BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking to Integrate and Refine Procurement Policies and Consider Long-Term Procurement Plans.	)	**Rulemaking 12-03-014 (Filed March 22, 2012)**

REPLY COMMENTS OF BEACON POWER, LLC ON THE ADMINISTRATIVE LAW JUDGE'S RULING SEEKING COMMENT ON WORKSHOP TOPICS

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I. INTRODUCTION

Pursuant to the September 14, 2012 California Public Utilities Commission (the "CPUC" or the "Commission") Administrative Law Judge's Ruling Seeking Comment on Workshop Topics ("ALJ Ruling"), Beacon Power, LLC ("Beacon Power" or the "Company"), a manufacturer and merchant developer of an innovative advanced energy storage technology that uses flywheels to provide fast accurate frequency regulation service to the grid is pleased to file its Reply Comments on the questions identified in the ALJ Ruling.

As detailed below, Beacon Power's flywheel technology has demonstrated success at providing fast, accurate regulation service on the grid. For California utilities and ratepayers to experience the benefits that energy storage resources provide to the grid, the CPUC must implement rules and support policies that promote the procurement of fast, environmentally friendly, cost effective storage resources.

II. COMMENTS

For California ratepayers to experience the well-documented benefits of energy storage, the CPUC must ensure that new advanced energy storage technologies, are appropriately valued in the rules governing the procurement process for Investor-Owned Utilities ("IOUs"). For IOUs and ratepayers to capture the full value and benefit of energy storage resources the CPUC should establish the following policies: (1) establish procurement targets for energy storage resources; (2) adopt rules that cause IOUs to look to energy storage resources to provide ancillary services before looking to fossil-fired generation for such services(i.e. given the importance of flexible capacity and energy storage's unique attributes in this regard, storage should be considered a preferred resource);[1] (3) enable IOUs to utilize a "portfolio approach" that allows them to procure resources that provide one specific service to the grid, such as frequency regulation, if utilization of that resource in the utility's portfolio provides a benefit (*i.e.* lower cost set of resources) to ratepayers; and (4) support rules and laws that would allow energy storage resources to enter into long-term contracts.

Below are Beacon Power's responses to the initial comments submitted on Questions 1-5, as outlined in the ALJ's Ruling Seeking Comments.

1. What changes should be made to the rules governing the Investor-owned Utilities (IOUs') procurement process that would allow all resources (natural gas combined cycle, combustion turbine, storage, demand response, combined heat and power, renewable, etc.) to compete fairly in

[1] In this proceeding, parties have argued that energy storage should be included in the "loading order" obe deemed to be a "preferred resource", as these terms are used in California's Energy Action Plan. See *Energy Action Plan I*, adopted May 8, 2003; *Energy Action Plan II - Implementation Roadmap for Energy Policies*, adopted October 2005; and *2008 Energy Action Plan Update*, adopted February 2008 (collectively, the "EAP"). Ideally, the CPUC would identify storage as a "preferred resource" as that term is used in the EAP. But, regardless of terminology, IOUs should look to energy storage to fulfill ancillaryservice needs before fossil-fired generation.

meeting identified needs? Please provide specific proposals for structuring an all-source procurement process.

Beacon agrees with MegaWatt Storage Farms, Inc. ("MWSF")[2] regarding the drawbacks of the current practice of bundling ancillary services with energy and capacity in the procurement process. Beacon Power and many other stakeholders stated in their initial comments that the CPUC should enable investor-owned utilities to utilize a "portfolio approach" to procurement that allows them to procure resources that provide one specific service to the grid, such as frequency regulation, if that resource provides an overall benefit to the grid.

An all source Request for Offers ("RFO") with relatively weak minimum requirements will not likely result in the most cost-effective, environmentally-friendly portfolio. That is why Beacon agrees with the Southern California Edison Company's ("SCE") flexible (*i.e.* "portfolio") approach to procurement.[3] However, for the portfolio approach to work properly, rules must be in place that establish the appropriate valuations and incentives for the IOUs to procure storage.

That is why Beacon Power disagrees with SCE's comments that SCE's current procurement processes are fairly administered and do not require modification to facilitate the ability of all resources to compete.[4] In response, Beacon refers to CESA's "Model All-Source RFO" Appendix to its initial comments and to arguments made by Beacon Power in its initial comments listing the changes required to the rules governing the CA procurement process to allow all resources (including storage) to compete fairly in meeting identified

[2] See MWSF Comments at 6.
[3] See SCE Comments at 5-7.
[4] See SCE Comments at 9-12.

needs so as to enable the IOUs and their customers to take advantage of the benefits of energy storage.

Beacon's position, as further outlined in Beacon's initial comments on the Workshop Topics and throughout these reply comments, is consistent with policy statements made by the California State Assembly. The California State Assembly has found and declared that (a) Energy storage systems can help integrate increased amounts of renewable energy resources into the electrical transmission and distribution grid in a manner that minimizes emissions of greenhouse gases; (b) Energy storage systems can optimize the use of the significant additional amounts of variable, intermittent, and offpeak electrical generation from wind and solar energy that will be entering the California power mix on an accelerated basis; (c) Expanded use of energy storage systems can reduce costs to ratepayers by avoiding or deferring the need for new fossil fuel-powered peaking power plants and avoiding or deferring distribution and transmission system upgrades and expansion of the grid; (d) Expanded use of energy storage systems will reduce the use of electricity generated from fossil fuels to meet peak load requirements on days with high electricity demand and can avoid or reduce the use of electricity generated by high carbon-emitting electrical generating facilities during those high electricity demand periods, which will have substantial cobenefits from reduced emissions of criteria pollutants; (e) Use of energy storage systems to provide the ancillary services otherwise provided by fossil-fueled generating facilities will reduce emissions of carbon dioxide and criteria pollutants; and (f) There are significant barriers to obtaining the benefits of energy storage systems, including inadequate evaluation of the use of energy storage to integrate renewable energy resources into the transmission and distribution grid through long-term electricity resource planning, lack of recognition of

technological and marketplace advancements, and inadequate statutory and regulatory support.[5]

Additionally, FERC has found that utilization of these energy storage resources can reduce the total amount of regulation service that needs to be procured to reliably manage the grid, provide the grid operator increased flexibility to deal with system imbalances and variability, and reduce overall emissions, thus providing cost, reliability and environmental benefits for ratepayers.[6] As suggested by the California State Assembly and discussed in these reply comments, the provision of ancillary services by conventional resources is not without cost. Therefore, procurement rules must change in order to enable a more efficient, cost-effective, and clean system that maintains enough capacity, produces enough energy, and secures sufficient ancillary services to meet policy goals and electric demand and reliability requirements. As the amount of power generated by wind and other intermittent resources increases in order to meet California's Renewable Portfolio Standards, the need for fast regulation will also increase. Beacon agrees with the comments of the California Energy Storage Alliance ("CESA")[7] that current procurement projections and RFOs do not appropriately account for storage resources' superior fast response ability. Fast regulation resources, such as Beacon's flywheels, will assist with maintaining grid reliability as wind penetration increases. Beacon Power's flywheel frequency regulation systems have demonstrated to be a more effective and environmentally friendly alternative to conventional fossil-fuel-powered frequency regulation methods. Because fast regulation resources are significantly more effective at responding to system imbalances than slower-ramping

[5] Assembly Bill (AB) 2514 (Stats. 2010, ch. 469).
[6] See, e.g., *Frequency Regulation Compensation in the Organized Wholesale PowerMarkets*, Order No. 755, 137 FERC ¶ 61,064 (2011).
[7] See Appendix A of CESA Comments.

generation resources, their use on the grid can lower the overall amount of frequency regulation that needs to be purchased by California's ratepayers to maintain system reliability. A study requested by the California Energy Commission found that a 30-50 MW fast-response storage device could provide as much or more regulation capability than a 100 MW combustion turbine.[8]

Deploying Beacon Power's flywheel energy storage for regulation service will reduce costs to California's ratepayers by introducing new competition to the market and by displacing relatively high cost regulation deployments by traditional generators. Existing fossil fuel-powered plants displaced by Beacon Power's flywheel-based frequency regulation can be shifted to provide a corresponding amount of added peak generation capacity. In doing so, these plants can run at full capacity, improving their energy efficiency and reducing emissions.

One main barrier to the fair and appropriate evaluation of the costs and benefits of storage is the current practice of bundling ancillary services with capacity and energy in long-term and short-term contracts. As described below, this practice causes the cost of provision of ancillary services from conventional resources to appear artificially low.

The best detailed description of the costs to provide regulation can be found in the PJM[9] Manual 15: Cost Development Guidelines section 2.8 Regulation Service.[10] PJM itemizes the costs to provide Regulation into four categories: (1) Fuel Cost Increase and Unit

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[8] "Research Evaluation of Wind Generation, Solar Generation, and Storage Impact on the California Grid," Study by KEMA, Inc., done for California Energy Commission fundedvia Public Interest Energy Research Program (PIER) at 6, June, 2010.

[9] PJM Interconnection is the largest regional transmission organization (RTO) in the United States. PJM coordinates the movement of wholesale electricity in the mid-Atlantic region, an area that includes more than 51 million people. As of December 31, 2009, it had installed generating capacity of 167,326 megawatts (GW) and over 500 market buyers, sellers and traders of electricity. Information available at: http://www.ferc.gov/market-oversight/mkt-electric/pjm.asp#rto

[10] Available at: http://www.pjm.com/~/media/documents/manuals/m15.ashx

Specific Heat Rate Degradation due to Operating at Lower Loads, (2) Cost Increase due to Heat Rate Increase during nonsteady state operation, (3) Cost Increase in VOM, (4) Margin Risk Adder.

An example using the default values offered by PJM and typical values for other parameters where appropriate shows the cost to provide regulation from a natural gas-fired combined cycle plant ("CC") or simple-cycle combustion turbine plant ("CT") to be $18-19/MW.[11]

- Fuel Cost Increase and Unit Specific Heat Rate Degradation due to Operating at Lower Loads = $4/MW.
- Cost Increase due to Heat Rate Increase during nonsteady state operation (heat rate factor limited to 0.35%) = $0.20-0.25/MW
- Cost Increase in VOM = $2.00-2.50/MW
- Margin Risk Adder = $12.00/MW

Alternatively, testimony of ISO-NE suggests there is a 1.6% to 2.6% increase in fuel consumption for fossil resources resulting from operating at a lower load and heat rate while providing regulation which means that there is a cost to providing regulation.[12] For example, applied to a 600 MW 7.000 MMBtu/MWh combined cycle natural gas plant that provides 50 MW of up and down regulation, assuming $4.00/MMBtu natural gas prices, this translates into an additional $5 to $8 in increased fuel cost per MW of regulation. ((550 MW set-point * 1.6% or 2.6% heat rate increase * 7.000 MMBtu/MWh * $4.00/MMBtu) ÷ 50 MW of

[11] Using PJM "Regulation Cost-Based Offer Calculation" spreadsheet (available at http://www.pjm.com/markets-and-operations/ancillary-services/~/media/markets-ops/ancillary/regulation-cost-based-offer-calculation.ashx) and natural gas price at $4.00/MMBtu and heat rates of 7.000 MMBtu/MWh for a CC and 9.000 MMBtu/MWh for a CT.

[12] FERC Technical Conference on Frequency Regulation Compensation in the Organized Wholesale Power Markets, May 26, 2010, transcript, at 110. Available at: http://www.ferc.gov/EventCalendar/Files/20100607104253-Transcript.pdf

regulation)). Note this estimate excludes the cost increase in VOM and any other costs to provide regulation.

As the Beacon and CESA comments point out, unlike generators that consume fossil fuel, storage resources like Beacon Power's flywheel technology recycle existing power, thereby lowering its operating costs to provide regulation and benefiting the environment by producing zero direct CO_2 greenhouse gas, particulates or other air emissions. A study by KEMA estimated a natural gas plant providing regulation in California emits about 500 tons of CO2 per MW per year, while a flywheel plant would account for much less.[13] 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.

Advanced energy storage technologies can provide ancillary services "a la carte", *i.e.* without additional energy generation. Conventional generators, on the other hand, need to be on-line producing energy in order to provide regulation, spinning reserves and system ramping creating market inefficiencies that are further exacerbated with increased renewables on the system. For example, when the wind blows during off-peak hours, the CAISO will need to be able to have resources available to provide regulation down service. If the only regulation resources available to the CAISO are traditional generators, the CAISO will need to operate these generators at some minimum power level just so they have room to provide regulation down further adding to the over-generation problem. Advanced energy storage on the other hand, can provide regulation a la carte, *i.e.* from a 0 Pmin. With Beacon Power's

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

flywheel energy storage on the system, operators will not need to ramp up operating units in off-peak hours, or bring on additional generation to provide regulation service.

At the Renewable Issues Forum that CAISO conducted on July 16, 2010, CAISO affirmed[14] that significant additional regulation capacity and ramp-rate capability must be available to assist with grid reliability as renewable resources are integrated onto the system to meet California's Renewable Portfolio Standards. CAISO forecasts a need for a maximum of 502 MWs of regulation-up capacity in 2012, and 1,135 MWs in 2020,[15] which is significantly increased from the 277 MWs needed in 2006. Similarly, CAISO forecasts a need for a maximum regulation-up ramp rate of 122 MW/min in 2012 and 447 MW/min in 2020, which is an increase of approximately 82% and 567%, respectively, of the 67 MW/min needed in 2006. In its November 2007 Integration Renewable Resources Report, CAISO stated that "an increase in the amount of wind generation will require increases in the amount of regulation and load following capability. Flywheel and NAS battery systems are ideally suited to provide some of the added regulation."[16]

Public Utilities Code Section 454.5(b)(9)(C) specifically requires that utilities meet their unmet resource needs through all available energy efficiency and demand reduction resources that are cost effective, reliable and feasible. The demonstrated success of Beacon Power's energy storage flywheels will be experienced by California utilities and ratepayers if these resources are incorporated into California's procurement process. As discussed above, storage resources like Beacon Power's flywheel systems are cost effective and reliable and a

[14] See Renewable Issues Forum 2010: Product and Market Review. Available at: http://www.caiso.com/2811/281182df363a0.pdf
[15] Renewable Issues Forum 2010: Product and Market Review, Slide 13. Available at: http://www.caiso.com/2811/281182df363a0.pdf
[16] CAISO "Integration of Renewable Resources" November 2007.

feasible solution to procurement needs. Similar to the positions taken by CESA[17] and Clean Energy Coalition,[18] the CPUC and IOUs should treat storage resources as preferred resources for the purposes of procurement.

Finally, there is a long-term need for energy storage because energy storage can help manage the challenges that the grid will face with increased penetration of intermittent renewable resources into the utilities' procurement process. California now allows utilities to sign contracts with renewable resources using terms greater than 10 years. As a policy matter, it makes sense that the duration of energy storage contracts should match those of renewable resources so that energy storage can help effectively integrate renewable resources into the grid. Accordingly, the CPUC should support policies and adopt rules that maximize the duration of energy storage contracts.

2. ***What amendments, if any, would be necessary to the most recent long-term Request for Offers issued by the Pacific Gas and Electric Company (PG&E), San Diego Gas & Electric (SDG&E, and Southern California Edison (SCE) to ensure that all resources are eligible to compete in meeting future Request for Offers (RFO)? Are there any changes specific to meeting Local Capacity Requirements (LCR)?***

Beacon Power disagrees with SCE's comments that the recent long-term RFOs do not need any changes to ensure that all resources (including storage) are eligible to compete.[19] To ensure that all energy storage resources, such as Beacon Power's flywheels are eligible to compete fairly in future IOU RFOs, Beacon agrees with the required changes to the most recent RFOs listed in Appendix A of CESA's initial comments on the Workshop Topics.

3. ***What specific characteristics or attributes must any resource – including demand-side, energy storage, or distributed – provide in order to meet future procurement needs? In the absence of a Net Qualifying Capacity, what methodology should be used to determine a proxy capacity value for***

[17] See CESA Comments at 2.
[18] See Clean Energy Coalition Comments at 4.
[19] See SCE Comments at 13-14.

resources lacing a Net Qualifying Capacity for use in LCR capacity accounting? How can these characteristics or criteria be turned into criteria to evaluate resources bid into a Request for Offers to meet LCR or other needs? How should those criteria be weighted?

As the comments of the California Independent System Operator Corporation ("CAISO") highlight, PMin (minimum load) is an important operating characteristic for all new resources.[20] Energy storage resources offer the superior quality of having a PMin of 0, far lower than most conventional resources, which enables storage resources to offer more flexibility than others.

Beacon Power disagrees with the Net Qualifying Capacity ("NQC") method that SCE proposes for energy storage, as it contains several key flaws. First, we disagree with SCE's assertion that "energy storage devices with less than one hour of capacity should not have an NQC, since their primary value is in ancillary service markets and/or as frequency response resources".[21] As stated by the CAISO in its comments, there is a clear need for flexible capacity "which the ISO has defined as the ability of the fleet to provide regulation, load following, and maximum continuous ramping".[22] Therefore, a more appropriate NQC value for storage with less than one hour capacity is to use the capacity formula that the CAISO applies under their Regulation Energy Management ("REM") market for frequency regulation, where storage resources with less than one hour of capacity are allocated MWs of capacity corresponding to their sustained output over 15 minutes.[23]

In addition, as Beacon Power mentioned in its initial comments,[24] existing fossil fuel-powered plants displaced by storage providing frequency regulation can be shifted to provide

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[20] See CAISO Comments at 8.
[21] SCE Comments at 16.
[22] CAISO comments at 8.
[23] CAISO Tariff Section 8.4.1.2 Regulation Energy Management
[24] Beacon Power Comments at 8.

a corresponding amount of added peak generation capacity and energy. A MW of regulation (or other ancillary service) capacity is freeing up a traditional capacity MW to respond to load requirements, so MWs from ancillary service-only should be allocated a NQC. NERC requires each Balancing Authority to maintain frequency within defined limits (BAL-001). Therefore, absent an ancillary service-only resource, generation capacity must be allocated to provide frequency regulation in order to maintain frequency. Generation capacity allocated to frequency regulation cannot also be counted to provide Operating Reserves or Energy. For each MW that an ancillary service-only storage resource replaces a generation resource, the generation resource gains two MWs that can now be counted to provide Operating Reserves or Energy. Since an ancillary-service-only resource frees up generation capacity for Operating Reserves, the ancillary service capacity should receive credit as a capacity resource.

Second, due to its benefits, any storage capacity that counts as NQC should also count towards LCR. The same "displacement" argument applies to LCR where the operational flexibility of storage means that it frees up less flexible, traditional plant who can dedicate their longer duration capability to meeting LCR needs. In the absence of storage as a local resource, the amount of capacity available from the traditional resource to meet LCR is compromised. Failure to recognize the locational benefit of storage greater than one hour also fails to recognize the greater modularity and ease of siting associated with these resources, as alternatives to conventional plant. The proposed three hour cut-off for LCR is entirely arbitrary – if storage was to be treated as a direct equivalent of a peaking plant, then this would make sense. But a storage facility is not a direct equivalent of a peaking plant and applying a peaking plant LCR value methodology is flawed.

Third, SCE's screening criterion of "highest and best use" is flawed because, while a storage resource may be limited to providing a certain set of products and services at a certain point in time, the same resource may provide additional products and services at other times, depending on market signals and grid needs. Thus, limiting the valuation of a storage resource to a single use based on a single expected mode of operating severely undervalues the flexibility and optionality of storage.

4. ***What the pros and cons of the following procurement methods with regard to: 1) local procurement considered in Track 1 of LTPP, and 2) operational flexibility and general system procurement considered in Track 2 of LTPP?***

In its comments, the Division of Ratepayer Advocates states (a) that individual resource types should not be given extra points that tilt the balance in their favor unless the parties have a chance to comment on and analyze data supporting such treatment, (b) that no minimum amount of energy storage should be mandated or suggested and (c) that, if a portfolio approach to procurement is adopted, then there should be no particular set aside for storage in the absence of a compelling justification.[25] Beacon Power generally supports the proposition that information and data (such as the data summarized in Beacon Power's initial comments and these reply comments) should support any preference given to energy storage. But, currently available data does support preferred treatment of energy storage. Additionally, the policy statements adopted by the California Assembly in AB 2514 provide more than a compelling justification to establish a "set aside" for energy storage. The administrative record of CPUC Rulemaking 10-12-007 also provides information, data and justifications supporting procurement targets or set asides for energy storage resources.

[25] See Division of Ratepayer Advocates Response/Commentsat 8.

Beacon Power requests that, in this proceeding, the Commission take notice of the record in 10-12-007.

5. ***At the September 7th workshop, some parties discussed retrofits to existing generation assets as a potential source of incremental capacity. What, if any, changes would need to be made to the most recent long term RFO issued by PG&E, SDG&E, and SCE to allow for incremental capacity associated with retrofits to existing generation to compete to meet Local Capacity Requirements? Are there any differences in payment streams that should be given for existing capacity, as opposed to upgraded capacity?***

Beacon Power agrees with CESA's comments[26] that state that RFOs must allow a separate contract for additional capacity provided by the addition of an energy storage device at an existing facility.

IV. CONCLUSION

Beacon Power appreciates the opportunity to participate in this docket, and looks forward to working with the Commission and other interested parties in ensuring that California's procurement rules, policies and procedures allow California's ratepayers to realize the many benefits that energy storage resources can provide.

[26] CESA Comments at 10.

Respectfully submitted,

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