Interval, only the IFM Start-Up Cost in a CAISO IFM Commitment Period is eligible for Bid Cost Recovery. The CAISO will determine the IFM Start-Up Costs for Multi-Stage Generating Resources based on the CAISO-committed MSG Configuration. The following rules shall apply sequentially to qualify the IFM Start-Up Cost in an IFM Commitment Period:

(a) The IFM Start-Up Cost for an IFM Commitment Period shall be zero if there is an IFM Self-Commitment Period within or overlapping with that IFM Commitment Period.

(b) The IFM Start-Up Cost for an IFM Commitment Period shall be zero if the Bid Cost Recovery Eligible Resource is manually pre-dispatched under an RMR Contract prior to the Day-Ahead Market or the resource is flagged as an RMR Dispatch in the Day-Ahead Schedule in the Day-Ahead Market anywhere within the applicable IFM Commitment Period.

(c) The IFM Start-Up Cost for an IFM Commitment Period shall be zero if there is no actual Start-Up at the start of the applicable IFM Commitment Period because the IFM Commitment Period is the continuation of an IFM, RUC, or RTM Commitment Period from the previous Trading Day.

(d) The IFM Start-Up Cost for an IFM Commitment Period shall be zero if the Start-Up is delayed by the Real-Time Market past the IFM Commitment Period in question or cancelled by the Real-Time Market before the start-up process has started.

(e) If an IFM Start-Up is terminated in the Real-Time within the applicable IFM Commitment Period through an Exceptional Dispatch Shut-Down Instruction issued while the Bid Cost Recovery Eligible Resource was starting up, the IFM Start-Up Cost for that IFM Commitment Period shall be prorated by the ratio of the Start-Up Time before termination over the total IFM Start-Up Time.

(f) The IFM Start-Up Cost is qualified if an actual Start-Up occurs within the applicable IFM Commitment Period. An actual Start-Up is detected between two consecutive Settlement Intervals when the relevant metered Energy in the applicable Settlement Intervals increases from below the Minimum Load Energy and reaches or exceeds the relevant Minimum Load Energy. The Minimum Load Energy is the product of the relevant Minimum Load and the duration of the Settlement Interval. The CAISO will determine the Minimum Load Energy for Multi-Stage Generating Resources based on the CAISO Commitment Period applicable MSG Configuration.

(g) The IFM Start-Up Cost will be qualified if an actual Start-Up occurs earlier than the start of the IFM Commitment Period if the advance Start-Up is as a result of a Start-Up instruction issued in a RUC or Real-Time Market process subsequent to the IFM, or the advance Start-Up is uninstructed but is still within the same Trading Day and the Bid Cost Recovery Eligible Resource actually stays on until the targeted IFM Start-Up.

11.8.2.1.2 IFM Minimum Load Cost.

The Minimum Load Cost for the applicable Settlement Interval shall be the Minimum Load Cost submitted to the CAISO in the IFM divided by the number of Settlement Intervals in a Trading Hour. For each Settlement Interval, only the IFM Minimum Load Cost in a CAISO IFM Commitment Period is eligible for Bid Cost Recovery. The IFM Minimum Load Cost for any Settlement Interval is zero if: (1) the Settlement Interval is in an IFM Self Commitment Period for the Bid Cost Recovery Eligible Resource; (2) the Bid Cost Recovery Eligible Resource is manually pre-dispatched under an RMR Contract prior to the Day-Ahead Market or the resource is flagged as an RMR Dispatch in the Day-Ahead Schedule for the applicable Settlement Interval; or (3) the Bid Cost Recovery Eligible Resource is determined not actually On during the applicable Settlement Interval. For the purposes of determining IFM Minimum Load Cost, a Bid Cost Recovery Eligible Resource is assumed to be On if its metered Energy in a Settlement Interval is equal to or greater than the difference between its Minimum Load Energy and the Tolerance Band. Otherwise, it is determined to be Off. The CAISO will determine the IFM Minimum Load Costs for Multi-Stage Generating Resources, based on the CAISO Commitment Period MSG Configuration.

11.8.2.1.3 IFM Pump Shut-Down Cost.

For Pumped-Storage Hydro Units and Participating Load only, the IFM Pump Shut-Down Costs for each Settlement Interval shall be equal to the relevant Pump Shut-Down Cost submitted to CAISO in the IFM divided by the number of Settlement Intervals in a Trading Hour that is preceded by a previous commitment by the IFM to pump, in which actual shut down occurs if the unit is committed by the IFM not to pump and actually does not operate in pumping mode in that

11.8.2.1.4 IFM Pumping Bid Cost.

For Pumped-Storage Hydro Units and Participating Load only, the IFM Pumping Bid Cost for the applicable Settlement Interval shall be the Pumping Cost submitted to the CAISO in the IFM divided by the number of Settlement Intervals in a Trading Hour. The Pumping Cost is negative. The Pumping Cost is included in IFM Bid Cost computation for a Pumped-Storage Hydro Unit and Participating Load committed by the IFM to pump or serve Load if it actually operates in pumping mode or serves Load in that Settlement Interval. The IFM Energy Bid Cost for a Participating Load for any Settlement Interval is set to zero for actual Energy consumed in excess of the Day-Ahead Schedule for Demand. The IFM Pumping Cost for any Settlement Interval is zero if: (1) the Settlement Interval is in an IFM Self-Commitment Period for the Bid Cost Recovery Eligible Resource; or (2) the Bid Cost Recovery Eligible Resource is manually pre-dispatched under an RMR Contract prior to the Day-Ahead Market or the resource is flagged as an RMR Dispatch in the Day-Ahead Schedule for the applicable Settlement Interval.

11.8.2.1.5 IFM Energy Bid Cost.

For any Settlement Interval, the IFM Energy Bid Cost for Bid Cost Recovery Eligible Resources, except Participating Loads, shall be the integral of the relevant Energy Bid submitted to the IFM, if any, from the higher of the registered Bid Cost Recovery Eligible Resource’s Minimum Load and the Day-Ahead Total Self-Schedule up to the relevant MWh scheduled in the Day-Ahead Schedule, divided by the number of Settlement Intervals in a Trading Hour. The IFM Energy Bid Cost for Bid Cost Recovery Eligible Resources, except Participating Loads, for any Settlement Interval is set to zero for any portion of the Day-Ahead Schedule that is not delivered from the otherwise Bid Cost Recovery Eligible Resource that has metered Generation below its Day-Ahead Schedule; any portion of the Day-Ahead Schedule that is actually delivered remains eligible for IFM Energy Bid Cost Recovery. The CAISO will determine the IFM Energy Bid Cost for a Multi-Stage Generating Resource at the Generating Unit or Dynamic Resource-Specific System Resource level.

11.8.2.1.6 IFM AS Bid Cost.

For any Settlement Interval, the IFM AS Bid Cost shall be the product of the IFM AS Award from each accepted IFM AS Bid and the relevant AS Bid Price, divided by the number of Settlement Intervals in a Trading Hour. The CAISO will determine and calculate IFM AS Bid Cost for a Multi-Stage Generating Resource at the Generating Unit or Dynamic Resource-Specific System Resource level.

11.8.2.1.7 IFM Transition Cost

For each Settlement Interval, the IFM Transition Costs shall be based on the MSG Configuration to which the Multi-Stage Generating Resource is transitioning and is allocated to the CAISO Commitment Period of that MSG Configuration.

11.8.2.2 IFM Market Revenue.

For any Settlement Interval in a CAISO IFM Commitment Period the IFM Market Revenue for a Bid Cost Recovery Eligible Resource is the algebraic sum of: (1) the product of the delivered MWh, in the relevant Day-Ahead Schedule in that Trading Hour where for Pumped-Storage Hydro Units and Participating Load operating in the pumping mode or serving Load, the MWh is negative, and the relevant IFM LMP, divided by the number of Settlement Intervals in a Trading Hour; and (2) the product of the IFM AS Award from each accepted IFM AS Bid and the relevant Resource-Specific ASMP, divided by the number of Settlement Intervals in a Trading Hour. In the case of a Multi-Stage Generating Resource, the CAISO will calculate the market revenue at the Generating Unit or Dynamic Resource-Specific System Resource level. For any Settlement Interval in a IFM Self-Commitment Period the IFM Market Revenue for a Bid Cost Recovery Eligible Resource is the algebraic sum of: (1) the product of the delivered MWh above the greater of Minimum Load and Self-Scheduled Energy, in the relevant Day-Ahead Schedule in that Trading Hour and the relevant IFM LMP, divided by the number of Settlement Intervals in a Trading Hour; and (2) the product of the IFM AS Award from each accepted IFM AS Bid and the relevant Resource-Specific ASMP, divided by the number of Settlement Intervals in a Trading Hour.

11.8.2.3 IFM Bid Cost Recovery Amounts for Metered Subsystems.

The IFM Bid Cost Recovery for MSS Operators differs based on whether the MSS Operator has elected gross or net Settlement.

11.8.2.3.1 MSS Elected Gross Settlement.

For an MSS Operator that has elected gross Settlement, regardless of other MSS optional elections (Load following or RUC opt-in or out), the IFM Bid Cost and the IFM Market Revenue are calculated similarly to non-MSS resources on an individual resource basis as described in Sections 11.8.2.1 and 11.8.2.2, respectively.

11.8.3.1 RUC Bid Cost Calculation.

For each Settlement Interval, the CAISO shall determine the RUC Bid Cost for a Bid Cost Recovery Eligible Resource as the algebraic sum of the RUC Start-Up Cost, RUC Transition Cost, RUC Minimum Load Cost and RUC Availability Bid Cost. For Multi-Stage Generating Resources, in addition to the specific RUC Bid Cost rules described in Section 11.8.3.1, the rules described in Section 11.8.1.3 will be applied to further determine the applicable MSG Configuration-based CAISO Market Start-Up Cost, Transition Cost, and Minimum Load Cost in any given Settlement Interval. For Multi-Stage Generating Resources, the incremental RUC Start-Up, Minimum Load, and Transition Costs to provide RUC awarded capacity for an MSG Configuration other than the self-scheduled MSG Configuration are determined by the RUC optimization rules in specified in Section 31.5.

11.8.3.1.1 RUC Start-Up Cost.

The RUC Start-Up Cost for any Settlement Interval in a RUC Commitment Period shall consist of Start-Up Cost of the Bid Cost Recovery Eligible Resource submitted to the CAISO for the applicable RUC Commitment Period divided by the number of Settlement Intervals in the applicable RUC Commitment Period. For each Settlement Interval, only the RUC Start-Up Cost in a CAISO RUC Commitment Period is eligible for Bid Cost Recovery. The CAISO will determine the RUC Start-Up Cost for a Multi-Stage Generating Resource based on the MSG Configuration committed by the CAISO in RUC. The following rules shall be applied in sequence and shall qualify the RUC Start-Up Cost in a RUC Commitment Period:

(a) The RUC Start-Up Cost for a RUC Commitment Period is zero if there is an IFM Commitment Period within that RUC Commitment Period.

(b) The RUC Start-Up Cost for a RUC Commitment Period is zero if the Bid Cost Recovery Eligible Resource is manually pre-dispatched under an RMR Contract prior to the Day-Ahead Market or is flagged as an RMR Dispatch in the Day-Ahead Schedule anywhere within that RUC Commitment Period.

(c) The RUC Start-Up Cost for a RUC Commitment Period is zero if there is no RUC Start-Up at the start of that RUC Commitment Period because the RUC Commitment Period is the continuation of an IFM, RUC, or RTM Commitment Period from the previous Trading Day.

(d) The RUC Start-Up Cost for a RUC Commitment Period is zero if the Start-Up is delayed beyond the RUC Commitment Period in question or cancelled by the Real-Time Market prior to the Bid Cost Recovery Eligible Resource starting its start-up process.

(e) If a RUC Start-Up is terminated in the Real-Time within the applicable RUC Commitment Period through an Exceptional Dispatch Shut-Down Instruction issued while the Bid Cost Recovery Eligible Resource is starting up the, RUC Start-Up Cost is prorated by the ratio of the Start-Up Time before termination over the RUC Start-Up Time.

(f) The RUC Start-Up Cost for a RUC Commitment Period is qualified if an actual Start-Up occurs within that RUC Commitment Period. An actual Start-Up is detected between two consecutive Settlement Intervals when the relevant metered Energy in the applicable Settlement Intervals increases from below the Minimum Load Energy and reaches or exceeds the relevant Minimum Load Energy. The Minimum Load Energy is the product of the relevant Minimum Load and the duration of the Settlement Interval. The CAISO will determine the Minimum Load Energy for Multi-Stage Generating Resources based on the CAISO-committed MSG Configuration.

(g) The RUC Start-Up Cost shall be qualified if an actual Start-Up occurs earlier than the start of the RUC Start-Up, if the relevant Start-Up is still within the same Trading Day and the Bid Cost Recovery Eligible Resource actually stays on until the RUC Start-Up, otherwise the Start-Up Cost is zero for the RUC Commitment Period.

11.8.3.1.2 RUC Minimum Load Cost.

The Minimum Load Cost for the applicable Settlement Interval shall be the Minimum Load Cost of the Bid Cost Recovery Eligible Resource divided by the number of Settlement Intervals in a Trading Hour. For each Settlement Interval, only the RUC Minimum Load Cost in a CAISO RUC

Commitment Period is eligible for Bid Cost Recovery. The RUC Minimum Load Cost for any Settlement Interval is zero if: (1) the Bid Cost Recovery Eligible Resource is manually pre-dispatched under an RMR Contract or the resource is flagged as an RMR Dispatch in the Day-Ahead Schedule in that Settlement Interval; (2) the Bid Cost Recovery Eligible Resource is not actually On in the applicable Settlement Interval; or (3) the applicable Settlement Interval is included in an IFM Commitment Period. For the purposes of determining RUC Minimum Load Cost, a Bid Cost Recovery Eligible Resource is assumed to be On if its metered Energy in a Settlement Interval is equal to or greater than the difference between its Minimum Load Energy and the Tolerance Band. Otherwise, it is determined to be Off. The CAISO will determine the RUC Minimum Load Cost for a Multi-Stage Generating Resource based on the MSG Configuration committed by the CAISO in RUC.

11.8.3.1.3 RUC Availability Bid Cost.

The RUC Availability Bid Cost is calculated as the product of the RUC Award with the relevant RUC Availability Bid price, divided by the number of Settlement Intervals in a Trading Hour. The RUC Availability Bid Cost for a Bid Cost Recovery Eligible Resource for a Settlement Interval is zero if the Bid Cost Recovery Eligible Resource is operating below its RUC Schedule, and also has a negative Uninstructed Imbalance Energy (UIE) magnitude in that Settlement Interval in excess of: (1) five (5) MWh divided by the number of Settlement Intervals in the Trading Hour; or (2) three percent (3%) of its maximum capacity divided by the number of Settlement Intervals in a Trading Hour. The CAISO will determine the RUC Availability Bid Cost based on the Multi-Stage Generating Resource Generating Unit level.

11.8.3.1.4 RUC Transition Cost

For each Settlement Interval, the RUC Transition Costs shall be based on the MSG Configuration to which the Multi-Stage Generating Resource is transitioning and is allocated to the CAISO commitment period of that MSG Configuration.

11.8.3.2 RUC Market Revenues.

For any Settlement Interval, the RUC Market Revenue for a Bid Cost Recovery Eligible Resource is the RUC Availability Payment as specified in Section 11.2.2.1 divided by the number of Settlement Intervals in a Trading Hour. If the RUC Availability Bid Cost of a BCR Eligible Resource is reduced to zero (0) in a Settlement Interval because of Uninstructed Deviation as stated in Section 11.8.3.1.3, then the RUC Market Revenue for that resource for that Settlement Interval shall also be set to zero (0) since the resource is subject to rescission of RUC Availability Payments as specified in Section 31.5.7. The CAISO will determine the RUC Market Revenues for Multi-Stage Generating Resources based on the Generating Unit or Dynamic Resource-Specific System Resource level.

11.8.4.1 RTM Bid Cost Calculation.

For each Settlement Interval, the CAISO shall calculate RTM Bid Cost for each Bid Cost Recovery Eligible Resource, as the algebraic sum of the RTM Start-Up Cost, RTM Minimum Load Cost, RTM Transition Cost, RTM Pump Shut-Down Cost, RTM Energy Bid Cost, RTM Pumping Cost and RTM AS Bid Cost. For Multi-Stage Generating Resources, in addition to the specific RTM Bid Cost rules described in Section 11.8.4.1, the rules described in Section 11.8.1.3 will be applied to further determine the applicable MSG Configuration-based CAISO Market Start-Up Cost, Transition Cost, and Minimum Load Cost in given Settlement Interval. For Multi-Stage Generating Resources, the incremental RTM Start-Up Cost, Minimum Load Cost, and Transition Cost to provide RTM committed Energy or awarded Ancillary Services capacity for an MSG Configuration other than the self-scheduled MSG Configuration are determined by the RTM optimization rules in specified in Section 34.

11.8.4.1.1 RTM Start-Up Cost.

For each Settlement Interval of the applicable Real-Time Market Commitment Period, the Real-Time Market Start-Up Cost shall consist of the Start-Up Cost of the Bid Cost Recovery Eligible Resource submitted to the CAISO for the Real-Time Market divided by the number of Settlement Intervals in the applicable Real-Time Market Commitment Period. For each Settlement Interval, only the Real-Time Market Start-Up Cost in a CAISO Real-Time Market Commitment Period is eligible for Bid Cost Recovery. The CAISO will determine the RTM Start-Up Cost for a Multi-Stage Generating Resource based on the MSG Configuration committed by the CAISO in RTM. The following rules shall be applied in sequence and shall qualify the Real-Time Market Start-Up Cost in a Real-Time Market Commitment Period:

(a) The Real-Time Market Start-Up Cost is zero if there is a Real-Time Market Self-Commitment Period within the Real-Time Market Commitment Period.

(b) The Real-Time Market Start-Up Cost is zero if the Bid Cost Recovery Eligible Resource has been manually pre-dispatched under an RMR Contract or the resource is flagged as an RMR Dispatch in the Day-Ahead Schedule or Real-Time Market anywhere within that Real-Time Market Commitment Period.

(c) The Real-Time Market Start-Up Cost is zero if the Bid Cost Recovery Eligible Resource is started within the Real-Time Market Commitment Period pursuant to an Exceptional Dispatch issued in accordance with Section 34.9.2 to (1) perform Ancillary Services testing; (2) perform pre-commercial operation testing for Generating Units; or (3) perform PMax testing.

(d) The Real-Time Market Start-Up Cost is zero if there is no Real-Time Market Start-Up at the start of that Real-Time Market Commitment Period because the Real-Time Market Commitment Period is the continuation of an IFM or RUC Commitment Period from the previous Trading Day.

(e) If a Real-Time Market Start-Up is terminated in the Real-Time within the applicable Real-Time Market Commitment Period through an Exceptional Dispatch Shut-Down Instruction issued while the Bid Cost Recovery Eligible Resource is starting up the Real-Time Market Start-Up Cost is prorated by the ratio of the Start-Up Time before termination over the Real-Time Market Start-Up Time.

(f) The Real-Time Market Start-Up Cost shall be qualified if an actual Start-Up occurs within that Real-Time Market Commitment Period. An actual Start-Up is detected between two consecutive Settlement Intervals when the relevant metered Energy in the applicable Settlement Intervals increases from below the Minimum Load Energy and reaches or exceeds the relevant Minimum Load Energy. The Minimum Load Energy is the product of the relevant Minimum Load and the duration of the Settlement Interval. The CAISO will determine the Minimum Load Energy for Multi-Stage Generating Resources based on the CAISO-committed MSG Configuration.

(g) The Real-Time Market Start-Up Cost for a Real-Time Market Commitment Period shall be qualified if an actual Start-Up occurs earlier than the start of the Real-Time Market Start-Up, if the relevant Start-Up is still within the same Trading Day and the Bid Cost Recovery Eligible Resource actually stays on until the Real-Time Market Start-Up, otherwise the Start-Up Cost is zero for the RUC Commitment Period.

11.8.4.1.2 RTM Minimum Load Cost.

The RTM Minimum Load Cost is the Minimum Load Cost of the Bid Cost Recovery Eligible Resource submitted to the CAISO for the Real-Time Market divided by the number of Settlement Intervals in a Trading Hour. For each Settlement Interval, only the RTM Minimum Load Cost in a CAISO RTM

Commitment Period is eligible for Bid Cost Recovery. The RTM Minimum Load Cost for any Settlement Interval is zero if: (1) the Settlement Interval is included in a RTM Self-Commitment Period for the Bid Cost Recovery Eligible Resource; (2) the Bid Cost Recovery Eligible Resource has been manually dispatched under an RMR Contract or the resource has been flagged as an RMR Dispatch in the Day-Ahead Schedule or the Real-Time Market in that Settlement Interval; (3) the Bid Cost Recovery Eligible Resource is not actually On in that Settlement Interval; (4) for all resources that are not Multi-Stage Generating Resources, that Settlement Interval is included in an IFM or RUC Commitment Period; or (5) the Bid Cost Recovery Eligible Resource is committed pursuant to Section 34.9.2 for the purpose of performing Ancillary Services testing, pre-commercial operation testing for Generating Units, or PMax testing. For the purposes of RTM Minimum Load Cost, a Bid Cost Recovery Eligible Resource is determined to not actually be On if the metered Energy in that Settlement Interval is less than the Tolerance Band referenced by the Minimum Load Energy. In addition, the CAISO will determine the Multi-Stage Generating Resource RTM Minimum Load Costs based on the MSG Configuration in which the CAISO commits the Multi-Stage Generating Resource in RTM. For Settlement Intervals that contain two Dispatch Intervals with two different MSG Configurations, the CAISO will determine the Transition Costs, and Minimum Load Costs based on the sum of the two applicable Dispatch Intervals.

11.8.4.1.3 RTM Pump Shut-Down Cost.

The RTM Pump Shut-Down Cost for each Settlement Interval is the relevant Pump Shut-Down Cost submitted by the Scheduling Coordinator only for Pumped-Storage Hydro Units and Participating Load, divided by the number of Settlement Intervals in which such resource was committed by the Real-Time Market in a Trading Hour with scheduled pumping operation and in which an actual Shut-Down occurs and the resource does not actually operate in pumping mode or serve Load in that Settlement Interval (as detected through Meter Data). The RTM Pump Shut-Down Cost for a Real-Time Market Shut-Down event shall be zero if: (1) it is followed by a RTM Self-Commitment Period in generation mode or offline mode; or (2) the Shut-Down is due to an Outage reported through SLIC.

11.8.4.1.5 RTM Energy Bid Cost.

For any Settlement Interval, the RTM Energy Bid Cost for the Bid Cost Recovery Eligible Resource except Participating Loads shall be computed as the sum of the products of each Instructed Imbalance Energy (IIE) portion, except Standard Ramping Energy, Residual Imbalance Energy, Exceptional Dispatch Energy, Derate Energy, MSS Load Following Energy, Ramping Energy Deviation and Regulating Energy, with the relevant Energy Bid prices, if any, for each Dispatch Interval in the Settlement Interval. The RTM Energy Bid Cost for a Bid Cost Recovery Eligible Resource except Participating Loads for a Settlement Interval is set to zero for any undelivered Real-Time Instructed Imbalance Energy by the Bid Cost Recovery Eligible Resource. Any Uninstructed Imbalance Energy in excess of Instructed Imbalance Energy is also not eligible for Bid Cost Recovery. For a Multi-Stage Generating Resource the CAISO will determine the RTM Energy Bid Cost based on the Generating Unit or Dynamic Resource-Specific System Resource level.

11.8.4.1.6 RTM AS Bid Cost.

For each Settlement Interval, the Real-Time Market AS Bid Cost shall be the product of the average Real-Time Market AS Award from each accepted AS Bid submitted in the Settlement Interval for the Real-Time Market, reduced by any relevant tier-1 No Pay capacity in that Settlement Interval (but not below zero), with the relevant AS Bid price. The average Real-Time Market AS Award for a given AS in a Settlement Interval is the sum of the 15-minute Real-Time Market AS Awards in that Settlement Interval, each divided by the number of 15-minute Commitment Intervals in a Trading Hour and prorated to the duration of the Settlement Interval (10/15 if the Real-Time Market AS Award spans the entire Settlement Interval, or 5/15 if the Real-Time Market AS Award spans half the Settlement Interval). For a Multi-Stage Generating Resource the CAISO will determine the RTM AS Bid Cost based on the Generating Unit or Dynamic Resource-Specific System Resource level.

11.8.4.1.7 RTM Transition Cost

For each Settlement Interval, the RTM Transition Costs shall be based on the MSG Configuration to which the Multi-Stage Generating Resource is transitioning and is allocated to the CAISO commitment period of that MSG Configuration.

11.8.4.2 RTM Market Revenue Calculations.

11.8.4.2.1 For each Settlement Interval in a CAISO Real-Time Market Commitment Period, the RTM Market Revenue for a Bid Cost Recovery Eligible Resource is the algebraic sum of the elements listed below in this Section. For Multi-Stage Generating Resources the RTM Market Revenue calculations will be made at the Generating Unit or Dynamic Resource-Specific System Resource level.

(a) The sum of the products of the Instructed Imbalance Energy (including Energy from Minimum Load of Bid Cost Recovery Eligible Resources committed in RUC where for Pumped-Storage Hydro Units and Participating Load operating in the pumping mode or serving Load, the MWh is negative), except Standard Ramping Energy, Residual Imbalance Energy, Exceptional Dispatch Energy, Derate Energy, MSS Load following Energy, Ramping Energy Deviation and Regulation Energy, with the relevant Real-Time Market LMP, for each Dispatch Interval in the Settlement Interval;

(b) The product of the Real-Time Market AS Award from each accepted Real-Time Market AS Bid in the Settlement Interval with the relevant ASMP, divided by the number of fifteen (15)-minute Commitment Intervals in a Trading Hour (4), and prorated to the duration of the Settlement Interval.

(c) The relevant tier-1 No Pay charges for that Bid Cost Recovery Eligible Resource in that Settlement Interval.

11.8.4.2.2 For each Settlement Interval in a non-CAISO Real-Time Market Commitment Period, the Real-Time Market Revenue for a Bid Cost Recovery Eligible Resource is the algebraic sum of the following:

11.8.5 Unrecovered Bid Cost Uplift Payment.

Scheduling Coordinators shall receive an Unrecovered Bid Cost Uplift Payment for a Bid Cost Recovery Eligible Resource, including resources for MSS Operators that have elected gross Settlement, if the net of all IFM Bid Cost Shortfalls and IFM Bid Cost Surpluses calculated pursuant to Section 11.8.2, RUC Bid Cost Shortfalls and RUC Bid Cost Surpluses calculated pursuant to Section 11.8.3, and the RTM Bid Cost Shortfalls and RTM Bid Cost Surpluses calculated pursuant to Section 11.8.4 for that Bid Cost Recovery Eligible Resource over a Trading Day is positive. For Multi-Stage Generating Resources, Unrecovered Bid Cost Uplift Payments will be calculated and made at the Generating Unit level or Dynamic Resource-Specific System Resource and not the MSG Configuration level. For MSS Operators that have elected net Settlement, the Unrecovered Bid Cost Uplift Payment is at the MSS level. The MSS IFM, RUC, and RTM Bid Cost Shortfall or IFM. RUC, and RTM Bid Cost Surplus for each market for each Trading Hour is the sum of the IFM, RUC, and RTM Bid Cost Shortfalls and IFM. RUC, and RTM Bid Cost Surpluses for all resources in the MSS. Scheduling Coordinators for MSS Operators that have elected net Settlement will receive an Unrecovered Bid Cost Uplift Payment if the net of all IFM, RUC, and RTM Bid Cost Shortfalls and IFM, RUC, and RTM Bid Cost Surpluses for that MSS over a Trading Day is positive.

11.8.6 System-wide IFM, RUC and RTM Bid Cost Uplift Allocation.

11.8.6.1 Determination of IFM, RUC and RTM Bid Cost Uplift.

For each Settlement Interval, the CAISO shall determine the IFM, RUC and RTM Bid Cost Uplift for purposes of allocating the IFM, RUC and RTM Bid Cost Uplift as described below. In determining the IFM, RUC and RTM Bid Cost Uplifts below, the Unrecovered Bid Cost Uplift Payments for MSS BCR Eligible Resources in Metered Subsystems where the MSS Operator has elected net Settlement will be included on an MSS basis and not on an individual resource basis.

(i) The IFM Bid Cost Uplift shall be the net of the IFM Bid Cost Shortfalls and IFM Bid Cost Surpluses for a Settlement Interval of all Bid Cost Recovery Eligible Resources with Unrecovered Bid Cost Uplift Payments.

27.8 Multi-Stage Generating Resources

27.8.1 Registration and Qualification

Scheduling Coordinators must comply with the registration and qualification process described in this Section 27.8.1, in order to effectuate any of the changes described in Section 27.8.3. No less than sixteen (16) days prior to the date that Scheduling Coordinator seeks to have the resource participate in the CAISO Markets under the new settings or MSG Configuration details, the Scheduling Coordinator must complete and submit to the CAISO the registration form and the resource data template provided by the CAISO for registration and qualification purposes. After the Scheduling Coordinator submits a request for registration of a Generating Unit or Dynamic Resource-Specific System Resource as a Multi-Stage Generating Resource or a change in the attributes in Section 27.8.3, the CAISO will coordinate with that Scheduling Coordinator to validate that the resource qualifies for the requested status and that all the requisite information has been successfully provided to the CAISO. The resource will be successfully registered and qualified as a Multi-Stage Generating Resource, or the requested changes in the attributes listed in Section 27.8.3 will be successfully registered and qualified as of the date on which the CAISO sends the responsible Scheduling Coordinator a notice that the resource has been successfully qualified as such. After the date on which the CAISO has provided such notice, any changes to the items listed in Section 27.8.3 will be subject to the timing and process requirements in this Section 27.8.1 and 27.8.3. The Scheduling Coordinator may modify all other Multi-Stage Generating Resource registered characteristics pursuant to the timing and processing requirements specified elsewhere in this CAISO Tariff, as they may apply.

If the CAISO has reason to believe that the resource's operating and technical characteristics are not consistent with the registered and qualified attributes, the CAISO may request that the Scheduling Coordinator provide additional information necessary to support their registered status and, if appropriate, may require that the resource be registered and qualified more consistent with the resource's operating and technical characteristics, including the revocation of its status as a Multi-Stage Generating Resource. Failure to provide such information may be grounds for revocation of Multi-Stage Generating Resource status. Such changes in status or MSG Configuration details would be subject to the registration and qualification requirements in this Section 27.8. Scheduling Coordinators may register the number MSG Configurations as are reasonably appropriate for the resource based on the technical and operating characteristics of the resource, which may not, however, exceed a total of ten MSG Configurations and cannot be fewer than two MSG Configurations. The information requirements specified in Section 27.8.2 will apply.

27.8.2 Informational Requirements

As part of the registration process described in Section 27.8.1, the Scheduling Coordinators for Generating Units or Dynamic Resource-Specific System Resources that seek to qualify as Multi-Stage Generating Resources must submit to the CAISO a Transition Matrix, which contains the Transition Costs and operating constraints associated with MSG Transitions. The responsible Scheduling Coordinator shall submit for each MSG Configuration a single segment Operational Ramp Rate, and as applicable an Operating Reserves ramp rate and Regulating Reserves ramp rate. The Scheduling Coordinator must establish the default MSG Configuration and its associated Default Resource Adequacy Path that apply to Multi-Stage Generating Resources that are subject to Resource Adequacy must-offer obligations. The Scheduling Coordinator may submit changes to this information consistent with Sections 27.8.1 and 27.8.3, as they may apply.

27.8.3 Changes in Status and Configurations of Resource

Scheduling Coordinators may seek modifications to the Multi-Stage Generating Resource attributes listed below consistent with the process and timing requirements specified in Section 27.8.1 and the additional requirements discussed below in this Section 27.8.3:

(1) Registration and qualification of a Generating Unit or Dynamic Resource-Specific System Resource as a Multi-Stage Generating Resource.

(2) Changes to the MSG Configurations attributes, which include:

a. addition of new MSG Configurations;

b. removal of an existing MSG Configuration;

c. a change in the physical units supporting the MSG Configuration;

d. a change to the MSG Configuration Start Up and Shut Down flags;

e. adding or removing an MSG Transition to the Transition Matrix;

f. a material change in the Transition Times contained in the Master File, which consists of a change that more than doubles the Transition Times or reduces it to less than half; and

g. a material change to the maximum Ramp Rate of the MSG Configuration(s) contained in the Master File, which consists of a change that more than doubles the maximum Ramp Rate or reduces it to less than half.

When transitioning to implement these changes across the midnight hour, for any Real-Time Market run in which the changes specified in this Section 27.8.3 are to take effect within the Time Horizon of any of the Real-Time Market runs, the CAISO will Schedule, Dispatch, or award resources consistent with either the prior or new status and definitions, as appropriate, and required by any Real-Time conditions regardless of the resource's state scheduled or awarded in the immediately preceding Day-Ahead Market. A Scheduling Coordinator may unregister a Generating Unit or Dynamic Resource-Specific System Resource from its Multi-Stage Generating Resource status subject to the timing requirements for Master File changes, and such changes are not subject to the timing requirements in Section 27.8.3. For the first forty-five (45) days after the effective date of this Section, Scheduling Coordinators may not change any of Multi-Stage Generating Resource attributes listed above in this Section. On the forty-sixth (46) day following the effective day of this Section, changes to the attributes listed above in this Section may take effect, including the registration of new Multi-Stage Generating Resources, provided Scheduling Coordinators have previously followed the registration process requirements listed in Section 27.8.1. Subsequently, further changes to the attributes listed above in this Section 27.8.3 may not take effect until after the one hundred-tenth (110) day following the effective date of this Section, subject to the procedures described in Section 27.8.1. As of the one hundred-tenth (110) day following the effective date of this Section, changes to these attributes may only be made every sixty (60) days after the day on which any such changes have taken effect.

(g) For Multi-Stage Generating Resources that receive a Day-Ahead Schedule, are awarded a RUC Schedule, or receive an Ancillary Services Award the Scheduling Coordinator must submit an Energy Bid, which may consist of a Self-Schedule, in the Real-Time Market for the same Trading Hour(s) for either the same MSG Configuration scheduled or awarded in the Integrated Forward Market or committed in RUC. In addition, the Scheduling Coordinator for such Multi-Stage Generating Resources may also submit Bids into the Real-Time Market for three other MSG Configurations provided that the MSG Transitions between the MSG Configurations bid into the Real-Time Market are feasible and the transition from the previous Trading Hour are also feasible.

(h) For the Trading Hours that Multi-Stage Generating Resources do not have a CAISO Schedule or award from a prior CAISO Market run, the Scheduling Coordinator can submit up to three MSG Configurations into the RTM.

(i) A Scheduling Coordinator cannot submit a Bid to the CAISO Markets for a MSG Configuration into which the Multi-Stage Generating Resource cannot transition due to lack of Bids for the specific Multi-Stage Generating Resource in other MSG Configurations that are required for the requisite MSG Transition.

(j) In order for Multi-Stage Generating Resource to meet any Resource Adequacy must-offer obligations, the responsible Scheduling Coordinator must submit either an Economic Bid or Self-Schedule for at least one MSG Configuration into the Day-Ahead Market and Real-Time Market that is capable of fulfilling that Resource Adequacy obligation, as feasible.

(k) For any given Trading Hour, a Scheduling Coordinator may submit Self-Schedules and/or Submissions to Self-Provide Ancillary Services in only one MSG Configuration for each Generating Unit or Dynamic Resource-Specific System Resource.

(l) In any given Trading Hour in which a Scheduling Coordinator has submitted a Self-Schedule for a Multi-Stage Generating Resource, the Scheduling Coordinator may also submit Bids for other MSG Configurations provided that they concurrently submit Bids that enable the applicable CAISO Market to transition the Multi-Stage Generating Resource to other MSG Configurations.

(m) If in any given Trading Hour the Multi-Stage Generating Resource was awarded Regulation or Operating Reserves in the IFM, any Self-Schedules or Submissions to Self-Provide Ancillary Services the Scheduling Coordinator submits for that Multi-Stage Generating Resource in the RTM must be for the same MSG Configuration for which Regulation or Operating Reserve is Awarded in IFM for that Multi-Stage Generating Resource in that given Trading Hour.

(n) If a Multi-Stage Generating Resource has received a binding RUC Start-Up Instruction as provided in Section 31, any Self-Schedule or Submission to Self-Provide Ancillary Services in the RTM must be in the same MSG Configuration committed in RUC.

(o) If in any given Trading Hour the Multi-Stage Generating Resource is scheduled for Energy in the IFM, any Self-Schedules the Scheduling Coordinator submits for that Multi-Stage Generating Resource in the RTM must be for the same MSG Configuration for which Energy is scheduled in IFM for that Multi-Stage Generating Resource in that given Trading Hour.

30.5.2 Supply Bids.

30.5.2.1 Common Elements for Supply Bids.

In addition to the resource-specific Bid requirements of this Section, all Supply Bids must contain the following components: Scheduling Coordinator ID Code; Resource ID and the MSG Configuration ID, as applicable; Resource Location; PNode or Aggregated Pricing Node as applicable; Energy Bid Curve; Self-Schedule component; Ancillary Services Bid; RUC Availability Bid; the Market to which the Bid applies; Trading Day to which the Bid applies; Priority Type (if any). Supply Bids offered in the CAISO Markets must be monotonically increasing. Energy Bids in the RTM must also contain a Bid for Ancillary Services to the extent the resource is certified and capable of providing Ancillary Service in the RTM up to the registered certified capacity for that Ancillary Service less any Day-Ahead Ancillary Services Awards.

Scheduling Coordinators must submit the applicable Supply Bid components, including Self-Schedules, for the submitted MSG Configuration.

30.5.2.2 Supply Bids for Participating Generators.

In addition to the common elements listed in Section 30.5.2.1, Supply Bids for Participating Generators shall contain the following components: Start-Up Bid, Minimum Load Bid, Ramp Rate, Minimum and Maximum Operating Limits; Energy Limit, Regulatory Must-Take/Must-Run Generation; Contingency Flag; and Contract Reference Number (if any). Scheduling Coordinators submitting these Bid components for a Multi-Stage Generating Resource must do so for the submitted MSG Configuration. A Scheduling Coordinator for a Physical Scheduling Plant or a System

Unit may include Generation Distribution Factors as part of its Supply Bid. If the Scheduling Coordinator has not submitted the Generation Distribution Factors applicable for the Bid, the CAISO will use default Generation Distribution Factors stored in the Master File. All Generation Distribution Factors used by the CAISO will be normalized based on Outage data that is available to the automated market systems. A Multi-Stage Generating Resource and its MSG Configurations are registered under a single Resource ID and Scheduling Coordinator for the Multi-Stage Generating Resource must submit all Bids for the resource's MSG Configurations under the same Resource ID. For a Multi-Stage Generating Resources Scheduling Coordinators may submit bid curves for up to ten individual MSG Configurations of their Multi-Stage Generating Resources into the Day-Ahead Market and up to three individual MSG Configurations into the Real-Time Market. Scheduling Coordinators for Multi-Stage Generating Resources must submit a single Operational Ramp Rate for each MSG Configuration for which it submits a supply Bid either in the Day-Ahead Market or Real-Time Market. For Multi-Stage Generating Resources the Scheduling Coordinator may submit the Transition Times, which cannot be greater than the maximum Transition Time registered in the Master File. To the extent the Scheduling Coordinator does not submit the Transition Time that is a registered feasible transition the CAISO will use the registered maximum Transition Time for that MSG Transition for the specific Multi-Stage Generating Resource.

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

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

30.5.2.4 Supply Bids for System Resources.

In addition to the common elements listed in Section 30.5.2.1, Supply Bids for System Resources shall also contain: the relevant Ramp Rate; Start-Up Costs; and Minimum Load Costs. Resource-Specific System Resources may elect the Proxy Cost option or Registered Cost option for Start-Up Costs and Minimum Load Costs as provided in Section 30.4. Other System Resources are not eligible to recover Start-Up Costs and Minimum Load Costs. Resource-Specific System Resources are eligible to

$/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 Fast Start Unit, no Self-Schedule for Energy for that resource is required. If a Scheduling Coordinator proposes to self-provide Spinning Reserve, the Scheduling Coordinator is obligated to submit a Self-Schedule for Energy for that particular resource, unless as discussed above the particular resource is a Fast Start Unit. When submitting Ancillary Service Bids in the HASP and 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.

Services in the following order from higher to lower capacity: (a) Regulation Up; (b) Spinning Reserve; and (c) Non-Spinning Reserve. For resources providing Regulation Up, the upper regulating limit shall be used if it is lower than the highest operating limit. The remaining portion of the Energy Bid (i.e. that portion not associated with capacity committed to provide Ancillary Services) shall constitute a Bid to provide Energy.

30.5.2.7 RUC Availability Bids.

Scheduling Coordinators may submit RUC Availability Bids for specific Generating Units in the DAM; however, Scheduling Coordinators for Resource Adequacy Capacity or ICPM Capacity must submit RUC Availability Bids for that capacity to the extent that the capacity has not been submitted in a Self-Schedule or already been committed to provide Energy or capacity in the IFM. For Multi-Stage Generating Resources the RUC Availability Bids shall be submitted at the MSG Configuration. Capacity that does not have Bids for Supply of Energy in the IFM will not be eligible to participate in the RUC process. The RUC Availability Bid component is MW-quantity of non-Resource Adequacy Capacity in $/MW per hour, and $0/MW for Resource Adequacy Capacity or ICPM Capacity.

30.5.3 Demand Bids.

Each Scheduling Coordinator representing Demand, including Non-Participating Load and Aggregated Participating Load, shall submit Bids indicating the hourly quantity of Energy in MWh that it intends to purchase in the IFM for each Trading Hour of the Trading Day. Scheduling Coordinators must submit Demand Bids, including Self Schedules, for CAISO Demand at Load Aggregation Points except as provided in Section 30.5.3.2. Scheduling Coordinators must submit a zero RUC Availability Bid for the portion of their qualified Resource Adequacy Capacity. If submitting Self-Schedules at Scheduling Points for export in the IFM, the Scheduling Coordinator shall indicate whether or not the export is served from Generation from Resource Adequacy Capacity, and if submitting Self-Schedules at Scheduling Points for export in HASP the Scheduling Coordinator shall indicate whether or not the export is served from Generation from Resource Adequacy Capacity or RUC Capacity. The procedure for identifying the non-Resource Adequacy Capacity or non-RUC Capacity is specified in the Business Practice Manuals.

30.6 [NOT USED]

30.7 Bid Validation.

The CAISO shall validate submitted Bids pursuant to the procedures set forth in this Section 30.7 and the rules set forth in the Business Practice Manuals.

30.7.1 Scheduling Coordinator Access.

Each Scheduling Coordinator will be provided access to the CAISO's secure communication system to submit, modify and cancel Bids prior to the close of both the DAM and HASP, as specified in Section 30.5.1. The CAISO shall provide information regarding submitted Bids including, but not be limited to, the following: (i) notification of acceptance; (ii) notification of validation; (iii) notification of rejection; (iv) notification of status; (v) notification of submission error(s); and (vi) default modification or generation of Bids as further provided below, if any, on behalf of Scheduling Coordinators.

30.7.2 Timing of CAISO Validation.

Once a Bid is submitted to the CAISO Markets, the Bid is available for validation, which is conducted in multiple steps. Clean Bids will be generated after Market Close.

30.7.3 DAM Validation.

30.7.3.1 Validation Prior to Market Close and Master File Update.

The CAISO conducts Bid validation in three steps as described below. For a Multi-Stage Generating Resource the validation described herein is done for each submitted MSG Configuration.

Step 1: The CAISO will validate all Bids after submission of the Bid for content validation which determines that the Bid adheres to the structural rules required of all Bids as further described in the Business Practices Manuals. If the Bid fails any of the content level rules the CAISO shall assign it a rejected status and the Scheduling Coordinator must correct and resubmit the Bid.

Step 2: After the Bids are successfully validated for content, but prior to the Market Close of the DAM, the Bids will continue through the second level of validation rules to verify that the Bid adheres to the

30.7.3.5 Bid Validation Rules for Multi-Stage Generating Resources

30.7.3.5 Bid Validation Rules for Multi-Stage Generating Resources

If a Scheduling Coordinator does not submit a Bid in the Day-Ahead Market or Real-Time Market for a Multi-Stage Generating Resource with a Resource Adequacy must-offer obligation at a MSG Configuration that can meet the applicable Resource Adequacy must-offer obligation, the ISO will create a Generated Bid for the default Resource Adequacy MSG Configuration. If the Multi-Stage Generating Resource is not capable of Start-Up in the default Resource Adequacy MSG Configuration, the CAISO will create a Generated Bid for every MSG Configuration in the registered Default Resource Adequacy Path. If the Scheduling Coordinator submits a Bid for the Multi-Stage Generating Resource, the CAISO will create this Generated Bid for the registered MSG Configurations before the Market Close, and if it does not submit such a Bid the CAISO will create this Generated Bid after the Market Close. Any Generated Bid created by the CAISO for the default Resource Adequacy MSG Configuration will be in addition to the MSG Configurations bid into the Real-Time Market by the responsible Scheduling Coordinator. If the Scheduling Coordinator submits a Bid in the Day-Ahead Market or Real-Time Market for a MSG Configuration that is not the default Resource Adequacy MSG Configuration and that does not cover the full amount of the resource's Resource Adequacy requirements, the CAISO will create a Generated Bid for the full Resource Adequacy Capacity. Before the market closes, if a Scheduling Coordinator submits a Bid in the Day-Ahead Market or Real-Time Market for the default Resource Adequacy MSG Configuration of an Multi-Stage Generating Resource that only meets part of the resource's Resource Adequacy must-offer obligation, the CAISO will extend the last segment of the Energy Bid curve in the submitted Bid for the Multi-Stage Generating Resource up to the Multi-Stage Generating Resource's Resource Adequacy must-offer obligation. After the market closes, to the extent that no Bid is submitted into the Real-Time Market for a Multi-Stage Generating Resource scheduled in the Integrated Forward Market as required in Section 30.5 the CAISO will create a Self-Schedule for MSG Configuration equal to the Day-Ahead Schedule for that resource for the MSG Configuration scheduled in the IFM.

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

30.7.8 Format and Validation of Start-Up and Shut-Down Times.

For a Generating Unit or a Resource-Specific System Resource, the submitted Start-Up Time expressed in minutes (min) as a function of down time expressed in minutes (min) must be a staircase function with up to three (3) segments defined by a set of 1 to 4 down time and Start-Up Time pairs. The Start-Up Time is the time required to start the resource if it is offline longer than the corresponding down time. The CAISO shall model Start-Up Times for Multi-Stage Generating Resource at the MSG Configuration level and Transition Times are validated based on the Transition Matrix submitted as provided in Section 27.8. The last segment will represent the time to start the unit from a cold start and will extend to infinity. The submitted Start-Up Time function shall be validated as follows:

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

(b) The down time entries must match exactly (in number, sequence, and value) the corresponding down time breakpoints of the maximum Start-Up Time function, as registered in the Master File for the relevant resource.

(c) The Start-Up Time for each segment must not exceed the Start-Up Time of the corresponding segment of the maximum Start-Up Time function, as registered in the Master File for the relevant resource.

(d) The Start-Up Time function must be strictly monotonically increasing, i.e., the Start-Up Time must increase as down time increases.

For Participating Load, a single Shut-Down time in minutes is the time required for the resource to Shut-Down after receiving a Dispatch Instruction.

30.7.9 Format and Validation of Start-Up Costs and Shut-Down Costs.

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

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

(b) The down time entries must match exactly (in number, sequence, and value) the corresponding down time breakpoints of the Start-Up Cost function, as registered in the Master File for the relevant resource as either the Proxy Cost or Registered Cost.

(c) The Start-Up Cost for each segment must not be negative and must be equal to the Start-Up Cost of the corresponding segment of the Start-Up Cost function, as registered in the Master File for the relevant resource. If a value is submitted in a Bid for the Start-Up Cost, it will be overwritten by the Master File value as either the Proxy Cost or Registered Cost based on the option elected pursuant to Section 30.4. If no value for Start-Up Cost is submitted in a Bid, the CAISO will insert the Master File value, as either the Proxy Cost or Registered Cost based on the option elected pursuant to Section 30.4.

(d) The Start-Up Cost function must be strictly monotonically increasing, i.e., the Start-Up Cost must increase as down time increases.

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

30.7.10 Format and Validation of Minimum Load Costs.

For a Generating Unit or a Resource-Specific System Resource, the submitted Minimum Load Cost expressed in dollars per hour ($/hr) is the cost incurred for operating the unit at Minimum Load. The submitted Minimum Load Cost must not be negative and must be equal to the Minimum Load Cost under the Proxy Cost option or Registered Cost option, as registered in the Master File for the relevant resource.

For Participating Loads, the submitted Minimum Load Cost ($/hr) is the cost incurred while operating the resource at reduced consumption after receiving a Dispatch Instruction. The submitted Minimum Load Cost must not be negative.

31.2.2.2 Non-RMR Units.

If the dispatch level produced through the ACR is greater than the dispatch level produced through CCR, then the resource is subject to Local Market Power Mitigation, in which case the entire portion of the unit's Energy Bid Curve that is above the CCR dispatch level will be mitigated to the lower of the Default Energy Bid as specified in Section 39, or the DAM Bid, but no lower than the unit's highest Bid price that cleared the CCR. To the extent a Multi-Stage Generating Resource's MWh dispatch level produced in in the All Constraints Run is greater than the MWhs dispatch level produced in the Competitive Constraints Run, for purposes of mitigation, all the MSG Configurations will be mitigated similarly and the CAISO will evaluate all submitted Energy Bids for all MSG Configurations based on the relevant Default Energy Bids for the applicable MSG Configuration. The CAISO will calculate the Default Energy Bids for Multi-Stage Generating Resources by submitted MSG Configuration. When the ACR dispatch level is higher than the CCR level, the market Bid at and below the CCR dispatch level will be retained in the IFM. If the dispatch level produced through the ACR is not greater than the dispatch level produced through the CCR, the unit's original, unmitigated DAM Bid will be retained in its entirety.

31.3 Integrated Forward Market.

After the MPM-RRD and prior to RUC, the CAISO shall perform the IFM. The IFM (1) performs Unit Commitment and Congestion Management (2) clears mitigated or unmitigated Bids cleared in the MPM-RRD as well as Bids that were not cleared in the MPM-RRD process against bid-in Demand, taking into account transmission limits and honoring technical and inter-temporal operating Constraints, such as Minimum Run Times (3) and procures Ancillary Services to meet one hundred percent (100%) of the CAISO Forecast of CAISO Demand requirements. The IFM utilizes a set of integrated programs that: (1) determine Day-Ahead Schedules and AS Awards, and related LMPs and ASMPs; and (2) optimally commits resources that are bid in to the DAM. The IFM utilizes a SCUC algorithm that optimizes Start-Up Costs, Minimum Load Costs, Transition Costs, and Energy Bids along with any Bids for Ancillary Services as well as Self-Schedules submitted by Scheduling Coordinators. The IFM selects the optimal MSG Configuration from a maximum of ten MSG Configurations of each Multi-Stage Generating Resource as mutually exclusive resources. If a Scheduling Coordinator submits a Self-Schedule or a Submission to Self-Provide Ancillary Services for a given MSG Configuration in a given Trading Hour, the IFM will consider the Start-Up Cost, Minimum Load Cost, and Transition Cost associated with any Economic Bids for other MSG Configurations as incremental costs between the other MSG Configurations and the self-scheduled MSG Configuration. In such cases, incremental costs are the additional costs incurred to transition or operate in an MSG Configuration in addition to the costs associated with the self-scheduled MSG Configuration. The IFM also provides for the optimal management of Use-Limited Resources. The ELS Resources committed through the ELC Process conducted two days before the day the IFM process is conducted for the next Trading Day as described in Section 31.7 are binding.

31.3.1 Market Clearing and Price Determination.

31.3.1.1 Integrated Forward Market Output.

The IFM produces: (1) a set of hourly Day-Ahead Schedules, AS Awards, and AS Schedules for all participating Scheduling Coordinators that cover each Trading Hour of the next Trading Day; and (2) the hourly LMPs for Energy and the ASMPs for Ancillary Services to be used for settlement of the IFM. For a Multi-Stage Generating Resource, the IFM produces a Day-Ahead Schedule for no more than one MSG Configuration per Trading Hour. In addition, the IFM will produce the MSG Transition and the MSG Configuration indicators for the Multi-Stage Generating Resource, which would establish the expected MSG Configuration in which the Multi-Stage Generating Resource will operate. During a transition, the committed MSG Configuration is considered to be the "from" MSG Configuration. The CAISO will publish the LMPs at each PNode as calculated in the IFM. In determining Day-Ahead Schedules, AS Awards, and AS Schedules the IFM optimization will minimize total Bid Costs based on submitted and mitigated Bids while respecting the operating characteristics of resources, the operating limits of transmission facilities, and a set of scheduling priorities that are described in Section 31.4. In performing its optimization, the IFM first tries to complete its required functions utilizing Effective Economic Bids without adjusting Self-Schedules, and skips Ineffective Economic Bids and adjusts Self-Schedules only if it is not possible to balance Supply and Demand and manage Congestion in an operationally prudent manner with available Effective Economic Bids. The process and criteria by which the IFM adjusts Self-Schedules and other Non-priced Quantities are described in Sections 27.4.3, 31.3.1.3 and 31.4. The Day-Ahead Schedules are binding commitments, including the commitment to Start-Up, if necessary, to comply with the Day-Ahead Schedules. The CAISO will not issue separate Start-Up Instructions for Day-Ahead commitments. A resource's status, however, can be modified as a result of additional market processes occurring in the HASP and RTM.

31.3.1.2 Treatment of Ancillary Services Bids in IFM.

As provided in Section 30.7.6.2 the CAISO shall co-optimize the Energy and Ancillary Services Bids in clearing the IFM. To the extent that capacity subject to an Ancillary Services Bid submitted in the Day-Ahead Market is not associated with an Energy Bid, there is no co-optimization, and therefore, no opportunity cost associated with that resource for that Bid for the purposes of calculating the Ancillary Services Marginal Price as specified in Section 27.1.2.2. When the capacity associated with the Energy Bid overlaps with the quantity submitted in the Ancillary Services Bid, then the Energy Bid will be used to determine the opportunity cost, if any, in the co-optimization to the extent of the overlap. Therefore, the capacity that will be considered when co-optimizing the procurement of Energy and Ancillary Services from Bids in the IFM will consider capacity up to the total capacity of the resource as reflected in the Ancillary Services Bid as derated through SLIC, if at all. In the case of Regulation, the capacity that will be considered is the lower of the capacity of the resource offered in the Ancillary Services Bid or the upper Regulation limit of the highest Regulating Range as contained in the Master File. For any Trading Hour within the period in which the Multi-Stage Generating Resource is transitioning from one MSG Configuration to another, the IFM will not award Ancillary Services and any Submission to Self-Provide Ancillary Services will be disqualified. Any Ancillary Services Awards in the IFM to Multi-Stage Generating Resources will carry through to the Real-Time Market in the same MSG Configuration that the Multi-Stage Generating Resource is awarded in the IFM.

31.3.1.3 Reduction of Self-Scheduled LAP Demand.

In the IFM, to the extent the market software cannot resolve a non-competitive transmission Constraint utilizing Effective Economic Bids such that Self-Scheduled Load at the LAP level would otherwise be reduced to relieve the Constraint, the CAISO Market software will adjust Non-priced Quantities in accordance with the process and criteria described in Section 27.4.3. For this purpose the priority sequence, starting with the first type of Non-priced Quantity to be adjusted, will be:

(a) Schedule the Energy from Self-Provided Ancillary Service Bids from capacity that is obligated to offer an Energy Bid under a must-offer obligation such as from an RMR Unit or a Resource Adequacy Resource. Consistent with Section 8.6.2, the CAISO Market software could also utilize the Energy from Self-Provided Ancillary Service Bids from capacity that is not under a must-offer obligation such as from an RMR or a Resource Adequacy Resource, to the extent the Scheduling Coordinator has submitted an Energy Bid for such capacity. The associated Energy Bid prices will be those resulting from the MPM process.

(b) Relax the Constraint consistent with Section 27.4.3.1, and establish prices consistent with Section 27.4.3.2. No Constraints on Interties with adjacent Balance Authority Areas will be relaxed in this procedure.

31.3.1.4 Eligibility to Set the Day-Ahead LMP.

All Generating Units, Participating Loads, non-Participating Loads, System Resources, System Units, or Constrained Output Generators subject to the provisions in Section 27.7, with Bids, including Generated Bids, that are unconstrained due to Ramp Rates, MSG Transitions, Forbidden Operating Regions, or other temporal constraints are eligible to set the LMP, provided that (a) the Schedule for the Generating Unit or Resource-Specific System Resource is between its Minimum Operating Limit and the highest MW value in its Economic Bid or Generated Bid, or (b) the Schedule for the Participating Load, non-Participating Load, non-Resource-Specific System Resource, or System Unit is between zero (0) MW and the highest MW value in its Economic Bid or Generated Bid. If (a) a resource's Schedule is constrained by its each hour of the next Trading Day. RUC Capacity is selected by a SCUC optimization that uses the same Base Market Model used in the IFM adjusted as described in Section 27.5.1 and 27.5.6 to help ensure the deliverability of Energy from the RUC Capacity. In the case of Multi-Stage Generating Resources, the RUC will optimize Transition Costs in addition to the Start-Up and Minimum Load Costs. If a Scheduling Coordinator submits a Self-Schedule or a Submission to Self-Provide Ancillary Services for a given MSG Configuration in a given Trading Hour, the RUC will consider the Start-Up Cost, Minimum Load Cost, and Transition Cost associated with any Economic Bids for other MSG Configurations as incremental costs between the other MSG Configurations and the self-scheduled MSG Configuration. In such cases, incremental costs are the additional costs incurred to transition or operate in an MSG Configuration in addition to the costs associated with the self-scheduled MSG Configuration.

31.5.1 RUC Participation.

31.5.1.1 Capacity Eligible for RUC Participation.

RUC participation is voluntary for capacity that has not been designated as Resource Adequacy Capacity. Scheduling Coordinators may make such capacity available for participation in RUC by submitting a RUC Availability Bid, provided the Scheduling Coordinator has also submitted an Energy Bid for such capacity into the IFM. Capacity from Non-Dynamic System Resources that has not been designated Resource Adequacy Capacity is not eligible to participate in RUC. Capacity from resources including System Resources that has been designated as qualified Resource Adequacy Capacity must participate in RUC. RUC participation is required for Resource Adequacy Capacity to the extent that Resource Adequacy Capacity is not committed following the IFM. System Resources eligible to participate in RUC will be considered on an hourly basis; that is, RUC will not observe any multi-hour block constraints. In RUC the CAISO may commit a Multi-Stage Generating Resource with a Resource Adequacy must-offer obligation at any MSG Configuration with capacity equal to or greater than the MSG Configuration committed in the Integrated Forward Market.

RUC will observe the Energy Limits that may have been submitted in conjunction with Energy Bids to the IFM. RMR Unit capacity will be considered in RUC in accordance with Section 31.5.1.3. MSS resources may participate in RUC in accordance with Section 31.5.2.3. COG resources are accounted for in RUC, but may not submit or be paid RUC Availability Payments. The ELS Resources committed through the ELC Process conducted two days before the day the RUC process is conducted for the next Trading Day as described in Section 31.7 are binding.

31.5.1.2 RUC Availability Bids.

Scheduling Coordinators may only submit RUC Availability Bids for capacity (above the Minimum Load) for which they are also submitting an Energy Bid to participate in the IFM. The RUC Availability Bid for the Resource Adequacy Capacity submitted by a Scheduling Coordinator must be $0/MW per hour for the entire Resource Adequacy Capacity. If the Scheduling Coordinator fails to submit a $0/MW per hour for

Resource Adequacy Capacity, the CAISO will insert the $0/MW per hour for the full amount of Resource Adequacy Capacity for a given resource reduced by any upward Ancillary Services Awards. For Multi-Stage Generating Resources that fail to submit a $0/MW per hour for the Resource Adequacy Capacity, the CAISO will insert the $0/MW per hour for the resource's Resource Adequacy Capacity at the MSG Configuration level up to the minimum of the Resource Adequacy Capacity or the PMax of the MSG Configuration. Scheduling Coordinators may submit non-zero RUC Availability Bids for the portion of a resource's capacity that is not Resource Adequacy Capacity.

31.5.1.3 RMR Generation Resources.

If a resource is determined to have an RMR Generation requirement for any Trading Hour of the next day, either by the MPM-RRD process or by the CAISO through a manual RMR Dispatch Notice, and if any portion of the RMR Generation requirement has not been cleared in the IFM, the entire portion of the RMR Generation requirement will be represented as a RMR Generation Self-Schedule in the RUC.

31.5.1.4 Eligibility to Set the RUC Price.

All resources that are eligible for RUC participation as described in Section 31.5.1.1 with RUC Bids that are unconstrained due to Ramp Rates or other temporal constraints, including MSG Transitions, are eligible to set the RUC Price, provided that (a) the RUC Schedule for the Generating Unit or Resource-Specific System Resource is between its Minimum Operating Limit and the highest MW value in its Economic Bid or Generated Bid, or (b) the Schedule for the eligible resource other than a Generating Unit or Resource-Specific System Resource is between zero (0) MW and the highest MW value in its Economic Bid or Generated Bid. If (a) a resource's Schedule is constrained by its Minimum Operating Limit or the highest MW value in its Economic Bid or Generated Bid, (b) the CAISO enforces a resource-specific constraint on the resource due to an RMR or Exceptional Dispatch or (c) the resource's full Ramping capability is constraining its inter-hour change in Schedule, the resource cannot be marginal and thus is not eligible to set the RUC Price. Resources identified as MSS Load following resources are not eligible to set the RUC Price.

Generation Units, net imports and Participating Loads plus the Minimum Load Energy committed by RUC is not greater than a configurable percentage of the system CAISO Forecast of CAISO Demand.

(c) The CAISO can limit the amount of RUC Capacity it will procure from resources that could otherwise be started during the Operating Day based on operational factors such as: 1) historical confidence that a Short Start Unit actually starts when needed based on the assessment of the CAISO Operators of the historical performance of Short Start Units; 2) need to conserve the number of run-hours and number of starts per year for critical loading periods; and 3) seasonal Constraints such as Overgeneration. The CAISO will verify that the total Day-Ahead Schedules and RUC Capacity from such resources is not greater than a configurable percentage of the total available capacity of all such resources.

31.5.5 Selection and Commitment of RUC Capacity.

Capacity that is not already scheduled in the IFM may be selected as RUC Capacity through the RUC process of the DAM. The RUC optimization will select RUC Capacity and produce nodal RUC Prices by minimizing total Bid cost based on RUC Availability Bids and Start-Up, Minimum Load Bids and Transition Costs. RUC will not consider Start-Up, Minimum Load Bids, or Transition Costs for resources already committed in the IFM. The RUC Capacity of a resource is the incremental amount of capacity selected in RUC above the resource's Day-Ahead Schedule. The resource's Day-Ahead Schedule plus its RUC Capacity comprise the resource's RUC Schedule. The CAISO will only issue RUC Start-Up Instructions to resources committed in RUC that must receive a Start-Up Instruction in the Day-Ahead in order to be available to meet Real-Time Demand. RUC Schedules will be provided to Scheduling Coordinators even if a RUC Start-Up Instruction is not issued at that time. RUC shall not Shut Down resources scheduled through the IFM and RUC will not commit a Multi-Stage Generating Resource to a lower MSG Configuration that is unable to support the Energy scheduled in the IFM. If the RUC process cannot find a feasible solution given the resources committed in the IFM, the RUC process will adjust Constraints as described in Section

31.5.4 to arrive at a feasible solution that accommodates all the resources committed in the IFM, and any necessary de-commitment of IFM committed units shall be effectuated through an Exceptional Dispatch.

31.5.6 Eligibility for RUC Compensation.

All RUC Capacity is eligible for the RUC Availability Payment except for: (i) RUC Capacity from RMR Units that has been designated as RMR Dispatch and included in RUC as a Self-Schedule; (ii) Resource Adequacy Capacity; and (iii) RUC Capacity that corresponds to the resource’s Minimum Load, which is compensated through the Bid Cost Recovery as described in Section 11.8. Resources not committed in the IFM that are committed in RUC, including RMR Units that were not designated for RMR Dispatches and Resource Adequacy Resources, are also eligible for RUC Cost Compensation, which includes Start-Up, Transition Costs, and Minimum Load Cost compensation, and Bid Cost Recovery, subject to the resource actually following its Dispatch Instructions as verified by the CAISO pursuant to procedures set forth in the Business Practice Manuals.

31.5.7 Rescission of Payments for Undispatchable and Undelivered RUC Capacity.

If capacity committed in RUC provided from a Generating Unit, Participating Load, System Unit or System Resource is Undispatchable Capacity or Undelivered Capacity during the relevant Settlement Interval, then payments will be rescinded as described in this Section 31.5.7 and settled in accordance with Section 11.2.2.2. If the CAISO determines that non-compliance of a Participating Load, Generating Unit, System Unit or System Resource with an operating order or Dispatch Instruction from the CAISO, or with any other applicable technical standard under the CAISO Tariff, causes or exacerbates system conditions for which the WECC imposes a penalty on the CAISO, then the Scheduling Coordinator of such Participating Load, Generating Unit, System Unit or System Resource shall be assigned that portion of the WECC penalty which the CAISO reasonably determines is attributable to such non-compliance, in addition to any other penalties or sanctions applicable under the CAISO Tariff. The rescission of payments in this Section 31.5.7 shall not apply to a capacity payment for any particular RUC Capacity if the RUC Availability Payment is less than or equal to zero.

31.5.7.1 Rescission of Payments for Undispatchable RUC Capacity.

The CAISO shall calculate the Real-Time ability of each Generating Unit, Participating Load, System Unit or System Resource to deliver Energy from or capacity committed in RUC for each Settlement Interval based on its maximum operating capability, actual telemetered output, and Operational Ramp Rate as described in Section 30.10, which for a Multi-Stage Generating Resource is evaluated by MSG Configuration. If the Undispatchable Capacity is capacity committed in RUC and is from a Generating Unit, System Unit or System Resource that is a Resource Adequacy Resource, there is no payment obligation to the CAISO for the Undispatchable Capacity. The CAISO will report the instance of non-compliance by the Resource Adequacy Resource to the appropriate Local Regulatory Authority.

31.5.7.2 Rescission of Payments for Undelivered RUC Capacity.

For each Settlement Interval in which a Generating Unit, Participating Load, System Unit or System Resource fails to supply Energy from capacity committed in RUC in accordance with a Dispatch Instruction, or supplies only a portion of the Energy specified in the Dispatch Instruction, the RUC Availability Payment will be reduced to the extent of the deficiency, in accordance with the provisions of Section 11.2.2.2.2, which for a Multi-Stage Generating Resource is evaluated for the Generating Unit or Dynamic Resource-Specific System Resource and not by the MSG Configuration.

31.6 Timing of Day-Ahead Scheduling.

31.6.1 The CAISO may at its sole discretion implement any temporary variation or waiver of the timing requirements of this Section 31 and Section 6.5.3 (including the omission of any step) if any of the following criteria are met:

In the case of Multi-Stage Generating Resources, the RTM procedures will optimize Transition Costs in addition to the Start-Up and Minimum Load Costs. If a Scheduling Coordinator submits a Self-Schedule or a Submission to Self-Provide Ancillary Services for a given MSG Configuration in a given Trading Hour, all of the RTM processes will consider the Start-Up Cost, Minimum Load Cost, and Transition Cost associated with any Economic Bids for other MSG Configurations as incremental costs between the other MSG Configurations and the self-scheduled MSG Configuration. In such cases, incremental costs are the additional costs incurred to transition or operate in an MSG Configuration in addition to the costs associated with the self-scheduled MSG Configuration.

34.2 Real-Time Unit Commitment.

The Real-Time Unit Commitment (RTUC) process uses SCUC and is run every fifteen (15) minutes to: (1) make commitment decisions for Fast Start and Short Start resources having Start-Up Times within the Time Horizon of the RTUC process, and (2) procure required additional Ancillary Services and calculate ASMP used for settling procured Ancillary Service capacity for the next fifteen-minute Real-Time Ancillary Service interval. In any fifteen (15) minute RTUC interval that falls within a time period in which a Multi-Stage Generating Resource is transitioning from one MSG Configuration to another MSG Configuration, the CAISO: (1) will not award any incremental Ancillary Services; (2) will disqualify any Day-Ahead Ancillary Services Awards; (3) will disqualify Day-Ahead qualified Submissions to Self-Provide Ancillary Services Award, and (4) will disqualify Submissions to Self-Provide Ancillary Services in RTM. 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 four times an hour, at the following times for the following Time Horizons: (1) at approximately 7.5 minutes prior to the next Trading Hour, in conjunction with 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 Trade Hour. The HASP, described in Section 33, is a special RTUC run that is performed at approximately 7.5 minutes before each hour and has the additional responsibility of: (1) pre-dispatching Energy and awarding Ancillary Services for hourly dispatched System Resources for the Trading Hour that begins 67.5 minutes later, and (2) performing the necessary MPM-RRD for that Trading Hour. 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 process taking into consideration the impacts of the derate or outage on the available MSG Configurations.

34.2.1 Commitment of Fast Start and Short Start Resources.

RTUC produces binding and advisory Start-Up and Shut-Down Dispatch Instructions for Fast Start and Short Start resources that have Start-Up Times that would allow the resource to be committed prior to the end of the relevant Time Horizon of the RTUC run. 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 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.

34.2.2 Real-Time Ancillary Services Procurement.

If the CAISO determines that additional Ancillary Services are required, other than those procured in the IFM, HASP, the RTUC will procure Ancillary Services on a fifteen (15) minute basis as necessary to meet reliability requirements and will determine Real-Time Ancillary Service interval ASMPs for such AS for the next Commitment Period. All Operating Reserves procured in the RTM are considered Contingency Only Operating Reserves. Any Ancillary Service awarded in RTUC will be taken as fixed for 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 will only decommit a resource to the extent that resource's physical characteristics allow it to be cycled in the same Time Horizon for which it was decommitted. STUC does not produce 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.

34.5 General Dispatch Principles.

The CAISO shall conduct all Dispatch activities consistent with the following principles:

(1) The CAISO shall issue AGC instructions electronically as often as every four seconds from its Energy Management System (EMS) to resources providing Regulation and on Automatic Generation Control to meet NERC and WECC performance requirements;

(2) In each run of the RTED or RTCD the objective will be to meet the projected Energy requirements over the Time Horizon of that run, subject to transmission and resource operational Constraints, taking into account the short term CAISO Forecast of CAISO Demand adjusted as necessary by the CAISO Operator to reflect scheduled changes to Interchange and non-dispatchable resources in subsequent Dispatch Intervals;

(3) Dispatch Instructions will be based on Energy Bids for those resources that are capable of intra-hour adjustments and will be determined through the use of SCED except when the CAISO must utilize the RTMD;

(4) When dispatching Energy from awarded Ancillary Service capacity the CAISO will not differentiate between Ancillary Services procured by the CAISO and Submissions to Self-Provide an Ancillary Service;

(5) The Dispatch Instructions of a resource for a subsequent Dispatch Interval shall take as a point of reference the actual output obtained from either the State Estimator solution or the last valid telemetry measurement and the resource's operational ramping capability. For Multi-Stage Generating Resources the determination of the point of reference is further affected by the MSG Configuration and the information contained in the Transition Matrix;

(6) In determining the Dispatch Instructions for a target Dispatch Interval while at the same time achieving the objective to minimize Dispatch costs to meet the forecasted conditions of the entire Time Horizon, the Dispatch for the target Dispatch Interval will be affected by: (a) Dispatch Instructions in prior intervals, (b) actual output of the resource, (c) forecasted conditions in subsequent intervals within the Time Horizon of the optimization, and (d) operational Constraints of the resource, such that a resource may be dispatched in a direction for the immediate target Dispatch Interval that is different than the direction of change in Energy needs from the current Dispatch Interval to the next immediate Dispatch Interval, considering the applicable MSG Configuration;

(7) Through Start-Up Instructions the CAISO may instruct resources to start up or shut down, or may reduce Load for Participating Loads, over the Time Horizon for the RTM based on submitted Bids, Start-Up Costs and Minimum Load Costs, Pumping Costs and Pump Shut-Down Costs, as appropriate for the resource, or for Multi-Stage Generating Resource as appropriate for the applicable MSG Configuration, consistent with operating characteristics of the resources that the SCED is able to enforce. In making Start-Up or Shut-Down decisions in the RTM, the CAISO may factor in limitations on number of run hours or Start-Ups of a resource to avoid exhausting its maximum number of run hours or Start-Ups during periods other than peak loading conditions;

(8) The CAISO shall only start up resources that can start within the Time Horizon used by the RTM optimization methodology;

(9) The RTM optimization may result in resources being shut down consistent with their Bids and operating characteristics provided that: (1) the resource does not need to be on-line to provide Energy, (2) the resource is able to start up within the RTM optimization Time Horizon, (3) the Generating Unit is not providing Regulation or Spinning Reserve, and (4) Generating Units online providing Non-Spinning Reserve may be shut down if they can be brought up within ten (10) minutes as such resources are needed to be online to provide Non-Spinning Reserves;

(10) For resources that are both providing Regulation and have submitted Energy Bids for the RTM, Dispatch Instructions will be based on the Regulation Ramp Rate of the resource rather than the Operational Ramp Rate if the Dispatch Operating Point remains within the Regulating Range. The Regulating Range will limit the Ramping of Dispatch Instructions issued to resources that are providing Regulation;

(11) For Multi-Stage Generating Resources the CAISO will issue Dispatch Instructions by Resource ID and Configuration ID;

(12) The CAISO may issue Transition Instructions to instruct resources to transition from one MSG Configuration to another over the Time Horizon for the RTM based on submitted Bids, Transition Costs and Minimum Load Costs, as appropriate for the MSG Configurations involved in the MSG Transition, consistent with Transition Matrix and operating characteristics of these MSG Configurations. The RTM optimization will factor in limitations on Minimum Up Time and Minimum Down Time defined for each MSG configuration and Minimum Up Time and Minimum Down Time at the Generating Unit or Dynamic Resource-Specific System Resource.

(d) the operation of voltage control equipment applied on Generating Units as described in this CAISO Tariff;

(e) MSS Load following instructions provided to the CAISO, which the CAISO incorporates to create their Dispatch Instructions;

(f) necessary to respond to a System Emergency or imminent emergency; or

(g) Transition Instructions.

34.7 Utilization of the Energy Bids.

The CAISO uses Energy Bids for the following purposes: (i) satisfying Real-Time Energy needs; (ii) mitigating Congestion; (iii) maintaining aggregate Regulation reserve capability in Real-Time; (iv) allowing recovery of Operating Reserves utilized in Real-Time operations; (v) procuring Voltage Support required from resources beyond their power factor ranges in Real-Time; (vi) establishing LMPs; (vii) as the basis for Bid Cost Recovery; and (viii) to the extent a Real-Time Energy Bid Curve is submitted starting at minimum operating level for a Short Start resource that is scheduled to be on-line, the RTM may Dispatch such a resource down to its minimum operating level and may issue a Shut-Down Instruction to the resource based on its Minimum Load Energy costs.

34.8 Dispatch of Energy From Ancillary Services.

The CAISO may issue Dispatch Instructions to Participating Generators, Participating Loads, System Units and System Resources contracted to provide Ancillary Services (either procured through the CAISO Markets, Self-Provided by Scheduling Coordinators, or dispatched in accordance with the RMR Contract) for the Supply of Energy. During normal operating conditions, the CAISO shall Dispatch those Participating Generators, Participating Loads, System Units and System Resources that have contracted to provide Spinning and Non-Spinning Reserve, except for those reserves designated as Contingency Only, in conjunction with the normal Dispatch of Energy. Contingency Only reserves are Operating Reserve capacity that have been designated, either by the Scheduling Coordinator or the CAISO, as available to supply Energy in the Real-Time only in the event of the occurrence of an unplanned Outage,

34.9 Exceptional Dispatch.

The CAISO may issue Exceptional Dispatches for the circumstances described in this Section 34.9, which may require the issuance of forced Shut-Downs, forced Start-Ups, or forced MSG Transitions and shall be consistent with Good Utility Practice. Dispatch Instructions issued pursuant to Exceptional Dispatches shall be entered manually by the CAISO Operator into the Day-Ahead or RTM optimization software so that they will be accounted for and included in the communication of Day-Ahead Schedules and Dispatch Instructions to Scheduling Coordinators. Exceptional Dispatches are not derived through the use of the IFM or RTM optimization software and are not used to establish the LMP at the applicable PNode. The CAISO will record the circumstances that have led to the Exceptional Dispatch. Except as provided in this Section 34.9, the CAISO shall consider the effectiveness of the resource along with Start-Up Costs, Transition Costs, and Minimum Load Costs when issuing Exceptional Dispatches to commit a resource to operate at Minimum Load. When the CAISO issues Exceptional Dispatches for Energy, the CAISO shall also consider Energy Bids, if available and as appropriate. The goal of the CAISO will be to issue Exceptional Dispatches on a least-cost basis. Imbalance Energy delivered or consumed pursuant to the various types of Exceptional Dispatch is settled according to the provisions in Section 11.5.6.

34.9.1 System Reliability Exceptional Dispatches.

The CAISO may issue a manual Exceptional Dispatch for Generation Units, System Units, Participating Loads, Dynamic System Resources, and Condition 2 RMR Units pursuant to Section 41.9, in addition to or instead of resources with a Day-Ahead Schedule dispatched by RTM optimization software during a System Emergency, or to prevent an imminent System Emergency or a situation that threatens System Reliability and cannot be addressed by the RTM optimization and system modeling. To the extent possible, the CAISO shall utilize available and effective Bids from resources before dispatching resources without Bids. To deal with any threats to System Reliability, the CAISO may also issue a manual Exceptional Dispatch in the Real-Time for Non-Dynamic System Resources that have not been or would not be selected by the RTM for Dispatch, but for which the relevant Scheduling Coordinator has submitted a Bid into the HASP.

(d) Maximum number of daily Start-Ups. The SCED shall not cause a resource to exceed its daily maximum number of Start-Ups.

(e) Minimum Run Time and Down Time. The SCED shall not start up off-line resources before their Minimum Down Time expires and shall not shut down on-line resources before their Minimum Run Time expires. For Multi-Stage Generating Resources these requirements shall be observed both for the Generating Unit or Dynamic Resource-Specific System Resource and MSG Configuration.

(f) Operating (Spinning and Non-Spinning) Reserve. The SCED shall Dispatch Spinning and Non-Spinning Reserve subject to the limitations set forth in Section 34.16.3.

(g) Non-Dynamic System Resources. If Dispatched, each Non-Dynamic System Resource flagged for hourly pre-dispatch in the next Trading Hour shall be Dispatched to operate at a constant level over the entire Trading Hour. The HASP shall perform the hourly pre-dispatch for each Trading Hour once prior to the Operating Hour. The hourly pre-dispatch shall not subsequently be revised by the SCED and the resulting HASP Intertie Schedules are financially binding and are settled pursuant to Section 11.4.

(h) Daily Energy use limitation to the extent that Energy limitation is expressed in a resource's Bid. If the Energy Limits are violated for purposes of Exceptional Dispatches for System Reliability, the Bid will be settled as provided in Section 11.5.6.1.

34.15.2 Calculation of Dispatch Operating Points Pursuant to Start-Up and Shut-Down Instructions.

The RTED process shall calculate Dispatch Operating Points as follows:

(a) After RTUC issues a Start-Up Instruction, RTED moves the Dispatch Operating Point of a resource immediately from zero (0) MW to the PMin, as defined in the Master File or as modified via SLIC, of a Generating Unit at the start of the Dispatch Interval pertaining to the Start-Up Instruction. The Dispatch Operating Point shall then be determined using the resource's applicable Operational Ramp Rate as further described in Sections 34.15.4, 34.15.5, and 34.15.6.

(b) After RTUC issues a Shut-Down Instruction, RTED shall first ramp the Dispatch Operating Point down to the PMin, as defined in the Master File or as modified via SLIC, of a Generating Unit at the end of the Dispatch Interval pertaining to the Shut-Down Instruction, using the resource's applicable Operational Ramp Rate. The Dispatch Operating Point shall then be set immediately to zero (0) MW.

(c) After RTUC issues a Transition Instruction: (1) for MSG Configurations where the operating ranges of the two MSG Configurations do not overlap, the RTD will move the Dispatch Operating Point of the resource immediately from the boundary of the “from” MSG Configuration to the boundary of the “to” MSG Configuration, as defined in the Master File or as modified via the CAISO’s outages reporting mechanism, of a Multi-Stage Generating Resource; and (2) for MSG Configurations for which the operating ranges of the two MSG Configurations do overlap, RTD will move the Dispatch Operating Point of the resource within the overlapping operating range of the MSG Configuration until the MSG Transition is complete.

34.15.3 [NOT USED]

34.15.4 Inter-hour Dispatch of Resources With Real-Time Energy Bids.

Dispatch Instructions associated with the ramp between the Real-Time Market Bid in one hour and the Real-Time Market Bid in the immediately succeeding Trading Hour shall be determined optimally by the SCED if the CAISO has Bids for either or both relevant Operating Hours. For any Operating Hour(s) for which Bids have been submitted Dispatch Instructions will be optimized such that the Dispatch Operating Point is within the Bid range(s). For any Operating Hour without submitted Bids, Dispatch Instructions will be optimized such that the Dispatch Operating Point conforms to the Schedule within the Operating Hour. Energy resulting from the Standard Ramp shall be deemed Standard Ramping Energy and will be settled in accordance with Section 11.5.1. Energy resulting from any ramp extending beyond the Standard Ramp will be deemed Ramping Energy Deviation and will be settled in accordance with Section 11.5.1. Energy delivered or consumed as a result

39.7 Local Market Power Mitigation for Energy Bids.

Local market power mitigation is based on a periodic assessment and designation of transmission constraints as competitive or non-competitive. Such periodic assessment will be performed at a minimum on an annual basis and potentially more frequently if needed due to changes in system conditions, network topology, or market performance. Any changes in constraint designations will be publicly noticed prior to making the change. Upon determination that an ad hoc assessment is warranted, the CAISO will notice market participants that such an assessment will be performed. The determination whether a unit is being dispatched to relieve congestion on a competitive or non-competitive transmission constraint is based on two preliminary market runs that are performed prior to the actual pricing run of the market and are described in Sections 31 and 33 for the DAM and RTM, respectively.

39.7.1 Calculation of Default Energy Bids

Default Energy Bids shall be calculated by the CAISO, for the on-peak hours and off-peak hours for both the DAM and RTMs, pursuant to one of the methodologies described in this Section. The Scheduling Coordinator for each Generating Unit owner or Participating Load must rank order the following options of calculating the Default Energy Bid starting with its preferred method. The Scheduling Coordinator must provide the data necessary for determining the Variable Costs unless the Negotiated Rate Option precedes the Variable Cost option in the rank order, in which case the Scheduling Coordinator must have a negotiated rate established with the Independent Entity charged with calculating the Default Energy Bid. If no rank order is specified for a Generating Unit or Participating Load, then the default rank order of (1) Variable Cost Option, (2) Negotiated Rate Option, (3) LMP Option will be applied. For the first ninety (90) days after changes to resource status and MSG Configurations as specified in Section 27.8.3, including the first ninety (90) days after the effective date of Section 27.8.3, the Default Energy Bid option for the resource is limited to the Negotiated Rate Option or the Variable Cost Option.

BCR	Bid Cost Recovery
Bid	An offer for the Supply or Demand of Energy or Ancillary Services, including Self-Schedules, submitted by Scheduling Coordinators for specific resources, conveyed through several components that apply differently to the different types of service offered to or demanded from any of the CAISO Markets.
Bid Adder	A dollar amount added to the Bid of a Frequently Mitigated Unit.
Bid Cost Recovery (BCR)	The CAISO settlements process through which Eligible Resources recover their Bid Costs.
Bid Cost Recovery Eligible Resources (BCR Eligible Resources)	Those resources eligible to participate in the Bid Cost Recovery as specified in Section 11.8, which include Generating Units, System Units, System Resources, and Participating Loads.
Bid Costs	The costs for resources manifested in the Bid components submitted, which include the Start-Up Cost, Minimum Load Cost, Energy Bid Cost, Transition Costs, Pump Shut-Down Cost, Pumping Cost, Ancillary Services Bid Cost and RUC Availability Payment.
Black Start	The procedure by which a Generating Unit self-starts without an external source of electricity thereby restoring a source of power to the CAISO Balancing Authority Area following system or local area blackouts.
Black Start Generator	A Participating Generator in its capacity as party to an Interim Black Start Agreement with the CAISO for the provision of Black Start services, but shall exclude Participating Generators in their capacity as providers of Black Start services under their Reliability Must-Run Contracts.
BPM	Business Practice Manual
BPM PRR	Business Practice Manual Proposed Revision Request
Bulk Supply Point	A Utility Distribution Company or Small Utility Distribution Company metering point.
Business Associate	Any entity with whom the CAISO interacts related to the CAISO Markets.

Decline Potential Charge – Imports	A potential charge that is calculated for any HASP Intertie Schedule for an Energy import when the HASP Intertie Schedule is not delivered for any reason, which potential charge and its applicability are determined pursuant to Section 11.31.
Decline Threshold Percentage – Imports/Exports	The rate at which Scheduling Coordinators may fail to deliver imports or exports in accordance with HASP Intertie Schedules without incurring Decline Monthly Charges – Imports or Decline Monthly Charges – Exports, as measured by the respective percentages of HASP Intertie Schedules for import or export MWh quantities that the Scheduling Coordinator does not deliver during a Trading Month. The Decline Threshold Percentage – Imports/Exports is ten percent (10%).
Decline Threshold Quantity – Imports/Exports	The MWh quantity of HASP Intertie Schedules for imports or exports of Energy that a Scheduling Coordinator may fail to deliver during a Trading Month without incurring Decline Monthly Charges – Imports or Decline Monthly Charges – Exports. The Decline Threshold Quantity – Imports/Exports is 300 MWh.
Default Energy Bid	The Energy Bid Curve used in Local Market Power Mitigation pursuant to Section 39.
Default LAP	The LAP defined for the TAC Area at which all Bids for Demand shall be submitted and settled, except as provided in Sections 27.2.1 and 30.5.3.2.
Default Modified Bid	A Bid that is submitted by a Scheduling Coordinator and is deemed valid and qualifies for modification under the provisions of Section 40.
Default Resource Adequacy Path	The registered sequence of MSG Configurations a Multi-Stage Generating Resource has to Start-Up and transition from off-line to reach the default Resource Adequacy MSG Configuration.

IFM	Integrated Forward Market
IFM Bid Cost	The sum of a BCR Eligible Resource's IFM Start-Up Cost, IFM Minimum Load Cost , IFM Pump Shut-Down Cost, IFM Transition Cost, IFM Pumping Cost, IFM Energy Bid Cost, and IFM AS Bid Cost.
IFM Bid Cost Shortfall	For each Settlement Interval, for any BCR Eligible Resource, the positive amount resulting from the difference between the IFM Bid Cost and the IFM Market Revenue.
IFM Bid Cost Surplus	For each Settlement Interval, for any BCR Eligible Resource, the negative amount resulting from the difference between the IFM Bid Cost and the IFM Market Revenue.
IFM Bid Cost Uplift	The system-wide net of the IFM Bid Cost Shortfalls and IFM Bid Cost Surpluses for a Settlement Interval of all BCR Eligible Resources with Unrecovered Bid Cost Uplift Payments. This amount will be netted according to Section 11.8.6.2 to calculate the Net IFM Bid Cost Uplift before allocation to Scheduling Coordinators.
IFM Commitment Period	A Commitment Period determined by the IFM.
IFM Congestion Charge	The Congestion Charge calculated by the CAISO for each Settlement Period of the IFM as the IFM MCC for Demand minus the IFM MCC for Supply.
IFM Congestion Credit	A credit provided to Scheduling Coordinators to offset any IFM Congestions Charges that would otherwise be applied to the valid and balanced portions of any ETC, TOR or Converted Rights Self-Schedule in the IFM as provided in Section 11.2.1.5.
IFM Congestion Fund	The funds the CAISO shall have available in each Settlement Period from which the CAISO will pay CRR Holders for the CRR(s) they hold in any Settlement Period, which shall determined as provided in Section 11.2.4.1.2.
IFM Load Uplift Obligation	The obligation of a Scheduling Coordinator to pay its share of unrecovered IFM Bid Costs paid to resources through Bid Cost Recovery.

MPM-RRD	Market Power Mitigation-Reliability Requirement Determination
MSA CAISOME	Metered Service Agreement for CAISO Metered Entities
MSA SC	Metered Service Agreement for Scheduling Coordinators
MSC	Market Surveillance Committee
MSG Configuration	A qualified and registered operating mode of a Multi-Stage Generating Resource, with a distinct set of operating characteristics. All MSG Configurations for Multi-Stage Generating Resources are operable on-line modes.
MSG Transition	A feasible operation from one MSG Configuration to another as registered in the Transition Matrix associated with a specific Transition Time and Transition Cost.
MSS	Metered Subsystem
MSS Aggregation	Either (1) a Metered Subsystem or (2) a collection of Metered Subsystems represented by a single MSS Aggregator.
MSS Aggregation Net Measured Demand	The sum of the net metered CAISO Demand from all the Net-Load MSSs in the MSS Aggregation plus any exports out of the CAISO Balancing Authority Area from the MSS Aggregation. Net metered CAISO Demand of a MSS is defined as the algebraic difference between the gross CAISO Demand and Generation internal to the MSS.
MSS Aggregation Net Non-ETC/TOR Measured Demand	The sum of the net metered non-ETC/TOR CAISO Demand from all of the non-ETC/TOR Net-Load MSSs in the MSS Aggregation plus any non-ETC/TOR exports out of the CAISO Balancing Authority Area from the MSS Aggregation. Net metered non-ETC/TOR CAISO Demand of an MSS is defined as the algebraic difference between the non-ETC/TOR CAISO Demand and the non-ETC/TOR Generation within the MSS.
MSS Aggregator	An entity that has executed an agreement with the CAISO that enables it to represent individual MSS Operators in the CAISO Markets on an aggregated basis, which agreement has been accepted by FERC.
MSS Aggregator CRR Entity Agent Agreement	An agreement between the CAISO and an MSS Aggregator by which the MSS Aggregator commits to act as agent for aggregation of MSS Operators in the CRR Allocation, CRR Auction, and Secondary Registration System process, a pro forma version of which is set forth in Appendix B.12.

Multi-Stage Generating Resources	A Generating Unit or Dynamic Resource-Specific System Resource that for reasons related to its technical characteristics can be operated in various MSG Configurations such that only one such MSG Configuration can be operated in any given Dispatch Interval. In addition, subject to the requirements in Section 27.8, the following technical characteristics qualify a Generating Unit or Dynamic Resource-Specific System Resource as a Multi-Stage Generating Resource if the resource; (1) is a combined cycle gas turbine resource; (2) is a Generating Unit or Dynamic Resource-Specific System Resources with multiple operating or regulating ranges but which can operate in only one of these ranges at any given time; or (3) has one or more Forbidden Operating Regions. Metered Subsystems, Pumped-Storage Hydro Units, and Pumping Loads, and System Resources that are not Dynamic Resource-Specific System Resources do not qualify as Multi-Stage Generating Resources.

RTM	Real-Time Market
RTM AS Bid Cost	The Bid Cost of a BCR Eligible Resource for Ancillary Service capacity in the RTM.
RTM Bid Cost	The total of a resource's RTM Start–Up Cost, RTM Minimum Load Cost, RTM Pump Shut-Down Cost, RTM Transition Cost, RTM Pumping Cost, RTM Energy Bid Cost, and RTM AS Bid Cost.
RTM Bid Cost Shortfall	For each Settlement Interval, for any BCR Eligible Resource, the negative amount resulting from the difference between its RTM Bid Cost and its RTM Market Revenue.
RTM Bid Cost Surplus	For each Settlement Interval, for any BCR Eligible Resource, the positive amount, if any, resulting from the difference between its RTM Bid Cost and its RTM Market Revenue.
RTM Bid Cost Uplift	The system-wide net of the RTM Bid Cost Shortfalls and RTM Bid Cost Surpluses for a Settlement Interval of all BCR Eligible Resources with Unrecovered Bid Cost Uplift Payments. This amount will be netted according to Section 11.8.6.2 to calculate the Net RTM Bid Cost Uplift before allocation to Scheduling Coordinators.
RTM Commitment Period	A Commitment Period determined by the RTM; provided that if the RTM changes the Commitment Status of units scheduled in the IFM or committed in the RUC, an RTM Commitment Period may or may not partially overlap with IFM Commitment Period and RUC Commitment Period.
RTMD	Real-Time Manual Dispatch
RTM Marginal Cost of Losses Credit for Eligible TOR Self-Schedules	A credit provided to Scheduling Coordinators pursuant to Section 17.3.3 to offset any HASP and RTM Marginal Cost of Losses that would otherwise be applied to the valid and balanced portions of any TOR Self-Schedule in the IFM as provided in Section 11.5.7.2.

Trading Hub	An aggregation of network Pricing Nodes, such as Existing Zone Generation Trading Hubs, maintained and calculated by the CAISO for settlement and trading purposes posted by the CAISO on its CAISO Website.
Trading Interval	A Settlement Period.
Trading Month	The period beginning at the start of the hour ending 0100 and ending at the end of the hour ending 2400 for each calendar month, except where there is a change to and from daylight savings time on the first or last day of a month.
Transformer and Line Loss Correction Factor	The transformer and line loss correction factor as set forth in the applicable Business Practice Manual or Technical Specifications to be applied to revenue quality meters of CAISO Metered Entities which are installed on the low voltage side of step-up transformers.
Transition Charge	The component of the Access Charge collected by the CAISO with the High Voltage Access Charge in accordance with Section 5.7 of Appendix F, Schedule 3.
Transition Cost	For a Multi-Stage Generating Resources, the dollar cost per feasible transition associated with a given MSG Configuration as registered in the Transition Matrix.
Transition Instructions	A binding instruction issued by the CAISO to Multi-Stage Generating Resources in the Real-Time that directs the Multi-Stage Generating Resource to move from between MSG Configurations and indicates: (1) “from” and “to” MSG Configurations; and (2) the start time and end time of the MSG Transition.
Transition Matrix	A matrix that, for Multi-State Generating Resources defines the possible MSG Transitions between all online MSG Configurations including the Transition Times and Transition Costs.
Transition Time	For a Multi-Stage Generating Resources, the time to complete a MSG Transition, as registered in the Transition Matrix.

Transmission Access Charge (TAC)	Access Charge
Transmission Access Charge Area (TAC Area)	A portion of the CAISO Controlled Grid with respect to which Participating TOs' High Voltage Transmission Revenue Requirements are recovered through a High Voltage Access Charge. TAC Areas are listed in Section 3 of Schedule 3 of Appendix F.
Transmission Control Agreement (TCA)	The agreement between the CAISO and Participating TOs establishing the terms and conditions under which TOs will become Participating TOs and how the CAISO and each Participating TO will discharge their respective duties and responsibilities, as may be modified from time to time.

CAISO Tariff Appendix AA

Transition Plan for Multi-Stage Generating Resources

CAISO Tariff Appendix AA

Transition Plan for Multi-Stage Generating Resources

This Appendix AA describes the registration and qualification requirements for Generating Units and Dynamic Resource-Specific System Resources that intend to qualify and participate in the CAISO Markets as Multi-Stage Generating Resources as of the first day on which the Multi-Stage Generating Resource CAISO Tariff provisions are effective.

No later than sixty (60) days prior to effective date of the CAISO Tariff provisions enabling the Multi-Stage Generating Resource functionality, Scheduling Coordinators shall commence the registration process to register and qualify Generating Units or Dynamic Resource-Specific System Resources as Multi-Stage Generating Resources as of the effective date of the CAISO Tariff provisions for the Multi-Stage Generating Resource functionality. The registration process commences with the submission by the responsible Scheduling Coordinator of the completed Multi-Stage Generating Resource registration form and the resource data template for Generating Unit or Dynamic Resource-Specific System Resource, which the CAISO provides as part of the registration process. After such submission, the CAISO will coordinate with the responsible Scheduling Coordinator to validate that the resource qualifies as a Multi-Stage Generating Resource, and that all the requisite information has been successfully provided to the CAISO. Successful completion of the registration process will occur upon the CAISO's notification to the responsible Scheduling Coordinator that the resource has been successfully qualified as a Multi-Stage Generating Resource. Once the CAISO has provided such notice, the resource will be registered and qualified to participate as a Multi-Stage Generating Resource as of the effective date of the CAISO Tariff provisions enabling the implementation of the Multi-Stage Generating Resource functionality. Scheduling Coordinators may register the number of MSG Configurations as are reasonably appropriate for the unit based on the operating characteristics of the unit, which may not, however, exceed a total of ten MSG Configurations and cannot be fewer than two MSG Configurations. The resource will be successfully registered and qualified for the requested status and MSG Configuration definitions on the date that the CAISO sends the notification to the responsible Scheduling Coordinator that the resource has been successfully qualified.

If the CAISO has reason to believe that the resource's operating and technical characteristics are not consistent with the registered and qualified attributes, the CAISO may request that the Scheduling Coordinator provide additional information necessary to support their registered status and, if appropriate, may require that the resource be registered and qualified more consistent with the resource's operating and technical characteristics, including the revocation of its status as a Multi-Stage Generating Resource. Failure to provide such information may be grounds for revocation of Multi-Generating Resource status.

As part of the registration process, the Scheduling Coordinators must submit to the CAISO a Transition Matrix, which contains the cost and operating constraints associated with feasible transitions between MSG Configurations. The responsible Scheduling Coordinator shall submit for each MSG Configuration a single segment Operational Ramp Rate, and as applicable an Operating Reserves Ramp Rate and Regulating Reserves Ramp Rate. The Scheduling Coordinator must establish the default MSG Configuration and its associated Default Resource Adequacy Path that apply to Multi-Stage Generating Resources that are subject to Resource Adequacy must-offer obligations as part of the resource data template provided in the registration process. The MSG Configurations and operational characteristics submitted to and accepted by the CAISO during this registration process will be in effect until the forty-fifth (45^{th}) day following the effective date of Section 27.8 of the CAISO Tariff, unless modified as specified below. Prior to that date, the Scheduling Coordinators may not make the following changes to a Generating Unit's or Dynamic Resource-Specific System Resource's attributes:

(1) Register a Generating Unit or Dynamic Resource-Specific System Resource as a Multi-Stage Generating Resource;

(2) Change the registered MSG Configurations for a Multi-Stage Generating Resource, which includes the;

a. addition of new MSG Configurations;

b. removal of an existing MSG Configuration;

c. a change to the definition of a registered MSG Configuration, which includes:

i. a change in the physical units supporting the MSG Configuration;

ii. a change to the MSG Configuration Start Up and Shut Down flags; and

iii. adding or removing a MSG Transition to the Transition Matrix;

d. a material change in the Transition Times contained in the Master File, which consists of a change that more than doubles a Transition Time or reduces it to less than half; and

e. a material change to the maximum Ramp Rate of the MSG Configuration(s) contained in the Master File, which consists of a change that more than doubles the maximum Ramp Rate or reduces it to less than half.

Thirty (30) days before the effective date of the CAISO Tariff provisions enabling the implementation of the Multi-Stage Generating Resource functionality, no changes may be made to any of the Multi-Stage Generating Resource attributes, fundamental or otherwise, except that the resources can drop out Multi-Stage Generating Resource status subject to the timing requirements of the Master file time line. When transitioning to implement these changes across the midnight hour, for any Real-Time Market run in which the changes specified above are to take effect within the Time Horizon of any of the Real-Time Market runs, the CAISO will Schedule, Dispatch, or award resources consistent with either the prior or new status and definitions, as appropriate and required by any Real-Time conditions regardless of the resource's state Scheduled or awarded in the immediately preceding Day-Ahead Market.

Resources that will be participating in the CAISO Markets as Multi-Stage Generating Resources when the CAISO Tariff Multi-Stage Generating Resource provisions become effective must submit all Outages reports required in Section 9 of the CAISO Tariff consistent with the registered MSG Configurations for such resources no later than forty-eight hours prior to the start of the first hour of the effective date of the CAISO Tariff provisions enabling the implementation of the Multi-Stage Generating Resource functionality.

Definitions

Default Resource Adequacy Path	The registered sequence of MSG Configurations a Multi-Stage Generating Resource has to Start-Up and transition from off-line to reach the default Resource Adequacy MSG Configuration.
Multi-Stage Generating Resources	A Generating Unit or Dynamic Resource-Specific System Resource that for reasons related to its technical characteristics can be operated in various MSG Configurations such that only one such MSG Configuration can be operated in any given Dispatch Interval. In addition, subject to the requirements in Section 27.8, the following technical characteristics qualify a Generating Unit or Dynamic Resource-Specific System Resource as a Multi-Stage Generating Resource if the resource; (1) is a combined cycle gas turbine resource; (2) is a Generating Unit or Dynamic Resource-Specific System Resources with multiple operating or regulating ranges but which can operate in only one of these ranges at any given time; or (3) has one or more Forbidden Operating Regions. Metered Subsystems, Pumped-Storage Hydro Units, and Pumping Loads, and System Resources that are not Dynamic Resource-Specific System Resources do not qualify as Multi-Stage Generating Resources.
MSG Configuration	A qualified and registered operating mode of a Multi-Stage Generating Resource, with a distinct set of operating characteristics. All MSG Configurations for Multi-Stage Generating Resources are operable on-line modes.
Transition Matrix	A matrix that, for Multi-State Generating Resources defines the possible MSG Transitions between all online MSG Configurations including the Transition Times and Transition Costs.

Attachment B - Blacklines

Multi-Stage Generating Resource Amendment

ER10-___-000

Fourth Replacement CAISO Tariff

May 28, 2010

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8.4.1 Operating Characteristics Required to Provide Ancillary Services.

Each Generating Unit, System Unit, Participating Load or System Resource for which a Scheduling Coordinator wishes to submit a Bid to provide Ancillary Services must comply with the requirements for the specific Ancillary Service as set forth in Appendix K and the Business Practice Manual. <u>The certification requirements in Section 8, Appendix K of the CAISO Tariff, and the Business Practice Manuals shall apply to Multi-Stage Generating Resources based on the MSG Configurations. Scheduling Coordinators shall submit Ancillary Services Bids or Submissions to Self-Provide Ancillary Services to the CAISO Markets only for MSG Configurations that are certified consistent with these requirements. In addition, to the extent the CAISO requires specific operating characteristics for Ancillary Services certification of Multi-Stage Generating Resources the responsible Scheduling Coordinator shall submit to the CAISO such specific operating characteristics at the MSG Configuration level.</u> The requirements in Appendix K and the Business Practice Manuals include Ancillary Service control, capability and availability standards. The requirements also involve the following operating characteristics:

(a) Ramp Rate increase and decrease (MW/minute);

(b) power factor (leading and lagging) as required by Section 8.2.3.3;

(c) maximum output (real and reactive), except that System Resources shall be required to comply only with the requirement for maximum real power;

(d) minimum output (real and reactive), except that System Resources shall be required to comply only with the requirement for minimum real power;

(e) AGC capability, control scheme, and range; and

(f) minimum length of time the resource can be available to provide the relevant Ancillary Service.

In Appendix K and the Business Practice Manuals the CAISO will differentiate the operating characteristics according to the Ancillary Service being provided.

* * *

8.9 Verification, Compliance Testing, and Audit of Ancillary Services.

Availability of contracted and Self-Provided Ancillary Services and RUC Capacity shall be verified by the CAISO by unannounced testing of Generating Units, Loads and System Resources, by auditing of response to CAISO Dispatch Instructions, and by analysis of the appropriate Meter Data, or Interchange Schedules. The CAISO may test the capability of any Generating Unit, System Unit, System Resource, external import of a System Resource, Participating Load, or reactive device providing Ancillary Services or RUC Capacity. Participating Generators, owners or operators of Participating Loads, operators of System Units or System Resources, owners or operators of reactive devices and Scheduling Coordinators shall notify the CAISO immediately whenever they become aware that an Ancillary Service or RUC Capacity is not available in any way. All Participating Generators, owners or operators of Loads, operators of System Units or System Resources and owners or operators of reactive devices shall check, monitor and/or test their system and related equipment routinely to assure availability of the committed Ancillary Services and RUC Capacity. These requirements apply to Ancillary Services whether the Ancillary Services are contracted or self-provided. For a duration specified by the CAISO, the CAISO may suspend the technical eligibility certificate of a Scheduling Coordinator for a Generating Unit, System Unit, Load or System Resource, which repeatedly fails to perform. The CAISO shall develop measures to discourage repeated non-performance on the part of both bidders and self-providers. Further, all of these requirements apply to each MSG Configuration.

* * *

8.9.2 Compliance Testing for Regulation.

The CAISO may test the capability of any Generating Unit or System Resource providing Regulation by using the CAISO EMS to move that Generating Unit's or System Resource's output over the full range of its Regulation capacity within a ten-minute period. For a Multi-Stage Generating Resource the full range of Regulation capacity is evaluated at the applicable MSG Configuration.

8.9.3 Compliance Testing for Non-Spinning Reserve.

8.9.3.1 Compliance Testing of a Generating Unit, System Unit or System Resource.

The CAISO may test the Non-Spinning Reserve capability of a Generating Unit, System Unit or an external import of a System Resource by issuing unannounced Dispatch Instructions requiring the Generating Unit or System Unit to come on line and ramp up or, in the case of a System Resource, to affirmatively respond to Real-Time interchange schedule adjustment; all in accordance with the Scheduling Coordinator's Bid. Such tests may not necessarily occur on the hour. The CAISO shall measure the response of the Generating Unit, System Unit or external import of a System Resource to determine compliance with its stated capabilities. For a Multi-Stage Generating Resource the full range of Non-Spinning capacity is evaluated at the applicable MSG Configuration.

* * *

8.9.6 Compliance Testing for RUC Capacity.

The CAISO may test the capability of a Generating Unit, System Unit or an external import of a System Resource to provide RUC Capacity by issuing unannounced Dispatch Instructions requiring the Generating Unit or System Unit to come on line and ramp up or, in the case of a System Resource, to affirmatively respond to a Real-Time Interchange Schedule adjustment; all in accordance with the Scheduling Coordinator's Bid. Such tests may not necessarily occur on the hour. The CAISO shall measure the response of the Generating Unit, System Unit or external import of a System Resource to determine compliance with its stated capabilities. For a Multi-Stage Generating Resource the range of RUC Capacity evaluated is the range for the applicable MSG Configuration.

* * *

8.9.9 Performance Audit for Regulation.

The CAISO will audit the performance of a Generating Unit providing Regulation by monitoring its response to CAISO EMS control or, in the case of an external import of a System Resource providing Regulation, by monitoring the dynamic Interchange response to CAISO EMS control around its Set Point within its rated MW/minute capability over the range of Regulation capacity scheduled for the current Settlement Period. For a Multi-Stage Generating Resource the range of Regulation capacity evaluated is the range for the applicable MSG Configuration.

8.9.10 Performance Audit for Spinning Reserve.

The CAISO will audit the performance of a Generating Unit or external import of a System Resource providing Spinning Reserve by auditing its response to Dispatch Instructions and by analysis of Meter Data associated with the Generating Unit. Such audits may not necessarily occur on the hour. A Generating Unit providing Spinning Reserve shall be evaluated on its ability to respond to a Dispatch Instruction, move at the MW/minute capability stated in its Bid, reach the amount of Spinning Reserve capacity scheduled for the current Settlement Period within ten (10) minutes of issue of the Dispatch Instruction by the CAISO, and respond to system frequency deviations outside the allowed frequency deadband. An external import of a System Resource providing Spinning Reserve shall be evaluated on its ability to respond to a Dispatch Instruction, move at the MW/minute capability stated in its Bid, reach the amount of Spinning Reserve capacity scheduled for the current Settlement Period within ten (10) minutes of issue of the Dispatch Instruction by the CAISO. For a Multi-Stage Generating Resource the range of Spinning Reserve capacity evaluated is the range for the applicable MSG Configuration.

8.9.11 Performance Audit for Non-Spinning Reserve.

The CAISO will audit the performance of a Generating Unit, Load, or System Resource providing Non-Spinning Reserve by auditing its response to Dispatch Instructions, and by analysis of Meter Data associated with the resource. Such audits may not necessarily occur on the hour. A Generating Unit providing Non-Spinning Reserve shall be evaluated on its ability to respond to a Dispatch Instruction, move in accordance with the time delay and MW/minute capability stated in its Bid, and reach the amount of Non-Spinning Reserve capacity under the control of the CAISO scheduled for the current Settlement Period within ten (10) minutes of issue of the Dispatch Instruction by the CAISO. An external import of a System Resource providing Non-Spinning Reserve shall be evaluated on its ability to respond to a Dispatch Instruction, move in accordance with the time delay and MW/minute capability stated in its Bid, and reach the amount of Non-Spinning Reserve capacity scheduled for the current Settlement Period within ten (10) minutes of issue of the Dispatch Instruction by the CAISO. A Load providing Non-Spinning Reserve from Curtailable Demand shall be evaluated on its ability to respond to a Dispatch Instruction, move in accordance with the time delay and MW/minute capability stated in its Bid, and reach the amount of Non-Spinning Reserve capacity scheduled for the current Settlement Period within ten (10) minutes of issue of the Dispatch Instruction by the CAISO. For a Multi-Stage Generating Resource the range of Non-Spinning capacity evaluated is the range for the applicable MSG Configuration.

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8.9.14 Performance Audit for RUC Capacity.

The CAISO will audit the performance of a Generating Unit, Participating Load, or System Resource providing RUC Capacity by auditing its response to Dispatch Instructions, and by analysis of Meter Data associated with the resource. Such audits may not necessarily occur on the hour. A Generating Unit providing RUC Capacity shall be evaluated on its ability to respond to a Dispatch Instruction, start within the designated time delay, move at the MW/minute capability stated in its Bid, reach the amount of RUC Capacity scheduled for the Settlement Period concerned and sustain operation at this level for a sufficient time to assure availability over the specified period. An external import of a System Resource providing RUC Capacity shall be evaluated on its ability to respond to a Dispatch Instruction, start within the designated time delay, move at the MW/minute capability stated in its Bid, reach the amount of RUC Capacity scheduled for the Settlement Period concerned and sustain operation at this level for a sufficient time to assure availability over the specified period. For a Multi-Stage Generating Resource range of RUC Capacity evaluated is the range for the applicable MSG Configuration.

* * *

8.10.2 Spinning Reserve.

The CAISO shall test the Spinning Reserve capability of a Generating Unit, System Unit or System Resource by issuing unannounced Dispatch Instructions requiring the Generating Unit, System Unit or System Resource to ramp up to its ten (10) minute capability. The CAISO shall measure the response of the Generating Unit, System Unit or System Resource to determine compliance with requirements. Such tests may not necessarily occur on the hour. The Scheduling Coordinator for the Generating Unit, System Unit or System Resource shall be paid pursuant to Section 11.5.6. For a Multi-Stage Generating Resource the range of Spinning capacity evaluated is the range for the applicable MSG Configuration.

8.10.3 Non-Spinning Reserve.

The CAISO may test the Non-Spinning Reserve capability of a Generating Unit, Load, System Unit or System Resource by issuing unannounced Dispatch Instructions requiring the Generating Unit, Load, System Unit or System Resource to come on line and ramp up or to reduce Demand to its ten (10) minute capability. The CAISO shall measure the response of the Generating Unit, System Unit, System Resource or Load to determine compliance with requirements. The Scheduling Coordinator for the Generating Unit, System Unit, Load or System Resource shall be paid pursuant to Section 11.5.6. For a Multi-Stage Generating Resource the range of Non-Spinning capacity evaluated is the range at the applicable MSG Configuration.

* * *

8.10.8.1 Rescission of Payments for Undispatchable Ancillary Service Capacity.

The CAISO shall calculate the Real-Time ability of each Generating Unit, Participating Load, System Unit or System Resource to deliver Energy from Ancillary Services capacity or Self-Provided Ancillary Services capacity for each Settlement Interval based on its maximum operating capability, actual telemetered output, and Operational Ramp Rate as described in Section 30.10. To make this determination for Multi-Stage Generating Resources the CAISO shall use the MSG-Configuration-specific Maximum Operating Limit and Operational Ramp Rate. System Resources that are awarded Ancillary Services capacity in the Day-Ahead Market are required to electronically tag (E-Tag as prescribed by the WECC) the Ancillary Services capacity. If the amounts of Ancillary Services capacity in an electronic tag differ from the amounts of Ancillary Services capacity for the System Resource, the Undispatchable Capacity will equal the amount of the difference, and will be settled in accordance with the provisions of Section 11.10.9.1.

8.10.8.2 Rescission of Payments for Unavailable Ancillary Service Capacity.

If the CAISO determines that a Scheduling Coordinator has supplied Uninstructed Imbalance Energy to the CAISO during a Settlement Interval from the capacity of a Generating Unit, Participating Load, System Unit or System Resource that is obligated to supply Spinning Reserve or Non-Spinning Reserve to the CAISO, payments to the Scheduling Coordinator for the Ancillary Service capacity used to supply Uninstructed Imbalance Energy shall be eliminated to the extent of the deficiency, in accordance with the provisions of Section 11.10.9.2. For Multi-Stage Generating Resources that have supplied Uninstructed

Imbalance Energy from capacity obligated to supply Spinning or Non-Spinning Reserves, the CAISO shall calculate the capacity for which payments will be rescinded at the Generating Unit or Dynamic Resource-Specific System Resource level, as applicable, and will use the MSG Configuration-specific Maximum Operating Limit.

* * *

9.7 Multi-Stage Generating Resources Outages

Participating Generators of Multi-Stage Generating Resources shall report Outages in accordance with the Outage reporting requirements in Section 9 for the Generating Unit and for each MSG Configuration, as applicable. In addition, to the extent that the responsible Scheduling Coordinator modifies the registered Multi-Stage Generating Resource's characteristics as provided in Section 27.8.3, the Participating Generator for the Multi-Stage Generating Resource shall modify any information or reports previously submitted pursuant to this Section 9 to account for any registered status and characteristic changes as soon as possible after receiving notice from the CAISO acceptance of the registered status or characteristics changes and no later than two (2) business days prior to the date on which the Section 27.8.3 changes are expected to be in effect.

* * *

11.8.1 CAISO Determination of Self-Commitment Periods.

For the purposes of identifying the periods during which a Bid Cost Recovery Eligible Resource is deemed self-committed and thus ineligible for Start-Up Costs, Transition Costs, Minimum Load Costs, IFM Pump Shut-Down Costs and IFM Pumping Costs, the CAISO derives the Self-Commitment Periods as described below. The CAISO will determine the Self-Commitment Periods for Multi-Stage Generating Resources based on the applicable MSG Configuration. MSS resources designated for Load following are considered to be self-committed if they have been scheduled with non-zero Load following capacity, or are otherwise used to follow Load in the Real-Time. The IFM and RUC Self-Commitment Periods will be available as part of the Day-Ahead Market results provided to the applicable Scheduling Coordinator. The interim RTM Self-Commitment Periods as reflected in the HASP will be available as part of the HASP results for the relevant Trading Hour as provided to the applicable Scheduling Coordinator. The final RTM

Self-Commitment Period is determined ex-post for Settlements purposes. ELS Resources committed through the ELC Process described in Section 31.7 are considered to have been committed in the IFM Commitment Period for the applicable Trading Day for the purposes of determining BCR settlement in this section 11.8.

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 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 + 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 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 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 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 or Dynamic

Resource-Specific System Resource and MSG Configuration levels are simultaneously respected.

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 Fast 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 or Dynamic Resource-Specific System Resource and MSG Configuration levels are simultaneously respected.

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11.8.1.3 Multi-Stage Generating Resource Start-Up, Minimum Load, or Transition Costs

For the settlement of the Multi-Stage Generating Resource Start-Up Cost, Minimum Load Cost, and Transition Cost in the IFM, RUC, and RTM, the CAISO will determine the applicable Commitment Period and select the applicable Start-Up Cost, Minimum Load Cost, and Transition Cost based on the following rules.

(1) In any given Settlement Interval, the CAISO will first apply the following rules to determine the applicable Start-Up Cost, Minimum Load Cost, and Transition Cost for the Multi-Stage Generating Resources. For a Commitment Period in which the:

(a) IFM Commitment Period and/or RUC Commitment Period MSG Configuration(s) are different than the RTM CAISO Commitment Period MSG Configuration, the Multi-Stage Generating Resource's Start-Up Cost, Minimum Load Cost, and Transition Cost will be settled based on the RTM CAISO Commitment Period MSG Configuration Start-Up Cost, Minimum Load Cost, and Transition Cost, as described in Section 11.8.4.1.

(b) IFM CAISO Commitment Period and/or RUC CAISO Commitment Period MSG Configuration(s) and there is a RTM Self-Commitment Period in any MSG Configuration, the Multi-Stage Generating Resource's Start-Up Cost, Minimum Load Cost, and Transition Cost will be settled based on the IFM CAISO Commitment Period and/or RUC CAISO Commitment Period MSG Configuration(s) Start-Up Cost, Minimum Load Cost, and Transition Cost, as described in Sections 11.8.2.1 and 11.8.3.1, and further determined pursuant to part (2) of this Section below.

(c) IFM CAISO Commitment Period and/or RUC CAISO Commitment Period MSG Configuration is the same as the RTM CAISO Commitment Period MSG Configuration, the Multi-Stage Generating Resource's Start-Up Cost, Minimum Load Cost, and Transition Cost will be settled based on the IFM CAISO Commitment Period and/or RUC CAISO Commitment Period MSG Configuration(s) Start-Up Cost, Minimum Load Cost, and Transition Cost described in Sections 11.8.2.1 and 11.8.3.1, and further determined pursuant to part (2) of this Section below.

(d) IFM and RUC Self-Commitment Period MSG Configuration(s) are the same as the RTM CAISO Commitment Period MSG Configuration, then the Multi-Stage Generating Resource's Start-Up Cost, Minimum Load Cost, and Transition Cost will be settled based on the RTM CAISO Commitment Period MSG Configuration Start-Up Cost, Minimum Load Cost, and Transition Cost as described in Section 11.8.4.1.

(2) In any given Settlement Interval, after the rules specified in part (1) above of this Section have been executed, the ISO will apply the following rules to determine whether the IFM or RUC Start-Up Cost, Minimum Load Cost, and Transition Cost apply for Multi-Stage Generating Resources. For a Commitment Period in which the:

(a) IFM Commitment Period MSG Configuration is different than the RUC CAISO Commitment Period MSG Configuration the Multi-Stage Generating Resource's Start-Up Cost, Minimum Load Cost, and Transition Cost will be settled based on the RUC CAISO Commitment Period MSG Configuration Start-Up Cost, Minimum Load Cost, and Transition Cost as described in Section 11.8.3.1.

(b) IFM CAISO Commitment Period MSG Configuration is the same as the RUC Commitment Period MSG Configuration, the Multi-Stage Generating Resource's Start-Up Cost, Minimum Load Cost, and Transition Cost will be based on the IFM CAISO Commitment Period MSG Configuration Start-Up Cost, Minimum Load Cost, and Transition Cost as described in Section 11.8.2.1.

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11.8.2.1 IFM Bid Cost Calculation.

For each Settlement Interval, the CAISO shall calculate IFM Bid Cost for each Bid Cost Recovery Eligible Resource as the algebraic sum of the IFM Start-Up Cost, IFM Transition Cost, IFM Minimum Load Cost, IFM Pump Shut-Down Cost, IFM Energy Bid Cost, IFM Pumping Cost, and IFM AS Bid Cost. For Multi-Stage Generating Resources, in addition to the specific IFM Bid Cost rules described in Section 11.8.2.1, the CAISO will apply the rules described in Section 11.8.1.3 to further determine the applicable MSG Configuration-based CAISO Market Start-Up Cost, Transition Cost and Minimum Load Cost in any given Settlement Interval. For Multi-Stage Generating Resources, the incremental IFM Start-Up, Minimum Load, and Transition Costs to provide Energy Scheduled in the Day-Ahead Schedule or awarded RUC or Ancillary Service capacity for an MSG Configuration other than the self-scheduled MSG Configuration are determined by the IFM rules specified in Section 31.3.

11.8.2.1.1 IFM Start-Up Cost.

The IFM Start-Up Cost for any IFM Commitment Period shall equal to the Start-Up Costs submitted by the Scheduling Coordinator to the CAISO for the IFM divided by the number of Settlement Intervals within the applicable IFM Commitment Period. For each Settlement Interval, only the IFM Start-Up Cost in a CAISO IFM Commitment Period is eligible for Bid Cost Recovery. The CAISO will determine the IFM Start-Up Costs for Multi-Stage Generating Resources based on the CAISO-committed MSG Configuration. The following rules shall apply sequentially to qualify the IFM Start-Up Cost in an IFM Commitment Period:

(a) The IFM Start-Up Cost for an IFM Commitment Period shall be zero if there is an IFM Self-Commitment Period within or overlapping with that IFM Commitment Period.

(b) The IFM Start-Up Cost for an IFM Commitment Period shall be zero if the Bid Cost Recovery Eligible Resource is manually pre-dispatched under an RMR Contract prior to the Day-Ahead Market or the resource is flagged as an RMR Dispatch in the Day-Ahead Schedule in the Day-Ahead Market anywhere within the applicable IFM Commitment Period.

(c) The IFM Start-Up Cost for an IFM Commitment Period shall be zero if there is no actual Start-Up at the start of the applicable IFM Commitment Period because the IFM Commitment Period is the continuation of an IFM, RUC, or RTM Commitment Period from the previous Trading Day.

(d) The IFM Start-Up Cost for an IFM Commitment Period shall be zero if the Start-Up is delayed by the Real-Time Market past the IFM Commitment Period in question or cancelled by the Real-Time Market before the start-up process has started.

(e) If an IFM Start-Up is terminated in the Real-Time within the applicable IFM Commitment Period through an Exceptional Dispatch Shut-Down Instruction issued while the Bid Cost Recovery Eligible Resource was starting up, the IFM Start-Up Cost for that IFM Commitment Period shall be prorated by the ratio of the Start-Up Time before termination over the total IFM Start-Up Time.

(f) The IFM Start-Up Cost is qualified if an actual Start-Up occurs within the applicable IFM Commitment Period. An actual Start-Up is detected between two consecutive Settlement Intervals when the relevant metered Energy in the applicable Settlement Intervals increases from below the Minimum Load Energy and reaches or exceeds the relevant Minimum Load Energy. The Minimum Load Energy is the product of the relevant Minimum Load and the duration of the Settlement Interval. The CAISO will determine the Minimum Load Energy for Multi-Stage Generating Resources based on the CAISO Commitment Period applicable MSG Configuration.

(g) The IFM Start-Up Cost will be qualified if an actual Start-Up occurs earlier than the start of the IFM Commitment Period if the advance Start-Up is as a result of a Start-Up instruction issued in a RUC or Real-Time Market process subsequent to the IFM, or the advance Start-Up is uninstructed but is still within the same Trading Day and the Bid Cost Recovery Eligible Resource actually stays on until the targeted IFM Start-Up.

11.8.2.1.2 IFM Minimum Load Cost.

The Minimum Load Cost for the applicable Settlement Interval shall be the Minimum Load Cost submitted to the CAISO in the IFM divided by the number of Settlement Intervals in a Trading Hour. For each Settlement Interval, only the IFM Minimum Load Cost in a CAISO IFM Commitment Period is eligible for Bid Cost Recovery. The IFM Minimum Load Cost for any Settlement Interval is zero if: (1) the Settlement Interval is in an IFM Self Commitment Period for the Bid Cost Recovery Eligible Resource; (2) the Bid Cost Recovery Eligible Resource is manually pre-dispatched under an RMR Contract prior to the Day-Ahead Market or the resource is flagged as an RMR Dispatch in the Day-Ahead Schedule for the applicable Settlement Interval; or (3) the Bid Cost Recovery Eligible Resource is determined not actually On during the applicable Settlement Interval. For the purposes of determining IFM Minimum Load Cost, a Bid Cost Recovery Eligible Resource is assumed to be On if its metered Energy in a Settlement Interval is equal to or greater than the difference between its Minimum Load Energy and the Tolerance Band. Otherwise, it is determined to be Off. The CAISO will determine the IFM Minimum Load Costs for Multi-Stage Generating Resources, based on the CAISO Commitment Period MSG Configuration.

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11.8.2.1.5 IFM Energy Bid Cost.

For any Settlement Interval, the IFM Energy Bid Cost for Bid Cost Recovery Eligible Resources, except Participating Loads, shall be the integral of the relevant Energy Bid submitted to the IFM, if any, from the higher of the registered Bid Cost Recovery Eligible Resource's Minimum Load and the Day-Ahead Total Self-Schedule up to the relevant MWh scheduled in the Day-Ahead Schedule, divided by the number of Settlement Intervals in a Trading Hour. The IFM Energy Bid Cost for Bid Cost Recovery Eligible Resources, except Participating Loads, for any Settlement Interval is set to zero for any portion of the Day-Ahead Schedule that is not delivered from the otherwise Bid Cost Recovery Eligible Resource that has metered Generation below its Day-Ahead Schedule; any portion of the Day-Ahead Schedule that is actually delivered remains eligible for IFM Energy Bid Cost Recovery. The CAISO will determine the IFM Energy Bid Cost for a Multi-Stage Generating Resource at the Generating Unit or Dynamic Resource-Specific System Resource level.

11.8.2.1.6 IFM AS Bid Cost.

For any Settlement Interval, the IFM AS Bid Cost shall be the product of the IFM AS Award from each accepted IFM AS Bid and the relevant AS Bid Price, divided by the number of Settlement Intervals in a Trading Hour. The CAISO will determine and calculate IFM AS Bid Cost for a Multi-Stage Generating Resource at the Generating Unit or Dynamic Resource-Specific System Resource level.

11.8.2.1.7 IFM Transition Cost

For each Settlement Interval, the IFM Transition Costs shall be based on the MSG Configuration to which the Multi-Stage Generating Resource is transitioning and is allocated to the CAISO Commitment Period of that MSG Configuration.

* * *

11.8.2.2 IFM Market Revenue.

For any Settlement Interval in a CAISO IFM Commitment Period the IFM Market Revenue for a Bid Cost Recovery Eligible Resource is the algebraic sum of: (1) the product of the delivered MWh, in the relevant Day-Ahead Schedule in that Trading Hour where for Pumped-Storage Hydro Units and Participating Load operating in the pumping mode or serving Load, the MWh is negative, and the relevant IFM LMP, divided by the number of Settlement Intervals in a Trading Hour; and (2) the product of the IFM AS Award from each accepted IFM AS Bid and the relevant Resource-Specific ASMP, divided by the number of Settlement Intervals in a Trading Hour. In the case of a Multi-Stage Generating Resource, the CAISO will calculate the market revenue at the Generating Unit or Dynamic Resource-Specific System Resource level. For any Settlement Interval in a IFM Self-Commitment Period the IFM Market Revenue for a Bid Cost Recovery Eligible Resource is the algebraic sum of: (1) the product of the delivered MWh above the greater of Minimum Load and Self-Scheduled Energy, in the relevant Day-Ahead Schedule in that Trading Hour and the relevant IFM LMP, divided by the number of Settlement Intervals in a Trading Hour; and (2) the product of the IFM AS Award from each accepted IFM AS Bid and the relevant Resource-Specific ASMP, divided by the number of Settlement Intervals in a Trading Hour.

* * *

11.8.3.1 RUC Bid Cost Calculation.

For each Settlement Interval, the CAISO shall determine the RUC Bid Cost for a Bid Cost Recovery Eligible Resource as the algebraic sum of the RUC Start-Up Cost, RUC Transition Cost, RUC Minimum Load Cost and RUC Availability Bid Cost. For Multi-Stage Generating Resources, in addition to the specific RUC Bid Cost rules described in Section 11.8.3.1, the rules described in Section 11.8.1.3 will be applied to further determine the applicable MSG Configuration-based CAISO Market Start-Up Cost, Transition Cost, and Minimum Load Cost in any given Settlement Interval. For Multi-Stage Generating Resources, the incremental RUC Start-Up, Minimum Load, and Transition Costs to provide RUC awarded capacity for an MSG Configuration other than the self-scheduled MSG Configuration are determined by the RUC optimization rules in specified in Section 31.5.

11.8.3.1.1 RUC Start-Up Cost.

The RUC Start-Up Cost for any Settlement Interval in a RUC Commitment Period shall consist of Start-Up Cost of the Bid Cost Recovery Eligible Resource submitted to the CAISO for the applicable RUC Commitment Period divided by the number of Settlement Intervals in the applicable RUC Commitment Period. For each Settlement Interval, only the RUC Start-Up Cost in a CAISO RUC Commitment Period is eligible for Bid Cost Recovery. The CAISO will determine the RUC Start-Up Cost for a Multi-Stage Generating Resource based on the MSG Configuration committed by the CAISO in RUC.

The following rules shall be applied in sequence and shall qualify the RUC Start-Up Cost in a RUC Commitment Period:

(a) The RUC Start-Up Cost for a RUC Commitment Period is zero if there is an IFM Commitment Period within that RUC Commitment Period.

(b) The RUC Start-Up Cost for a RUC Commitment Period is zero if the Bid Cost Recovery Eligible Resource is manually pre-dispatched under an RMR Contract prior to the Day-Ahead Market or is flagged as an RMR Dispatch in the Day-Ahead Schedule anywhere within that RUC Commitment Period.

(c) The RUC Start-Up Cost for a RUC Commitment Period is zero if there is no RUC Start-Up at the start of that RUC Commitment Period because the RUC

Commitment Period is the continuation of an IFM, RUC, or RTM Commitment Period from the previous Trading Day.

(d) The RUC Start-Up Cost for a RUC Commitment Period is zero if the Start-Up is delayed beyond the RUC Commitment Period in question or cancelled by the Real-Time Market prior to the Bid Cost Recovery Eligible Resource starting its start-up process.

(e) If a RUC Start-Up is terminated in the Real-Time within the applicable RUC Commitment Period through an Exceptional Dispatch Shut-Down Instruction issued while the Bid Cost Recovery Eligible Resource is starting up the, RUC Start-Up Cost is prorated by the ratio of the Start-Up Time before termination over the RUC Start-Up Time.

(f) The RUC Start-Up Cost for a RUC Commitment Period is qualified if an actual Start-Up occurs within that RUC Commitment Period. An actual Start-Up is detected between two consecutive Settlement Intervals when the relevant metered Energy in the applicable Settlement Intervals increases from below the Minimum Load Energy and reaches or exceeds the relevant Minimum Load Energy. The Minimum Load Energy is the product of the relevant Minimum Load and the duration of the Settlement Interval. The CAISO will determine the Minimum Load Energy for Multi-Stage Generating Resources based on the CAISO-committed MSG Configuration.

(g) The RUC Start-Up Cost shall be qualified if an actual Start-Up occurs earlier than the start of the RUC Start-Up, if the relevant Start-Up is still within the same Trading Day and the Bid Cost Recovery Eligible Resource actually stays on until the RUC Start-Up, otherwise the Start-Up Cost is zero for the RUC Commitment Period.

11.8.3.1.2 RUC Minimum Load Cost.

The Minimum Load Cost for the applicable Settlement Interval shall be the Minimum Load Cost of the Bid Cost Recovery Eligible Resource divided by the number of Settlement Intervals in a Trading Hour. For each Settlement Interval, only the RUC Minimum Load Cost in a CAISO RUC Commitment Period is eligible for Bid Cost Recovery. The RUC Minimum Load Cost for any Settlement Interval is zero if: (1) the Bid Cost Recovery Eligible Resource is manually pre-dispatched under an RMR Contract or the resource is flagged as an RMR Dispatch in the Day-Ahead Schedule in that Settlement Interval; (2) the Bid Cost Recovery Eligible Resource is not actually On in the applicable Settlement Interval; or (3) the applicable Settlement Interval is included in an IFM Commitment Period. For the purposes of determining RUC Minimum Load Cost, a Bid Cost Recovery Eligible Resource is assumed to be On if its metered Energy in a Settlement Interval is equal to or greater than the difference between its Minimum Load Energy and the Tolerance Band. Otherwise, it is determined to be Off. The CAISO will determine the RUC Minimum Load Cost for a Multi-Stage Generating Resource based on the MSG Configuration committed by the CAISO in RUC.

11.8.3.1.3 RUC Availability Bid Cost.

The RUC Availability Bid Cost is calculated as the product of the RUC Award with the relevant RUC Availability Bid price, divided by the number of Settlement Intervals in a Trading Hour. The RUC Availability Bid Cost for a Bid Cost Recovery Eligible Resource for a Settlement Interval is zero if the Bid Cost Recovery Eligible Resource is operating below its RUC Schedule, and also has a negative Uninstructed Imbalance Energy (UIE) magnitude in that Settlement Interval in excess of: (1) five (5) MWh divided by the number of Settlement Intervals in the Trading Hour; or (2) three percent (3%) of its maximum capacity divided by the number of Settlement Intervals in a Trading Hour. The CAISO will determine the RUC Availability Bid Cost based on the Multi-Stage Generating Resource Generating Unit level.

11.8.3.1.4 RUC Transition Cost

For each Settlement Interval, the RUC Transition Costs shall be based on the MSG Configuration to which the Multi-Stage Generating Resource is transitioning and is allocated to the CAISO commitment period of that MSG Configuration.

11.8.3.2 RUC Market Revenues.

For any Settlement Interval, the RUC Market Revenue for a Bid Cost Recovery Eligible Resource is the RUC Availability Payment as specified in Section 11.2.2.1 divided by the number of Settlement Intervals in a Trading Hour. If the RUC Availability Bid Cost of a BCR Eligible Resource is reduced to zero (0) in a Settlement Interval because of Uninstructed Deviation as stated in Section 11.8.3.1.3, then the RUC Market Revenue for that resource for that Settlement Interval shall also be set to zero (0) since the resource is subject to rescission of RUC Availability Payments as specified in Section 31.5.7. The CAISO will determine the RUC Market Revenues for Multi-Stage Generating Resources based on the Generating Unit or Dynamic Resource-Specific System Resource level.

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11.8.4.1 RTM Bid Cost Calculation.

For each Settlement Interval, the CAISO shall calculate RTM Bid Cost for each Bid Cost Recovery Eligible Resource, as the algebraic sum of the RTM Start-Up Cost, RTM Minimum Load Cost, RTM Transition Cost, RTM Pump Shut-Down Cost, RTM Energy Bid Cost, RTM Pumping Cost and RTM AS Bid Cost. For Multi-Stage Generating Resources, in addition to the specific RTM Bid Cost rules described in Section 11.8.4.1, the rules described in Section 11.8.1.3 will be applied to further determine the applicable MSG Configuration-based CAISO Market Start-Up Cost, Transition Cost, and Minimum Load Cost in given Settlement Interval. For Multi-Stage Generating Resources, the incremental RTM Start-Up Cost, Minimum Load Cost, and Transition Cost to provide RTM committed Energy or awarded Ancillary Services capacity for an MSG Configuration other than the self-scheduled MSG Configuration are determined by the RTM optimization rules in specified in Section 34.

11.8.4.1.1 RTM Start-Up Cost.

For each Settlement Interval of the applicable Real-Time Market Commitment Period, the Real-Time Market Start-Up Cost shall consist of the Start-Up Cost of the Bid Cost Recovery Eligible Resource submitted to the CAISO for the Real-Time Market divided by the number of Settlement Intervals in the applicable Real-Time Market Commitment Period. For each Settlement Interval, only the Real-Time Market Start-Up Cost in a CAISO Real-Time Market Commitment Period is eligible for Bid Cost Recovery. The CAISO will determine the RTM Start-Up Cost for a Multi-Stage Generating Resource based on the

MSG Configuration committed by the CAISO in RTM. The following rules shall be applied in sequence and shall qualify the Real-Time Market Start-Up Cost in a Real-Time Market Commitment Period:

(a) The Real-Time Market Start-Up Cost is zero if there is a Real-Time Market Self-Commitment Period within the Real-Time Market Commitment Period.

(b) The Real-Time Market Start-Up Cost is zero if the Bid Cost Recovery Eligible Resource has been manually pre-dispatched under an RMR Contract or the resource is flagged as an RMR Dispatch in the Day-Ahead Schedule or Real-Time Market anywhere within that Real-Time Market Commitment Period.

(c) The Real-Time Market Start-Up Cost is zero if the Bid Cost Recovery Eligible Resource is started within the Real-Time Market Commitment Period pursuant to an Exceptional Dispatch issued in accordance with Section 34.9.2 to (1) perform Ancillary Services testing; (2) perform pre-commercial operation testing for Generating Units; or (3) perform PMax testing.

(d) The Real-Time Market Start-Up Cost is zero if there is no Real-Time Market Start-Up at the start of that Real-Time Market Commitment Period because the Real-Time Market Commitment Period is the continuation of an IFM or RUC Commitment Period from the previous Trading Day.

(e) If a Real-Time Market Start-Up is terminated in the Real-Time within the applicable Real-Time Market Commitment Period through an Exceptional Dispatch Shut-Down Instruction issued while the Bid Cost Recovery Eligible Resource is starting up the Real-Time Market Start-Up Cost is prorated by the ratio of the Start-Up Time before termination over the Real-Time Market Start-Up Time.

(f) The Real-Time Market Start-Up Cost shall be qualified if an actual Start-Up occurs within that Real-Time Market Commitment Period. An actual Start-Up is detected between two consecutive Settlement Intervals when the relevant metered Energy in the applicable Settlement Intervals increases from below the

Minimum Load Energy and reaches or exceeds the relevant Minimum Load Energy. The Minimum Load Energy is the product of the relevant Minimum Load and the duration of the Settlement Interval. The CAISO will determine the Minimum Load Energy for Multi-Stage Generating Resources based on the CAISO-committed MSG Configuration.

(g) The Real-Time Market Start-Up Cost for a Real-Time Market Commitment Period shall be qualified if an actual Start-Up occurs earlier than the start of the Real-Time Market Start-Up, if the relevant Start-Up is still within the same Trading Day and the Bid Cost Recovery Eligible Resource actually stays on until the Real-Time Market Start-Up, otherwise the Start-Up Cost is zero for the RUC Commitment Period.

11.8.4.1.2 RTM Minimum Load Cost.

The RTM Minimum Load Cost is the Minimum Load Cost of the Bid Cost Recovery Eligible Resource submitted to the CAISO for the Real-Time Market divided by the number of Settlement Intervals in a Trading Hour. For each Settlement Interval, only the RTM Minimum Load Cost in a CAISO RTM Commitment Period is eligible for Bid Cost Recovery. The RTM Minimum Load Cost for any Settlement Interval is zero if: (1) the Settlement Interval is included in a RTM Self-Commitment Period for the Bid Cost Recovery Eligible Resource; (2) the Bid Cost Recovery Eligible Resource has been manually dispatched under an RMR Contract or the resource has been flagged as an RMR Dispatch in the Day-Ahead Schedule or the Real-Time Market in that Settlement Interval; (3) the Bid Cost Recovery Eligible Resource is not actually On in that Settlement Interval; (4) for all resources that are not Multi-Stage Generating Resources, that Settlement Interval is included in an IFM or RUC Commitment Period; or (5) the Bid Cost Recovery Eligible Resource is committed pursuant to Section 34.9.2 for the purpose of performing Ancillary Services testing, pre-commercial operation testing for Generating Units, or PMax testing. For the purposes of RTM Minimum Load Cost, a Bid Cost Recovery Eligible Resource is determined to not actually be On if the metered Energy in that Settlement Interval is less than the Tolerance Band referenced by the Minimum Load Energy. In addition, the CAISO will determine the Multi-Stage Generating Resource RTM Minimum Load Costs based on the MSG Configuration in which the

CAISO commits the Multi-Stage Generating Resource in RTM. For Settlement Intervals that contain two Dispatch Intervals with two different MSG Configurations, the CAISO will determine the Transition Costs, and Minimum Load Costs based on the sum of the two applicable Dispatch Intervals.

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11.8.4.1.5 RTM Energy Bid Cost.

For any Settlement Interval, the RTM Energy Bid Cost for the Bid Cost Recovery Eligible Resource except Participating Loads shall be computed as the sum of the products of each Instructed Imbalance Energy (IIE) portion, except Standard Ramping Energy, Residual Imbalance Energy, Exceptional Dispatch Energy, Derate Energy, MSS Load Following Energy, Ramping Energy Deviation and Regulating Energy, with the relevant Energy Bid prices, if any, for each Dispatch Interval in the Settlement Interval. The RTM Energy Bid Cost for a Bid Cost Recovery Eligible Resource except Participating Loads for a Settlement Interval is set to zero for any undelivered Real-Time Instructed Imbalance Energy by the Bid Cost Recovery Eligible Resource. Any Uninstructed Imbalance Energy in excess of Instructed Imbalance Energy is also not eligible for Bid Cost Recovery. For a Multi-Stage Generating Resource the CAISO will determine the RTM Energy Bid Cost based on the Generating Unit or Dynamic Resource-Specific System Resource level.

11.8.4.1.6 RTM AS Bid Cost.

For each Settlement Interval, the Real-Time Market AS Bid Cost shall be the product of the average Real-Time Market AS Award from each accepted AS Bid submitted in the Settlement Interval for the Real-Time Market, reduced by any relevant tier-1 No Pay capacity in that Settlement Interval (but not below zero), with the relevant AS Bid price. The average Real-Time Market AS Award for a given AS in a Settlement Interval is the sum of the 15-minute Real-Time Market AS Awards in that Settlement Interval, each divided by the number of 15-minute Commitment Intervals in a Trading Hour and prorated to the duration of the Settlement Interval (10/15 if the Real-Time Market AS Award spans the entire Settlement Interval, or 5/15 if the Real-Time Market AS Award spans half the Settlement Interval). For a Multi-Stage Generating Resource the CAISO will determine the RTM AS Bid Cost based on the Generating Unit or Dynamic Resource-Specific System Resource level.

11.8.4.1.7 RTM Transition Cost

For each Settlement Interval, the RTM Transition Costs shall be based on the MSG Configuration to which the Multi-Stage Generating Resource is transitioning and is allocated to the CAISO commitment period of that MSG Configuration.

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11.8.4.2 RTM Market Revenue Calculations.

11.8.4.2.1 For each Settlement Interval in a CAISO Real-Time Market Commitment Period, the RTM Market Revenue for a Bid Cost Recovery Eligible Resource is the algebraic sum of the ~~following:~~ elements listed below in this Section. For Multi-Stage Generating Resources the RTM Market Revenue calculations will be made at the Generating Unit or Dynamic Resource-Specific System Resource level.

(a) The sum of the products of the Instructed Imbalance Energy (including Energy from Minimum Load of Bid Cost Recovery Eligible Resources committed in RUC where for Pumped-Storage Hydro Units and Participating Load operating in the pumping mode or serving Load, the MWh is negative), except Standard Ramping Energy, Residual Imbalance Energy, Exceptional Dispatch Energy, Derate Energy, MSS Load following Energy, Ramping Energy Deviation and Regulation Energy, with the relevant Real-Time Market LMP, for each Dispatch Interval in the Settlement Interval;

(b) The product of the Real-Time Market AS Award from each accepted Real-Time Market AS Bid in the Settlement Interval with the relevant ASMP, divided by the number of fifteen (15)-minute Commitment Intervals in a Trading Hour (4), and prorated to the duration of the Settlement Interval.

(c) The relevant tier-1 No Pay charges for that Bid Cost Recovery Eligible Resource in that Settlement Interval.

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11.8.5 Unrecovered Bid Cost Uplift Payment.

Scheduling Coordinators shall receive an Unrecovered Bid Cost Uplift Payment for a Bid Cost Recovery Eligible Resource, including resources for MSS Operators that have elected gross Settlement, if the net of all IFM Bid Cost Shortfalls and IFM Bid Cost Surpluses calculated pursuant to Section 11.8.2, RUC Bid Cost Shortfalls and RUC Bid Cost Surpluses calculated pursuant to Section 11.8.3, and the RTM Bid Cost Shortfalls and RTM Bid Cost Surpluses calculated pursuant to Section 11.8.4 for that Bid Cost Recovery Eligible Resource over a Trading Day is positive. For Multi-Stage Generating Resources, Unrecovered Bid Cost Uplift Payments will be calculated and made at the Generating Unit level or Dynamic Resource-Specific System Resource and not the MSG Configuration level. For MSS Operators that have elected net Settlement, the Unrecovered Bid Cost Uplift Payment is at the MSS level. The MSS IFM, RUC, and RTM Bid Cost Shortfall or IFM. RUC, and RTM Bid Cost Surplus for each market for each Trading Hour is the sum of the IFM, RUC, and RTM Bid Cost Shortfalls and IFM. RUC, and RTM Bid Cost Surpluses for all resources in the MSS. Scheduling Coordinators for MSS Operators that have elected net Settlement will receive an Unrecovered Bid Cost Uplift Payment if the net of all IFM, RUC, and RTM Bid Cost Shortfalls and IFM, RUC, and RTM Bid Cost Surpluses for that MSS over a Trading Day is positive.

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27.8 Multi-Stage Generating Resources

27.8.1 Registration and Qualification

Scheduling Coordinators must comply with the registration and qualification process described in this Section 27.8.1, in order to effectuate any of the changes described in Section 27.8.3. No less than sixteen (16) days prior to the date that Scheduling Coordinator seeks to have the resource participate in the CAISO Markets under the new settings or MSG Configuration details, the Scheduling Coordinator must complete and submit to the CAISO the registration form and the resource data template provided by the CAISO for registration and qualification purposes. After the Scheduling Coordinator submits a request for registration of a Generating Unit or Dynamic Resource-Specific System Resource as a Multi-Stage Generating Resource or a change in the attributes in Section 27.8.3, the CAISO will coordinate with that Scheduling Coordinator to validate that the resource qualifies for the requested status and that all the requisite information has been successfully provided to the CAISO. The resource will be successfully registered and qualified as a Multi-Stage Generating Resource, or the requested changes in the attributes listed in Section 27.8.3 will be successfully registered and qualified as of the date on which the CAISO sends the responsible Scheduling Coordinator a notice that the resource has been successfully qualified as such. After the date on which the CAISO has provided such notice, any changes to the items listed in Section 27.8.3 will be subject to the timing and process requirements in this Section 27.8.1 and 27.8.3. The Scheduling Coordinator may modify all other Multi-Stage Generating Resource registered characteristics pursuant to the timing and processing requirements specified elsewhere in this CAISO Tariff, as they may apply. If the CAISO has reason to believe that the resource's operating and technical characteristics are not consistent with the registered and qualified attributes, the CAISO may request that the Scheduling Coordinator provide additional information necessary to support their registered status and, if appropriate, may require that the resource be registered and qualified more consistent with the resource's operating and technical characteristics, including the revocation of its status as a Multi-Stage Generating Resource. Failure to provide such information may be grounds for revocation of Multi-Stage Generating Resource status. Such changes in status or MSG Configuration details would be subject to the registration and qualification requirements in this Section 27.8. Scheduling Coordinators may register the number MSG Configurations as are reasonably appropriate for the resource based on the technical and operating characteristics of the resource, which may not, however, exceed a total of ten MSG Configurations and cannot be fewer than two MSG Configurations. The information requirements specified in Section 27.8.2 will apply.

27.8.2 Informational Requirements

As part of the registration process described in Section 27.8.1, the Scheduling Coordinators for Generating Units or Dynamic Resource-Specific System Resources that seek to qualify as Multi-Stage Generating Resources must submit to the CAISO a Transition Matrix, which contains the Transition Costs and operating constraints associated with MSG Transitions. The responsible Scheduling Coordinator shall submit for each MSG Configuration a single segment Operational Ramp Rate, and as applicable an Operating Reserves ramp rate and Regulating Reserves ramp rate. The Scheduling Coordinator must establish the default MSG Configuration and its associated Default Resource Adequacy Path that apply to Multi-Stage Generating Resources that are subject to Resource Adequacy must-offer obligations. The

Scheduling Coordinator may submit changes to this information consistent with Sections 27.8.1 and 27.8.3, as they may apply.

27.8.3 Changes in Status and Configurations of Resource

Scheduling Coordinators may seek modifications to the Multi-Stage Generating Resource attributes listed below consistent with the process and timing requirements specified in Section 27.8.1 and the additional requirements discussed below in this Section 27.8.3:

(1) Registration and qualification of a Generating Unit or Dynamic Resource-Specific System Resource as a Multi-Stage Generating Resource.

(2) Changes to the MSG Configurations attributes, which include:

a. addition of new MSG Configurations;

b. removal of an existing MSG Configuration;

c. a change in the physical units supporting the MSG Configuration;

d. a change to the MSG Configuration Start Up and Shut Down flags;

e. adding or removing an MSG Transition to the Transition Matrix;

f. a material change in the Transition Times contained in the Master File, which consists of a change that more than doubles the Transition Times or reduces it to less than half; and

g. a material change to the maximum Ramp Rate of the MSG Configuration(s) contained in the Master File, which consists of a change that more than doubles the maximum Ramp Rate or reduces it to less than half.

When transitioning to implement these changes across the midnight hour, for any Real-Time Market run in which the changes specified in this Section 27.8.3 are to take effect within the Time Horizon of any of the Real-Time Market runs, the CAISO will Schedule, Dispatch, or award resources consistent with either the prior or new status and definitions, as appropriate, and required by any Real-Time conditions regardless of the resource's state scheduled or awarded in the immediately preceding Day-Ahead Market.

A Scheduling Coordinator may unregister a Generating Unit or Dynamic Resource-Specific System Resource from its Multi-Stage Generating Resource status subject to the timing requirements for Master File changes, and such changes are not subject to the timing requirements in Section 27.8.3. For the first forty-five (45) days after the effective date of this Section, Scheduling Coordinators may not change any of Multi-Stage Generating Resource attributes listed above in this Section. On the forty-sixth (46) day following the effective day of this Section, changes to the attributes listed above in this Section may take effect, including the registration of new Multi-Stage Generating Resources, provided Scheduling Coordinators have previously followed the registration process requirements listed in Section 27.8.1. Subsequently, further changes to the attributes listed above in this Section 27.8.3 may not take effect until after the one hundred-tenth (110) day following the effective date of this Section, subject to the procedures described in Section 27.8.1. As of the one hundred-tenth (110) day following the effective date of this Section, changes to these attributes may only be made every sixty (60) days after the day on which any such changes have taken effect.

* * *

30.5 Bidding Rules.

30.5.1 General Bidding Rules.

(a) All Energy and Ancillary Services Bids of each Scheduling Coordinator submitted to the DAM for the following Trading Day shall be submitted at or prior to 10:00 a.m. on the day preceding the Trading Day, but no sooner than seven (7) days prior to the Trading Day. All Energy and Ancillary Services Bids of each Scheduling Coordinator submitted to the HASP for the following Trading Day shall be submitted starting from the time of publication, at 1:00 p.m. on the day preceding the Trading Day, of DAM results for the Trading Day, and ending seventy-five (75) minutes prior to each applicable Trading Hour in the RTM. The CAISO will not accept any Energy or Ancillary Services Bids for the following Trading Day between 10:00 a.m. on the day preceding the Trading Day and the publication, at 1:00 p.m. on the day preceding the Trading Day, of DAM results for the Trading Day;

(b) Bid prices submitted by a Scheduling Coordinator for Energy accepted and cleared in the IFM and scheduled in the Day-Ahead Schedule may be increased or decreased in the HASP. Bid prices for Energy submitted but not scheduled in the Day-Ahead Schedule may be increased or decreased in the HASP. Incremental Bid prices for Energy associated with Day-Ahead AS or RUC Awards in Bids submitted to the HASP may be revised. Scheduling Coordinators may revise ETC Self-Schedules for Supply only in the HASP to the extent such a change is consistent with TRTC Instructions provided to the CAISO by the Participating TO in accordance with Section 16. Scheduling Coordinators may revise TOR Self-Schedules for Supply only in the HASP to the extent such a change is consistent with TRTC Instructions provided to the CAISO by the Non-Participating TO in accordance with Section 17. Energy associated with awarded Ancillary Services capacity cannot be offered in the HASP or Real-Time Market separate and apart from the awarded Ancillary Services capacity;

(c) Scheduling Coordinators may submit Energy, AS and RUC Bids in the DAM that are different for each Trading Hour of the Trading Day;

(d) Bids for Energy or capacity that are submitted to one CAISO Market, but are not accepted in that market are no longer a binding commitment and Scheduling Coordinators may submit Bids in a subsequent CAISO Market at a different price;

(e) The CAISO shall be entitled to take all reasonable measures to verify that Scheduling Coordinators meet the technical and financial criteria set forth in Section 4.5.1 and the accuracy of information submitted to the CAISO pursuant to this Section 30; and

(f) In order to retain the priorities specified in Section 31.4 and 34.10 for scheduled amounts in the Day-Ahead Schedule associated with ETC and TOR Self-Schedules or Self-Schedules associated with Regulatory Must-Take Generation, a Scheduling Coordinator must submit to the HASP and Real-Time Market ETC or TOR Self-Schedules, or Self-Schedules associated with Regulatory Must-Take

Generation, at or below the Day-Ahead Schedule quantities associated with the scheduled ETC, TOR or Regulatory Must-Take Generation Self-Schedules. If the Scheduling Coordinator fails to submit such HASP or Real-Time Market ETC, TOR or Regulatory Must-Take Generation Self-Schedules, the defined scheduling priorities of the ETC, TOR, or Regulatory Must-Take Generation Day-Ahead Schedule quantities may be subject to adjustment in the HASP and the Real-Time Market as further provided in Section 31.4 and 34.10 in order to meet operating conditions.

(g) For Multi-Stage Generating Resources that receive a Day-Ahead Schedule, are awarded a RUC Schedule, or receive an Ancillary Services Award the Scheduling Coordinator must submit an Energy Bid, which may consist of a Self-Schedule, in the Real-Time Market for the same Trading Hour(s) for either the same MSG Configuration scheduled or awarded in the Integrated Forward Market or committed in RUC. In addition, the Scheduling Coordinator for such Multi-Stage Generating Resources may also submit Bids into the Real-Time Market for three other MSG Configurations provided that the MSG Transitions between the MSG Configurations bid into the Real-Time Market are feasible and the transition from the previous Trading Hour are also feasible.

(h) For the Trading Hours that Multi-Stage Generating Resources do not have a CAISO Schedule or award from a prior CAISO Market run, the Scheduling Coordinator can submit up to three MSG Configurations into the RTM.

(i) A Scheduling Coordinator cannot submit a Bid to the CAISO Markets for a MSG Configuration into which the Multi-Stage Generating Resource cannot transition due to lack of Bids for the specific Multi-Stage Generating Resource in other MSG Configurations that are required for the requisite MSG Transition.

(j) In order for Multi-Stage Generating Resource to meet any Resource Adequacy must-offer obligations, the responsible Scheduling Coordinator must submit either an Economic Bid or Self-Schedule for at least one MSG Configuration into the Day-Ahead Market and Real-Time Market that is capable of fulfilling that Resource Adequacy obligation, as feasible.

(k) For any given Trading Hour, a Scheduling Coordinator may submit Self-Schedules and/or Submissions to Self-Provide Ancillary Services in only one MSG Configuration for each Generating Unit or Dynamic Resource-Specific System Resource.

(l) In any given Trading Hour in which a Scheduling Coordinator has submitted a Self-Schedule for a Multi-Stage Generating Resource, the Scheduling Coordinator may also submit Bids for other MSG Configurations provided that they concurrently submit Bids that enable the applicable CAISO Market to transition the Multi-Stage Generating Resource to other MSG Configurations.

(m) If in any given Trading Hour the Multi-Stage Generating Resource was awarded Regulation or Operating Reserves in the IFM, any Self-Schedules or Submissions to Self-Provide Ancillary Services the Scheduling Coordinator submits for that Multi-Stage Generating Resource in the RTM must be for the same MSG Configuration for which Regulation or Operating Reserve is Awarded in IFM for that Multi-Stage Generating Resource in that given Trading Hour.

(n) If a Multi-Stage Generating Resource has received a binding RUC Start-Up Instruction as provided in Section 31, any Self-Schedule or Submission to Self-Provide Ancillary Services in the RTM must be in the same MSG Configuration committed in RUC.

(o) If in any given Trading Hour the Multi-Stage Generating Resource is scheduled for Energy in the IFM, any Self-Schedules the Scheduling Coordinator submits for that Multi-Stage Generating Resource in the RTM must be for the same MSG Configuration for which Energy is scheduled in IFM for that Multi-Stage Generating Resource in that given Trading Hour.

30.5.2 Supply Bids.

30.5.2.1 Common Elements for Supply Bids.

In addition to the resource-specific Bid requirements of this Section, all Supply Bids must contain the following components: Scheduling Coordinator ID Code; Resource ID and the MSG Configuration ID, as applicable; Resource Location; PNode or Aggregated Pricing Node as applicable; Energy Bid Curve; Self-Schedule component; Ancillary Services Bid; RUC Availability Bid; the Market to which the Bid applies; Trading Day to which the Bid applies; Priority Type (if any). Supply Bids offered in the CAISO Markets must be monotonically increasing. Energy Bids in the RTM must also contain a Bid for Ancillary Services to the extent the resource is certified and capable of providing Ancillary Service in the RTM up to the registered certified capacity for that Ancillary Service less any Day-Ahead Ancillary Services Awards. Scheduling Coordinators must submit the applicable Supply Bid components, including Self-Schedules, for the submitted MSG Configuration.

30.5.2.2 Supply Bids for Participating Generators.

In addition to the common elements listed in Section 30.5.2.1, Supply Bids for Participating Generators shall contain the following components: Start-Up Bid, Minimum Load Bid, Ramp Rate, Minimum and Maximum Operating Limits; Energy Limit, Regulatory Must-Take/Must-Run Generation; Contingency Flag; and Contract Reference Number (if any). Scheduling Coordinators submitting these Bid components for a Multi-Stage Generating Resource must do so for the submitted MSG Configuration. A Scheduling Coordinator for a Physical Scheduling Plant or a System Unit may include Generation Distribution Factors as part of its Supply Bid. If the Scheduling Coordinator has not submitted the Generation Distribution Factors applicable for the Bid, the CAISO will use default Generation Distribution Factors stored in the Master File. All Generation Distribution Factors used by the CAISO will be normalized based on Outage data that is available to the automated market systems. ~~Combined-cycle Generating Units may only be registered under a single Resource ID.~~ A Multi-Stage Generating Resource and its MSG Configurations are registered under a single Resource ID and Scheduling Coordinator for the Multi-Stage Generating Resource must submit all Bids for the resource's MSG Configurations under the same Resource ID. For a Multi-Stage Generating Resources Scheduling Coordinators may submit bid curves for up to ten individual MSG Configurations of their Multi-Stage Generating Resources into the Day-Ahead Market and up to three individual MSG Configurations into the

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

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**30.5.2.6	Ancillary Services Bids.**

There are four distinct Ancillary Services: Regulation Up, Regulation Down, Spinning Reserve and Non-Spinning Reserve. Participating Generators are eligible to provide all Ancillary Services. Dynamic System Resources are eligible to provide Operating Reserves and Regulation. Non-Dynamic System Resources are eligible to provide Operating Reserves only. Scheduling Coordinators may use Dynamic System Resources to Self-Provide Ancillary Services as specified in Section 8. Scheduling Coordinators may not use Non-Dynamic System Resources to Self-Provide Ancillary Services. 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. Participating Loads are eligible to provide Non-Spinning Reserve only. 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 Fast Start Unit, no Self-Schedule for Energy for that resource is required. If a Scheduling Coordinator proposes to self-provide Spinning Reserve, the Scheduling Coordinator is obligated to submit a Self-Schedule for Energy for that particular resource, unless as discussed above the particular resource is a Fast Start Unit. When submitting Ancillary Service Bids in the HASP and 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 Ancillary Services Bids for System Resources in the HASP or 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 33.7, if the resource is a Non-Dynamic System Resource, the CAISO will only use the Ancillary Services Bid in the HASP 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 HASP. Scheduling Coordinators must also comply with the bidding rules associated with the must offer requirements for Ancillary Services specified in Section 40.6.

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30.5.2.7 RUC Availability Bids.

Scheduling Coordinators may submit RUC Availability Bids for specific Generating Units in the DAM; however, Scheduling Coordinators for Resource Adequacy Capacity or ICPM Capacity must submit RUC Availability Bids for that capacity to the extent that the capacity has not been submitted in a Self-Schedule or already been committed to provide Energy or capacity in the IFM. For Multi-Stage Generating Resources the RUC Availability Bids shall be submitted at the MSG Configuration. Capacity that does not have Bids for Supply of Energy in the IFM will not be eligible to participate in the RUC process. The RUC Availability Bid component is MW-quantity of non-Resource Adequacy Capacity in $/MW per hour, and $0/MW for Resource Adequacy Capacity or ICPM Capacity.

* * *

30.7.3 DAM Validation.

30.7.3.1 Validation Prior to Market Close and Master File Update.

The CAISO conducts Bid validation in three steps as described below. For a Multi-Stage Generating Resource the validation described herein is done for each submitted MSG Configuration.~~:~~

Step 1: The CAISO will validate all Bids after submission of the Bid for content validation which determines that the Bid adheres to the structural rules required of all Bids as further described in the Business Practices Manuals. If the Bid fails any of the content level rules the CAISO shall assign it a rejected status and the Scheduling Coordinator must correct and resubmit the Bid.

Step 2: After the Bids are successfully validated for content, but prior to the Market Close of the DAM, the Bids will continue through the second level of validation rules to verify that the Bid adheres to the applicable CAISO Market rules and if applicable, limits based on Master File data. If the Bid fails any level two validation rules, the CAISO shall assign the Bid as invalid and the Scheduling Coordinator must either correct or resubmit the Bid.

Step 3: If the Bid successfully passes validation in Step 2, it will continue through the third level of validation where the Bid will be analyzed based on its contents to identify any missing Bid components that must be either present for the Bid to be valid consistent with the market rules contained in Article III of this CAISO Tariff and as reflected in the Business Practice Manuals. At this stage the Bid will either be automatically modified for correctness and assigned a status of conditionally modified or modified, or if it can be accepted as is, the Bid will be assigned a status of conditionally valid, or valid. A Bid will be automatically modified and assigned a status of modified or conditionally modified Bid, whenever the CAISO inserts or modifies a Bid component. The CAISO will insert or modify a Bid component whenever (1) a Self-Schedule quantity is less than the lowest quantity specified as an Economic Bid for either an Energy Bid or Demand Bid, in which case the CAISO extends the Self-Schedule to cover the gap; (2) for non-Resource Adequacy Resources, the CAISO will extend the Energy Bid Curve using Proxy Costs to cover any capacity in a RUC Bid component, if necessary; and (3) for a Resource Adequacy Resource that is not a Use-Limited Resource, the CAISO will extend the Energy Bid Curve using Proxy Costs to cover any capacity in a RUC Bid component and, if necessary, up to the full registered Resource Adequacy Capacity. The CAISO will generate a Proxy Bid or extend an Energy Bid or Self-Schedule to cover any RUC Award or Day-Ahead Schedule in the absence of any Self-Schedule or Economic Bid components, or to fill in any gaps between any Self-Schedule Bid and any Economic Bid components to cover a RUC Award or Day-Ahead Schedule. To the extent that an Energy Bid to the HASP/RTM is not accompanied by an Ancillary Services Bid, the CAISO will insert a Spinning Reserve and Non-Spinning Reserve Ancillary Services Bid at $ 0/MW for any certified Operating Reserve capacity. The CAISO will also generate a Self-Schedule Bid for any Generating Unit that has a Day-Ahead Schedule but has not submitted Bids in HASP/RTM, up to the quantity in the Day-Ahead Schedule. Throughout the Bid evaluation process, the Scheduling Coordinator shall have the ability to view the Bid and may choose to cancel the Bid, modify and re-submit the Bid, or leave the modified, conditionally modified or valid, conditionally valid Bid as is to be processed in the designated CAISO Market. The CAISO will not insert or extend any Bid for a Resource Adequacy Resource that is a Use-Limited Resource.

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30.7.3.5 Bid Validation Rules for Multi-Stage Generating Resources

If a Scheduling Coordinator does not submit a Bid in the Day-Ahead Market or Real-Time Market for a Multi-Stage Generating Resource with a Resource Adequacy must-offer obligation at a MSG Configuration that can meet the applicable Resource Adequacy must-offer obligation, the ISO will create a Generated Bid for the default Resource Adequacy MSG Configuration. If the Multi-Stage Generating Resource is not capable of Start-Up in the default Resource Adequacy MSG Configuration, the CAISO will create a Generated Bid for every MSG Configuration in the registered Default Resource Adequacy Path. If the Scheduling Coordinator submits a Bid for the Multi-Stage Generating Resource, the CAISO will create this Generated Bid for the registered MSG Configurations before the Market Close, and if it does not submit such a Bid the CAISO will create this Generated Bid after the Market Close. Any Generated Bid created by the CAISO for the default Resource Adequacy MSG Configuration will be in addition to the MSG Configurations bid into the Real-Time Market by the responsible Scheduling Coordinator. If the Scheduling Coordinator submits a Bid in the Day-Ahead Market or Real-Time Market for a MSG Configuration that is not the default Resource Adequacy MSG Configuration and that does not cover the full amount of the resource's Resource Adequacy requirements, the CAISO will create a Generated Bid for the full Resource Adequacy Capacity. Before the market closes, if a Scheduling Coordinator submits a Bid in the Day-Ahead Market or Real-Time Market for the default Resource Adequacy MSG Configuration of an Multi-Stage Generating Resource that only meets part of the resource's Resource Adequacy must-offer obligation, the CAISO will extend the last segment of the Energy Bid curve in the submitted Bid for the Multi-Stage Generating Resource up to the Multi-Stage Generating Resource's Resource Adequacy must-offer obligation. After the market closes, to the extent that no Bid is submitted into the Real-Time Market for a Multi-Stage Generating Resource scheduled in the Integrated Forward Market as required in Section 30.5 the CAISO will create a Self-Schedule for MSG Configuration equal to the Day-Ahead Schedule for that resource for the MSG Configuration scheduled in the IFM. To the extent a Multi-Stage Generating Resource is awarded Operating Reserves in the Day-

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

* * *

30.7.8 Format and Validation of Start-Up and Shut-Down Times.

For a Generating Unit or a Resource-Specific System Resource, the submitted Start-Up Time expressed in minutes (min) as a function of down time expressed in minutes (min) must be a staircase function with up to three (3) segments defined by a set of 1 to 4 down time and Start-Up Time pairs. The Start-Up Time is the time required to start the resource if it is offline longer than the corresponding down time. The CAISO shall model Start-Up Times for Multi-Stage Generating Resource at the MSG Configuration level and Transition Times are validated based on the Transition Matrix submitted as provided in Section 27.8. The last segment will represent the time to start the unit from a cold start and will extend to infinity. The submitted Start-Up Time function shall be validated as follows:

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

(b) The down time entries must match exactly (in number, sequence, and value) the corresponding down time breakpoints of the maximum Start-Up Time function, as registered in the Master File for the relevant resource.

(c) The Start-Up Time for each segment must not exceed the Start-Up Time of the corresponding segment of the maximum Start-Up Time function, as registered in the Master File for the relevant resource.

(d) The Start-Up Time function must be strictly monotonically increasing, i.e., the Start-Up Time must increase as down time increases.

For Participating Load, a single Shut-Down time in minutes is the time required for the resource to Shut-Down after receiving a Dispatch Instruction.

30.7.9 Format and Validation of Start-Up Costs and Shut-Down Costs.

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

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

(b) The down time entries must match exactly (in number, sequence, and value) the corresponding down time breakpoints of the Start-Up Cost function, as registered in the Master File for the relevant resource as either the Proxy Cost or Registered Cost.

(c) The Start-Up Cost for each segment must not be negative and must be equal to the Start-Up Cost of the corresponding segment of the Start-Up Cost function, as registered in the Master File for the relevant resource. If a value is submitted in a Bid for the Start-Up Cost, it will be overwritten by the Master File value as either the Proxy Cost or Registered Cost based on the option elected pursuant to Section 30.4. If no value for Start-Up Cost is submitted in a Bid, the CAISO will insert the Master File value, as either the Proxy Cost or Registered Cost based on the option elected pursuant to Section 30.4.

(d) The Start-Up Cost function must be strictly monotonically increasing, i.e., the Start-Up Cost must increase as down time increases.

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

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31.2.2.2 Non-RMR Units.

If the dispatch level produced through the ACR is greater than the dispatch level produced through CCR, then the resource is subject to Local Market Power Mitigation, in which case the entire portion of the unit's Energy Bid Curve that is above the CCR dispatch level will be mitigated to the lower of the Default Energy Bid as specified in Section 39, or the DAM Bid, but no lower than the unit's highest Bid price that cleared the CCR. To the extent a Multi-Stage Generating Resource's MWh dispatch level produced in in the All Constraints Run is greater than the MWhs dispatch level produced in the Competitive Constraints Run, for purposes of mitigation, all the MSG Configurations will be mitigated similarly and the CAISO will evaluate all submitted Energy Bids for all MSG Configurations based on the relevant Default Energy Bids for the applicable MSG Configuration. The CAISO will calculate the Default Energy Bids for Multi-Stage Generating Resources by submitted MSG Configuration. When the ACR dispatch level is higher than the CCR level, the market Bid at and below the CCR dispatch level will be retained in the IFM. If the dispatch level produced through the ACR is not greater than the dispatch level produced through the CCR, the unit's original, unmitigated DAM Bid will be retained in its entirety.

31.3 Integrated Forward Market.

After the MPM-RRD and prior to RUC, the CAISO shall perform the IFM. The IFM (1) performs Unit Commitment and Congestion Management (2) clears mitigated or unmitigated Bids cleared in the MPM-RRD as well as Bids that were not cleared in the MPM-RRD process against bid-in Demand, taking into account transmission limits and honoring technical and inter-temporal operating Constraints, such as Minimum Run Times (3) and procures Ancillary Services to meet one hundred percent (100%) of the

CAISO Forecast of CAISO Demand requirements. The IFM utilizes a set of integrated programs that: (1) determine Day-Ahead Schedules and AS Awards, and related LMPs and ASMPs; and (2) optimally commits resources that are bid in to the DAM. The IFM utilizes a SCUC algorithm that optimizes Start-Up Costs, Minimum Load Costs, Transition Costs, and Energy Bids along with any Bids for Ancillary Services as well as Self-Schedules submitted by Scheduling Coordinators. The IFM selects the optimal MSG Configuration from a maximum of ten MSG Configurations of each Multi-Stage Generating Resource as mutually exclusive resources. If a Scheduling Coordinator submits a Self-Schedule or a Submission to Self-Provide Ancillary Services for a given MSG Configuration in a given Trading Hour, the IFM will consider the Start-Up Cost, Minimum Load Cost, and Transition Cost associated with any Economic Bids for other MSG Configurations as incremental costs between the other MSG Configurations and the self-scheduled MSG Configuration. In such cases, incremental costs are the additional costs incurred to transition or operate in an MSG Configuration in addition to the costs associated with the self-scheduled MSG Configuration. The IFM also provides for the optimal management of Use-Limited Resources. The ELS Resources committed through the ELC Process conducted two days before the day the IFM process is conducted for the next Trading Day as described in Section 31.7 are binding.

31.3.1 Market Clearing and Price Determination.

31.3.1.1 Integrated Forward Market Output.

The IFM produces: (1) a set of hourly Day-Ahead Schedules, AS Awards, and AS Schedules for all participating Scheduling Coordinators that cover each Trading Hour of the next Trading Day; and (2) the hourly LMPs for Energy and the ASMPs for Ancillary Services to be used for settlement of the IFM. For a Multi-Stage Generating Resource, the IFM produces a Day-Ahead Schedule for no more than one MSG Configuration per Trading Hour. In addition, the IFM will produce the MSG Transition and the MSG Configuration indicators for the Multi-Stage Generating Resource, which would establish the expected MSG Configuration in which the Multi-Stage Generating Resource will operate. During a transition, the committed MSG Configuration is considered to be the “from” MSG Configuration. The CAISO will publish the LMPs at each PNode as calculated in the IFM. In determining Day-Ahead Schedules, AS Awards, and AS Schedules the IFM optimization will minimize total Bid Costs based on submitted and mitigated Bids while respecting the operating characteristics of resources, the operating limits of transmission facilities, and a set of scheduling priorities that are described in Section 31.4. In performing its optimization, the IFM first tries to complete its required functions utilizing Effective Economic Bids without adjusting Self-Schedules, and skips Ineffective Economic Bids and adjusts Self-Schedules only if it is not possible to balance Supply and Demand and manage Congestion in an operationally prudent manner with available Effective Economic Bids. The process and criteria by which the IFM adjusts Self-Schedules and other Non-priced Quantities are described in Sections 27.4.3, 31.3.1.3 and 31.4. The Day-Ahead Schedules are binding commitments, including the commitment to Start-Up, if necessary, to comply with the Day-Ahead Schedules. The CAISO will not issue separate Start-Up Instructions for Day-Ahead commitments. A resource's status, however, can be modified as a result of additional market processes occurring in the HASP and RTM.

31.3.1.2 Treatment of Ancillary Services Bids in IFM.

As provided in Section 30.7.6.2 the CAISO shall co-optimize the Energy and Ancillary Services Bids in clearing the IFM. To the extent that capacity subject to an Ancillary Services Bid submitted in the Day-Ahead Market is not associated with an Energy Bid, there is no co-optimization, and therefore, no opportunity cost associated with that resource for that Bid for the purposes of calculating the Ancillary Services Marginal Price as specified in Section 27.1.2.2. When the capacity associated with the Energy Bid overlaps with the quantity submitted in the Ancillary Services Bid, then the Energy Bid will be used to determine the opportunity cost, if any, in the co-optimization to the extent of the overlap. Therefore, the capacity that will be considered when co-optimizing the procurement of Energy and Ancillary Services from Bids in the IFM will consider capacity up to the total capacity of the resource as reflected in the Ancillary Services Bid as derated through SLIC, if at all. In the case of Regulation, the capacity that will be considered is the lower of the capacity of the resource offered in the Ancillary Services Bid or the upper Regulation limit of the highest Regulating Range as contained in the Master File. For any Trading Hour within the period in which the Multi-Stage Generating Resource is transitioning from one MSG Configuration to another, the IFM will not award Ancillary Services and any Submission to Self-Provide Ancillary Services will be disqualified. Any Ancillary Services Awards in the IFM to Multi-Stage Generating Resources will carry through to the Real-Time Market in the same MSG Configuration that the Multi-Stage Generating Resource is awarded in the IFM.

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31.3.1.4 Eligibility to Set the Day-Ahead LMP.

All Generating Units, Participating Loads, non-Participating Loads, System Resources, System Units, or Constrained Output Generators subject to the provisions in Section 27.7, with Bids, including Generated Bids, that are unconstrained due to Ramp Rates, MSG Transitions, Forbidden Operating Regions, or other temporal constraints are eligible to set the LMP, provided that (a) the Schedule for the Generating Unit or Resource-Specific System Resource is between its Minimum Operating Limit and the highest MW value in its Economic Bid or Generated Bid, or (b) the Schedule for the Participating Load, non-Participating Load, non-Resource-Specific System Resource, or System Unit is between zero (0) MW and the highest MW value in its Economic Bid or Generated Bid. If (a) a resource's Schedule is constrained by its Minimum Operating Limit or the highest MW value in its Economic Bid or Generated Bid, (b) the CAISO enforces a resource-specific constraint on the resource due to an RMR or Exceptional Dispatch, (c) the resource is constrained by a boundary of a Forbidden Operating Region or is Ramping through a Forbidden Operating Region, or (d) the resource's full Ramping capability is constraining its inter-hour change in Schedule, the resource cannot be marginal and thus is not eligible to set the LMP. Resources identified as MSS Load following resources are not eligible to set the LMP. A Constrained Output Generator will be eligible to set the hourly LMP if any portion of its Energy is necessary to serve Demand.

* * *

31.5 Residual Unit Commitment.

The CAISO shall perform the RUC process after the IFM. In the event that the IFM did not commit sufficient resources to meet the CAISO Forecast of CAISO Demand and account for other factors such as Demand Forecast error, as described in the Business Practice Manuals, the RUC shall commit additional resources and identify additional RUC Capacity to ensure sufficient on-line resources to meet Demand for each hour of the next Trading Day. RUC Capacity is selected by a SCUC optimization that uses the same Base Market Model used in the IFM adjusted as described in Section 27.5.1 and 27.5.6 to help ensure the deliverability of Energy from the RUC Capacity. In the case of Multi-Stage Generating Resources, the RUC will optimize Transition Costs in addition to the Start-Up and Minimum Load Costs. If a Scheduling Coordinator submits a Self-Schedule or a Submission to Self-Provide Ancillary Services for a given MSG Configuration in a given Trading Hour, the RUC will consider the Start-Up Cost, Minimum Load Cost, and Transition Cost associated with any Economic Bids for other MSG Configurations as incremental costs between the other MSG Configurations and the self-scheduled MSG Configuration. In such cases, incremental costs are the additional costs incurred to transition or operate in an MSG Configuration in addition to the costs associated with the self-scheduled MSG Configuration.

31.5.1 RUC Participation.

31.5.1.1 Capacity Eligible for RUC Participation.

RUC participation is voluntary for capacity that has not been designated as Resource Adequacy Capacity. Scheduling Coordinators may make such capacity available for participation in RUC by submitting a RUC Availability Bid, provided the Scheduling Coordinator has also submitted an Energy Bid for such capacity into the IFM. Capacity from Non-Dynamic System Resources that has not been designated Resource Adequacy Capacity is not eligible to participate in RUC. Capacity from resources including System Resources that has been designated as qualified Resource Adequacy Capacity must participate in RUC. RUC participation is required for Resource Adequacy Capacity to the extent that Resource Adequacy Capacity is not committed following the IFM. System Resources eligible to participate in RUC will be considered on an hourly basis; that is, RUC will not observe any multi-hour block constraints. In RUC the CAISO may commit a Multi-Stage Generating Resource with a Resource Adequacy must-offer obligation at any MSG Configuration with capacity equal to or greater than the MSG Configuration committed in the Integrated Forward Market. RUC will observe the Energy Limits that may have been submitted in conjunction with Energy Bids to the IFM. RMR Unit capacity will be considered in RUC in accordance with Section 31.5.1.3. MSS resources may participate in RUC in accordance with Section 31.5.2.3. COG resources are accounted for in RUC, but may not submit or be paid RUC Availability Payments. The ELS Resources committed through the ELC Process conducted two days before the day the RUC process is conducted for the next Trading Day as described in Section 31.7 are binding.

31.5.1.2 RUC Availability Bids.

Scheduling Coordinators may only submit RUC Availability Bids for capacity (above the Minimum Load) for which they are also submitting an Energy Bid to participate in the IFM. The RUC Availability Bid for the Resource Adequacy Capacity submitted by a Scheduling Coordinator must be $0/MW per hour for the entire Resource Adequacy Capacity. If the Scheduling Coordinator fails to submit a $0/MW per hour for Resource Adequacy Capacity, the CAISO will insert the $0/MW per hour for the full amount of Resource Adequacy Capacity for a given resource reduced by any upward Ancillary Services Awards. For Multi-Stage Generating Resources that fail to submit a $0/MW per hour for the Resource Adequacy Capacity, the CAISO will insert the $0/MW per hour for the resource's Resource Adequacy Capacity at the MSG Configuration level up to the minimum of the Resource Adequacy Capacity or the PMax of the MSG Configuration. Scheduling Coordinators may submit non-zero RUC Availability Bids for the portion of a resource's capacity that is not Resource Adequacy Capacity.

* * *

31.5.1.4 Eligibility to Set the RUC Price.

All resources that are eligible for RUC participation as described in Section 31.5.1.1 with RUC Bids that are unconstrained due to Ramp Rates or other temporal constraints, including MSG Transitions, are eligible to set the RUC Price, provided that (a) the RUC Schedule for the Generating Unit or Resource-Specific System Resource is between its Minimum Operating Limit and the highest MW value in its Economic Bid or Generated Bid, or (b) the Schedule for the eligible resource other than a Generating Unit or Resource-Specific System Resource is between zero (0) MW and the highest MW value in its Economic Bid or Generated Bid. If (a) a resource's Schedule is constrained by its Minimum Operating Limit or the highest MW value in its Economic Bid or Generated Bid, (b) the CAISO enforces a resource-specific constraint on the resource due to an RMR or Exceptional Dispatch or (c) the resource's full Ramping capability is constraining its inter-hour change in Schedule, the resource cannot be marginal and thus is not eligible to set the RUC Price. Resources identified as MSS Load following resources are not eligible to set the RUC Price.

* * *

31.5.5 Selection and Commitment of RUC Capacity.

Capacity that is not already scheduled in the IFM may be selected as RUC Capacity through the RUC process of the DAM. The RUC optimization will select RUC Capacity and produce nodal RUC Prices by minimizing total Bid cost based on RUC Availability Bids and Start-Up, ~~and~~ Minimum Load Bids and Transition Costs. RUC will not consider Start-Up, ~~and~~ Minimum Load Bids, or Transition Costs for resources already committed in the IFM. The RUC Capacity of a resource is the incremental amount of capacity selected in RUC above the resource's Day-Ahead Schedule. The resource's Day-Ahead Schedule plus its RUC Capacity comprise the resource's RUC Schedule. The CAISO will only issue RUC Start-Up Instructions to resources committed in RUC that must receive a Start-Up Instruction in the Day-Ahead in order to be available to meet Real-Time Demand. RUC Schedules will be provided to Scheduling Coordinators even if a RUC Start-Up Instruction is not issued at that time. RUC shall not Shut Down resources ~~reverse commitments~~ scheduled ~~issued~~ through the IFM and RUC will not commit a Multi-Stage Generating Resource to a lower MSG Configuration that is unable to support the Energy scheduled in the IFM. If the RUC process cannot find a feasible solution given the resources committed in the IFM, the RUC process will adjust Constraints as described in Section 31.5.4 to arrive at a feasible solution that accommodates all the resources committed in the IFM, and any necessary de-commitment of IFM committed units shall be effectuated through an Exceptional Dispatch.

31.5.6 Eligibility for RUC Compensation.

All RUC Capacity is eligible for the RUC Availability Payment except for: (i) RUC Capacity from RMR Units that has been designated as RMR Dispatch and included in RUC as a Self-Schedule; (ii) Resource Adequacy Capacity; and (iii) RUC Capacity that corresponds to the resource's Minimum Load, which is compensated through the Bid Cost Recovery as described in Section 11.8. Resources not committed in the IFM that are committed in RUC, including RMR Units that were not designated for RMR Dispatches and Resource Adequacy Resources, are also eligible for RUC Cost Compensation, which includes Start-Up, Transition Costs, and Minimum Load Cost compensation, and Bid Cost Recovery, subject to the resource actually following its Dispatch Instructions as verified by the CAISO pursuant to procedures set forth in the Business Practice Manuals.

* * *

31.5.7.1 Rescission of Payments for Undispatchable RUC Capacity.

The CAISO shall calculate the Real-Time ability of each Generating Unit, Participating Load, System Unit or System Resource to deliver Energy from or capacity committed in RUC for each Settlement Interval based on its maximum operating capability, actual telemetered output, and Operational Ramp Rate as described in Section 30.10, which for a Multi-Stage Generating Resource is evaluated by MSG Configuration. If the Undispatchable Capacity is capacity committed in RUC and is from a Generating Unit, System Unit or System Resource that is a Resource Adequacy Resource, there is no payment obligation to the CAISO for the Undispatchable Capacity. The CAISO will report the instance of non-compliance by the Resource Adequacy Resource to the appropriate Local Regulatory Authority.

31.5.7.2 Rescission of Payments for Undelivered RUC Capacity.

For each Settlement Interval in which a Generating Unit, Participating Load, System Unit or System Resource fails to supply Energy from capacity committed in RUC in accordance with a Dispatch Instruction, or supplies only a portion of the Energy specified in the Dispatch Instruction, the RUC Availability Payment will be reduced to the extent of the deficiency, in accordance with the provisions of Section 11.2.2.2.2, which for a Multi-Stage Generating Resource is evaluated for the Generating Unit or Dynamic Resource-Specific System Resource and not by the MSG Configuration.

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34. REAL-TIME MARKET

The RTM is the market conducted by the CAISO during any given Operating Day in which Scheduling Coordinators may provide Real-Time Imbalance Energy and Ancillary Services. The Real-Time Market consists of the Real-Time Unit Commitment (RTUC), the Short-Term Unit Commitment (STUC) and the Real-Time Dispatch (RTD) processes. The Short-Term Unit Commitment (STUC) runs once per hour near the top of the hour and utilizes the SCUC optimization to commit Medium Start, Short Start and Fast Start Units to meet the CAISO Demand Forecast. The CAISO shall dispatch all resources, including Participating Load pursuant to submitted Bids or pursuant to the provisions below on Exceptional Dispatch. In Real-Time, resources are required to follow Real-Time Dispatch Instructions. The Time Horizon of the STUC starts with the third fifteen-minute interval of the current Trading Hour and extending for the next four Trading Hours. The RTUC runs every fifteen (15) minutes and utilizes the SCUC optimization to commit Fast Start and some Short Start resources and to procure any needed AS on a fifteen-minute basis. Any given run of the RTUC will have a Time Horizon of approximately sixty (60) to 105 minutes (four to seven fifteen-minute intervals) depending on when during the hour the run occurs.

Not all resources committed in a given STUC or 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. The RTD uses a Security Constrained Economic Dispatch (SCED) algorithm every five minutes throughout the Trading Hour to determine optimal Dispatch Instructions to balance Supply and Demand. Updates to the Base Market Model adjusted as described in Sections 27.5.1 and 27.5.6 used in the RTM optimization include current estimates of real-time unscheduled flow at the Interties. The RTD optimization utilizes up to a sixty-five-minute Time Horizon (thirteen (13) five-minute intervals), but the CAISO issues Dispatch Instructions only for the next target five-minute Interval. The RTUC, STUC and RTD processes of the RTM use the same Base Market Model adjusted as described in Sections 27.5.1 and 27.5.6 used in the DAM and the HASP, subject to any necessary updates of the Base Market Model adjusted as described in Sections 27.5.1 and 27.5.6 pursuant to changes in grid conditions after the DAM has run. In the case of Multi-Stage Generating Resources, the RTM procedures will optimize Transition Costs in addition to the Start-Up and Minimum Load Costs. If a Scheduling Coordinator submits a Self-Schedule or a Submission to Self-Provide Ancillary Services for a given MSG Configuration in a given Trading Hour, all of the RTM processes will consider the Start-Up Cost, Minimum Load Cost, and Transition Cost associated with any Economic Bids for other MSG Configurations as incremental costs between the other MSG Configurations and the self-scheduled MSG Configuration. In such cases, incremental costs are the additional costs incurred to transition or operate in an MSG Configuration in addition to the costs associated with the self-scheduled MSG Configuration.

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34.2 Real-Time Unit Commitment.

The Real-Time Unit Commitment (RTUC) process uses SCUC and is run every fifteen (15) minutes to: (1) make commitment decisions for Fast Start and Short Start resources having Start-Up Times within the Time Horizon of the RTUC process, and (2) procure required additional Ancillary Services and calculate ASMP used for settling procured Ancillary Service capacity for the next fifteen-minute Real-Time Ancillary Service interval. In any fifteen (15) minute RTUC interval that falls within a time period in which a Multi-Stage Generating Resource is transitioning from one MSG Configuration to another MSG Configuration, the CAISO: (1) will not award any incremental Ancillary Services; (2) will disqualify any Day-Ahead Ancillary Services Awards; (3) will disqualify Day-Ahead qualified Submissions to Self-Provide Ancillary Services Award, and (4) will disqualify Submissions to Self-Provide Ancillary Services in RTM. 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 four times an hour, at the following times for the following Time Horizons: (1) at approximately 7.5 minutes prior to the next Trading Hour, in conjunction with 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 Trade Hour. The HASP, described in Section 33, is a special RTUC run that is performed at approximately 7.5 minutes before each hour and has the additional responsibility of: (1) pre-dispatching Energy and awarding Ancillary Services for hourly dispatched System Resources for the Trading Hour that begins 67.5 minutes later, and (2) performing the necessary MPM-RRD for that Trading Hour. 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 process taking into consideration the impacts of the derate or outage on the available MSG Configurations.

34.2.1 Commitment of Fast Start and Short Start Resources.

RTUC produces binding and advisory Start-Up and Shut-Down Dispatch Instructions for Fast Start and Short Start resources that have Start-Up Times that would allow the resource to be committed prior to the end of the relevant Time Horizon of the RTUC run. 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 ~~could not achieve the target start time as determined in the current RTUC run in a subsequent RTUC run as a result of the~~ Start-Up ~~Time of~~ 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 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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34.4 Short-Term Unit Commitment.

At the top of each Trading Hour, immediately after the RTUC run 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 to commit Medium Start Units and Short Start Units with Start-Up Times greater than the Time Horizon covered by the RTUC. The Time Horizon for the STUC optimization run will extend three hours beyond the Trading Hour for which the RTUC optimization was run, and will replicate the Bids used in that Trading Hour for these additional hours. The CAISO revises these replicated Bids each time the hourly STUC is run, to utilize the most recently submitted Bids. 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 will only decommit a resource to the extent that resource's physical characteristics allow it to be cycled in the same Time Horizon for which it was decommitted. STUC does not produce 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.

34.5 General Dispatch Principles.

The CAISO shall conduct all Dispatch activities consistent with the following principles:

(1) The CAISO shall issue AGC instructions electronically as often as every four seconds from its Energy Management System (EMS) to resources providing Regulation and on Automatic Generation Control to meet NERC and WECC performance requirements;

(2) In each run of the RTED or RTCD the objective will be to meet the projected Energy requirements over the Time Horizon of that run, subject to transmission and resource operational Constraints, taking into account the short term CAISO Forecast of CAISO Demand adjusted as necessary by the CAISO Operator to reflect scheduled changes to Interchange and non-dispatchable resources in subsequent Dispatch Intervals;

(3) Dispatch Instructions will be based on Energy Bids for those resources that are capable of intra-hour adjustments and will be determined through the use of SCED except when the CAISO must utilize the RTMD;

(4) When dispatching Energy from awarded Ancillary Service capacity the CAISO will not differentiate between Ancillary Services procured by the CAISO and Submissions to Self-Provide an Ancillary Service;

(5) The Dispatch Instructions of a resource for a subsequent Dispatch Interval shall take as a point of reference the actual output obtained from either the State Estimator solution or the last valid telemetry measurement and the resource's operational ramping capability. For Multi-Stage Generating Resources the determination of the point of reference is further affected by the MSG Configuration and the information contained in the Transition Matrix;

(6) In determining the Dispatch Instructions for a target Dispatch Interval while at the same time achieving the objective to minimize Dispatch costs to meet the forecasted conditions of the entire Time Horizon, the Dispatch for the target Dispatch Interval will be affected by: (a) Dispatch Instructions in prior intervals, (b) actual output of the resource, (c) forecasted conditions in subsequent intervals within the Time Horizon of the optimization, and (d) operational Constraints of the resource, such that a resource may be dispatched in a direction for the immediate target Dispatch Interval that is different than the direction of change in Energy needs from the current Dispatch Interval to the next immediate Dispatch Interval, considering the applicable MSG Configuration;

(7) Through Start-Up Instructions the CAISO may instruct resources to start up or shut down, or may reduce Load for Participating Loads, over the Time Horizon for the RTM based on submitted Bids, Start-Up Costs and Minimum Load Costs, Pumping Costs and Pump Shut-Down Costs, as appropriate for the resource, or for Multi-Stage Generating Resource as appropriate for the applicable MSG Configuration, consistent with operating characteristics of the resources that the SCED is able to enforce. In making Start-Up or Shut-Down decisions in the RTM, the CAISO may factor in limitations on number of run hours or Start-Ups of a resource to avoid exhausting its maximum number of run hours or Start-Ups during periods other than peak loading conditions;

(8) The CAISO shall only start up resources that can start within the Time Horizon used by the RTM optimization methodology;

(9) The RTM optimization may result in resources being shut down consistent with their Bids and operating characteristics provided that: (1) the resource does not need to be on-line to provide Energy, (2) the resource is able to start up within the RTM optimization Time Horizon, (3) the Generating Unit is not providing Regulation or Spinning Reserve, and (4) Generating Units online providing Non-Spinning Reserve may be shut down if they can be brought up within ten (10) minutes as such resources are needed to be online to provide Non-Spinning Reserves; ~~and~~

(10) For resources that are both providing Regulation and have submitted Energy Bids for the RTM, Dispatch Instructions will be based on the Regulation Ramp Rate of the resource rather than the Operational Ramp Rate if the Dispatch Operating Point remains within the Regulating Range. The Regulating Range will limit the Ramping of Dispatch Instructions issued to resources that are providing Regulation~~.~~;

(11) For Multi-Stage Generating Resources the CAISO will issue Dispatch Instructions by Resource ID and Configuration ID;

(12) The CAISO may issue Transition Instructions to instruct resources to transition from one MSG Configuration to another over the Time Horizon for the RTM based on submitted Bids, Transition Costs and Minimum Load Costs, as appropriate for the MSG Configurations involved in the MSG Transition, consistent with Transition Matrix and operating characteristics of these MSG Configurations. The RTM optimization will factor in limitations on Minimum Up Time and Minimum Down Time defined for each MSG configuration and Minimum Up Time and Minimum Down Time at the Generating Unit or Dynamic Resource-Specific System Resource.

34.6 Dispatch Instructions for Generating Units and Participating Load.

The CAISO may issue Dispatch Instructions covering:

(a) Ancillary Services;

(b) Energy, which may be used for:

(i) Congestion relief;

(ii) provision of Imbalance Energy; or

(iii) replacement of an Ancillary Service;

(c) agency operation of Generating Units, Participating Loads or Interconnection schedules, for example:

(i) output or Demand that can be Dispatched to meet Applicable Reliability Criteria;

(ii) Generating Units that can be Dispatched for Black Start;

(iii) Generating Units that can be Dispatched to maintain governor control regardless of their Energy schedules;

(d) the operation of voltage control equipment applied on Generating Units as described in this CAISO Tariff;

(e) MSS Load following instructions provided to the CAISO, which the CAISO incorporates to create their Dispatch Instructions; ~~or~~

(f) necessary to respond to a System Emergency or imminent emergency~~.~~; or

(g) Transition Instructions.

* * *

34.9 Exceptional Dispatch.

The CAISO may issue Exceptional Dispatches for the circumstances described in this Section 34.9, which may require the issuance of forced Shut-Downs, ~~or~~ forced Start-Ups, or forced MSG Transitions and shall be consistent with Good Utility Practice. Dispatch Instructions issued pursuant to Exceptional Dispatches shall be entered manually by the CAISO Operator into the Day-Ahead or RTM optimization software so that they will be accounted for and included in the communication of Day-Ahead Schedules and Dispatch Instructions to Scheduling Coordinators. Exceptional Dispatches are not derived through the use of the

IFM or RTM optimization software and are not used to establish the LMP at the applicable PNode. The CAISO will record the circumstances that have led to the Exceptional Dispatch. Except as provided in this Section 34.9, the CAISO shall consider the effectiveness of the resource along with Start-Up Costs, Transition Costs, and Minimum Load Costs when issuing Exceptional Dispatches to commit a resource to operate at Minimum Load. When the CAISO issues Exceptional Dispatches for Energy, the CAISO shall also consider Energy Bids, if available and as appropriate. The goal of the CAISO will be to issue Exceptional Dispatches on a least-cost basis. Imbalance Energy delivered or consumed pursuant to the various types of Exceptional Dispatch is settled according to the provisions in Section 11.5.6.

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34.15.1 Resource Constraints.

The SCED shall enforce the following resource physical Constraints:

(a) Minimum and maximum operating resource limits. Outages and limitations due to transmission clearances shall be reflected in these limits. The more restrictive operating or regulating limit shall be used for resources providing Regulation so that the SCED shall not Dispatch them outside their Regulating Range.

(b) Forbidden Operating Regions. When ramping in the Forbidden Operating Region, the implicit ramp rate will be used as determined based on the time it takes for the resource to cross its Forbidden Operating Region. A resource can only be ramped through a Forbidden Operating Region after being dispatched into a Forbidden Operation Region. The CAISO will not Dispatch a resource within its Forbidden Operating Regions in the Real-Time Market, except that the CAISO may Dispatch the resource through the Forbidden Operating Region in the direction that the resource entered the Forbidden Operating Region at the maximum applicable Ramp Rate over consecutive Dispatch Intervals. A resource with a Forbidden Operating Region cannot provide Ancillary Services in a particular fifteen (15) minute Dispatch Interval unless that resource can complete its transit through the relevant Forbidden Operating Region within that particular Dispatch Interval.

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

(d) Maximum number of daily Start-Ups. The SCED shall not cause a resource to exceed its daily maximum number of Start-Ups.

(e) Minimum Run Time and Down Time. The SCED shall not start up off-line resources before their Minimum Down Time expires and shall not shut down on-line resources before their Minimum Run Time expires. For Multi-Stage Generating Resources these requirements shall be observed both for the Generating Unit or Dynamic Resource-Specific System Resource and MSG Configuration.

(f) Operating (Spinning and Non-Spinning) Reserve. The SCED shall Dispatch Spinning and Non-Spinning Reserve subject to the limitations set forth in Section 34.16.3.

(g) Non-Dynamic System Resources. If Dispatched, each Non-Dynamic System Resource flagged for hourly pre-dispatch in the next Trading Hour shall be Dispatched to operate at a constant level over the entire Trading Hour. The HASP shall perform the hourly pre-dispatch for each Trading Hour once prior to the Operating Hour. The hourly pre-dispatch shall not subsequently be revised by the SCED and the resulting HASP Intertie Schedules are financially binding and are settled pursuant to Section 11.4.

(h) Daily Energy use limitation to the extent that Energy limitation is expressed in a resource's Bid. If the Energy Limits are violated for purposes of Exceptional Dispatches for System Reliability, the Bid will be settled as provided in Section 11.5.6.1.

34.15.2 Calculation of Dispatch Operating Points Pursuant to Start-Up and Shut-Down Instructions.

The RTED process shall calculate Dispatch Operating Points as follows:

(a) After RTUC issues a Start-Up Instruction, RTED moves the Dispatch Operating Point of a resource immediately from zero (0) MW to the PMin, as defined in the Master File or as modified via SLIC, of a Generating Unit at the start of the Dispatch Interval pertaining to the Start-Up Instruction. The Dispatch Operating Point shall then be determined using the resource's applicable Operational Ramp Rate as further described in Sections 34.15.4, 34.15.5, and 34.15.6.

(b) After RTUC issues a Shut-Down Instruction, RTED shall first ramp the Dispatch Operating Point down to the PMin, as defined in the Master File or as modified via SLIC, of a Generating Unit at the end of the Dispatch Interval pertaining to the Shut-Down Instruction, using the resource's applicable Operational Ramp Rate. The Dispatch Operating Point shall then be set immediately to zero (0) MW.

(c) After RTUC issues a Transition Instruction: (1) for MSG Configurations where the operating ranges of the two MSG Configurations do not overlap, the RTD will move the Dispatch Operating Point of the resource immediately from the boundary of the "from" MSG Configuration to the boundary of the "to" MSG Configuration, as defined in the Master File or as modified via the CAISO's outages reporting mechanism, of a Multi-Stage Generating Resource; and (2) for MSG Configurations for which the operating ranges of the two MSG Configurations do overlap, RTD will move the Dispatch Operating Point of the resource within the overlapping operating range of the MSG Configuration until the MSG Transition is complete.

* * *

39.7.1 Calculation of Default Energy Bids

Default Energy Bids shall be calculated by the CAISO, for the on-peak hours and off-peak hours for both the DAM and RTMs, pursuant to one of the methodologies described in this Section. The Scheduling Coordinator for each Generating Unit owner or Participating Load must rank order the following options of calculating the Default Energy Bid starting with its preferred method. The Scheduling Coordinator must provide the data necessary for determining the Variable Costs unless the Negotiated Rate Option precedes the Variable Cost option in the rank order, in which case the Scheduling Coordinator must have a negotiated rate established with the Independent Entity charged with calculating the Default Energy Bid. If no rank order is specified for a Generating Unit or Participating Load, then the default rank order of (1) Variable Cost Option, (2) Negotiated Rate Option, (3) LMP Option will be applied. For the first ninety (90) days after changes to resource status and MSG Configurations as specified in Section 27.8.3, including the first ninety (90) days after the effective date of Section 27.8.3, the Default Energy Bid option for the resource is limited to the Negotiated Rate Option or the Variable Cost Option.

* * *

CAISO Tariff Appendix A

Master Definitions Supplement

* * *

Bid Costs	The costs for resources manifested in the Bid components submitted, which include the Start-Up Cost, Minimum Load Cost, Energy Bid Cost, Transition Costs, Pump Shut-Down Cost, Pumping Cost, Ancillary Services Bid Cost and RUC Availability Payment.

* * *

Default Resource Adequacy Path	The registered sequence of MSG Configurations a Multi-Stage Generating Resource has to Start-Up and transition from off-line to reach the default Resource Adequacy MSG Configuration.

* * *

IFM Bid Cost	The sum of a BCR Eligible Resource's IFM Start-Up Cost, IFM Minimum Load Cost , IFM Pump Shut-Down Cost, IFM Transition Cost, IFM Pumping Cost, IFM Energy Bid Cost, and IFM AS Bid Cost.

* * *

MSG Configuration	A qualified and registered operating mode of a Multi-Stage Generating Resource, with a distinct set of operating characteristics. All MSG Configurations for Multi-Stage Generating Resources are operable on-line modes.
MSG Transition	A feasible operation from one MSG Configuration to another as registered in the Transition Matrix associated with a specific Transition Time and Transition Cost.

* * *

Multi-Stage Generating Resources	A Generating Unit or Dynamic Resource-Specific System Resource that for reasons related to its technical characteristics can be operated in various MSG Configurations such that only one such MSG Configuration can be operated in any given Dispatch Interval. In addition, subject to the requirements in Section 27.8, the following technical characteristics qualify a Generating Unit or Dynamic Resource-Specific System Resource as a Multi-Stage Generating Resource if the resource; (1) is a

combined cycle gas turbine resource; (2) is a Generating Unit or Dynamic Resource-Specific System Resources with multiple operating or regulating ranges but which can operate in only one of these ranges at any given time; or (3) has one or more Forbidden Operating Regions. Metered Subsystems, Pumped-Storage Hydro Units, and Pumping Loads, and System Resources that are not Dynamic Resource-Specific System Resources do not qualify as Multi-Stage Generating Resources.

* * *

RTM Bid Cost The total of a resource's RTM Start–Up Cost, RTM Minimum Load Cost, RTM Pump Shut-Down Cost, RTM Transition Cost, RTM Pumping Cost, RTM Energy Bid Cost, and RTM AS Bid Cost.

* * *

Transition Cost For a Multi-Stage Generating Resources, the dollar cost per feasible transition associated with a given MSG Configuration as registered in the Transition Matrix.

Transition Instructions A binding instruction issued by the CAISO to Multi-Stage Generating Resources in the Real-Time that directs the Multi-Stage Generating Resource to move from between MSG Configurations and indicates: (1) "from" and "to" MSG Configurations; and (2) the start time and end time of the MSG Transition.

Transition Matrix A matrix that, for Multi-State Generating Resources defines the possible MSG Transitions between all online MSG Configurations including the Transition Times and Transition Costs.

Transition Time For a Multi-Stage Generating Resources, the time to complete a MSG Transition, as registered in the Transition Matrix.

*** * ***

CAISO Tariff Appendix AA

Transition Plan for Multi-Stage Generating Resources

This Appendix AA describes the registration and qualification requirements for Generating Units and Dynamic Resource-Specific System Resources that intend to qualify and participate in the CAISO

Markets as Multi-Stage Generating Resources as of the first day on which the Multi-Stage Generating Resource CAISO Tariff provisions are effective.

No later than sixty (60) days prior to effective date of the CAISO Tariff provisions enabling the Multi-Stage Generating Resource functionality, Scheduling Coordinators shall commence the registration process to register and qualify Generating Units or Dynamic Resource-Specific System Resources as Multi-Stage Generating Resources as of the effective date of the CAISO Tariff provisions for the Multi-Stage Generating Resource functionality. The registration process commences with the submission by the responsible Scheduling Coordinator of the completed Multi-Stage Generating Resource registration form and the resource data template for Generating Unit or Dynamic Resource-Specific System Resource, which the CAISO provides as part of the registration process. After such submission, the CAISO will coordinate with the responsible Scheduling Coordinator to validate that the resource qualifies as a Multi-Stage Generating Resource, and that all the requisite information has been successfully provided to the CAISO. Successful completion of the registration process will occur upon the CAISO's notification to the responsible Scheduling Coordinator that the resource has been successfully qualified as a Multi-Stage Generating Resource. Once the CAISO has provided such notice, the resource will be registered and qualified to participate as a Multi-Stage Generating Resource as of the effective date of the CAISO Tariff provisions enabling the implementation of the Multi-Stage Generating Resource functionality. Scheduling Coordinators may register the number of MSG Configurations as are reasonably appropriate for the unit based on the operating characteristics of the unit, which may not, however, exceed a total of ten MSG Configurations and cannot be fewer than two MSG Configurations. The resource will be successfully registered and qualified for the requested status and MSG Configuration definitions on the date that the CAISO sends the notification to the responsible Scheduling Coordinator that the resource has been successfully qualified. If the CAISO has reason to believe that the resource's operating and technical characteristics are not consistent with the registered and qualified attributes, the CAISO may request that the Scheduling Coordinator provide additional information necessary to support their registered status and, if appropriate, may require that the resource be registered and qualified more consistent with the resource's operating and technical characteristics, including the revocation of its status as a Multi-Stage

Generating Resource. Failure to provide such information may be grounds for revocation of Multi-Generating Resource status.

As part of the registration process, the Scheduling Coordinators must submit to the CAISO a Transition Matrix, which contains the cost and operating constraints associated with feasible transitions between MSG Configurations. The responsible Scheduling Coordinator shall submit for each MSG Configuration a single segment Operational Ramp Rate, and as applicable an Operating Reserves Ramp Rate and Regulating Reserves Ramp Rate. The Scheduling Coordinator must establish the default MSG Configuration and its associated Default Resource Adequacy Path that apply to Multi-Stage Generating Resources that are subject to Resource Adequacy must-offer obligations as part of the resource data template provided in the registration process. The MSG Configurations and operational characteristics submitted to and accepted by the CAISO during this registration process will be in effect until the forty-fifth (45^{th}) day following the effective date of Section 27.8 of the CAISO Tariff, unless modified as specified below. Prior to that date, the Scheduling Coordinators may not make the following changes to a Generating Unit's or Dynamic Resource-Specific System Resource's attributes:

(1) Register a Generating Unit or Dynamic Resource-Specific System Resource as a Multi-Stage Generating Resource;

(2) Change the registered MSG Configurations for a Multi-Stage Generating Resource, which includes the;

a. addition of new MSG Configurations;

b. removal of an existing MSG Configuration;

c. a change to the definition of a registered MSG Configuration, which includes:

i. a change in the physical units supporting the MSG Configuration;

ii. a change to the MSG Configuration Start Up and Shut Down flags; and

iii. adding or removing a MSG Transition to the Transition Matrix;

d. a material change in the Transition Times contained in the Master File, which consists of a change that more than doubles a Transition Time or reduces it to less than half; and

e. a material change to the maximum Ramp Rate of the MSG Configuration(s) contained in the Master File, which consists of a change that more than doubles the maximum Ramp Rate or reduces it to less than half.

Thirty (30) days before the effective date of the CAISO Tariff provisions enabling the implementation of the Multi-Stage Generating Resource functionality, no changes may be made to any of the Multi-Stage Generating Resource attributes, fundamental or otherwise, except that the resources can drop out Multi-Stage Generating Resource status subject to the timing requirements of the Master file time line. When transitioning to implement these changes across the midnight hour, for any Real-Time Market run in which the changes specified above are to take effect within the Time Horizon of any of the Real-Time Market runs, the CAISO will Schedule, Dispatch, or award resources consistent with either the prior or new status and definitions, as appropriate and required by any Real-Time conditions regardless of the resource's state Scheduled or awarded in the immediately preceding Day-Ahead Market.

Resources that will be participating in the CAISO Markets as Multi-Stage Generating Resources when the CAISO Tariff Multi-Stage Generating Resource provisions become effective must submit all Outages reports required in Section 9 of the CAISO Tariff consistent with the registered MSG Configurations for such resources no later than forty-eight hours prior to the start of the first hour of the effective date of the CAISO Tariff provisions enabling the implementation of the Multi-Stage Generating Resource functionality.

Definitions

* * *

Default Resource Adequacy Path	The registered sequence of MSG Configurations a Multi-Stage Generating Resource has to Start-Up and transition from off-line to reach the default Resource Adequacy MSG Configuration.

* * *

Multi-Stage Generating Resources	A Generating Unit or Dynamic Resource-Specific System Resource that for reasons related to its technical characteristics can be operated in various MSG Configurations such that only one such MSG Configuration

can be operated in any given Dispatch Interval. In addition, subject to the requirements in Section 27.8, the following technical characteristics qualify a Generating Unit or Dynamic Resource-Specific System Resource as a Multi-Stage Generating Resource if the resource; (1) is a combined cycle gas turbine resource; (2) is a Generating Unit or Dynamic Resource-Specific System Resources with multiple operating or regulating ranges but which can operate in only one of these ranges at any given time; or (3) has one or more Forbidden Operating Regions. Metered Subsystems, Pumped-Storage Hydro Units, and Pumping Loads, and System Resources that are not Dynamic Resource-Specific System Resources do not qualify as Multi-Stage Generating Resources.

* * *

MSG Configuration	A qualified and registered operating mode of a Multi-Stage Generating Resource, with a distinct set of operating characteristics. All MSG Configurations for Multi-Stage Generating Resources are operable on-line modes.

* * *

Transition Matrix	A matrix that, for Multi-State Generating Resources defines the possible MSG Transitions between all online MSG Configurations including the Transition Times and Transition Costs.

* * *

Attachment C

Table of Proposed Tariff Changes and a Description of the Changes to the Tariff Sheets Since the last Version was Posted for Stakeholder Review

Section	Section Title	Existing or New	Reason for Change	Changes Made Since Last Posting
8.4.1	Operating Characteristics Required to Provide Ancillary Services.	Existing	Incorporating specific ancillary services requirements for Multi-Stage Generating Resources	Grammatical edits
8.9	Verification, Compliance Testing, and Audit of Ancillary Services.	Existing	Incorporating specific ancillary services requirements for Multi-Stage Generating Resources	Grammatical edits
8.9.2	Compliance Testing for Regulation	Existing	Incorporating specific ancillary services requirements for Multi-Stage Generating Resources	None
8.9.3.1	Compliance Testing of a Generating Unit, System Unit or System Resource.	Existing	Incorporating specific ancillary services requirements for Multi-Stage Generating Resources	None
8.9.6	Compliance Testing for RUC Capacity	Existing	Incorporating specific residual unit commitment capacity compliance testing requirements for Multi-Stage Generating Resources	None
8.9.9	Performance Audit for Regulation	Existing	Incorporating specific ancillary services requirements for Multi-Stage Generating Resources	none
8.9.10	Performance Audit for Spinning Reserve	Existing	Incorporating specific ancillary services requirements for Multi-Stage Generating Resources	None
8.9.11	Performance Audit for Non-Spinning Reserve.	Existing	Incorporating specific ancillary services requirements for Multi-Stage Generating Resources	None
8.9.14	Performance Audit for RUC Capacity.	Existing	Incorporating specific residual unit commitment capacity compliance testing requirements for Multi-Stage Generating Resources	None
8.10.2	Spinning Reserve	Existing	Incorporating specific ancillary services requirements for Multi-Stage Generating Resources	None
8.10.3	Non-Spinning Reserve.	Existing	Incorporating specific ancillary services requirements for Multi-Stage Generating Resources	None
8.10.8.1	Rescission of Payments for Undispatchable Ancillary Service Capacity.	Existing	Incorporating specific ancillary services requirements for Multi-Stage Generating Resources	Conforming use of defined terms
8.10.8.2	Rescission of Payments for Unavailable Ancillary Service Capacity.	Existing	Incorporating specific ancillary services requirements for Multi-Stage Generating Resources	Conforming use of defined terms
9.7	Multi-Stage Generating Resources Outages	New	Specify outages additional rules that apply to outages reporting for Multi-Stage Generating Resources	Grammatical edits; clarified that 2 days mean 2 business days
11.8.1	CAISO Determination of Self-Commitment Periods	Existing	Incorporating rules for the determination of self-commitment periods for Multi-Stage Generating Resources specifically	None
11.8.1.1	IFM Self-Commitment Period	Existing	Incorporating rules for the determination of IFM Self-Commitment periods for Multi-Stage Generating Resources specifically	Conforming use of defined terms

Section	Section Title	Existing or New	Reason for Change	Changes Made Since Last Posting
11.8.1.2	Real-Time Self-Commitment Period	Existing	Incorporating rules for the determination of RTM Self-Commitment periods for Multi-Stage Generating Resources specifically	Conforming use of defined terms
11.8.1.3	Multi-Stage Generating Resource Start-Up, Minimum Load, or Transition Costs	New	Adding new rules used for the purpose of determine which commitment period applies as to between IFM, RUC, and RTM and which commitment costs apply from the respective markets	Including description that these rules are used to determine the applicable Commitment Period; gramatical edits.
11.8.2.1	IFM Bid Cost Calculation	Existing	Adding cross references for the additional rules that will apply for Multi-Stage Generating Resources in determing the IFM Bid Costs	Grammatical edits; conforming use of defined terms
11.8.2.1.1	IFM Start-Up Cost	Existing	Adding new rules used for the determination of IFM Start-Up Costs for Multi-Stage Generating Resources	None
11.8.2.1.2	IFM Minimum Load Cost	Existing	Adding new rules used for the determination of IFM Minimum Load Costs for Multi-Stage Generating Resources	None
11.8.2.1.5	IFM Energy Bid Cost	Existing	Adding new rules that apply to Multi-Stage Generating Resources in determining IFM Energy Bid Costs	Conforming use of defined terms
11.8.2.1.6	IFM AS Bid Cost	Existing	Adding new rules that apply to Multi-Stage Generating Resources in determining IFM AS Bid Costs	Conforming use of defined terms
11.8.2.1.7	IFM Transition Cost	New	Adding new language to include component of IFM Transition Costs are determined as part of the bid cost recovery mechanism	None
11.8.2.2	IFM Market Revenue	Existing	Adding new language to specify how IFM Market Revenues are determined for Multi-Stage Generating Resources	Conforming use of defined terms
11.8.3.1	RUC Bid Cost Calculation	Existing	Adding cross references for the additional rules that will apply for Multi-Stage Generating Resources in determing the RUC Bid Costs	Conforming use of defined terms
11.8.3.1.1	RUC Start-Up Cost	Existing	Adding new language to specify how RUC Start-Up Costs will be determined for Multi-Stage Generating Resources	None
11.8.3.1.2	RUC Minimum Load Cost	Existing	Adding specification for how RUC Minimum Load Costs will be determined for Multi-Stage Generating Resources	None
11.8.3.1.3	RUC Availability Bid Cost	Existing	adding specification for how RUC Availability Bid Costs will be determined for Multi-Stage Generating Resources	None
11.8.3.1.4	RUC Transitition Cost	New	Adding new language to include component of RUC Transition Costs are determined as part of the bid cost recovery mechanism	None
11.8.3.2	RUC Market Revenues	Existing	Adding new language to specify how RUC Market Revenues are determined for Multi-Stage Generating Resources	Grammatical edits; removed erroneous reference to Multi-Stage Generating Resource

Section	Section Title	Existing or New	Reason for Change	Changes Made Since Last Posting
11.8.4.1	RTM Bid Cost Calculation	Existing	Adding cross references for the additional rules that will apply for Multi-Stage Generating Resources in determing the RTM Bid Costs	Grammatical edits; conforming use of defined terms
11.8.4.1.1	RTM Start-Up Cost	Existing	Adding new rules used for the determination of RTM Start-Up Costs for Multi-Stage Generating Resources	None
11.8.4.1.2	RTM Minimum Load Cost	Existing	Adding new rules used for the determination of RTM Minimum Load Costs for Multi-Stage Generating Resources	Grammatical edits
11.8.4.1.5	RTM Energy Bid Cost	Existing	Adding new rules that apply to Multi-Stage Generating Resources in determining RTM Energy Bid Costs	Grammatical edits; removed erroneous reference to Multi-Stage Generating Resource
11.8.4.1.6	RTM AS Bid Cost	Existing	Adding new rules that apply to Multi-Stage Generating Resources in determining RTM AS Bid Costs	Grammatical edits; removed erroneous reference to Multi-Stage Generating Resource
11.8.4.1.7	RTM Transition Cost	New	Adding new language to include component of RTM Transition Costs are determined as part of the bid cost recovery mechanism	None
11.8.4.2	RTM Market Revenue Calculations	Existing	Adding new language to specify how RTM Market Revenues are determined for Multi-Stage Generating Resources	Grammatical edit
11.8.5	Uncovered Bid Cost Uplift Payment	Existing	Adding language to specify that the Unrecovered Bid Cost Uplift Payments for Multi-Stage Generating Resources not done at the MSG Configuration level	Grammatical edit
27.8	Multi-Stage Generating Resources Resources	New	Section added to include details regarding the registration and qualification or Multi-Stage Generating Resources	None
27.8.1	Registration and Qualification	New	Section added to include details regarding the registration and qualification or Multi-Stage Generating Resources	Grammatical edits; conforming use of defined terms
27.8.2	Informational Requirements	New	Section added to include details regarding the information requirments for Multi-Stage Generating Resources	Grammatical edits; corrected cross references
27.8.3	Changes in Status and Configurations of Resource	New	Section added to indicate what rules apply to fundamental changes to Multi-Stage Generating Resources registered information	Conforming use of defined terms
30.5.1	General Bidding Rules	Existing	Adding additional rules that apply to Multi-Generating Resource bidding.	Grammatical edits; conforming use of defined terms
30.5.2.1	Common Elements for Supply Bids	Existing	Adding additional rules that apply to Multi-Generating Resource bids.	None
30.5.2.2	Supply Bids for Participating Generators	Existing	Adding additional rules that apply to Multi-Generating Resource bids.	Grammatical edit
30.5.2.6	Ancillary Service Bids	Existing	Adding additional rules that apply to Multi-Generating Resource bids.	None
30.5.2.7	RUC Availability Bids	Existing	Adding additional rules that apply to Multi-Generating Resource bids.	None

Section	Section Title	Existing or New	Reason for Change	Changes Made Since Last Posting
30.7.3.1	Validation Prior to Market Close and Master File Update	Existing	Adding additional rules that apply to Multi-Generating Resource bid validation	None
30.7.3.5	Bid Validation Rules for Multi-Stage Generating Resources	New	Adding additional rules that apply to Multi-Generating Resource bid validation	Conforming use of defined terms
30.7.8	Format and Validation of Start-Up and Shut-Down Times	Existing	Adding detail that applies to format of Multi-Stage Generating Resources Start-Up and Shut Down Times	None
30.7.9	Format and Validation of Start-Up and Shut-Down Costs	Existing	Adding detail that applies to format of Multi-Stage Generating Resources Start-Up and Shut Down Costs	None
31.2.2.2	Non-RMR Units	Existing	Adding detail on how the market power mitigation rules apply to Multi-Stage Generating Resources	None
31.3	Integrated Forward Market	Existing	Adding detail regarding how Multi-Stage Generating Resources are treated in the IFM	Grammatical edit
31.3.1.1	Integrated Forward Market Output	Existing	Adding detail regarding how Multi-Stage Generating Resources are treated in the IFM	None
31.3.1.2	Treatment of Ancillary Services Bids in IFM	Existing	Adding detail regarding how Multi-Stage Generating Resources ancillary services bids are treated in the IFM	Conforming use of defined terms
31.3.1.4	Eligibility to Set the Day-Ahead LMP	Existing	Noting that eligibility to set the LMP is limited if the resource is constrained due to an MSG Transition	Conforming use of defined terms
31.5	Residual Unit Commitment	Existing	Adding detail regarding how Multi-Stage Generating Resources are treated in the RUC	Grammatical edit
31.5.1.1	Capacity Eligible for RUC Participating	Existing	Adding detail regarding how Multi-Stage Generating Resources capacity may be commited in RUC	Grammitical edit
31.5.1.2	RUC Availability Bids	Existing	Adding detail regarding how RUC Availability Bids for Multi-Stage Generating Resources are treated; completing an existing sentence that was incomplete to also clarifiy that for all resources the ISO inserted bid will be for the full amount of the Resource Adequacy Capacity reduced by the upward Ancillary Services Award	None
31.5.1.4	Eligibility to Set the RUC Price	Existing	Noting that eligibility to set the LMP is limited if the resource is constrained due to an MSG Transition	Conforming use of defined terms
31.5.5	Selection and Commitment of RUC Capacity	Existing	Added detail regarding Transitions Costs for Multi-Stage Generating Resources; clarifying RUC's treatment of IFM schedules	Clarified how RUC treats configurations scheduled in IFM
31.5.6	Eligibility for RUC Compensation	Existing	Added detail regarding Transitions Costs for Multi-Stage Generating Resources	None
31.5.7.1	Rescission of Payments for Undispatchable RUC Capacity	Existing	Adding detail that for Multi-Stage Generating Resources the evaluation is done at the MSG Configuration level	None

Section	Section Title	Existing or New	Reason for Change	Changes Made Since Last Posting
31.5.7.2	Rescission of Payments for Undelivered RUC Capacity	Existing	Adding detail that for Multi-Stage Generating Resources the evaluation is done at the plant level and not the MSG Configuration level	None
34.2	Real-Time Unit Commitment	Existing	Adding detail regarding how Multi-Stage Generating Resources are treated in RTM	Grammatical edit
34.2.1	Commitment of Fast Start and Short Start Resources	Existing	Adding detail regarding how Multi-Stage Generating Resources will be treated in the RTUC	None
34.4	Short-Term Unit Commitment	Existing	Adding detail regarding how Fast or Short Start Multi-Stage Generating Resources will be treated in the STUC	None
34.5	General Dispatch Principles	Existing	Adding detail regarding the general dispatch rules that apply to Multi-Stage Generating Resources	Grammatical edits
34.6	Dispatch Instructions for Generating Units and Participating Load	Existing	Adding detail that Dispatch Instructions may cover Transition Instructions	None
34.9	Exceptional Disptach	Existing	Adding specification that Exceptional Dispatch may require that the issuance of forced MSG Transitions	Corrected spelling error
34.15.1	Resource Constraints	Existing	Adding detail that Minimum Run and Down Times for Multi-Stage Generating resources are at the plant level and the configuration level	Added term to clarify the sentence
34.15.2	Calculation of Dispatch Operating Points Pursuant to Start-Up and Shut-Down Instructions	Existing	Adding detail for overlapping and non-overlapping MSG Configurations	Grammatical edits; conforming use of defined terms
39.7.1	Calculation of Default Energy Bids	Existing	Adding restrictions for use of LMP option for 90 day time period	None
Appendix A	Bid Costs	Existing	Modifying defintion to include Transitions Costs	None
Appendix A	Default Resource Adequacy Path	New	Adding new defined term	Grammatical edit; conforming use of defined terms
Appendix A	IFM Bid Cost	Existing	Modifying defintion to include IFM Transitions Costs	None
Appendix A	Multi-Stage Generating Resources	New	Adding new defined term	Grammatical edits
Appendix A	RTM Bid Cost	Existing	Modifying definition to include RTM Transition Cost	None
Appendix A	MSG Configuration	New	Adding new defined term	Conforming use of defined terms
Appendix A	MSG Transition	New	Adding new defined term	None
Appendix A	Transition Cost	New	Adding new defined term	None
Appendix A	Transition Instructions	New	Adding new defined term	None
Appendix A	Transition Matrix	New	Adding new defined term	None
Appendix A	Transition Time	New	Adding new defined term	None
Appendix AA	Transition Plan for Multi-Stage Generating Resources	New	Adding details for plan to transition to the new functionality	Grammatical edits; conforming use of defined terms; included in Appendix AA necessary defined terms as proposed for Appendix A

Attachment D

Final Stakeholder Proposal

Draft Final Proposal

Modeling of Multi-Stage Generating Units

May 8, 2009

Modeling of Multi-Stage Generating Units

Prepared for Decision by the CAISO Board of Governors Meeting – May 18-19, 2009

1 Summary

The operational capabilities of multi-stage generating resources are similar to an aggregation of individual units. In fact, many are aggregations of sub-resource generating units. As a result, they can provide valuable flexible generation to the system, but they also are more complex to accurately model and dispatch. Specifically, these multi-stage generating units often have output ranges in which they cannot operate. That is, between their minimum and maximum operating levels, there are output levels at which the units cannot be dispatched. Transitioning between operating these operating ranges, or configurations, is costly, takes time, and should be done a limited number of times each operating day. In order to model multi-stage generating resources with these considerations accurately reflected, and to thereby achieve feasible, optimal dispatch for them, the California Independent System Operator (the ISO) proposes to implement the design described in this *Draft Final Proposal*.

The new ISO market design has Forbidden Operating Regions (FOR) captured in the Master File data set by which the ISO records critical operating and business information for each generating unit. FOR are ranges through which a unit must be ramped up or down, but within which it cannot be dispatched. The Forbidden Operating Ranges were intended to be used to prevent infeasible dispatch of multi-stage units at the start of the new ISO markets. However, while the enforcement of the Forbidden Operating Region constraints keeps units from being dispatched at infeasible output levels, it does not economically optimize the dispatch of multi-stage generating units. That is to say, simply forbidding the software from certain dispatch ranges for specific units does not optimize that dispatch with respect to costs, the various operating configurations of multi-stage generating units, and other resources in the market. It is for this reason that the Federal Energy Regulatory Commission mandated[1] that the ISO modify the software used to reach an economic dispatch solution to explicitly account for the operating constraints of multi-stage generating units within three years of the start of the new ISO markets.

The market simulations done in preparation for the start-up of the new markets revealed stability and performance issues relative to enforcement of the Forbidden Operating Region constraints. These issues were reviewed during the October 28th meeting of the ISO Board of Governors, and the Board approved a recommendation to defer the functionality for enforcing Forbidden Operating Regions from the Real Time Market optimization. The Commission has since approved the proposed tariff amendment deferring the implementation of the functionality enforcing Forbidden Operating Regions in the Real-Time. [2]

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1 Paragraph 573 of FERC's September 21, 2006 Order on MRTU "direct(s) the ISO to continue working with software vendors to develop an application that will accurately detail the constraints of combined cycle units, and to file tariff language" for implementation of such improvements no later than three years after MRTU start up.

2 The explanatory memorandum and presentation to the ISO Board of Governors and the approved Board motion to defer this functionality is located at:

Thus, the new ISO market software will not automatically dispatch multi-stage generating units through their Forbidden Operating Regions. This will require market participants and the ISO to manually manage the dispatch of multi-stage units by using outage reporting tools and Exceptional Dispatch. As a result, the ISO now proposes to expedite the design and implementation for the explicit modeling of multi-stage generating units into the market software. Specifically, the ISO is targeting resolution of policy issues associated with this modeling enhancement to go before the ISO Board of Governors for approval in May of 2009, and it is targeting the fourth quarter of 2009 for implementation of these modeling features.

It is planned that reinstatement of the Forbidden Operating Region functionality in the real-time market will tested along with the modeling of multi-stage units. As long as the FOR functionality is not being used to substitute for accurate modeling of multi-stage units, its reinstatement is not anticipated to contribute to unstable results like those seen in market simulation. The rationale for re-instating the Forbidden Operating Region functionality in the real time is that there are some generating resources for which FOR better capture the operating constraints. Specifically, units with operating ranges through which they can ramp up or down, but in which they cannot be dispatched might do better to choose to rely on the FOR functionality than to submit configuration-level bids. Units for which transitions between configurations are more costly and time-intensive would do better to use the multi-stage generating unit modeling to account for this. It may be that some multi-stage generators have, within a configuration, a true FOR. Re-instatement of the FOR functionality will also enable those resources to specify such operating constraints.

At this time, the proposal for changes to modeling multi-stage units will be applied only to those units that have specified Forbidden Operating Regions in the Master File.[3] This will resolve the issue of infeasible dispatch of those units, and will satisfy the FERC mandate. It may well be that additional generating resources other than those with FOR in the Master File would be more accurately modeled and feasibly dispatched were they able to bid in multiple configurations. It is in the best interest of market participants as well as the ISO to extend MSG unit modeling to such resources. Therefore, in conjunction with the testing of the MSG modeling functionality and of the re-instatement of FOR in the real time market, the ISO will evaluate the impact of extending MSG modeling to other generating resources.

With this *Draft Final Proposal*, the ISO offers a conceptual approach for the modeling of multi-stage generation units in the new market software that is based on the pseudo-plant model. Scheduling Coordinators will submit operating parameters and costs associated with up to *ten* configurations of their multi-stage unit. Scheduling Coordinators will be able to submit monotonically non-decreasing configuration-level bid curves into the Integrated Forward Market. The ISO model will use these configuration-based or "sub-resource" bids to determine the optimal dispatch for a given hour. Scheduling Coordinators can submit up to *three* configurations (currently planned default value) of

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http://www.caiso.com/2067/2067aeac40f40.html. *See California Indep. Sys. Operator Corp.,* 125 FERC ¶ 61,081 (2009) http://www.caiso.com/2347/2347502a5c5d0.pdf.

3 Metered Sub-System (MSS) load-following resources will not eligible to bid multiple configurations under this initial implementation due to the significant added complexity posed by the fact that those resources follow load on their own as well as bid into the ISO markets.

their multi-stage unit into the real time market, subject to some restrictions which are described in section 4.2 of this *Draft Final Proposal*.

2 Key Criteria for Evaluating Potential Solutions

This section provides some key evaluation criteria the ISO believes are important. Stakeholders are invited to identify and suggest other criteria that should be considered in assessing potential solutions.

- Any policy that is developed should achieve the objective of more accurately incorporating the operating parameters of multi-stage generating units so that the units will be economically and feasibly dispatched, and so that the market can benefit from their full participation.

- Any policy that is developed should address the need for Bid Cost Recovery for the embedded generators, i.e. operating configurations, of multi-stage generating units.

- Policy and design options should be evaluated for implementation feasibility and costs for both the ISO Stakeholder and for the ISO. This evaluation should be done keeping in mind (1) the magnitude of the potential issue, and (2) work that has already been done on multi-stage modeling for other markets.

3 Candidate Design Options

There are two primary categories of models for multi-stage generating units. These are pseudo-plant (or configuration-based) models, and pseudo-unit models. Discussion of these approaches is included below:

Pseudo-plant models treat various configurations of a multi-stage unit as units themselves, allowing the resource owner to bid these configurations or pseudo-plants into the market independently. The market optimization chooses which configuration, if any, is part of the optimal solution. In this type of model, the configurations are mutually exclusive, which means that only one configuration can be chosen by the optimization. This pseudo-plant model is employed by the market being developed by ERCOT.

The pseudo-plant approach is problematic from an implementation standpoint. A 3 x 1 combined cycle unit that could have more than ten possible configurations would thus require ten pseudo-plants. A 4 x 2 combined cycle unit could have over forty possible configurations or pseudo-plants. Modeling each of the potential configurations of a resource would give more granularity to the dispatch results. However, investigation into recent attempts to model multi-stage units based on the pseudo-plant approach has shown this to be infeasible due to the large number of variables and permutations with which the optimization engine must cope. In particular, these trials take more time to run than is acceptable for real time dispatch due to their complexity.

Pseudo-unit models divide resources into mutually exclusive aggregations that may include portions of an embedded unit. For example, a 3 x 1 combined cycle generating unit would be modeled as three separate pseudo-units. Each of the three pseudo-units would be one gas turbine plus one third of a steam turbine. This is similar to the way the NYISO and PJM approximate the modeling of different configurations of multi-stage generators. This is less than ideal because such a model requires market participants to assign costs and operating parameters to pseudo-units, which is not necessarily intuitive or accurate. In addition to assigning costs to such a pseudo-unit, resource owners would need to provide operating constraints for them.

Although the pseudo-unit model is much simpler from an implementation standpoint, it does not appreciably improve the ability of market participants to offer the inherent flexibility of multi-stage units into the market.

4 Proposed Resolution

The ISO's *Draft Final Proposal*, summarized below, seeks to respect the implementation constraints we will face while providing the framework necessary to accurately bid and model and dispatch multi-stage units. Multi-stage units, for the purpose of the current implementation effort are those with Forbidden Operating Regions specified in the Master File. The set of resources includes combined cycle, steam-injected gas turbines, steam turbines, and a handful of other units. Forbidden Operating Regions have been specified for many of these units in order to avoid being dispatched back and forth between operating configurations. A true FOR is simply a range through which a unit can be ramped but within which it cannot be dispatched. Therefore, there is no functionality associated with that range that prevents the market optimization from repeatedly moving from one side of a FOR to the other. Any generating unit with a specified Forbidden Operating Region that actually represents a "dead zone" between operating configurations, and not simply a range through which to be ramped, will be able to benefit from multi-stage modeling.

4.1 IFM Bidding

We recommended that the model optimize over up to *ten* configurations of each multi-stage units as mutually exclusive resources in the IFM. Under this proposal, market participants will be able to submit bid curves for the individual configurations of their multi-stage units into the IFM. Those bids must follow all the bid-submission rules for standard resources including being non-decreasing. The IFM will yield a schedule for at most one configuration per multi-stage unit.

4.2 Real Time Bidding

We recommend that Market Participants be able to bid in up to *three* configurations of a multi-stage unit into the Real Time Market. This limitation is recommended in order to limit the number of configurations over which the Real Time Market must optimize, but at the same time enable the multi-stage units to fully participate in the market. If one of a multi-stage unit's configurations is taken in the IFM, then that configuration or one that can support the day-ahead energy schedule and RUC schedules or awards must be bid into the real time market for that same hour. Two other configurations may also be bid into the real time market provided that transitions within those three configurations are feasible and that the transition from the previous hour is feasible. All configurations bid into the real time market must reflect a reservation of capacity in the amount and for the product of any day-ahead award of ancillary services. The SIBR software will validate real-time configuration-level bids to ensure that these stipulations are met, and that transitions between bid-in configurations are feasible according to the information in the ISO Master File data.

To reiterate, the main limitations, in addition to the number of configurations that participants may bid into real time for an MSG unit, are the requirements as follow:

1. At least one configuration's bid must be sufficient to cover any day-ahead energy schedule **and** any Resource Adequacy must-offer obligation;
2. At least one configuration's bid must be sufficient to cover any Residual Unit Commitment schedule or award **and** transition to this configuration must be feasible given the configurations bid into the previous hour;
3. All configurations bid into real time must reserve capacity to fulfill day-ahead ancillary services awards;
4. Configurations bid into the real time market for a particular hour can be feasibly transitioned between one another by the 15-minute unit commitment that occurs in real time; and
5. At least one configuration bid into the real-time market must be feasible given the configurations bid into the previous hour.

The intention of the first three requirements listed above is not to place any additional or different burdens on MSG units. The motivation is to ensure that the units are not physically withheld from the real time ISO market. If, between the day-ahead and real-time market timeframes, the costs associated with operating at a particular level or in a given configuration change, market participants should submit bids commensurate with those updated costs and trade-offs.

The fourth and fifth requirements are intended to avoid situations in which a resource cannot be utilized by the market because it cannot be feasibly transitioned from the configuration in which it is operating to the ones it has bid into the market for the subsequent interval. In section 4.8 below, there is a discussion of the transition matrix which will contain the cost and operating constraints associated with transitioning between configurations. Transitions for which those parameters are specified are feasible by definition.

4.3 Bid Cost Recovery

We recommend that Bid Cost Recovery be available at the resource level, and that the ISO only pay commitment costs (including transition costs) associated with the real time market. If, however, a resource self-schedules energy and/or self-provides ancillary services in the real time, then IFM commitment costs (including transition costs) would be eligible for BCR. If a unit is not taken in the real-time market, then day-ahead commitment costs would be used for the BCR calculation for that hour. Because configurations are essentially modeled as individual generators in the market optimization, and re-aggregated for the purpose of settlements, it is essential to alter the BCR calculation methodology for multi-stage units. If the standard BCR calculation methodology were used, it would result in significant double-payment of eligible commitment costs.

The net revenue calculation for any given hour will be performed at the resource level although the cost component of that calculation will be informed by the configuration-level costs. In actuality, the sequential netting that is performed to arrive at the BCR values is complex. For the purpose of gaining intuition for how the calculation would be done in the case of MGS units, but without going through the rigorous accounting, please consider the simple example included as Appendix B to this Proposal.

4.4 Resource Adequacy Offer Obligations

In order to meet resource adequacy offer obligations, multi-stage units with such contractual arrangements should offer in at least one configuration into each the day-ahead and real-time markets.[4] If a multi-stage resource with an offer obligation does not offer in a configuration that can fulfill the offer obligation, the SIBR system will insert a default energy bid and $0 ancillary services bid for the configuration designated by the Scheduling Coordinator as the default configuration for meeting the unit's resource adequacy obligation.[5] The SIBR system will *not* extend the bid curve for a configuration that was not bid in to the full megawatt value of the RA obligation.

In the real-time market, in which the number of configurations that can be bid in for a multi-stage unit is limited to three, the automatic insertion of the default price-taking resource adequacy would be a fourth configuration. Rather than overwrite a submitted configuration-level bid, the system will insert a fourth configuration bid for the resource.

The validation of the fulfillment of the Resource Adequacy must-offer obligation will be based on the generation capacity bid in for a configuration. It will not be based on the increment of generating capacity that can be provided by a configuration. For example, consider a multi-stage unit with two configurations, (C1 and C2) with MW ranges (100, 250) and (300, 525), and a resource adequacy contract for 300 MW. The RA offer obligation is met by bidding in the second configuration (C2) with a minimum operating level of 300 MW and a maximum of 525 MW despite the fact that the incremental capacity that is provided by C2 is only 225 MW which is less than the RA contract.

4.5 Residual Unit Commitment

A multi-stage unit with a resource adequacy contract can be committed in the Residual Unit Commitment run at any configuration with capacity equal to or greater than the configuration

4 Note that the real-time RA offer obligation does not extend to long-start units. If long-start RA units are not picked up in the day-ahead market, they are not required to offer their RA capacity in real time. There is true for all RA units, multi-stage units and otherwise.

5 Note that the RA offer obligation does not currently extend to Ancillary Services. This change has been filed with FERC within the filing of the Standard Capacity Product tariff language. It is anticipated that a FERC Order will be released in response to this filing during 2009. The ISO filing is available at the following link: http://www.caiso.com/239e/239ee59b11f50.pdf

committed in the day-ahead market. If a configuration is given a RUC schedule or award, the scheduling coordinator is obligated to offer the configuration for the megawatt value scheduled/awarded into the real-time market. Additionally, the configuration chosen to support the RUC commitment must be one to which the unit can feasibly transition. If the configuration scheduled or awarded by RUC can additionally accommodate the day-ahead energy schedule and ancillary service award and any Resource Adequacy offer obligation, then bidding in this configuration to that megawatt value will satisfy the all the real-time bidding requirements. In that case, the Scheduling Coordinator has two remaining configuration-level bids that are restricted only in that they can be feasibly transitioned within and between hours, and that capacity is reserved and the configuration is certified to provide any day-ahead AS award.

4.6 Reliability Must Run Units

Reliability Must Run (RMR) units will be dispatched and settled per their contracts. RMR contracts negotiated in the future can include different costs for different configurations. Currently there is only one MSG unit with an RMR contract. Ramifications for the dispatch and settlement of this unit will be analyzed, and any required tailored treatment of this unit will be consistent with the RMR contract.

4.7 Ancillary Services

We propose that multi-stage generating units that are certified to provide Ancillary Services obtain certification to provide AS at the configuration level, and can then bid in AS for those configurations for which they are certified.

Any ancillary services award from the day-ahead market will carry through to the real-time market. Thus, bids for any configuration in the real-time must respect the reservation of awarded AS capacity. SIBR will reject real-time bids for which energy bid plus the day-ahead awarded AS capacity exceed the upper operating limit of the configuration. SIBR will also reject bids for configurations that are not certified to provide ancillary services if the resource received an AS award in the day-ahead market.

4.8 Information Submittal

Market participants with multi-stage generating units will need to submit detailed information on those units[6]. In particular, information will be required for each configuration and will include the same specificity as is required for generators in general. Parameters such as operating minimum and maximum values, minimum run times, minimum down times, ramp rates, AS certifications, heat rates, and *etcetera* will be stored at the configuration level. **The ISO recommends that each configuration be able to submit a single operational ramp rate, and up to two AS ramp rates – one for Spinning and Non-Spinning Reserves, and one for Regulating Reserves.**

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6 A sample of the form used by ERCOT for the capture of this information was included as Appendix B to the Straw Proposal posted on February 17, 2009. This document and the glossary that accompanies it are available at the following link: http://www.caiso.com/2078/2078908392d0.html

Additionally, the ISO will require data related to the transitions between the configurations of each multi-stage unit. This information will be stored in a "transition matrix," a simple example of which is provided below. For each transition between configurations that is feasible, the ISO will require transition time and cost information as well as the number of times in an operating day that this transition can be made. This is akin to the start-up and shut-down related data provided for single-stage generators since each transition between the configurations of multi-stage units is like a shut down of one configuration and a start up of another. Note that, in the example below, the all transitions between configurations are feasible.

<u>Table 2</u>: Simple Example of a Transitions Matrix

		"To" Configuration			
		0 – offline	**1**	**2**	**3**
"From" Configuration	**0 – offline**		**\$ # minutes max/day**	**\$ # minutes max/day**	**\$ # minutes max/day**
	1	**\$ # minutes max/day**		**\$ # minutes max/day**	**\$ # minutes max/day**
	2	**\$ # minutes max/day**	**\$ # minutes max/day**		**\$ # minutes max/day**
	3	**\$ # minutes max/day**	**\$ # minutes max/day**	**\$ # minutes max/day**	

There will be the need to have a default configuration flag for the purpose of meeting resource adequacy offer obligations as noted above. The need for additional data items may become apparent in the implementation stage of this effort.

Data for the ten (or fewer) configurations associated with a given multi-stage resource will be stored in the Master File. Any changes to the configurations can be made through the ten-day process by which changes are made to Master File data.

4.9 Local Market Power Mitigation

We recommend that Local Market Power Mitigation (LMPM) be performed on a configuration-by-configuration basis. Since LMPM is performed on all clean bids submitted for use in the IFM, individual configurations' bids may be flagged for mitigation. Configurations (or pseudo-plants) that are incremented up in the All Constraints Run would have their bid mitigated based on the relevant operating parameters which would be included in the configuration-level information. In addition, if a unit has a configuration committed in the Competitive Constraints Run, and another committed in the All Constraints Run, both configurations' bids would be flagged for mitigation.

Default Energy Bids, whether cost-based or negotiated, will be developed by configuration.

Two examples of how the market power mitigation will be implemented are included in Appendix B to this proposal. The second example is new to this *Draft Final Proposal* and is provided to address questions in the stakeholder comments on the first market power mitigation example provided previously.

4.10 Self-Schedules

Self-Schedules must be such that transitions between configurations are feasible. In addition, market bids must be feasible given self-schedules. For each hour, only one configuration is permissible in a self-schedule. It is possible to change the self scheduled configuration between DA and real-time for the same trade hour.

Note that if a multi-stage unit submits a self-schedule for part of its capacity, any additional capacity for which the participant wants to submit economic bids must be for the same configuration. The reason for this is that submitting a self-schedule in a particular configuration indicates to the market software that the unit is being self-committed into the configuration. To submit an economic bid for a different configuration would run counter to the iterative nature and logical structure of the market software. SIBR will not accept bids for a configuration other than the one self-scheduled.

Based on stakeholder feedback, the ISO understands that this causes concern for participants bidding in units with both RA contracts and firm energy obligations, for example bi-lateral contracts. The full RA capacity must be bid in (or self-scheduled) in order to meet the offer obligation. The bi-lateral contract, however, might be more efficiently delivered by a different, perhaps lower, configuration and so the participant would like to self-schedule in this configuration. Again, the market optimization software does not permit a sequential evaluation of two alternative dispatch configurations of a multi-stage unit. The optimization can only pick one configuration for dispatch. In order to satisfy the RA must-offer obligation as well as protect the bid for the bi-lateral contract, market participants will need to submit economic bids for both configurations. Participants can structure those economic bids so as to protect the schedule for the bi-lateral contract.

4.11 Outage & De-Rate Reporting

For multi-stage units that are comprised of one physical generating unit, SLIC tickets for each configuration impacted by an outage or de-rate of that unit will need to be submitted. Multi-stage units comprised of more than one generating unit are likely to have more configurations, and thus putting in SLIC tickets for each effected configuration could be onerous. For this reason, the ISO's ideal proposal is that the SLIC tool for outage and de-rate reporting be adapted such that, within a resource's SLIC screen, a Scheduling Coordinator can select specific units within the multi-stage resource that are out or de-rated. The SLIC tool would then be able to extrapolate these outages or de-rates to the configurations of which the unit is a component.

The extent to which this is ideal proposal is feasible is not certain at this time. It may be that SLIC cannot readily be augmented to extrapolate sub-resource generating unit outages and de-rates to the effected configurations. If that is the case, participants will have to submit SLIC tickets for each configuration of their multi-stage units that is impacted by an outage or de-rate. Stakeholder feedback has indicated that, while the ideal SLIC functionality would be desirable, the burden of submitting SLIC tickets for individual configurations is not troublesome, and may be preferred to uncertainties associated with more dramatic modifications to the SLIC tool.

Based on stakeholder input, the current proposal is to enable SLIC to manage the outrages, de-rates and re-rates at the plant level, and to manage ramp-rate changes at the configuration level.

4.12 Uninstructed Deviations

Under the new ISO market design, penalties for uninstructed deviations from dispatches are tabulated but not assessed. In part, this is because multi-stage units are not currently being modeled and thus dispatched accurately, and so penalizing participants for deviated from sub-optimal dispatches would be unfair. The extent of uninstructed deviations will continue to be carefully monitored after the implementation of MSG unit modeling to determine if there is a need to seek authority to impose uninstructed deviation penalties. To clarify, the ISO is not proposing to seek authority to implement uninstructed deviation penalties as part of this stakeholder effort. The change in modeling to more accurately dispatch units is intended and expected to alleviate many instances of uninstructed deviations. Simply, the monitoring effort associated with uninstructed deviations will continue, and will be informed by the change in the accuracy of unit dispatch.

Telemetry data will indicate to the ISO the operating range of the configuration in which the resource was dispatched. The ISO will incorporate into the market systems the individual telemetry data from each unit that is part of a multi-stage resource. If the resource is operating within the range of the dispatched configuration and deviates from instructions, the usual non-response to dispatch rules will apply. If the resource is outside the configuration's range based on telemetry data, then it will be dispatched to the boundary of the actual configuration based on the requirements of the dispatcher.

5 Stakeholder Feedback

Stakeholder feedback on the *Revised Straw Proposal* was generally supportive. The stakeholder comments matrix included as Appendix C to this *Draft Final Proposal* summarizes this feedback. In addition, brief responses are provided. The *Draft Final Proposal* also seeks to provide additional clarification and examples that was requested in the written stakeholder comments.

6 Conclusion

The ISO is targeting the fourth quarter of 2009 for the incorporation of modeling multi-stage generating units within the ISO market systems. Particularly in light of the significant enhancements that this *Draft Final Proposal* offers, significant software performance issues may need to be overcome. Given the importance and value of competing enhancements to the new market design in this first year of its operation, it may be necessary to prioritize and compromise to accomplish important market enhancements. The ISO will seek to keep stakeholders apprised should changes become necessary in the planned implementation of multi-stage generating unit modeling.

Having completed a thorough process of soliciting and incorporating stakeholder feedback, the ISO will be presenting this *Draft Final Proposal* to its Board of Governors at the May 18-19, 2009 meeting. If questions, comments or concerns arise on multi-stage generating unit modeling in general, or this *Draft Final Proposal* specifically, please address them to gbiedler@caiso.com or call Gillian Biedler at 916-608-7203.

7 Appendix A: MSG Unit Bid Cost Recovery Example

The following simple example describes the Bid Cost Recovery calculation for a day in which an MSG resource was dispatched in only three hours, and in which real-time dispatch is hourly:

Table 1: Simple Example of Bid Cost Recovery for MSG Units

	Hour Ending		Configuration	Bid Costs	MW * LMP	Net Revenue
Day-Ahead	13	Economic Bid	C1	$10,000 (SU and ML)	120 MW*$25	($7,000)
	14	Economic Bid	C2	$2,000 (transition)	200 MW*$30	$4,000
	15	Economic Bid	C2	-	190 MW*$15	$2,850
Real-Time	13	Economic Bid	C1	$10,000 (SU and ML)	30 MW*$25	($9,250)
		Self-Schedule	C1	-	120 MW*$25	$3,000
	14	Economic Bid	C1	-	Not Taken	$0
		Self-Schedule	C1	-	150 MW*$35	$5,250
	15	Economic Bid	C2	$2,000 (transition)	25 MW*$18	($1,550)
		Self-Schedule	C2	-	190 MW*$18	$3,420

	Hour Ending		Bid Costs	BCR Calculation	Rationale
Bid Cost Recovery	13	Day Ahead	($7,000)		Defer to RT dispatch
		Real Time	($9,250)	($9,250)	In RT, C1 was dispatched
		RT- Self-Schedule	$3,000		SS not eligible for BCR
	14	Day Ahead	$4,000	$4,000	No RT dispatch, defer to DA costs
		Real Time	$0		No RT dispatch
		RT- Self-Schedule	$5,250		SS not eligible for BCR
	15	Day Ahead	$2,850		Defer to RT dispatch
		Real Time	($1,550)	($1,550)	In RT, C2 was dispatched
		RT- Self-Schedule	$3,420		SS not eligible for BCR

Overall Value Eligible for Bid Cost Recovery	**($6,800)**

In this simplified case, the resource came up short for this day, and is eligible for Bid Cost Recovery in the amount of $6,800.

8 Appendix B: MSG Unit Local Market Power Mitigation Examples

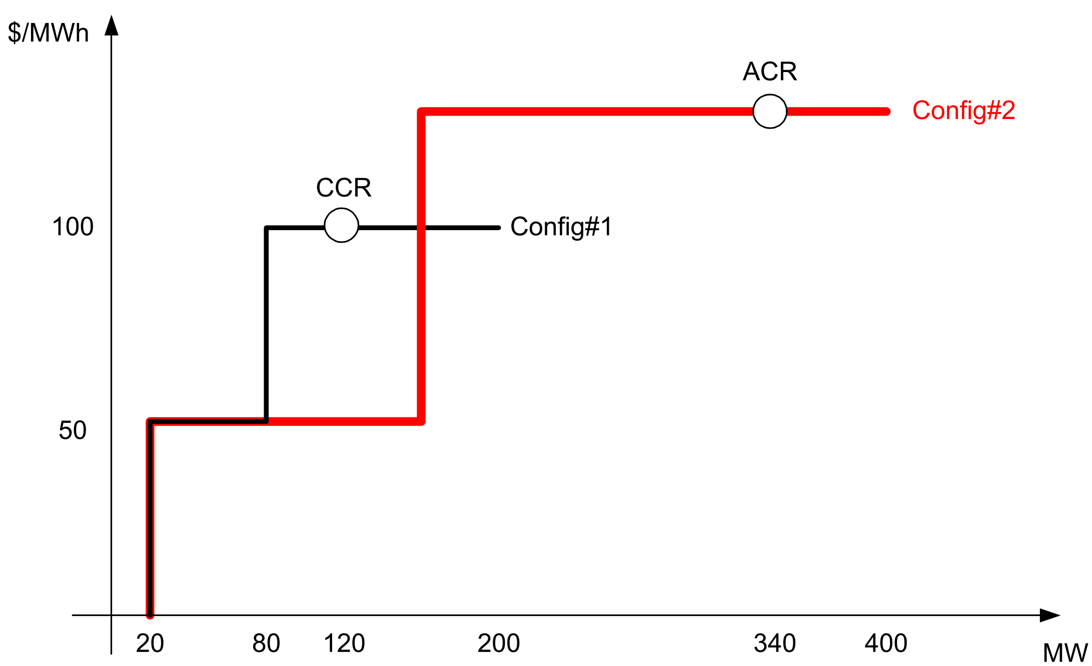
8.1 Example 1

Assumptions

1. The MSG resource has 2 identical Gas Turbines (GT1 and GT2) and 1 Steam Turbine (ST). The feasible configurations are:
   a. Configuration 1: (GT1 and ST) or (GT2 and ST)
   b. Configuration 2: GT1 and GT2 and ST

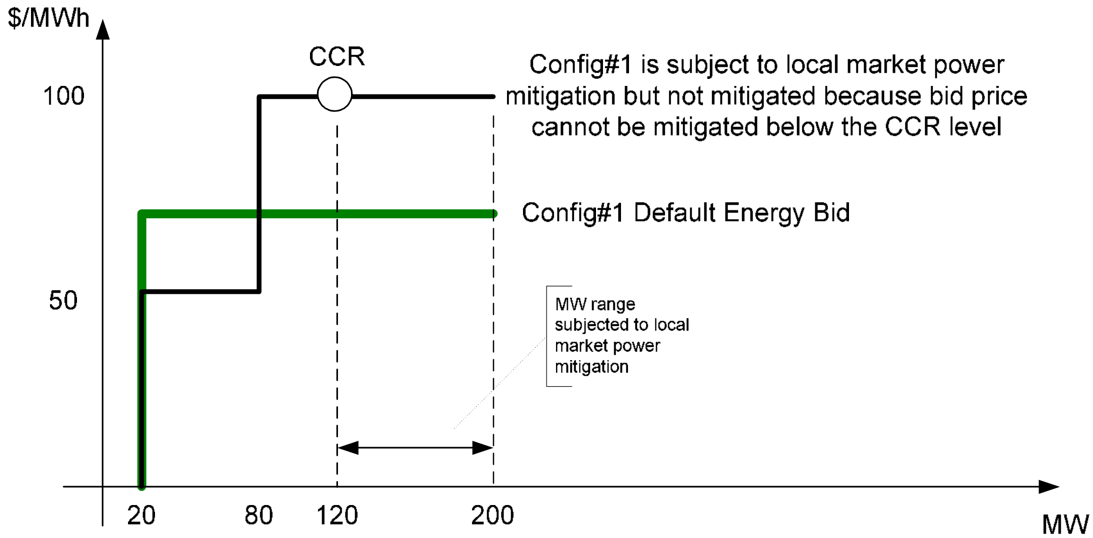
2. The bid curves are as follow:
   a. Configuration 1 (MW, $/MW): (20, 50), (80, 100), (200, 100)
   b. Configuration 2 (MW, $/MW): (20, 50), (160, 130), (400, 130)

3. Configuration 1 (Config#1) is committed in the Competitive Constraints Run (CCR) at 120 MW; configuration 2 (Config#2) is committed in the All Constraints Run (ACR) at 340 MW, as is shown below:



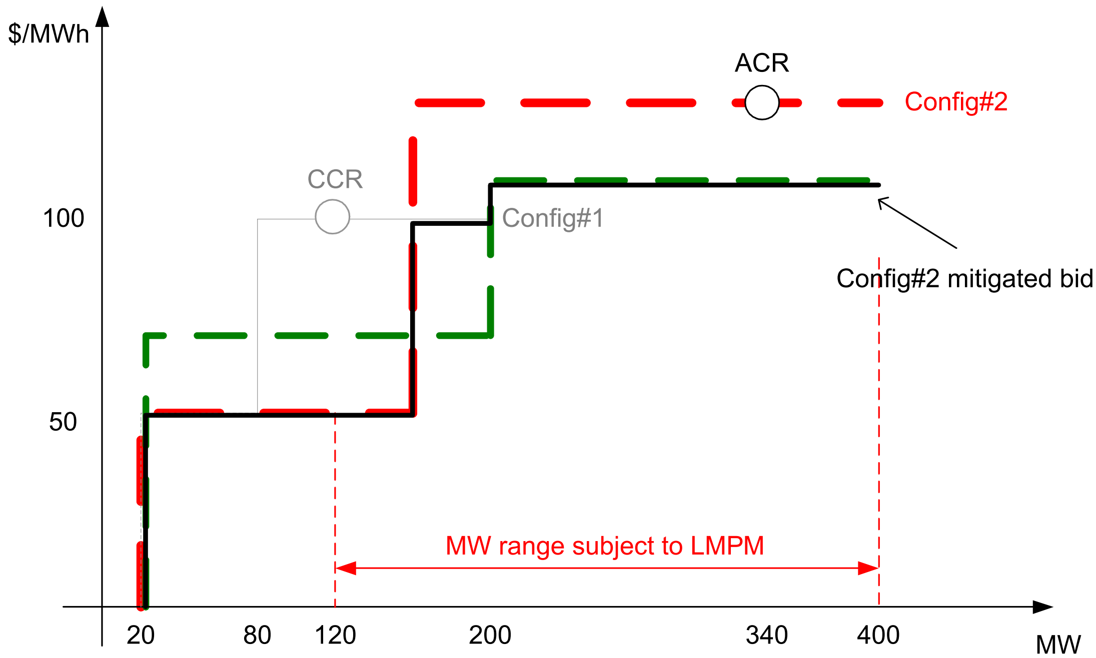
Configuration 1 Mitigation

Config#1 is subject to local market power mitigation but not mitigated because bid price cannot be mitigated below the CCR level.



Configuration 2 Mitigation

Config#2 is mitigated to the lower of the submitted bid price and the default energy bid price but not lower than the CCR bid price of the CCR corresponding configuration.



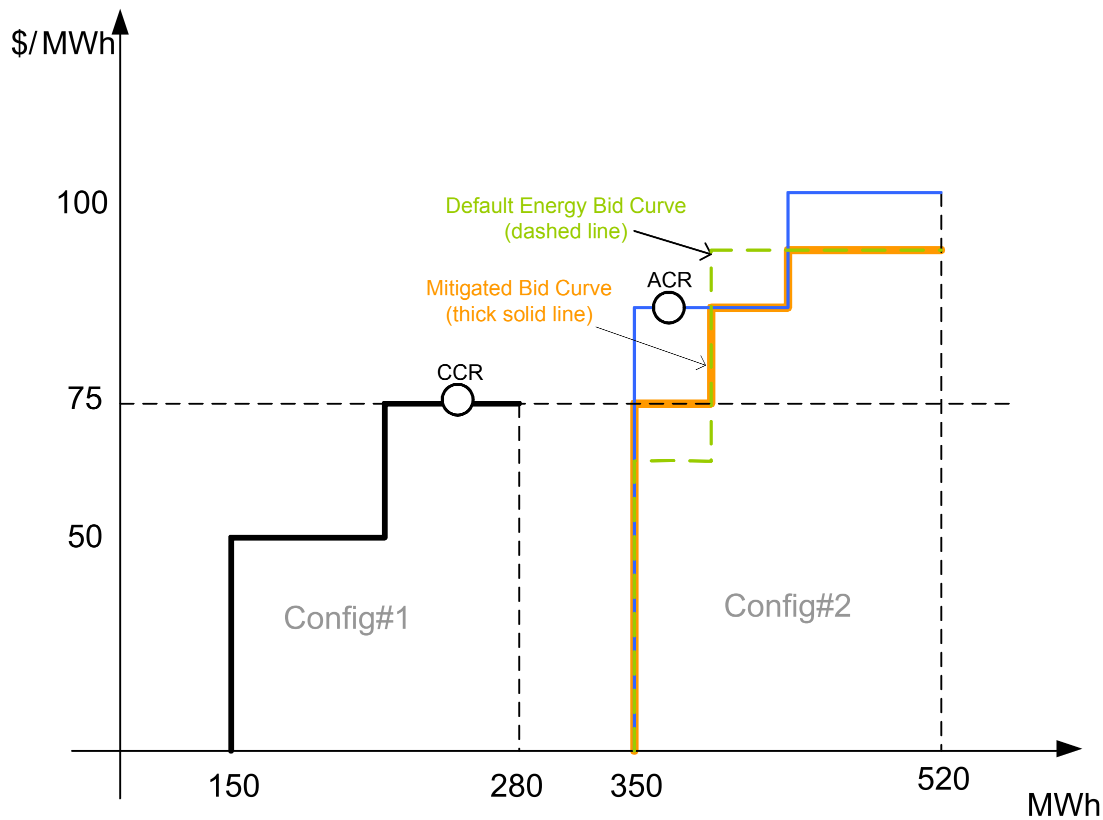
8.2 Example 2

<u>Assumptions</u>

1. The MSG resource has 2 configurations such that:
   a. Configuration 1: Pmin = 150, Pmax = 280
   b. Configuration 2: Pmin = 350, Pmax = 520

2. The bid curves are as follow:
   a. Configuration 1 (MW, $/MW): (150, 50), (230, 75), (280, 75)
   b. Configuration 2 (MW, $/MW): (350,75), (430, 85), (520, 100)

3. Configuration 1 (Config#1) is committed in the Competitive Constraints Run (CCR) at 260 MW; configuration 2 (Config#2) is committed in the All Constraints Run (ACR) at 360 MW, as is shown below:



Configuration 1 is not mitigated. Configuration 2 has a mitigated bid curve (think orange line) that is the higher of the Default Energy Bid Curve (dashed green line) and the last bid segment from the Competitive Constraints Run, but not above the submitted bid curve (thin blue line) for Configuration 2.

9 Appendix C: Stakeholder Feedback on the MSG unit modeling *Revised Straw Proposal*

The following matrix summarizes the stakeholder feedback on the *Revised Straw Proposal* on multi-stage modeling. The *Revised Straw Proposal*, upon which this *Draft Final Proposal* is largely based, was posted on April 13, 2009, and a stakeholder conference call was held to discuss it on April 17, 2009. The written comments upon which the following matrix is based were due April 24, 2009. All documents related to the stakeholder process for multi-stage generating unit modeling are posted and available at the following link: http://www.caiso.com/2078/2078908392d0.html.

Management Proposal	Calpine Corp.	J.P. Morgan Ventures Energy Corp.	Pacific Gas & Electric	Reliant Energy	San Diego Gas & Electric	Southern California Edison	Management Response
MSG units limited initially to those units that have Forbidden Operating Regions in the Master File	No Comment	No Comment	Conditional Plans to evaluate the dispatch of pump storage hydro units under new market. May seek MSG modeling for those units.	No Comment	No Comment	Conditional Encourages the ISO to set a timeline for extending MSG modeling to units without Forbidden Operating Regions.	The initial implementation of MSG modeling is intended to mitigate the suspension of the Forbidden Operating Region (FOR) functionality. Those units with FOR will be addressed first. The ISO will work to establish a timeline for opening the functionality to other units. It is management's position that the MSG modeling should ultimately be extended to all units it would enable to be accurately modeled. This goal needs to be balanced against software performance limitations which are not fully known at this time.
Up to *ten* configurations of an MSG unit can be bid into the **DA market**. One must meet RA obligation.	Support Supports configuration-based modeling of MSG units. Comfortable with limiting DA configurations to ten.	Support	Support	Notes that the transition matrix needs to include the maximum number of times per day that a unit can be transitioned between two configurations.	Support Notes that the transition matrix is the key to accurate modeling	Support	Management agrees that ten configurations will adequately capture the operating configurations of MSG units. Capturing the cost and operational considerations associated with all feasible transitions is indeed essential to successful MSG modeling. The maximum number of times a transition can occur within a day will be included in the transition matrix.
Up to *three*	Support	Conditional	Support	No Comment		Support	MSG resources that receive a DA

Management Proposal	Calpine Corp.	J.P. Morgan Ventures Energy Corp.	Pacific Gas & Electric	Reliant Energy	San Diego Gas & Electric	Southern California Edison	Management Response
configurations can be bid into the **RT market**. One must meet RA and RUC obligation, one must meet DA schedule, and all must honor DA A/S awards.	Limitation to three configurations balances desired flexibility with processing time constraints.	Seeks clarification that MSG resources will not face offer obligations or restrictions not imposed on other generating units.	Notes that one configuration's bid should meet the DA and RUC schedules and be feasibly transitioned to from the previous interval's configuration.		Seeks clarification on the requirement that configurations bid into the RT market be feasibly transitioned between one another.		schedule must bid a configuration into RT that can fulfill that schedule. The RT bid for the energy and/or A/S capacity can be different from the bid submitted in DA. Specifically, the RT bid can be structured to reflect changes in operating conditions and/or opportunity costs. If different configurations bid in to successive intervals, the transition matrix should indicate that the transition between these two configurations is feasible.
Forbidden Operating Region Functionality will be evaluated for re-instatement in the RT market.	No Comment	No Comment	No Comment	Conditional Seeks confirmation that MSG modeling would be appropriately used for units such as a steam turbine which is currently modeled as having a Forbidden Operating Region..	No Comment	No Comment	MSG modeling can effectively be used to model combined-cycle units, steam units, and steam-injected gas turbine units. There may be other generation technologies that could also be accurately modeled and dispatched using MSG functionality. For some units, however, the Forbidden Operating Region functionality will better capture their operating constraints than MSG modeling would. Additionally, it is possible that some MSG units will have true FORs within a configuration. Therefore, the proposal is to re-

Management Proposal	Calpine Corp.	J.P. Morgan Ventures Energy Corp.	Pacific Gas & Electric	Reliant Energy	San Diego Gas & Electric	Southern California Edison	Management Response
							instate FOR functionality in the RT market once MSG functionality is in place..
Self-Schedules must be for a configuration that satisfies RA obligation. Any additional market bids must be for the same configuration as the Self-Schedule	Support Given the structure of the market optimization, this limitation is understandable and acceptable, though not ideal.	No Comment	No Comment	No Comment	No Comment	Does not Support	If an MSG unit self-schedules a configuration, it is thus indicating that it must be dispatched in that configuration. To then submit a market bid for a different configuration is at odds with the iterative logic and structure of the optimization software. Participants can structure their market bids so that RA capacity is offered, and the desired schedule is protected.
Bid Cost Recovery is calculated based on the configuration dispatched in RT	Support	No Comment	No Comment	Conditional Seeks clarification as to the limitations to changes in scheduled configurations while retaining eligibility for BCR. Also, requests summary of difference in BCR between MSG and non-MSG units.	No Comment	Conditional Would not support a BCR scheme in which a unit committed in the DA and not in the RT would not be eligible for BCR.	The final proposal clarified that a unit committed in DA and not in RT would be eligible for BCR based on the DA commitment costs.
RA must-offer obligations must	Support	No Comment	Conditional	Conditional	No Comment	No Comment	Management confirms that RA units are not currently required to

Management Proposal	Calpine Corp.	J.P. Morgan Ventures Energy Corp.	Pacific Gas & Electric	Reliant Energy	San Diego Gas & Electric	Southern California Edison	Management Response
be met in the DA and RT by submitting a configuration that can supply the obligated MWs	Clarifies that the obligation of RA units to offer A/S bids is not in effect at this time. This obligation will not be specific to MSG units.		Notes that the requirement that RA units bid in A/S capacity is not yet approved by FERC.	Seeks clarification that there is not a requirement that long-start RA units bid into the RT market. Seeks clarification that satisfaction of the RA obligation is not calculated based on the *incremental* capacity made available by a configuration.			offer A/S capacity. This requirement is pending approval by FERC. It will not be limited to MSG RA units. Long-start MSG units with RA obligations must offer their RA capacity into the DA market. If the unit is not taken in the DA market, it is not required to offer into the RT market. Its obligation would be met by the DA bid or self-schedule. The RA obligation would be met by offering in a bid or self-schedule for a configuration such that the MW value meets or exceeds the RA obligation. Thus, the satisfaction of the obligation is based on the total capacity of the configuration and not the incremental increase from a lower configuration.
RMR units will be dispatched and paid according to their contractual arrangements	Conditional Recommends more study, particularly in the case of units with partial RMR contracts	No Comment	No Comment	No Comment	No Comment	No Comment	Management appreciates this thoughtful observation. This issue will be studied further. As with the whole of the MSG modeling proposal, it is designed to limit the extent to which treatment of MSG units differs from non-MSG units.

Management Proposal	Calpine Corp.	J.P. Morgan Ventures Energy Corp.	Pacific Gas & Electric	Reliant Energy	San Diego Gas & Electric	Southern California Edison	Management Response
Local Market Power Mitigation	Conditional Poses clarifying questions which the final draft proposal will seek to address.	No Comment	No Comment	No Comment	No Comment	No Comment	An additional example was added to the appendix of the Draft Final Proposal to help clarify this issue. In short, bids are only mitigated down (not up). Thus, the mitigated price is the higher of the accepted price or the DEB, but *not* higher than the submitted bid.
Outage and de-rate reporting	No Comment	No Comment	Conditional Is supportive of the goal to save participants the task of entering outages and de-rates by configuration, but has implementation feasibility concerns.	Conditional Seeks confirmation that outages and de-rates can be submitted on an hourly basis, and that participants can ensure that RT dispatches are consistent with outages.	No Comment	Does Not Support Does not support the goal of automated extrapolation from unit level outage information to configuration availability. Supports configuration-level outage reporting which places more of a burden on stakeholders and less on the SLIC system.	Management is mindful that unit-level outage reporting, and automated extrapolation of that information to configurations may not be feasible. This was proposed to alleviate the burden that configuration-level reporting could place on participants. If the proposal is not feasible, then configuration-level outage reporting will be implemented. Management appreciates Stakeholder willingness to take on configuration-level outage reporting.
Uninstructed deviations (UD) will be monitored to assess the need to seek authority	No Comment	No Comment	No Comment	No Comment	No Comment	Objects to the notion that successful implementation of MSG modeling is a step toward	Under MSG modeling, dispatches will be more accurate, and thus UD should decrease. Management recognizes that MSG units operating in the wrong configuration have the potential to

Management Proposal	Calpine Corp.	J.P. Morgan Ventures Energy Corp.	Pacific Gas & Electric	Reliant Energy	San Diego Gas & Electric	Southern California Edison	Management Response
to charge penalties						implementing UD penalties.	cause reliability problems. Management simply recommends monitoring of UDs, and points out that, if UDs are problematic, penalties could be sought.

Attachment E

California ISO Board of Governors Memo on Multi-Stage Generating Resources

California Independent
System Operator Corporation

Memorandum

To: ISO Board of Governors

From: Laura Manz, Vice President – Market & Infrastructure Development

Date: May 8, 2009

Re: **Decision on Multi-Stage Generating Unit Modeling**

This memorandum requires Board action.

EXECUTIVE SUMMARY

Management proposes to implement multi-stage generating unit modeling within the market software to facilitate the efficient dispatch of generation resources with forbidden operating regions. Management has developed a proposal that balances flexible modeling of these units with software constraints. Multi-stage generating unit modeling is targeted for implementation in the fourth quarter of 2009. The proposal:

- Enables market participants to bid up to ten configurations of their multi-stage units into the integrated forward market; and

- Provides multi-stage generating units with the flexibility to bid up to three configurations into the real-time market. At least one configuration bid into the real-time market must support the day-ahead schedule, ancillary services award, residual commitment award/schedule, and resource adequacy offer obligation. All configurations bid into real time must be certified for the ancillary services product and capacity awarded in the day-ahead market, and must reserve that capacity for operating reserves in real time.

  Moved, that the ISO Board of Governors approves the policy to implement Multi-Stage Generating Unit Modeling as outlined in the memorandum dated May 8, 2009; and

  That the ISO Board of Governors authorizes Management to make all the necessary and appropriate tariff filings with the Federal Energy Regulatory Commission to implement this policy.

BACKGROUND

Within the fleet of resources available to the California Independent System Operator Corporation (the ISO), several resources are multi-stage generating units characterized by multiple operating configurations. While this makes them more flexible, it also requires explicit modeling of the configurations in order to take advantage of that flexibility, and to avoid infeasible dispatch of the resources.

The current market software does not yet support the efficient, feasible dispatch of multi-stage generation units. Initially, the ISO had intended to use the forbidden operating region functionality to act as a proxy for modeling of multi-stage units. The use of forbidden operating regions to capture the operating constraints of multi-stage generating units proved both inadequate and unstable in market simulations. As a result, the forbidden operating region functionality was suspended, leaving ISO operators and market participants to manage these units in more manual ways. To ensure that units are not dispatched to infeasible output levels, market participants will manually limit dispatches of multi-stage units using outage reporting tools and, as a last resort, ISO operators will use exceptional dispatch to guard against infeasible dispatches.

As directed in a Federal Energy Regulatory Commission (FERC) order,[1] implementation of explicit modeling of multi-stage units was planned for within three years of the launch of the new ISO markets. Due to the suspension of the forbidden operating region functionality, and because manually managing the dispatch of these units is burdensome and inexact, as accepted by FERC most recently, the timeline for implementation of multi-stage generating unit modeling is targeted for the fourth quarter of 2009.[2]

DESIGN CRITERIA

In developing an approach to the modeling of multi-stage generating units, Management sought to balance the importance of capturing the flexibility of these units with the need to respect software performance constraints. In particular, Management sought design options that:

- More accurately incorporate the operating parameters of multi-stage generating units so that the units will be economically and feasibly dispatched, and the market can benefit from their full participation; and

- Consider the feasibility and cost of implementation for both the ISO and stakeholders.

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[1] Paragraph 573 of FERC's September 21, 2006 *Order on MRTU* "direct(s) the ISO to continue working with software vendors to develop an application that will accurately detail the constraints of combined cycle units, and to file tariff language" for implementation of such improvements no later than three years after MRTU start up.
[2] Paragraph 30 of FERC's January 30, 2009, *Order on Deferred Functionality* accepts the ISO's commitment to develop the multi-stage modeling functionality within six to nine months following MRTU go live.

OPTIONS CONSIDERED

Considering the above design criteria, the following four options were evaluated:

- To model multi-stage units by dividing them up into identical, mutually exclusive sub-resources, also known as pseudo-units. Stakeholders and the ISO agreed that this approach would not enable the accurate modeling of the embedded configurations of multi-stage units;

- To model all configurations of multi-stage units in both the day-ahead and real-time markets. Although this approach would capture all the operating and economic constraints of the multi-stage units, it would lead to a major computational burden in the real-time market timeline. In fact, it is unlikely that optimizing over all multi-stage unit configurations would be feasible in real time;

- To model all configurations of multi-stage units on a configuration basis in the integrated forward market, and use the outcome of the forward market to set a single configuration for the real time optimization. To keep a resource that is not taken in the integrated forward market available to the market in real time, a market participant could submit a bid for one configuration of the resource into the real-time market optimization. Stakeholder feedback indicated that this option was not satisfactory because fixing the integrated forward market configuration for real time does not enable the market to take advantage of the flexibility of multi-stage units; and

- To model multi-stage units on a configuration basis in both the day-ahead and real-time markets while limiting the number of configurations that can be bid into the markets. In the day-ahead market bids can be submitted for up to ten configurations, and up to three configuration-level bids can be submitted into the real-time market. This fourth option adds considerable complexity over options described in the first and third bullets above. This option better meets participants' needs than those options, however, and mitigates software performance issues raised by the ISO software vendor.

STAKEHOLDER FEEDBACK

Throughout the stakeholder process leading up to this proposal, all comments have favored multi-stage generating unit modeling. In addition, all stakeholders who expressed a preference between configuration-based modeling and the pseudo-unit models were in favor of the former. In response to the first straw proposal, which proposed the third option described above, stakeholders commented that fixing the configuration chosen in the integrated forward market did not allow enough flexibility to effectively bid multi-stage units in the ISO markets.

In response to this feedback, Management prepared a revised straw proposal based on the fourth option described above. Generally, stakeholders expressed support for this revised straw proposal. There were some requests for clarification and some expression of concern about particular elements of the proposal. These comments are summarized in the attached matrix.

MANAGEMENT RECOMMENDATION

After careful consideration of input from both stakeholders and ISO software developers, Management recommends the approach outlined in the fourth item above. Our recommendation for the design of multi-stage generating unit modeling is based on the goal of offering market participants maximal opportunity to bid the flexibility of these units into the ISO markets, while adhering to software performance constraints. This will enable both the participants and the ISO to avoid infeasible dispatches, thus relieving the burden of manually managing the units using outages, de-rates, and exceptional dispatch. The proposed design for multi-stage generating unit modeling will not only keep those units in the market, but will provide participants the ability to offer up the inherent flexibility of these units and for the ISO to employ that flexibility.

The proposal enables market participants to submit bids for up to ten configurations of their multi-stage units into the integrated forward market, which would select one configuration based on the market optimization. The market participant can submit up to three configuration-level bids for the resource into the real-time market. Only one configuration would be selected for real-time dispatch.

In addition, with respect to the design for multi-stage generating unit modeling, Management recommends the following:

1. Bids for ancillary services should be submitted at the configuration level for multi-stage generating units. This will require that individual configurations be tested and certified to provide ancillary services. Furthermore, all valid real-time bids should be certified to provide the capacity and product of any day-ahead award for ancillary services;

2. Local market power mitigation should be performed at the configuration level, and default energy bids should be developed at the configuration level as well;

3. Multi-stage units with resource adequacy offer obligations should be required to offer the contracted capacity into both the day-ahead and real-time markets;

4. For resource adequacy multi-stage units, residual unit commitment should consider all configurations that have capacity equal to or greater than the configuration scheduled in the day-ahead market; and

5. Bid cost recovery should be calculated at the resource level, and should be based on the costs associated with the configuration actually dispatched by the optimization as well as the costs of transitioning between configurations.