

**UNITED STATES OF AMERICA
BEFORE THE FEDERAL ENERGY REGULATORY COMMISSION**

**Frequency Regulation Compensation
in the Organized Wholesale Power Markets**

Docket Nos. RM 11-7/AD10-11

COMMENTS OF THE ELECTRICITY STORAGE ASSOCIATION

The Energy Storage Association d/b/a Electricity Storage Association (“ESA”) appreciates the opportunity to submit comments in support of the compensation mechanism proposed by the Federal Energy Regulatory Commission (“FERC” or the “Commission”) in its Notice of Proposed Rulemaking (“NOPR”) as issued in the above-captioned matter.¹ As proposed, FERC would require all ISO/RTOs to adopt a Regulation compensation formula that pays resources based on two components: (1) a uniform capacity payment that includes marginal regulatory resource’s opportunity costs (*i.e.*, the amount of megawatts (“MW”) that a resource makes available to provide Regulation); and (2) a performance payment based on the amount of up and down movement (in MWs) that the resource provides in response to a control signal.² Paying resources based on these two components will ensure that fast-ramping regulation resources, such as batteries and flywheels, are justly and reasonably compensated for their ability to quickly and accurately correct the Area Control Error (“ACE”).

Once the proposed rules are implemented, the undue discrimination that is inherent in the majority of the ISOs/RTOs regulation payment mechanisms will be

¹ *Frequency Regulation Compensation in the Organized Wholesale Power Markets*, 134 FERC ¶61,124 (Notice of Proposed Rulemaking) (issued on February 17, 2011).

² *Id.* at 34.

remedied, thereby sustaining the viability of existing advanced storage regulation plants, encouraging investment in future regulation storage facilities and enabling the grid and consumers to experience the economic, reliability and environmental benefits that result from using fast responding resources to regulate the grid.

Accordingly, ESA applauds FERC for its pro-active approach to ensure that markets are just and reasonable for new fast-ramping storage resources. ESA respectfully requests that FERC issue an Order directing ISOs/RTOs to implement tariffs that compensate regulation resources in accordance with the payment model outlined in its NOPR.

I. COMMUNICATIONS

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II. ABOUT THE ELECTRICITY STORAGE ASSOCIATION

The ESA is an international trade association that was established over 20 years ago to foster development and commercialization of energy storage technologies. Since then, our mission has always been the promotion, development and commercialization of competitive and reliable energy storage delivery systems for use by electricity suppliers and their customers. ESA members represent a diverse group of entities, including electric utilities, energy service companies, independent power producers, technology developers involved with advanced batteries, flywheels, compressed air energy storage,

pumped hydro, supercapacitors and component suppliers, such as power conversion systems. Our members also include researchers who are committed to advancing the state of the art in energy storage solutions.

III. COMMENTS

The ESA is pleased to provide comments in response to the specific issues raised by the Commission in its NOPR.

A. Faster-Ramping Resources and Potential for Market Efficiencies

1. FERC Request

In its NOPR, the Commission requested comments on the benefits that faster-ramping resources, no matter their exact type, can and do bring to the RTO and ISO markets. Conversely, the Commission sought comments on the drawbacks, if any, of using faster-ramping resources for regulation.³

2. ESA Response

Utilizing Fast Ramping Resources to provide Regulation Service in the ISO/RTO markets will yield lower costs for consumers, increased flexibility to maintain reliability and environmental benefits.

- a. *Lower Cost to Consumers because the grid needs to procure less Regulation.*

As acknowledged by FERC in its NOPR, using fast-ramping resources to provide regulation will result in improved operational and economic efficiency of the transmission system and lower costs to consumers in the organized wholesale energy markets.⁴ Specifically, the amount of ACE correction that can be provided by fast regulation resources is much greater per MW of procured capacity than would be provided by more traditional, slower ramping resources. As a result, the grid procures less regulation.

³ NOPR at P 33.

⁴ *Id.* at P 2.

Data collected from ESA’s electricity storage members (such as batteries and flywheels) to document their experiences operating fast-ramping resources and from studies commissioned from private and public entities to ascertain the benefits of fast-responding regulation affirms that by using fast-responding resources to regulate the grid, less regulation needs to be procured. The plants listed in Figure 1 (below) are ESA members that have been providing commercial regulation service and have proven their ability to follow a regulation signal almost instantaneously and demonstrated that their availability and reliability is equal to or greater than traditional generation resources. For example, AES Energy Storage’s Project Barbados has logged over 15,000 hours participating in the PJM regulation market. At the Technical Session on May 26, 2010, PJM affirmed that this project has demonstrated its ability to respond nearly instantaneously to the signals received by PJM and Andy Ott stated “We have seen excellent response. I mean, way above what we are seeing in generation; it is not even close.”⁵

Figure 1

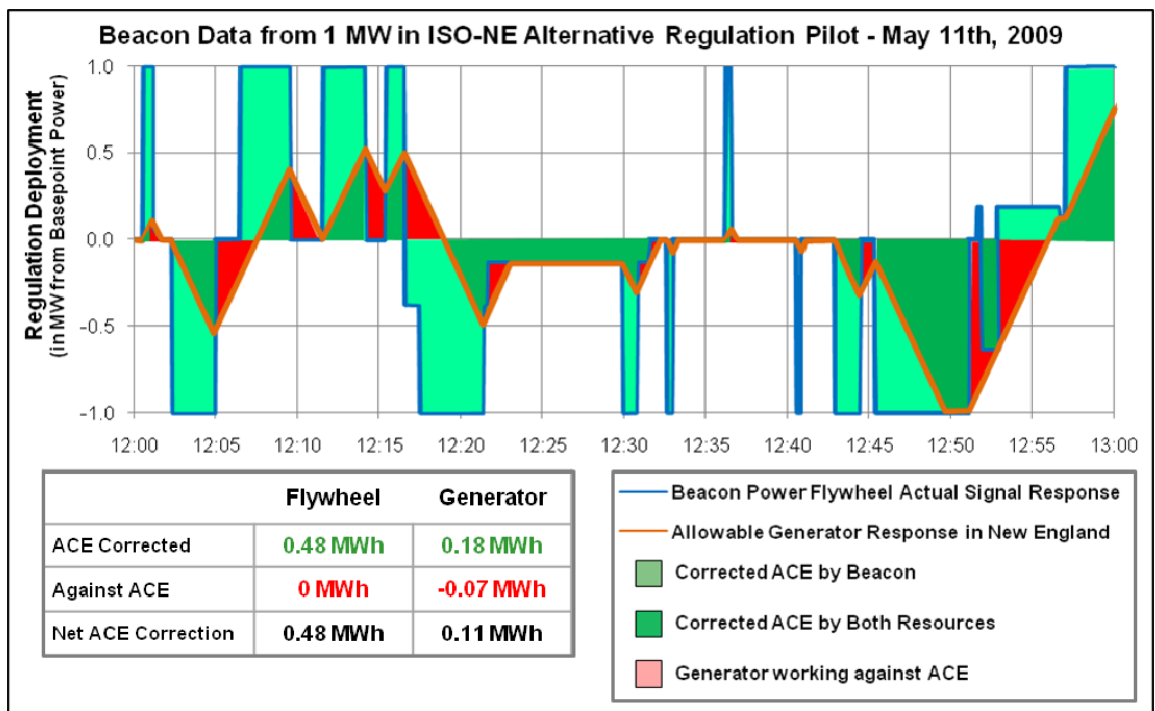
Energy Storage Plant Providing Regulation	ISO	Technology	Owner / Technology Provider	Operating Capacity	Commercial Operation Date
Tyngsboro	NEISO	Flywheel	Beacon / Beacon	Up to 3 MW	November, 2008
Barbados	PJM	Battery	AES / Altairnano	1 MW	May, 2009
Johnson City	NYISO	Battery	AES / A123	8 MW	December, 2010
Oahu	Hawaii	Battery	Xtreme Power	15MW/10MWH	March 2011
Stephentown	NYISO	Flywheel	Beacon / Beacon	Up to 14 MW (total of 20 MW planned by Q2 2011)	January, 2011
Odessa	ERCOT	Battery	Xtreme Power	36MW/24MWH	Q3-2012

Data from Beacon Power Corporation’s Tyngsboro project operating experience using flywheels to regulate the grid in ISO-NE illustrates the potential reduction in total

⁵ See Transcript from May 26, 2010 Technical Session at 14 (line 6).

regulation procurement that can be achieved by utilizing a resource that is capable of quickly and accurately responding to frequency deviations. For example, **Figure 2** (below) compares the ACE Correction of Beacon Power’s 1MW flywheel plant responding accurately and nearly instantaneously to the control signal sent by ISO-NE with one that would have been provided by 1 MW of regulation provided by a resource with a ramp time of 5 minutes, the allowable response time in ISO-NE.⁶

Figure 2



As demonstrated in Figure 2, while both the flywheel and the slow-ramping resources provide ISO-NE with same amount of Regulation capacity (*i.e.*, 1 MW), the fast responding flywheel provided four times as much regulation value to the grid per MW capacity as the slow resource. Specifically, the data demonstrates that the flywheel provided 0.48 MWh of net ACE correction in this hour whereas the slow-ramping resource provided just 0.11 MWh of net ACE correction. Therefore, if 0.48 MWh of net

⁶ ISO New England, Transmission, Markets and Services Tariff, Section III, Market Rule 1, Section III.1.10.1A (e), Last Revision Date: March 14, 2011. http://www.iso-ne.com/regulatory/tariff/sect_3/mr1_sec_1-12.pdf

ACE correction in this hour were desired, 4 MW of regulation capacity would need to be procured by the ISO using a traditional slow-ramping resource as opposed to 1 MW of regulation capacity using a fast-ramping energy storage resource such as a flywheel or battery. In this way, the fast-ramping energy storage resources will reduce the amount of regulation capacity that needs to be procured for a given amount of ACE correction.

The fast-ramping flywheel is able to provide more ACE correction for two reasons. First, the flywheel can deliver its full regulation power output within seconds, whereas the slow resource takes 5 minutes to deliver the same quantity of power. The flywheel provides more total energy to correct the ACE. Second, because the flywheel can switch directions nearly instantaneously upon receiving a control signal it is always contributing to correcting ACE.

Conversely, the slow-ramping resource cannot switch directions quickly and thus often provides regulation in a direction that is counterproductive to the needs of the grid. As a result, the slow-ramping resource actually adds to the ACE, requiring another resource to be dispatched to re-balance the grid. As shown in Figure 2, the slow-ramping resource provided 0.18 MWh of energy in response to the control signal however, because of its slow-ramping time, 0.07 MWh of this energy worked against the ACE correction.

As the fast-ramping resource corrected significantly more ACE than the slower ramping resource, it provided the grid with more regulation value per MW of regulation capacity, thereby demonstrating that 1 MW of regulation capacity from a fast-ramping resource can displace more than 1 MW of regulation capacity from a slow-ramping resource for the same level of system ACE Correction. Accordingly, by using fast-

ramping regulation resources, grids need to procure less regulation capacity, which in turn, benefits ratepayers.

Another way to consider the benefits of procuring regulation from new fast-ramping storage resources is to compare the amount of MW capacity that needs to be installed and reserved from other types of Regulation resources in order to provide the same amount of ACE Correction. For example, gas turbines provide the fastest of conventional regulation capacity reserve at 20% ramp rate per minute (*see* Figure 3) and typically can use about 20% of their total capacity for regulation without violating their emissions permits or significant degrading efficiency. New storage technologies can use 100% of their total capacity for regulation, can both absorb and provide energy to the grid, and can ramp from zero to full capacity in a few seconds. This means that a 100 MW gas turbine can set aside approximately 20 MW of its capacity for regulation to provide 10 MW of regulation (up and down). The gas turbine can then provide 10 MW of regulation in either direction within thirty seconds, whereas a 20-MW storage resource can provide all 20 MW of its capacity up or down within 4 seconds. Most regulation signals change every 2 – 6 seconds depending on the ISO/RTO region. Therefore, for gas turbines to provide 20 MW of regulation response in 4 seconds (like a 20 MW fast-response storage resource) it would require 1500 MW of gas turbines reserving 20% of their capacity for Regulation (300 MW) and then all ramping in unison. This example demonstrates the significance that speed of response plays in the overall amount of regulation that must be procured by a ISO/RTO in order to reliably manage the frequency of its grid.

Figure 3

Generation Type	Ramp Rate/Minute, %	Typical Size, MW	Ramp Rate/Minute, MW	Installed MW to provide 20MW of Ramping in 4 seconds
Nuclear	0	1,000	-	
Coal	2.50%	500	12.5	12,000
Combined Cycle (CCGT)	5.00%	500	25.0	6,000
Gas Fired Steam	3%	200	6.0	10,000
Gas Turbine	20%	100	20.0	1,500

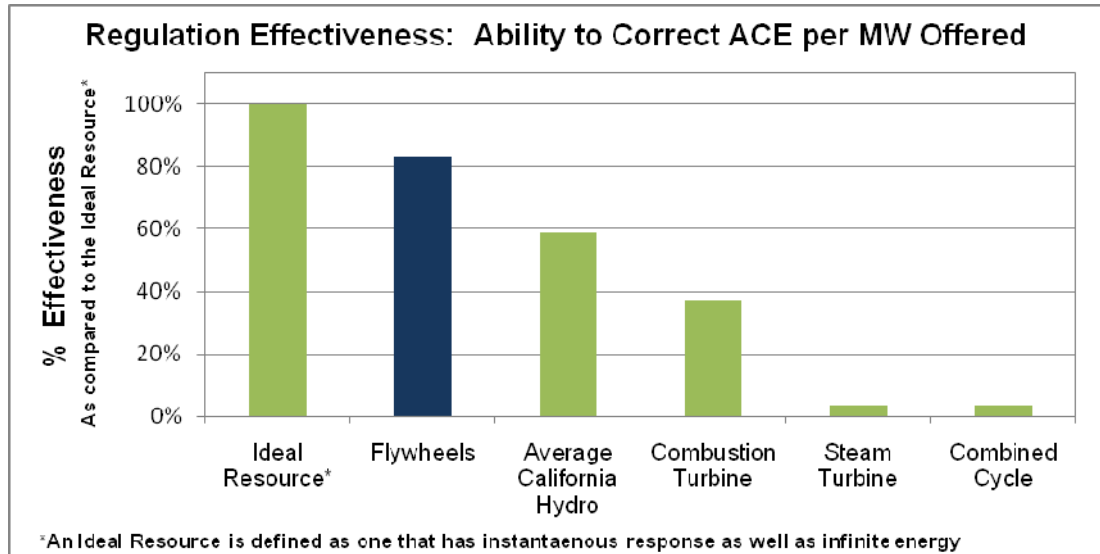
The premise that dispatching faster responding resources will reduce ISOs' costs to procure Regulation was the subject of several studies. A June 2008 paper issued by the Pacific Northwest National Laboratory ("PNNL") and entitled, "Assessing the Value of Regulation Resources Based on Their Time Response Characteristics."⁷ In its study, PNNL compared the Regulation effectiveness (*i.e.*, the ability of a given resource to correct the ACE per MW offered) of an "ideal regulation resource" (defined as one that has infinite energy and can respond instantly with perfect accuracy to any system imbalance) with a number of regulation resources⁸ and concluded that fast responding energy storage resources (such as flywheels and batteries) could be as much as 17 times more effective than conventional ramp limited regulation resources because of how quickly and accurately it responds to a system imbalance. In its study, which was conducted using data from CAISO, PNNL concluded that CAISO could reduce its Regulation procurement by as much as 40 percent if it dispatched fast responding regulation resources. A recent California Energy Commission ("CEC") study further supports these claims, concluding that "on an incremental basis, storage can be up to two

⁷ Makarov, Y.V., Ma, J., Lu, S., Nguyen, T.B. "Assessing the value of Regulation Resources Based on Their Time Response Characteristics." Pacific Northwest National Laboratory, PNNL – 17632, June 2008.

⁸ See Figure 4.

to three times as effective as adding a combustion turbine to the system for regulation purposes.”⁹

Figure 4



A comparison of the amount of Regulation Service procured by each ISO/RTO region as a percent of average system load in 2010 provides further support for the benefits of utilizing fast-ramping resources. ISO-NE is the only region in the country today that both dispatches and compensates resources based on their ramp-rate capability, (*i.e.*, they utilize the fastest ramping resources in their market to respond to ACE deviations first and then compensate these fast-ramping resources for being deployed to do more of the work to correct the ACE). As seen in Figure 5, in 2010 ISO-NE procured the least amount of Regulation as a percent of average system load than any other ISO. The second lowest region was the Midwest ISO, the only other ISO that prioritizes the dispatch of all their regulation resources based on their ramp-rate. The Midwest ISO, however, does not compensate resources for doing more of the work to correct the ACE

⁹ “Research Evaluation of Wind Generation, Solar Generation, and Storage Impact on the California Grid,” Study by KEMA, Inc., done for California Energy Commission, June, 2010.

and therefore does not incent resources to bid in as high a ramp rate as possible. In 2010, the other ISOs dispatched ACE based on the pro rata share of the market participants with no priority given to those resources who could respond the fastest to the ACE deviation.¹⁰ As compared to New England ratepayers, where the ISO both dispatches resources based on their speed of response and has a market incentive for faster response, PJM ratepayers bought 2.25 times more regulation, New York ratepayers bought 2.46 times more regulation, and in California, which allows resources up to 10 minutes to respond to a control signal, ratepayers bought 2.86 times more regulation on a per capita of average system load basis. This data demonstrates the dramatic difference in total regulation that can be procured if ISOs dispatch, and furthermore compensate, resources based on their ramping ability.

Figure 5¹¹

2010 Status	ISO-NE	MISO	PJM	NYISO	CAISO	ERCOT
Dispatch prioritized based on Ramp Rate	✓	✓	N	N	N	N
Pay-for-Performance	✓	N	N	N	N	N
Maximum Allowable Response time (minutes)	5 min	5 min	5 min	5 min	10 min	10 min
Regulation Procurement (as % of Avg. Load)	0.47%	0.58%	1.07%	1.17%	1.36%	1.88%
Regulation Procurement vs. ISO-NE	100% (baseline)	122%	225%	246%	286%	396%

¹⁰ In May 2009, FERC approved NYISO's tariff that integrated Limited Energy Storage Resources ("LESRs") into the regulation market and established that fast-response LESRs would be given priority in the dispatch to correct ACE deviations first. However, in 2010 no LESRs were operating in the region and thus all providers were dispatched using the pro-rata method. In 2009, PJM began giving a fast signal to a 1 MW energy storage resource on its system however, all other resources (approximately 799 MWs) are dispatched on a pro-rata basis.

¹¹ Load data collected from each individual ISO and aggregated by Ventyx in their Velocity Suite. Regulation procurement data obtained from each ISO's monthly reports.

b. *Using Fast Responding Resources Has the Potential to Reduce the Cost of Energy.*

Using new fast-ramping storage resources to provide Regulation has the potential to reduce the cost of energy being generated. Existing fossil fuel-powered plants that are displaced by storage-based frequency regulation can be shifted to provide a corresponding amount of energy capacity. In doing so, these facilities are available to run at full capacity and at a steady state which will improve their heat rate and reduce the wear and tear on their equipment, thereby lowering their cost to operate. As shown in Figure 3 (above), 300 MW of gas turbine capacity will be shifted to the energy market for each 20 MW of energy storage resources that participate in the regulation market.

ESA agrees with FERC's premise that this should enable generators to offer lower energy bids into the energy market and therefore lower the cost of energy for ratepayers.

c. *Using Fast-ramping resources provides reliability and environmental benefits.*

The North American Electric Reliability Corporation ("NERC") estimates that 145,000 MW of wind generation will be added to the grid over the next 10 years. The resultant increase in supply variability will require increased system flexibility to support the greater differentials between load and available supply.¹² NYISO's Integration of Wind into System Dispatch paper dated October 2008 notes that "wind plants may create a significant demand for increased regulation and reserves, thus making it imperative to look for new sources and new technologies for these services."¹³ The CAISO 20% Renewable Portfolio Standard ("RPS") study identified a need for additional regulation, as well, for example in the summer season when the total simulated requirement of

¹² Rick Sergel, President and CEO, North American Electric Reliability Corporation, Executive Remarks, FERC Technical Conference on Integrating Renewable Resources into the Wholesale Electric Grid, March 2, 2009.

¹³ Integration of Wind into System Dispatch, A New York ISO White Paper, October 2008.

Regulation Up in 2012 is 37% greater than 2006 levels and Regulation Down in 2012 is 11% greater than 2006 levels.¹⁴ Because of their capability to provide more ACE connection per MW of capacity supplied, using new fast response regulation technologies should insulate ratepayers from the projected additional regulation required in order to manage more renewable generators integrating onto the system.

Furthermore, their greater speed and accuracy of response provides more value to the electric system through improved flexibility to respond to variability on the system. As FERC stated in its Order approving NYISO's tariff revisions to integrate Limited Energy Storage Resources ("LESRs") onto the grid, FERC found that (1) LESRs have unique operational characteristics that enable very fast responses needed for regulation and (2) adding LESRs will enhance operational control of New York's wind resources' output changes. "We recognize that these LESRs can assist in the effective integration of wind resources into the New York control area. Further, the integration of LESRs in the regulation service market should improve the NYISO's control performance and assist it in meeting or exceeding NERC control performance criteria."¹⁵ LESRs in reacting nearly instantaneously to the NYISO's direction are well suited to assist in the management of the frequency and unpredictable changes in wind output.

In addition, unlike generators that experience higher rates of fuel consumption and air pollutant emissions when they provide regulation service, storage resources recycle existing power without burning fossil fuel or producing any air emissions,

¹⁴ CAISO study on "Integration of Renewable Resources: Operational Requirements and Generation Fleet Capability at 20% RPS", pg 52, table 3.3 at: <http://www.aiso.com/2804/2804d036401f0.pdf>

¹⁵ See New York Independent System Operator, Inc., 127 FERC 61,135 at P19-20.

thereby lowering total system operating costs and air pollutant emissions.¹⁶ KEMA notes that continued reliance on thermal generating units to meet increased regulation requirements could actually increase emissions of CO₂, NO_x and other pollutants, thereby defeating one of the main benefits of wind generation.

Similarly, a study by Carnegie Mellon in October 2008 estimates that 20% of the CO₂ emission reduction and up to 100% of the NO_x emission reduction expected from introducing wind and solar power will be lost because of the extra ramping requirements they impose on traditional generation.¹⁷

NERC has also identified reliability concerns due to the declining frequency responsiveness of the US interconnections.¹⁸ In December 2010, Lawrence Berkeley National Laboratory (“LBNL”) published a paper sponsored by the FERC to determine metrics regarding the measurement of frequency responsiveness¹⁹ wherein it states that if the amount of regulation procured is inadequate and cannot fully address deviations in frequency, then primary frequency control reserves available from other on-line sources (*i.e.*, spinning reserves and other on-line reserves) will also be used (automatically) to control frequency. When this happens, the reserves of primary frequency control available to provide additional primary frequency control actions will be reduced. This creates a reliability risk because primary frequency control reserves may be exhausted or depleted to the point where they are no longer capable of arresting declining frequency following the sudden loss of generation. The paper states further that this interaction

¹⁶ KEMA, Emissions Comparison for a 20MW Flywheel-based Frequency Regulation Power Plant, May 18, 2007.

¹⁷ Katzenstein, W., and Jay Apt. Air Emissions Due To Wind And Solar Power. *Environmental Science & Technology*. 2009, 43, 253-258. <http://pubs.acs.org/doi/pdf/10.1021/es801437t>

¹⁸ NERC 2010 Long Term Reliability Assessment, at: <http://www.nerc.com/files/2010%20LTRA.pdf>

¹⁹ Eto, Joseph H. et al. “Use of Frequency Response Metrics to Assess the Planning and Operating Requirements for Reliable Integration of Variable Renewable Generation.” Lawrence Berkeley National Laboratory. LBNL-4142E. December 2010. <http://certs.lbl.gov/pdf/lbnl-4142e.pdf>

between primary and secondary frequency control reserves during normal operations will emerge as an important aspect of the reliability impacts of variable renewable generation. In order to address these reliability concerns, LBNL recommends to expand the frequency control capability of the ISO/RTO interconnections using advanced technologies, such as energy storage.

Accordingly, there are significant economic, reliability enhancement and environmental benefits of using fast-ramping technologies to provide frequency regulation, including reductions in regulation procurement requirements, reduced costs to ratepayers, improved ability to maintain reliability and reductions in overall emissions on the grid.

The ESA appreciates FERC's efforts to eliminate the unduly discriminatory pricing structures that exists today in the ISO/RTO Regulation markets that are serving as a market barrier to the participation of advanced fast-ramping storage and respectfully request that the Commission expeditiously implement a final rule in this proceeding that will mandate a two-part compensation scheme with a payment for capacity *and* performance. Implementation of a compensation mechanism that values the benefits of a resource's capability to quickly and accurately respond to a regulation control signal will send the right price signals to encourage fast accurate regulation technologies, such as flywheels and batteries, to provide Regulation service and will ensure grid reliability is maintained efficiently and in a cost effective manner. To attract investment in these new fast response technologies, the market must place a monetary value on the greater performance that the resources can provide to the grid in response to a regulation signal.

Without such a price signal, the market will lack the incentives necessary to attract investors to finance these new technologies.

B. The Proposed Compensation Mechanism

The ESA applauds FERC’s proposal to compensate regulation resources with a two-part compensation mechanism: (1) a uniform capacity payment that includes the opportunity cost of marginal regulating resource for the amount of megawatts that a resource makes available to provide Regulation; and (2) a performance payment based on the amount of up and down movement, in megawatts, the resource provides in response to a control signal. Paying resources based on these two components will ensure that resources are just and reasonably compensated for the value they provide to the grid in correcting the ACE and will remedy the undue discrimination that exists today in the way that the organized wholesale power markets compensate frequency regulation resources.

1. Opportunity Costs: Inclusion in Uniform Capacity Payment

a. Commission Request

The Commission proposes to require that each regulating resource is paid a uniform capacity payment that includes the opportunity cost of the marginal regulating resource²⁰ and preliminarily finds that cross-product opportunity costs²¹ should be calculated by the RTO or ISO and, where appropriate, indicates that resources should be permitted to include inter-temporal opportunity costs in their capacity bid²². In the NOPR, the Commission seeks comment on its proposal to require each regulating resource to be paid a uniform capacity payment that includes the opportunity cost of the marginal regulating resource.”²³

²⁰ *Id.* at P35.

²¹ A cross-product opportunity cost, in this case, is the revenue a regulation provider loses because it is on stand-by to provide regulation and is not providing energy.

²² An inter-temporal opportunity cost represents the foregone value when a resource must operate at one time, and therefore must either forego a profit from selling energy at a later time or incur costs due to consuming at a later time. The trade-off presented to thermal storage provides an example of inter-temporal opportunity costs. A thermal storage operator would prefer to “charge” (heat bricks or freeze water) when prices are low. If such a resource were to provide frequency regulation, it could be asked to stop charging during low price periods and then be forced to charge during high price periods.

²³ *NOPR* at P 36.

b. ESA Response

By paying a uniform capacity payment based on the total marginal costs, including opportunity costs, of the marginal cleared unit, FERC will send the strongest price signal to low cost resources and create market efficiencies that will benefit ratepayers.

ESA agrees with FERC that the capacity payment should be based on the true marginal unit's costs including its opportunity cost ("OC"). A large part of a traditional resource's cost to provide regulation is the lost opportunity cost for not using the capacity to sell a different product, such as energy. Many new advanced storage technologies are designed to provide Regulation and not sustained Energy and thus have no opportunity costs. The ISOs that pay unit-specific OC actually send a distorted market signal to lower cost providers because a higher cost resource in total (its bid plus OC) could be selected to provide service in lieu of a lower cost resource. By establishing a uniform capacity payment that includes OC (versus paying OC on a unit-specific basis), FERC will send the strongest price signal to low cost resources, and the grid should experience a reduction in the overall market costs because low cost providers will be encouraged to enter the market. There appears to be widespread agreement among the ISO/RTO regions that the best way to calculate the regulation capacity payment is to pay a uniform price including opportunity cost. NYISO, Midwest ISO and CAISO already do this in their current regulation market compensation structure and PJM has submitted a proposal to FERC that would follow suit. While, PJM attempts to include OC cost in its Regulation Market Clearing Price ("RMCP"), but because of the timing of when it estimates the OC for the RMCP (an hour ahead of the market) it often has significant after-market uplift charges to compensate generators for their actual OC incurred during the hour. PJM submitted to FERC, on June 18, 2010 in Docket No. ER09-1063-004, a

proposal to change how it calculates Regulation prices in order to minimize the resource-specific, opportunity cost uplift payments. Under the proposed tariff, Regulation prices will be calculated every five minutes (as opposed to forecasted one hour in advance), which would likely result in more of opportunity costs being included in the RMCP paid to all resources. As PJM acknowledges in its filing, pricing Regulation service every five minutes will "... help to reduce after-the-fact, non-market changes to Regulation resource compensation, and enhance price signals that will better enable new, innovative resources and technologies to meet the system's Regulation needs"²⁴

In addition, ISO-NE, which pays opportunity costs on a unit-specific basis, has also acknowledged the merits of including opportunity costs in determining the marginal unit's costs in order to set the price paid for regulation capacity. At the technical conference held on May 26, 2010, Jon Lowell, representing ISO-NE, stated that ISO-NE is "heading in that direction."²⁵ And more recently at the November 2010 NEPOOL Markets Committee meeting, ISO-NE stated that a "uniform clearing price provides more efficient long run investment signals".²⁶

A uniform capacity payment that includes OC will remove an economic barrier to entry of new alternative regulation technologies by ensuring the capacity payment reflects the full value of that service. Setting a market formula that consistently results in artificially and inaccurately low clearing prices because they do not include the total cost of reserving regulation capacity is a barrier to the entry of storage technologies. PJM's Market Monitor concurred with this opinion in PJM's *2010 State of the Market* report,

²⁴ See PJM's proposed package of reforms to establish just and reasonable pricing for operative reserve shortages in the PJM Region, Docket No. ER09-1063-004 at 3 (submitted on June 18, 2010).

²⁵ pg. 149, line 15-16 of the technical conference transcript

²⁶ NEPOOL Markets Committee presentation, "Alternative Technology Regulation Pilot Program." November 9, 2010.

which stated that in 2010 “[t]he payment of a large portion of regulation charges on a unit specific basis rather than on the basis of a market clearing price remains a cause for concern as it results in a weakened market price signal to the providers of regulation.”²⁷ Based on our experience, it is difficult to finance projects where the market compensation does not efficiently value the service provided by the resource.

Accordingly, ESA supports FERC’s proposal to require each ISO/RTO to pay a uniform capacity payment that includes the opportunity cost of the marginal regulating resource to all providers of Regulation capacity. ESA agrees that the cross-product opportunity costs should be calculated by the RTO or ISO, as it has the best information to determine a frequency regulation resource’s cross-product opportunity cost for not participating in the energy market. Further, we agree, that where appropriate, resources should be permitted to include inter-temporal opportunity costs in their capacity bid because it reflects the total cost of that resource providing Regulation capacity.

2. Performance Payment

a. Commission Request

*In its NOPR, FERC proposes to require that all regulating resources be paid for their performance, with this payment taking the form of a payment for each MW, up or down, provided by the resource in response to the system operator’s dispatch signal. Specifically, an RTO or ISO would determine the total movement up and down and then multiply the sum by a price-per-MW of ACE Correction. FERC seeks comment on how to design the price-per-MW ACE Correction, whether it should be market-based or administratively set. FERC seeks comment on its proposal and whether there are alternative payments for performance that can alleviate concerns about undue discrimination from the existing payment models.*²⁸

b. ESA’s Response

FERC’s proposed two-part payment structure, that pays regulation resources for their performance, will ensure that the Regulation markets are not unduly

²⁷ Monitoring Analytics, LLC. “2010 State of the Market Report for PJM.” March 10, 2011.

²⁸ NOPR at P 37.

discriminatory because resources will be appropriately compensated commensurate with the value they provide and it will send the right market price signals to lead to less overall regulation costs for consumers. ESA supports a performance payment that takes the form of a payment for each MW, up or down, provided by the resource in response to the system operator's dispatch signal multiplied by a market-based price per MW-movement based on the marginal unit's cost to ramp up and down.

ESA strongly endorses a performance payment for the provision of frequency regulation. The performance payment is necessary to ensure that (1) the ISO/RTO Regulation markets are not unduly discriminatory and instead, compensate resources commensurate with the value they provide and (2) FERC sends efficient market signals for resources to maximize their response to ACE deviations that can lead to overall reductions in the amount of regulation that needs to be procured.

Frequency error is the function of both the amount (in MWs) of imbalance *and* the speed in which the imbalance is corrected. Therefore, it is appropriate to compensate regulation providers based on both the amount of MWs capacity it makes available *and* how quickly it can deliver that capacity in response to an ISO control signal. In fact, to do otherwise (*i.e.*, only compensate resources based on the MWs it makes "on call") is unjust, unreasonable and unduly discriminatory because it results in compensation not being tied to the amount service provided.

NEED FOR REFORM

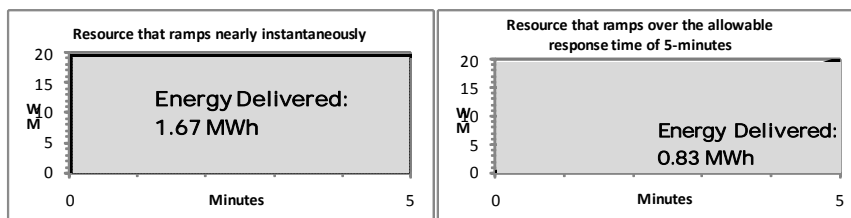
1. Performance Payment Remedies Discriminatory Pricing in the Regulation Markets

As discussed above, because of their fast and accurate response, energy storage technologies provide a greater amount of ACE correction per MW of Regulation capacity than slower ramping resources.²⁹ Yet, the additional value provided by faster ramping

²⁹ For example, a resource that responds instantaneously with their full output provides twice the amount of energy over 5 minutes than a resource that takes the allowable 5 minutes to respond.

resources is not reflected in most ISO/RTO pricing constructs (with ISO-NE the only exception), because today all resources, regardless of how frequently they are deployed or how much of the ACE Correction they provide, are paid the same \$/MW price per MW offered. Pricing is based solely on the amount of MWs a resource offers to be on “standby” to respond to a regulation signal, not on how much the resource is actually deployed to provide frequency regulation. Thus, the compensation mechanism employed by most ISOs/RTOs is unjust and unreasonable because fast-responding and slower-responding resources are paid the same price per MW even though the fast-responding resource is providing more ACE Correction. Simply stated, the manner in which the majority of ISOs/RTOs pay for regulation is discriminatory against fast-ramping energy storage regulation resources.

ESA’s operating experience in the NYISO provides a clear example of how a market compensation scheme that bases Regulation compensation solely on the capacity offered to be available and not on how much the resource is actually deployed is unduly discriminatory.³⁰



³⁰ Beacon Power began operation of its Stephentown flywheel energy storage plant on January 19, 2011. Beacon’s flywheel plant is defined by NYISO as a Limited Energy Storage Resource (“LESR”) which is “A Generator authorized to offer Regulation Service only and characterized by limited Energy storage, that is, the inability to sustain continuous operation at maximum Energy withdrawal or maximum Energy injection for a minimum period of one hour. LESRs must bid as IDO-Committed Flexible Resources.” NYISO, Market Services Tariff, Section 2.12, Document Generated on: 4/15/2011, http://www.nyiso.com/public/webdocs/documents/tariffs/marketing_servcies/services_tariff.pdf.

In its filing letter to FERC for its Proposed Tariff Revisions to Integrate Energy Storage Devices into the NYISO-Administered Regulation Service Market,³¹ NYISO states that “LESRs can provide benefits to both NYISO operations and the market and are especially well suited to provide Regulation Service in the Ancillary Services market.”

NYISO goes on to list several benefits of LESRs:

- LESRs, in reacting almost instantaneously to the NYISO's direction, are well suited to assist in the management of the unpredictable minute by minute changes in wind output when such changes result in control errors.
- The integration of LESRs in the Regulation Service market should improve the NYISO's control performance and assist it in meeting or exceeding NERC control performance criteria.
- LESRs can reduce the cost of Regulation Service by introducing new competition to that market and by displacing relatively high cost regulation deployments by traditional generator-based regulation providers.

To take advantage of the benefits of LESR's superior speed and accuracy, NYISO utilizes LESRs as “first responders” to ACE Correction, meaning NYISO selects LESRs first to respond with their full MW-capacity within one 6-second AGC cycle, resulting in LESRs being deployed disproportionately more to correct ACE than other resources.³² Yet the NYISO fails to compensate LESRs commensurate with the amount of service it was dispatched to provide. For example, on February 17, 2011, at hour beginning 8, Beacon's flywheel regulation plant supplied 9 MW of Regulation capacity to the NYISO regulation market, or 3.3% of the total 275 MW of Regulation capacity procured during

³¹ New York Independent System Operator, Inc. FERC filing on “Proposed Tariff Revisions to Integrate Energy Storage Devices into the NYISO-Administered Regulation Service Market.” Docket No. ER09-836.(March 11, 2009).

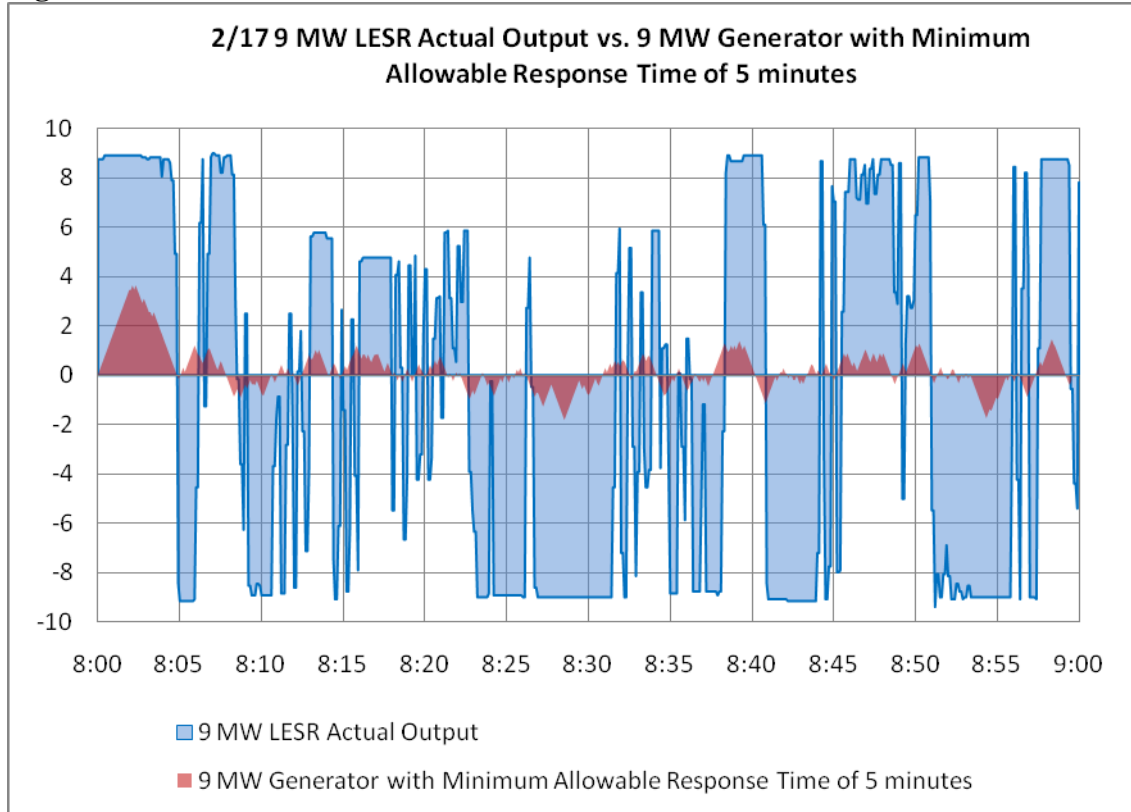
³² NYISO Ancillary Services Manual, Section 4.3.4 Regulation Service. “The AGC function calculates an area control error and allocates this error to selected Regulation Service scheduled by RTD (Real Time Dispatch). LESR devices are selected first and assigned UDGs (Unit Desired Generation) at the maximum values required, up to the regulation limits of the device, to address the regulation error. If additional regulation energy deployments are required, the remaining Regulation Service resources will be assigned the error in proportion to the amount of their Regulation Service capacity scheduled.”

the hour.³³ Based upon data provided by NYISO, during that hour the ACE positive and negative energy was 31.1 MWh (the sum of positive ACE MWh with the absolute value of negative ACE MWh)³⁴ and Beacon's 9 MW flywheel plant was dispatched to provide 7.4 MWh of energy to correct ACE or 23.8% of the total ACE Correction. For the same hour, ESA modeled a slow-ramping generator supplying 9 MW of Regulation capacity with the allowable 5-minute response time following NYISO's pro-rated control signal derived from ACE. Based on its models, the generator would be dispatched to provide 0.59 MWh of energy to correct ACE correction, or just 1.9% of the total ACE Correction needed. (See Figure 6).

³³ NYISO Regulation Requirements, http://www.nyiso.com/public/webdocs/market_data/reports_info/nyiso_regulation_req.pdf, Accessed 4/29/11.

³⁴ ACE data provided by NYISO Customer Relations on 3/4/2011.

Figure 6



In this hour the fast-ramping flywheel was dispatched to provide 12.5 times the ACE Correction as a slow-ramping resource, yet under the existing NYISO tariff the flywheel was actually paid *less* than the slow-ramping generator.³⁵ Because the NYISO may reduce the real-time capacity it dispatches an LESR to provide in order to account for the amount of energy stored in the device, the flywheel was only paid for 92% of its 9 MW capacity in this hour or \$15.64/MW whereas the generator was paid the full \$17.00/MW. The 9 MW flywheel storage plant was paid a total of \$140.76 for its Regulation service versus the slow-ramping generator that provided 9 MW of Regulation would have been compensated \$153 for the hour. Given that the fast-ramping flywheel plant was specifically deployed to provide a significantly greater amount of ACE

³⁵ NYISO Tariff, Section 15.3.2.1 (d), Regulation Service Offers from Limited Energy Storage Resources. “The ISO may reduce the real-time Regulation Service offer (in MWs) from a Limited Energy Storage Resource to account for the Energy storage capacity of such Resource.”

Correction, it is discriminatory (and frankly, inconceivable) that the flywheel was paid less than the slow-ramping generator ramping.

Another example of the discriminatory pricing is in the Midwest ISO region. The Midwest ISO recognizes the value of using faster resources to correct ACE deviations and has, since the start of its Ancillary Services Market in 2009, prioritized the dispatch of their regulation resources based on their ramp-rate capabilities. As Mr. Ramey, stated at the May 26, 2010 Technical Session, “[Resources that have a higher ramp capability] will over time be asked to provide more regulation service in deployment than a slower resource.”³⁶ However, the Midwest ISO does not compensate the resources deployed to provide more regulation service any more than the resources who are deployed to provide less service. That is simply unfair and discriminatory.

A performance payment is essential to remedy the current discriminatory pricing in most ISO/RTO markets as it ensures that resource compensation is tied to the amount of service the resource actually provided.

2. A Performance Payment Sends the Correct Market Signals to incent fast-ramping storage resources into the Regulation markets and creates Market Efficiencies that ultimately lower costs to consumers.

By mandating that ISOs/RTOs implement a performance payment for Regulation resources, FERC will ensure that the Regulation market pricing structure is sending the right market signals to encourage all resources to offer faster ramp-rates into the market because (1) faster-ramping resources will be paid for the additional value provided by responding more quickly and accurately to an ISO control signal and (2) resources that offer a greater ramp-rate will be compensated proportionately for the additional cost, if any, they incur for being moved up and down more to respond to ACE deviations than

³⁶ Pg. 81, line 24 to pg. 82, line 14. Technical conference transcript.

slower-ramping resources. Furthermore, a performance payment will encourage continued innovation and investment in fast-ramping regulation technologies, by compensating the additional value it provides. Lastly, a performance payment by encouraging the use of faster-ramping resources for frequency regulation will send the right market signals to improve operational and economic efficiencies and, in turn, lower costs to consumers in the organized markets.

3. Example of the Cost Savings and Market Efficiencies achieved by using a two component compensation mechanism

Market efficiencies can be achieved when resources are compensated for both capacity and performance. This type of compensation will send price signals in the Regulation market that encourages resources to offer in as much ramp-rate as possible and thus be deployed to respond more quickly to correct ACE deviations.

Specifically, the traditional approach to dispatching and compensating Regulation resources is to assume all resources have the same ramp-rate and to pay based on the amount of capacity (*i.e.*, MWs) the resource offers regardless of its response capability. For example, as shown in **Table A** (below), if a grid operator has five 20 MW resources then it will compensate each resource the same (*i.e.*, 20 MW times the Regulation Clearing Price (“RCP”)). Moreover, if each resource is given the same dispatch signal, then each resource will provide the same Regulation Service (miles) to the grid. ISO-NE has found that the average generator provides ten megawatts of Regulation Service (up and down movement in response to a signal) for every megawatt of Regulation Capacity.³⁷ In this example, each 20 MW resource provides 200 MW of Regulation

³⁷ ISO New England, Transmission, Markets and Services Tariff, Section III, Market Rule 1, Section III.3.2.2.(h), Last Revision Date: March, 14 2011. http://www.iso-ne.com/regulatory/tariff/sect_3/mr1_sec_1-12.pdf

Service. The total Regulation Service provided by the five resources is 1000 MW. If the RCP is \$32 the total cost for the Regulation is \$3,200.

Table A

Traditional Regulation Compensation method						
Ramp Rate	Clearing Price (RCP)	Regulation Capacity	Regulation Service	Capacity Payment	Performance Payment	Total Payment
Average	\$32	20 MW	200 MW	\$640	\$0	\$640
Average	\$32	20 MW	200 MW	\$640	\$0	\$640
Fast	\$32	20 MW	200 MW	\$640	\$0	\$640
Slow	\$32	20 MW	200 MW	\$640	\$0	\$640
Slow	\$32	20 MW	200 MW	\$640	\$0	\$640
Total Market	\$32	100 MW	1,000 MW	\$3,200	\$0	\$3,200

If instead the ISO/RTO pays each resource a capacity and performance payment, which will attract the participation of faster ramping resources, the need for the ISO to procure Regulation from slower ramping resources is reduced.

We assume that the clearing price for capacity will likely be lower under a two-component system because resources have another component of revenue, lower cost resources are expected to displace higher cost resources and less overall capacity will need to be procured to provide the same level of Regulation. In **Table B** it is assumed to be \$22/MW. (However, note, that even if capacity prices didn't drop there would still be overall savings.) For the price-per-MW movement used in the performance payment in **Table B** we assumed it to be \$1.00/MW-movement, which is slightly higher than the current \$.80 - .90/MW-movement in ISO-NE today.

Using these assumptions, the average 20 MW resource in this method will provide and be compensated equivalently as shown in **Table B** (*i.e.* \$640 for 200 MW of Regulation Service). A fast responding energy storage resource that provides 3 times more Regulation Service than the average generator (*i.e.*, a total of 600 MW of

Regulation Service) will be compensated for this additional service. In this example, two average speed 20MW resources and one fast responding 20 MW resource provide the same 1000 MW of Regulation Service (MWs of movement to correct ACE) to the grid as did the five 20 MW Resources (*see Table A*).

The example in **Table B** demonstrates that when resources are paid based on both their capacity and performance, the ISO can procure 40% less Regulation Capacity (60 MW vs. 100 MW), yet provide the same Regulation Service (1000 MW) to the grid. Overall the cost of Regulation using the ISO-NE approach is 20% cheaper than that of all other ISOs (*e.g.*, \$2,320 vs. \$3,200). As demonstrated in this example, even though the fast responding resources are paid more, the total cost of Regulation for rate-payers is reduced. Furthermore, the 40 MW of slower ramping resources are freed up to provide energy or other reserves.

Table B

Two-Part Regulation Compensation method – Capacity and Performance							
Ramp Rate	Clearing Price (RCP)	MW-Movement Price	Regulation Capacity	Regulation Service	Capacity Payment	Performance Payment	Total Payment
Average	\$22	\$1.00	20 MW	200 MW	\$440	\$200	\$640
Average	\$22	\$1.00	20 MW	200 MW	\$440	\$200	\$640
Fast	\$22	\$1.00	20 MW	600 MW	\$440	\$600	\$1,040
Slow	\$22	\$1.00	20 MW	0 MW	\$0	\$0	\$0
Slow	\$22	\$1.00	20 MW	0 MW	\$0	\$0	\$0
Total Market	\$22	\$1.00	60 MW	1,000 MW	\$1,320	\$1,000	\$2,320
27% Savings from the Traditional Method (\$2,320 vs. \$3,200) The Same Amount of Regulation Service for Less Money							

MARKET DESIGN RECOMMENDATIONS

ESA supports FERC’s proposal to have the performance payment take the form of a credit for each MW, up or down, provided by the resource in response to the system

operator's dispatch signal. This is a good measurement of each resources relative contribution to ACE Correction and is consistent with industry "best practices" (*i.e.*, the design has already been successfully implemented in ISO-NE).

Basing the performance payment on the sum of the absolute value of a resource's MW movement up or down in response to a regulation signal ensures that the payment received by a resource equates to the regulation value it provided because (1) resources that can move more quickly to their dispatch target in turn provide more energy to correct ACE, (2) resources that reach their dispatch target faster will be ready for re-dispatch more often thereby ready to provide further ACE correction, and (3) faster-ramping resources are more capable at switching directions when ACE reverses direction and thus can provide regulation less often in a direction that is counterproductive to the needs of the grid. Furthermore, such a performance payment mechanism will incent resources to offer as much ramp-rate capability as possible because the resource will be compensated for the additional movement (and additional costs it incurs) to provide a superior service.

ESA recommends that each resource bid in a price-per-MW movement, as this aligns with the fact that the payment is based on total MW movement. (Another alternative is to calculate the performance payment based on the total amount of MWh ACE Correction and have resources bid in a price-per-MW ACE Correction). The importance is that the bidding parameters match the way payments are ultimately calculated to aid resources in determining their bidding strategy.

Additionally, ESA recommends that the price paid for performance be market-based. Market-based pricing will encourage resources with the lowest costs to provide regulation movement (ramp-rate) to enter the market and ensure that rate-payers get the

benefit of new low-cost resources competing in the market. While, each ISO could administratively set a fixed price-per-MW movement, this will likely delay the implementation of a performance payment due to the potential difficulty in getting agreement among stakeholders on a specific rate and it is important to remedy the existing discriminatory pricing in a timely manner.

1. Bid Parameters

ESA supports FERC's proposal to mandate a two-part bid structure to select and pay resources to provide Regulation, as follows:

- 1) Capacity: The amount of Capacity (MW) it is offering to be available and a price MW capacity (\$/MW). [In addition, the ISO would calculate the resource's lost opportunity cost to include in determining the marginal resource's total cost.]
- 2) Performance: The Ramp Rate in MW/min and a price for each MW of movement (\$/MW-movement)

A two-part bid makes sense given that the underlying costs for making capacity available to provide frequency regulation are different from the cost of being deployed up and down in response to a regulation signal. The cost of making capacity available is primarily tied to the lost opportunity cost of not utilizing the capacity for a different product and the additional fuel cost of operating the unit at a lower operating set-point. The cost for ramping up and down in response to an ISO/RTO control signal is the increased fuel costs of operating in a non-steady state condition, the increased costs of operations and maintenance due to additional 'wear and tear' on the equipment, and potentially the cost of decreased cycle life.

Using each resources bid-in ramp-rate and total capacity offered, the ISO can reasonably determine, based on its dispatch method, how much movement each resource would be able to provide relative to its capacity offered. For example, it could determine that a 20 MW resource bidding at a 4 MW/min ramp-rate could provide 200 MW of movement for the hour, as compared to a 20 MW resource bidding a 300 MW/min ramp rate could provide 900 MW of movement for the hour. Therefore, a two-part bid structure will allow the ISO/RTO to evaluate the additional value that a faster-ramping resource can provide versus a slower-ramping resource per amount of capacity offered and use this information in their selection algorithm to determine the least-cost set of resources to provide Regulation.

This method of bidding, selecting and compensating resources will ensure that the ISO is able to select the least-cost set of resources to provide regulation and send the right market signals for resources to offer as much capacity and ramp-rate as possible. Since frequency is a function of both the amount of MWs of imbalance there is on the grid *and* the speed in which the imbalance is corrected, it is appropriate to select and compensate regulation providers based on both the amount of MWs capacity it makes available *and* how quickly it can deliver that capacity in response to an ISO control signal.

Additionally, FERC should also allow ISO/RTOs the flexibility to utilize a single bid to set the price for both the capacity and performance payment, as is done in ISO-NE today, as long as the ISO/RTO can demonstrate, as ISO-NE has done, that its performance payment will result in paying resources commensurate with the service they provide.

ISO-NE already has a performance payment mechanism in place today that pays resources based on the amount of MW movement, up and down, each resource provides in response to control signal. However, ISO-NE uses a single bid approach (\$/MW) to set the clearing-price for both the capacity and performance payment. The Regulation performance credit is the product of \$/MW clearing price multiplied by the unit's Regulation Service Megawatts (the sum of the absolute value of up and down movement in response to the ISO's control signal) multiplied by the Capacity-to-Service Ratio set at 0.1 (a value calculated by the ISO to based on their finding that the average regulation resource in their market provides 10 MW of movement per 1 MW of capacity).³⁸ This ensures that a resource that is dispatched to provide an average amount of Regulation movement in the market will have a 50/50 split between their capacity and performance payment and a resource that is dispatched to provide more work (MW-movement) will be paid more than average and a resource that is dispatched to provide less work (MW-movement) will be paid less than the average resource. Therefore, a resource that does more movement to correct ACE gets paid more.

While the design of the ISO-NE Regulation market does not enable the ISO to optimize in real-time between the amount of capacity to procure and amount of performance to select the least cost portfolio of resources like a two-bid market would enable, it clearly sends the right market signals for resources to bid-in as high a ramp-rate as possible because if resources are deployed more to provide regulation they will be compensated for it. Over time ISO-NE has been able to administratively lower its average regulation capacity procurement as a % of average system load, i.e. in 2008 ISO-

³⁸ ISO New England, Transmission, Markets and Services Tariff, Section III, Market rule 1, Section III.3.2.2.(h), Last Revision Date: March 14, 2011, http://www.iso-ne.com/regulatory/tariff/sect_3/mrl_sec_1-12.pdf.

NE procured 120 MW of Regulation capacity (0.8% of load), in 2009 ISO-NE procured 94 MW of Regulation capacity (0.66% of load) and in 2010 ISO-NE procured 70 MW of Regulation capacity (0.47% of load). Moreover, in all three years, ISO-NE procured the least amount of Regulation per capita of average system load than all other ISOs, as seen in Figure 5 above. Compensating resources to ramp quickly to correct ACE deviations will result in grid operators needing to procure less total Regulation which in turn results in lower market costs for ratepayers. Therefore, the relatively simpler methodology used in ISO-NE that uses a single market-based clearing price for capacity and performance along with an administratively determined capacity-to-service ratio is another methodology to pay-for-performance.³⁹

Accordingly, given that new fast-response storage technologies are providing service today, ESA recommends FERC direct each ISO/RTO to immediately implement a performance payment compensation mechanism such that resources are paid proportionally for the amount of work they are dispatched to provide to correct the ACE, in order to eliminate the discriminatory pricing practices that exist in the ISO/RTO Frequency Regulation markets today and send the market signals to encourage resources to offer as much ramp-rate capability as possible (as well as capacity).

Existing ISO-NE Co-Optimization Algorithms: Compatibility with FERC's Proposal

1. Commission Request

In its NOPR, FERC stated that commenters stressed the importance of the ISO's and RTO's energy and ancillary service co-optimization algorithms in producing

³⁹ However, as noted in our comments on the Capacity payment, we strongly recommend that ISO-NE change its capacity payment to include the marginal resource's opportunity cost.

*the least-cost portfolio of resources. FERC therefore seeks comments on how this proposal will integrate with the ISO's and RTO's existing co-optimization algorithms.*⁴⁰

2. ESA Response

It is imperative for the viability of the energy storage market that new rules be implemented imminently. Given the importance of ensuring that a payment mechanism is implemented imminently that eliminates the undue discrimination that exists under the current payment mechanisms implemented in most ISOs/RTOs, FERC should ensure that the process is not delayed by computer software issues.

ESA appreciates that FERC has issued this NOPR, which will send appropriate market signals to investors who are looking to fund fast-ramping storage facilities that are designed to provide dedicated regulation service. As the ESA noted in its letter to FERC dated January 14, 2011, it is imperative that steps be taken expeditiously to compensate appropriately the superior value provided by fast-responding and accurate resources, especially as storage projects with these characteristics are being commercially developed specifically to provide regulation in the organized markets. Not implementing such a compensation mechanism that pays resources based on the performance provided to the grid will jeopardize the viability of existing and planned energy storage projects.⁴¹

To date, no documentation has been provided that would suggest any reason why FERC's proposal could not be integrated into the ISO/RTO existing co-optimization algorithms. As noted above, ISO-NE already has a proven methodology to compensate resources based on both capacity and performance. Therefore, while ESA acknowledges that there may need to be some flexibility given to each ISO/RTO in how to implement a performance payment within their existing market operations systems, FERC must insist that ISO/RTOs immediately begin to pay resources based on both on a uniform capacity payment (including OC) and a performance payment in order to eliminate the current

⁴⁰ NOPR at 38.

⁴¹ Letter from Electricity Storage Association to the Commission dated January 14, 2011 at 2.

undue discrimination that exists in ISO/RTO Regulation markets. Delaying the implementation of pay-for-performance would send inappropriate signals to potential investors in energy storage technologies that could ultimately be catastrophic to the industry.

C. **Regulating in the Wrong Direction at Any Given Time: Desired Effect on Compensation**

1. Commission Request

FERC seeks comments on alternative methods, including methods to incorporate accuracy into the ACE correction calculation. The Commission seeks comments on how to structure payments for frequency regulation that compensate a resource for its contribution to ACE correction. As such, FERC seeks comments on whether this method could result in a resource being penalized through lower measured ACE correction even when it is following the system operator’s dispatch signal”).

2. ESA Response

FERC should implement a performance payment with an accuracy performance metric that measures how well a resource is hitting its dispatch signal within a tolerance band. This is similar to the performance index used successfully in other ISOs.

Incorporating an accuracy metric into the performance payment that measures how well a resource is hitting its dispatch signal within a tolerance band will encourage resources to accurately respond to the control signal sent by the ISO and ensuring that the performance payment is truly tied to the resources actual service provided. If a resource is determined by the accuracy metric to not be following its signal, the ISO would rescind a portion of the performance payment received by that resource. A good example of an accuracy metric is NYISO’s performance index⁴² which tracks how well a regulation supplier responds to the system operators dispatch signals every 30-seconds and then calculates a percentage accuracy every 5 minutes which is applied to the resources

⁴² New York Independent System Operator Accounting and Billing Manual , Manual 14, Revision Date 12/17/2010, Version 2.0, <http://www.nyiso.com/public/webdocs/documents/manuals/administrative/acctbillmnl.pdf>

Regulation compensation. The performance index is designed such that resources performing at greater than 90% of their expected response will not receive an accuracy adjustment less than 100%. However, the 30-second snapshot of accuracy is too slow to capture the accuracy of a fast-ramping LESR that can dramatically change its output each 6-second AGC cycle. Therefore, any accuracy metric must be capable of measuring performance each AGC dispatch cycle and must account for any latency in the ISO's dispatch software.

Furthermore, it is important to note, that compensating a resource for accuracy alone is not sufficient to send efficient price signals to fast and accurate resources since it fails to value the greater amount of ACE Correction that can be provided by a faster-ramping resource than a slow-ramping resource. Slow resources that respond accurately to slow signals are not as valuable to the grid as are fast resources that respond accurately to fast signals. For example, as shown in Figure 5, above, both the fast-ramping LESR and slow-ramping generator are both following accurately the dispatch signal being sent by the NYISO, however the fast-ramping LESR is providing a far greater (12 times) amount of regulation service (*i.e.*, ACE Correction, to the grid). Therefore, ESA recommends an accuracy metric be coupled with FERC's proposed performance payment, which pays resources based on their total MW movement, not in lieu of the performance payment. This will ensure that compensation for all resources is tied to how well it actually responded to the ISO's control signal while ensuring that an accurate fast resource is appropriately being paid more than an accurate slow resource. In response to the Commission's inquiry about whether a resource should be compensated for performance when it is moving in a direction that is against ACE, the ESA recommends

subtracting from the sum of the resources total MW sum of up and down movement any MW movement that is not in the direction of correcting ACE. While this could result in a resource receiving a lower measured ACE correction, even when it is following the system operator's dispatch signal, such a result is appropriate given that the movement was not contributing to correcting the ACE. This further aligns the payment a resource receives with the value it provides to the grid. However, ESA notes that existence of a reward or penalty for ACE correction should not change the requirement for a resource to follow the operator's dispatch instructions.

D. Net Energy Payments: Whether They are Redundant in Light of the Performance Payment

1. Commission Request

The Commission seeks comment on the appropriateness of retaining net energy payments in light of the two-part payment proposed here. Specifically, the Commission seeks comment on whether the provisions in existing tariffs for net energy payments are redundant given the proposed requirement discussed herein that all RTOs and ISOs must pay regulating resources a performance payment for the ACE correction they provide, or whether this payment is a necessary, appropriate feature of day-ahead and real-time energy account balancing and settlement.⁴³ (P 41)

2. ESA Response

Hourly Net-Energy Payments and Performance Payments are not redundant. In fact, both types of Payments are needed to ensure appropriate compensation of Regulation providers.

With regards to the redundancy of hourly net-energy payments with performance payments, our opinion is that both types of payments are necessary components of the appropriate compensation structure for regulation resources. Resources should be paid for both their capacity and performance in the Regulation market (using the market design approach recommended above) *and* should either be paid or pay for the Energy it

⁴³ NOPR at P 41.

injects or withdraws on the system or pay for the Energy withdrawn at the wholesale LMP. Regulation is a separate market product from Energy.

Energy storage resources provide Regulation Service by injecting or withdrawing energy on the grid. Therefore, all regulation resources should either be paid or pay for the energy it injects or withdraws. For example, net energy sales or purchases for the purpose of maintaining state of charge should be settled in the appropriate energy market.

Energy settlements also provides desirable incentives for efficiency – a storage device with low conversion losses would pay less for net energy than a device with high losses. Therefore, ESA recommends maintaining separate Energy settlements and Regulation payments.

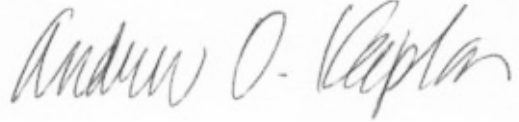
IV. CONCLUSION

As detailed herein, the ESA is pleased to support FERC's proposal and respectfully requests that the Commission issue an Order imminently that directs ISOs/RTOs to submit tariffs designed to "pay-for-performance" by mandating the implementation of a compensation mechanism that values the benefits of a resource's capability to quickly and accurately respond to a regulation control signal. Doing so would ensure that regulation resources are paid justly and reasonably for the value of the service they provide and send the appropriate market signals to ensure the continued financing of existing facilities and the investment in new energy storage plants.

Respectfully submitted,

THE ELECTRICITY ASSOCIATION

By its attorney,

A handwritten signature in black ink that reads "Andrew O. Kaplan". The signature is written in a cursive style and is positioned above a horizontal line.

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Dated: May 2, 2011

CERTIFICATE OF SERVICE

I, Patricia A. Muse, certify that I have on this 2nd day of May 2011, served a copy of the foregoing “**COMMENTS OF THE ELECTRICITY STORAGE ASSOCIATION**” on the service list for RM 11-7/AD 10-11 to all known parties listed on the most recently updated service list available.

Executed this 2nd day of May 2011 in Boston, Massachusetts.



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