BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

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And Related Matters.	Application 18-03-001 Application 18-03-002

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In accordance with the Rules of Practice and Procedure of the California Public Utilities Commission ("Commission"), the California Energy Storage Alliance ("CESA")[1] hereby submits these comments to the *Assigned Commissioner's and Assigned Administrative Law Judges' Ruling Requesting Comments on Issues Pertaining to Energy Storage Technology Diversity* ("Ruling"), filed by Assigned Commissioner Carla J. Peterman and Administrative Law Judge ("ALJ") Brian

[1] 8minutenergy Renewables, Able Grid Energy Solutions, Advanced Microgrid Solutions, AltaGas Services, Amber Kinetics, American Honda Motor Company, Inc., Axiom Exergy, Brenmiller Energy, Bright Energy Storage Technologies, Brookfield Renewables, Carbon Solutions Group, Centrica Business Solutions, Consolidated Edison Development, Inc., Customized Energy Solutions, Dimension Renewable Energy, Doosan GridTech, Eagle Crest Energy Company, East Penn Manufacturing Company, Ecoult, EDF Renewable Energy, ElectrIQ Power, eMotorWerks, Inc., Enel, Energport, ENGIE, E.ON Climate & Renewables North America, esVolta, Fluence Energy, GAF, General Electric Company, Greensmith Energy, Ingersoll Rand, Innovation Core SEI, Inc. (A Sumitomo Electric Company), Iteros, Johnson Controls, Lendlease Energy Development, LG Chem Power, Inc., Lockheed Martin Advanced Energy Storage LLC, LS Power Development, LLC, Magnum CAES, Mercedes-Benz Energy, NantEnergy, National Grid, NEC Energy Solutions, Inc., NextEra Energy Resources, NEXTracker, NGK Insulators, Ltd., NRG Energy, Inc., Parker Hannifin Corporation, Pintail Power, Primus Power, Range Energy Storage Systems, Recurrent Energy, Renewable Energy Systems (RES), Sempra Renewables, Sharp Electronics Corporation, SNC Lavalin, Southwest Generation, Sovereign Energy, Stem, STOREME, Inc., Sunrun, Swell Energy, True North Venture Partners, Viridity Energy, VRB Energy, Wellhead Electric, and Younicos. 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).

R. Stevens on August 8, 2018. Pursuant to ALJ Stevens' *E-Mail Ruling Granting Modification of Motion Requesting an Extension of Deadlines for Comments in Response to 8/8/18 Ruling* ("É-Mail Ruling") on August 14, 2018, granting an extension for parties to file comments, CESA timely files its comments here on August 28, 2018.

I. INTRODUCTION.

CESA supports examination of the role of diversity in energy storage procurements. Ratepayers benefit when procurement processes develop energy storage markets and encourage competition and innovation. It is therefore prudent to explore some diversification within the generation or 'resource' portfolio in the power sector, including within the newest asset class – energy storage. CESA appreciates the Commission's leadership in considering these issues.

CESA recommends a multi-pronged consideration of diversity. CESA believes that the remaining Assembly Bill ("AB") 2514 procurement are needed to continue ongoing market transformation goals, but also that other solutions are needed to further transform the sector. One near-term option is to direct a new emerging-technology-focused solicitation that could still complement the goals of AB 2514 without disrupting the ongoing market transformation noted in the Ruling. The Commission, in an August 2014 Decision in the Self Generation Incentive Program (D.14-08-029) defined emerging technologies as energy storage technologies commercialized within the last ten years. CESA respectfully recommends that the Commission solicit comments from parties to build the record on what defines emerging technologies for the purpose of the aforementioned solicitation. This is consistent with direction from the 2014 Decision, as the Commission noted that "we reiterate that the definition of 'emerging' would benefit from a fuller record and more specific criteria."

Establishing a clear definition for eligible emerging technologies and a focused procurement on these new solutions is a relatively straight-forward approach and could take the shape of an incremental 180 MW procurement, spread across the three IOUs, wherein each IOU must procure at least four energy storage solutions defined as meeting emerging technology goals. The 180 MW amount is based on the reasoning that emerging technologies tend to need one or more 10 MW projects to qualify for "experience requirements" as typically required in utility solicitations. It may also help if these solicitations include variability in the energy durations being sought, as CESA notes that the primary use case for most of the energy storage procured under the AB 2514 framework to be for four-hour energy storage that is eligible for Resource Adequacy ("RA") capacity. CESA thus recommends some exploration of six- to ten-hour energy storage durations.

Other options for promoting diversity exist as well. Diversity should be properly valued, where applicable, in procurement solicitations. State-agency-led coordination to ease or support procurement of less bankable (but still commercially available) technologies should be explored. This may involve collaboration between the California Energy Commission ("CEC"), if willing, and the Commission regarding how Electric Program Investment Charge ("EPIC") Program funds can support 'technology buy-downs' or how loan guarantee programs may also support bankability in ways that ease financing costs for some energy storage technologies. Finally, procurement practices can be modified to promote more diversity through longer bid windows, or more flexibility in the solicitation design. For some companies developing bids into utility solicitations using 'less routine' technologies, additional time can be needed for vetting pricing, financing, and warranty terms and for evaluating risks, among other considerations.

It is unwise to remove the experience requirement from the remaining (already authorized) AB 2514 procurement targets. These solicitations are achieving key goals by supporting robust competition within the storage asset class. While lithium-ion technologies have won the lion's share of procurement under the program to date, that does not, in of itself indicate a failing of the energy storage procurement framework. Rather it is an indication that given the needs identified, lithium-ion solutions have been identified as the most cost effective solution bidding into the utility solicitations. CESA further notes that diversity does exist within lithium-ion battery solutions today and that this diversity should be recognized, even as broader diversity goals are explored. The lithium-ion sub-class of electrochemical battery storage leverages various chemistries, including but not limited to lithium cobalt oxide, lithium manganese oxide, lithium iron phosphate, lithium titanite, and lithium nickel manganese cobalt oxide. Additional new lithium-based chemistries are under development that could qualify for the above 'emerging technology' procurements.

Finally, CESA suggests the development of a new Energy Storage Rulemaking in order to create a forum specifically for the elucidation and evaluation of this diversity, as well as to address other energy storage matters. Other technology classes have, at times, needed standalone proceedings in order to support the development of programs, rules, or practices of that resources class (*e.g.*, Renewable Portfolio Standard, Energy Efficiency, and Demand Response). Energy storage is a complex asset class that could benefit from a standalone proceeding going forward.

The addition of any energy storage, regardless of its type, into our power sector planning toolkit adds diversity to the grid. A new Energy Storage Rulemaking will also further build the record, following D.14-08-029, for defining 'emerging energy storage technology.' This could

include a more standard framework for any emerging technology competitive solicitation to ensure barriers are addressed on a going forward basis.

In conclusion, CESA supports ensuring that there is a persistent pathway to commercialization for innovative new solutions and appreciates the Commission's Ruling on this topic. CESA strongly recommends that the Commission endeavor to structure fair and open markets and procurement processes that ultimately require any new solution to compete head-to-head with incumbent solutions on a level playing field. This will ensure competition and continued innovation, and help ensure that ratepayer interests are met.

II. EXPLORING ADDITIONAL DIVERSITY CAPABILITIES FOR THE ENERGY STORAGE SECTOR IS PRUDENT AT THIS TIME.

The Massachusetts Institute of Technology ("MIT") recently assessed how energy storage diversity may be at a pivotal point. MIT explains how the emerging lithium ion procurement pattern may indicate a 'technology lock-in' that is "a characteristic pattern in the history of technology in which on 'dominant design' drives out alternatives that would perform the same function." MIT cautions that there can be both pros and cons of lock-ins, but also that lock-ins can, in some cases, thwart ongoing innovation.[2]

Energy storage market transformation should lead to 'readiness' of an available set of energy storage solutions for both near-term and long-term goals. Future grid conditions may warrant energy storage solutions that meet various site, duration, or performance goals, and an energy storage toolkit that is primed to compete in all cases seems productive and in line with the state's ongoing grid evolution. CESA believes that emerging energy storage technologies have

[2] "Energy Storage for the Grid: Policy Options for Sustaining Innovation", Hart (George Mason University), Bonvillian (MIT), and Austin (Johns Hopkins University), April 2018. http://energy.mit.edu/wp-content/uploads/2018/04/Energy-Storage-for-the-Grid.pdf

faced barriers, challenges, and an uneven playing field. These may include challenges not only with experience requirements in utility solicitations, but also with bankability, solicitation timelines, and valuation methodologies.

These factors prompt CESA to recommend a new and incremental procurement for emerging energy storage technologies. These solutions will include various forms of flow batteries, rechargeable metal air, other chemistries, newly commercialized thermal (*e.g.*, ice, chilled water, heat), mechanical, kinetic and gravitational energy storage solutions. Many of these solutions may be better suited to some applications over others. To the degree that there are barriers that are preventing a given storage technology from being considered on its merits, CESA submits that the Commission should identify these barriers and, where possible, address such barriers in the service of ensuring that the full field of potential solutions are fairly considered. Similarly, CESA believes that the Commission should also endeavor to ensure that all the services and capabilities of energy storage are being recognized in the utilities' evaluative processes.

III. CESA RECOMMENDS A STANDALONE ENERGY STORAGE EMERGING TECHNOLOGY PROCUREMENT PLAN (ES-ETPP) THAT IS INCREMENTAL TO EXISTING AB 2514 PROCUREMENTS BECAUSE THOSE PROCUREMENTS ARE PROVIDING IMPORTANT SIGNALS AND MARKET TRANSFORMATION TO A SUB-SECTOR OF THE ENERGY STORAGE INDUSTRY.

"Market transformation" could be defined as "having enabled competition from a sufficiently diverse set of energy storage solutions, that includes both mature as well as more newly-commercialized solutions."

CESA observes that newly commercialized systems, as well as some established solutions with limited deployments, hold promise as energy storage technologies with the potential to support long-term market transformation goals. These systems, however, may face barriers to compete in nearer-term solicitations. This outcome can stem from various factors. It may result

from the recent focus on four-hour duration systems, even though longer-duration systems can solve additional or future grid issues. It may stem from operational expectations of only 10 to 20 years, even though some resources may be able to operate for 30 to 40+ years. It may stem from experience requirements or other participation barriers in utility solicitations. It may stem from a lack of quantitative valuation factors about diversity of source materials or other factors. Finally, it may stem from financing and bankability challenges that affect the first one to two installations of emerging technologies, creating a 'chicken or the egg' problem of deployment.

In light of these challenges, CESA strongly recommends a new procurement plan that is incremental to existing AB 2514 procurements for emerging energy storage technologies. This Energy Storage Emerging Technology Procurement Plan ("ES-ETPP" or "ETPP") will address the goals of market transformation in smart ways. The ETPP outline is reflected in Table 1.

Table 1: Energy Storage Emerging Technology Procurement Plan (ES-ETPP)

Total Incremental Procurement	Minimum Number of Discrete Emerging Technologies Each IOU Must Procure Under This Incremental Procurement	Solicitation Timing and Size	Other Considerations to be Met in Some or All Solicitations
180 MW (60 MW per IOU)	4	Dec 2019 (30 MW per IOU) Dec 2021 (30 MW per IOU)	TBD

There is a basis for the 180 MW target and other dimensions of the ETPP. The ETPP focuses on the concept of an experience requirement. Typically, this requirement stipulates that technologies are prohibited from some energy storage solicitations unless that technology can point to existing operations of 10 MW or more. This is a major barrier for emerging technologies that could otherwise compete. CESA thus recommends that each IOU seek to procure an array of emerging technologies to support the market transformation goals. This can be done by each investor-owned utility ("IOU") through an ETPP that solicits for 30 MW in two rounds (2019

and 2021). This means that each IOU could help up to six emerging technologies to achieve the 10 MW threshold of an experience requirement.

To provide the IOUs with flexibility, CESA recommends that each IOU be required to procure a minimum of four different emerging technologies. The IOUs can thus procure more of some promising technologies while still supporting broader market transformation. Importantly, the IOU contracts provide a 'deep balance sheet' counterparty, which can be essential for financing. IOU contracts must thus be of sufficient length and terms for supporting ETPP procurements. CESA recommends 20-year contract lengths. In some cases, IOUs should explore full tolling arrangements, as the IOUs can diversify risk away from a single resource by virtue of their larger portfolio. Note that some energy storage developers do not seek full tolling agreements and may instead want operational control.

Precedent on emerging technology definitions should guide the eligibility requirements in the ETPP, though other factors may also apply. CESA recommends eligibility be minimally defined as any solution that has been commercially available for ten or fewer years. This precedent is based on D.14-08-029 issued August 18, 2014, which in turn built on D.12-04-045. These decisions note that the CPUC determined that "in the absence of what constitutes an "emerging" technology in either D.12-04-045 or Resolution E-4586, and until such time as the Commission develops a record and provides clear criteria for "emerging" technologies, the guidance from the Self Generation Incentive Program ("SGIP") on this matter serves as a reasonable interim substitute. In D.11-09-015, the Commission states that new technologies may become eligible for the SGIP emerging technology program component, if, among other criteria, they have been commercially available for ten years or fewer at the time they seek to enter the

SGIP program." The decision further states "we reiterate that the definition of 'emerging' technology would benefit from a fuller record and more specific criteria."

CESA also recommends some additional focus on longer-duration storage in light of emerging grid challenges. The standing four-hour duration requirement related to RA have informed much of the energy storage procurement. Going forward, the CAISO's remarks in the RA proceeding indicate there may be needs for longer-duration storage.[3] The Puente Power Plant replacement efforts also documented how storage designed in part for meeting contingency conditions may benefit from longer-durations.[4] While different from emerging technology definitions, CESA also believes longer-duration storage could play a key role in market transformation and 'readiness' for the future so should be explored in the ETPP.

As diversification discussions occur, it is also important to 'do no harm' to already developing market sectors that fit with current and future grid needs. In some areas, such as with SGIP, further diversification may occur, but the program should not be interrupted due to AB 2514 diversity goals. CESA notes that much of the SGIP funding remains due to the challenges of developing the energy storage sector of the market, and market development in SGIP remains a work in progress. CESA recommends that any opportunities for lithium-ion companies persist – *e.g.*, through the already stipulated AB 2514 procurements, SGIP, and others.

The Commission is authorized to direct an ETPP. In D.14-10-045, the Commission found that it "is reasonable to design and implement a 'balanced' portfolio approach in which the IOUs

[3] In comments, the CAISO seeks to explore limits on energy limited resources providing RA in local or sub-local areas. *See* Comments of the CAISO on Track 2 RA Scoping.

[4] Initial studies related to the Puente matter identified that 8-hour or 9-hour energy storage might be needed to address contingencies, some of which involved maintaining power sources (voltage) in local areas for a sufficiently long-period of time due to transmission restrictions or limitations on output from other local sources.

should promote a mix of technologies and contract terms based on an IOU's particular needs and requirements and strategy to diversify risk."[5] Relatedly, the more recent Multiple Use Application ("MUA") Decision, D.18-01-003, provides that the "Energy Division must prepare and present a report no later than 90 days following the Compliance Report filing in Ordering Paragraph 4 on the state of utility energy storage procurement, a survey of the market, a recommendation on whether additional refinements to the energy storage procurement framework or policies are required and procedural options for accomplishing any needed refinements or recommendations by the working group."[6] Therefore, in addition to this Ruling, the Commission has both building blocks and procedural steps available for further addressing diversification goals for energy storage.

Finally, numerous qualitative or quantitative factors can also inform the goal of broader energy storage market transformation. These include the following:

- Building skills with comparability among energy storage technologies
- Duration diversity (*e.g.*, greater than 6 hours, greater than 9 hours)
- Supplier diversity
- Technology diversity
- Flammability/safety protocol or standard diversity
- Source materials diversity
- Use case diversity (*e.g.*, high-cycling frequency, deep cycling, or limited cycling)
- Developer diversity
- Build emerging technologies towards experience requirements (where applicable)

[5] D.14-10-045, Findings of Fact 38, p. 103.

[6] MUA Report, D.18-01-003, p. 29.

IV. A NEW ENERGY STORAGE RULEMAKING SHOULD BE COMMENCED TO FURTHER EXPLORE AND EVALUATE MARKET TRANSFORMATION GOALS.

Energy storage remains an emerging technology class. The cumulative amount of energy storage recently deployed remains approximately 2% of the deployed capacity of all generating resources in the state.[7] Barriers still remain even for the energy storage solutions already procured. Yet, the many roles and key benefits of storage indicate this technology class will play material roles in the grid going forward. The ES-ETPP and an ongoing focus on energy storage deployment issues is a prudent step for the Commission as it prepares California for meeting the high renewable and very low GHG goals of the legislature.

V. COMMENTS TO THE QUESTIONS POSED IN THE RULING.

Below, CESA provides our responses to the questions posed in the Ruling.

Question 1: Can the Commission's stated goal in D.13-10-040 of transforming the energy storage market be considered achieved if a single energy storage technology comprises the majority of the owned and operated storage systems in PG&E, SCE and SDG&E's service territories? Why or why not?

Generally, CESA sees benefit in augmenting the diversity of grid-ready energy storage solutions. CESA understands the broad intent of D.13-10-040 was to build the energy storage industry to a point where near-term and future needs could be met through a competitive and viable set of energy storage solutions. CESA considers market transformation, in this regard, to be an outcome of "enabling competition from a diverse solution set, that includes both mature as well as

[7] CESA tracks procurement announcements. Removing established pump-hydro energy storage from calculations, CESA estimates only 1605 MWs of energy storage are either operating or procured (but not yet online). If total state generating (with planning reserve margin) needs are 82,000 MW, then 2% of that would be from energy storage.

more newly-commercialized solutions." This outcome would foster continued innovation and progress and will support price competition.

CESA therefore recommends an ES-ETPP, incremental to the planned AB 2514 procurements, to better ensure a robust, transformed, and ready set of energy storage solutions for providing and meeting grid needs competitively in the future.

Notwithstanding the above points, progress to date in the lithium ion battery space should be celebrated, and disruption to this market sub-class should be avoided. The lithium ion energy storage technology sub-class is showing strong cost reductions and making progress in line with many Commission and stakeholder goals. The diversity of the lithium-ion battery sub-class fits well with the concept of market transformation, but nurturing additional diversity (and even encouragement of new lithium-ion innovations) through an additional procurement target focused on emerging technologies may be beneficial to avoid a technology lock-in.

<u>Question 2</u>: Are there any grid or ratepayer-beneficial attributes of energy storage that storage technologies besides lithium ion batteries may adequately provide (i.e. long duration, safety)? If so, what are they? Are these attributes already captured in the utilities' cost-effectiveness valuation methodologies? If so, are they quantitative or qualitative values? Please list the relevant energy storage technology associated with each attribute.

CESA believes a diverse marketplace of energy storage solutions will reduce overall risks on ratepayers and continue to enhance electric system reliability. Ongoing innovation of an array of solutions sufficient to meet the array of future grid conditions or needs is both pragmatic and prescient in the sense that it we should prepare for grid conditions to evolve. The pace of change in the electric system is very rapid. The array of expected grid challenges is also very broad, ranging from the need for four-hour 'local' energy storage systems, to dynamic demand response

solutions, to broad and deep cycling systems that can support more serious reliability contingencies, renewables integration, or back-up power needs, etc.[8]

As CESA understands it, the current utility solicitations do not quantitatively value energy storage technology diversity, although PG&E does use, in some cases, a portfolio adjusted value ("PAV") approach which may take diversity into account in some fashion. It is thus reasonable to direct valuation of market transformation through an ES-ETPP and through improved valuations of diversity in the IOU solicitation process, even if only as a qualitative factor. In the longer term, this allows utilities to choose the least-cost, best-fit energy storage solutions.

Question 3: Are there risks to ratepayers and the grid of utility energy storage portfolios comprised predominantly of a single energy storage technology?

CESA maintains that risks of overreliance on any one solution can exist for some aspects of the power sector. For example, source material supply disruption or other unforeseen exogenous factors that could uniquely impact a large number of solutions should be explored. In some cases, homogeneity may be low risk, but in others heterogeneity provides benefits. Generally, the solicitation evaluation and contracting process should address such risks before they would be realized.

CESA notes that diversity exists in the lithium-ion deployments and that this diversity is important. It highlights how suppliers are competing today to provide least-cost, best fit solutions, albeit usually to meet four-hour needs. CESA is proud to have industry-leading lithium-ion battery members, who have competed heavily to develop solutions, scale up, seek deployments, establish warranties, etc. Generally, CESA supports competition amongst all types of energy storage, but

[8] Some CESA members highlight how, using public data such as Lazard's *Levelized Cost of Storage Version 3.0* from November 2017, non-lithium based energy storage solutions may also be cost competitive in eight-hour applications, in part via lower expected O&M or degradation.

CESA also sees benefits in enabling sub-classes to compete more effectively. As diversification discussions occur, it is important to do no harm to the lithium-ion sub-category of the energy storage industry.

Question 4: Are there risks to ratepayers and the grid of utility energy storage portfolios comprised predominantly of a single energy storage technology?

CESA recommends that the remaining AB 2514 procurements be allowed to play out as planned, but that the Commission also direct a new, incremental ES-ETPP along with recommending the use of other diversity-related RFO practices. This is detailed above in Table 1 and discussed in Section III of these comments. Generally, even the AB 2514 solicitations can be augmented to support emerging-technology-related market transformation goals when time or conditions allow. CESA also respects how flexibility in the Request for Offers ("RFO") design process can be important. For instance, short and standardized RFOs can be appropriate for speedy solicitations or for cases where a product is more commoditized. In other cases, however, flexibility and lengthier bid windows in an RFO can expand the available pool of bids. This is a good thing, generally.

Question 4: If the Commission were to direct the utilities to prioritize technology diversity in their 2018 solicitations, but there are not enough sufficiently cost-effective bids to allow them to meet their 2018 procurement targets, does the 2020 solicitation provide sufficient opportunity for the utilities to procure the remaining capacity to meet their targets in a cost-effective manner?

CESA recommends that the remaining AB 2514 procurements be allowed to play out as planned, but that the Commission also direct a new, incremental ES-ETPP along with recommending the use of other diversity-related RFO practices. This is detailed above in Table 1 and discussed in Section III of these comments. For the remaining AB 2514 solicitations, no technologies should be 'blocked out', but RFO designs and valuations methods should seek to

fully evaluate or 'value' all bids while promoting a deep and competitive bidding pool, supporting emerging-technology-related market transformation goals when time or conditions allow. CESA respects how some flexibility in the Request for Offers ("RFO") design process can be reasonable to provide to the utility and so seeks to provide adequate flexibility to the buying utility while also ensuring competitive outcomes and market transformation goals.

Question 5: If the Commission were to direct the utilities to procure a minimum amount of non-lithium ion technologies from their 2018 solicitation, what should that minimum threshold be based on, for example a minimum percentage of total capacity procured, a minimum number of energy storage technologies, or another metric/basis? If so, what would be an appropriate minimum threshold to ensure sufficient diversity in the procurement?

As stated previously, CESA recommends the Commission direct an incremental amount of emerging-technology-oriented procurement. CESA does not support a non-lithium-ion carveout within the existing procurement targets. CESA's recommended ETPP framework, which involves directing the utilities to procure an incremental amount of storage capacity beyond the existing requirements would allow emerging lithium-ion solutions to compete as well. This is detailed above in Table 1 and discussed in Section III of these comments.

VI. CONCLUSION.

CESA appreciates the opportunity to submit these comments to the questions posed in the Ruling and looks forward to working with the Commission and stakeholders in this proceeding or a potential successor Rulemaking.

Respectfully submitted,

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