**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.	Rulemaking R-10-12-007

COMMENTS OF THE GREEN POWER INSTITUTE ON THE PHASE 2 INTERIM STAFF REPORT

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Introduction

Pursuant to the Oct. 1, 2012, *Scoping Memo and Ruling of Assigned Commissioner and Administrative Law Judge*, as modified by the January 18, 2013, *Administrative Law Judge's Ruling Entering Interim Staff Report Into Record and Seeking Comments*, in Proceeding R.10-12-007, the **Order Instituting Rulemaking Pursuant to Assembly Bill 2514 to Consider the Adoption of Procurement targets for Viable and Cost-Effective Energy Storage Systems**, the Green Power Institute (GPI), a program of the Pacific Institute for Studies in Development, Environment, and Security, provides these *Comments of the Green Power Institute on the Phase 2 Interim Staff Report*. Our *Comments* discuss the *Phase 2 Interim Staff Report*, the Use Cases that are appendices to the Report, and documents from the January 14, 2013, Workshop.

At the outset, we note that one of the threshold issues that has been raised in this Proceeding is how to perform a needs assessment for storage, in order to assess the possible need for mandates, targets, and/or procurement incentives. The GPI believes that it is important to keep two immutable facts in mind when considering the options available for implementing AB 2514. First, there is no absolute need for storage in an electricity grid, as demonstrated by the fact that many electric grids have been successfully operated for years without storage. The relevant question is not whether there is an absolute need for storage, but whether storage can contribute positively and cost effectively to the operation of the grid. Second, storage is not an energy generating resource. It is an operating asset that can be used by generators, grid operators, and others to upgrade the value of electricity.

We also note that the most fundamental thing that potential developers and owner/operators of storage systems need is proper tariffs, including tariffs under which they will be able to purchase charging energy from the grid, and tariffs under which they will be able to provide a range of services to the grid. Some of the parties, including the utilities, argue that storage systems should provide their products and services to the grid under existing tariffs. We disagree. Existing tariffs are structured around the capabilities

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of conventional fossil-fired turbine and engine technologies, and in many cases do not work very well for storage technologies, which have different characteristics and capabilities.

Use Cases

The Use Cases generally do a good job of representing the kinds of applications that storage can serve, although there are some notable deficiencies. For example, across the board we believe that the Use Cases fail to focus sufficiently on the issues of ownership or operational control, particularly the first four Use Cases, which are the transmission and distribution-connected Use Cases. In particular, we believe that the Use Cases fail to adequately address the possibility of storage systems that are owned and operated by grid operators, which means the CAISO at the transmission level, and the wire utilities at the transmission and distribution levels, as appropriate. We recognize that the Use Cases are designed primarily around applications and technologies, but we submit that ownership models could have a significant influence on how a storage system is operated, and how cost effectively, and that this should be accounted for in the transmission- and distribution-connected Use Cases.

Transmission Connected Energy Storage

The CAISO is accustomed to purchasing the products and services needed to operate the grid from independent providers, and the Transmission Connected Energy Storage Use Case is based on an assumption that storage systems similarly will be separately owned and operated from the operators of the transmission grid, with operations of storage systems designed to produce grid-operating services subject to participation in the CAISO markets. These markets have been designed around the capabilities of the conventional generators that currently provide the services, mainly turbines and engines powered by natural gas. In our opinion, these markets are not necessarily the optimal way for storage to contribute to the operation of the transmission grid. We believe that this Use Case should be expanded to consider, as an additional alternative, the possibility of the CAISO or wire utilities owning and/or having full operational control over transmission-connected energy storage installations. The important element here is not so much ownership of the asset as it is direct operational control.

Storage technologies, which come in a variety of forms, can provide the full range of ancillary services needed to operate the grid, often in ways that are different than

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conventional generators, including in some instances in ways that are more responsive to real-time system needs. If grid operators had direct operational control over storage systems, we believe that they would be able to derive benefits from the systems that will be difficult to elicit from storage systems that are operating in conventional, generator-oriented markets. One of the quickest ways to surmount this predicament would be to put storage systems under the direct operational control of grid operators, allowing them to use the installations in accordance with deriving the maximum benefits for the grid, without the need to try to do so within the yoke of the current tariff structures. Storage is fundamentally different than generation, so we would hope that this would free storage systems to be utilized differently than generators, particularly from an operational perspective. We believe that the lack of consideration of direct, grid-operator control over transmission-connected storage installations is a serious deficiency in the Transmission Connected Energy Storage Use Case.

The Transmission Connected Use Case covers a range of storage technologies, which can be used in a variety of ways. We are particularly interested in the subset of this Use Case in which an energy-storage system is coupled to a renewable generator in order to increase the value of the electrical product that the generator provides to the grid. This is not just a theoretical application. Storage systems associated with intermittent generators are already being deployed commercially in California, for example in the case of several projects incorporating thermal storage systems into solar thermal generating facilities. These storage systems will primarily allow the generators to shift some of their output from earlier in the day to later in the day, in order to provide a product that better matches demand shapes on the grid. The thermal storage systems may also provide some amount of modulation to the overall system output rate on cloudy days. Energy storage systems built in conjunction with wind generators are likely to be more oriented to output modulation than to time-of-delivery shifting, although what is most beneficial for any given application is highly site-specific.

One of the important topics under consideration in this Proceeding is the cost-effectiveness of storage systems. Compared to many applications for storage systems, onsite storage incorporated into an intermittent generating resource presents different economic considerations that will need to be taken into account in order to understand their cost effectiveness. For most grid-connected storage applications the cost of charging the system is dependent on a yet-to-be-developed tariff. For generator-associated storage systems the cost of charging the storage system will be a function of

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the intrinsic characteristics of the generator, which is under the control of the generator. Similarly, the value of the energy that is upgraded via the storage system is a function of the generator's PPA, not a yet-to-be-developed tariff. In this sense these types of storage systems can be developed today without the uncertainty of having to wait for future progress in the development of tariffs applicable to storage systems that charge off the grid, and supply energy and services to the grid. Indeed, this is already happening. And it is happening in no small part because the Commission recognizes that these pioneering commercial-scale installations deserve special consideration in the contract approval process. While these systems are primarily designed to upgrade the value of the generator's output, we believe that in some cases there may be some capacity for also providing ancillary services to the grid from these installations.

EV Charging

We have a major objection to the structure of the seventh Use Case, which deals with electric vehicle (EV) charging. This Use Case, as currently structured, is based on commercial charging stations that include fixed (extra-vehicular) energy-storage devices in their installations. In fact, commercial charging of EVs is a nascent business, and the optimal charging-station configuration has yet to be determined. As far as we know there is no reason to assume, a priori, that a fixed storage device is a good investment for a commercial EV charging station. Nor is there any reason to force one on the charging-station Use Case. In fact, by design a commercial charging station will be full of mobile storage devices, which are the batteries in the vehicles that are using its services. Before requiring a charging station to consider installing expensive fixed storage devices, we believe that it makes more sense to consider what kinds of grid services the charging station could provide using just the batteries in the vehicles that are being charged. In our opinion, there is a great deal that can be done in this configuration.

One of the interesting features of vehicle charging is that in many cases the vehicles are plugged into the charging source for a longer period of time than is required to give them the desired charge. This includes, for example, vehicles that are charged overnight, and vehicles that are charged during the course of the work day. This would allow, in theory, the charging station to supply a variety of ancillary services to the grid, in addition to providing charging services to the vehicles. For example, for vehicles hooked up for longer periods of time than is needed to supply the desired charge, the charging can be turned on and off in response to imbalances on the grid, providing extremely rapid

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response rates for a variety of real-time grid imbalance needs. This can be accomplished using just the storage that is in the vehicles being charged, and without the need for any generation to be performed for purposes of providing the ancillary services. In other words, EV charging stations can offer ancillary services to the grid that are completely emissions free, and that in many cases are capable of being more responsive to grid needs than conventional technologies are capable of being.

EV smart charging will not be able to fully deliver on its promise to be able to deliver ancillary services to the grid until it attains a sufficient market size; in effect a sort of critical mass. We cannot predict when that will occur. However, given the observed uneven distribution of users of the first generations of hybrid vehicles around the state, it is likely that early purchasers of plug-in vehicles will be similarly unevenly distributed, and that charging stations of sufficient magnitude to provide ancillary services will be viable in a number of locations in the state in the not-too-distant future.

There is an interesting and important association between EV charging and renewable DG power generation that should also be taken into account in this Use Case. Many purchasers of renewable DG systems are also interested in electric transportation, and more specifically in using their PV systems not only for powering their homes, but also their plug-in EVs. In order to accomplish this a storage system is usually employed, because the vehicle is often off-site during the part of the day when the PV output is at its maximum.

Preferred Resources

California's energy loading order is based on a combination of measures to reduce and readjust demand, and to produce the cleanest energy possible. The adopted loading order is as follows:

- Efficiency
- Demand Response
- Renewables
- Distributed Generation
- Clean Fossil

The first two preferred resources are both aimed at minimizing the amount of energy generation that is required to energize the grid, especially when demand is highest. They

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are not generation resources. Storage installations are aimed at minimizing the amount of energy generation that is required to both energize and operate the grid.[1] Indeed, one of the services that some storage systems are capable of providing is essentially equivalent to demand response (DR), and DR is second in the loading order. In the opinion of the GPI, it would be perfectly appropriate to add storage to the loading order. The logical place to put it would be either before or after demand response.

We believe that the only way to fully, or officially, insert storage into the loading order would be to do so using the same joint-agency process as has been used in the past to establish and update the state's *Energy Action Plan*. We further believe that it would be worth the effort that would be necessary to do this.

With regards to this Proceeding, and more generally to work at this agency, as far as we know the Commission is free to give as much prominence to storage as it wishes to do. Of course storage, and the implementation of AB 2514, is the objective of this Proceeding (R.10-12-007), which is an indication of the importance that this Commission gives to energy storage. Nevertheless, we do not think that the state's loading order is particularly relevant to this Proceeding.

Where the loading order does come into play at the Commission in particular is in the LTPP proceeding, R.12-03-014. The good news is that the LTPP Proceeding is already well aware of storage, and has already held a joint workshop with the Storage Proceeding. On the other hand the GPI, which is a party to the LTPP, has long been frustrated by the fact that the system-need modeling that is a core function of the LTPP, in the past has not taken into account the possible contributions that could be made by storage, and we are concerned that the modeling that is currently underway in R.12-03-014 for the 2012 LTPP will also fail to take new technologies, including storage, into account. Putting storage into the loading order would help, but probably could not be achieved in time to affect the modeling that is already underway for the 2012 LTPPs. If there is anything that this Proceeding can do in the very short term to encourage the LTPP Proceeding to include storage in the modeling for the 2012 plans, we would certainly support it.

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[1] In a technical sense storage systems consume energy in the form of charge/discharge losses. However, they avoid energy generation when demand is highest and the dirtiest resources are used, and they reduce fossil consumption by avoiding the need for conventional ancillary services, more than compensating for their consumption.

Procurement Targets

One of the primary issues that this Proceeding has to address is whether, and if so how, to enact procurement targets for energy storage systems. It is clear from the January 14, 2013, workshop presentations that the energy storage industry organization, CESA, favors using targets, while the utilities oppose it. The core of the argument against the use of procurement targets is that targets distort the competitive marketplace. The core of the argument in favor of targets is that storage systems are not yet fully commercialized, meaning that in many cases there are commercialization costs that the competitive marketplace is not equipped to underwrite. We tend to agree that energy systems are still in the early commercialization phase of development, and not yet ready to thrive unassisted in the competitive marketplace. Indeed, in California today there are no more than a handful of energy storage systems on the grid. Thus in our opinion, some kinds of procurement targets or incentives are certainly in order.

The GPI believes that the quickest means available to bring the storage industry into the competitive marketplace is to pursue a series of pilot projects based on some of the Use Cases that have been developed for this Proceeding. Although our discussion is not meant to be comprehensive, we believe that some near-term demonstration projects jump out as being desirable to pursue. For example, one or more demonstration projects of storage technologies connected to the transmission system, and designed to provide flexible ancillary services, would certainly help to move the various technologies forward. The Commission has already funded a couple of demonstration projects of thermal-energy storage systems associated with solar-thermal generators, by approving PPAs for these projects with explicit consideration given to the fact that they are moving new technology forward into the marketplace. The Commission has also included a 50 MW procurement authorization for storage as one component of SCE's pending LCR Decision in the LTPP Proceeding (R.12-03-014).

We would also support one or more demonstration projects in the distribution-system-connected Use Case categories. The ability of storage systems to strengthen and stabilize weak parts of the distribution system, to provide ancillary services at the distribution system level, and to allow for the deferral or avoidance of the installation of new equipment, needs to be tested and demonstrated in real-world applications.

We are also in favor of demonstration projects in the three Use Cases involving behind-the-meter applications, including smart-charging of vehicles, but demonstration projects in these categories might be more appropriately scheduled in a second phase of demonstration projects, when supporting markets for these types of systems will have had more time to develop.

With respect to the setting of procurement targets for energy storage systems at this point in time, the GPI feels that it is probably premature to set the kinds of aggressive, far-reaching procurement targets for storage that were used, for example, to drive the RPS program. CESA also does not recommend pursuing this approach at this point in time. On the other hand, it might make sense to set reasonable, near-term program goals for a defined set of promising applications for storage systems, probably based on the Use Cases. This would send a clear signal to the marketplace that significant growth in energy-storage systems in California is on the horizon.

Cost-Effectiveness Methodology

The cost-effective operation of an energy-storage system essentially involves taking lower-valued energy, either from an associated generator or from the grid, and converting it to a higher-valued energy product that is supplied to the grid. In order to be cost effective, the increased value of the energy product compared with the value of the input energy has to cover the capital and operating costs of the storage system, as well as the storage device's efficiency losses (energy out < energy in). Within this framework, standard methods of determining the cost-effectiveness of an investment in energy infrastructure can be applied, consistent with AB 2514. Methodologies to perform cost-effectiveness analysis are well established.

The difficult part of applying cost-effectiveness analysis to energy-storage systems is twofold. First, the capital costs of these capital-intensive systems currently reflect a market that is in the early stages of commercialization, which means that there is every reason to believe that costs will decline, in real terms, as the market matures. Estimating by how much and how quickly this will happen is the difficult part. Second, as discussed previously, tariffs and rules specific to storage systems have yet to be developed, with the result that the cost of acquiring charging energy, and the value of the products that storage systems can provide, have yet to be determined. These uncertainties are the major source of the challenge that is presented by the statute's requirement to perform cost-

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effectiveness analysis, as indeed they are a major impediment to the development of the market for energy-storage systems.

Policy Options and Related Proceedings

Energy-storage systems represent a variety of technologies that can provide a broad range of products. As a result, energy-storage systems are applicable to many different aspects of the operation of California's electrical grid. In the context of the work that is underway at this Commission, this means that energy storage, while meriting its own Proceeding, is also applicable to several additional Commission Proceedings, including the LTPP, the RPS, DR, and EV.

In the opinion of the GPI, the *Phase 2 Interim Staff Report* does an adequate job of identifying the most important issues facing storage in the related Proceedings that we are involved with, as well as storage issues relevant to related agencies. The entire spectrum of the energy-storage world is rapidly developing, and this development is happening on a global basis. California does not have to carry the load for these new technologies, but it can certainly be a major player.

Conclusion

The *Energy Storage Phase 2 Interim Staff Report* does a good job of constructing and presenting a range of Use Cases that cover the broad range of technologies and applications that comprise energy storage. We have proposed some enhancements to the Use Cases, and provided our comments on the various policy issues covered in the document.

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Respectfully Submitted,

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