BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking to Develop an Electricity Integrated Resource Planning Framework and to Coordinate and Refine Long-Term Procurement Planning Requirements.	Rulemaking 16-02-007 (Filed February 11, 2016)

COMMENTS OF THE CALIFORNIA ENERGY STORAGE ALLIANCE TO THE RULING OF ASSIGNED COMMISSIONER AND ADMINISTRATIVE LAW JUDGE SEEKING COMMENT ON POLICY ISSUES AND OPTIONS RELATED TO RELIABILITY

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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 on *Ruling of Assigned Commissioner and Administrative Law Judge Seeking Comment on Policy Issues and Options Related to Reliability* ("Ruling"), issued by Commissioner Liane M. Randolph and Administrative Law Judge Julie A. Fitch on November 16, 2018.

[1] 174 Power Global, 8minutenergy Renewables, Able Grid Energy Solutions, Advanced Microgrid Solutions, AltaGas Services, Amber Kinetics, American Honda Motor Company, Inc., Avangrid Renewables, Axiom Exergy, Boston Energy Trading & Marketing, Brenmiller Energy, Bright Energy Storage Technologies, Brookfield Renewables, Carbon Solutions Group, Centrica Business Solutions, Clean Energy Associates, 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 X North America, Energport, ENGIE, E.ON Climate & Renewables North America, esVolta, Fluence, Form Energy, GAF, General Electric Company, Greensmith Energy, Ingersoll Rand, Innovation Core SEI, Inc. (A Sumitomo Electric Company), Iteros, Johnson Controls, KeraCel, 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, Quidnet Energy, 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, Tenaska, Inc., True North Venture Partners, Viridity Energy, VRB Energy, WattTime, 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).

I. INTRODUCTION.

CESA appreciates the opportunity to provide our views on near-term reliability issues, as posed in the Ruling, that identifies challenges around ensuring sufficient local and flexible capacity, cost-effectively integrating renewables, among many other issues. The Ruling paints a picture of potential tensions between advancing the state's greenhouse gas ("GHG") and disadvantaged community ("DAC") goals while the state continues to partly rely on thermal generation during this transition period to support near-term reliability, which combined with other factors, lead to a situation with tight supply conditions and potential market power issues. The complexity of these challenges also expands due to the need to conduct resource and grid planning with over 40 load-serving entities ("LSEs"), according to the Ruling. Finally, the Ruling points to the Reliability Threshold Mechanism proposed by Southern California Edison Company ("SCE") in its 2018 LSE Plan, filed on August 1, 2018, as an example of a potential solution to address some of these near-term concerns by automatically authorizing LSEs to undertake reliability-based procurement for energy storage resources if certain defined thresholds are exceeded.

CESA asserts that there are near-term and medium-term reliability and economic challenges that need to be addressed and understands that there are sometimes tensions that manifest in planning and in adjustment periods for the grid as it undergoes a major overhaul of its generation and reliability fleet. Broadly, reliability issues should be managed through established programs and planning to ensure the appropriate resource mix is developed, procured and contracted, and subsequently committed and operated efficiently in the California Independent System Operator ("CAISO") markets. Alternatively, where long-term planning is not necessarily meeting near-term and medium-term needs, the state can manage reliability issues partly through backstop procurement (*e.g.*, with reliability must-run ["RMR"] designations in the South Bay-Moss Landing local areas) and through expedited energy storage procurement (*e.g.*, to mitigate the

reliability impacts of the leakage of and subsequent moratorium of the Aliso Canyon natural gas storage facility). Ideally, the state relies on an appropriate balance and linkage between long-term, medium-term, and short-term planning approaches.

Alignment in the planning processes is critical to delivery grid reliability with an orderly and efficient fleet transition. Planning should include real-world condition realities while also incorporating long-term policy trajectories. Real-world conditions may involve granular load or 'sub-local' pockets, transmission and generation outages, intra-hour reliability, and uncertainty with respect to generator contracting, etc. Long-term planning models should seek to incorporate or represent these realities. Meanwhile, short-run planning that lacks 'an eye' towards future expected fleet evolution – *e.g.*, establishing a fleet designed to support renewables integration – will invariably misalign near-term incentives with long-term goals. Such misalignment may increase reliance on back-stop tools. These misalignments may exist in the Commission's planning processes today. Some long-term scenario planning may not focus sufficiently on intra-hour needs, while some short-term planning tools may not 'signal' how resources should be evolving to meet near-term and future needs – *e.g.*, ramping 'capacity' approaches should value fast-ramping more than slow three-hour ramping.

Cost-efficient planning approaches likely avoid excessive reliance on backstops. CESA cautions that some use of backstops are *not necessarily* inefficient procurements. Instead, *some backstops can serve as a relief valve against potential exercises of market power.* So long as backstop pricing, when used, is reasonable, the ability to use out-of-market procurements to 'work around' high-priced, undesired, or otherwise sub-optimal generation may signal to existing generators that they should 'play ball' in a reasonable way or be cast aside. This disciplining of market participants is important. SCE's proposed Reliability Threshold Mechanism may be useful

for addressing market dysfunction and is worth exploring. That said, CESA continues to also support upfront efforts to allow LSEs to identify and procure resources that they prefer and need.

In these comments and in our responses to the questions, CESA expresses that SCE's proposed Reliability Threshold Mechanism should be discussed in further detail in this proceeding to establish a 'backstop like' or 'safety valve' mechanism that manages the state through this transition period and that leverages energy storage and other alternatives (*e.g.*, demand-side and transmission investments) – potentially more cost-effectively and with a cleaner impact than leveraging existing backstop mechanisms to prolong the use for certain standalone thermal assets. In the meantime, the Commission, the CAISO, and other stakeholders can work through refinements and/or reforms to the Integrated Resources Planning ("IRP") process to plan realistically for the grid of the future, and for using a Resource Adequacy ("RA") Program that provides a fleet selected by LSEs that is truly sufficient to operate the grid.

II. RESPONSE TO QUESTIONS.

Question 1: Does the California electricity system face a near- or medium-term reliability challenge? If so, describe how you see the nature of the problem.

Yes, CESA believes that the California electricity system faces a number of near- or medium-term reliability challenges, many of which were highlighted to some degree in the Ruling. Fortunately, the state has avoided reliability events, but CESA envisions some of the below-mentioned reliability challenges as growing in frequency and magnitude in the future. However, it is important that the Commission distinguish the underlying cause of reliability events – *e.g.*, economic reasons, LSE resource selections, market power, or even potential actual shortages of available generation. In any case, CESA believes that reliability challenges will be faced by the California electricity grid because of the challenges naturally resulting from switching from the

past centralized fossil fleet approach to the going-forward fleet, which will likely involve large amounts of intermittent renewables, hydro, energy storage, and energy storage hybrids, such as gas-plus-storage resources that ensure reliability while also addressing day-to-day GHG emissions and air-quality goals. A manifestation of the fleet transition is the price trends in the RA Program and CAISO markets, which have shown price softening punctuated by high-price periods where and when older fleet resources retire yet the new fleet may not yet sufficiently address a grid or policy need. CESA recommends the Commission, along with LSEs, the CAISO and stakeholders, address near-term reliability issues on five 'fronts', each of which may have a different or specific solution set:

- Potential economic retirement or market power exercise of the gas fleet in sub-local areas where capacity needs remain.
- Potential elimination or minimization of the Aliso Canyon natural gas storage facility
- Multi-hour, hourly, and sub-hourly flexibility needs
- Prudently leveraging renewables by smartly approaching overgeneration and curtailment periods
- Faster-than-expected end-use electrification, particularly for the transportation sector

CESA elaborates on these five areas below.

A. Potential economic retirement or market power exercise of the gas fleet in sub-local areas where capacity needs remain

First, as raised by many parties including CESA,[2] the potential economic retirement of the gas fleet poses a number of potential reliability challenges – an issue that was not

[2] *Comments of the California Energy Storage Alliance on the Administrative Law Judge's Ruling Seeking Comment on Proposed Reference System Plan and Related Commission Policy Actions*, R.16-02-007, filed on October 26, 2017, pp. 9-10. See link here.

explicitly modeled in the 2017-2018 IRP process, which reflected many gas plants operating into the future incongruously with ongoing economic retirement concerns. Depending on the local or sub-local area, localized generation resources may be needed to deliver Local RA capacity but face capacity prices signaling the capacity is not needed. This can occur due to the aggregation of sub-local zones, which originally was used in part to limit market power from sub-local resources, and can also occur due to the lack of preference or available suite of buyers for the capacity. Some Local RA selections by LSEs have prompted Capacity Procurement Mechanism ("CPM") or RMR designations for select gas plants to retain them for Local RA, such as what was done in 2017 for the Metcalf Energy Center in the South Bay-Moss Landing sub-area, Feather River Energy Center in the Bogue sub-area, and the Yuba City Energy Center in the Pease sub-area. Unless new procurement for alternatives or hybrids is authorized or directed, the Commission faces the continued risk of relying on backstop procurement to keep thermal generation plants online for local reliability. Given the policy direction and trajectory of the state to reduce GHG emissions down to zero by 2045 and reduce environmental impacts to DACs, many gas plants will face pressures to be replaced even as they are needed in the near term for local capacity.

The reliability impacts of the economic retirements of the gas fleet are a concern not only for local reliability areas but also for system-wide reliability requirements that must be met by the CAISO balancing authority, including load following, operating reserves, and frequency regulation. In a special study conducted in the 2016-2017 Transmission Planning Process ("TPP"), the CAISO found major shortfalls in load following and reserves when 4,000 to 6,000 MW of economic retirements were modeled,

with the shortfall collectively exceeding 10,000 MWh in the 6,000-MW case.[3] This presents a reliability issue for the CAISO, which would need to trigger a staged system emergency to take the necessary actions to restore the reserve. Similarly, the CAISO faces increased challenges to achieve primary frequency response performance that meet NERC reliability standards due to the increased portion of renewable generation on the grid and the decreased levels of synchronous inertia on the grid from turbine-based generators like gas, among other factors.[4] While economic retirements of gas are not the sole cause of reduced primary frequency response performance, this may be a continuing challenge going forward. Thus, the focus of the reliability impacts of economic retirements of the gas fleet should also encompass the reserves and ancillary services impact.

B. Potential elimination or minimization of the Aliso Canyon natural gas storage facility

Second, there is an immediate physical reliability challenge due to the ongoing moratorium and limitations to the Aliso Canyon natural gas storage facility. Aliso Canyon is an important gas supply resource for 18 fast-ramping natural gas generation facilities (9,800 MW in total) in the LA Basin during summer peak periods, so removal or limitations of Aliso Canyon from full service has created ongoing reliability concerns for these peaker plants that serve up to 60% of summer peak demand. Some of these reliability concerns have been mitigated through expedited energy storage procurement in 2016, followed by additional energy storage procurement expected in 2019, but the potential to eliminate or

[3] *Supplemental Sensitivity Analysis: Risk of Early Economic Retirement of Gas Fleet*, ISO 2016-2017 Transmission Planning Process, published on January 4, 2018, p. 4 and Attachment p. 2. http://www.caiso.com/Documents/SupplementalSensitivityAnalysis-Risksofearlyeconomicretirementofgasfleet.pdf

[4] *Frequency Response Issue Paper*, published on August 7, 2015, p. 8. http://www.caiso.com/Documents/IssuePaper_FrequencyResponse.pdf

minimize reliance on the Aliso Canyon facility presents near-term reliability issues that need to be addressed in conjunction with policy considerations. The ongoing Aliso Canyon Investigation (I.17-02-002) is conducting hydraulic modeling, production cost modeling, and economic modeling to determine the feasibility of eliminating and minimizing reliance on Aliso Canyon, but this is another issue where the future of natural gas and associated infrastructure presents reliability issues that need to be considered.

C. Multi-hour, hourly, and sub-hourly flexibility needs

Third, the state's solar-heavy electricity grid will increasingly face flexibility challenges to meet the multi-hour net load ramp and to mitigate sub-hourly uncertainty from variable generation. In the Flexible Resource Adequacy Capacity and Must Offer Obligation ("FRACMOO") Phase 2 Initiative, the CAISO observed that the three-hour Flexible RA capacity product is relevant and shows increased usage with renewables and behind-the-meter ("BTM") solar photovoltaic ("PV") build-out. The FRACMOO Initiative also demonstrated an increased need to address one-hour and intra-hour ramping needs.[5] In addition, the CAISO highlighted how ramping needs are not just spring-time issues as actual monthly one-hour and three-hour downward ramps were greater during summer months for 2016, and how downward ramps are comparable to upward ramps in terms of speed and magnitude. Net load also varies from one day to the next due to day-ahead and real-time forecast error of load and variable generation, creating difficulties for the fleet to meet ramps in real time. Collectively, the CAISO's assessment of the flexibility challenges faced by the grid today and into the near future is not just limited to local

[5] Flexible Resource Adequacy Capacity and Must Offer Obligation Working Group Meeting, CAISO stakeholder meeting on September 26, 2017, pp. 11-19. https://www.caiso.com/Documents/Presentation-FlexibleResourceAdequacyCriteria_MustOfferObligationSep26_2017.pdf

peaking capacity. CESA extrapolated some of these flexibility challenges through 2030 using IRP assumptions and scenarios as well, demonstrating how these ramping needs will grow substantially.[6]

D. Prudently leveraging renewables by smartly approaching overgeneration and curtailment periods

Fourth, the increased levels of projected curtailment and overgeneration will present reliability issues that the Commission should consider and take into account in developing their planning and capacity tools. Often, curtailment is viewed as an economic rather than a reliability issue, and to some initial degree, curtailment is an economic issue and the CAISO has relied on economic curtailments to manage overgeneration, which is also reflected in renewable power purchase agreements ("PPAs"). However, if market-based solutions have not cleared the surplus of electricity that has been generated, the CAISO must resort to exceptional dispatches where it manually intervenes and initiates reliability-based curtailments to prevent or relieve conditions that risk grid reliability. As the need for curtailment rises, the Commission should not assume that curtailments can occur in unlimited quantities, which would pose near-term and medium-term reliability risks.

E. Faster-than-expected end-use electrification, particularly for the transportation sector

Fifth and finally, the Commission may be underestimating demand and the timing of the new demand from end-use electrification, particularly from the transportation sector,

[6] *Notice of Ex Parte Communication of the California Energy Storage Alliance*, R.16-02-007, filed on October 25, 2017, pp. 7-8.
http://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M199/K321/199321253.PDF

which may exacerbate some of the challenges identified in the Ruling around tight supply as compared to demand on the grid. Understandably, there is some difficulty in planning for the electrification of certain sectors of the economy, given some of the uncertainties around forecasting load and the challenges with coordinating across multiple California regulating and planning agencies. However, in order to ensure sufficient generation capacity is procured, deployed, and committed to meet future load needs, the Commission must be aware of and plan for the electrification of medium-duty ("MD") and heavy-duty ("HD") transportation happening more quickly than planners are anticipating, as new MD and HD products are brought to the market over the next few years. Moreover, the business needs of MD and HD truck operators will likely necessitate charging in the range of 500 kW to 1.5 MW per vehicle, which may require the Commission to plan for electric vehicle ("EV") chargers that operate at higher levels of instantaneous electric demand than currently exist today. The combination of these two factors (*i.e.*, adoption rates and power draw) could create a reliability challenge wherein the state faces electricity shortfalls due to the increase in energy demand from achievement of a key state policy goal – electrification of transportation – occurring more quickly than anticipated.[7] There are other areas where end-use electrification forecasts may present grid planning and reliability challenges, but the transportation electrification portion of this forecasted load presents the greatest high-end uncertainty that must be accounted for.

[7] For example, the California Energy Commission ("CEC") has forecasted a total demand of 2,830 GWh by 2023 for all commercial EVs, with additions of roughly 600 GWh of demand per year, in its "High Demand Case" in the Integrated Energy Policy Report ("IEPR"). By contrast, Tesla CEO Elon Musk has stated publicly that he expects Tesla to sell 100,000 electric semi-trucks per year. If 10% of those vehicles were registered in California, it would represent an additional 10,000 electric semi-trucks added to the California grid in a single year, adding roughly 1,635 GWh of demand, or three times the CEC's annual growth forecast. To support that volume of demand, California would need approximately 1,150 MW of new electric generating capacity, or two large power plants.

Question 2: Is the resource adequacy or the IRP proceeding (or a mix of both) the appropriate venue for addressing these types of reliability concerns? Explain your rationale.

CESA believes that many of the near-term and medium-term reliability issues identified in our response to Question 1 will require discussion and policy development in both the RA and IRP proceedings. The IRP proceeding (R.16-02-007) is positioned to identify the 'optimal' resource mix and authorize re-contracting of existing resources or new resource additions for procurement through competitive solicitation, whereas the RA proceeding (R.17-09-020) is focused on committing resources along the availability and operational requirements across the System, Local, and Flexible RA product definitions, which shape fleet operations and, to some degree, guide LSE procurement. CESA presents in table format the five reliability issues identified in our response to Question 1 and our position and rationale on the appropriate venue.

Issue	Venue	Rationale
Potential economic retirement or market power exercise of the gas fleet in sub-local areas where capacity needs remain	IRP, RA	Both the IRP and RA proceedings need to address this issue. The IRP proceeding is focused on long-term planning and thus would identify opportunities to systematically retire or hybridize gas plants that face future risk of economic retirement and policy risk due to the environmental and DAC goals. IRP models must also accurately represent the reserve requirements needed. The RA proceeding is focused on committing reliability capacity in the short term (1-3 years ahead) and thus would identify opportunities to procure alternatives to gas plants that have a near-term risk of economic retirement and would identify opportunities to optimize the gas fleet to meet the 'clean RA' requirements of SB 1136. There should also be a feedback loop between the IRP and RA proceedings since the IRP is a good venue to have discussions around the environmental impacts of retirements, which can then inform RA procurements, since the IRP modeling may not be capturing all the reliability issues.
Potential elimination or minimization of the Aliso Canyon natural gas storage facility	IRP, Aliso Canyon OII	The Aliso Canyon OII (I.17-02-002) is not considering non-gas solutions such as energy storage and demand-side resources, in the scope of this Phase 1 assessment, so following the Phase 2 analysis, there may be opportunities to incorporate preferred resource alternatives in the IRP modeling to evaluate the feasibility of an alternative pathway.

Issue	Venue	Rationale
Multi-hour, hourly, and sub-hourly flexibility needs	IRP, RA, CAISO	Both the IRP and RA proceedings need to address this issue. The IRP models need to correctly understand sub-hourly challenges and to also model the costs of flexibility to direct the long-term procurement of the appropriate resources. Flexible RA rules must also evolve to ensure the fleet can meet not only the three-hour ramps but also the balancing and uncertainty needs of hourly and sub-hourly ramps. The CAISO will also need to be involved to shape the operationalization of the RA fleet in the market.
Prudently leveraging renewables by smartly approaching overgeneration and curtailment periods	IRP, RA	Both the IRP and RA proceedings need to address this issue. The IRP models need to correctly model the quantity and costs of curtailment to direct the long-term procurement of the appropriate resources such as energy storage. New RA product(s) may need to be developed to sufficiently guarantee that the RA fleet will support economic and reliable operations. Currently, many RA resources provide curtailment for 'free', equating to a $0/kW-month payment.
Faster-than-expected end-use electrification, particularly for the transportation sector	IRP, CEC	The CEC's IEPR is responsible for load growth forecasts and the IRP process will need to coordinate with the IEPR process to ensure the appropriate forecasts and sensitivities are modeled. If load forecasts end up being higher and materialize quicker than expected, then the IRP proceeding may need to direct expedited procurement processes if generation must be added more quickly than the current two-year IRP cycle.

Question 3: Are potential solutions to the problems you describe in answer to Question 1 already under consideration? If so, where?

Some of the analysis identifying the reliability issues in response to Question 1 has been conducted in other venues and some of the potential solutions have also been proposed to some degree in those venues. The Commission should work within the appropriate venue and with the appropriate state agencies (*e.g.*, CAISO, CEC) if it requires coordination. However, CESA generally finds that the potential solutions to the problems identified in response to Question 1 require further or faster attention. Some of the potential solutions require further development, but there are also potential solutions that have not been raised in or scoped into any of the venues.

Issue	Venue	Rationale
Potential economic retirement or market power exercise of the	IRP, RA, CAISO	Both the IRP and RA proceedings have taken some early steps to address this issue, though more could be done. In a recent Ruling, the Commission staff issued a draft

Issue	Venue	Rationale
gas fleet in sub-local areas where capacity needs remain		Assumptions and Inputs document for the 2019-2020 IRP modeling that indicated that economic gas retirements will be modeled to some degree.[8] Similarly, the RA proceeding has been developing central buyer and multi-year Local RA concepts to address some of these issues, but with a somewhat narrower focus on minimizing the need for backstop procurement. The CAISO recently launched the RA Enhancements Initiative that will contemplate a number of RA changes, but it is still in the scoping stage and does not have a singular focus on this one issue. The CAISO is also conducting a special study in the 2018-2019 TPP to identify opportunities to economically reduce local capacity requirements in specific local and sub-local areas while taking into account DAC factors – a study that appears to have strong synergies with this issue and may inform the IRP and RA proceedings.
Potential elimination or minimization of the Aliso Canyon natural gas storage facility	Aliso Canyon OII	The Aliso Canyon OII (I.17-02-002) is the only proceeding that is focused on this issue at this time. There are active solicitations by SCE pursuant to SB 801 that would feed into the IRP as an input once energy storage resources are procured, but there is no Commission proceeding at this time on the broader planning and procurement issue.
Multi-hour, hourly, and sub-hourly flexibility needs	CAISO	The CAISO's FRACMOO Phase 2 Initiative conducted much of the analysis on current and future flexibility needs and a proposal was developed in the initiative and submitted as a Track 2 proposal in the RA proceeding. The proposal has not been taken up in the RA proceeding, which has been focused on central buyer and multi-year Local RA proposals. However, the proposal may be addressed in Track 3. The CAISO recently launched the RA Enhancements Initiative to continue the progress made in the FRACMOO Initiative, including around potential Flexible RA reforms.
Prudently leveraging renewables by smartly approaching overgeneration and curtailment periods	RA, RPS	The IRP proceeding is modeling overgeneration and curtailment but is not focused on addressing renewable integration concerns, other than to model certain constraints and to produce modeling outputs. Both the RA and the Renewable Portfolio Standards ("RPS") (R.18-07-003) proceedings have active Effective Load Carrying Capability ("ELCC") proposals that contemplate capacity values and 'diversity-related' capacity benefits of solar-paired-storage resources, but more progress could be made. Generally, the 'signaling' effect of RA program designs could be improved by developing a Flex Down product and downward flexible qualifying capacity ("QC") value. Such an approach could

[8] *Administrative Law Judge's Ruling Seeking Comments on Inputs and Assumptions for Development of the 2019-2020 Reference System Plan*, *Appendix A: Proposed Inputs & Assumptions: 2019-2020 Integrated Resource Planning*, R.16-02-007, filed on November 29, 2018, pp. 13, 15-16. http://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M245/K545/245545781.PDF

Issue	Venue	Rationale
		also support must-offer obligations for variable energy resources ("VERs") so that economic curtailments compete with other downward ramping solutions while ensuring grid conditions are met through 'in-market' solutions available to the CAISO.
Faster-than-expected end-use electrification, particularly for the transportation sector	IRP, CEC	The CEC's Demand Analysis Working Group ("DAWG") develops the demand forecast for each sector that is then adopted in the IEPR and fed into the IRP modeling as an input.

Question 4: If your preferred solutions are not already under consideration, describe what else is needed, why, and where. In making your recommendations, please address issues of cost allocation, cost minimization, environmental justice, impacts on existing LSE procurement processes, ability to support achievement of state policy goals, and any other topics relevant to your recommendations.

To address the reliability issues identified in our response to Question 1, the Commission will need to make progress on some preliminary proposals that have been raised in certain venues or introduce new preferred solutions altogether. CESA presents several preferred solutions below that should be considered and further developed that support the Commission's objectives around cost minimization, environmental justice, achievement of state policy goals, and local reliability.

A. Hybridization of energy storage with existing generators

There is no venue or focus on hybridizing the existing gas fleet with energy storage. Under this configuration, energy storage operates on the 'front end' in being dispatched for RA and providing a 'runway' for the paired gas facility to remain offline until needed during critical contingencies – in essence, allowing the gas facility to serve as 'backup' and

to provide reserves in the meantime. See Appendix A for more details on modeling that CESA has commissioned to demonstrate the justify some of our responses below:[9]

- **Issues it addresses:** Potential economic retirement of the gas fleet.

- **Reliability:** Hybrid gas-storage resources can provide Local RA that is not duration limited and provide critical operation reserves and frequency response.

- **Cost:** Adding energy storage to existing gas generators can be very cost-effective since it may require shorter-duration batteries. Our results pointed to a reduction in annual revenue requirements of $49 million to $60 million with the near-term hybridization of approximately 1,110 MW of existing gas peakers. SCE also reported on how its enhanced gas turbine procurement had one of the highest net present values of any of its energy storage solicitations.[10]

- **Environmental justice:** This hybrid configuration can reduce unit starts and associated criteria pollutants – a 42% reduction in the annual number of gas peaker plant unit starts by 2022 as well as an immediate reduction in NOx emissions in DACs of over 33,000 lbs/yr (increasing to over a 100,000 lbs/yr reduction) by 2022 with the near-term hybridization of approximately 1,110 MW of existing gas peakers.

- **LSE procurement:** This may involve development of re-contracting processes for plants with existing contracts or contracting in general for some plants that may currently not be under contract. Energy storage hybridization can be deployed in a timely manner.

- **State policy:** This hybrid configuration can reduce fuel consumption from reduced run hours and associated GHG emissions through more optimal system dispatch.

[9] CESA recently commissioned Blue Marble Analytics to conduct an analysis of hybrid resource potential in the CAISO balancing authority area. See Appendix 1 to find further details on the modeling outputs and outcomes.

[10] *Decision Granting Cost Recovery for Utility-Owned Energy Storage Projects Pursuant to Resolution E-4791*, D.18-06-009, issued on June 25, 2018, pp. 18. http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M215/K985/215985480.PDF

- **Cost allocation:** This can be addressed through LSE self-procurement and may depend on the specific need and/or gas generator resource that is being hybridized.

B. Expedited Energy Storage Procurement

In the first Energy Storage proceeding (R.10-12-007), the Commission ruled that energy storage procurements should proceed through a formal application approval process and that it would revisit this determination at a later date once the Commission had more experience with the review of energy storage procurements.[11] CESA believes it is ripe to consider and move forward with a more streamlined advice letter process since several energy storage solicitations have been conducted to date and utilities have become familiar with procuring, contracting for, and operating energy storage resources. *Pro forma* contracts have not materially changed in recent years, as the utilities have become familiar with how to contract for energy storage. Thus, it is prudent to promote the use of energy storage to meet near-term reliability needs with a more streamlined process. Moreover, in the recent Commission-directed procurements at Moss Landing, Aliso Canyon and Metcalf, the Commission authorized the utilities to utilize a Tier 3 advice letter review process in certain instances, especially where expediency is needed and where the Commission is within its authority to direct as such.[12]

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[11] *Decision Approving San Diego Gas and Electric Company, Pacific Gas and Electric Company, and Southern California Edison Company's Storage Procurement Framework and Program Applications for the 2014 Biennial Procurement Period*, D.14-10-045, issued October 16, 2014, pp. 103-104. http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M127/K426/127426247.PDF

[12] *Resolution E-4909. Authorizing PG&E to procure energy storage or preferred resources to address local deficiencies and ensure local reliability*, issued January 12, 2018, p. 16. http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M205/K602/205602530.PDF

Resolution E-4949. Pacific Gas and Electric request approval of four energy storage facilities with the following counterparties: mNOC, Dynegy, Hummingbird Energy Storage, LLC, and Tesla, issued

To facilitate expedited procurement, the Commission could create rules and guidelines governing the process so that LSEs can meet the needs of the changing electric grid quickly while preserving parties' due process rights. This may involve considering broader situations with the right balance of due-process review and expediency rather than just "certain instances" where advice letter review could be used, given the Commission's experience with energy storage solicitations to date. Other standardized procurements such as the Renewable Auction Mechanism ("RAM") or the Demand Response Auction Mechanism ("DRAM") allow for such approval of contracts through advice letter processes, and thus it may be worthwhile for the Commission to initiate a stakeholder process to begin the formation of such standardized contracts to streamline approval processes that also serve to address near-term and potentially urgent reliability needs. With a streamlined approval process, it will support the cost-effective and timely deployment of energy storage to address many of the aforementioned near-term reliability issues.

Additionally, SCE's proposed Reliability Threshold Mechanism[13] to allow for the expedited procurement of flexible energy storage resources to address critical reliability conditions, which may stem from the unplanned economic retirement of gas generation resources or various 'unplanned' events, should be considered and developed in the IRP

November 8, 2018, p. 30.
http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M240/K050/240050937.PDF

Resolution E-4937. Authorizing Southern California Edison's plan to conduct a solicitation for energy storage to comply with SB 801 (Stern), issued on August 9, 2018.
http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M221/K689/221689899.PDF

[13] *Integrated Resource Plan of Southern California Edison Company (U 338-E)*, filed on August 1, 2018, pp. 126-134.

proceeding. The specific thresholds will need to be discussed to determine whether they are appropriate.[14]

- **Issues it addresses:** Potential economic retirement of the gas fleet; potential elimination or minimization of the Aliso Canyon natural gas storage facility; and underestimation of end-use electrification, particularly for the transportation sector.

- **Reliability:** Pursuant to Resolution E-4791 and Resolution E-4909, energy storage has been procured to meet critical Local RA needs and provides flexibility and fast-response capabilities.

- **Cost:** Procuring energy storage as an alternative to backstop procurement has been demonstrated to be more cost-effective, as evidenced in Resolution E-4949 approving the PG&E's 2018 Local Energy Storage RFO.[15] Similar results could be seen with a formal expedited process.

- **Environmental justice:** If energy storage is procured to replace a gas generator in a DAC, the energy storage operations should reduce local pollutant impacts of the gas facility.

- **LSE procurement:** Energy storage can be procured and deployed in 8 months, as demonstrated in the Resolution E-4791 procurement, or have the procurement cycle compressed to 10 months, as evidenced in Resolution E-4909 procurement. Longer deployment timelines may improve the cost-effectiveness of energy storage resources, so some balance may be needed to address near-term reliability issues quickly but also the most cost-effectively as possible. An advice letter and resolution process is needed to enable a formal expedited procurement process.

- **State policy:** Energy storage resources generally charge during low-priced wholesale market periods and discharge to meet peak capacity, as well as providing flexible ramping capabilities to support renewables integration.

[14] SCE proposed that additional natural gas-fired generation retirement(s) cumulatively greater than 360 MW would exceed the reliability threshold and trigger expedited energy storage procurement. The IRP process may wish to analyze this threshold level and determine whether it is prudent and reasonable. A case could be made for a lower threshold if there is the potentially to cost-effectively displace certain gas-fired generation.

[15] *Energy Storage Contracts Resulting from PG&E's Local Sub-Area Requests for Offers Per Resolution E-4909*, PG&E Advice Letter 5322-E, submitted on June 29, 2018, pp. 22-23.

Together, energy storage supports the state's GHG emissions reduction goals.

- **Cost allocation:** This can be addressed through LSE self-procurement and may depend on the specific need and/or gas generator resource that is being hybridized. CESA also notes that LSEs with accurate information on sub-local needs may be able to develop energy storage quickly to manage grid needs while selecting capacity that they prefer, avoiding backstop approaches.

C. FRACMOO Phase 2 Proposal Adoption

In the since-suspended initiative, the CAISO proposed a suite of solutions that were also introduced in Track 2 of the RA proceeding. The CAISO proposed to meet the flexible capacity requirements with three new products: (1) day-ahead load shaping product; (2) 15-minute Flexible RA product; and (3) 5-minute Flexible RA product. In addition, the CAISO also proposed to develop products with ramping capabilities based on short-duration ramp periods and to fully unbundle a resource's Effective Flexible Capacity ("EFC") from its Net Qualifying Capacity ("NQC"), but recommended that additional vetting of the methodology and uncertainty and variability metrics are warranted to ensure the metrics yield logical outcomes that also address the CAISO's downward ramping needs and self-scheduling effects. CESA supported these proposals and recommends that the Commission continue to advance some of these ideas in the RA proceeding.

- **Issues it addresses:** Multi-hour, hourly, and sub-hourly flexibility needs.

- **Reliability:** The 5-minute and 15-minute Flexible RA products are designed to address real-time uncertainty and the sub-hourly flexibility challenges.

- **Cost:** The unbundling of System/Local RA and Flexible RA will allow for more cost-effective Flexible RA resources to be procured and deployed given the potential for reduced deliverability study costs for only addressing the Flexible RA need.

- **Environmental justice:** By better incentivizing and compensating energy storage resources to provide Flexible RA, it may reduce the need for gas generators.

- **LSE procurement:** No major changes will be needed.

- **State policy:** Improved Flexible RA rules will support greater renewables integration and thus support further reduced GHG emissions.

- **Cost allocation:** This can be addressed through LSE self-procurement and the usual cost allocation rules.

D. Solar-plus-storage and wind-plus-storage ELCC value authorizations

The RA and RPS proceedings are in the early stages of considering changes to the ELCC methodology to quantify and value the capacity contribution of paired-storage resources. Currently, no paired-storage ELCC values are authorized outside of a one-off approval of an ELCC counting and valuation methodology as approved in SCE's Moorpark Procurement Plan. The Commission should continue the development of an ELCC 'count' and work toward authorizing this value for all RA resources going forward.

- **Issues it addresses:** Multi-hour, hourly, and sub-hourly flexibility needs; and increased levels of overgeneration and curtailment

- **Reliability:** A higher ELCC value indicates a higher capacity value to the grid, thereby improving the reliability of solar resources when paired with energy storage, as opposed to when it is a standalone resource.

- **Cost:** Further incentives to pair solar and energy storage resources will allow energy storage to take advantage of the Federal investment tax credit as well as cost savings from shared facilities.

- **Environmental justice:** There will likely be indirect system impacts of having solar-plus-storage resources being able to reduce the need for flexible ramping capability and peaking capacity from gas, as compared to a standalone solar resource, which can have impacts on DACs.

- **LSE procurement:** No major changes will be needed in terms of procurement processes. If energy storage resources are contracted as part of the RPS Program, changes to RPS PPAs may be needed.

- **State policy:** Pairing of energy storage with renewables allows for the state to achieve its RPS and GHG emissions reduction goals without having to overbuild RPS resources and/or contract for GHG-emitting resources that are needed to integrate renewables. .

- **Cost allocation:** No major change is needed.

E. Flex Down RA Product Development

CESA proposed that the Commission develop a Flex Down RA product in the RA proceeding in order to ensure the provision of downward ramping bids in the CAISO markets during key times. A Flex Down RA product also provides an important 'market signal' that fast-ramping energy storage solutions are likely needed to integrate renewables and to promote reliability.

- **Issues it addresses:** Multi-hour, hourly, and sub-hourly flexibility needs; and increased levels of overgeneration and curtailment

- **Reliability:** Reduced reliance on curtailments will improve market efficiency and reduce the burden on the CAISO to exceptionally dispatch curtailments or dispatch other integrating resources. With more energy storage resources, it may also decrease the 'belly of the duck' and reduce the size and frequency of various ramping needs.

- **Cost:** An over-reliance on curtailment may inadvertently authorize over-commitments of fossil resources, leading to out-of-market costs and inefficiency.

- **Environmental justice:** Fewer run hours of gas-fired generation to integrate renewables can reduce local pollutant impact to DACs.

- **LSE procurement:** No major changes are needed.

- **State policy:** An over-reliance on curtailment may require a reliance on fossil resources, causing GHG emissions to be higher than, though a more efficient dispatch via Flex Down RA offers could have been scheduled.

- **Cost allocation:** No major changes are needed.

Question 5: Is the CAISO market structure equipped to handle the challenges you identified in response to Question 1? Why or why not?

CESA believes that the CAISO market structure is structured to handle some of the near-term reliability challenges, but many changes are being discussed and potentially implemented, as some gaps have been identified. In their market performance reports, the CAISO has discussed the challenges of operating the grid in real time due to forecast uncertainty of net load, leading to it starting the Day-Ahead Market Enhancements ("DAME") and RA Enhancements Initiative as well as developing several key proposals in Phase 2 of the FRACMOO Initiative. However, the CAISO needs close coordination with the Commission to move forward with foundational proposals that would reform the RA Program, and thus many of the recommendations that CESA makes related to the RA Program and RA products will require Commission action.

Question 6: Are there more global solutions available via Commission coordination with the CAISO and/or beyond the reach of the Commission on its own? What are they are how should they be addressed?

To the extent that near- and medium- term issues require a more planning focus, the IRP could be broadened to plan for a horizon that greater than three years out. In turn, the RA program can then have less pressure to retain a fleet that may or may not balance between reliability, cost, policy, and choice goals, and can instead focus on lining up a fleet that pragmatically ensures reliability for grid operations in all circumstances. It may mean that multi-year RA will be less needed since the planning related to having a portfolio-sufficient fleet can be done by the IRP.

Question 7: **How can the Commission and the public monitor market behavior by generation owners? For example, offering capacity in LSE solicitations, receiving contracts in any Commission-mandated or LSE-sponsored venue, making public data on CAISO market bid prices, or requests for special designation by the CAISO. What types of reporting should be required and what types of entities should report? Should generators seeking contracts be required, via the Commission's procurement rules, to attest that they have or will offer their other available capacity into any solicitations from Commission-jurisdictional LSEs?**

CESA has no comment at this time.

Question 8: **What challenges do the advent of 40+ LSEs present for near-and medium-term reliability investments, particularly to support renewable integration?**

CESA has no comment at this time.

Question 9: **Provide any other information you think would be relevant to the Commission's consideration of these issues.**

CESA has no further comment at this time.

III. CONCLUSION.

CESA appreciates the opportunity to submit these comments to the Ruling. CESA looks forward to working with the Commission and stakeholders in this proceeding.

Respectfully submitted,

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CALIFORNIA ENERGY STORAGE ALLIANCE

Date: December 20, 2018

Attachment A:
Blue Marble Capacity Expansion Modeling Results & Methodology

OVERVIEW OF HYBRID MODELING RESULTS IN GRIDPATH

CESA commissioned Blue Marble to conduct an analysis of hybridizing generators in the CAISO system using its GridPath model. The model's capacity-expansion functionality was used to co-optimize power system operations and investments through 2030 under several scenarios. While similar to RESOLVE, the model allows for a more granular, plant-specific analysis of capacity expansion and production costs. Within GridPath, a candidate list of 23 gas peaker plants, which were located in local capacity requirement ("LCR") areas and in DACs, was made eligible for hybridization with energy storage.

Summary Results

At a high level, the modeling results showed that near-term hybridization (*i.e.*, within a few years) of approximately 1,110 MW of existing gas peakers (222 MW of storage) in LCR areas was able to achieve the following:

- Provision of a variety of reliability services (*e.g.*, Local RA, spinning reserves, frequency response) at a reduced overall cost and with lower emissions relative to the baseline scenario.
- A reduction in overall annual GHG emissions of 222,000 to 351,000 MT by 2022.[16]
- A reduction in annual revenue requirements of $49 million to $60 million, which equates to a net present value of $836 million.[17]

[16] Based on a comparison of Scenario 3 and Scenario 5 to the baseline (Scenario 1).

[17] Based on a comparison of Scenario 5 to the baseline (Scenario 1). Note that the modeled scenario assumes energy storage deployed for hybridization contributes to the energy storage mandate in lieu of longer-duration batteries assumed in the IRP base case.

- An immediate reduction in NOx emissions in DACs of over 33,000 lbs/yr, increasing to over a 100,000 lbs/yr reduction by 2022.[18]

- A 42% reduction in the annual number of gas peaker plant unit starts by 2022.[19]

Scenarios

The model ran five scenarios for the CAISO power system under a 42 MMT California carbon cap by 2030:

- Scenario 1 has "default" assumptions like those in the 2017-2018 CPUC IRP, with no hybridization allowed.

- Scenario 2 is based on Scenario 1, but also gives the model the option to hybridize the candidate resources (if economically optimal).

- Scenario 3 is also based on Scenario 1, but forces hybridization of the 23 candidate plants in 2018.

- Scenario 4 is based on Scenario 1, but requires 34% of spinning reserves to be provided by CCGTs (approximating current market conditions).[20]

- Scenario 5 is based on Scenario 4, but forces hybridization of the 23 candidate plants in 2018, and counts hybrid resources towards the 1.3 GW energy storage mandate.

Results 1: Hybridization Decisions

Under Scenario 2, all candidate plants are fully hybridized by 2030. About half of the plants are hybridized by 2026 and the rest by 2030.[21] These results suggests that, under the default IRP

[18] Based on a comparison of Scenario 5 to the baseline (Scenario 1).

[19] *Ibid*.

[20] Note that Scenario 4 is virtually identical to Scenario 1. Upon further examination, it was discovered that there was enough headroom on CCGT units in GridPath to provide up to 34% spinning reserves without altering unit commitment or dispatch.

[21] Note that hybridization decisions are linearized in the model for computational feasibility, so a few plants are "partly" hybridized in 2026, with hybridization completed in 2030

assumptions, it is economically optimal to hybridize all of the candidate generators considered and that the optimal timing for doing so for many of these plants is in the mid-2020s. The timing of these decisions is significantly linked to the stringency of the carbon cap (*i.e.* a more stringent cap could accelerate hybridization decisions). Additionally, Scenario 2 did not assume any hybrid resources would count towards the energy storage mandate, which could also affect the timing of these decisions in the model.

Results 2: Cost Savings

Under Scenario 2, allowing hybridization results in annual cost savings of $7 million annually by 2026 and $23 million annually by 2030. In 2026, the cost savings are due largely to operational cost savings, which offset the cost of hybridization. By 2030, operational costs are similar in Scenario 1 and Scenario 2, but hybridized resources are built instead of higher-cost lithium-ion batteries to provide similar services, resulting in savings. Scenario 3 does result in savings of $11 million annually by 2030 relative to Scenario 1, but is more expensive than the case with no hybridization before 2030. Under Scenario 5, allowing hybridized resources to count towards the energy storage mandate results in annual cost savings of $49 million in 2018, $60 million in 2022, $59 million in 2026, and $53 million in 2030. The NPV of these savings over all years is $836 million.

Results 3: Use and Value of Hybridized Resources

In Scenario 1, the capacity factors of the candidate hybrid resources are on the order of 1% to 2% in 2018, increase to 3% to 4% in 2022 and 2026 due to solar deployment and evening load growth, then decrease again to almost 0% in 2030, as the carbon cap becomes stringent enough to

make them uneconomic. When hybridized, the gas plants are used almost exclusively to provide spinning reserves and frequency response rather than power. For example, the spinning reserve "capacity factors"[22] of the hybridized candidate plants in Scenario 2 range between 17% and 42%. By taking on the provision of reserves, the hybrid resources make it possible to remove constraints on other more efficient resources and thus increase the overall efficiency of the system dispatch. See for example RESOLVE Day 24 in 2026: on this day, CCGTs are run at slightly higher setpoints in some hours, fewer peakers are started up, and hydro and storage are allocated more efficiently when the hybridized resources are providing reserves.

The ability to shift excess solar via storage to other hours of the day, allocate hydro to non-solar hours, and generally run gas plants efficiently becomes even more important with a more stringent carbon cap in 2030. In Scenario 1, GridPath builds 1.1 GW of one-hour lithium-ion batteries to provide reserves in 2030, and much of this battery capacity is displaced by hybridized gas in Scenario 2. As the batteries in Scenario 1 and hybridized resources in Scenario 2 provide similar services to the grid, the differences in dispatch in 2030 are subtle, but the same outcome is achieved at a lower cost in the case where the candidate hybrid resources are available.

In fact, even if the candidate resources are hybridized in 2018 as in Scenario 3 – at a higher cost than the 2030 hybrids – the annualized 2030 system cost in Scenario 1, which includes the Li-ion battery cost, is still higher than that in Scenario 3. Before 2030, however, the operational savings resulting from hybridization are offset by the higher 2018 hybridization cost. While more expensive than Scenario 1 before 2030, Scenario 3 does greatly reduce the number of starts of the candidate hybrid resources, which provide reserves and free up other resources to provide power

[22] This is calculated similarly to a capacity factor – *i.e.*, the total spinning reserve provision over a year divided the maximum possible provision (assuming the entire plant capacity is dedicated to spinning reserves in every hour of the year).

instead. Similar reductions in unit starts and more efficient dispatch are also found in Scenario 5. Fewer 4-hour batteries are included in Scenario 5, which somewhat limits the system's capabilities, thus increasing operating costs relative to Scenario 1, however, this is more than offset by the reduced initial cost of the batteries.

Results 4: New Capacity

There is almost no change in investment decisions between Scenario 1, 2, and 3 except that hybridization displaces a large fraction of the one-hour lithium-ion batteries that are built in 2030 to provide reserves in Scenario 1. Similarly, hybridizing the candidate resources in Scenario 5 results in a lower 2030 deployment of new batteries relative to Scenario 1.

Under Scenario 5, all 1,110 MW of candidate resources are hybridized in 2018, which equates to 222 MW of energy storage. This 222 MW of storage is assumed to count towards the AB 2514 energy storage mandate. The amount of four-hour batteries assumed in the 2017-2018 IRP assumptions to meet the mandate are reduced accordingly. In Scenario 5, reducing the storage mandate battery capacity by 222 MW produces a lower deployment of solar (108 MW reduction), higher investment in geothermal (66 MW increase), and more new batteries (38 MW increase) relative to Scenario 3.

Next Steps: CCGT Hybrid Modeling

CESA pursued this modeling effort as an initial step towards understanding the impacts of hybridizing existing generators in the CAISO system. In doing so, the initial scope was limited to a small subset of gas peaker plants. However, we believe that even larger benefits could be realized by hybridizing of a larger portion of the overall generation fleet, including CCGT units. CESA has

reviewed some additional modeling work that was recently performed in RESOLVE to study CCGT hybridization.[23] These results suggest that hybridizing additional generation units (including CCGTs) could achieve even greater emissions reductions while also eliminating potential future shortages in load following reserves and spinning reserves, even under scenarios with substantial retirements. Additionally, unit starts were shown to be reduced even more substantially than under the limited peaker scenario examined here. Given the promising nature of these findings, CESA plans to pursue additional modeling efforts using GridPath soon to further explore the full potential of hybridization.

[23] This CCGT analysis was completed by Gridwell Consulting as a follow up to their recent study on hybridization: https://docs.wixstatic.com/ugd/fe68bf_ff74a8c24c6d4907b8bea661be9f99df.pdf