CAREBS Coalition to Advance Renewable Energy through Bulk Storage

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California Energy Commission

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Subject: Workshop on Strategies to Minimize Renewable Integration Costs and Requirements and Improve Integration Technologies

The Commission has posed several questions for Panel 4, The Role of Energy Storage in Supporting Renewable Integration, as part of the workshop, "Strategies to Minimize Renewable Integration Costs and Technologies and Improve Integration Technologies." Two of the questions are: (1) How do we deploy thousands of MWs of energy storage within the next 5 and 10 years respectively and (2) Given the current regulatory structure, what business models exist for deploying energy storage to facilitate renewable integration? Do you have any suggestions?

The Coalition to Advance Renewable Energy through Bulk Storage (CAREBS) urges the Commission – in this workshop as well as for its Integrated Energy Policy Report investigations – to give more attention to in-state and regional, large-scale pumped storage hydroelectric (PHS) and compressed air energy storage (CAES) systems to deliver more renewable energy to more Californians more of the time. For the reasons delineated below, deploying bulk storage is the most expedient way to have thousands of MWs of storage on-line and integrating renewable energy within the next decade.

With the potential retirement of significant fossil fuel power stations, the addition of vast quantities of renewable energy to meet state RPS and carbon mandates, as well as new gas-fired capacity to "fill-in" around renewable facilities, it is imperative that the state begin planning immediately for economical, flexible, ultra-low or no emissions facilities that will provide the *balancing function* [1] for the state's electrical system. Balancing can also be considered "shock absorption" for the system. The state is rapidly shifting to generating resources that have less inertia and response capability (this includes both renewable energy and gas-fired resources) than traditional power stations. Bulk storage is the only solution set capable of providing *all* of the components of the balancing function without adding technology and operating risk to the California electric system.

Unlike generating resources, storage can add load to the system and/*or absorb load from the system and return it* (unlike synchronous condensers, for example). CAES and PHS are large-scale options for balancing the grid that are commercially available today and are consistently evaluated as the most economical storage technologies. Virtually all of the distributed storage, demand response, and advanced renewable energy management (improved monitoring, forecasting, and modeling) technologies must be substantially scaled up and therefore are not ready for large-scale deployment. Because of this, they add significant technology risk and therefore, the only business models that will support their widespread deployment over the next five years rely by necessity on substantial government funding and/or additional costs to ratepayers. Gas turbine based solutions can provide some of the flexibility required for balancing but not to the degree that bulk storage can. Gas turbines also pose aggravated emissions profiles when the machines are cycled rapidly to meet flexible output. Plus, they consume more fossil fuel.

On the other hand, *Bulk storage can be deployed now with no additional subsidies or mandates*. California utilities are more than comfortable with PHS (several thousand megawatts currently operate in California) and private equity and independent project developers, along with system suppliers, financiers, and utilities, are ready to construct PHS and CAES facilities in strategic locations to integrate renewable energy and provide other performance characteristics that enhance reliability and reduce costs to California ratepayers. While CAES does require a small amount of fossil fuel, the amount, and the resulting emissions, are substantially less than gas-turbine based solutions.

For bulk storage, then, business models are not the barrier. However, the regulatory structure and policy framework must be modified. Our suggestion for making the policy framework "bulk storage friendly" is simple: Allow cost recovery for bulk storage facilities, indeed any technology that can provide the renewable integration balancing function, in a manner similar to how the Federal Energy Regulatory Commission (FERC) Order 1000 treats multi-value transmission projects. Keeping the California electricity system "in balance" and integrating renewable energy is a benefit that clearly accrues to all California ratepayers. Therefore, the costs should be apportioned across the rate base. Focusing on the *balancing function* rather than specific system solutions (or solution sets) ensures that the state does not pick winners or losers, existing asset classes are not protected, and all commercial solutions can compete on a level playing field.

FERC Order 1000 addresses transmission issues that are similar to challenges facing bulk storage. Essentially, Order 1000 allows a transmission project that provides multiple value streams to recover costs on a regional basis. A new transmission line not only connects a renewable energy rich area (supply) with population centers (demand), it also strengthens the grid generally and enhances reliability. The positive environmental impact of adding emissions-free electricity is also regional in nature. Order 1000 allows costs to be socialized across the region when the project's value extends throughout the region.

Bulk storage is similar. It provides a variety of specific benefits with respect to balancing (and other values – see accompanying table) that cannot be monetized under the current regulatory and policy framework. Monetizing this value will drive the business models towards widespread deployment.

Our more detailed recommendations include the following: (1) acknowledge the growing importance of the *balancing function* to grid operations under significant renewable energy penetration; (2) acknowledge that the *benefits of providing balancing services accrue to all ratepayers in the jurisdiction*; (3) ensure that utilities and *CAISO make the full costs of balancing transparent to all stakeholders*; (4) require that integrated resource planning, capital budgeting, cost evaluations, and grid modeling exercises determine the need and costs for balancing *separately* from generation, transmission, and distribution needs and costs, and that they include the assessment of bulk storage options; (5) allow all assets that can provide balancing services to compete for the privilege of providing them; and (6) allow investment recovery for providing balancing through a similar mechanism used for multi-value transmission projects.

The ultimate goal is to lower the cost of electricity to ratepayers while providing the greatest range of benefits. *Bulk energy storage transforms intermittent, variable renewable energy into a firm, dispatchable, and fully predictable source of electricity*. While all of the solution sets have their advantages and disadvantages, CAREBS believes that additional deployment of large-scale bulk storage resources, in parallel with the expansion of renewable energy, will allow California to capture the economic development, environmental, and health benefits of renewable energy while mitigating its operational impacts on the grid. Bulk storage options PHS and CAES ultimately will provide the most overall value with respect to renewable energy integration for the least cost on a life cycle basis.

Respectfully Submitted,

Jason Makansi, Executive Director

The Coalition to Advance Renewable Energy through Bulk Storage

[1] *Getting Bulk Energy Storage Projects Built: Monetizing the Balancing Function for Electricity Grid Operations*, a policy brief and proposal issued by The Coalition to Advance Renewable Energy through Bulk Storage (CAREBS – www.carebs.org), March 2012.

		Bulk storage (PHS, CAES) [6]	Distributed storage [1]	Gas turbines CCs [3]	Cycling older fossil plants [4]	Hydro-electric	Demand Mgmt [5]	Synchronous condensers [2]
Traditional Ancillary Services	Regulation	Y	N	Y	Y	Y	N	Y
	Energy imbalance	Y	N	?	Y	Y	N	N
	Spinning/operating reserve	Y	N	N	Y	Y	N	N
	Black Start	Y	N	N	N	Y	N	N
	Reactive power	Y	N	N	N	Y	N	Y
	Reliability reserves	Y	N	Y	N	Y	Y	N
	Supplementary reserves	Y	N	Y	N	Y	Y	N
Additional "Balancing" Services	Absorbing load – decremental reserves	Y	N	N	N	Y	N	Y
	Transmission line loading optimization	Y	N	N	N	N	N	N
	Shifting on-peak to off-peak	Y	N	N	N	N	N	N
Other Desirable Attributes	Avoiding transmission upgrades, investment	Y	N	N	N	N	N	N
	Weekly balancing	Y	N	N	N	Y	N	N
	Seasonal load shifting	Y	N	N	N	Y	N	N

[1] Technologies not yet scalable and economical for large-scale regional balancing service, but appropriate for distribution level balancing
[2] Synchronous condensers can absorb load from the grid, but can't return it
[3] Fast-acting (or "flex") gas turbines respond faster than earlier models but are less efficient and have worse emissions profiles at part load
[4] Cycling older coal-fired plants can provide some ancillary services but under aggravated emissions profiles and typically significant metallurgical damage to major components and high operating costs
[5] Interrupting customer load through demand management programs can help balance the system but typically for regional balancing, a substantial amount of load must participate at the same time
[6] Bulk storage is the only solution set capable of providing all the components of *regional balancing* for grid management