BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking Pursuant to Assembly Bill 2514 to Consider the Adoption of Procurement Targets for Viable and Cost-Effective Energy Storage Systems.	R. 10-12-007 (Filed December 16, 2010)

COMMENTS OF CALPINE CORPORATION ON ASSIGNED COMMISSIONER'S RULING PROPOSING STORAGE PROCUREMENT TARGETS

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Pursuant to the *Assigned Commissioner's Ruling Proposing Storage Procurement Targets and Mechanisms and Noticing All-Party Meeting* issued on June 10, 2013 ("*ACR*"), Calpine Corporation ("Calpine") provides these comments addressing several flaws in the approach to storage procurement outlined in the *ACR*.

I. INTRODUCTION

As a general matter, Calpine is concerned about further distortions to wholesale markets from the subsidized entry of storage that would result from the adoption of specific numeric procurement targets. Energy efficiency, demand response, renewable generation, combined heat and power, and distributed generation currently benefit from procurement mandates and subsidies. Such procurement mandates and subsidies artificially depress prices in the short-term wholesale markets from which unsubsidized resources, such as most existing conventional generation resources, must recover their costs.

Consistent with least-cost/best-fit procurement principles, storage should participate in competitive wholesale markets and all-source solicitations. Requiring storage to compete in wholesale markets and all-source solicitations will better ensure that the "procurement of energy

storage systems by a load-serving entity or local publicly owned electric utility [is] cost effective,"[1] and that an appropriate and efficient amount of storage will be developed.

II. COMMENTS ON ISSUES IDENTIFIED IN THE *ACR*

Calpine's comments focus primarily on storage that participates directly in wholesale energy, Ancillary Service ("AS"), and capacity markets, regardless of the voltage at which it is interconnected.

A. Please comment on this proposal overall, with emphasis on the proposed procurement targets and design.

The California Public Utilities Commission ("Commission") should not adopt the *ACR*'s proposed procurement proposal for storage. Public Utilities Code section 2836 addresses the potential procurement of *cost-effective* storage but does not mandate it:

> On or before March 1, 2012, the [C]ommission shall open a proceeding to determine appropriate targets, *if any*, for each load-serving entity to procure viable and *cost-effective* energy storage systems.[2]

In contrast to the specific language in section 2836, the *ACR* proposal presumes that storage must be procured and would further mandate procurement targets notwithstanding a lack of evidence demonstrating that storage is cost-effective. Indeed, contrary to section 2836.6,[3] the *ACR* proposal would mandate the procurement of storage even in instances in which an IOU (or other LSE) affirmatively demonstrates that storage is not cost-effective.[4]

There are significant unanswered questions regarding the cost-effectiveness of storage. For example, cost-effectiveness studies performed by the Electric Power Research Institute

[1] Pub. Util. Code § 2836.6.
[2] Pub. Util. Code § 2836(a)(1) (emphasis added).
[3] Pub. Util. Code § 2836.6 provides that "[a]ll procurement of energy storage systems by a load-serving entity or local publicly owned electric utility *shall be cost effective*." (emphasis added).
[4] *See ACR*, mimeo at 19 ("As an example, an IOU may be permitted relief from up to *40 percent* of its 2014 procurement target" upon "an affirmative showing of unreasonableness of cost.") (emphasis added).

("EPRI")[5] and DNV KEMA Energy & Sustainability ("KEMA")[6] do not demonstrate the cost-effectiveness of storage. Both studies are based on a series of overly optimistic assumptions, including: (i) estimated storage costs that are too low, (ii) inflated projections of regulation prices and of the ability of storage to capture those prices, and (iii) the presumption that storage will have a high capacity value. Correcting these flaws significantly reduces the cost-effectiveness of storage found in these studies.

Costs

With respect to the costs of storage, at least the EPRI study relies on an overly optimistic assumption that storage will cost $528/kWh for a two hour system.[7] In stark contrast, Southern California Edison Company's recent Tehachapi project cost approximately $1,700/kWh for a four hour system.[8] Similarly, KEMA's own plausible estimates of storage costs, which EPRI did not use in its cost-effectiveness analysis, suggest that storage is not cost-effective (*e.g.*, KEMA's estimate that a two-hour system costs $1,750/kWh is approximately double the Base Case breakeven capital cost of $842/kWh for a similar system analyzed in EPRI's Bulk Energy Storage use case).[9] While storage may be a rapidly-evolving technology with presumably

[5] B. Kaun, *Cost-Effectiveness of Energy Storage in California: Application of the EPRI Energy Storage Valuation Tool to Inform the California Public Utility Commission Proceeding R.10-12*-007 ("EPRI Study"), Electric Power Research Institute , June 13, 2013. A copy is available at: http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000003002001162.

[6] Abrams, Alicia, *Draft – Energy Storage Cost – effectiveness Methodology and Preliminary Results* ("KEMA Study"), California Energy Commission, June 21, 2013. A copy is available at: http://websafe.kemainc.com/CPUC/DNVKEMA-Energy%20Storage%20CostEffectiveness_Report_DRAFT3_June%2021-2013.pdf.

[7] EPRI Study, Table 4-4 at 4-7.

[8] *See* Trabish, K. Herman, *Southern California Edison's 8MW Li-Ion Battery for Wind Power Storage*, Greentech Media, Inc., February 21, 2012. A copy is available at: http://www.greentechmedia.com/articles/read/Southern-California-Edisons-8MW-Li-ion-Battery-for-Wind-Power-Storage. As shown in Table 4 of the KEMA Study, storage costs per kWh tend to decline with duration, so the costs of the Tehachapi installation should provide a conservatively low benchmark to which to compare the costs of the shorter duration systems modeled by EPRI and KEMA. KEMA Study, Table 4 at 24.

[9] EPRI Study, Table A-2 at A-2 and KEMA Study, Table 2 at 19

declining costs, the Commission should not make cost-effectiveness determinations based on speculative estimates of costs that are not supported by real world evidence.

Regulation Value

The EPRI and KEMA studies also inappropriately assume that storage will be able to capture significant frequency regulation revenues.[10] While certain types of storage may be uniquely well suited to providing regulation, the regulation market is small as the EPRI study acknowledges.[11]

For example, in PJM, the regulation requirement is 0.7 percent of load, or approximately 800 MW in an approximately 150,000 MW system.[12] Moreover, because PJM counts the capacity of different resources differently depending on their performance characteristics, storage counts more towards the regulation procurement target (*i.e.*, 1 MW of storage counts as approximately the equivalent of 1-3 MW of conventional generation) and is compensated accordingly.[13] While the fact that storage counts 2-3 times its rated MW towards regulation requirements may present attractive opportunities for a few storage projects, it effectively shrinks an already small market even further as the entire 800 MW requirement could be fulfilled with substantially less than 800 MW of storage.

[10] For example, regulation value accounts for approximately half of the benefits of storage in EPRI's Bulk Energy Storage use case Base Case ($81 million of the $164 million in total benefits). *See* EPRI Study, Table A-3 Regulation is the only revenue stream considered in the KEMA cost-effectiveness analysis. *See* KEMA Study, Chapter 3 at 20-27.

[11] As EPRI acknowledges ". . . due to the limited size of the regulation market, a large amount of storage participation may reduce the profitability in the market quickly. To understand how storage will do without regulation, another modeling run was performed with the base case minus regulation service." EPRI Study at 4-13.

[12] PJM has been able to reduce its requirement partly due to the participation of faster and more accurate resources such as storage in the market. *See* 2012 State of the Market Report for PJM, Section 9, "Ancillary Services" at 274. A copy is available at: http://www.monitoringanalytics.com/reports/PJM_State_of_the_Market/2012/2012-som-pjm-volume2-sec9.pdf,.

[13] *See* 2012 State of the Market Report for PJM, Section 9, "Ancillary Services" at 274.

Opportunities to sell regulation in California are potentially even more limited than in PJM, in part, because the market is smaller.[14] For example, in 2012, the California Independent System Operator ("CAISO") procured less than 400 MW of regulation per hour. As in PJM, the requirement will presumably decrease as performance-based regulation is implemented. In addition, unlike PJM, California already has abundant capacity capable of providing regulation, including most of the state's gas-fired generation as well as multiple gigawatts of hydroelectric and pump storage capacity.[15] Further, the supply of regulation-capable capacity is likely to expand as other new resources, such as demand response, increasingly participate in wholesale markets. As the EPRI study itself demonstrates, storage is not cost-effective in the event that it cannot capture frequency regulation revenues.[16] Similarly, because regulation is the only revenue stream considered in the KEMA analysis, to the extent that storage cannot capture regulation value, the KEMA analysis would conclude that it is not cost-effective.

Capacity Value

The EPRI study assumes that storage will realize large capacity-related revenue streams. While capacity counting rules for storage under the state's existing Resource Adequacy program remain in flux and counting rules for prospective flexible capacity procurement requirements have yet to be defined, the CAISO has repeatedly expressed a need for resources that can sustain their output for three hours or more.[17]

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[14] *See* Section 5 of *2012 Annual Report on Market Issues & Performance,* California ISO, April 2013. A copy is available at: http://www.caiso.com/Documents/2012AnnualReport-MarketIssue-Performance.pdf.

[15] For example, a recent CAISO analysis shows approximately 20,000 MW of regulation capability in capacity procured to meet Commission and CAISO Resource Adequacy requirements. *See* Figure 4 of *Supplement to August 2010 Report on the Integration of Renewable Resources Operational Requirements and Generation Fleet Capability at 20% RPS,* California ISO, May 31, 2011. A copy is available at: http://www.caiso.com/Documents/Supplement_August2010Report_Integration_RenewableResourcesOperationalRequirements_GenerationFleetCapability_20RPS.pdf.

[16] EPRI Study, Table A-9.

[17] *See, e.g.,* R.11-10-023, *Resource Adequacy and Flexible Capacity Procurement Joint Parties' Proposal (Joint Parties' Proposal), Attachment A to Phase 2 Scoping Memo and Ruling of Assigned Commissioner and*

In contrast, the EPRI study attributes capacity value to resources that can sustain their output only for relatively short durations. For example, "System Electric Supply Capacity" accounts for approximately 20 percent of the benefits in EPRI's Bulk Energy Storage Base Case, which considers a system with two hours of storage. While it is impossible to calculate the precise impact on cost-effectiveness without actually running the model, presumably eliminating 20 percent of the benefits from the case would reduce the benefit to cost ratio from 1.17 to close to 1.[18]

B. Comment on whether any of the projects proposed to count toward the procurement targets be excluded, or any additional projects included, and on what basis.

To the extent that storage procurement targets are implemented, storage that already has been procured by the IOUs should count towards the targets in order to minimize the distortion to wholesale markets from the procurement targets.

C. Comment on how actual operational deployment should be defined for PIER- and EPIC-funded projects potentially eligible to count toward a utility's procurement target.

Calpine has no comment on this issue at this time.

D. Comment on how any utility's procurement that exceeds a target in one year should be addressed and considered for future procurement targets.

Calpine has no comment on this issue at this time.

Administrative Law Judge. The CAISO is one of the Joint Parties. Section 1.5 of the proposal notes "After analyzing various possible flexible characteristics,, the Joint Parties determined that three-hour ramping capabilities offered the best single characteristic to ensure the ISO could meet its ramping and contingency needs and enable a large pool of resources to qualify as flexible capacity resources. Therefore, the Joint Parties recommend that a resource must be able to ramp and sustain energy output for a minimum of three hours." *Joint Parties' Proposal* at 12.

[18] Based on Table A-3 of the EPRI Study at A-3.

E. Comment on whether and to what extent utilities should be permitted flexibility in procuring among the use-case "buckets" (transmission, distribution, and customer-sited) of energy storage within one auction, and whether a minimum amount in each "bucket" must be targeted.

To the extent that procurement mandates are implemented, the IOUs should be allowed to procure the most cost-effective storage, regardless of "bucket." However, the "buckets" must also be further clarified.

As currently defined, the "buckets" differentiate between the physical locations of different storage resources. However, the buckets should also differentiate between the functions of different resources, particularly with respect to the potential for utility-owned resources. For example, a storage system that is interconnected at distribution voltage may still serve a Bulk Energy Storage/wholesale market function just as the primary function of most generation interconnected at distribution voltage is the provision of energy, AS, and capacity in wholesale markets. Differentiation of the "buckets" by function will also allow the Commission to ensure that, to the extent that the IOUs are allowed to pursue utility-owned storage, the IOUs only pursue utility-owned storage where the storage will serve a function closely related to the IOU's regulated distribution business (*e.g.*, storage that defers the need to add or upgrade distribution circuits).

F. Comment on the appropriate "off ramps" for relief from procuring up to each target and what metrics should be used to evaluate the appropriateness of the off ramps.

The IOUs and other LSEs should be relieved of *any* obligation to purchase storage to the extent that storage is not cost-effective. To determine a storage project's cost-effectiveness, the IOUs and LSEs should be allowed to rely on and justify their own input assumptions, particularly with respect to the cost of specific storage projects, if not their own models.

Assumptions about storage costs in the IOUs' cost-effectiveness demonstrations should reflect actual offers received in competitive solicitations and/or firm vendor quotes.

G. Comment on how this proposal may be coordinated with Renewable Portfolio Standard procurement plans, as set out in Public Utilities Code section 2837.

To the extent that the need for flexible capacity, such as storage, is driven by renewables procurement, LSEs with portfolios of renewable resources that increase the need for flexible capacity requirements should bear larger flexible capacity procurement requirements, as the CAISO recently has proposed.[19] Similarly, to the extent that certain types of renewable resources increase other costs associated with operating the grid reliably, the costs should be allocated either to the resources themselves or the LSEs who have them under contract. Presumably, once appropriate allocations of flexible capacity and other renewable integration costs are in place, the IOUs and other LSEs will have appropriate incentives to procure efficient mixes of both renewable resources (potentially including embedded storage) and flexible resources (potentially including storage).

H. Comment on the options presented for ESPs and CCAs to either a) be required to procure an equivalent amount of storage projects commensurate with the load they serve or b) have their customers assessed the costs of the IOU procurement of energy storage projects through a cost allocation mechanism.

Calpine has no comment on this issue at this time.

I. Comment on how the preliminary results of the cost-effectiveness models should be applied to the question of setting procurement targets.

The preliminary results of the cost-effectiveness models should not be used to set procurement targets. Instead, storage should be considered as a possible solution to well-defined

[19] *See Flexible Resource Adequacy Criteria and Must-Offer Obligation, Market and Infrastructure Policy Revised Straw* Proposal, California ISO, June 13, 2013. A copy is available at: http://www.caiso.com/Documents/RevisedStrawProposal-FlexibleResourceAdequacyCriteria-MustOfferObligations.pdf.

needs, such as those identified in the Long-Term Procurement Proceeding. Once such needs are identified, storage should compete with other resources in competitive solicitations to meet those needs. To the extent that a storage offer is chosen by an IOU in a competitive solicitation, its selection should be justified in an application to the Commission that includes a detailed analysis of the specific offer's cost-effectiveness.

J. Based on the preliminary results, should the utilities set a cost cap for offers to be submitted in the 2014 auction? If yes, what should the cap be and how should the auction be structured to incorporate the cap?

Calpine has no comment on this issue at this time.

Respectfully submitted,

By:/s/

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