UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Frequency Regulation Compensation in the Organized Wholesale Power Markets	Docket Nos. RM11-7-000 AD10-11-000

MOTION TO INTERVENE AND COMMENTS OF THE CALIFORNIA ENERGY STORAGE ALLIANCE

The California Energy Storage Alliance ("CESA")[1] hereby respectfully submits these comments in response to the *Notice of Proposed Rulemaking on Frequency Regulation in the Organized Wholesale Power Markets* issued in this docket on February 17, 2011 ("Frequency Regulation NOPR"). CESA appreciates the opportunity to comment in this important proceeding, and emphasize the key role energy storage technology will play in advancing performance payment for the provision of frequency regulation service.

I. BACKGROUND.

CESA is an industry group advocating for the rapid expansion of use of energy storage, in all of its many forms, to promote growth of renewable energy and a clean, affordable, and reliable and secure electric system. CESA is technology-neutral and supportive of all business models for deployment of energy storage. CESA's member companies include a diverse range of advanced energy storage technology and manufacturing companies, systems integrators, and renewable energy developers.

II. COMMUNICATIONS AND CORRESPONDENCE.

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[1] CESA's member companies are listed at Section 3 below. http://www.storagealliance.org.

III. CESA'S MOTION TO INTERVENE IN THE ABOVE-CAPTIONED PROCEEDING

CESA is an unincorporated association, the membership of which consists of A123 Systems, Altairnano, Applied Intellectual Capital/East Penn Manufacturing Co., Inc., Beacon Power Corporation, CALMAC, Chevron Energy Solutions, Debenham Energy, Deeya Energy, Enersys, EnerVault, Exide Technologies, Fluidic Energy, General Compression, Greensmith Energy Management Systems, HDR, Inc., Ice Energy, International Battery, Inc., LightSail Energy, Inc., MEMC/SunEdison, Powergetics, Primus Power, Prudent Energy, RedFlow, RES Americas, Saft America, Inc., Samsung SDI, SANYO, Seeo, Sharp Labs of America, Silent Power, Sumitomo Electric, Suntech, SunPower, Sunverge, SustainX, Xtreme Power, and Younicos. .[2] CESA's intervention in this proceeding is in the public interest, and CESA's interests will not be adequately represented by any other party. CESA therefore respectfully requests that this motion to intervene be granted.

IV. COMMENTS.

CESA strongly supports the FERC's proposal to require a uniform price for regulation capacity paid to all cleared resources, including energy storage, and a performance payment for the provision of frequency regulation, with such payment reflecting a resource's accuracy of performance.[3] The time is right, because the following energy storage resources - the tip of the iceberg - are already participating in today's wholesale generation markets:

[2] The views expressed in this motion to intervene and comments are those of CESA, and do not necessarily reflect the views of all of the individual CESA's member companies.

[3] CESA generally concurs with the substance of the comments filed by Electricity Storage Association on this date.

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

CESA's comments are set forth below in the form of responses to the specific requests made by the FERC.

A. Faster-Ramping Resources and Potential for Market Efficiencies.

FERC's Request

What are the benefits that faster-ramping resources, no matter their exact type, can and do bring to the RTO and ISO markets and what are the drawbacks of using faster ramping resources for regulation, if any?[4]

CESA's Response

Using fast-ramping resources to provide regulation service in the ISO/RTO markets will yield lower costs for consumers, increase flexibility to maintain reliability, and deliver environmental benefits.

a. *Cost to Consumers will be lower because less regulation will be needed.*

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

[4] Frequency Regulation NOPR, at P 33.

organized wholesale energy markets.[5] Specifically, the amount of correction to Area Control Error ("ACE") that can be provided by fast regulation resources is much greater per MW of procured capacity than would be provided by slower ramping resources.

The premise that dispatching faster responding resources will reduce system operator costs to procure regulation was the subject of a June 2008 paper issued by the Pacific Northwest National Laboratory ("PNNL") entitled, *Assessing the Value of Regulation Resources Based on Their Time Response Characteristics*.[6] 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 resources and concluded that fast-responding regulation resources could be as much as 17 times more effective than conventional ramp limited regulation resources due to how quickly and accurately it responds to a system imbalance. In its study, which was conducted using data from the California Independent System Operator ("CAISO"), PNNL concluded that the CAISO could reduce its regulation procurement by as much as 40 % if it dispatched fast-responding regulation resources. A recent California Energy Commission study further supports these findings, concluding that "on an incremental basis, storage can be up to two to three times as effective as adding a combustion turbine to the system for regulation purposes."[7]

b. *Using Fast-Responding Resources Has the Potential to Reduce the Cost of Generating Electricity.*

Gas turbines are the fastest source of conventional regulation capacity reserve at 20% ramp rate per minute and typically can use about 20% of their total capacity for regulation.

Energy 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 in thirty seconds, whereas a 20 MW energy storage resource

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[5] *Id.* at P 2.

[6] 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.

[7] "*Research Evaluation of Wind Generation, Solar Generation, and Storage Impact on the California Grid*," Study by KEMA, Inc., prepared for the California Energy Commission, June 2010.

can provide all 20 MW of its capacity up or down within four seconds. 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 300 MW for regulation if they could all ramp at the same time.

Using new fast-ramping energy storage resources to provide regulation has the potential to reduce the cost of electricity being generated. Existing fossil fuel-powered plants that are displaced by energy 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, which will improve their heat rate efficiency and reduce wear and tear on their equipment. This should enable generators to offer lower energy bids and therefore lower the cost of energy for ratepayers.

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

Using energy storage regulation technologies should insulate ratepayers from the projected additional regulation required in order to manage more variable energy resources ("VERs") on the electric system due to their capability to provide more regulation value per MW offered. Their greater speed and accuracy of response provides more value to the electric system through improved flexibility to respond to variability.

Unlike generators that consume fossil fuel, energy storage resources recycle existing power, thereby lowering operating costs to provide regulation and benefiting the environment by producing zero direct CO2 greenhouse gas, particulates or other air emissions.[8] A study by KEMA concluded that a 20MW Storage System emits 56% less CO2 than a natural gas power plant providing regulation and 26% less emissions than a pumped hydro power plant.[9] KEMA notes that continued reliance on thermal generating units to meet increased regulation requirements could actually increase emissions of CO2, NOX and other pollutants, thereby defeating one of the main benefits of wind generation.[10] A study by Carnegie Mellon in October 2008 reached similar conclusions, estimating that 20% of the CO2 emission reduction and up

[8] Some emissions occur indirectly, because some electricity from the grid must be used to compensate for energy losses during operation.

[9] KEMA, *Emissions Comparison for a 20MW Flywheel-based Frequency Regulation Power Plant*, May 18, 2007.

[10] *Integration of Wind into System Dispatch*, A New York ISO White Paper, October 2008.

100% of the NOx emission reduction expected from introducing wind and solar power will be lost because of the extra ramping requirements they impose on traditional generation.[11]

In December 2010, Lawrence Berkeley National Laboratory ("LBNL") published a paper sponsored by the FERC to determine metrics regarding the measurement of frequency response[12] in which 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 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 a sudden loss of generation. The paper states further that this interaction 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 that the frequency control capability of the ISO/RTO interconnections should be expanded by using advanced technologies, such as energy storage.

B. Inclusion of Opportunity Costs in Uniform Capacity Payments.

FERC's Request

FERC 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.

CESA's Response

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

The capacity payment should be based on the true marginal unit's costs including its opportunity cost. A large part of a traditional resource's payment to provide regulation is the lost opportunity cost for not using the capacity to sell a different product, such as energy. Many new

[11] 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

[12] (http://certs.lbl.gov/pdf/lbnl-4142e.pdf)

advanced energy storage technologies are designed to provide regulation but not sustained energy, and thus have no opportunity costs. Therefore, paying unit-specific operational control ("OC"), the market signal gets distorted because a higher cost resource in total (its bid plus OC) could be selected to provide service in lieu of a lower cost resource and does not send the right market signals to low cost resources. By establishing a uniform capacity payment that includes OC (versus paying OC on a unit-specific basis), will send the right market signals to encourage low cost providers into the market, which will likely bring down the overall market costs in the long term. PJM has submitted a proposal to change how it calculates regulation prices in order to minimize resource-specific, opportunity cost uplift payments. The proposed tariff changes will calculate regulation prices every five minutes and will result in a more accurate estimation of opportunity costs. This will lead to inclusion of the unit-specific opportunity costs in the market-wide 5-minute clearing prices. PJM Comments filed in connection with the FERC's Technical Conference states, "…to help 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, PJM will price regulation service every five minutes."[13]

ISO-NE 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."[14] 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."[15]

Having a market formula that consistently results in a capacity payment that is artificially and inaccurately low because it does not include the total cost of reserving regulation capacity is a barrier to the entry of energy storage technologies. PJM's Market Monitor concurred with this opinion in PJM's *2009 State of the Market* report, 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

[13] PJM Comments, at p. 3.

[14] See, page 149, line 15-16 of the Technical Conference transcript.

[15] ISO-NE Markets Committee presentation, "*Alternative Technology Regulation Pilot Program*." November 9, 2010.

clearing price remains a cause for concern as it results in a weakened market price signal to the providers of regulation".[16]

CESA supports the FERC's proposal to require each regulating resource to be paid a uniform capacity payment that includes the opportunity cost of the marginal regulating resource. Cross-product opportunity costs should be calculated by the system operator, as it has the best information to determine a frequency regulation resource's cross-product opportunity cost for not participating in the energy market. 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.

C. Performance Payment.

FERC's Request

Are there alternative payments for performance that can alleviate concerns about undue discrimination from the existing payment models?[17]

CESA'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 discriminatory because resources will be appropriately compensated commensurate with the value they provide.

Many energy storage technologies are able to provide a nearly instantaneous response to regulation signals in a manner that is also more accurate than conventional resources. This greater speed and accuracy of response enables these energy storage technologies to provide a greater amount of ACE correction per MW of regulation capacity offered than could be provided by slower ramping resources. Yet the additional value provided by faster ramping resources is not reflected in most system operator pricing constructs 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 its ramp rate or how much the resource is actually being deployed to provide frequency regulation. This results in unjust and

[16] Monitoring Analytics, LLC. "2010 State of the Market Report for PJM." March 10, 2011.

[17] Frequency Regulation *NOPR* at P 37.

unduly discriminatory pricing 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.

Compensating regulation resources based on both capacity and performance sends the right market signal because it recognizes the additional service provided by those resources that are asked to change power output more frequently. Adequately compensating the value provided by fast regulation resources will encourage *all* resources to bid in as much ramping capability as possible. Furthermore, it is essential to attract investment in these new fast response regulation-only technologies. Without such a price signal, the market will lack the incentives necessary to attract investors to finance these new technologies.

D. Market-Based Price for ACE Correction

FERC's Request

FERC seeks comments on its proposal to allow resources to specify the capacity (in MW) available to provide regulation, a ramp rate (in MW/minute), and bid into the market a price-per-MWh ramping capability and price-per-MW of ACE correction as well as the alternative of an administratively determined price, including how an administratively determined price could be set.[18]

CESA's Response

Each resource should bid in its price–per-MW cost per MW movement for regulation service and the system operator should set the price-per-MW used in the performance payment at the price of the marginal unit's bid.

Each resource should bid its price-per-MW of movement based on its cost to ramp up and down in response to system operator control signals. A price-per-MW movement aligns with basing the performance payment on total MW movement, up and down. 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 important point is that the bidding parameters match the way payments are ultimately calculated to aid resources in determining their bidding strategy.

[18] *NOPR* at P 38.

The system operator should then select the resources with the least cost ability to provide regulation. This will ensure that the right market signals are being sent and will improve overall market efficiency.

E. Compatibility of Existing ISO-NE Co-Optimization Algorithms with FERC's Proposal.

FERC's Request

FERC seeks comments on how the ISO's and RTO's energy and ancillary service co-optimization algorithms in producing the least-cost portfolio of resources will integrate with the system operator's existing co-optimization algorithms.[19]

CESA's Response

FERC should ensure that a payment mechanism is not delayed by computer software issues that eliminates the undue discrimination that exists under the current payment mechanisms implemented in most ISOs/RTOs.

There is no reason why the FERC's proposal could not be integrated into the system operators' existing co-optimization algorithms. As noted in the CAISO's recent, *Discussion and Scoping Paper on Renewable Integration, Phase 2*, April 5, 2011: "As a general matter the ISO strongly prefers solutions that result in more economic bids and fewer self-schedules, because that is how the market as a whole receives the greatest benefits from the economic dispatch and unit commitment algorithms used in the market software."[20]

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

FERC's Request

FERC seeks comments on alternative methods, including methods to incorporate accuracy into the ACE correction calculation and how to structure payments for frequency regulation that compensate a resource for its contribution to ACE correction. FERC seeks specific 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"

[19] Frequency Regulation *NOPR,* at 38.

[20] at p. 18.

CESA's Response

FERC should implement an accuracy performance metric as part of a performance payment for MW movement (not in lieu of the performance payment) that measures how well a resource is hitting its dispatch signal within a tolerance band.

Measuring accuracy encourages resources to accurately respond to the control signal sent by the system operator. However, 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. The FERC should couple an accuracy metric with the FERC's proposed performance payment. The accuracy metric would measure how well a resource is hitting its dispatch signal within a tolerance band. If a resource is determined not to be following its signal, the system operator would rescind a portion of the performance payment received by that resource. This will ensure that compensation for all resources is tied to how well it actually responded to the system operator's control signal while ensuring an accurate fast resource appropriately being paid more than an accurate slow resource.

CESA 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 provided to the grid.

G. Whether or not Net Energy Payments are Redundant in Light of the proposed Performance Payment

FERC's 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 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.[21]

CESA's 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.

Regulation is a separate ancillary service market product that should compensate resources to set aside capacity and then modify its output as directed by a system operator's control signal. The performance payment is designed to compensate regulation resources for the amount of ACE correction the resource is providing in real-time to maintain system reliability. In addition, all regulation resources should either be paid or pay for the energy it injects or withdraws.

V. CONCLUSION.

CESA appreciates this opportunity to submit these comments in response to the Frequency Regulation NOPR and looks forward to continuing to work with the FERC and stakeholders going forward.

Respectfully submitted,

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May 2, 2011

[21] Frequency Regulation *NOPR,* at P 41.

CERTIFICATE OF SERVICE

I hereby certify that I have this day served a copy of the ***Motion to Intervene and Comments of the California Energy Storage Alliance*** on all parties of record in proceedings ***RM11-7-000 and AD10-11-000*** by serving an electronic copy on their email addresses of record and by mailing a properly addressed copy by first-class mail with postage prepaid to each party for whom an email address is not available.

Executed on May 2, 2011, at Woodland Hills, California.

Michelle Dangott

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