Docket No.: R.12-03-014

Exhibit No.: ____________________

Date: June 25, 2012

Witness: Janice Lin

TESTIMONY OF JANICE LIN

ON BEHALF OF THE CALIFORNIA ENERGY STORAGE ALLIANCE

CONCERNING LONG TERM PROCUREMENT PLANNING,

TRACK 1 – LOCAL RELIABILITY

Q: Please state your name and business address.

A: My name is Janice Lin. I am Executive Director of the California Energy Storage Alliance ("CESA").[1] I am also Managing Director of StrateGen Consulting, LLC. My business address is David Brower Center, 2150 Allston Way, Suite 210, Berkeley, CA 94704

Q: Please summarize your professional and educational background.

In my capacity as Managing Director of StrateGen Consulting, LLC, and Co-Founder and Executive Director of CESA, I am actively involved in helping clients market distributed grid connected energy systems to a wide range of potential customers. I provide strategic and technical support to CESA member companies and end users of energy storage to deploy new energy storage projects, and accomplish their business objectives. Prior to founding StrateGen and CESA, I served as Vice President of Business Development and Vice President of Product Strategy at PowerLight Corporation, a leading designer and installer of large-scale grid-connected solar electric systems and energy efficiency services (now SunPower Systems). I hold an MBA from the Stanford Graduate School of Business, a BS from the Wharton School of Business and a BA in International Relations form the University of Pennsylvania's College of Arts and Sciences.

Q.: Have you ever testified before this Commission?

A: Yes.

Q: On whose behalf are you testifying?

[1] The California Energy Storage Alliance consists of A123 Systems, Bright Energy Storage Technologies, CALMAC, Chevron Energy Solutions, Deeya Energy, East Penn Manufacturing Co., EnerVault, Fluidic Energy, GE Energy Storage, Green Charge Networks, Greensmith Energy Management Systems, Growing Energy Labs, HDR Engineering, Ice Energy, Kelvin Storage Technologies, LG Chem, LightSail Energy, Primus Power, Prudent Energy, RedFlow Technologies, RES Americas, Saft America, Samsung SDI, SANYO Energy, Seeo, Sharp Labs of America, Silent Power, Stem, Sumitomo Electric, Sumitomo Corporation of America, SunEdison, SunVerge, TAS Energy, and Xtreme Power. The views expressed in these Comments are those of CESA, and do not necessarily reflect the views of all of the individual CESA member companies (http://storagealliance.org).

A: I am testifying on behalf of CESA. CESA is a broad advocacy coalition that is committed to advancing the role of energy storage to promote the growth of renewable energy and a more efficient, affordable, clean, and reliable electric power system. CESA's members are a diverse mix of energy storage technology manufacturers, renewable energy component manufacturers, developers and systems integrators. CESA is a technology-neutral and business model-neutral association of members who share a common mission, and is supported solely by the contributions and coordinated activities of its members.[2]

Q: What is the definition of Energy Storage?

A: Energy storage represents a class of technologies which store, and later discharge, energy in one of many forms. In general, energy storage transfers generated electricity to some energy-capacity holder, which may be represented by electrical, thermal, gravitational or mechanical energy storage. This energy is then discharged during times of high need, ranging from peak-demand hours to times when power supplies are interrupted. Energy storage is a flexible and diverse asset class that represents multiple technologies with multiple applications.

Energy Storage technologies include, but are not limited to: electricity storage, such as batteries, which store generated electricity for later use; gravitational energy storage, such as pumped hydroelectric, which stores energy using transferred pressure or inertia that may be fed through turbines for further electricity generation; mechanical storage, such as flywheels that store energy in a rotating mass; or thermal storage, such as ice storage, which uses generated electricity to generate heat or cold to be dispatched at a

[2] *See*, "About Us – Overview." *California Energy Storage Alliance,* http://www.storagealliance.org/about.html.

later time. Energy storage technologies may be paired with a number of grid-based or local generation resources, and may be placed in multiple locations on the grid. Depending on design and location, energy storage may be used to meet a number of policy goals, from load leveling to voltage regulation.

Q. What is the purpose of your testimony?

A: The purpose of this testimony is to explain how and why energy storage should be expressly considered in determining future local reliability needs in this proceeding.

1. The Commission should emphasize the game changing importance of energy storage in utility procurement.

The grid today is not the grid that we've known for the last 50 years. The grid of today has a less constant supply profile, and variable generation is entering the system in increasing amounts. Today's grid also has a more variable demand profile, especially with the widespread use of electronic devices and the electrification of transportation, including electric vehicles. Looking forward, this evolving grid will require increasing flexibility, intelligence, and diversity to remain reliable, sustainable, efficient, and effective. Energy storage is a crucial asset in this energy future - and thus needs support and emphasis at all levels, as advocated for by utilities such as San Diego Gas & electric Company:

> "Storage Technology (ST) can also be used with DR [Distributed Renewables] and DG [Distributed Generation] to provide dispatchable energy and capacity, ramping, voltage support, and frequency control. The most advanced ST can provide capacity, instructed energy, and other CAISO services in order to obtain greater revenue. Location on the grid is also a possible NPV/BCR driver, particularly to remedy specific grid constraints. Strategically located ST may directly reduce

T&D costs. *ST is similar to DR but provides even greater optionality* (Emphasis added)”.[3]

These multiple applications will allow California to optimize and more efficiently utilize the assets that we have. This includes the generation, transmission, distribution, and consumption levels of the energy system. As a point of reference, California’s load factor currently stands at 51.4%,[4] meaning that we have nearly double the installed capacity that would be needed if the annual consumption of electricity total were spread out evenly throughout the year. While energy storage cannot completely eliminate this discrepancy, it can improve California’s load factor by reducing the need for installed peak production capacity. Through this characteristic and others, deployment of energy storage will result in greater utilization of our existing assets - both conventional and renewable energy facilities, transmission and distribution infrastructure, and consumption-level resources - leading to savings for ratepayers and a more secure, resilient electric system.

Energy storage can also be a highly effective tool to facilitate other energy policy goals, such as implementing the Renewables Portfolio Standard. The breadth of energy storage deployment capabilities is reflected in the entire asset class’s multiple benefit streams, which include load leveling, energy time transfer, energy reserve capacity, and voltage regulation, among others. These benefit streams may be applied in multiple

[3] “Integrated Demand-Side Management (IDSM) Cost-Effectiveness Framework White Paper.” Prepared by Black & Veatch Corporation for San Diego Gas & Electric Company, May 12, 2011. Pg. 8

[4] “Preliminary California Energy Demand Forecast” Mark Ciminelli, et. al., California Energy Commission Draft Staff Report, August 2011. http://www.energy.ca.gov/2011publications/CEC-200-2011-011/CEC-200-2011-011-SD.pdf. Peak load trends from 1990-2022 (projected) in Fig. 1-4, pp. 17-18. Annual consumption & peak load figures on pg. 12; Load factors for 2010 calculated using:

$$Load\ Factor = \frac{\left[\frac{Annual\ Energy\ Consumption\ in\ MWh}{365 * 24h}\right]}{Peak\ Demand\ in\ MW}$$

flexible situations to further a number of policy goals, from infrastructure investment management to emissions reduction. For example, the Commission will be working over the next several decades to reduce California's energy-based carbon footprint. Energy storage enables a smarter, more flexible, more optimized electric power system and that will enable us to use more and more renewable energy sources. Further, because of the difference between the environmental impacts of base load and peak generation facilities, energy storage helps reduce emissions by minimizing the need for peaker plants; similar savings are also achieved because of differences because of transmission and distribution losses during the night and daytime. Energy storage will also provide greenhouse gas emissions savings as well as market-transformational savings.

Ultimately, the Commission's emphasis on energy storage in procurement will enable the benefits of this versatile asset class to be realized sooner. Once the market is seeded with actual procurement, industry and stakeholders will get involved. This will stimulate further investment, which will create jobs, drive down costs in general, and start building the ecosystem of investors, manufacturers, and installers that are needed to create a healthy industry. The more mature that ecosystem becomes, the lower the cost, the wider the use, and the greater the benefits will all be.

2. The Commission should closely coordinate this proceeding with the Energy Storage Rulemaking.

The great challenge that energy storage has historically faced in California is that it lacked a "home" in any one proceeding at the Commission, so in essence it belonged everywhere and as a result, lacked focus from a regulatory policy standpoint.

Fortunately, this is changing. The Energy Storage Rulemaking[5] being implemented pursuant to Assembly Bill 2514 is the first such effort to establish a policy decision-making process in California focused on energy storage. The Energy Storage Rulemaking is now the home for energy storage, where all energy storage issues can be a primary focus and can be simultaneously and closely coordinated to related proceedings.

Of course, one very important energy storage-related proceeding at the Commission is this one. The issues in this proceeding are very broad and encompass a diverse range of technologies. As noted above, energy storage is an inherently valuable set of technologies that has broad benefits when widely implemented throughout the grid. It is also a technology that inherently relies on interconnection with the grid and other procured infrastructure. Energy storage should accordingly be incorporated into the long term procurement process as a powerful interconnected asset similarly to how pumped storage was during the nuclear generation build out period in California, effectively, purposefully and in a distributed fashion. CESA and others have already urged the Commission to adopt multi-year, or long-term, contracting for resource adequacy ("RA") capacity provided, enabled, or enhanced by energy storage technology."[6] CESA's comments underscore the necessity of full integration of storage into long-term procurement planning as a powerful and resource adequacy RA-improving asset class.

The energy storage industry, with exception of pumped hydro, is a nascent industry that must establish and fully understand its related regulations and future economic opportunities in order to thrive. Both of these aspects are necessary for

[5] Order Instituting Rulemaking Pursuant to Assembly Bill 2513 to Consider the Adoption of Procurement Targets for Viable and Cost-Effective Energy Storage Systems, R.10-12-007, filed December 16, 2010.

[6] *See*, "Comments of the California Energy Storage Alliance," R.11-10-023, *Order Instituting Rulemaking to Oversee the Resource Adequacy Program, Consider Program Refinements, and Establish Annual Local Procurement Obligations*, April 11, 2012.

effective stability, growth, and widespread implementation of energy storage. In this particular case, regulation is represented by the Energy Storage Rulemaking and economic opportunities will largely be dependent on statewide long term procurement planning. Just as these are both critically important to the future of the energy storage industry, they are also related and must be carefully coordinated to ensure the best possible deployment of energy storage statewide. All of the Commission's proceedings should recognize the state's goals for procurement and integration of energy storage, and utility procurement plans should reflect both the limitations and flexibility afforded by storage-related regulatory policy. By coordinating this proceeding and the Energy Storage Rulemaking, the Commission can best ensure the successful development of this valuable asset class.

3. The Commission's long-term procurement planning assumptions should begin including energy storage immediately.

The grid is a very dynamic and constantly evolving system, and if we wish to envision the best-functioning future grid, we must understand how every beneficial technology can be integrated into it going forward. Energy storage represents a very broad and useful technology class that (with the exception of pumped hydro) is currently in its early stages of adaptation for grid-use. Incorporating energy storage into all stages of the planning process, including the most immediate timetables, will facilitate the development of both the energy storage industry and a resilient, dynamic grid that meets our vision. Early prioritization of energy storage will give the industry certainty, allow for expansion and widespread integration of energy storage into the grid, and give California a head start on understanding and implementing the most beneficial applications of energy storage. On the other hand, delays and related uncertainty surrounding energy storage in the long-term procurement planning process will stunt industry growth and negatively impact grid integration and all its related benefits. CESA therefore strongly urges that some of the scenarios to be considered expressly factor in the potential of this very broad asset class. In fact, CESA recommends a very strong emphasis on energy storage in all planning scenarios, as this will both stimulate industry development and attendant grid improvement.

Energy storage with multiple benefit streams is already being included in long-term grid projections at the national level. The National Renewable Energy Laboratory ("NREL"), in projections allowing high grid penetration of renewable generation, recognizes the necessity of energy storage and its related expansion to the success of tomorrow's grid. Under the 80%-renewable scenarios for 2050 outlined in NREL's recent Renewable Energy Futures Study, storage capacity expands to 100-152 gigawatts ("GW") nationwide for energy flexibility ("the ability to shift bulk energy over several hours or more") alone, depending on the specific scenario studied.[7] As much as 10-20 GW of this capacity is projected for California,[8] including other applications – power quality and regulation, bridging power, etc., – will expand this capacity further. As important, NREL projects a front-loading of capacity installation, especially in the early-2020s to early-2030s, with extremely active years in 2022-2023.[9]

Achieving these much-needed levels of energy storage deployment - both annual and cumulative - will be significantly easier if installation and industry expansion begin

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[7] "Renewable Energy Futures Study. Volume 2: Renewable Electricity Generation and Storage Technologies" Hand, M.M. et. al. (ed.) *National Renewable Energy Laboratory*. Figure 12-7: Deployment of Energy Storage Technologies in 2050 under 80% RE Scenarios. Pg. 12-29. http://www.nrel.gov/analysis/re_futures/.

[8] NREL. Vol. 2, Figure 12-13. "Regional deployment of storage in the contiguous United States in the constrained flexibility scenario." Pg. 12-28.

[9] NREL. Vol. 2, Figure 12-12. "Deployment of energy storage technologies in the constrained flexibility scenario." Pg. 12-27.

immediately. Starting now will facilitate much-needed industry growth, which will in turn lead to lower costs and greater annual installation capabilities. It is also imperative that the Commission recognize the urgency and necessity of including energy storage, both in terms of achieving statewide goals and in doing so cost-effectively. CEERT, for example, concurred with this point this in its Reply Comments:

> "At a time when the Commission and the California Independent System Operator (CAISO) are focused on renewable integration and the potential need for 'flexible capacity,' any standard planning assumptions or scenarios should recognize that demand response [of which storage is included] can provide 'balancing capabilities faster and more cost-effectively than traditional generation.'"[10]

Acting now will smooth out the overall incorporation of energy storage into the grid, lowering average annual costs and allowing for more effective integration with other technologies.

Early adoption of energy storage in procurement planning assumptions is a specific an area where there should be close coordination with the Energy Storage Rulemaking. The Energy Storage Rulemaking is actively defining priority applications for energy storage and may in fact provide the vision and roadmap toward integration and aggregation of multiple benefits streams for key priority applications. These priority applications will allow energy storage to expand in the very near term, if not immediately. The procurement planning process has continually increasing opportunities to include energy storage and should take advantage of them as quickly as possible. Furthermore, incorporation of energy storage into near-term procurement plans will send signals to decision-makers regarding which applications to address immediately. This

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[10] "Reply Comments of the Center for Energy Efficiency and Renewable Technologies on Energy Division's Standard Planning Assumptions Straw Proposal", June 11, 2012

will allow for smoother policy development, increased certainty for industry, and more seamless development and grid-integration for energy storage technologies.

4. The Commission should consider the role of energy storage in utility procurement at the earliest possible time.

As pointed out in CESA's Reply Comments,[11] the Commission has not mentioned energy storage at all in this proceeding. In areas where energy storage should be included, the framework surrounding it – both in terms of understanding of technological benefits and an outline of long-term plans lack necessary specificity. Unless corrected by the Commission, this omission will severely impair the progress of California's energy infrastructure and related industries, and would clearly be counter to evolving nationwide trends. The longer uncertainty continues, the worse the lost benefits will be. The Commission can and should begin planning immediately and facilitate positive, concurrent industry development and grid improvement. More specifically, the Commission should make an effort to create a reference model for energy storage in general: this can then be used as a point for comparing energy storage to other technologies, giving it appropriate benefits recognition, and incorporating it into an evolving energy system. This could, for example, acknowledge the environmental benefits and energy savings parallels between energy storage and renewables. Such recognition would facilitate planning policy and procurement processes by giving utilities needed guidance as to rate setting, verifying the financial cost-benefit balance of storage, and outlining rewards for environmental characteristics of energy storage.

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[11] "Reply Comments of the California Energy Storage Alliance on 2012 Energy Division Straw Proposal on LTPP Planning Standards", June 11, 2012.

Earlier consideration will allow for improved industry confidence and planning; it will also allow the Commission to better investigate the benefits, characteristics, and applications of energy storage before more widespread procurement begins. Both will lead to lower costs, improved industry development, smoother incorporation of storage into the grid, and a better electricity system overall.

As stated above, energy storage is a capital-intensive industry that greatly benefits from, and in many ways requires, economic confidence for future success. Early consideration by the Commission will send positive signals to industry developers and financers that will facilitate necessary expansion and related benefits, including reduced costs and industry readiness. Similarly, grid developers will know that energy storage will likely be incorporated into the system if the Energy Storage Rulemaking provides the necessary signals. This awareness will contribute to more flexible, storage-ready grid development even before local procurement plans are developed; it will also prevent unnecessary expenditures that could otherwise be minimized by energy storage deployment in the future. The Commission should incorporate energy storage in planning and modeling, as later incorporation will be difficult and will lead to less than optimum deployment. This point is made in Vote Solar's Reply Comments:

> "Once a rational for procuring long-term system resources is established, however, it becomes very difficult to model a posteriori the effectiveness and impact of any putative future package of incremental EE, DR, DG or storage. Thus, to ensure the widest scope of possible flexible system resource solutions now and in the future, the planning scenarios should consider much larger amounts of DR, EE, DG and storage in the resource mix."[12]

CESA's view is that the best method of developing future plans involves learning by doing. There is no substitute to having real applications, real deployments, and real

[12] "Reply Comments of the Vote Solar Initiative," June 11, 2012.

data concerning the performance, costs, and benefits that are achievable by a given technology's implementation. By considering energy storage's role as early as possible, the Commission can better collect, analyze, and understand all data surrounding this valuable asset class. This will lead to more efficient development and incorporation; it will also allow for the full actualization of the dynamic, reliable, and sustainable grid that widespread deployment of energy storage enables.

Due to the educational benefits of early grid integration, immediate procurement will help the Commission shape any future targets. This information will be best used if storage is implemented on a test basis for the priority applications identified in the energy storage rulemaking. With such an approach, the Commission can analyze available information from already-installed projects. Installed project data is strategically important to consideration of procurement targets in the Energy Storage Rulemaking as well as future long term procurement planning. This data can then assist the Commission with understanding the benefits of various applications, which will lead to better grid development. Early and sustained procurement will also allow for industry expansion, which will produce high-quality data concerning cost reductions and technological development. So, early consideration combined with early procurement will stimulate industry growth and development, improve the Commission's understanding of the entire asset class, and facilitate the planning and development of the best possible grid for California.

5. The Commission should focus on assumptions needed to model the performance, costs, and benefits of energy storage.

Because grid-connected energy storage is such a nascent industry with limited current deployment, much of the planning for its further expansion is dependent on modeling. These planning models, by their nature, require accurate inputs regarding performance, costs, capabilities, and benefits of modeled technology. Accordingly, the modeling of energy storage must develop a set of clear assumptions underpinning these parameters, and issues related to these technological assumptions must be addressed early if accurate modeling is to occur.

Fortunately, today that there are today sufficient energy storage deployments - either funded through state and federal grants – for us to analyze certain commercial applications. Through the Energy Storage Rulemaking and actual procurement, there will be a further refinement of energy storage applications in the system. There is information available today that can be used to develop modeling assumptions needed for projecting the impacts of further energy storage development. The Commission should promptly gather necessary information from these existing projects in order to develop accurate assumptions needed for modeling. As mentioned above, data gathering may be further improved if the Commission encourages expanded procurement as quickly as possible.

Better modeling assumptions should also include grid characteristics impacting energy storage. For example, the California Energy Commission has recognized the need for more information regarding differences between peak and off-peak line losses in California, as this data currently is limited to a handful of studies, some two decades old.[13] CESA's view is that differential line losses highlight energy and emissions savings achieved by load-shifting energy storage assets, as transmission is shifted from high-loss to low-loss times. Focusing on both energy storage assets and their surrounding

[13] *See*, "A Review of Transmission Losses in Planning Studies." Lana Wong. California Energy Commission, August 2011.

ecosystem will allow the Commission to collect information on differential losses and similar grid characteristics. This will lead in turn to better understanding of the full benefits of energy storage. A new, clearer picture of energy storage will enable more accurate procurement of all grid-wide assets, full recognition of emissions and energy savings, and better long term procurement policy.

Of course, the Commission should utilize all available resources to facilitate accurate modeling. This may include consultation with industry developers, academics, utility managers, and others. The Sierra Club highlighted this point in its Reply Comments addressing energy storage placement on the grid:

> "[t]he assumptions should recognize that energy storage is a unique resource that can fill a role both as a generator and as dispatchable demand, and that its real value to the grid has therefore much higher megawatt capacity than its nameplate."[14]

Data should be collected and analyzed for all potential applications. Once this data is collected, the Commission can begin grid-wide modeling that accurately incorporates energy storage. This will enable the effective planning of energy storage procurement and installation necessary to develop an ideal grid for California.

6. The Commission should adopt a multi-year procurement mechanism that includes energy storage.

To provide more affordable and large-scale energy storage for the benefit of California, the industry must expand and develop effective economies of scale. Accordingly, a number of parties, including CESA, have advocated for multi-year procurement. This is critical for energy storage because energy storage, like any other capital-intensive energy asset, requires certainty of cash flows in order to attract debt and equity financing necessary for project development. Multi-year procurement

[14] Reply Comments of the Sierra Club, June 11, 2012.

mechanisms will thus provide revenue security for individual projects. They will also provide economic certainty necessary for industry to comfortably expand production, installation, and other related capacities. For example, battery developers will feel more comfortable making investments in factories if they are guaranteed purchases for their products for several years, if not more. Without such procurement certainty, concerns about future revenue streams for storage products themselves will limit production capacity and related benefits, including affordability and technological advancement.

There are currently no multi-year procurement mechanisms or multi-year cash flow guarantees that investors can rely on for energy storage. Because of this, investment in energy storage has been insufficient to stimulate effective development and expansion; both will also remain stunted until we can secure dependable long-term cash flows. Furthermore, future revenue projections must be sufficient to ensure payback for these capital-intensive projects. Accordingly, the Commission should develop processes for multi-year procurement that provide reasonable rates of return for energy storage investments, including industry infrastructure and individual projects. This will require robust modeling of project costs and benefits/revenues, which is directly related to accurately developed assumptions discussed above.

Further, effective multi-year procurement for storage can shape the long-term procurement process for the entire grid. For example, long-term procurement includes finding sources for base load and peak generation. If the Commission prioritizes and facilitates the expansion of energy storage - that is able to shave peak load generating capacity in the future - that means that the state’s long-term procurement planning can further minimize the purchase and installation of peak generation facilities. California will clearly be able to save money by reducing our unneeded investment in new peaker plants if there is effective multi-year procurement for energy storage. Ultimately, CESA's view is that the benefits of energy storage within this type of planning process will greatly outweigh the costs, and CESA accordingly encourages the Commission to investigate and pursue energy storage in long-term procurement planning to the fullest possible extent.

Q: Does this conclude your testimony?

A: Yes it does.