Memorandum

To: ISO Board of Governors

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

Date: January 27, 2011

Re: **Decision on Regulation Energy Management**

This memorandum requires Board action.

EXECUTIVE SUMMARY

Regulation energy management is a proposed market enhancement to the rules the California Independent System Operator Corporation uses for procuring regulation services. This enhancement will allow new types of storage resources, such as batteries and flywheels, to provide regulation service. The extremely fast ramping ability of these resources can provide significant operational benefits to the ISO. However, these resources also have limitations in the amount of energy they can produce for a sustained period of time. Without regulation energy management, these resources are limited to providing only a portion of their available capacity to the regulation market. Management believes that implementing regulation energy management will lead to increased participation in the ancillary service market by energy storage and demand response resources and will support the integration of additional renewable resources.

Regulation energy management also allows new storage technologies to provide regulation energy over a continued sustained period. The ISO maintains the resource's state of charge by balancing the energy dispatched from the resource providing regulation service with offsetting dispatches through the real-time energy market in subsequent periods. By ensuring that the energy offset is met by the real-time energy market, the ISO is assured that the resource will provide the regulation capacity the ISO procured.

The integration of renewable resources introduces new requirements to reliably manage the grid, and new market solutions and technologies will be needed to meet the emerging challenges. This enhancement will allow the ISO to gain valuable operational experience with new technologies that provide more varied capabilities for ISO grid operations. Management proposes the following motion:

Moved, that the ISO Board of Governors approves the proposed regulation energy management software enhancement, as described in the memorandum dated January 27, 2011; and

Moved, that the ISO Board of Governors authorizes Management to make all necessary and appropriate filings with the Federal Energy Regulatory Commission to implement the proposed tariff change.

BACKGROUND

The ISO originally commenced this initiative in connection with FERC Order Nos. 719 and 890. Order 719 directs regional transmission organizations and independent system operators to allow demand response resources to participate in ancillary services markets, assuming the demand response resources are technically capable. Order 890 requires RTOs and ISOs to evaluate non-generation resources, such as demand response and storage, 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.

In March 2010, the Board approved modifications to existing operating characteristics and technical requirements for ancillary services to remove barriers for non-generation resource participation in the ISO's regulation markets. Specifically, the Board approved a proposal that reduced the minimum rated capacity and continuous energy requirements for providing ancillary services. With these modifications, limited energy resources such as flywheels and batteries are now able to participate in the day-ahead and real-time regulation market. However, the amount of day-ahead capacity for providing regulation service from these resources is significantly limited by a one hour continuous energy requirement. The ISO tariff requires that regulation capacity offered must be dispatchable on a continuous basis for at least sixty minutes in the day-ahead market and at least thirty minutes in the real-time market after issuance of a dispatch instruction.

Management planned to include a regulation energy management feature as part of the March 2010 proposal but removed it prior to the Board meeting based on stakeholder concerns that outstanding issues with the design were not adequately resolved. Management committed to the Board and to stakeholders to revisit regulation energy management in Phase 1 of the Renewable Integration –Market & Product Review stakeholder process. As described further in this memo, we believe the proposed design addresses issues raised in both the prior and current stakeholder processes.

Barriers for limited energy resources providing regulation

There are existing barriers in the current regulation market design to limited energy resources for providing regulation services. In the day-ahead market, the ISO procures regulation in one hour intervals. In order to receive the capacity payment for regulation ($/MW), a resource must certify that it can produce energy to satisfy a regulation up award and reduce energy production or consume energy to satisfy a regulation down award over the entire hour. Since the ISO procures 100% of the forecasted regulation needs in the day-ahead market, the 60 minute requirement for regulation sold in that market creates a barrier for resources that can provide regulation, but only produce or consume energy for a limited duration (i.e., "limited energy resources").

By implementing measures that utilize the real-time market more dynamically to manage the resources state of charge, limited energy resources are able to meet the continuous energy requirement for providing regulation services.

Comparison with other ISOs

The ISO's proposed approach to implement software functionality to maintain a limited energy resource's regulating range through the real-time market is similar to the approaches developed by the Midwest ISO, PJM Interconnection, ISO New England and the New York ISO. As in this

proposal, these ISOs/RTOs enable limited energy resources like small batteries and flywheels to provide regulation service by managing their state of charge on behalf of the resource.

Regulation energy management is consistent with future market software needs

The proposed functionality, while initially applied to limited energy resources providing regulation, will also be used in the future to support other expected software enhancements to integrate storage and to allow demand response resources to provide regulation service. The software logic used to accommodate a resource with 15 minutes duration is the same as the logic needed to handle any length of duration less than 24 hours, such as a 2 hour or 8 hour storage resource. The cost of this software functionality is estimated to be around one million dollars.

PROPOSAL

Operation of resources using regulation energy management

Under regulation energy management, a resource's scheduling coordinator agrees to allow the ISO to maintain the resource's state of charge by balancing the energy dispatched from the resource in providing regulation service with offsetting dispatches from the real-time energy imbalance market in subsequent intervals. By ensuring that the energy offset is met by the real-time energy market, a resource which has selected regulation energy management can satisfy the 60 minute continuous energy requirement for regulation in the day-ahead market.

Bidding

Regulation energy management resources will submit separate bids for regulation up and regulation down capacity the same as conventional generation. Bids to provide regulation may be submitted into the day-ahead and/or real-time market. In contrast to conventional generation resources that must have a day-ahead energy schedule to provide regulation, limited energy resources have a set point of zero and will only provide regulation energy through the use of regulation energy management. Therefore, these resources will not submit day-ahead energy bids and are not required to have a day-ahead schedule.

Settlement of regulation energy and energy offset

Management proposes to settle resources using regulation energy management the same as conventional generation providing regulation. Resources that utilize regulation energy management will receive regulation capacity payments from the market and will be paid the locational marginal price for providing regulation up and charged the locational marginal price for providing regulation down. The real-time energy produced and/consumed by a resource to maintain the resource's state of charge, including losses, will be settled at the real-time locational marginal price.

Monitoring of regulation energy management design

Management intends to monitor the operational performance of resources using regulation energy management on an ongoing basis and will determine if modifications are needed based on actual operating experience. We plan to monitor the resources state of charge while providing regulation, the regulation dispatch received, frequency and duration of regulation awarded, and performance

under various grid system conditions. The ISO likely will develop additional monitoring metrics in the future as more experience is gained with these storage resources.

Disqualification and rescission of payment

Management proposes to disqualify, on a pro-rata basis, resources using regulation energy management from providing regulation in the event that the real-time energy market cannot meet the ISO forecast of ISO demand plus the regulation energy management energy offset. This rule recognizes that the combination of the resource's discharge/charge rate and the real-time market are needed to meet ISO regulation requirements. This pro-rata allocation will result in a rescission of the regulation capacity payment for the allocated shortfall.

In addition, whenever a resource using regulation energy management fails to respond to automatic generation control, the ISO will rescind the regulation capacity payments. This rescission of payment is similar to the provisions in place for conventional generators.

Eligibility to participate in regulation energy management

Management proposes that a resource can select regulation energy management only if its technical characteristics require a real-time energy offset to provide regulation (i.e., it cannot meet the 60-minute continuous energy requirement for its full capacity). Resources such as flywheels, batteries, and some demand response resources may require a real-time energy offset; whereas, a traditional hydro or thermal unit does not.

POSITIONS OF THE PARTIES

Stakeholder Process

The ISO examined a proposal to implement regulation energy management as part of the modifications to ancillary services to support non-generation resources initiative that was approved by the Board in March 2010. Management deferred bringing regulation energy management to the Board so that we could address several outstanding issues related to the functionality, including whether regulation energy management created a separate ancillary service product, whether or not to implement a procurement limit, and whether or not to settle regulation energy dispatched from these resources.

In the current stakeholder process, Management has worked to resolve each of these issues so that the regulation service provided by resources using regulation energy management is comparable to that of a conventional generator. Specifically, the proposal differs from the previous proposal in that it removes the limit on the amount of regulation energy management capacity that could be procured by the ISO and settles the energy provided and consumed by these resources at the real-time locational marginal price.

Most stakeholders have expressed support or at least acceptance of the proposal, subject to a review of regulation energy management based on actual operating experience. The proposal has received strong support from limited energy storage interests. Some stakeholders remain neutral, but continue to express concerns about potential operational issues given the energy limitations of these resources. The ISO Department of Market Monitoring (DMM) expressed concerns and proposed potential modifications to the design. These concerns were resolved through

modification to the design and a commitment to monitor the effectiveness of the regulation energy management design after implementation. For additional information on DMM's concerns, please refer to their separate Board memo, provided in the Board materials for this meeting and posted on the ISO website. PG&E continues to oppose the design and requests additional analysis and modeling prior to implementation. The Market Surveillance Committee (MSC) has also raised concerns and recommends the ISO place three different caps on participation by limited energy storage resources. Their concerns are described in the MSC Opinion on regulation energy management. The Opinion is attached to the MSC Board memo which was also provided in the Board materials for this meeting.

In response to the MSC opinion, Management believes that the volume of energy limited storage resources participating in the ISO's regulation markets over the next several years will be very small. If this is indeed the case, the caps suggested by the MSC are unwarranted and create unnecessary complexity for implementation. As described above, the ISO will be closely monitoring the participation of these resources in the regulation markets and will propose modifications to the design if warranted. Caps on participation can be added later if necessary, after the ISO gains experience with these new resources and has better justification for future design modifications.

The concerns described above expose the ongoing paradox with accommodating new technologies in the ISO markets. If the ISO does not remove existing barriers to allow participation of new technologies, the new resources will not enter the ISO market and we will not gain the operational experience necessary to address stakeholder concerns. Stakeholders expressed similar concerns regarding performance in the market to the proxy demand resource product, as the ISO had no experience with demand response resources and performance of these new resources was not proven.

Below is a discussion of the key issues that staff addressed and the design modifications that were made based on stakeholder feedback. Comments are summarized in more detail in the Stakeholder Matrix, which is *Attachment A* to this memo.

Regulation energy management as a new product

Stakeholders were divided on the issue of whether or not regulation energy management is sufficiently different from traditional regulation to warrant creation of a new product. Some stakeholders advocated that regulation energy management is similar to other software enhancements, such as multi-stage generation, which enable a resource to make its full capabilities available to the ISO market. The opposing view is that regulation energy management is a new and unique product from traditional regulation and should be procured and priced separately. Management views regulation energy management as an enhancement that will allow the ISO to utilize the full range of regulation capability available from limited energy resources and does not at this time require the development of a new product. However, we recognize that a new regulation market product may be warranted in the future.

Settling imbalance energy

Previously, Management proposed not to settle real-time imbalance energy for resources participating in regulation energy management to simplify implementation. However, we modified the proposal in response to stakeholder concerns that this approach may not accurately account for the efficiency losses of a resource using regulation energy management and different energy prices during times of charge and discharge.

Eligibility Limits

This design feature was added to resolve stakeholder concerns that regulation energy management could be used by conventional generators to withhold regulation capacity from the market. Only resources that require an energy offset due to their operational characteristics may participate in regulation energy management.

Review threshold for regulation energy management design

During the stakeholder process, there was discussion of establishing a review threshold based upon the penetration of resources using regulation energy management. Once the threshold is reached, stakeholder review of the design would be initiated. The purpose of the review threshold was to address stakeholder concerns that operational issues could emerge at higher penetration of resources using regulation energy management. Management previously proposed a 40 percent threshold and DMM suggested that if a threshold were to be used, a much lower 5 percent threshold would be more appropriate. Others suggested that ongoing monitoring should allow review if operational issues occur at any penetration level. Management agrees a review threshold is not warranted as we plan to monitor on an ongoing basis. If operational issues arise, the ISO will engage with stakeholders to make appropriate changes to the design.

Procurement limits

Previously, Management proposed an initial procurement limit for regulation energy management equal to 10 percent of the total regulation requirement to allow for operational experience with limited energy resources. A number of stakeholders argued against this limit on the grounds that it would hinder the development of commercial-scale limited energy storage in California. DMM also raised concerns that if the procurement limit was exceeded it would result in differential pricing for resources providing regulation through regulation energy management and resources providing regulation conventionally. On further examination, we removed this design element and believe the ongoing monitoring of the design is preferable to a market constraint.

Ancillary services substitution

Under the ISO's current market rules, regulation up may substitute for spinning and non-spinning reserves, when it is economic to do so. Regulation energy management functionality enables limited energy resources to meet the continuous energy requirement for day-ahead regulation of 60 minutes. This timeframe exceeds the continuous energy requirement for spinning and non-spinning reserves of 30 minutes.

Stakeholders expressed concern with allowing resources using regulation energy management to substitute for spinning reserve requirements given their inherent energy limitations. Given the

anticipated quantity of resources using regulation energy management over the next several years and the current duration of contingency events, the ISO believes that a separate constraint to prevent regulation up capacity provided from resources using regulation energy management from substituting for spinning reserve is unwarranted. The ISO will monitor the design during contingency events and if unforeseen operational issues arise, the ISO will revisit this issue and determine, based upon actual operational data, if design changes are required.

Implementation of a mileage payment

Some stakeholders have advocated that the ISO should provide an additional payment to regulation resources based upon their movement from the preferred operating point. A "mileage payment" would be an administrative payment based upon the sum of the absolute value of all deviations from the resources preferred operating point in response to ISO regulation signals. While there may be merit in implementing such a payment, as has been done by ISO New England, this would be a fundamental change in how the ISO procures and pays for regulation. This proposal is more appropriately within the scope of the larger market product discussion in Phase 2 of the Renewable Integration –Market & Product Review. In the future, if a new payment approach were implemented, these limited energy resources will still require the regulation energy management functionality.

MANAGEMENT RECOMMENDATION

Management requests Board approval of regulation energy management as detailed in this memorandum. Regulation energy management will remove barriers to participation in the ISO regulation market by storage and demand response resources that are energy limited and allow the ISO to gain operational experience with new technologies that provide more varied capabilities to ISO markets. If approved, the ISO intends to implement this functionality as part of the ancillary services for non-generation resources project in Spring 2012.