Staff Workshop On 2020 Strategic Analysis of Energy Storage in California

Prepared Comments of Jack Ellis

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Good morning. I'd like to thank the CEC staff for providing an opportunity to share some of my thoughts on this report and on storage in general. For the record, I have prepared these comments on my own initiative and at my own expense.

I was among those who reviewed several drafts of the report we're here to discuss today and I think the authors have assembled an impressive body of information on the state-of-the art and the technical hurdles that still need to be overcome. The report offers a number of recommendations that are based on the assumption that storage is a policy priority in this state. While I agree that storage could be an attractive resource as California pursues the 33% RPS target, in my view the report is a bit too focused on advocacy and does not give enough weight to several other critical factors.

The first of these is cost-effectiveness. Most storage technologies tend to be more expensive than competing alternatives and therefore, they are typically not cost effective, which is a key reason utilities have been reluctant to deploy them. In California's current market environment, which is characterized by low, stable energy prices and low incremental capacity values [that are a consequence of today's large power supply surplus, storage is far from cost-effective, and the situation is not likely to improve before the end of this decade. Moreover, market conditions that allowed storage to receive a credit equal to the cost of new entry for a gas-fired peaking plant would do no better than narrow the gap Even DR doesn't get credit for capacity value greater than this.

There may be some who would urge this Commission and the CPUC to look past cost-effectiveness because numerous technical studies identify a need for storage, or because California needs to maintain its leadership in energy innovation, or because the added cost of a few thousand megawatts of storage to meet a storage portfolio standard is small compared with the $100 billion California is spending for renewable generation and transmission to meet the 33% RPS requirement, or because large scale deployment will produce desperately needed jobs and lead to market transformation. As I will discuss shortly, the need argument is largely without merit. The other arguments are meaningless for the 25% of residential consumers who qualify for CARE and are struggling to pay their bills in a weak economy, and for the few remaining manufacturers in California that are struggling to survive in a brutally competitive global economy. They can't afford the luxury of subsidizing any more large scale deployments of immature technology unless there's a clear value proposition, and they should not be asked to do so. Moreover, while a storage build-out on the order of 3,000 MW would create lots of jobs, many of them would not be in California, because most of the equipment that would be needed is manufactured somewhere else.

Second, I think it's fair to ask whether all of the identified economic benefits can actually be realized. Particularly for storage projects that are built to time-shift energy and are likely to comprise the largest

application of storage, I am convinced the answer is no. Wholesale electricity markets in the US are designed around thermal plants that know their marginal costs with a high degree of precision. Even if day-night price differences are sufficiently large, and it is not certain they will be, the only way a storage device can consistently generate operating profits is by being able to purchase and sell electricity at prices that are known with a fair degree of certainty in any or all of the upcoming 24 hours. Today's wholesale markets provide neither the forward price visibility nor the opportunity to trade on those prices once the day-ahead auction is finished. Consequently, storage operators have to estimate prices. While estimates might be good enough when system conditions are nearly identical from one day to the ext, they are going to be less accurate and subject to greater day-to-day variation as more wind and solar are added to the grid. Retail tariffs that provide predictable on- and off-peak energy prices but are decoupled from system conditions might provide the price certainty an owner or operator needs, but at the cost of diminished societal benefits. Having the ISO determine how to operate storage is also not a feasible solution. PJM found that trying to determine an optimal day-ahead operating schedule for a single large storage system in its footprint led to a five-fold increase in computing effort. Even if having the grid operator determine how to dispatch storage seems like a good idea, and I don't believe it is, the fact that each storage system is different means a schedule that is economically optimal for one project won't necessarily be optimal for another.

Third, recipients of out-of-market ratepayer funding have to held be accountable for delivering the benefits upon which that funding based. For storage deployments that receive public funding and for utility investments that are placed in rate base, there needs to be a robust, objective and administratively simple way of holding recipients accountable for delivering the benefits that were used to justify public funding or rate base treatment for storage to begin with. Ratepayers are not economically indifferent when a subsidy is paid up front or rate base treatment is provided for a project that delivers only a portion of the benefits upon which it was justified. This is particularly important for storage projects that are designed to take advantage of daily price differentials since as I noted above, the current wholesale market structure limits their ability to operate profitably. While I hate to pick on my friends from PG&E, their Helms project is a classic example of an asset that customers have been paying for over more than two decades in spite of the fact that its operation has been impaired because there has never been enough transmission to allow all three pumps to operate concurrently.

Fourth, subsidized storage may conflict with EV deployments. If California policymakers are serious about promoting electric transportation, and if they are also serious about encouraging electric vehicle users to charge off-peak, then they should be aware that subsidized storage for time-shifting energy disadvantages EV users in two important ways. First, it will increase competition for access to off-peak energy, which will increase the cost of off-peak charging energy for those EV users who do choose to charge their vehicles at night. Second, EV users will be forced to effectively subsidize a competitor. At pilot scale, the impact on an individual EV owner will be inconsequential, but at the level of a few thousand megawatts of subsidized or mandated storage, the impact will be meaningful.

Fifth, the emissions-related impacts of deploying storage need to be better understood and articulated. While it is true that storage devices other than certain CAES implementations do not emit CO2 or other pollutants directly, their use either increases emissions from other supply resources or drives the need

for more renewable production. A pumped storage plant operating at 75% efficiency withdraws one third more energy from the grid when charging than it injects back into the grid when it is discharged. If that additional energy is deemed to be supplied by a fossil-fired plant or from imports, then storage operation leads to a corresponding increase in emissions. If the losses are deemed to be supplied by renewable energy, then additional renewable resources must be built because the RPS is tied to retail sales rather than busbar production. Either way, storage has emissions and economic impacts that may not be as benign as proponents have been suggesting.

Sixth, regulators, policymakers and lawmakers need to realize that the benefits of storage used to time-shift renewable production and to provide longer duration balancing services depend on credible economic signals. Wholesale prices that are low and stable make storage operation economically challenging because revenues from discharging the storage device might not cover the cost of charging energy that includes losses. Overly generous supply margins that minimize the likelihood of politically inconvenient price spikes undermine storage economics and needlessly inflate customer bills.

Both the report and Dr. Bining's presentation suggest storage is essential in order to meet the 33% RPS by citing a conclusion from the 2010 KEMA analysis. Both state, "Studies indicate 3,000-4,000 MW [of storage] needed for 33% renewable portfolio standard". I disagree with this characterization. The conclusion contained in the KEMA report stated "Large-scale storage can improve system performance by providing regulation and imbalance energy for ramping or load following capability. The 3,000 to 4,000 MW range of fast-acting storage with a two-hour duration achieved solid system performance across all renewable penetration scenarios examined. " A conclusion that performance would benefit is not the same as a statement of need. Several other points about the KEMA study also suggest that it is premature to conclude there is a need for large amounts of storage: KEMA explicitly noted that cost-effectiveness was outside the scope of its analysis, KEMA did not assess the relative effectiveness of wide-area coordination across Balancing Authority Areas as an alternative to storage or other sources of system flexibility, the KEMA study focused on a few days, and KEMA did not consider how the need for ramping capacity might be affected by less stringint balancing standards such as the WECC's Reliability-Based Control field trial, which tolerates larger variations in area control error so long as system frequency doesn't deviate from 60 Hz.

Finally, I'd like to offer some policy recommendations of my own. First, the California ISO, the CEC and the CPUC need to overhaul certain elements of California's market and regulatory structure before taking on another expensive policy initiative. These include a wholesale spot market design that currently doesn't work for storage or flexible demand, a bias for generous supply margins that undermines the economic case for all other options, and a propensity to fix one market failure with subsidies that create other market failures.

Second, before committing public benefit and other types of taxpayer- and consumer-supported funding to programs with the objective of driving market transformation and manufacturing economies of scale, policymakers should ask tough questions about technology maturity, whether volume purchase will, in fact, drive down costs, and how risks and benefits should be shared equitably. It makes no sense to

burden consumers with large amounts of expensive storage procured on an expedited basis that could be rendered technologically and economically obsolete within a relatively short time. Instead, I recommend policymakers establish and direct modest amounts of cost-shared funding toward pilot programs and R&D efforts that focus on technology and cost improvements, with funding for subsequent phases dependent on meeting cost reduction goals that are ambitious enough to drive innovation and realistic enough to be achievable. R&D efforts should be accompanied by oversight that is thorough enough to ensure public money is being spent responsibly but not so overbearing that it gets in the way.

Third, this agency and the CPUC should examine options for permanent load shifting that don't require a large expenditures or immature technology before they conclude new and expensive hardware is needed. The Statewide Joint IOU Report on Permanent Load Shifting that was prepared for CPUC docket R.07-01-041 notes, "A number of PLS systems were installed during previous programs, or outside of any incentive structure. Many of these existing systems are not run optimally, and there may be potential to "fine-tune" for less money than a full retrofit or a new install." It is possible that a lot of cost-effective storage and other forms of permanent load shifting could be obtained by harvesting this metaphorical low-hanging fruit.

Fourth, although I believe subsidies are unnecessary and inadvisable, if they are offered, storage project sponsors who accept them should be held accountable for delivering the benefits they promise before they are allowed to recoup their own investment. Development, market and operating risks are within the control of project sponsors, and project sponsors should bear them. If developers cite job creation as a benefit, then they should be required to create and maintain those jobs here in California. Any subsidies for storage should be set well below levels that would otherwise leave ratepayers economically indifferent. There is no reason ratepayers should provide a subsidy, assume much of the downside risk, and also forfeit any opportunity to capture a portion of any benefits that materialize.

Thank you for allowing me to share these thoughts with you today. I have forwarded a copy of my remarks to the docket office and it should be posted on the CEC web site shortly.