Docket No.: R.12-03-014

Exhibit No.:

Date: July 23, 2012

Witness: Janice Lin

REPLY TESTIMONY OF JANICE LIN
ON BEHALF OF THE CALIFORNIA ENERGY STORAGE ALLIANCE
CONCERNING LONG TERM PROCUREMENT PLANNING,
TRACK 1 – LOCAL RELIABILITY

Pursuant to the *Scoping Memo and Ruling of Assigned Commissioner and Administrative Law Judge*, issued on May 17, 2012, and the *Assigned Commissioner's Ruling* issued on July 13, 2012 ("ACR"), CESA submits this reply testimony.

Q. What is the purpose of your reply testimony?

A. The purpose of this reply testimony is to: (a) respond to the opening testimonies of parties that were served in this proceeding on June 25, 2012, and (b) respond to the questions posed in the ACR.

RESPONSES TO TESTIMONIES OF PARTIES

Q. What were the broad points that were made in your opening testimony?

A. The Commission's long-term procurement planning assumptions should begin including energy storage immediately. The Commission should consider the role of energy storage in utility procurement at the earliest possible time. The Commission should focus on assumptions needed to model the performance, costs, and benefits of energy storage. The Commission should adopt a multi-year procurement mechanism that includes energy storage.

Additionally I note that CESA has filed directly relevant comments to the Commission in several closely related proceedings, including the Storage OIR, Resource Adequacy and Renewables Portfolio Standard.

Q. Several parties state in their opening testimonies that energy storage, along with other non-generation resources, needs to be considered in LTPP. Do you agree with these parties?

A. Yes. As stated in CESA's opening testimony, and in other filings in this and other active proceedings at the Commission, energy storage is an appropriate and very valuable non-generation resource that should be considered in LTPP, especially for LCR. Non-generation resources typically have the attributes needed to meet or exceed LCR needs; for example energy storage typically has some attributes that are even better than most generation resources (*e.g.* siting and permitting speed, lower emissions profile, lower life-cycle cost, enhanced system efficiency, more modular scaling; see Appendix A for a more complete list of energy storage's attributes).

CESA also notes that while traditional fossil generation can typically perform the functions desired for LCR, we strongly disagree with the implication in the opening testimonies of some parties that *only* generation can perform those functions. Energy storage can certainly meet LCR and, like generation, is dispatchable. (In fact, storage is often more dispatchable in that unlike gas turbines which must be run at some minimum output level, most storage technologies have a minimum utilization of zero. As a result, it can be constantly synchronized to the grid, ready to provide fast-ramping flexibility in response to dispatch instructions, allowing lower cost alternative supply sources to be used.) Distributed energy storage (like other non-generation resources) does not have most of the concerns that SCE, for example, cites in its opening testimony as to why new generation in the LA Basin is difficult and time consuming (*e.g.* permitting delays and other difficulties).

Q. SCE states in its opening testimony that "There are a limited number of non-generation options to meet LCR need." Do you agree with SCE?

A. No. Although the statement is literally accurate, in reality there are enormous non-generation options to meet LCR need throughout California. Energy storage is one such non-generation option that can plentifully meet LCR needs in the areas under evaluation in this proceeding, and often with attributes superior to those of generation resources (improved system asset utilization, ability to defer or avoid T&D expenditures, contribution to a diversified resource portfolio, etc.).

Q. SCE states in its opening testimony that LCR near retiring resources is required. Do you agree with SCE?

A. Like SCE and certain other parties CESA believes that siting LCR near retiring resources is beneficial. However, even more beneficial is siting LCR near load and near or in T&D constrained areas. Although some energy storage resources do depend on local topography, the great majority of energy storage resources are readily distributable to be where the need for – and value to – the system is greatest. Distributed energy storage can often be sited actually with load, namely in or adjoining end users' buildings and facilities. CESA shares not only SCE's view, but also that of the Division of Ratepayer Advocates in is opening testimony that: "The CAISO has not properly accounted for the amount of preferred resources expected to be available to reduce load or meet electricity demand in these areas…[they] can be implemented close to load pockets to reduce demand."

Q. Several parties state in their opening testimonies there is a need to address the significant uncertainty in long term LCR procurement planning. Is that planning uncertainty relevant for energy storage?

A. Yes – and in fact the characteristics of energy storage make it a more valuable contributor than other resources in an uncertain planning environment.

Like other distributed, aggregatable non-generation resources – and unlike larger scale more expensive generation resources – energy storage's modular nature, scalability and optionality provide great flexibility and benefit. As a result of smart grid technologies, distributed energy storage can readily be aggregated to needed scale. Hence, like other distributed non-generation, aggregatable resources, storage can provide the best of both worlds: utility-scale and modular.

This operational flexibility of energy storage not only results in lower cost, but also encouraged renewable deployment and reduces emissions.

- Regarding locational flexibility:
    - Energy storage can be sited in small, modular increments virtually anywhere in the electric power system, thus targeting areas of greatest local constraint.
    - Siting and permitting requirements for energy storage are much less strict than those of fossil fuel plants – thus, energy storage can be much more quickly and easily sited.
- Regarding timing flexibility:
    - Energy storage can be installed in modular increments over time, as energy and capacity requirements become more certain. By installing smaller increments of capacity over time, the risk of over-installing (or under-installing) capacity is greatly reduced.
- Regarding system efficiency:
    - Energy storage helps existing fossil fuel plants operate at their most efficient levels (*i.e.,* let energy storage be load-following so that fossil plants can run more evenly).
    - Energy storage helps flatten peak demand, thus better utilizing fixed investment in T&D and improving California's overall electric system load factor.

Q. SDG&E in its opening testimony testifies about the importance of performance certainty in LCR. Is energy storage a resource that provides performance certainty as SDG&E describes it?

A. Yes. Storage is dispatchable and can be counted to meet Qualifying Capacity deliverability requirements of California's utilities under defined circumstances discussed specifically by the Commission in its Resource Adequacy decisions, including most recently in D.12-06-025, issued June 21, 2012.

Q. SDG&E also states in its opening testimony that: "With regard to energy storage, inclusion of this resource for resource planning purposes is premature. There exists no reasonable basis to assume that storage will develop in advance of determining local need in this LTPP cycle. Moreover, to the extent energy storage does presently exist, it is intended to deal with intermittency issues. It is not storage that is being specifically designed to contribute to meeting the peak load that local reliability planning must address." Do you agree with SDG&E's assessment?

A. No, because it is simply inaccurate. The attached Appendix B to this reply testimony, for example, clearly identifies a multitude of applications of energy storage that are being seriously evaluated and are at various stages of deployment by utilities today in California and elsewhere around the U.S. Further, utilities in other states have received proposals from developers offering storage as a resource option in long-term capacity procurement. California utilities could attract the same interest if developers had confidence that the evaluation process would fairly count the benefits.

Q. Several parties comment in their opening testimonies on the value of connecting LCR and this entire proceeding to the Resource Adequacy and other Commission proceedings? Do you agree with them?

A. The need to connect with the Resource Adequacy proceeding is well established, and CESA agrees. Just as importantly, the Commission needs to also closely coordinate this proceeding with the Energy Storage Rulemaking, R. 12-07-004, as well as the RPS proceeding (R. 11-05-005). The Commission and Energy Division Staff have indicated that they agree with this need, and CESA greatly appreciates their support on this vitally important point.

RESPONSES TO QUESTIONS POSED IN THE ACR

Q. The ACR states that: "In the past, the Commission has allowed all source Request for Offers (RFOs) for incremental resources in which any type of resource could compete to fill an identified need." Do you agree with the ACR's characterization of California's historical experience with RFOs?

A. Yes, in a general sense. Early experience with the post-electricity restructuring utility procurement process experimented with the approach, but over time RFOs for both fossil fuel and renewable resources have become increasingly focused to the exclusion of resources other than those specifically and often very narrowly proscribed.

Q. The ACR asks: "What barriers may currently exist to ensuring effective all source RFOs?" What is your response?

A. CESA believes that the barriers exist in two ways. First and foremost, RFOs need to fully and fairly value the attributes needed by the system and that can be provided by the widest variety of potential bidding resources. These include the well understood attributes that traditional generation brings as well as the additional benefits provided by energy storage and other non-generation resources described in responses to questions related to opening testimonies of parties above and elsewhere, including the Energy Storage Rulemaking.

Second, there appears to be in general a perception (and perhaps a reality) on the part of potential bidders that any California RFO process will not sufficiently consider the attributes of non-traditional resources such as energy storage and therefore it isn't worth a potential bidder's expense and effort to put forward an offer of a non-generation resource. As stated earlier, utilities in other states have received proposals from developers offering storage as a resource option in long-term capacity procurement. California utilities could attract the same interest if developers had confidence that the evaluation process would fairly count the benefits.

Q. The ACR asks: "What specific performance characteristics should be accounted for in [an] RFO to effectively enable the participation of non-traditional resources like energy storage, demand response and distributed generation?" What is your response?

A. In RFO process, as well as in other bilateral procurement methods, the Commission should direct the utilities to meet LCR by procuring resources provided by *any and all business models* for energy storage deployment, namely utility-owned, customer-owned, and third party-owned.

Furthermore, CESA would like to underscore that this latter point reflects a larger point about utility resource procurement in general and utility energy storage procurement in particular. While procurement standards and "carve outs" or "set asides" for specific resources that are desirable from a public policy perspective (*e.g.* renewables, efficiency, demand response, AMI) have played, and are certainly expected to continue to play, a major role (particularly for not yet fully mature resources), it is generally preferable to develop a workable procurement regime that is built upon a scoring (or other evaluation) scheme that can *properly and meaningfully weight the attributes* of desirable resources, thus giving them the opportunity to compete with more established resources that lack the same or comparably valuable attributes.

Q. The ACR asks: "Would the Commission need to be specific about the characteristics of the resources needed to meet the need (e.g., minimum hours of availability required to meet local reliability needs)? If so, what characteristics should the Commission require?" What is your response?

A. CESA recommends that at least the following characteristics should be required:

- Explicit recognition of energy storage's ability to participate (and being technology neutral among energy storage technologies),
- Fair comparison between the energy storage technology's cost and capabilities on a delivered service basis factoring in storage's flexible capacity, service hours and ramp speed benefits
    - (Lower Cost of Delivered Flexibility -- In some or perhaps many circumstances storage's net cost (benefits minus cost) is likely to be less than traditional combustion turbines when compared on a delivered service basis, and simultaneously improve overall system efficiency.
        - Regarding Flexible Capacity -- Fairly comparing cost of delivered service:
            - Example: 100 MW gas turbine – if this capacity to be flexible, then it can only be run at 40 MW to obtain +/- 40 MW of flexibility (80 MW of total flexible capacity). This has implications in that

    running this turbine at 60MW is not its most efficient operational capacity, resulting in greater emissions and lower overall heat rate efficiency

  - The same up/down 40MW frequency regulation and ramping service (80 MW of total flexible capacity) can be provided by 40 MW of storage. 40 MW of procured storage will be far more cost effective than 100 MW of combustion turbines even at today's commercially available storage prices. Another way to look at the same example is to compare apples to apples flexible capacity: 100 MW of storage can provide 200 MW of flexibility as compared to a 100 MW gas turbine which can only provide 80 MW of total flexible capacity. Storage thus provides 2.5x more flexible capacity for each MW of rated capacity.
  - While charging storage can provide 2x its capacity as reserves and when charged storage can provide spinning reserves while on standby.

- Regarding Service hours and ramp speed. Storage's value is even greater when service hours and ramp speed are factored in.
  - Gas turbines must always be run at some minimum output level (or their efficiency is too low). Such minimum 'must-run' required runtimes may displace lower-cost alternative sources of energy for California.
  - Conversely; storage, has a minimum utilization of 0. As a result, it

    can be constantly synchronized to the grid, ready to provide fast-ramping flexibility in response to dispatch instructions, allowing lower cost supply sources to be used.

    - Storage's ability to respond instantaneously to control signals (as compared to the slow response of combustion turbines) means that less overall balancing services need to be procured. In other words, storage provides superior performance. This is the main reason why FERC recently issued Order 755 requiring ISOs and RTOs around the country to implement a new 'pay for performance' tariff that rewards fast-responding resources.

- Reasonable time of availability for the resource, such as four hour duration (if not shorter),
- Recognizing energy storage's fast ramp rate capabilities,
- Recognizing energy storage's ability to start/stop immediately,
- Recognizing energy storage's ability to be sited close to load, where needed,
- Recognizing energy storage's minimal siting and permitting risk,
- Recognizing energy storage's ability to deliver modular installations over time as a valuable deployment and planning option,
- Recognizing energy storage's ability to increase existing generation, T&D asset utilization (more kWh delivered per kW of system capacity), and
- Recognizing energy storage's ability to reduce T&D line losses.

Q. Do you have anything to add to the responses to the specific questions posed by the ACR?

A. CESA also believes strongly that procurement (local or otherwise) should not just be a collection of individual “least cost best fit” choices. Procurement ideally should also employ a portfolio approach that uses resource diversity to diversify – and therefore mitigate – risk.

Q. Do you think scheduling a workshop to discuss the foregoing questions and responses would be useful for the Commission?

A. Yes – these issues are sufficiently complicated and new to the LCR discussion in LTPP that CESA believes it would be very valuable for the Commission, Energy Division Staff and parties to advance greater detailed discussion in a workshop setting.

Q. Does this conclude your testimony?

A. Yes it does.

Appendix A: Summary List of Energy Storage's Benefits

1. Lower Cost of Delivered Flexibility – In some or perhaps many circumstances storage's net cost (benefits minus cost) is likely to be less than traditional combustion turbines when compared on a delivered service basis, and simultaneously improve overall system efficiency.

    a. Regarding Flexible Capacity – Fairly comparing cost of delivered service:

    - Example: 100MW gas turbine – if this capacity to be flexible, then it can only be run at 40 MW to obtain +/- 40 MW of flexibility (80 MW of total flexible capacity). This has implications in that running this turbine at 60MW is not its most efficient operational capacity, resulting in greater emissions and lower overall heat rate efficiency.

    - The same up/down 40MW frequency regulation and ramping service (80 MW of total flexible capacity) can be provided by 40 MW of storage. 40MW of procured storage will be far more cost effective than 100 MW of combustion turbines even at today's commercially available storage prices. Another way to look at the same example is to compare apples to apples flexible capacity: 100MW of storage can provide 200MW of flexibility as compared to a 100MW gas turbine which can only provide 80 MW of total flexible capacity. Storage thus provides 2.5x more flexible capacity for each MW of rated capacity.

    - While charging storage can provide 2x its capacity as reserves and when charged storage can provide spinning reserves while on standby.

    b. Regarding Service hours and ramp speed. Storage's value is even greater when service hours and ramp speed are factored in.

    - Gas turbines must always be run at some minimum output level (or their efficiency is too low). Such minimum 'must-run' required runtimes may displace lower-cost alternative sources of energy for California.

    - Conversely; storage, has a minimum utilization of 0. As a result, it can be constantly synchronized to the grid, ready to provide fast-ramping flexibility in response to dispatch instructions, allowing lower cost supply sources to be used.

    - Storage's ability to respond instantaneously to control signals (as compared to the slow response of combustion turbines) means that less overall balancing services need to be procured. In other words, storage provides superior performance. This is the main reason why FERC recently issued Order 755 requiring ISOs and RTOs around the country to implement a new 'pay for performance' tariff that rewards fast-responding resources.

2. Significant locational flexibility – storage can be sited in small, modular increments anywhere in the electric power system resulting in a number of unique benefits:

    a. Far fewer siting and permitting requirements as compared to a large fossil plant, particularly because many storage technologies have no local emissions impacts.

    b. Storage can accurately target areas of greatest local constraint.

    c. Siting and permitting requirements for storage are significantly less than that of a fossil plant – thus, storage can be more quickly and easily sited.

3. Significant timing flexibility – again, storage's ability to be sited in small, modular increments enables unique benefits related to system planning/timing of new capacity. Namely, by installing smaller increments of capacity over time, the risk of adding too little or too much capacity is reduced.

4. Enhancing overall system efficiency; improving system asset utilization to deliver more kWh per kW of system capacity. There are a number of ways that energy storage can improve overall system efficiency:

    a. Storage helps existing fossil fuel plants operate at their most efficient levels (let storage be load-following, not the fossil plants) (i.e. due to reduced start-ups, commitment, part load operation and ramping to reduce fuel use, air emissions and generation wear per kWh delivered).

    b. Storage helps flatten peak, thus better utilizing fixed investment in transmission and distribution and improving California's overall load factor.

    c. Distributed storage can also help reduce line losses which reduces affects fuel use and capacity needs.

5. Accelerating renewable deployment – collectively, the operational flexibility benefits of storage as described above not only results in lower overall system operational cost, but also can enable greater renewable deployment and reduced system-wide emissions.

Appendix B: Proposed Application Priorities

#	End Use (Application)	Description/ Problem Solving	Potential Compensation or Ownership	Likely Siting & Scale	Primary Benefits	Conventional Solutions or Alternatives	Energy Storage Case Study Example
1	Distribution Storage	Defers distribution upgrades. (For Example: overloaded wire, transformers, capacitor – not a load modifier) Use energy storage in lieu of subtransmission capacity (for 1-4 years)	• Utility Ratebased • Third party • End User	• At or down- stream from overloaded equipment • Substation • Circuit • Likely scale: MW x 4 hours	• Upgrade Deferral* • Replacement Deferral* • Equipment life extension • Service reliability • T&D congestion • Transportability	• Upgrade wires or transformers.	• SDG&E primary distribution storage (batteries)

*Operational considerations: Will operate on a scheduled basis (load modifier) **OR** maintains a prescribed level of charge and responds automatically to improve operational reliability (voltage support, etc.).

#	End Use (Application)	Description/ Problem Solving	Potential Compensation or Ownership	Likely Siting & Scale	Primary Benefits	Conventional Solutions or Alternatives	Energy Storage Case Study Example
2	Community Energy Storage	Improve local service reliability. Integration of distributed VREs Voltage control	• Utility Ratebased • Third Party under contract	• Adjacent to loads, on utility 'easement' >25 kW x 2 hr	• Service Reliability* • D Deferral* • T Congestion* • Electric Supply* • Ancillary Services* • Transportability	• Capacitor • Transformer	• AEP CES • Detroit Edison CES • SMUD Solar Smart RES/CES Project • SDG&E secondary storage projects

Operational considerations: Will operate on a scheduled basis (load shift) **OR** on an automated basis (power quality / operational reliability) depending on the nature of the problem to be solved [**OR** Bid into ISO markets; operate according to awards and ISO dispatch signal]

#	End Use (Application)	Description/ Problem Solving	Potential Compensation or Ownership	Likely Siting & Scale	Primary Benefits	Conventional Solutions or Alternatives	Energy Storage Case Study Example
3	Distributed Peaker (Load Modifier -- primarily in lieu of added electric supply capacity)	Energy cycling to address peaking needs (part year operated by utility, part year operated by CAISO)	• Utility Ratebased • Third Party ownership, PPA	• Subtransmission • Substation >25 MW x 4 hr or aggregated MW sized units	• Electric Supply* • Ancillary Services* • T Congestion* • Service Reliability* • D Deferral* • Transportability	• Conventional Generation (CT, CC) • PPA • DR • Critical Peak Pricing (CPP) • EE TES	• Modesto Irrigation District • Raleigh, NC (TAS Energy)

Operational considerations: Bid into ISO markets; operate according to awards and ISO dispatch signal **OR** Operate on a scheduled basis (load shift) **OR** on an automated basis (power quality / operational reliability).

The unit is operated as a traditional generation resource bidding into the market; thus the unit is *not* operated to meet local reliability needs. The "potential additional" benefits are the cost savings resulting from proximity to load, thus avoided some congestion charges and line losses.

#	End Use (Application)	Description/ Problem Solving	Potential Compensation or Ownership	Likely Siting & Scale	Primary Benefits	Conventional Solutions or Alternatives	Energy Storage Case Study Example
4	Generation-sited (co located with fossil fuel plant or renewables)	On-site firming or shaping of intermittent generation Improving efficiency of existing fossil generation	• Expensed by LSE (if third party owns and sells higher value power to LSE) • Third Party PPA • Ratebased (If IOU owns and pairs with generation) • Market	• At or near RE Generation ✓ Subtransmission ✓ Substation ✓ Distribution 5 MW – 250 MW (variable, depending on size of co-located generation)	• Variable RE Generation Integration energy time- shift capacity- firming ramping Volt/VAR support • Resource adequacy • Ancillary services	• Additional Sub-T or D Infrastructure • Static VAR Compensator • Switched Capacitor Banks	• Xtreme Power - various • Solar Thermal with molten salt or other • TAS Generation Storage™ • Laurel Mtn AES

Operational Considerations: Dispatch coordinated to smooth VER output to avoid future integration charges. **OR** Bid into ISO markets; operate according to awards and ISO dispatch signal.

This application is distinct from the [Bulk] Generation application only when the storage device is integrated in to the VER itself, such as solar thermal coupled with thermal storage. Otherwise, there is no need for the storage device to be co-located with the VER as opposed to at a transmission substation. There could *potentially* be additional value if the storage device was able to reduce or avoid an investment to increase the transmission capacity necessary to accommodate the VER, but this would be a FERC-jurisdictional benefit.

#	End Use (Application)	Description/ Problem Solving	Potential Compensation or Ownership	Likely Siting & Scale	Primary Benefits	Conventional Solutions or Alternatives	Energy Storage Case Study Example
5	Bulk Generation/Storage	Electric Supply Capacity/ provides resource adequacy, ancillary services, and energy	• Market • Utility Ratebasing • Third Party PPA	• Transmission • Generator co-located >100 MW x 6 hr (or aggregated units of smaller size)	• Resource adequacy • Ancillary services • Energy	• Conventional Generation (CT, CC) • PPA • DR	• Utility-owned Pumped Hydro-electric • Alabama CAES • TAS Energy Generation Storage™ Case Study

Operational considerations: While this application is conceived as large scale storage, the C/E template would be the same for a much smaller (or aggregated) device so long as that device is interconnected at the transmission level and intended to earn revenues through markets exclusively.

#	End Use (Application)	Description/ Problem Solving	Potential Compensation or Ownership	Likely Siting & Scale	Primary Benefits	Conventional Solutions or Alternatives	Energy Storage Case Study Example
6	Demand Side Management	End-use Customer Bill Management System load modification Service Reliability/ Quality Integration with BTM renewables	• Customer • Market (for ancillary services) • End-user • Third-party • Utility	• Customer-side of Meter	• TOU Energy Cost Management • Demand Charge Management • Reliability (back-up power) • Power Quality • Ancillary Services	• Energy Efficiency • Combined Heat and Power (CHP) • Combined Cooling Heat and Power (CCHP)	• Alameda County Santa Rita Jail • Various recently funded SGIP funded projects • TES

Operational considerations: Operated to minimize customer energy and demand charges, potentially responding to price signals sent by utility; potentially providing backup power in an outage if outage occurs when battery happens to be charged