

Memorandum

To: ISO Board of Governors

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

Date: March 15, 2012

Re: **Decision on Pay for Performance Regulation**

This memorandum requires Board action.

EXECUTIVE SUMMARY

Last fall, the Federal Energy Regulatory Commission adopted Order 755 to remedy what FERC identified as undue discrimination in the procurement of frequency regulation in the organized wholesale electric markets. The ISO uses frequency regulation for system balancing to manage the differences between generating units' responses to dispatch instructions and actual load within a 5-minute period. The final rule requires ISOs to adopt a two-part payment for frequency regulation: (1) a payment for regulation capacity and (2) a payment for performance of the resource in response to a regulation signal. FERC's order adopting the final rule requires the ISO to submit a compliance filing with proposed tariff language by April 30, 2012 and to implement the new provisions by October 2012.

To comply with Order 755, Management recommends the following market design enhancements:

- The market optimization will consider two separately priced components of frequency regulation in determining market awards: regulation capacity and expected movement in response to the regulation signal (mileage).
- In addition to a regulation capacity payment, compensation will include a payment based upon a resource's actual movement in response to the regulation signal. This payment will be adjusted based upon the accuracy of the resource's response to the regulation signal.

Due to the scope and complexity of these proposed modifications, it is not possible to implement these changes by the FERC deadline of October 2012. Therefore, Management also recommends requesting authority from FERC to implement this enhancement in the spring of 2013.

Management proposes the following motion:

Moved, that the ISO Board of Governors approves the proposed pay for performance regulation market design, as described in the memorandum dated March 15, 2012; 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.

DISCUSSION AND ANALYSIS

FERC Order 755 requires the ISO to revise its procurement of regulation service by addressing each of the following requirements:

1. Regulation capacity payments must include opportunity costs of the marginal resource;
2. Resources must be allowed to include inter-temporal opportunity costs as part of their regulation bid;
3. Payment to resources must be based upon their actual response to the regulation signals;
4. Payments to resources for their actual response should reflect the accuracy of the resource's response to regulation signals;
5. Resources must receive a two part payment for frequency regulation: (1) a payment for regulation capacity and (2) a payment for performance of the resource in response to a regulation signal; and
6. The payment for regulation performance must include two components: (1) the actual movement or mileage based upon the regulation signal and (2) an accuracy adjustment.

The following sections of this memorandum provide an overview of frequency regulation and then describe Management's proposal to comply with FERC Order 755.

Overview of frequency regulation

The ISO uses frequency regulation for system balancing to manage the differences between generating units' responses to dispatch instructions and actual load within a 5-minute period. The ISO procures regulation up and regulation down as separate products. Regulation up is used to balance the system when actual load is higher than

generation dispatch. Regulation down is used to balance the system when actual load is lower than generation dispatch. In the day-ahead market, the ISO procures 100 percent of forecast regulation needs in hourly intervals. If additional regulation requirements arise in real-time, the ISO procures incremental regulation up and regulation down in 15 minute intervals during the real-time unit commitment process.

Frequency regulation services will be increasingly important as the ISO works to integrate increasing volumes of variable energy resources. The ISO has forecasted a substantial increase in hourly regulation requirements in some hours due to a more variable generation fleet.

Regulation capacity payment includes opportunity costs

Management is not recommending any modifications to the ISO's current approach for calculating opportunity costs for regulation capacity to comply with Order 755. The ISO currently considers opportunity costs when it co-optimizes energy and ancillary services as part of determining regulation capacity awards and market clearing prices. In the day-ahead market, the market clearing price for regulation capacity includes any opportunity costs incurred by providing regulation. This opportunity cost can be in the same hour as the regulation award, or can be an opportunity cost in another hour of the day resulting from inter-temporal constraints. In the real-time unit commitment process, the ISO procures incremental regulation capacity which also reflects energy opportunity costs calculated by the real-time unit commitment process. While the energy prices calculated by the real-time unit commitment process are not financially binding, they do reflect the energy prices projected at the time the market clearing price for regulation capacity is established.

Inter-temporal opportunity costs

Order 755 requires the ISO to allow resources to include other inter-temporal opportunity costs in a resource's offer to sell frequency regulation service, with the requirement that the costs be verifiable. An example of such inter-temporal opportunity costs would be a resource foregoing energy production in a future say in order to provide regulation. The order does not require the ISO to calculate inter-temporal opportunity costs for resources beyond what is already considered within the horizon of the market optimization. Management recommends allowing inter-temporal opportunity costs not considered in the current market optimization to be included in regulation bids. Scheduling coordinators would have the burden to justify inter-temporal opportunity costs contained within a resource's bid, upon request, and the \$250 capacity bid cap would remain.

Uniform market clearing prices for regulation capacity and regulation mileage

Management's proposed market modifications to comply with Order 755 follows two guiding principles. First, the ISO sought to minimize the impact to the current regulation capacity market design, including the economic substitution of regulation up for spinning

reserve and non-spinning reserve. Second, the proposal targeted the determination of a uniform clearing price for regulation mileage. Regulation mileage is the movement in output of a regulation resource in response to the ISO's regulation signal. While the clearing price for regulation mileage is based on expected mileage needed by the ISO, resources are compensated for the actual mileage they incurred in responding to the ISO regulation signal.

Regulation capacity and regulation mileage are two attributes of frequency regulation service. Therefore, a relationship exists between the regulation capacity awarded and regulation mileage awarded. The market optimization will consider both attributes to minimize the total cost of frequency regulation service.

Resources will not submit a mileage quantity to the market. Instead, the ISO will calculate a resource specific mileage multiplier and apply that multiplier to the resource's offered regulation capacity. The resource specific mileage multiplier will reflect the historical accuracy of the resource and the resource's certified 10-minute ramp capability. The resource specific mileage multiplier will then be applied to each resource's offered regulation capacity to determine the mileage offered.

A resource will receive a mileage award that is at least as much as its capacity award, but no more than the product of its resource specific mileage multiplier and its capacity award. The ISO will use mileage awards to determine a uniform mileage price but the mileage quantity awards will not be financially binding since resources will be paid based upon actual mileage resulting from the regulation signal.

Management does not propose to change its method for determining the amount of regulation capacity it procures for each hour to comply with Order 755. The ISO establishes hourly regulation capacity requirements that are largely driven by load levels and load forecast uncertainty.¹

Management proposes to add a second element, the expected movement (or mileage) of resources in response to the regulation signal, to the regulation procurement requirement to comply with Order 755. This element will be used as part of the optimization's procurement decisions and will be used to determine the regulation mileage price. The mileage procurement requirement will be set at the minimum of three values:

1. The product of actual mileage observed for each MW of regulation capacity from the prior week and the regulation capacity requirement for the given hour;

¹ An hourly variable regulation capacity forecasting tool calculates the coincidental 10-minute peak requirement for regulation separately in the up and down direction for each hour based on changes in the demand forecast, generation self-schedule changes, and hourly inertia fluctuation.

2. The average actual mileage from the prior week for the given hour. The ISO may adjust the average requirement based on operational needs resulting from actual system conditions; and
3. The sum of each resource's specific mileage multiplier and its bid-in regulation capacity. This third variable is designed to avoid mileage scarcity by never setting the requirement more than what bid-in capacity is able to provide.

Resources will continue to submit regulation capacity bids and a MW quantity for both regulation up and regulation down. The current \$0.00 capacity bid floor and \$250.00 bid cap of will remain. The addition of the regulation mileage requirement should not increase regulation capacity procurement.

Under the pay for performance regulation market design, resources will also submit separate mileage bids for regulation up and regulation down. Management proposes a \$0.00 mileage bid floor and a \$50.00 bid cap . If a resource does not submit a mileage bid when submitting a regulation capacity bid, the ISO will generate a default mileage bid of \$0.00 for the resource.

Payment and calculation of resource movement from regulation signal or mileage

Every 4 seconds, the ISO sends a regulation signal that instructs resources providing regulation the output level needed. Management proposes to define mileage as the absolute change in regulation signals between the 4 second intervals. A resource will be compensated for its actual mileage delivered. Since the ISO procures separate capacity for regulation up and regulation down, there will be a separate mileage calculation for each of these two products. Each resource's actual mileage will be summed for each 15-minute settlement interval and paid at the uniform market clearing price for mileage subject to performance adjustments outlined below.

The ISO procures incremental regulation in the real-time market during the real-time unit commitment process for 15-minute intervals. Since mileage prices can differ between the day-ahead and real-time markets, Management proposes to establish a resource specific single mileage price for each 15-minute interval, similar to the current calculation of regulation capacity prices. In the event a resource is awarded incremental regulation in the real-time market, the mileage price for that 15-minute interval will be the weighted average price of both the day-ahead and real-time mileage clearing price.

Calculation of accuracy adjustments to measure resource performance

Accuracy is the absolute value of actual telemetry compared to the regulation signal in a given regulation interval. The ISO will determine an accuracy adjustment for each 15-minute interval for each resource based on its deviations from the regulation signal.

The ISO will calculate the simple average of all 15-minute interval accuracy calculations for each resource on a monthly basis. The average 15-minute accuracy will be used in determining the resource specific mileage multiplier for the following month. This will ensure that if all else is equal for two resources, the ISO will provide a regulation award to the more accurate resource.

In addition, Management proposes a minimum performance threshold for resources that provide frequency regulation service. A resource would have to be recertified to provide regulation if its performance falls below the minimum performance threshold. The minimum performance threshold will initially be set at 50% accuracy.

Additional market design impacts

The pay for performance regulation market design impacts numerous market rules, systems and policies. As such Management recommends the following in connection with this market enhancement:

- Include both regulation capacity and mileage revenue and costs in the bid cost recovery calculations;
- Allocate costs from mileage payments to scheduling coordinators' ancillary services obligations in the same manner as the current allocation of regulation capacity costs;
- Disqualify a resource from mileage payments for any period a resource is disqualified from regulation capacity payments;
- Measure resources' certified regulation ramp rate over a ten minute period;
- Publish the mileage price, system mileage multiplier, and actual mileage incurred on OASIS; and
- Subject mileage bids to the grid management charge bid segment fee of \$0.005.

Conduct review after one year of operation experience

Management proposes to review of this market enhancement one year after it is put into production. Since many design elements of this proposal are based upon historical data under the current regulation design, Management believes it will be prudent to evaluate this design once actual production data under the design is available and determine if any modifications are necessary. One year of operational data will be used to evaluate the design, including, but not limited to, the appropriateness of the minimum performance threshold level, the historical data used to calculate the system wide mileage multiplier, the level of the mileage maximum bid price and mileage scarcity

price, and the change in resource participation in regulation under the new regulation service design.

Implementation timing

Management proposes to request an extension from FERC to spring of 2013 to implement the system changes to comply with Order 755. It will not be possible to comply with the October 2012 deadline mandated by Order 755. Implementing the market changes described in this memorandum to comply with Order 755 will require modifications across many of the ISO's market systems.

The requirement for separate bids for regulation capacity and mileage translates to data model changes for the market applications, new types of resource reference data, and new bid content, validation, and processing rules. The new mileage requirement and capacity-mileage constraints augment the model in the optimization engine that is used to clear the day-ahead and real-time markets. New external reports must be developed for the ISO's external facing systems. The new ex post mileage payment requires new settlement charge codes and procedures. Furthermore, regulation accuracy determination and actual regulation mileage measurements will need new calculations to be performed on real-time telemetry data.

POSITIONS OF THE PARTIES

Stakeholders are generally supportive of the proposed market enhancements. The market design has evolved through the stakeholder process. The final proposal has taken into consideration the concerns raised by stakeholders, the Market Surveillance Committee and the Department of Market Monitoring. The concerns arise from the fact that Order 755 requires compensating two attributes of the single regulation service based on separate market clearing prices for capacity and mileage. The Market Surveillance Committee opinion on this topic is attached for your reference. Comments by the Department of Market Monitoring on this topic are provided in DMM's March Board report for this meeting.

MANAGEMENT RECOMMENDATION

Management requests Board approval of the pay for performance regulation market design as described in this memorandum. The market design is intended to comply with Order 755 and will compensate resources that provide frequency regulation through a capacity payment and a performance payment.