

**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
ON THE ADMINISTRATIVE LAW JUDGE'S RULING SEEKING COMMENT ON
PROPOSED REFERENCE SYSTEM PORTFOLIO AND RELATED POLICY ACTIONS**

Alex J. Morris
Executive Director

Jin Noh
Senior Policy Manager

CALIFORNIA ENERGY STORAGE ALLIANCE
2150 Allston Way, Suite 400
Berkeley, California 94704
Telephone: (510) 665-7811
Email: cesa_regulatory@storagealliance.org

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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”) hereby submits these comments on the *Administrative Law Judge’s Ruling Seeking Comment on Proposed Reference System Portfolio and Related Policy Actions* (“Ruling”), issued by Administrative Law Judge (“ALJ”) Julie A. Fitch on November 6, 2019.

I. INTRODUCTION.

CESA commends the Commission for its work on the development of a Reference System Portfolio (“RSP”) that seeks to enable California to reliably meet its ambitious energy and environmental goals. CESA supports this effort, as it provides guidance to the load serving entities (“LSEs”) responsible for procurement and emphasizes the resources necessary to decarbonize the electric sector, and, in particular, the important role of energy storage resources to provide critical system flexibility and capacity.

In these comments, CESA provides feedback on the proposed RSP. Specifically, CESA urges the Commission to consider the following modifications and recommendations:

- RESOLVE should be updated to include multi-day optimization, evaluation of extreme weather events, and further candidate resources.
- SERVVM validation should be run for different sensitivities, including the 38 and 30 million metric ton (“MMT”) cases. This will serve to evaluate the most reliable policy pathways as California progresses to its 2045 goals and to determine the resource types and attributes that would be most cost-effective at providing the reliability associated with the 2 GW of generic effective capacity.
- The Commission should consider the implementation of a storage-specific effective load carrying capacity (“ELCC”) methodology that properly reflects the differences in durations and operational characteristics of storage resources.
- The Commission should use the 30 MMT scenario as the base case since it is within the California Air Resources Board (“CARB”) range and will support deep decarbonization needed to achieve our greenhouse gas (“GHG”) goals.
- The Commission should develop an all-resource solicitation process in preparation for the retirement of Diablo Canyon.
- The Commission should take steps to facilitate the development of zero-carbon resources with performance attributions like pumped hydro storage in order to further renewable integration as well as assess the role of long-duration storage in supplying local capacity.

II. **RESPONSES TO QUESTIONS POSED TO PARTIES IN SECTION 2.1.**

Question 1: Please provide any comments on the use of the RESOLVE model.

RESOLVE is a powerful capacity expansion model that has been developed to incorporate policy and operational constraints and select an optimal resource portfolio that enables California to meet its energy and environmental targets. Nevertheless, CESA believes RESOLVE has fundamental limitations that could misrepresent or overlook future capacity needs. Particularly, CESA believes RESOLVE is not equipped to properly assess the energy needs of a system that is highly reliant on variable energy resources (“VERs”) due to its optimization timeframe, locational specificity, and candidate resource representation.

RESOLVE is set up to optimize investment in new resources and dispatch of the overall fleet in a multi-year horizon.¹ Each one of those years is modeled as a collection 37 representative days that portray different weather conditions and is weighed accordingly.² CESA finds that this approach can systematically understate the capacity needs of the system since it does not take into account sequences of continuous challenging days (e.g., a cloudy week or a multi-day extreme weather event). Thus, RESOLVE focuses on satisfying daily arbitrage needs, but it does not capture the need for, or the benefit of, multi-day arbitrage. This is particularly concerning considering that the results of the core cases show that the duration of selected battery storage increases from four hours in the 46 MMT case to six hours in the 30 MMT, signaling increased need for long-duration resources as decarbonization advances. In this context, a model that does not accurately portray multi-day energy shifting applications is sub-optimal for long-term planning purposes.

Furthermore, RESOLVE is not equipped with the locational granularity used by the California Independent System Operator (“CAISO”) in their Local Capacity Requirement (“LCR”) Technical Studies, which analyze and determine capacity needs in areas that are transmission and/or generation constrained. Hence, RESOLVE’s allocation of new resources might not match with the needs identified by the CAISO, limiting their applicability and increasing the time needed to properly process the resulting portfolio and provide the system operator with a clear deployment panorama.

Lastly, RESOLVE has a limited array of candidate resources to select from, particularly those related with hybrid configurations and storage technologies beyond lithium-ion battery

¹ CPUC, *Ruling Seeking Comment on Proposed Reference System Portfolio and Related policy Actions, Attachment C Inputs & Assumptions: 2019-2020 Integrated Resource Planning* (“Inputs and Assumptions document”), filed under R.16-02-007, at 4.

² Inputs and Assumptions document, at 69.

systems. CESA believes the exclusion of hybrid configurations, specifically solar photovoltaic (“PV”) generation paired with storage resources, is particularly limiting. As of July 3, 2019, the CAISO Interconnection Queue included over 35,000 MW of hybrid and/or co-located projects.³ CESA considers that the magnitude of interest in the deployment of these resources warrants their inclusion in any capacity expansion model used for long-term planning. CESA is aware that the Commission has tried to approximate hybrid resource deployment via a cost sensitivity, the Paired Battery Cost scenario.⁴ While this scenario captures some of the financial benefits associated with co-location, it does not reflect the operational differences between standalone and paired assets, such as the firming of output or the ability to minimize losses via a direct current (“DC”) pairing between the generating asset and the storage resource.⁵ Hence, CESA urges the Commission to evaluate the inclusion of hybrid resources as candidate resources. Furthermore, CESA exhorts the Commission to consider the inclusion of storage technologies such as compressed air energy storage (“CAES”) and hydrogen as a generation asset in order to reflect the vast toolkit available for LSEs and state agencies to enable policy compliance. The inclusion of additional technologies would enable RESOLVE to produce more credible and specific portfolios that align with the state’s vision for a carbon-free electric grid.

In sum, CESA considers RESOLVE’s use in the IRP proceeding to be adequate; nonetheless, improvements need to be done to further refine this model and ensure its results are reflective of the complexities and opportunities posed by a highly renewable future.

Question 2: Provide any comments on the use of SERVIM.

³ See CAISO, *Hybrid Resources Revised Straw Proposal*, December 2019, at 5. Available at: <http://www.caiso.com/InitiativeDocuments/RevisedStrawProposal-HybridResources.pdf>

⁴ CPUC, *Ruling Seeking Comment on Proposed Reference System Portfolio and Related policy Actions, Attachment A 2019-20 IRP: Proposed Reference System Plan* (“PRSP Presentation”), filed under R. 16-02-007, at 94.

⁵ *Ibid.*

CESA supports the Commission utilizing the SERVVM model as a reliability check once RESOLVE has selected optimal portfolios. RESOLVE is not set up to inform its capacity expansion modeling with industry-standard reliability targets such as loss-of-load expectation (“LOLE”); thus, a model that validates the trustworthiness of RESOLVE’s results is warranted.

While SERVVM has been useful in this cycle to ultimately uncover the potential inadequacy of the 46 MMT core case, CESA would have preferred if the Commission had used SERVVM to validate other cases and sensitivities developed in RESOLVE. Such an analysis would provide further guidance regarding future RESOLVE reforms, as it could shed light on systematic limitations of the model and inform modifications to be pursued in upcoming cycles and other regulatory and scoping forums such as the effort currently undertaken by the California Energy Commission (“CEC”) in the development of the Joint Agency Report regarding Senate Bill (“SB”) 100. Further comments on the use of SERVVM can be found in CESA’s response to question 8.

Question 3: Provide any comments on baseline assumptions.

CESA has several concerns regarding the baseline assumptions considered for the 2019-2020 IRP cycle. First, CESA is concerned with the representation of behind-the-meter (“BTM”) resources. Currently, the IRP uses the CEC’s Integrated Energy Policy Report (“IEPR”) dataset to inform load forecasts and shapes within RESOLVE.⁶ IEPR considers BTM resources, such as projected distributed solar PV and BTM storage assets, as load modifiers.⁷ This representation constrains BTM resources within the model to perform as predetermined, not accurately portraying flexibility and responsiveness of certain supply-side and dispatchable BTM resources. Furthermore, the inclusion of these resources solely as load modifiers does not account for the

⁶ Inputs and Assumptions document, at 9.

⁷ Ibid.

potential benefits they bring to the grid in terms of transmission and distribution deferral and resiliency, among others. In order to minimize this issue, RESOLVE has been updated to include BTM PV and storage as candidate resources; nevertheless, RESOLVE is set up to minimize costs and since these resources appear to be significantly more costly due to the lack of benefit considerations, they are not selected in any of the core cases.

CESA acknowledges this issue might not be possible to attend in the current IRP cycle, but recommends considering the experience of other modeling tools in incorporating these issues. Namely, CESA points at the effort of the National Renewable Energy Laboratory (“NREL”) along with the Los Angeles Department of Water and Power (“LADWP”) within the LA100 Initiative. For LA100, NREL has deployed a bottom-up modeling strategy that allows the estimation of BTM deployments based on adoption likelihood.⁸ Moreover, NREL’s model captures the dynamic implications of BTM resource deployment, allowing it to optimize the utility-level procurement considering the actual operation of flexible and fast-responding BTM assets.⁹ CESA believes an incorporation of such complexities in scenarios done before the RESOLVE runs could approximate NREL’s exercise.

A second area where CESA would like to provide feedback refers to the ELCC curve that has been adopted within RESOLVE for energy storage resources. In the Inputs and Assumptions Document, the Commission recognizes that battery storage does not provide equivalent capacity to thermal resources at higher battery storage penetrations.¹⁰ The document goes on to explain that this derating of capacity is due to storage’s ability to flatten the net peak, requiring longer duration

⁸ NREL, *Methodology, Data, and Assumptions for Analyzing Pathways to 100% Renewable Electricity*, August 2019, at 22-24.

⁹ Ibid.

¹⁰ Inputs and Assumptions Document at 92.

storage to be deployed.¹¹ CESA understands the need for a counting criteria that clearly represents the capacity benefits of each candidate resource selected; nevertheless, the Commission should consider the implementation of an ELCC methodology that properly reflects the differences in durations and operational characteristics of storage resources, rather than adopting one based solely on the features of one resource (*i.e.*, four-hour lithium-ion batteries). Furthermore, considering the need for longer-duration storage in the years beyond 2026, CESA recommends that the Commission evaluate the benefits of diversifying the state’s energy storage portfolio by incentivizing the development of technologies with durations over eight hours. CESA develops this proposal further in our responses to subsequent questions.

Finally, CESA is concerned that gas-plus-storage hybrids are not included in the baseline resources despite there being 100 MW of such hybrids operating in the CAISO today and another 150 MW expected to come online by the end of 2020. By not differentiating the operational and performance characteristics of gas-plus-storage hybrids from standalone conventional gas generation, the modeling exercises will not capture the unique attributes and potential benefits that such resources can provide (*e.g.*, reduced GHG emissions in disadvantaged communities). To address this critical oversight, CESA recommends an easy and quick fix to the RESOLVE modeling to replace “Advanced CCGT” and “Aero CT” with “CAISO_Hybrid_CCGT” and “CAISO_Hybrid_Aero” resource classes with the following characteristics:¹²

- CAISO_Hybrid_Aero:
 - Pmax = 50MW

¹¹ Ibid.

¹² These changes should be done for the following resources: CENTER_6_PEAKEER (Active); ETIWND_6_GRPLND (Active); STANTN_2_STAGT1 (New hybrid unit contracted to LSE - COD 2020); STANTN_2_STAGT2 (New hybrid unit contracted to LSE - COD 2020); and AGRICO_7_UNIT (contracted to LSE for modification of existing unit to hybrid - COD 2020).

- Pmin = 0 MW
- Start time = 0 min
- Min run = 0 min
- Min down = 0 min
- Spin reserve = Yes
- CAISO_Hybrid_CCGT
 - Ramp rate 40MW/min

Going forward, the RESOLVE model should be modified to incorporate gas-plus-storage hybrids as a candidate resource given the significant potential these resources can provide. However, at minimum, the above changes to the baseline resources should be made to capture the value that already existing and upcoming gas-plus-storage hybrids provide.

Question 5: Provide any comments on the scenarios and sensitivities modeled.

Please refer to CESA's responses to questions 9, 10, and 11.

Question 6: Provide any comments on the common metrics compared across cases.

Please refer to CESA's responses to questions 10 and 11.

III. RESPONSES TO QUESTIONS POSED TO PARTIES IN SECTION 3.1.

Question 8: Comment on the modifications to SERVM made by Commission staff to approximate RESOLVE's PRM constraint, which limits the amount of imports that can count towards resource adequacy. Were the changes appropriate? Why or why not?

CESA supports the changes made by the Commission to better represent the amount of imports that can count towards RA requirements. CESA believes that tuning SERVM and RESOLVE to represent the same operational constraints can lead to better, more reliable results. By minimizing the differences and discrepancies between both models, the Commission can

produce optimal portfolios that send the correct market signals to developers and guide LSE procurement in an efficient manner, reducing the risk for future capacity shortfalls.

Question 9: Comment on the manual addition of 2,000 MW of “generic effective capacity” in order to produce a portfolio with an LOLE result of less than 0.1. Would you recommend a different way of depicting the reliability gap in the portfolio? If so, describe in detail.

CESA does not believe the manual inclusion of 2 GW of generic effective capacity was an appropriate decision. By manually including zero-cost, zero-emission resources in order to produce a reliable portfolio (*i.e.*, one with an LOLE under 0.1), the Commission has jeopardized the integrity of the results, both in terms of cost and overall emissions. Such a decision undermines the core case metrics related to average rates and CAISO-wide emissions, since, as of now, there is no certainty regarding which resource or combination of resources would provide the 2 GW required. Moreover, the inclusion of generic effective capacity hinders the busbar mapping effort as it provides no guidance to the CAISO relative to the spatial needs or operating characteristics of these resources.

Instead of manually including 2 GW of generic effective capacity, CESA recommends the Commission force the selection of 2 GW of different resources (*e.g.*, different long-duration energy storage resources constructed from lithium-ion, flow batteries, and pumped hydro storage candidate resource assumptions) within RESOLVE and then verify the reliability of those portfolios using SERVIM. Forcing the selection of those resources in RESOLVE would provide insights relative to cost, while allowing CAISO to continue with its busbar mapping process. Furthermore, checking the reliability of those portfolios using SERVIM would enable the Commission to draw conclusions about needs, such as for long-duration energy storage resources that may not be fully captured by RESOLVE due to some of its technical limitations.

Finally, CESA urges the Commission to clarify the role the 3,300 MW of capacity directed in Decision (“D.”) 19-11-016 would play relative to the perceived 2 GW deficit. The Ruling states that the Commission included the capacity associated with once-through cooling (“OTC”) plants in the development of the 46 MMT Alternate case; nevertheless, it appears there was no consideration of the 3.3 GW directed for procurement.¹³ CESA believes this capacity was excluded as it may not necessarily come from new resources; however, it is reasonable to assume at least a fraction of those 3.3 GW will be provided by new capacity. Thus, the need for 2 GW of generic effective capacity might be overstated. Consequently, CESA would appreciate if the Commission could clarify how the procurement directed in D.19-11-016 relates to this 2 GW of generic effective capacity.

IV. **RESPONSES TO QUESTIONS POSED TO PARTIES IN SECTION 4.1.**

Question 10: Do you support the 46 MMT Alternate Scenario as the basis for the GHG emissions goal for 2030 to be affirmed by the Commission? Why or why not? If you propose a different scenario, explain your rationale.

Due to the state’s push for electrification of a wide variety of end-uses, namely transportation, CESA believes that the establishment of a more stringent emission target is warranted in order to avoid unexpected emissions related to load growth. CESA has found that other stakeholders also support the adoption of a more aggressive GHG target. Southern California Edison (“SCE”), for example, has advocated for a target below 46 MMT since the previous IRP cycle.¹⁴ More recently, SCE released a whitepaper, *Pathway 2045*, that lays out their clean energy strategy for the next 25 years and shows that, to achieve the 2030 and 2045 decarbonization goals,

¹³ Ruling, at 12.

¹⁴ See *Integrated Resource Plan of Southern California Edison Company (U 338-E)*, August 1, 2018 (“SCE IRP”), at 48-49. In this filing, SCE proposed using a 28 MMT GHG target.

the electric sector must be decarbonized at a quicker pace than currently required by the state¹⁵ due to the projected load growth associated with the electrification of buildings and transportation. In the white paper, by 2045, SCE estimated that electricity sales and peak load will increase by 60% and 40%, respectively.¹⁶ Consequently, an accelerated decarbonization of the energy sector is necessary to enable cross-sectoral emission reductions in a consistent manner. Due to this need, SCE assumes a 30 MMT target for 2030 in Pathway 2045.¹⁷

CESA agrees with this vision and thus recommends the Commission consider adopting the 30 MMT scenario as the basis for the 2030 GHG goal. Such a decision would be in line with the range recommended by CARB and would support the deep decarbonization needed for California to achieve its environmental targets. CESA urges the Commission to recognize that quickly decarbonizing the electrical grid is a least-regrets decision as it would guarantee GHG reductions regardless of load growth or cross-sectoral interactions (*i.e.*, massive electrification of transportation).

V. RESPONSES TO QUESTIONS POSED TO PARTIES IN SECTION 5.1.

Question 11: Are you concerned about the risk of overreliance on solar as part of the recommended portfolio? Why or why not?

Question 12: Are you concerned about the risk of overreliance on battery storage as part of the recommended portfolio? Why or why not?

Overreliance on any given resource presents some risks given the long-term nature of resource planning, where resource costs, availability, and performance can deviate from forecasts or expectations. In assessing these risk factors, CESA believes that it is prudent for the

¹⁵ SCE, *Pathway 2045*, November 2019, at 1. Available at <https://www.edison.com/content/dam/eix/documents/our-perspective/201911-pathway-to-2045-white-paper.pdf>

¹⁶ *Ibid.*

¹⁷ *Ibid.*, at 5.

Commission to consider risk mitigation strategies, such as least-regrets investments in some diversification. For example, Attachment A of the Ruling shows the incremental costs relative to the reference case (46 MMT) for each of the sensitivities modeled. The cost sensitivity cases that result in the highest incremental costs are those with high solar costs and high battery costs, which, for the 46 MMT scenario, result in incremental costs of \$556 million per year and \$586 million per year, respectively.¹⁸ CESA believes that the likelihood of such cost trajectories is slim considering resource cost trends; nonetheless, it is important that the Commission seeks to minimize these risks by considering some least-regrets actions to further evaluate and possibly develop a diverse portfolio. To do so, CESA recommends considering the merits of dispatchable zero-carbon technologies that can support the state's renewable integration goals while providing the energy for the durations needed at higher penetrations of both VERs and lithium-ion battery storage. This includes but is not limited to long-duration energy storage resources such as pumped hydro resources, flow batteries, storage via hydrogen production, compressed air energy storage, and other emerging technologies.

However, in interpreting the significant selection of battery storage resources in the model, CESA recommends that the Commission focus on the storage resource and performance attributes that the model is determining as being needed to provide reliability and renewable integration at least cost. Until additional storage candidate resources are incorporated into RESOLVE, the Commission should not elevate concerns about an overreliance on battery storage, as the results likely indicate a general large need for stored energy, which can be provided via several different technologies, but the Commission should also not lose sight of the reality that certain storage

¹⁸ PRSP Presentation, at 95.

resources involve long-lead times and must be timely identified and procured if they are to be operational when needed.

Question 13: Is the retention of most or all of the current thermal generation fleet reasonable and realistic? Why or why not?

CESA commends the Commission for its work to include an economic retirement module for fossil-fueled resources. CESA deems this approach as much more accurate than the 40-year lifetime assumption used in the previous IRP cycle. CESA believes the gas capacity retention function better reflects the pathways to achieve the environmental goals of California, as it would provide backup rather than energy to the system. More concretely, CESA would like to emphasize that the adverse environmental effects of the remaining gas generation assets can be mitigated by pairing those resources with energy storage technologies that would improve the operational characteristics of fossil-fueled resources and minimize the consumption of natural gas. Hence, CESA considers the retention of some gas-fired capacity plausible.

Nevertheless, CESA is concerned with the differences in economic retention of thermal generation between the 2030-ending cases and the 2045-ending cases. The results, which can be visualized in the RESOLVE model shared by the Commission, show that all 2030-ending core cases economically decide to not retain more gas capacity than their 2045-ending counterparts. Table 1 illustrates these differences. CESA believes the discrepancies between the 2030- and the 2045-ending cases shed light on the fact that, at higher levels of renewable penetration, the need for dispatchable capacity with significant duration increases. This also highlights significant opportunities for zero-carbon dispatchable resources, like long-duration energy storage, which have benefits that are not fully captured by RESOLVE.

Table 1. Summary of Gas Capacity Not Retained by Core Case¹⁹

Case	30 MMT case		38 MMT case		46 MMT case	
	2045	2030	2045	2030	2045	2030
Gas capacity not retained	6,001	8,569	5,340	6,416	2,942	3,645
Difference	2,568		1,076		703	

Given these results, CESA recommends that the Commission consider their implications and act accordingly by recognizing the increased need for resources that are able to provide long-duration zero-carbon dispatchable generation. This recommendation is further developed in CESA’s answer to question 16.

VI. RESPONSES TO QUESTIONS POSED TO PARTIES IN SECTION 6.1.

Question 16: Should the Commission take steps to support the development of at least one pumped storage facility in California? If so, what steps? If not, why not?

CESA believes there is sufficient evidence in this Ruling to demonstrate the development of at least one pumped storage facility and other emerging energy storage resources that can deliver similar performance in California is worthy of consideration. First, the proposed RSP includes 2 GW of generic effective capacity that the Commission has modeled as zero-carbon. Second, the proposed RSP is heavily reliant on solar PV and battery storage; hence, additional resources must be able to further renewable integration and minimize the risks associated with high cost trends for solar PV and lithium-ion batteries. Third, the 30 MMT core case, which CESA has advocated for in these comments, economically selects 374 MW of pumped hydro storage by 2030 despite

¹⁹ Elaborated by CESA based on data included in the RESOLVE package shared by the Commission, available at <https://www.cpuc.ca.gov/General.aspx?id=6442463176>

the modeling gaps in RESOLVE which systematically undervalue resources capable of providing multi-day energy arbitrage. Fourth, the differences in economic retention of gas capacity between the 2030- and 2045-ending cases signal that a decarbonized grid by 2045 will require an amount of dispatchable capacity beyond what is now forecasted in the 2030-ending portfolios. Fifth, when analyzing the results of the core cases, it can be appreciated that as the GHG target becomes more stringent, the duration of selected battery storage increases from four hours in the 46 MMT case to six to eight hours in the 30 MMT; signaling increased need for long-duration resources.

Due to these reasons, there is sufficient evidence at this time for the Commission to take steps to further validate the need for long-duration energy storage resources like pumped hydro storage and to develop procurement pathways for such long lead-time resources and low-regrets resources like energy storage. We also believe there is sufficient evidence to pursue a concerted effort to develop longer-duration energy storage resources in general. A working group should be convened to further evaluate the costs and benefits of developing a pumped hydro storage asset and other long-duration energy storage resources by 2026, in line with the date of the perceived need for 2 GW of generic effective capacity. However, as part of these efforts, the Commission should explore not only the benefits, costs, and procurement pathways of pumped hydro storage facilities and other long-duration energy storage resources but also other infrastructure-scale and/or long lead-time storage resources.

Question 17: Are there other actions the Commission should take specifically with respect to replacement capacity for the Diablo Canyon nuclear plant? Describe in detail.

In light of the retirement of the Diablo Canyon nuclear power plant, CESA urges the Commission to act in an expedite fashion and commence an all-resource solicitation process similar to the one directed in D.19-11-016. CESA believes the retirement of Diablo Canyon might be one of the factors contributing to the need for the manual addition of 2 GW of generic effective

capacity in 2026; thus, there is some evidence that, without effective planning, this retirement could significantly hinder the reliability of California's power sector. In order to avoid the need for emergency procurement and provide certainty to LSEs and ratepayers alike, CESA believes a procurement strategy based on the precedent set by D.19-11-016 is reasonable.

VII. CONCLUSION.

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

Respectfully submitted,

A handwritten signature in blue ink, appearing to read "Alex J. Morris".

Alex J. Morris
Executive Director
CALIFORNIA ENERGY STORAGE ALLIANCE

Date: December 17, 2019