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CESAâ€™s Revised Comments on Non-Lithium-Ion LDES Value & Program Design

With edit made on page 17

Additional submitted attachment is included below.

April 26, 2022

Email to: docket@energy.ca.gov
Docket Number: 19-ERDD-01
Subject: CESA's Revised Comments on Non-Lithium-Ion LDES Value & Program Design

Re: Revised Comments of the California Energy Storage Alliance on Workshop on Advancing Non-Lithium-Ion Long Duration Energy Storage Technologies

Dear Sir or Madam:

The California Energy Storage Alliance ("CESA") welcomed the opportunity to present on at the workshop on April 5, 2022 on advancing non-lithium-ion long-duration energy storage ("LDES") technologies and to speak to the importance, urgency, and need of doing so. As presented at the workshop, CESA underscores that non-lithium-ion LDES technologies, companies, and developers are ready to help California meet its reliability objectives and decarbonization goals and become a greater part of the energy storage portfolio. To this end, CESA strongly supports the Governor's proposed 2022-2023 Budget allocating $380 million to the CEC to advance non-lithium-ion LDES technologies and projects. We therefore appreciate the opportunity to comment on the California Energy Commission ("CEC") workshop on August 4, 2021 and look forward to collaborating with the CEC on potential program design to shape it for success.

CESA is a 501(c)(6) organization representing over 100 member companies across the energy storage industry. CESA member companies span the energy storage ecosystem, involving many technology types, sectors, configurations, and services offered. As the definitive voice of energy storage in California, CESA is involved in a number of proceedings and initiatives in which energy storage is positioned to support a more reliable, cleaner, and more efficient electric grid. Importantly, CESA represents a significant cross-section of the companies developing and commercializing various LDES technologies today, such that we are uniquely positioned to speak to the need, capabilities, and readiness of a wide range of LDES technologies and projects. As such, we hope to be a conduit for the CEC Commissioners and staff, along with the other energy agencies, regarding any future conversations or questions about the proposed budget, potential program, or LDES issues at large.

I. INTRODUCTION & SUMMARY.

The CEC held a workshop on April 5, 2022 to review activities, experiences, and lessons learned from the Electric Program Investment Charge ("EPIC") Program, discuss the need and potential benefits of the Governor's proposed 2022-2023 Budget Proposal for $380 million in LDES project funding, and examine opportunities to leverage federal infrastructure funding, such as those from the Infrastructure, Investment & Jobs Act ("IIJA") of 2021. In addition, LDES industry

association representatives (*e.g.*, CESA) and LDES technology providers were invited to discuss the values and abilities of non-lithium-ion LDES technologies to meet California's projected needs and how the state can help accelerate the commercialization status of these technology solutions.

Similar to how the CEC sometimes hosts "pre-EPIC concept" workshops prior to an official Grant Funding Opportunity ("GFO"), this workshop served a similar purpose in seeking Commissioner questions and stakeholder input on how best to position and design a potential $380-million program, referred to herein as the LDES Commercialization Program. Such input and discussion play an important role in ensuring that the program is designed in a way to support the state's policy objectives. To this end, in these comments, CESA offers our perspective and recommendations on various questions about the program:

- The need and value of LDES resources are clear:
    - LDES resources have been identified in 2030 and 2045 system capacity portfolios, which is the minimum baseline of what is needed but is likely underestimating the amount of LDES needed to advance decarbonization and support reliability at least cost.
    - LDES resources are likely needed to support local contingencies and offset or replace local fossil-fueled generation capacity.
    - LDES resources are well-positioned to support infrastructure deferral and grid resiliency applications.
    - The greater energy reservoir of LDES resources can reduce real-time market optimization risks.
    - LDES resources present opportunities to diversify supply chain and project execution risks.
- Some LDES technologies and companies are ready for commercial projects and are primed to focus on the California market:
    - Significant amounts of private investment being directed toward LDES companies are some signals that the market is ready.
    - Anecdotal evidence points to how some LDES projects are positioning themselves to support commercial operations.
    - LDES providers are starting to show up in resource solicitations.
- Putting aside policy, modeling, or valuation barriers, there are two main commercialization barriers that can be addressed by the LDES Commercialization Program:

- The process and participation requirements of resource solicitations pose barriers to LDES technologies.

- Developers, insurers, and financiers seek an operational track record and/or require significant amount of due diligence.

- Program design considerations:

  - The purpose and focus of the LDES Commercialization Program should be to support first-of-its-kind commercial projects in a technology-neutral way, either in-front-of-the-meter ("IFOM") or behind-the-meter ("BTM"), that can meet real grid obligations and/or needs.

  - The eligibility criteria should be designed to align with the core purpose of the program yet reasonably cast a wide net.

  - Some key scoring criteria should be applied on a qualitative basis to identify "best-fit" technologies and projects to meet proposed program objectives.

  - Approaches to evaluating and awarding projects should reasonably balance administrative efficiency with timely supporting a handful of first-of-its-kind commercial projects.

  - To support immediately ready projects and afford some limited window of opportunity for LDES providers to prepare projects and applications, a two-tranche approach should be adopted.

  - Unless the CEC is able to be allocated federal funds in advance, federal co-funding should be encouraged but not required to participate in the LDES Commercialization Program.

  - Program contract terms and conditions should be discussed, and if EPIC is used as a template or starting point, potential modifications should be considered.

- Policies, regulations, and market designs must continue to be developed to accommodate and value LDES resources:

  - Continued improvement to Integrated Resource Planning ("IRP") models is needed to more accurately identify the least-cost portfolio and appropriately value LDES technologies and attributes in meeting decarbonization goals and reliability needs.

  - Reforms to Resource Adequacy ("RA") counting rules are needed to incrementally value LDES resources.

- Energy storage market participation models and products may need to evolve to accommodate and value different LDES technologies and projects.

II. NEED AND VALUE OF LDES.

As an asset class, energy storage presents multiple opportunities to cost-effectively and reliably meet the state's decarbonization goals and various grid needs. Energy storage resources of many types are flexible assets that support the integration of renewables and optimize/strengthen the use of transmission and distribution ("T&D") infrastructure. These needs and values have been evident in the significant growth of energy storage procurement and deployment to date, with close to 10,000 MW procured to meet various needs or obligations through the mid-2020s and just over 3,000 MW in operation today.

To date, four-hour lithium-ion battery energy storage systems ("BESS") have constituted the vast majority of this new installed capacity, but the need for LDES is also clear. As discussed further below, there is robust evidence that LDES technologies are needed for various use cases, can serve as a complement to the existing portfolio of shorter-duration BESS, and provide unique attributes or overall portfolio cost savings. In light of today's supply chain crunch, LDES resources also represent an opportunity to rely on different supply chains and advance a risk diversification strategy.

Overall, as an organization, CESA is technology and business model neutral, but we generally hold the position that a portfolio of energy storage technologies is better than deploying only one. The degree to which the energy storage portfolio is balanced between lithium-ion technologies versus non-lithium-ion technologies should be guided by CEC and CPUC assessment of evolving grid needs and consideration of execution strategy, as well as accurate models that balance granularity (*e.g.*, 8,760-hour dispatch, technology-specific capabilities and costs), practicality, and accurately identifying least-cost, best-fit portfolios. Regardless of how we right-size the appropriate amount of LDES, the need and value of LDES resources are clear, minimally to meet MTR and other key grid obligations, but likely more.

1. LDES resources have been identified in 2030 and 2045 system capacity portfolios, which is the minimum baseline of what is needed but is likely underestimating the amount of LDES needed to advance decarbonization and support reliability at least cost.

The study results and reports from the California Public Utility Commission ("CPUC") IRP and the Joint Agency Senate Bill ("SB") 100 processes have highlighted the significant and unprecedented buildout of clean generation and energy storage resources needed through 2045 to achieve our decarbonization goals, including 1 GW of LDES by 2030 and 4 GW of LDES by 2045. As James McGarry, Senior Analyst in the CPUC Energy Division, noted at the April 5, 2022 workshop, LDES resources can support longer and flatter net load peak needs and provide energy for multi-day durations. Given the retirement of

fossil-fueled generation and significant building and transportation electrification expected over the next decade, LDES need will only continue to grow.

While the SB 100 study is more directional in nature, the CPUC issued Decision ("D.") 21-06-035 – often referred to as the Mid-Term Reliability ("MTR") Procurement Order – that included a minimum of 1,000 MW of LDES by 2026, informed by its IRP capacity expansion modeling and spurred by findings that the system needs firm and/or dispatchable energy when the grid needs it the most (*e.g.*, impending loss of nuclear capacity, retirement of once-through-cooling thermal plants).[1] Given the long lead-time nature of these resources, the CPUC allowed load-serving entities ("LSEs") to bring these resources online by 2028 if good-faith efforts are otherwise demonstrated.[2] All in all, even though linkages between modeling results and procurement orders could be greatly improved, the CPUC minimally recognized the value of some resource diversification and greater duration from energy storage resources to support the evolving resource mix and meet decarbonization goals. To CESA's knowledge, no other state has directed procurement specifically for LDES resources – a milestone that should be celebrated for sending a market signal to focus the LDES market in California, but also one that clearly underscores the system need for LDES that could be supported by the LDES Commercialization Program.

Building on the rough framework of the CPUC IRP models, CESA also commissioned our own study that dug deeper into how the resource portfolio may change if we used refined inputs and assumptions that reflect different representative LDES characteristics around capital costs, roundtrip efficiency, and minimum duration rather than just using pumped storage as a proxy for all LDES. Ultimately, CESA found that 45-55 GW of LDES will be required to support California's grid by 2045 and 2-11 GW will be required by 2030.[3] When the need is mapped out over time, the linear annualized amount of GWh of energy storage need is staggering to achieve our 2045 goals, leading to the conclusion that it is smart and rational to begin least-regrets procurement now. Since duration needs grow over time,[4] CESA also believes that it is smart to begin assessing and potentially procuring resources that exceed the minimum duration requirements for LDES resources – *e.g.*, those with durations at 12 hours, across multiple days, or even across seasons. Given our complementary study, CESA emphasizes how the LDES Commercialization Program can minimally position the state to meet MTR obligations but also serve as a launching pad for LDES needs that will only grow over time and LDES attributes that will only evolve as the state moves to greater levels of renewable penetration and electric sector decarbonization.

[1] D.21-06-035 at 35 and Ordering Paragraph ("OP") 2.
[2] *Ibid* at 36 and Conclusion of Law ("COL") 8.
[3] *Long-Duration Energy Storage for California's Clean, Reliable Grid* ("CESA LDES Report") prepared by Strategen Consulting for the California Energy Storage Alliance on December 8, 2020. Access the report here.
[4] CESA LDES Report at 52-54.

2. LDES resources are likely needed to support local contingencies and offset or replace local fossil-fueled generation capacity.

Over the years, the California Independent System Operator ("CAISO") published annual Local Capacity Technical Studies ("LCTS") that have been identifying charging energy requirements, the energy storage duration requirements to replace existing local generation, and the maximum MW quantity of four-hour 1-for-1 replacement.[5] Clearly, due to transmission constraints under contingency events, these results show that the path to retire existing gas generation facilities, many of which are located in disadvantaged communities ("DACs"), will require either firm clean generation capacity resources or LDES resources. The LDES Commercialization Program could advance the technologies likely necessary to support these goals in local capacity areas.

3. LDES resources are well-positioned to support infrastructure deferral and grid resiliency applications.

As part of ongoing planning processes and procurement frameworks for distribution grid needs, the investor-owned utilities ("IOUs") have consistently highlighted the challenges of meeting longer-duration deferral and resiliency needs, which range anywhere from 2-24 hours of distribution capacity in the former and are defined as 24-96 hours of islanding and resiliency in the latter given typical customer needs and/or PSPS outage duration.[6] For the longer-duration service needs, notwithstanding some of the process-related barriers to distributed energy resource ("DER") solutions (*e.g.*, lead times, siting concerns, changing grid needs or cost caps), the IOUs have struggled to solicit and procure clean generation and storage solutions to meet these needs given the lack of commercial availability of DER alternatives to traditional infrastructure solutions (distribution deferral) or diesel generators (resiliency). LDES resources are well-positioned to support these applications if supported through a program such as the one proposed for the CEC.

4. The greater energy reservoir of LDES resources can reduce real-time market optimization risks.

As energy storage penetration has increased, particularly with four-hour duration systems, the CAISO has recently highlighted the perceived risks of ensuring sufficient state of charge to deliver RA reliability benefits during certain stressed periods, especially given

[5] *See, e.g.,* 2021 Final Local Capacity Technical Study at 27-29. https://www.caiso.com/Documents/May1-2020-Final-2021-LocalCapacityTechnicalStudyReport-R19-11-009.pdf

[6] *See, e.g.,* IOU Grid Needs Assessment ("GNA") and Distribution Deferral Opportunity Report ("DDOR") filed annually in R.14-08-013 and R.21-06-017, as well as PG&E 2019 DGEMS RFO or PG&E 2021 Clean Substation Pilot RFO.

the limited time horizon of the real-time market.[7] In some part, this is due to the energy limitations of the existing storage fleet in market operation today. However, these perceived risks are likely less for LDES resources with greater energy reservoirs, which are more likely to avoid depletion ahead of critical summer net peak load events as a result of sub-optimal real-time market dispatches. While the measures adopted to address these risks in the interim are sub-optimal and the subject of revisions in the ongoing Energy Storage Enhancements ("ESE") Initiative, another way to defray these concerns is through the procurement and operations of energy storage resources with greater duration, for which out-of-market actions will likely be less prevalent. The LDES Commercialization Program can support the development of a broader energy storage portfolio with reduced operational risks or concerns.

5. LDES resources present opportunities to diversify supply chain and project execution risks.

As evidenced by the current commodity price spikes, tariffs, and other supply chain constraints (*e.g.*, shipping costs, labor availability),[8] LDES technologies present opportunities to diversify supply chain and project execution risks. Rather than "putting all our eggs in one basket" in solar and lithium-ion BESS in meeting the state's decarbonization goals and reliability needs, reasonable levels of diversification away from a small subset of supply chains will mitigate risk factors in project execution and in supporting near- and mid-term reliability, where energy storage places a pivotal role. A singular focus on a narrow supply chain to meet the significant build rate projected through 2045 is risky, where LDES resources can help reduce the pressure not only in the short term but also in the longer term as electric vehicle ("EV") and stationary storage markets compete for the same lithium-ion batteries and other materials and commodities. With stationary energy storage becoming a global marketplace, it will also be increasingly competitive for California to reserve and direct manufacturing capacity and lithium-ion BESS to serve its grid needs.[9] At the end of the day, the LDES Commercialization Program will play a critical role in positioning LDES technologies to be manufacturing-ready to the scale that is needed beyond 2030 as well. To reach such large scales, a track record of procurement and operational performance is needed prior to 2030.

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[7] *Tariff Amendment to Implement the Resource Adequacy Enhancements Phase 1 Initiative – Summer 2021 Provisions* filed by CAISO in Docket No. ER21-1551 on March 29, 2021 at 13. https://www.caiso.com/Documents/Mar29-2021-Tariff-Amendment-ResourceAdequacyRAEnhancements-ER21-1551.pdf

[8] *See, e.g.*, Balaraman, Kavya. "Supply-chain squeeze: Solar, storage industries grapple with delays, price spikes as demand continues to grow," published on March 31, 2022 in Utility Dive. https://www.utilitydive.com/news/solar-storage-delays-price-supply-chain/620537/

[9] *See, e.g.*, Ribeiro, Henrique and Melanie Yuen. "Infographic: Insufficient lithium supply could decelerate energy transition," published on January 26, 2022 by S&P Global. https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/metals/012622-infographic-the-lithium-deficit-road-map-will-future-supply-meet-demand

III. READINESS OF LDES TECHNOLOGIES AND COMPANIES.

The LDES market is represented by a wide range of technologies and companies at different levels of maturity, but within this energy storage asset sub-class, CESA wishes to bring to the CEC's attention how there are some technologies, companies, and projects that are ready for commercialization and for deployment to meet real grid obligations, if not for some of the "valley of death" challenges discussed further in the next section. In CESA's view, California is the leading LDES market in the nation and world because of the advanced penetration and familiarity with energy storage as an asset class and progressing efforts to model LDES resources in grid planning. By comparison, a number of other states are in the early stages of renewable and energy storage penetration, as evidenced by the setting of state procurement targets;[10] in many of these cases, CESA anticipates that commissions and utilities in these states will first target, on the most part, the "low-hanging fruit" in displacing peaker capacity and starting with shorter-duration lithium-ion BESS procurement and deployment.

Critically, California stands apart in setting an explicit procurement signal for 1,000 MW of LDES resources by 2026, which is critically important to focus the industry on the California market. With energy storage being a global marketplace, there are opportunity costs associated with participating in solicitations in the form of time and resources to prepare bids, navigate the interconnection process, and conduct related project development activities, which can be in short supply for LDES companies seeking to develop a first-of-its-kind commercial project.

In this context, CESA believes that the supply and demand conditions for LDES technologies and projects are ripe for the LDES Commercialization Program to begin to tip the LDES industry over the edge into the commercial space. As elaborated below, there are a number of indicators that the LDES industry is ready for a catalyzing program like the LDES Commercialization Program. Taking together the fact that LDES is needed and valued, California is positioned once again to lead the nation and world on building the energy storage toolkit for a deep decarbonization future.

1. Significant amounts of private investment being directed toward LDES companies are some signals that the market is ready.

LDES companies and projects are seeing significant amounts of private investment being directed toward LDES companies. According to McKinsey and other sources, cumulative global deals (*e.g.*, venture capital, corporate/debt investment, private equity) reached 183, amounting to over $2.6 billion.[11] In looking at a select range of LDES

[10] California has already achieved its Assembly Bill ("AB") 2514 procurement targets for 1,325 MW of energy storage by 2030. To illustrate California's leadership, California LSEs procured over 4,000 MW of incremental energy storage in the 2020-2022 timeframe, thus procuring many folds the original target amount over the past two years. *See, e.g.*, Burwen, Jason. "Energy Storage Goals, Targets, Mandates: What's the Difference?" published on April 24, 2020 in The ESA Blog. https://energystorage.org/energy-storage-goals-targets-and-mandates-whats-the-difference/

[11] Golden, Sarah. "Big money flows into long-duration energy storage," published in GreenBiz on September 17, 2021: https://www.greenbiz.com/article/big-money-flows-long-duration-energy-storage; *Net-zero power: Long duration*

companies, some of them have also attracted mature and institutional investors, who are more conservative in nature and focused on revenue-generating fundamentals as compared to venture capital investors. While far from a perfect proxy for technology or commercial viability, companies that have attracted significant private capital have demonstrated some technology viability or potential, coupled with a rising recognition of their need, suggesting that some of these companies are ready for the next step to tip over into full-scale commercialization.

2. Anecdotal evidence points to how some LDES projects are already in the interconnection queue and are positioning themselves to support commercial operations.

While not all projects in the interconnection queue materialize to sign generator interconnection agreements ("GIAs"), secure off-take contracts, and come online, the queue represents a reasonable proxy for some level of readiness of projects, a fraction of which will actually come online. Unfortunately, the current CAISO interconnection queue data does not present the type of energy storage technology or the MWh behind interconnection applications as a sign of things to come. However, despite the lack of this type of information, CESA is aware of many of our members with projects in the interconnection queue, positioning themselves to meet the MTR and bring projects online over the next several years. In other words, a commercial pipeline is building, though it is unclear the magnitude of which could be on the horizon.

Yet, even if the quantity of LDES projects is not significant at this time, there are opportunities for LDES technologies to be included in developers' standalone and hybrid energy storage projects, especially as supply chain constraints make it difficult or more expensive to secure lithium-ion BESS in line with their original project development plans. A technology change through the material modification assessment ("MMA") process could be pursued to substitute and switch underlying storage technology type, such that the LDES technologies could enter a more favorable queue position to support near- and mid-term needs. Furthermore, there may also be opportunities for LDES resources to repower existing thermal generating facilities in some part or be added as a retrofit to an existing solar facility. With the LDES Commercialization Program in place, developers may begin to identify LDES technologies to include in their projects, including those that are already in the queue.

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energy storage for a renewable grid published in November 2021 by the LDES Council in collaboration with McKinsey & Company at 12: https://www.mckinsey.com/~/media/mckinsey/business%20functions/sustainability/our%20insights/net%20zero%20power%20long%20duration%20energy%20storage%20for%20a%20renewable%20grid/net-zero-power-long-duration-energy-storage-for-a-renewable-grid.pdf

3. LDES providers are starting to show up in resource solicitations.

Combined with the MTR Procurement Order for LDES resources, California LSEs and utilities are starting to see bids, offers, and proposals that involve LDES technologies. Most notably, California Community Power ("CC Power"), a joint power authority of a handful of community choice aggregators ("CCAs"), launched a landmark 2020 Long-Duration Storage ("LDS") Request for Offers ("RFO") that was reported to have solicited 9,000 MW of LDES resources across over 200 unique offers, representing close to 20 distinct technologies. Though two 8-hour lithium-ion BESS projects were ultimately selected and procured, CC Power reports that they are in conversations with an emerging LDES technology. Similarly, as part of the annual Southern California Public Power Authority ("SCPPA") Request for Proposals ("RFP"), Los Angeles Department of Water and Power ("LADWP") is specifically looking to procure standalone energy storage resources that can meet their unique in-basin generation needs, where solicitation requirements have been customized to highlight the need for LDES resources.[12] Several LDES projects have been in contention in the past, and LADWP has re-issued their procurement guidance in the 2022 SCPPA RFP to take a second crack at trying to procure LDES resources. Finally, Central Coast Community Energy ("3CE") achieved a major milestone in procuring and executing a contract with over 30 MW of energy storage projects utilizing vanadium redox flow battery[13] – the only commercial procurement of a non-lithium-ion LDES technology and project in California.

The stories and experiences from these solicitations highlight some of the increased interest and participation in resource solicitations, but it also underscores the key challenges that the proposed LDES Commercialization Program budget could support. Each time, the LDES market appeared on the cusp of a wave of procurement and projects involving non-lithium-ion LDES technologies, but for various reasons, only the 3CE projects emerged. Other LSEs, to CESA's knowledge, did not report much LDES offers, bids, or proposals, which may be attributed to the focus of LDES providers on a handful of solicitations given their limited time and resources to pursue multiple opportunities. Altogether, CESA believes that these experiences underscore how LDES technologies and projects are close to ready for commercial opportunities but need support from the LDES Commercialization Program to bridge the valley of death and achieve commercialization.

IV. COMMERCIALIZATION CHALLENGES AND BARRIERS.

The LDES Commercialization Program, if approved, would support several known challenges and barriers to bridging the valley of death to commercialization. Putting some of the

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[12] *See* Appendix B for LADWP BESS Requirements in 2022 SCPPA Standalone Energy Storage RFP: http://scppa.org/page/RFPs-ResourceProject

[13] Colthorpe, Andy. "226MWh of vanadium flow batteries on the way for California community energy group CCCE," published in *Energy Storage News* on November 25, 2021. https://www.energy-storage.news/226mwh-of-vanadium-flow-batteries-on-the-way-for-california-community-energy-group-ccce/

policy, modeling, valuation, and market design barriers aside (see last section for further detail), LDES providers face two main barriers to competing in commercial resource solicitations and opportunities, even as pilots and demonstrations have been conducted for the specific LDES technology.

1. The process and participation requirements of resource solicitations pose barriers to LDES technologies.

CESA has observed that RFOs and RFPs for new incremental capacity presents inherent barriers and challenges that make it difficult, if not impossible, for new LDES providers to participate and make available their technologies and/or projects. Some of these barriers include the following:

- **Experience requirements:** LSE solicitations typically require commercial experience with any given technology, presenting a chicken-or-egg problem for LDES providers that cannot gain such experience if ineligible for any commercial opportunity. Compared to history, this requirement appears to have relaxed over time in some LSE solicitations, with the experience requirement being evaluated on the development team instead (*e.g.*, an individual or team of respondents on the development team with experience in developing projects of similar size or technology).

- **Response windows:** As renewable and energy storage procurement becomes routine, LSE solicitations have progressively shortened the window of time between RFO/RFP announcement and launch to submission deadline, typically ranging between 1-2 months. This short window of time may be suitable for familiar and conventional solar and lithium-ion BESS developers and providers, but it presents significant challenges for LDES providers to secure financing and/or insurance and to prepare bids in time.

- **Minimum project sizes:** As resource buildout needs grow and solicitations are needed on a more frequent basis, LSEs have increasingly imposed higher minimum project sizes for any bids, offers, or proposals as compared to past solicitations. Whereas past solicitations may have set 1 MW as the minimum project size requirement to qualify for participation, recent solicitations have increased these minimums to 10 MW in some cases.[14] CESA believes that these minimums have been set to limit the quantity of offers submitted and shortlisted offers for further contract negotiation in order to make it manageable for LSE procurement teams, and likely in some parts, to pursue projects with higher economies of scale and thus lower costs. However, for LDES providers, this presents a higher bar to entry. Put in the context of how

[14] *See, e.g.,* PG&E MTR RFO Phase 1 Protocol at 8. https://www.pge.com/pge_global/common/pdfs/for-our-business-partners/energy-supply/electric-rfo/wholesale-electric-power-procurement/Mid%20Term%20RFO%20-%20Phase%201/Mid-Term%20Reliability%20RFO%20Protocol_Phase%201_8-17Update.pdf

pilots and demonstrations typically range between 50 kW and 1 MW, LDES providers will be challenged to scale up in such a significant way in commercializing their technologies.

- **Contract length terms:** Despite the CPUC requiring or encouraging long-term contracts to support new resource build (*e.g.*, minimum 10-year contract terms), LSE solicitations will typically cap contract term lengths at 20 years, even though some LDES resources may be able to operate for 30 to 40+ years. The long-lived nature of LDES resources as an advantage therefore becomes moot in actual resource solicitations and makes LDES projects unfinanceable with the latter years being uncontracted. With augmentation and replacement assumptions being challenged in light of recent supply chain constraints and potential long-term competition for lithium-ion BESS supply, it may be prudent to reconsider these requirements.

It should be noted that many of the above challenges are more prevalent in all-source solicitations as compared to LDES-specific solicitations or procurements tied to specific grid-service requirements.[15] The LDES Commercialization Program would nonetheless overcome some of the above solicitation-related barriers, or alternatively, may spur LSEs to take action to modify or customize a solicitation or pursue bilateral negotiations to be able to leverage available funds for LDES projects.

2. Developers, insurers, and financiers seek an operational track record and/or require significant amount of due diligence.

An operational track record is needed to attract mature and institutional insurance and finance to help scale emerging and pre-commercial LDES technologies. Attracting such capital requires projects to have 1-2 years of operational data to give confidence in the viability, performance, and reliability of the LDES technology. Often times, this operational data is needed for projects at a larger scale (*e.g.*, 20 MW), such that pilot-scale projects in the 1-3 MW range may still be insufficient. Alternatively, CESA has observed that certain LSEs, developers, financiers, or insurance providers have conducted their own due diligence to support the scaling of a particular LDES technology, but such due diligence require significant amount of time and resources, which can be challenging to justify when there are opportunity costs to pursue a global energy storage market opportunity using lithium-ion BESS technologies. While this assumption is being reconsidered in light of the current supply chain constraints, the time and resource burden remains where this alternative path is likely the exception than an emerging norm. Overall, to get LDES projects to be investment grade and prime for supporting significant long-term needs beyond 2030, the

[15] *See, e.g.*, Appendix A of the 2022 SCPPA Standalone Energy Storage RFP that defines specific requirements or parameters with LDES resources in consideration, such as energy-land density requirements, lower monthly availability guarantees (99% for lithium-ion BESS versus 90% for all other storage technologies)

LDES Commercialization Program is needed today for projects that can come online by 2028 or earlier.

V. PROGRAM DESIGN CONSIDERATIONS.

To facilitate development of potential program design and "hit the ground running" if and as soon as the Governor's proposed budget is approved and allocated to the CEC, CESA offers our preliminary recommendations on program goals, scope, criteria, and design. Again, we reiterate our appreciation of the CEC's holding of the April 5, 2022 workshop in the first place, which is a smart strategy to minimize the time gap from funds being approved by the Legislature and the funds being made available to the CEC to disperse across eligible LDES projects. In doing so, LDES projects can be more immediately supported to address real grid obligations that have been identified to be needed in the mid-term timeframe (2026-2028).

Further work is likely needed on these recommendations to fine-tune the program details, but we hope that these preliminary recommendations represent a starting point for further discussion and collaboration. To be able to iterate, refine, and finalize these program details, CESA requests that the CEC hold at least one additional workshop to share and discuss program proposals from CESA and/or from CEC staff and other stakeholders.

1. The purpose and focus of the LDES Commercialization Program should be to support first-of-its-kind commercial projects in a technology-neutral way, either in IFOM or BTM, that can meet real grid obligations and/or needs.

The LDES Commercialization Program should focus on technologies that are at their "tipping point" and projects that are on the "verge of commercialization" knowing that the CEC already has the EPIC Program that supports pilots and demonstration projects. Combined with federally-available grants to universities and private entities to support research, development, and demonstration ("RD&D") activities, CESA believes that there is already sufficient funding to support early-stage startups and *technology-focused* proof-of-concept projects, such that this new proposed program should not duplicate funding for these purposes.

There are a number of LDES technologies that have already participated in pilots or demonstrations and are now seeking to bridge the "valley of death" from pre-commercial technology into the commercial space. As discussed further in the previous section, many of these pre-commercial technologies struggle to compete in all-source solicitations for commercial opportunities for a variety of reasons, where the LDES Commercialization Program could play an important role in providing grants that attract project partners (*e.g.*, financing, insurance) and ease the first-mover burden to procure non-lithium LDES technologies.

To this end, CESA recommends that the purpose of the LDES Commercialization Program be to support first-of-its-kind commercial, non-pilot projects. Having a *project-*

focused proof of concept to support not only commercial scale but also actually meet near- and mid-term LSE obligations for IRP, RA, and microgrid resiliency and/or to integrate in the CAISO market would go a long way to bankability of the project for future opportunities, creating this positive snowball effect for these technologies to be well-positioned in the long-term, fostering supply chain and technology diversity, and overcoming experience requirements. If well designed, the funds made available in the LDES Commercialization Program could facilitate the achievement of scale for projects to be cost-competitive in commercial solicitations.

Currently, there is a gap in California, let alone nationwide, for a program like the LDES Commercialization Program. While the CEC has recurring GFOs such as the Bringing Rapid Innovation Development to Green Energy ("BRIDGE") and Realizing Accelerated Manufacturing and Production ("RAMP") to bridge some of these funding gaps and support manufacturing and deployment scaling, those GFOs are more limited in scale (*e.g.*, only up to $10 million for Group 2 Energy Storage as a whole) and in applicants (*e.g.*, projects must have previously received a funding award from the CEC or an eligible federal agency).[16] Given the scale of LDES capacity needed and the level of funding to achieve that total need and to make a difference for any given LDES technology or project, the LDES Commercialization Program stands apart as a means to make a meaningful impact in catalyzing the LDES market to widespread commercial deployment.

If "first-of-its-kind" requires some definition, CESA recommends one that is flexible, but if tied to real grid obligations or needs, a prescriptive definition is not needed. By having a path to interconnection and/or deliverability, for example, eligible LDES projects would be positioning itself for a commercial opportunity, with program funds serving as a "tipping point" to a commercial off-take agreement if not yet already secured at the time of application. In other words, whereas a pilot or demonstration that primarily serves a learning objective by running inconsequential field tests, projects supported in the LDES Commercialization Program would be positioned to be subject to real market/contract obligations (*e.g.*, performance, availability, LSE compliance). Despite everything said about MTR procurement needs, CESA does not recommend that these first-of-its-kind commercial applications be limited to IRP/RA needs but also be expansively considered for other use cases, such as Public Safety Power Shutoff ("PSPS") or other outage-related resiliency and T&D deferral use cases – each of which have high performance standards and reliability purposes. If LDES projects are able to be deployed and positioned to support these use cases, it would serve the same effect in proving the bankability of the underlying LDES technologies.

At the same time, CESA supports alignment and consistency of the LDES Commercialization Program with the overarching goals and guiding principles of EPIC, as

[16] https://www.energy.ca.gov/solicitations/2020-07/gfo-20-301-bringing-rapid-innovation-development-green-energy-bridge-2020

established in D.12-05-037 and affirmed in D.21-11-028,[17] which aim to promote greater reliability, increase safety, maximize benefits, advance clean energy technologies and approaches, and overcome barriers to achieving the state's clean energy goals. A greater focus in EPIC has also been placed on ensuring equitable adoption of clean energy technologies. These are worthwhile, laudable, and consistent principles that should be incorporated in the LDES Commercialization Program, except in contrast to EPIC, the types of projects supported should be for commercial opportunities and real grid needs, and the funding approach and model, as discussed further below, should be modified to achieve administrative efficiencies and support ready projects given the objectives of the program.[18]

Importantly, in addition to our recommendation to focus on first-of-its-kind commercial projects, CESA understands that the CEC is intent on encumbering funds in a short period of time (*e.g.*, three years). Given this consideration, as well as the near- and mid-term nature of various grid needs (*e.g.*, MTR, PSPS resiliency), CESA believes that the program should be designed with administrative efficiency and project readiness in mind. A balance should be struck around supporting the best-fit projects and having quality control versus efficiently dispersing funds to get LDES projects online and delivering on real needs and commercial opportunities.

Furthermore, CESA understands that the CEC may be bound to give grants to projects that have either received California Environmental Quality Act ("CEQA") permitting approval or that qualify for CEQA exemptions,[19] which may limit the scope of eligible projects mostly to very advanced projects, BTM or smaller projects, energy retrofits to existing facilities, and/or utility-owned storage ("UOS") projects sited on existing facilities and land. CESA is still in the process of more deeply understanding this issue, but we have concerns that this requirement may constrain the eligibility or viability of a number of LDES projects. Even if an applicant was to dutifully proceed through CEQA review, CESA fears that the timelines to approval may be protracted due to the volume of overall energy storage permit applications (*i.e.*, almost entirely from lithium-ion BESS) and since agency officials and local stakeholders would be reviewing LDES technologies and projects for the first time. On the latter point, even if certain LDES technologies and projects may achieve permitting efficiencies in the long term given certain advantages (*e.g.*, no thermal

[17] Appendix A of *Decision Approving the Utilities as Electric Program Investment Charge Administrators with Additional Administrative Requirements*, D.21-11-028 issued on November 22, 2021. https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M425/K515/425515575.PDF

[18] With the above in mind, CESA recognizes the important role of EPIC, which has a decade-long history of funding energy storage R&D, with a focus on LDES in recent years. As Mike Gravely, CEC EPIC Team Lead and Supervisor, shared at the April 5, 2022 workshop, for example, recent EPIC solicitations have prioritized LDES pilots and demonstrations to improve grid resiliency and reliability in under-resourced communities, such as in mitigating outages of 24-36 hours, and to advance the technology readiness of seasonal energy storage solutions, such as in field demonstrations of energy storage technologies with 20- to 100-hour duration and green hydrogen storage technologies.

[19] Exhibit C EPIC Terms and Conditions at 18: "Permits and Clearances: The Recipient is responsible for ensuring that all necessary permits and environmental documents are prepared and that clearances are obtained from the appropriate agencies." *Ibid* at 27: "The Recipient must obtain all required permits and shall comply with all applicable federal, state, and local laws, codes, rules, and regulations for all work performed under the Agreement." https://www.energy.ca.gov/sites/default/files/2020-02/EPIC_Standard_Contract_Terms_ada.pdf

runaway safety concerns), they may still be subject to long processes by virtue of being a first-of-its-kind project involving a type of technology that they may have never encountered; permitting officials would have a learning curve as is the case for anything new. To the degree possible, CESA wishes to further explore this issue to enable the widest range of potential LDES projects to apply, not just those that qualify for exemptions or categorical exemptions, and whether the same EPIC terms and conditions should apply. On the same note, CESA wishes to explore whether the type of funding or award mechanism (*e.g.*, grant, incentive, or loan) impacts the CEC's requirement for any funds to be given only to projects with permits already secured.

Finally, CESA presumes that the CEC may wish to balance going "big" with a few LDES technologies and projects versus making multiple smaller "bets" on different LDES technologies and projects. There are naturally tradeoffs between going with one approach over the other. On the one hand, providing significant funds on a few LDES projects and technologies could make a huge difference and better ensure that the project succeeds and potentially scale, but it would result in these precious one-time funds to be made in a narrow subset of LDES technologies, where it is possibly unclear at this stage which LDES technology will emerge as the least-cost, most valuable for our electric grid needs. On the other hand, providing smaller fund amounts on a larger number of LDES technologies and projects and offers greater risk diversification, but it may not make a difference in supporting project viability (especially for LDES technologies requiring larger minimum project sizes), addressing funding gaps, or helping to achieve a commercial scale for any given LDES technology, except for some LDES technologies that can achieve commercialization at smaller scale. CESA understands this challenge and balancing act, which may inform the ultimate funding approach and mechanism (*e.g.*, grant, incentive, loan).

Considering these tradeoffs, CESA recommends a blended approach that provides the CEC with greater market discovery in identifying the right portfolio mix and in gathering information on what amount of funds is needed to make an LDES project work. This proposal is discussed further below.

2. The eligibility criteria should be designed to align with the core purpose of the program yet reasonably cast a wide net.

Below, CESA offers a list of potential eligibility criteria, along with details and justifications for them. Taken together, CESA aims to ensure that the LDES Commercialization Program casts the widest net possible for LDES technologies and projects while still aligning with the core purpose and goal of the program, which we reiterate should be on first-of-its-kind commercial projects addressing real grid obligations and needs, distinct from pilots and demonstrations already offered by the CEC's EPIC Program.

Technology type: CESA supports a technology agnostic and neutral approach to allowing LDES project participation in the program, with the one exception that the technology cannot be a lithium-ion-based system. For obvious reasons, grid-connected lithium-ion battery systems already dominate the stationary energy storage market in terms of new installed capacity in recent and future years.[20] However, Mr. Gravely also shared at the April 5, 2022 workshop how pumped hydro storage ("PHS") would also be excluded from the program since they are a proven technology with a long track record. In most cases, CESA agrees that conventional PHS technologies (*e.g.*, large above-surface closed-loop systems) should not be eligible, but the CEC should not preclude novel configurations or approaches to PHS technologies, such as sub-surface PHS projects or closed-loop fire water tanks on a hill.[21] Other than the lithium-ion technology exception, all energy storage systems that meet the basic definitions establish in Public Utilities Code §2835 Sections (a)(1)-(4) should be eligible for program funds. Eligibility should also be agnostic to IFOM or BTM technologies.

Duration: CESA recommends that the definition of eligible LDES resources regarding duration be aligned with the CPUC definition from its MTR Procurement Order (D.21-06-035), where LDES is defined as resources that are able to deliver at maximum capacity for at least eight hours from a single resource.[22] Aligning commercial investments to those that have been identified in robust grid planning and modeling represents a key means to ensure ratepayer benefit and position the state to address both mid-term and long-term needs.

Online date: With focuses on deployable technologies involving non-lithium-ion LDES technologies and on aligning with real grid obligations, CESA recommends eligibility criteria to be established for eligible projects that can come online by 2028 or earlier. With 2028 representing the latest time by which LDES projects must come online to meet MTR Procurement Order requirements, this 2028 commercial online date ("COD") is reasonable and in alignment with the CPUC.

Project size: CESA recommends a minimum 3-MW LDES installed or contracted capacity requirement to qualify for the LDES Commercialization Program, thereby supporting minimum commercial level of deployment in most cases and casting a wide net of applications. In addition, this project size minimum will minimize duplication with EPIC solicitations, which we have observed have a minimum rating between 50 kW to 400 kW, at

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[20] *Battery Storage in the United States: An Update on Market Trends* published by U.S. Energy Information Administration in July 2020 at 13, reporting energy storage capacity represents over 90% of the market: https://www.eia.gov/analysis/studies/electricity/batterystorage/pdf/battery_storage.pdf;
See also "Global energy storage set to triple in 2021" news release by Wood Mackenzie on October 7, 2021, reporting that lithium-ion batteries in 2030 will account for 89% of global battery cell capacity: https://www.woodmac.com/press-releases/global_energy_storage_report/

[21] *County of Lake Comments on Long-Duration Energy Storage, Considerations for Project Metrics* submitted in Docket No. 19-ERDD-01 on April 7, 2022.

[22] *See* Ordering Paragraph (OP) 2 of D.21-06-035.
https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M389/K603/389603637.PDF

least in one instance.[23] To the same end, considering that the most recent 2021-2025 EPIC Investment Plan proposed by the CEC also targets an undefined "MW scale" for the proposed *Long Duration Energy Storage Technology Demonstrations to Support Grid Reliability* Initiative,[24] the LDES Commercialization Program should not set a project size cap in order to invite the widest range of possibilities of LDES projects and inform how the CEC wishes to develop a portfolio of LDES projects as part of this program, which may yield a combination of larger projects (*e.g.*, 50-200 MW) and smaller projects (*e.g.*, 3-10 MW).

3. Some key scoring criteria should be applied on a qualitative basis to identify "best-fit" technologies and projects to meet proposed program objectives.

Below, CESA outlines some potential scoring criteria that represent factors that are informed by the CEC's and the state's policy and decarbonization goals and reliability needs, in addition to emerging factors in the mid to long term. Whereas the proposed eligibility criteria are intended to screen out projects to minimally address the program objective while casting a wide net, the scoring criteria are intended to help prioritize or prefer certain project types that represent the "best fit" in terms of meeting multiple or as many goals and needs identified by the state. These criteria can be applied in different ways depending on the ultimate funding approach and mechanism adopted.

Sponsor letter: Similar to how the CEC seeks commitment letters or support letters as an indication of match funding, in-kind contributions, or general project interest, CESA recommends that a scoring criterion be established whereby an LSE, developer, or customer submits a sponsor letter as a sign of potential or impending off-take contract and/or to support future or ongoing bankability of the project. This criterion could represent a proxy for a project on the verge of commercialization, where CEC funds from the program would act as the tipping point to its use for grid obligations or needs. By making developers or customers to be eligible sponsors for the purposes of this program, CESA also does not seek to limit the eligibility or preference for projects to those with impending off-take contracts since projects could support other use cases (*e.g.*, BTM bill management, grid resiliency) or support interim merchant or energy-only operations. Furthermore, CESA does not believe that these entities should be limited to a sponsor; in some cases, it may be appropriate for the LSE, developer, or customer to be the prime applicant or co-applicant, such as in UOS projects.

Online date: In support of MTR procurement needs, preference or higher scoring could be given to projects that can come online by 2026 or earlier. Whereas the 2028 COD is intended to be the minimally required to be eligible for the program, aligning with the maximum allowed time to come online (but only if LSEs demonstrate good-faith efforts and

[23] *See, e.g.*, GFO-19-306, *Demonstrating Long-Duration & Title 24 Compatible Storage* released on January 3, 2020.
[24] *Final Commission Report – The Electric Program Investment Charge Proposed 2021-2025 Investment Plan* submitted in CEC Docket No. 20-EPIC-01 on November 16, 2021 at 47.

is approved as such by the CPUC), the 2026 COD is the actual COD requirement for LDES resource procurement pursuant to D.21-06-035. Although these criteria are intended to align with the MTR Procurement Order, earlier projects should generally be preferred, whether for the MTR or other use case. For the PSPS use case, for instance, the needs are annual and urgent given the ongoing cycle of wildfire risks and seasons, such that earlier projects than 2026 should also be considered and prioritized.

Duration: Notwithstanding the 8-hour minimum duration to qualify as an eligible LDES technology in a project, there should be no upper limit placed on the energy duration of resources, such that projects with duration significantly beyond 8 hours (*e.g.*, 24 hours, multi-day, seasonal) should be allowed and should be afforded an opportunity to differentiate their technology/project in meeting grid needs.

Equity: In line with EPIC guiding principles and other state policies, CESA recommends prioritization of projects that support equity objectives. Examples of how this criterion could be developed is to prioritize LDES projects located in a DAC, defined in accordance with the CalEnviroScreen 4.0, or where they directly support low-income or vulnerable customers (*e.g.*, in the case of community or BTM microgrids).

Community and workforce benefits: If LDES projects can demonstrate the use of local workforce, support for local economic development, and/or advancing in-state manufacturing, there may be incremental advantages to prioritizing the funding of these projects.

Resiliency for critical or vulnerable customers and infrastructure: Consistent with CPUC policies and programs,[25] eligible projects could be prioritized based on their location in a Tier 2 or 3 High Fire Threat District ("HFTD") (as determined by CalFire) and/or located in an area prone to PSPS or other outage events. This criterion will only be a deciding factor when a project is being proposed for a resiliency-focused primary or secondary use case, whether IFOM for community or local contingency needs or BTM for single-customer resiliency needs. In BTM resiliency use cases, eligibility criteria can also be defined to apply to target customer groups who are in most need and are the most vulnerable to outage events in order to prioritize the limited pool of funds in any given program.[26]

Supply chain resiliency: Robust, scalable, and resilient supply chains can help the state withstand any supply chain disruptions. If LDES technologies can demonstrate a

[25] CPUC eligibility criteria across a number of microgrid and DER programs are defined using similar criteria. *See, e.g.*, D.20-06-017 for PG&E's Community Microgrid Enablement Program ("CMEP"), Resolution E-5132 for PG&E's Remote Grid Program

[26] Many CPUC decisions have been made to define customer eligibility criteria, such as for critical facilities, medical baseline ("MB") customers, access and functional needs ("AFN") customers, and/or low-income and vulnerable customers. *See, e.g.*, D.19-05-042, D.20-05-051, and D.21-06-034 setting Utility De-Energization Guidelines, or D.20-01-021, D.20-10-025, and D.21-06-005 establishing and refining customer eligibility definitions for the purposes of resiliency funds in the Self-Generation Incentive Program ("SGIP").

decoupling of their supply chains with that of lithium-ion BESS, there may be advantages to prioritizing such projects for funding. If using in-state manufacturing, it would represent a plus. However, CESA cautions against an overly complex materials content accounting given the complex nature of global supply chains and the important objective of ensuring administrative efficiency of the program.

Unique resource attributes: First, recognizing some of the known limitations, risk factors, or tradeoffs of current lithium-ion batteries that could be improved upon (*e.g.*, degradation, lifetime performance, charge-discharge operating range, operating ambient temperatures, safety), LDES technologies could be scored on how they rate on various performance characteristics in comparison. For example, in line with the CEC's recognition of power quality issues in an inverter-centric grid, the California electric grid will also see a long-term need for frequency response with the penetration of inverter-based resources,[27] where LDES technologies that have spinning masses and/or can provide inertia may be a valuable investment. Second, due to land use limitations or concerns of siting lithium-ion storage projects locally or in building large storage fields, the CEC could also consider how LDES technologies and projects can not only offset or replace local fossil-fueled generation facilities but also support more efficient land use in the near and long term. In turn, a more balanced storage portfolio could reduce in half the stress placed on lithium-ion battery storage in terms of annual deployment rate, which defrays some of the supply chain risk of relying on a singular technology as well as potentially achieve greater energy density per square foot of land.[28] Finally, there could be differentiating factors among LDES applicants. For example, LDES technologies that decouple maximum charge and discharge rates[29] or have higher roundtrip efficiencies may pose unique advantages and offset typical tradeoffs of LDES technologies.

Sustainability: While lithium-ion battery recycling and second-life use is improving and actively being developed, certain LDES technologies may present opportunities to advance environmental sustainability, for example, through the use of certain sustainably-derived or inherently recyclable materials, or through the long lifetimes of technologies and projects (including without degradation), thereby reducing the replacement or augmentation of storage units over time.

Safety: Many LDES technologies may offer unique attributes in terms of energy storage safety by using inherently safe components, materials, or operations. For example,

[27] 2020-2021 Transmission Plan at 393-404.
http://www.caiso.com/Documents/BoardApproved2020-2021TransmissionPlan.pdf

[28] The CAISO's annual LCT studies have consistently identified larger energy duration needs from storage resources to displace gas in transmission-constrained local load pockets, where land is limited in dense urban areas and can be very expensive. With storage technologies that, for example, maximize energy per square feet, the CEC can support viable storage solutions to address local needs while displacing local gas generation.

[29] Depending on the use case, the ability to fully or substantially recharge in time for when the grid needs the discharge is a critical consideration for LDES technologies. Typically, inverter-based storage technologies have symmetrical charge and discharge rates that limit the ability to use them for longer duration needs, but technologies that can decouple these rates may have unique value to the system in charging during limited solar generation periods and discharging over longer periods of time.

depending on the technology, the LDES technology may pose no fire, chemical, or explosive risk, which are factors that must and can be mitigated for lithium-ion BESS resources, though not completely eliminated. By eliminating or drastically reducing such thermal runaway or other safety risks by comparison, non-lithium-ion LDES technologies could offer greater ease of mind and potentially offer comparative deployment efficiencies if safety-related permitting considerations are less or not a concern.

Learning curve opportunities: Technologies and projects that have the potential for "repeat business" could be a criterion for potential scoring and preference. Without unduly discriminating against larger infrastructure-like projects,[30] modular LDES technologies that can achieve economies of scale and facilitate learning/cost curve opportunities[31] may represent a smart use of limited CEC funds, which are used to support first-of-its-kind commercial projects but facilitate a "snowball effect" where second, third, and so on projects are procured, developed, and built thereafter, leveraging private investment or project financing. Upon crossing the initial valley of death to commercialization, follow-on investments in supply chains and manufacturing capacity can be better justified to achieve efficiencies that drive cost declines of a given LDES technology.

4. Approaches to evaluating and awarding projects should reasonably balance administrative efficiency with timely supporting a handful of first-of-its-kind commercial projects.

In considering different mechanisms to award projects, whether through grants, incentives, loans, or some combination thereof, the CEC should evaluate how different approaches and mechanisms fulfill the core purpose of the LDES Commercialization Program. According to our recommended purpose and objectives of the program above, the LDES Commercialization Program should focus on advance first-of-its-kind non-pilot projects, which align with and support the real grid obligations or needs. Given the near- and mid-term nature of these needs, the lead times required to bring projects online, and the three-year period to encumber the funds, CESA leans toward approaches that are flexible and lend itself to administrative efficiency.

With this in mind, CESA offers several potential mechanisms or approaches to dispersing funds:

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[30] *See, e.g.*, Castaic Power Plant has been a reliable and long-lived (since 1973) asset for Los Angeles Department of Water and Power ("LADWP"), representing the types of projects that achieve economies of scale through project size as opposed to volume of projects or modules. *See, e.g.*, Doughty, Kelly, and Mathias, *Staff Paper: Bulk Energy Storage in California* published by CEC Supply Analysis Office, Energy Assessments Division in July 2016 (CEC 200-2016-006).

[31] Kittner, N., Lill, F. & Kammen, D. M. Energy storage deployment and innovation for the clean energy transition. *Nature Energy* **2**, 17125 (2017). Paper and supplemental data available at: https://rael.berkeley.edu/project/innovation-in-energy-storage/

- **EPIC grant application process:** Mirroring the EPIC GFO solicitation and evaluation process, one potential model could be conduct an extensive grant application review process with equitable funding caps for any given application (*e.g.*, if 20 projects are the goal for the $380 million in total funds, then the cap would be $19 million per project). Similar to EPIC, after applying the eligibility criteria as a pass/fail screen, projects could be rated in terms of the established scoring criteria with weights indicating relative importance of any given criterion.

    - **Pros:** This approach is equitable for all applicants in being eligible for the same amount and would best support the "best-fit" criteria that advances multiple objectives and goals, as reflected in the adopted scoring criteria.

    - **Cons:** This approach could be administratively burdensome when time is of the essence to meet real grid obligations or needs. It may be infeasible or inefficient to conduct an EPIC-style evaluation process that can take 6-12 months in CESA's estimate. In addition, a greater distribution of funds may not support larger projects in some cases or help companies reach scale in other cases.

    - **Recommendation:** CESA does <u>not</u> recommend this approach at this time since the downsides outweigh the upsides. If pursued given the CEC's familiarity with EPIC and the readiness of this approach, CESA recommends that the CEC modify and streamline the EPIC solicitation, evaluation, and award process for the purposes of the LDES Commercialization Program.

- **Incentives:** Similar to Self-Generation Incentive Program ("SGIP"), incentives based on a key LDES attribute (*e.g.*, $/kWh) could be developed to enable the program to fund a target MWh in the LDES portfolio. After applying eligibility screens, an incentive could be established, for example, for the "unvalued" RA attributes for LDES resources (*e.g.*, incremental 4-8 hours of duration and beyond).[32] Like SGIP, each applicant could seek grants up to a certain amount (*e.g.*, incentive cap) and be made available either on a first-come first-served basis or in two application windows, with a lottery in cases where applicants exceed the amount of incentive funds available.

    - **Pros:** This approach could potentially be more efficient in terms of administration, *once* the program is up and running, in dispersing funds for ready projects. In addition, it could more flexibly support

[32] In some ways, this could be viewed as compensating for the difference in cost between a generic four-hour lithium-ion BESS versus an 8-hour or longer LDES asset.

technologies with different LDES durations if storage MWh is what is ultimately what is needed in the broader system resource mix.

- **Cons:** This approach may present significant startup costs and questions about how the incentive would be calculated. Furthermore, this approach would be less able to support "best-fit" criteria, creating a bias toward ready projects over those that may achieve multiple goals as reflected in scoring criteria, even though some of them could be reflected in incentive "adders". Finally, this incentive approach has fewer upfront controls in place and may narrowly focus on one LDES attribute (*e.g.*, duration) over other criteria.

- **Recommendation:** CESA does not recommend this approach at this time since the downsides outweigh the upsides. If pursued, this may be more appropriate for the second round of funding to avoid delays in program implementation and launch.

- **Open-ended funding request:** Drawing from elements of the EPIC or SGIP approach, this approach would more flexibly request that applicants submit funding requests to make their LDES project work ("tell me what you need"). After applying eligibility screens, applicants may request however much funds needed to make an LDES project work and come online within requirements. There would be no funding cap set, but if some cap is desired, it could be set at $50 million[33] or some significant amount to avoid screening out larger but still high-potential opportunities. Unlike the EPIC grant application process, however, the scoring process under this approach should be simplified to optimize, for example, for $/MWh requested or on a portfolio basis to achieve the greatest bang for buck on either a $/MWh basis or in the number of projects.

  - **Pros:** This approach is potentially more efficient in terms of administration compared to a full-on scoring process involving a technical review committee. In contrast to an equitable funding cap limit or amount, this approach would have the greatest variability in terms of the number of projects or MWh supported under more limiting EPIC or SGIP approaches, but it could offer the CEC with a great market discovery opportunity to understand what it will take to advance "X" number of first-of-its-kind commercial LDES projects or "Y" MW or MWh of LDES capacity online.

[33] As context, if all awarded LDES projects requested $50 million, it would still support 7 first-of-its-kind commercial LDES projects – a remarkable achievement that has never been accomplished anywhere in the world. Even supporting 1 or 2 first-of-its-kind commercial LDES projects would be newsworthy and a significant achievement, such that the CEC should not be adverse to setting a higher funding cap or no cap at all, at the very least for the purposes of gathering information on the full range of possibilities of LDES portfolios supported by the LDES Commercialization Program.

- **Cons:** This approach would present challenges in ensuring equitable outcomes or opportunities for different applicants; fewer projects may be supported as a result. Without a more detailed scoring/evaluation process, it may be unclear to the CEC on how they will select projects to award funds.

- **Recommendation:** CESA recommends this approach at this time since the upsides outweigh the downsides and it best aligns with our proposed objectives and purpose of the program. This approach best accommodates LDES projects of different types and stages, and the CEC would have an opportunity to flexibly build a high-impact portfolio. If structured correctly, this design could help close funding gaps of projects for different use cases – *e.g.*, RA contract revenue could cover a portion of projects costs (thus reducing funding request amounts) for system capacity applications, whereas the lack of a monetizable value of resiliency could justify a higher funding request amount. Given that this is a competitive process, applicants will also not have an incentive to claim excessive funds, which only poses greater risk of not being awarded.

The three above approaches do not represent the full universe of approaches, which may also include low-cost investment debt or loans, or some others that CESA has not anticipated. There could also be opportunities to apply one of the above approaches in the first round and a different approach in the second round of funding. However, at this time, CESA presents three potential program designs, and upon our review, we favor the "tell me what you need" open-ended funding request approach as best balancing the tradeoffs and various goals and objectives of the program.

5. To support immediately ready projects and afford some limited window of opportunity for LDES providers to prepare projects and applications, a two-tranche approach should be adopted.

Depending on the funding and award approach used, such as any of the ones discussed above, CESA recommends a two-tranche approach for applications. Specifically, we recommend that the first application window occur in Q3 or Q4 in 2022. Such a quick and immediate launch of the program will support funding for LDES projects that are ready and in need of support in the near term. Accounting for project lead times (*e.g.*, interconnection, siting, permitting, construction) and the timing of LSE solicitations for LDES resources to meet MTR needs,[34] it would be wise to make a first round of LDES

[34] Pacific Gas and Electric Company ("PG&E") recently issued their MTR RFO seeking LDES resources. Southern California Edison Company ("SCE") and San Diego Gas and Electric Company ("SDG&E") have yet to issue RFOs for their LDES procurement obligations. Many CCAs as part of CC Power have met most of their LDES requirements, but many other CCAs are still short of their LDES obligations.

Commercialization Program funds available to position projects to competitively bid/offer into these solicitations and potentially generate LSE project sponsors, co-applicants, or indications of support. For PSPS applications as well, there may be reasons to support projects that can provide resiliency ahead of the 2023 or 2024 wildfire season. Given lithium-ion BESS supply chain constraints, there may be additional technology substitution needs for LSEs to meet their near-term obligations, which have their own timelines in the CAISO interconnection process. In any case, there is a multitude of needs and obligations that merit a more immediate first round of funds to be available to support "ready" projects.

Subsequently, CESA recommends a second round of funds to be made available that could support a broader response and range of applications from LDES providers. Knowing that the program can support commercialization needs, LDES providers can take deliberate efforts to find project sponsors or collaborators, identify developer partners to incorporate their LDES technologies into their plans or projects in the queue, more comprehensively pursue federal co-funding opportunities as those programs become available, and/or accelerate some of their existing pilot or demonstration efforts to be ready for the next commercialization stage. This second tranche of funds could be made available in Q3 or Q4 of 2023, still enabling funds to be encumbered within three years of allocation to the CEC and supporting needs or obligations starting in 2028 or earlier.

How the total $380 million in funds are divided between the two tranches should be the subject of future workshops. There could be a case for the funding allocation between the two tranches to remain flexible, especially as the number, installed power and energy capacity, and estimated amount of funds requested is unknown if a first round was conducted before the end of the 2022 calendar year.

6. Unless the CEC is able to be allocated federal funds in advance, federal co-funding should be encouraged but not required to participate in the LDES Commercialization Program.

Understandably, the CEC is looking to seek cost shares with funds authorized by IIJA and grants being made available through various federal agencies, such as the Department of Energy ("DOE") and Department of Defense ("DOD"). As Eric Hsieh, DOE Director of Grid Components and Co-Lead for Storage Initiatives, shared at the April 5, 2022 workshop, the DOE launched its Long Duration Storage Shot Initiative to reduce energy storage costs by 90%, and the IIJA should make $500 million available for LDES demonstration projects, along with other programs where energy storage would be eligible for specific use cases (*e.g.*, grid resilience). To the degree that the criteria can be aligned, the CEC should do so, thereby helping to stretch the $380 million to more or larger projects.

However, CESA does not recommend that the LDES Commercialization Program require cost sharing using federal funds and instead merely encourage the pursuit of such opportunities, which will reduce the amount of funds potentially requested by the applicant

(thereby making the applicant "more competitive" in the eyes of the CEC). Since time is of the essence to support ready LDES projects to meet near- and mid-term needs, waiting for federal programs to launch would be ill-advised. In fact, Mr. Hsieh also acknowledged that California has already shown it is a market leader and mover that has defined what is needed. To add, it is unclear if the federal funds would support commercialization projects since preliminary program descriptions appear to have them focused on LDES pilot and demonstration projects, in line with the CEC's EPIC Program. Taking this into account, CESA believes that federal funds are a means to reduce the amount requested from the CEC and a means to increase "competitiveness" of applications as a result (*e.g.*, scoring criterion), but it should not be a prerequisite for submitting an application.

7. Program contract terms and conditions should be discussed, and if EPIC is used as a template or starting point, potential modifications should be considered.

As CESA envisions the LDES Commercialization Program, it would provide funds for projects involving commercial-ready LDES technologies, not for the demonstration or piloting of a pre-commercial LDES technology itself. As such, EPIC contract terms and conditions may not be appropriate for use. Rather, CESA wonders whether a new set of contract terms and conditions should be developed that is more consistent with a commercialization program.

In the absence of an immediate alternative or one that can be developed in a short timeframe, given the importance of "hitting the ground running" with the LDES Commercialization Program, the CEC may find it easier and/or more sensible to leverage the current EPIC contract terms and conditions as the template or starting point for use in this program, even if it opts to avoid the same application and funding dispersal process as EPIC. If so, CESA believes that EPIC contract terms and conditions may need to be modified to facilitate more robust participation, align with the intent of the program, and reflect common industry practice.

Many CESA members have gone through the process of submitting grant applications and/or reviewing the terms and conditions for participation. However, for all initiatives, member companies have highlighted several key challenges in participating in the program. While beyond the scope of any particular draft initiative, CESA offers our recommendations to address said challenges in order to invite greater participation from the energy storage community in these important initiatives:

- **Introduce limitation of liability provision in standard grant contracts:** Currently, in EPIC standard contracts,[35] there are no limitations of liability, nor exclusion for consequential damages, which is a problem because it asks companies to indemnify with no limitations. This is not common commercial

[35] *Exhibit C: Electric Program Investment Charge (EPIC) Standard Grant Terms and Conditions*.

practice and could limit commercial participation. With limitation of liability provision, exposure is capped in an agreement that is more balanced between parties. Liability should be capped at contract level or at aggregate amount of payments received and should exclude consequential, incidental, punitive, exemplary, special, indirect or other business interruption damages, including damages for loss of use, revenue or profit or loss of data or diminution in value.

- **Amend indemnification clause such that it excludes any and all claims and losses, stemming from errors, omissions, or misconduct on the part of the CEC:** As currently written in Section 17, the contractor could be liable even if the claims or losses were attributable to CEC fault. Several companies have reported that this term presents excessive risk that deters their participation in the program.

- **Remove royalty payments clause in Section 21 for projects that are deploying already-developed technology:** Since cost share is already required, additional compensation of royalty payment is excessive and could potentially limit industry participation. Royalty payments may be more standard for R&D-level projects, but it should not be necessary for technologies that are already developed.

- **Remove "Time is of the Essence" language:** The inclusion of the 'Time is of the Essence' clause in Section 22(d) means that the parties agree that all performance dates, including interim milestones, are materially important. Thus, the contract could be terminated for cause if the contractor is late on an interim milestone. Generally, the contractor is unable to recoup all costs incurred upon terminations for cause. Contract termination as a result of schedule slippage can present excessive risk to certain interested grant applicants and deter participation from promising technologies or project use cases despite offering potential learning opportunities.

- **Allow companies to retain intellectual property for later-stage technologies:** Storage technology companies have expressed that they want to ensure that all IP remains the property of the companies responsible for creating it, particularly as it relates to later-stage technologies that have been designed and developed by the companies themselves. Considering the CEC is not funding the R&D of new technologies, this is an important issue to the industry that could have the potential to limit industry participation.

- **Allow for some flexibility in negotiating the terms and conditions in certain cases:** Currently, there are no exceptions to the EPIC standard contract. While this practice supports timely and efficient contracting in most cases, there may be instances where some flexibility in the EPIC standard

contract is necessary and warranted to ensure fair and balanced agreements for all parties.

In addition to the above, if EPIC contract terms and conditions, CESA also believes that cancelation/termination, confidentiality, financial disclosure, and subcontractor flow downs are all areas that warrant review and potential modification. If an additional workshop is held to seek further stakeholder input, CESA recommends the potential contract terms and conditions for awarded projects to be a topic of review, discussion, and follow-on comments.

VI. CONTINUED FOCUS ON POLICY REFORMS NEEDED.

In addition to the need for the LDES Commercialization Program, CESA also offers several comments on the importance of continuing to improve and refine our policies, frameworks, and market designs to properly accommodate and value their procurement and operations.

1. Continued improvement to IRP models is needed to more accurately identify the least-cost portfolio and appropriately value LDES technologies and attributes in meeting decarbonization goals and reliability needs.

CESA recognizes and commends the CPUC for modeling LDES resources in their IRP capacity expansion modeling, as well as the Joint Agencies for considering LDES needs in their 2045 modeling, but as discussed above, improvements are still needed to modeling functionality as well as in representing a broader array of candidate LDES technologies. As currently constituted, the RESOLVE model used in both the IRP and SB 100 processes overlook multi-day events with a simplifying approach (*i.e.*, 37 representative days instead of an 8,760-hour model) and fail to capture the opportunity for and value of seasonal arbitrage, unduly biasing the modeling results in favor of shorter-duration storage due to the limitation of the balancing horizon. Furthermore, LDES resources are limited in their representation in these models, with only flow batteries and PHS as a proxy for all LDES resources being inputted, resulting in potential LDES solutions to be overlooked despite different cost structures and resource attributes. These two flaws have been highlighted in discrepancies of the resulting portfolios from RESOLVE 37-day capacity expansion modeling versus SERVM 8,760-hour production cost modeling runs and in complementary studies commissioned by CESA.

Despite our criticisms of the state of current modeling approaches and tools, CESA appreciates the CEC's grant-funded efforts to improve LDES modeling strategies and approaches. These efforts are appropriately looking and modeling enhancements to refine our understanding of LDES need for system purposes. We continue to support these efforts, which appear to be going in the right direction, but we continue to stress the importance in incorporating these enhancements into the IRP and SB 100 modeling processes as soon as

possible. We refer the CEC staff to specific areas of feedback and recommendations that were submitted in CEC Docket No. 20-MISC-01.[36]

2. Reforms to RA counting rules are needed to incrementally value LDES resources.

The four-hour duration of the vast majority of the energy storage deployments in California is driven by the RA capacity counting methodology that sets a four-hour minimum duration requirement to qualify as RA resources. As a result, absent specific procurement requirements as done in D.21-06-035 for 1,000 MW of energy storage resources with at least 8 hours duration when operating at maximum capacity, LSEs have limited incentive to procure energy storage resources that are longer than four hours in duration since a 4-hour storage resource costs the same in $/MW as a 6-, 8-, 12-, or longer duration asset. Until LSEs hit their Maximum Cumulative Capacity ("MCC") limits for four-hour resources, they have no incentive to procure LDES resources, and even then, they would not have incremental energy attributes valued. In this context, CESA urges the CEC and the CPUC to work together to adopt and refine 24-hourly slice-of-day ("SOD") reforms, as proposed by Southern California Edison Company ("SCE"), which would explicitly recognize the incremental energy attributes of LDES resources.

3. Energy storage market participation models and products may need to evolve to accommodate and value different LDES technologies and projects.

Gabe Murtaugh, Storage Sector Manager for the CAISO, presented at the workshop on the significant milestone of integrating over 3,000 MW of operational battery energy storage systems, a major increase from just 200 MW just two years ago and a testament to the CAISO's market participation models and tools and staff efforts. While bringing energy storage planning and procurement to reality with operational assets, Mr. Murtaugh also shared about recent enhancements to the Non-Generator Resource ("NGR") model, as well as proposals for a new Energy Storage Resource ("ESR") model in the ongoing ESE Initiative to improve tools that better represent energy storage marginal costs and operational parameters. On each of these accounts, the CAISO should be commended.

However, as explained by Mr. Murtaugh, there will likely be additional refinements and enhancements that will be needed to operationalize LDES resources. Despite various improvement areas as identified in the ongoing ESE Initiative, the current market participation models are currently better designed for four-hour lithium-ion battery energy storage systems. As LDES projects are procured in the coming years, the CAISO will need to consider whether the current tools and market products are positioned to support the

[36] *CESA Comments on the Public Workshop on the Preliminary Results of Assessing the Value of Long Duration Energy Storage* submitted in CEC Docket No. 20-MISC-01 on April 19, 2022. https://efiling.energy.ca.gov/GetDocument.aspx?tn=242719&DocumentContentId=76268

operationalization of LDES technologies. For example, different LDES technologies may have different marginal costs and operating parameters (*e.g.*, not all LDES have 0 Pmin) that may not be captured in today's market models, or sufficiency of state of charge ("SOC") may be less of a concern with LDES technologies that have greater energy sufficiency. Furthermore, depending on the grid need, new market products may also need to be developed to address multi-day low-solar events or winter peaking needs, which are not readily captured in today's market products or in the current RA construct. While not immediately urgent to resolve, it will be important to prioritize these wholesale market integration issues in the next couple years to be prepared for their deployment in the 2025-2028 timeframe.

VII. CONCLUSION.

CESA appreciates the opportunity to provide these comments and feedback on the April 5, 2022 workshop and look forward to collaborating with the CEC and other stakeholders in this docket.

Respectfully submitted,

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