



California ISO
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**Draft Final Proposal for
Participation of Non-Generator
Resources in California ISO
Ancillary Services Markets**

November 20, 2009

Draft Final Proposal for Participation of Non-Generator Resources in California ISO Ancillary Services Markets

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1 Executive Summary

The ISO commenced the Participation of Non-Generator Resources in the California Independent System Operator Corporation Ancillary Services Markets stakeholder initiative (Non-Generator Initiative) to comply with FERC Order Nos. 719 and 890. FERC Order No. 719, Wholesale Competition in Regions with Organized Electric Markets, directs regional transmission organizations (RTOs) and independent system operators (ISOs) to allow demand response resources to participate in ancillary services (A/S) markets assuming the demand response resources are technically capable of providing the ancillary service within response times and other reasonable requirements adopted by the RTO or ISO. FERC Order No. 890, Preventing Undue Discrimination and Preference in Transmission Service, requires that non-generation resources, such as demand response and storage, must be evaluated on a comparable basis to services provided by generation resources in meeting mandatory reliability standards, providing ancillary services and planning the expansion of the transmission grid.

Based on the ISO's review, the following modifications to existing operating characteristics and technical requirements are proposed:

- The continuous energy requirement for spinning and non-spinning reserves should be reduced to 30 minutes from the existing 2 hour requirement.
- The continuous energy requirement for regulation up/down should depend on the resources' willingness to allow the CAISO to manage its energy in real time. In this regard, the following will be made available that will allow resources to participate in both the day ahead and real-time market for regulation:
 - Real Time is 15 minutes
 - Day Ahead with ISO Controlled Energy Dispatch is 15 minutes
 - Day Ahead without ISO Controlled Energy Dispatch is 60 minutes
- The measurement of the continuous energy requirement should be clarified to start from the point a resource reaches their award capacity rather than the existing measurement starting after the 10 minute ramp requirement.
- The minimum rated capacity requirement should be reduced to 500KW from the existing 1MW requirement.

The ISO recognizes that WECC standards currently define spinning reserve as "unloaded generation which is synchronized and ready to serve additional demand." Thus, the current definition limits A/S market participation to generation resources for regulation and spinning reserves which is inconsistent with the intentions of FERC Order No. 719 and 890. The ISO has reviewed the WECC BAL-002-WECC-1 which is currently awaiting approval by FERC. The new standard for contingency reserves removes the definitional limits for spinning reserves and now defines spinning reserves as a resource that "immediately and automatically responds proportionally to frequency deviations, e.g. through the action of a governor or other control systems." Once approved, ISO changes made through this stakeholder initiative will be consistent with WECC requirements.

The ISO believes that the modifications to the requirements for the current A/S products will greatly increase the pool of resources and technologies able to participate in the ISO market. The ISO views the completion of this initiative as the first step in our forward looking approach to A/S markets to address the integration of renewable resources, the transformation of generation and load within the ISO balancing authority area, and technological innovations

surrounding smart grid. The ISO is planning to hold a more long-term discussion and comprehensive review of its future A/S market commencing in Q2 2010.

The ISO recognizes that Loads, Energy Storage and other resources have different operating characteristics and different implementation issues for integrating them into the ISO AS markets. It is the ISO's intent, where appropriate, to vet these issues with stakeholders through separate discussion papers, pilots and/or stakeholder meetings.

2 Introduction

FERC Order No. 719 directs RTOs and ISOs to allow demand response resources to participate in Ancillary Service Markets. According to the Commission, demand response resources that are technically capable of providing the ancillary service within the response time requirements, and that meet reasonable requirements adopted by the RTO or ISO as to size, telemetry, metering and bidding, must be eligible to bid to supply energy imbalance, spinning reserves, supplemental reserves, reactive and voltage control, and regulation and frequency response¹.

The ISO recognizes, however, that the current technical requirements defined in the ISO Tariff limit the participation of demand response resources (or other non-generator resources such as energy storage) to a greater extent than Order No. 719 contemplates.

Accordingly, the ISO is undertaking a stakeholder process to explore mechanisms by which non-generator resources may be capable of providing Regulation and Spinning Reserve comparable to a generator.

The development of new A/S products is outside the scope of this stakeholder initiative, but will continue to be reviewed as part of the Market Initiatives Roadmap process. Market participants have highlighted the potential for new A/S products through this process, such as Frequency Only Regulation. The ISO plans to review holistically the A/S products in mid-2010. The development of new A/S products will be in scope for this initiative.

3 Plan for Stakeholder Engagement

Item	Date
Post Final Proposal	November 20, 2009
Stakeholder Conference Call	December 1, 2009
Stakeholder Comments Due	December 8, 2009
Additional Conference Call if Needed	TBD
Board Meeting	February 11, 2010
Publish WECC Proposal	Late February 2010
Post Draft Tariff Language	Late February 2010
Stakeholder Conference Call	Early March 2010
FERC Filing	March, 2010

¹ Order No. 719, 125 FERC ¶ 61,071 (Issued October 17, 2008) at P 49..

4 FERC Order No. 719

FERC Order No. 719, Wholesale Competition in Regions with Organized Electric Markets, directs RTOs and ISOs to allow demand response resources to participate in A/S Markets. Specifically, the Commission required each RTO or ISO to accept bids from demand response resources, on a basis comparable to any other resources, for ancillary services that are acquired in a competitive bidding process if the demand response resources (1) are technically capable of providing the ancillary service and meet the necessary technical requirements; and (2) submit a bid under the generally applicable bidding rules at or below the market clearing price². According to the Commission, demand response resources that are technically capable of providing the ancillary service within the response time requirements, and that meet reasonable requirements adopted by the RTO or ISO as to size, telemetry, metering and bidding, must be eligible to bid to supply energy imbalance, spinning reserves, supplemental reserves, reactive and voltage control, and regulation and frequency response³.

The Commission declined to adopt a standardized set of technical requirements for demand response resources (or other non-generator resources such as Storage) participating in ancillary services markets. Rather, the Commission is allowing each RTO and ISO, in conjunction with its stakeholders, to develop its own minimum requirements. The Commission directed the RTOs and ISOs, in their compliance filings, to set forth a proposal to adopt reasonable standards necessary for system operators to call on non-generator resources for ancillary services, and mechanisms to measure, verify, and ensure compliance with any standards for the provision of ancillary services⁴.

5 FERC Order No. 890

FERC Order No. 890, Preventing Undue Discrimination and Preference in Transmission Service, was designed to (1) strengthen the pro forma OATT to ensure that it achieves its original purpose of remedying undue discrimination; (2) provide greater specificity to reduce opportunities for undue discrimination and facilitate the Commission's enforcement efforts; and (3) increase transparency in the rules applicable to planning and use of the transmission system. The Commission adopted numerous reforms in Order No. 890 including, *inter alia*, the following: (1) a requirement that transmission providers include in Attachment C to their OATTs tariff provisions to improve transparency and consistency in the determination of ATC; (2) modifications to the terms and conditions of point-to-point and network transmission services, as well as the type of information that must be posted on OASIS with respect to these services; (3) a requirement that transmission providers post on OASIS their business rules, practices and standards that relate to transmission service; (4) revisions to the rollover rights provision of the pro forma OATT; (5) a requirement that transmission providers include in Attachment L to their OATTs tariff provisions setting forth the transmission provider's basic credit standards; (6) changes to the pricing of energy and generator imbalances; and (7) the requirement to provide conditional firm service and planning re-dispatch under certain circumstances in connection with point-to-point service. In addition to the aforementioned non-transmission planning requirements adopted in Order No. 890, the Commission required transmission providers to implement a

² *Id.* at P 47. The Commission exempted circumstances where the laws or regulations of the relevant electric retail regulatory authority do not permit a retail customer to participate.

³ *Id.* at P 49.

⁴ *Id.* at P 61.

coordinated, open, and transparent transmission planning process that satisfies nine planning principles enunciated in the order.

In Order No. 890, the Commission adopted a number of changes to the pro forma Open Access Transmission Tariff ("OATT") requirements of Order No. 888, including a change to indicate that, in addition to generating units, non-generation resources such as demand resources may, where appropriate, provide certain ancillary services – namely, reactive supply and voltage control, regulation and frequency response, energy imbalance, spinning reserves, supplemental reserves and generator imbalance services.⁵ In the pro forma OATT, the Commission modified Schedules 2--6 and 9 to add language that allows each Ancillary Service to be provided by other non-generation resources capable of providing the service.

6 NERC Requirements

6.1 Standard BAL-001-0 - Real Power Balancing Control Performance

The purpose of Real Power Balancing Control Performance is to maintain Interconnection steady-state frequency within defined limits by balancing real power demand and supply in real-time. There are two requirements: CPS1 and CPS2.

CPS1 requires each Balancing Authority to operate such that, on a rolling 12-month basis, the average of the clock-minute averages of the Balancing Authority's Area Control Error (ACE) divided by 10B (B is the clock-minute average of the Balancing Authority Area's Frequency Bias) times the corresponding clock-minute averages of the Interconnection's Frequency Error is less than a specific limit.

CPS2 requires each Balancing Authority to operate such that its average ACE for at least 90% of clock-ten-minute periods (6 non-overlapping periods per hour) during a calendar month is within a specific limit.

6.2 Standard BAL-002-0 – Disturbance Control Performance

The purpose of the Disturbance Control Standard (DCS) is to ensure the Balancing Authority is able to utilize its Contingency Reserve to balance resources and demand and return Interconnection frequency to within defined limits following a Reportable Disturbance.

Contingency Reserve may be supplied from generation, controllable load resources, or coordinated adjustments to Interchange Schedules.

For 100% of Reportable Disturbances, a Balancing Authority must return its ACE to zero if just prior to the Reportable Disturbance was positive or equal to zero. For negative initial ACE values the Balancing Authority must return ACE to its pre-Disturbance level. The default Disturbance Recovery Period is 15 minutes after the start of a Reportable Disturbance. The Balancing Authority shall fully restore its Contingency Reserves with 90 minutes of the end of the Disturbance Recovery Period.

⁵ Order No. 890 at P 888.

7 WECC Requirements

7.1 BAL-STD-002-0 – Operating Reserves

The purpose of this standard is to address the Operating Reserves of the Western Interconnection. The standard separates operating reserves in to two categories: regulating reserve and contingency reserve. WECC also defines spinning reserve as unloaded generation which is synchronized and ready to serve additional demand.

The requirement for regulating reserve is spinning reserve, immediately responsive to Automatic Generation Control (AGC) to allow the Balancing Authority to meet the NERC Real Power Balancing Control Performance (see BAL-001-0 above).

The requirement for contingency reserve is spinning reserve and non-spinning reserve sufficient to meeting the NERC Disturbance Control Standard (see BAL-002-0 above). In addition, at least 50% of the contingency reserve must be spinning reserve. The quantity of reserves is set at the greater of the most severe single contingency or 5% of load served by hydro generation+ 7% of load served by thermal generation.

Acceptable non-spinning reserves include interruptible load, interruptible exports, on-demand rights from other entities or Balancing Authorities, spinning reserve in excess of 50% contingency reserve, regulating reserve, and off-line quick-start generation.

Contingency reserves must be fully deployable within 10 minutes of a disturbance and must be restored within 60 minutes following an event. The WECC recovery time requirements are stricter than those outlined in the NERC Disturbance Control Standard.

8 Current ISO Ancillary Services Requirements Protocol

The detailed operating characteristics and technical requirements are outlined in ISO Tariff Appendix K – Ancillary Service Requirements Protocol.

For all ancillary services the minimum rated capacity must be 1MW or greater unless the generating unit or system resource is participating in an aggregation arrangement approved by the ISO.

8.1 Regulation Up and Regulation Down Requirements

A Generator wishing to provide Regulation as an Ancillary Service from a Generating Unit must meet the following operating characteristics and technical requirements:

- the maximum amount of Regulation to be offered must be reached within a period that may range from a minimum of 10 minutes to a maximum of 30 minutes.
- a direct, digital, unfiltered control signal generated from the ISO Energy Management System (EMS) through a standard ISO direct communication.
- power output response (in MW) to a control signal must respond immediately without manual operator intervention for each minute of control response.
- direct communication and direct control system to send signals to EMS to dynamically monitor, at a minimum: actual power output (MW), high limit, low limit and rate limit, and in-service status indication.
- primary and back up voice communication between ISO Control Center, Scheduling Coordinator and Operator.

The WECC definition of spinning reserves limits the system resources able to provide Regulation to unloaded generation which is synchronized and ready to serve additional demand.

8.2 Spinning Reserve Requirements

A Generator wishing to provide Spinning Reserve as an Ancillary Service from a Generating Unit or System Resource must meet the following operating characteristics and technical requirements.

- minimum governor performance of 5% droop, deadband plus or minus 0.036Hz and the power output must change within one second for any frequency deviation outside the governor deadband.
- operator must have a means of receiving Dispatch Instructions to initiate an increase in real power output (MW) within one minute.
- must be able to increase real power output (MW) by the maximum amount of Spinning Reserve to be offered within 10 minutes.
- primary and back up voice communication between ISO Control Center and the operator.

The WECC definition of spinning reserves limits the system resources able to provide Spinning Reserves to unloaded generation which is synchronized and ready to serve additional demand.

8.3 Non-Spinning Reserve Requirements

An Ancillary Service Provider wishing to provide Non-Spinning Reserve as an Ancillary Service from a Generating Unit, System Resource, or Interruptible Load must meet the following operating characteristics and technical requirements.

- must be able to increase output (disconnect load) as soon as possible to the value indicated in a Dispatch Instruction, reaching the indicated value within 10 minutes after issue of the instruction and be capable of maintaining output for 2 hours.
- operator must have a means of receiving Dispatch Instructions to initiate an increase in real power output (MW) or disconnect load within one minute.

The WECC definition of non-spinning reserves expands system resources able to provide Non-Spinning Reserve to unloaded generation and interruptible load.

8.4 Voltage Support

Voltage support is not within scope of this stakeholder initiative.

8.5 Black Start Capability

Black Start Capability is not within scope of this stakeholder initiative.

9 ISO Analysis of Ancillary Services Market

9.1 Analysis of Major DCS Events in September 2009

The ISO analyzed major Disturbance Control Standard (DCS) events during the month of September 2009 to determine how long operating reserves are actually dispatched to supply energy in response to a major DCS event. The data of the major DCS events is summarized in the table below:

	MW Loss	Recovery Time	Return to Set Point
Event #1	459	13 Min	15 Min
Event #2	200	2 Min	2 Min
Event #3	478	6.5 Min	9 Min
Event #4	297	2 Min	2 Min
Event #5	495	8 Min	15 Min
Event #6	892	11 Min	15 Min
Event #7	76	< 1 Min	< 1 Min
Event #8	489	7 Min	10 Min
Event #9	1514	8.5 Min	10 Min

The frequency excursion and Area Control Error (ACE) were recovered within a 15 minute period and contingency resources were returned to their pre contingency point within 15 minutes. The market system is able to respond quickly to the loss of generation by dispatching other generating units to cover the loss of generation.

9.2 Analysis of RTCD since MRTU

The ISO analyzed the Real-Time Contingency Dispatch (RTCD) since April 1, 2009 through September 19, 2009. RTCD mode is invoked under abnormal conditions resulting from a contingency. ISO analyzed the number of RTCD occurrences and determined the length of a contingency resolution by summing RTCD runs with sequential dispatch intervals. The data is summarized in the table below:

	5 MIN	10 MIN	15 MIN	Total
RTCD Invoked	14	10	1	25
	56%	40%	4%	100%

The data above provides evidence that the abnormal conditions which caused RTCD to be invoked were resolved within a 15 minute period. The market was then able to return to RTED for 5 minute energy dispatches.

9.3 Real Time Market Timeline: RTUC, RTED, RTCD

Real-Time Unit Commitment (RTUC) is a market process for committing Fast and Short-Start Units and awarding additional Ancillary Services at 15-minute intervals. The RTUC function runs every 15 minutes and looks ahead in 15-minute intervals spanning the current Trading Hour and next Trading Hour.

The Real-Time Economic Dispatch (RTED) is a market process that dispatches Imbalance Energy and dispatches Energy from AS and normally runs automatically every five minutes to produce Dispatch Instructions. The following two alternative modes to RTED are invoked under abnormal conditions: Real-Time Contingency Dispatch (RTCD) and Real-Time Manual Dispatch (RTMD).

The Real-Time Contingency Dispatch (RTCD) function executes upon CAISO Operator action, usually following a Generating Unit or transmission system Contingency. The RTCD execution is for a single 10-minute interval and includes all Operating Reserves and all Real-Time Energy Bids in the optimization process.

Assuming a contingency event occurs, (RTCD) will commit resources to recover within 15 minutes as the analysis in section 10.1 and 10.2 support. Two iterations of RTUC are required to commit non-reserve resources and return to a normal market state. The first RTUC run after the contingency event will seek to solve energy supply and demand and procure incremental ancillary services as operating reserves ramp to their energy awards. The second RTUC run after the contingency event will seek to solve energy supply and demand after contingency resources have resolved the contingency event returning the market to a normal state.

10 WECC Request for Standard Revision

The WECC definition of spinning reserves limits the type of resources able to provide regulation and spinning reserves to unloaded generation that is synchronized and ready to serve additional demand. The new standard for contingency reserves, WECC BAL-002-WECC-1, which is currently awaiting approval by FERC, removes the definitional limits for spinning reserves and now defines spinning reserves as a resource that “immediately and automatically responds proportionally to frequency deviations, e.g. through the action of a governor or other control systems.” Once approved, ISO changes made through this stakeholder initiative will be consistent with WECC requirements.

11 Proposed ISO Ancillary Services Requirements Protocol Modifications

The following proposed changes to operating characteristics and technical requirements will be reflected in ISO Tariff Appendix K – Ancillary Service Requirements Protocol.

11.1 Proposed Resource Definition

For all ancillary services the resource definition will utilize non-prescriptive language. Ancillary Service Providers for Regulation, Spinning and Non-Spinning Reserves will not be technology specific. Ancillary Service Providers will be defined as any resource meeting the operating characteristics and technical requirements for each ancillary service.

11.2 Proposed Minimum Capacity Requirement

For all ancillary services the minimum rated capacity will be 500KW or greater unless the system resource is participating in an aggregation arrangement approved by the ISO.

11.3 Proposed Continuous Energy Requirement

Continuous energy requirement is defined as the amount of energy a resources is required to deliver at a sustained level for a determined interval.

The continuous energy requirement for spinning and non-spinning reserves will be 30 minutes. The 30 minute time period is based upon the data in Section 9 showing contingency recovery within 15 minutes and allows another 15 minutes for the market to return to a normal

state. Since the RTUC process runs every 15 minutes, the first RTUC run after a contingency event will occur while contingency reserves are dispatched. The next RTUC run will occur after the contingency event has been recovered and contingency reserves are no longer required to be dispatched and the market has returned to normal operation.

The continuous energy requirement for regulation up and regulation down will be 60 minutes for the Day Ahead market and 15 minutes for the Real Time market. The regulation continuous energy requirements align to the awarded interval's time duration. A resource's awarded regulation is required to be able to provide energy for the entire awarded interval for regulation up and consume (reduce) energy for the entire awarded interval for regulation down. An additional option for resources able to meet the Real Time regulation continuous energy requirement, will allow the resource to bid the full real time capacity in the Day Ahead market if the resource agrees to purchase or sell energy in the real time market necessary to meet the one hour continuous energy requirement for the Day Ahead market. Additional details are outlined in section 12.

11.4 Proposed Clarification of Measurement of Continuous Energy

The continuous energy requirements outlined in section 11.3 will be measured from the point at which a resource reaches their awarded capacity. The requirement that resources must be able to ramp to their awarded capacity within 10 minutes remains unchanged. Thus if a resource reaches their awarded capacity in a time period less than the 10 minute ramp requirement, the measurement of the continuous energy requirement will start at the point the resource reaches their awarded capacity and not the end of the 10 minute ramp requirement.

12 Meeting Day Ahead Requirements based on 15 minutes Continuous Energy

For regulation up and regulation down, resources must be able to provide continuous energy for the entire award interval. Resources can provide sustained energy in the Day Ahead market based upon their rated capacity available for 15 minutes by procuring/selling energy in the Real Time market to maintain their rated capacity. For example, a resource which has 20MW capacity available for a sustained 15 minute period in the real time market could be awarded 20MW of regulation in the Day Ahead market if the resource selected the option to have the capacity automatically maintained by procuring/selling energy in the real time market.

A resource selecting the option above will allow the ISO to automatically maintain their preferred operating point (POP) by purchasing/selling energy based upon the energy dispatched in 5 minute intervals to meet ISO regulation requirements. The ISO will automatically place an energy bid for the next 5 minute interval based upon the last 5 minute interval energy dispatch. For example, if a resource awarded regulation up is dispatched to inject 2MW of energy, an energy bid to procure 2MW will be placed for the next 5 minute interval. If a resource is awarded regulation down and is dispatched to extract 2MW of energy, an energy bid to sell 2MW will be placed for the next 5 minute interval. The purchase/sale of this 5 minutes of energy on behalf of the participating resources will be settled based upon the Real Time energy price for the energy required to maintain their capacity at the awarded Day Ahead level. See scenario below for more details assuming a 20MW rated capacity resource.

All resources are eligible to select this option to allow the ISO to purchase/sell energy in the Real Time market to maintain a resource providing regulation in the Day Ahead market at their desired preferred operating point. The option does expose the resource to the volatility of the real time energy prices.

12.1 Example: Regulation Up and Regulation Down

In the scenario below, a resource has a rated capacity of 20MW. The resource has chosen to have the ISO monitor the amount of energy injected or extracted by over a five minute interval. The ISO will then calculate and recover the net difference in the real time energy market that returns the resource to its set point for the following interval. In the example below, the resource has chosen a set point of zero by bidding equal capacity in to both regulation up and regulation down. In interval 6, the resource injects 2 MW of energy in to the market. The resource then procures 2 MW of energy in interval 8. At interval 8, the resource extracts 3 MW of energy from the market. In interval 10, the resource sell 3MW of energy to return to it awarded set point. There energy dispatched through regulation in any 5 minutes is calculated based on deviation of telemetry from POP and the energy amount is injected/extracted from the next 5 minute interval to be dispatched. For example, at 12:05 the energy used by regulation based on deviation for interval 12:00 to 12:05 is calculated and used to affect the dispatch of Interval 12:15 to 12:20. So when RTD is run at 12:07.5 it will dispatch interval for DOT at 12:17.5 and will have the energy amount needed to recover the regulation used during the interval 12:00 to 12:05.

		Hour 1											
	Award	Interval 1	Interval 2	Interval 3	Interval 4	Interval 5	Interval 6	Interval 7	Interval 8	Interval 9	Interval 10	Interval 11	Interval 12
Regulation Up	10	8	7	8	7	10	10	6	11	10	12	13	10
Regulation Down	10	12	13	12	13	10	10	14	9	10	8	7	10
Energy Procured	0	0	0	2	1	1	2	0	2	2	0	3	0
Energy Sold	0	0	0	0	0	0	0	2	0	0	3	0	5
Delta to POP	0	2	3	2	3	0	0	4	-1	0	-2	-3	0
Regulation Dispatch (+ UP, - DOWN)	0	2	1	1	2	-2	2	2	-3	3	-5	2	-2

A detailed discussion of this option as it relates to Limited Energy Storage Resources is available in a separate paper “Straw Proposal for Participation of Energy Storage Resources in CAISO Ancillary Services Markets” that will be posted on the CAISO web site under Integration of Renewable Resources.

13 Next Steps

The ISO will hold a stakeholder teleconference on December 1, 2009 to discuss the recommendations presented in this Draft Final Proposal. Stakeholders should submit written comments by December 8, 2009 to Non-GenAS@caiso.com