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CESA's Comments on the SB 100 Draft Results Workshop

Additional submitted attachment is included below.

CESA
CALIFORNIA ENERGY STORAGE ALLIANCE

September 15, 2020

Email to: docket@energy.ca.gov
Docket Number: 19-SB-100
Subject: CESA's SB 100 Draft Results Workshop Comments

Re: Comments of the California Energy Storage Alliance (CESA) following the September 2, 2020 Senate Bill 100 Draft Results Workshop

The California Energy Storage Alliance (CESA) appreciates the opportunity to comment on the Draft Results Workshop held in support of the Senate Bill (SB) 100 Joint Agency Report development. CESA acknowledges the leadership of the California Energy Commission (CEC), the California Public Utilities Commission (CPUC), and the California Air Resources Board (CARB) in assembling a vast group of stakeholders to share their concerns regarding the challenges the State will face in its transition to a zero-carbon electric grid by December 31, 2045.

CESA is a 501(c)(6) organization representing 100 member companies across the energy storage industry and is involved in a number of proceedings and initiatives that energy storage is positioned to support a more reliable, cleaner, and more efficient electric grid. Our background and experience providing technical and policy insights in stakeholder processes across the CPUC, CEC, and the California Independent System Operator (CAISO) are of particular relevance to this subject. The challenges associated with the selection of an optimal path towards decarbonization are not unique to this initiative. CESA has actively participated in the Integrated Resource Planning (IRP) proceeding at the CPUC and the LA100 Initiative at the Los Angeles Department of Water and Power (LADWP), where both efforts have had to wrangle with similar complexities in planning for long-term decarbonization.

CESA is generally pleased with the clarifications and perspectives shared on the September 2, 2020 workshop. We agree with the sentiments from many stakeholders on the need to conduct iterative modeling that takes into account reliability studies and ensures that the portfolio is both clean and reliable on an 8,760-basis. In addition, broader consideration of distributed energy resources (DERs) would also inform the achievement of the SB 100 goals. Our comments focus on the following areas:

- **The Joint Agencies should adopt the interpretation of SB 100 used for the Study cases, as it most closely reflects the Legislature's intent to phase out the use of fossil fuels:** Within the Draft Results presentation, the CEC presented a series of cases. Notably, the Study cases interpret SB 100 in a manner that includes retail sales, state loads, transmission and distribution (T&D) losses, and storage losses within the coverage of zero carbon load by 2045. The Joint Agencies should adopt this interpretation for the Core cases as well in order to materialize the intent of SB 100.

- **RESOLVE must be modified to solve for long-duration storage needs:** As CESA has previously noted, RESOLVE's optimization scheme may overlook the need for multi-day dispatch of storage assets, hindering its ability to robustly select an optimal portfolio for the purposes of SB 100. Moreover, RESOLVE must be revised to include long-duration storage candidate resources beyond pumped hydro storage. Once these modifications are done, the CPUC should similarly apply the same changes to the RESOLVE model used in the IRP proceeding.

- **The Joint Agencies should clarify the optimization of energy storage operations within RESOLVE:** In the Inputs and Assumptions document, Energy + Environmental Economics (E3) notes that energy storage losses are counted towards the Renewable Portfolio Standard (RPS) targets in certain scenarios. CESA considers this approach merits a clarification on the assumptions for the optimization of energy storage assets, particularly regarding the interactions between RPS and Resource Adequacy (RA) incentives.

- **Hydrogen must be integrated as an alternative drop-in fuel within the SB 100 Joint Agency Report:** During the September 2, 2020 workshop, CEC staff mentioned hydrogen is being considered as a generation solution via the inclusion of hydrogen fuel cells as candidate resources. While CESA considers this inclusion as a valuable first step, it is necessary to fully consider the benefits and flexibility hydrogen can bring to the electric sector; namely, the CEC should model hydrogen as a drop-in fuel to replace natural gas.

- **The Joint Agencies should use the Draft Results to identify near-term, no-regrets procurement opportunities:** CESA urges the Joint Agencies to use these results to inform near-term actions that could ease the transition to a grid compliant with SB 100. This, in particular, should focus on resources that can sustainably allow the State to improve the lives of California's most vulnerable and maintain grid reliability.

The Joint Agencies should adopt the interpretation of SB 100 used for the Study cases, as it most closely reflects the Legislature's intent to phase out the use of fossil fuels

CESA appreciates the CEC's efforts to model different potential interpretations of SB 100's decarbonization intent. As it was noted in the Inputs and Assumptions Workshop, several stakeholders believe the spirit of SB 100 targets is the complete phase out of fossil fuels in California's electric sector. This intent is clearly included in SB 100 Section 2 399.11(b), which states that one of the benefits associated with increasing the share of renewable energy resources within the state is the displacement of fossil fuel consumption.[1] CESA believes this intention is fundamental to the adoption and compliance of SB 100 targets; thus, CESA supports the CEC's efforts to model more ambitious interpretations of SB 100.

[1] SB 100, Section 2, 399.11 (b), (1), available at https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180SB100

During the Draft Results Workshop, CEC staff noted that the Core SB 100 cases focus on the kWh sold at retail – *i.e.*, it excludes losses at the transmission or distribution level, as well as storage losses related to round-trip efficiency. This interpretation would allow a non-trivial fraction of generation to be supplied by carbon-emitting resources. In order to test for more constraining assumptions, the CEC included Study cases, which assume SB 100's intent covers the aforementioned losses as well, essentially increasing the ratio of kWh that must be generated from zero-carbon resources. Unsurprisingly, the Study assumptions result in more incremental capacity additions relative to the Core cases, particularly after 2035. Given the weight that the Legislature has placed on fossil fuel displacement and the fact that modeling has been performed under both assumptions, CESA believes that the State would be better served by adhering to the Study assumptions on SB 100. It is worth noting that the Study case results in substantial gas generation retirements relative to the Core case. This economic retirement is aligned with the Legislature's intent when passing SB 100. Moreover, further fossil-fueled capacity retirement could benefit ratepayers, as they would minimize the need to maintaining two parallel grids, one serving energy and the other one preserving capacity. CESA recognizes that, currently, the Draft Results do not identify cost savings under the Study case relative to the Core case; however, this could be associated to the characterization of candidate resources, particularly long-duration storage. CESA elaborates on this point in following sections. Considering the intent of SB 100, CESA urges the CEC to adopt the Study assumptions on SB 100 interpretation as the preferred assumption for other cases, including the Core case.

RESOLVE must be modified to solve for long-duration storage needs

CESA generally supports some of the modifications E3 has made to the RESOLVE model. In particular, we are pleased to see E3 has expanded the pool of candidate resources, including, for example, technologies such as hydrogen fuel cells. Generally, CESA agrees with the modeling of technologies with a focus on attributes rather than every single technology type,[2] especially in cases where publicly-available information and data is not available.

Nevertheless, CESA is still concerned with the inherent deficiencies of the RESOLVE model to identify and solve for long-duration storage (LDS) needs. As noted by James Barner from the Los Angeles Department of Water and Power (LADWP), additional modeling techniques and iterations are needed to validate the capacity expansion results to reflect physical and technical constraints (*e.g.*, power flows, 8760 reliability), as done in the LA100 Initiative. These considerations may not be captured by the current RESOLVE model. CESA completely agrees. Even if directional in nature, such validated and iterative modeling is needed to inform long-term planning and policies. Similarly, as CESA's Executive Director, Alex Morris highlighted during the September 2, 2020 Workshop, RESOLVE's architecture does not optimize build decisions based on an 8,760-hour optimization horizon. This limitation inhibits the model from identifying the

[2] *Modeling Framework and Scenarios Overview* published by the California Energy Commission for the SB 100 Joint Agency Report in Docket 19-SB-100 on August 31, 2020 at 8.

potential need for inter-day energy arbitrage, effectively overlooking the value proposition of several energy storage technologies.

Second, despite the comments of CESA and other stakeholders, the RESOLVE model has not included long-duration energy storage technologies that are commercially available and could substantially contribute to California's decarbonization efforts. Instead, RESOLVE approximates long-duration storage build by using pumped hydro storage as a proxy. This is a suboptimal arrangement. The Joint Agencies and E3 should incorporate additional candidate resources, which have unique and different cost structures and capabilities, thus enabling the model to better select a realistic and diversified capacity portfolio. This could be done by integrating technologies such as compressed air energy storage (CAES) as its own candidate resource given their publicly-available data.[3]

In cases where sufficient publicly-available data is not available, we recommend that E3 and the Joint Agencies instead characterize LDS options as "generic representative resources" that focus on the attributes that may be needed to achieve SB 100 objectives. Long-duration storage can generally be characterized as generic candidate resource options with higher capacity cost, lower energy cost, and lower roundtrip efficiency relative to battery storage. CESA has been working with Blue Marble and a wide range of the most prominent long-duration storage providers to better estimate California's LDS needs by 2045. In our study, CESA constructed two categories of generic LDS by differentiating their performance characteristics and costs per MW and per MWh, informed by leading LDS manufacturers and providers and benchmarked against some preliminary industry estimates. A similar approach could be adopted by the Joint Agencies[4], similar to what the model did for generic zero-carbon firm dispatchable and baseload resources to capture "emerging" resources.[5] CESA recommends that the Joint Agencies consider our proposed cost structure for the "general representative" LDS technology resource. As seen in Table 1, *infra*, CESA opted to represent the costs of generic LDS technologies relative to the cost assumptions used for lithium-ion batteries in the IRP proceeding (R.16-02-007, R.20-05-003) at the CPUC. This approach eases comprehension of the projected cost trends, has been vetted by leading LDS providers, and focuses on the need for certain attributes from resources. In addition, this is the approach used by CESA in the special modeling effort that Alex Morris discussed in the Resources Buildout panel at the workshop. Results of this special study will be shared at a future date.

[3] *Informal Comments of the California Energy Storage Alliance on the Draft Sources for 2019-2020 IRP Supply-Side Resources Document* submitted on April 23, 2018 to the CPUC IRP Modeling Advisory Group at 14. See link here.
[4] In fact, the Zero Carbon Firm Resources case comes close to this scenario.
[5] *Modeling Framework and Scenarios Overview* published by the California Energy Commission for the SB 100 Joint Agency Report in Docket 19-SB-100 on August 31, 2020 at 3.

Table 1. Characteristics and costs associated with generic LDS options within CESA's LDS study

	Cost multiplier (Annualized all inclusive cost)		Round Trip Efficiency	Minimum Duration
	$/MW	$/MWh		(hrs)
Lithium Ion	1.0	1.0	85%	1
Flow Battery	8.0 – 9.6	0.62 – .7	70%	1
Pumped Storage	10.1 – 12.4	0.39 – .64	81%	12
Tech Neutral: LDES Option 1	6	0.25	72%	10
Tech Neutral: LDES Option 2	7.5	0.125	64%	100

Some storage options are based on assumptions from the CPUC's IRP

Some storage options are unique to this study, and intended to be indicative of long duration energy storage solutions

The incorporation of generic LDS candidate resources is of particular importance considering the magnitude of selected battery storage assets. It is worth noting that battery energy storage is subject to an effective load carrying capability (ELCC) curve that derates the reliability contributions of these resources as a function of storage penetration and the underlying resource mix.[6] CESA has noted that, relative to other studies,[7] the ELCC curve derived by Astrape Consulting might unduly derate the capacity contributions of battery storage; nevertheless, its adoption within this modeling effort did not result in a systemic deference to pumped hydro. In this context, the inclusion of generic LDS resources would offer additional insights on the trade-offs between duration and costs given the assumption of four-hour duration in Astrape's ELCC curve.

Finally, CESA considers this modification must be done since the current method of modeling long-duration storage is accompanied with a 2026 first available year for pumped hydro. Currently, RESOLVE assumes pumped hydro availability by 2026 due to siting concerns.[8] While this assumption is appropriate for projects as site-specific and capital-intensive resources such as pumped hydro facilities, the same is not true for all LDS solutions. This issue is exacerbated by the fact the Joint Agencies have essentially agreed upon to model long-duration storage by proxy via pumped hydro. Thus, the Joint Agencies must revise the current array of candidate resources and properly represent their costs, benefits, and potential first year of adoption. Not doing so would be a disservice to this modeling exercise which seeks to shed light on which resources are essential to keep the lights on and our State clean.

[6] *See* Inputs and Assumptions Document, at 89.
[7] *See* National Renewable Energy Laboratory (NREL), "The Potential for Battery Storage to Provide Peaking Capacity in the United States", June 2019, at 20.
[8] *See* Inputs and Assumptions Document, at 41.

The Joint Agencies should clarify the optimization of energy storage operations within RESOLVE

The Draft Results show a grid heavily reliant on solar PV generation and energy storage assets that facilitate its usage. Given the prevalence of solar energy, it is safe to assume storage assets would charge from these sources in the majority of daytime hours, particularly during periods of system-wide overgeneration. This, in turn, would result in a fraction of the energy used to charge to be lost due to the losses associated with the round-trip efficiency of the storage asset. In previous versions of RESOLVE, E3 modeled these losses as curtailment, eliminating the need to account for them for Renewable Energy Credit (REC) purposes. In this iteration of the modeling, however, E3 is contemplating counting these losses towards RPS targets.[9] CESA is concerned with the lack of clarity regarding this assumption and its consequences on the expected behavior of storage resources.

First, CESA requests the Joint Agencies clarify which scenarios contemplate storage losses as counting towards RPS targets. Notably, neither the SB 100 Draft Results presentation nor the Modeling Framework and Scenarios Overview describe the application of this assumption across the different scenarios considered. This question is relevant as the usage of this assumption could create unintended consequences on the optimization of energy storage assets. This brings us to our second concern: the potential for repeated charge and discharge of energy storage assets during periods of overgeneration due to RPS-related incentives.

In the Draft Results, it is quite clear that the value proposition of energy storage is to provide support for the diurnal shift of solar energy. This, in turn, would require resources to charge during periods of solar energy abundance in order to be able to meet load during the afternoon ramp and the evening peak. As CESA understands the Inputs and Assumptions document, there will be cases where storage might be incented to deviate from this behavior due to the potential to generate RECs by charging and discharging at periods of high solar irradiance. Acknowledging the disruptive potential of this assumption, E3 sought to reduce its impact by limiting the ability of storage resources to cycle on an hourly and daily basis.[10] While this modification is beneficial, it might not be sufficient to avoid the potential consequences of seeking to co-optimize REC and RA value. This assumption could result in an inaccurate representation of the value of energy storage, as it could inadequately result in the need for additional resources destined to meet evening peak needs, including but not limited to natural gas resources. As such, CESA requests the Joint Agencies both clarify and reconsider this operational assumption.

[9] *See* Inputs and Assumptions Document at 95.
[10] *Ibid*.

Hydrogen must be integrated as an alternative drop-in fuel within the SB 100 Joint Agency Report

As mentioned previously, E3 has incorporated new candidate resources into the version of RESOLVE used by the Joint Agencies. Notably, E3 has included hydrogen fuel cells as candidate resources, a decision that begins to tap into the potential these technologies have for the acceleration of decarbonization. The inclusion of these options is welcome; nonetheless, it should be considered as an initial step. CESA echoes the suggestions of several stakeholders shared during the workshop regarding the modeling of hydrogen as a drop-in fuel. CESA believes this is can be easily achieved by E3 as it would only require the inclusion of: (1) improvement costs for existing gas generators; and (2) expected hydrogen costs as a function of electrolyzer costs and expected energy prices. The inclusion of hydrogen as a drop-in fuel is essential to visualize California's decarbonization efforts in a cross-sector context. California is uniquely positioned to economically produce hydrogen from zero-carbon sources. The climate conditions of the State, paired with the commitment to bolster the solar and wind capacity in light of SB 100, would allow for massive, cost-effective production of hydrogen via electrolysis. Given the potential to generate this fuel, it is reasonable and responsible for the State to use it in order to accelerate the displacement of fossil fuels, particularly in disadvantaged communities (DACs).

The Joint Agencies should use the Draft Results to identify near-term, no-regrets procurement opportunities

The Joint Agencies have undertaken the complex challenge of modeling a grid with an energy mix unlike any other given California's ambitious targets. These Draft Results are valuable as they give clear directional glimpses into the grid of 2045. The Draft Results show a grid mainly based on solar photovoltaic (PV) generation and energy storage. Even considering the fact that these results are directional, the order of magnitude of incremental capacity for these two resources shows a clear need for early action. In the Draft Results deck, the CEC correctly notes that the expected rate of yearly deployment to meet 2045 storage projections is about 2.2 GW per year for the High Electrification case. The maximum single year build for storage, in comparison, is 0.1 GW per year.[11] Given the gap between what has been recently achieved and what is required, CESA urges the Joint Agencies to consider these results as a starting point for a conversation on near-term, no-regrets procurement.

CESA cautions against "analysis paralysis" especially as we are reminded of the urgency to mitigate the impacts of climate change due to the wildfires raging across the State. These conditions remind us that climate change will continue to provoke more common and prolonged periods of exceptional weather. This is even more clear considering the events of August 14, 2020, where an unusually prolonged and regional heat wave was met by supply capacity shortfalls. These conditions are unlikely to be perfectly represented within a model and show the delicate balance that California could require to maintain during the transition to a decarbonized energy

[11] See CEC, SB 100 Draft Results, at 23.

mix. California needs more clean and reliable incremental procurement to address the supply capacity need while advancing the state's decarbonization goals.

In light of the massive deployment challenge ahead, climate change, and the potential for disruptive weather events, the Joint Agencies must use the Draft Results as a starting point for near-term action. As it was mentioned by Delphine Hou from the California Independent System Operator (CAISO), the Joint Agency Report process is planned to be conducted on a four-year basis. As such, by the time the next Report is considered, resources modeled for 2026 deploy must already be in construction due to the resource interconnection and transmission upgrade study/construction process, which typically require three- to six-year lead times. In order to mitigate the risks associated with this timeline, CESA recommends the Joint Agencies work together to identify resources that can ease the integration of renewable generation and maintain grid reliability without increasing greenhouse gas (GHG) emissions. This must be done in a manner that: (1) prioritizes the testing and commercialization of technologies that can provide zero carbon, dispatchable energy; and (2) benefits the Californians more susceptible to adverse climate effects and local air pollution. The CEC and CARB are well equipped to address those key elements, respectively. With regards to the magnitude or scale of these no-regret procurements, CESA considers the CPUC is reasonably positioned to compare these results to those of its own IRP process and identify a feasible amount.

At a higher level, the Joint Agencies should also consider strategic roadmaps to provide the platforms and tools to enable the record-setting resource buildouts required to meet the SB 100 goals. For example, transmission buildout roadmaps and "pre-planned zones" (similar to Competitive Renewable Energy Zones in Texas) could facilitate advanced infrastructure build to enable timely resource interconnections. Similarly, policies are needed to advance the development of the millions of DERs that can provide incremental and dispatchable supply via load shifting and/or export capacity. Market transformation programs may be needed to advance the innovation and emerging technologies that were cited as being needed to provide dispatchable clean capacity. In sum, an all-hands-on-deck approach and roadmap is needed, which is something that the Joint Agencies are best positioned to address as a coordinated effort while each agency's initiatives and proceedings address some of the narrower details.

Conclusion

CESA appreciates the opportunity to provide these comments and feedback on the Joint Agency Report's Draft Results Workshop. We look forward to collaborating with the CEC, CPUC, CARB, and other stakeholders in this proceeding.

Sincerely,

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