CALIFORNIA ENERGY STORAGE ALLIANCE

June 16, 2022

Email to: EnergyStorage41001RFI@ee.doe.gov
Docket Number: Request for Information #DE-FOA-0002777
Subject: CESA's Response to the LD ESEE Initiative RFI

Re: Response of the California Energy Storage Alliance to the Request for Information (RFI) on the Long Duration Energy Storage for Everyone, Everywhere (LD ESEE) Initiative

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Dear Sir or Madam:

The California Energy Storage Alliance ("CESA") appreciate this opportunity to provide feedback on the implementation strategy and eligibility requirements for the Long Duration Energy Storage for Everyone, Everywhere ("LD ESEE") Initiative and to provide responses to key questions related to the Request for Information ("RFI") issued by the Department of Energy ("DOE") on May 12, 2022.

As the leading market in the nation not only for energy storage deployments but also long-duration energy storage ("LDES") research, pilots, demonstrations, modeling, and procurement, California is uniquely positioned to leverage portions of the $505 million dedicated to the LD ESEE Initiative and animate commercial growth of LDES technologies and projects that further the initiative's goals – *i.e.*, to increase the availability of clean electricity for everyone and everywhere, and support the ramp-up of affordable and reliable clean energy solutions. This pioneering leadership to advance California's and the nation's decarbonization goals is evident in the submission of these comments highlighting key planning needs and policy drivers for LDES solutions and pointing to major synergies with potential state funds and commercial-ready projects in the state.

CESA is a 501(c)(6) organization representing over 110 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 the nation-leading market for energy storage solutions and LDES opportunities, CESA aims to provide industry perspective on early experiences regarding LDES commercialization barriers, as well as on how to best structure the initiative. In addition to representing the collective perspective of the energy storage ecosystem, CESA sought the consultation and input from municipal utilities, investor-owned utilities ("IOUs"), community choice aggregators ("CCAs"), and environmental organizations to shape these responses. In doing so, CESA aimed to submit responses to the DOE that also incorporated the perspective of buyers and off-takers as well as environmental justice representatives from California in order to best position potential LDES projects for success and to the maximum benefit of California's local communities and ratepayers at large.

While the responses below represent the collective feedback of several key California stakeholders, we implore the DOE to not narrowly view these responses as just representing California's interests but those of the nation as well. As discussed further below, the need and value of LDES have been formally recognized in state grid planning models and regulator decisions, leading to procurement orders and active solicitations for LDES projects to meet various utility and other load-serving entity ("LSE") compliance obligations and/or grid needs. To our knowledge, California is a first mover in this regard, but as is the case for any first mover, certain commercialization barriers are discovered and encountered in the process.

The LD ESEE Initiative therefore presents a unique opportunity to overcome these commercialization barriers to the benefit of not only California but also all other states in paving the way for LDES technologies and projects to support their imminent grid needs and decarbonization goals. The technologies, strategies, and solutions developed in response to these near-term LDES commercialization challenges will play multi-fold dividends in positioning LDES solutions to be commercially- and manufacturing-ready in several years when California will not be the only one to identify a significant need for LDES technologies and projects. In other words, lessons learned and successful outcomes in California will propagate to all states and jurisdictions in the near future as they advance further into the clean energy transition.

Taken together, CESA firmly believes that the LD ESEE Initiative has the potential to catalyze cost reductions of needed LDES solutions, validate performance of emerging technologies, mitigate risks associated with material availability and supply chains, reduce the overall energy burden, and advance equitable energy access objectives.

I. INTRODUCTION.

California is at the forefront of decarbonizing many sectors of its economy. For the electric grid, Senate Bill ("SB") 100 was adopted in 2018[1] and currently serves as the "north star" for electric grid planning to ensure reliability while advancing the state along its long-term decarbonization trajectory, whereby eligible renewable energy resources and zero-carbon resources supply 100% of all retail sales of electricity to California end-use customers and 100% of electricity procured to serve all state agencies by December 31, 2045. To achieve these goals to decarbonize the electric sector, energy storage plays a dominant role in integrating the clean and renewable generation resources and delivering stored energy to periods of need. 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 California's (as well as the nation's) new installed capacity, but the need for LDES is also clear and has been formally recognized. The study results and reports from the California

[1] *See* https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180SB100

Public Utility Commission ("CPUC") Integrated Resource Planning ("IRP") and the Joint Agency SB 100 study and modeling processes have highlighted the significant and unprecedented buildout of clean generation and energy storage resources needed through 2045 to achieve California's decarbonization goals, including 1 GW of LDES by 2030 and 4 GW of LDES by 2045.[2] Similarly, the Los Angeles Department of Water and Power ("LADWP") commissioned a multi-year study with the National Renewable Energy Laboratory ("NREL") to assess new resource needs to meet their utility- and city-specific LA100 goals and found significant need for attributes that can be met by either clean firm generation capacity or LDES capacity given the local contingency risks faced with the Los Angeles Basin load pocket.[3]

Building on the rough framework of the CPUC IRP models, CESA also commissioned a complementary study that dug deeper into how the resource portfolio may change if refined inputs and assumptions are used 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.[4] 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 storage duration needs grow over time,[5] the study also highlighted the need to begin procuring for resources that exceed the minimum duration requirements for CPUC-defined LDES resources (*i.e.*, minimum 8 hours of duration) to those with durations at 12 hours, across multiple days, or even across seasons.

Given the eventual retirement of fossil-fueled generation and significant building and transportation electrification expected over the next decade, LDES need will only continue to grow to address longer duration (greater than 10 hours), local contingency, multi-day, and seasonal reliability needs. Altogether, the identified grid needs may only be a minimum baseline for the amount of LDES needed going forward based on the range of studies conducted on California's future clean and reliable grid.

California has mandated LDES as necessary through actionable procurement. In June 2021, the CPUC issued Decision ("D.") 21-06-035 – often referred to as the Mid-Term Reliability ("MTR") Procurement Order – that required LSEs to procure 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).[6] Given the long lead-time

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[2] *2021 SB 100 Joint Agency Report* published on March 15, 2021, at 75.
https://efiling.energy.ca.gov/EFiling/GetFile.aspx?tn=237167&DocumentContentId=70349

[3] *FINAL REPORT: LA100—The Los Angeles 100% Renewable Energy Study*. "Chapter 6. Renewable Energy Investments and Operations" at 2-4, published by NREL in March 2021 for LADWP. https://www.nrel.gov/docs/fy21osti/79444-6.pdf

[4] *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:
https://www.storagealliance.org/longduration

[5] CESA LDES Report at 52-54.

[6] D.21-06-035 at 35 and Ordering Paragraph 2.
https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M389/K603/389603637.PDF

nature of these resources, the CPUC allowed obligated LSEs to bring these resources online by 2028 if good-faith efforts are otherwise demonstrated.[7] Pursuant to 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 nine 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. Two 8-hour lithium-ion BESS projects for over 100 MW was ultimately selected and procured. CC Power reports that they are in conversations with an emerging LDES technology, but the likelihood of a resulting contract is uncertain at this time. 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[8] – the only commercial procurement of a non-lithium-ion LDES technology and project in California.

For non-CPUC-jurisdictional municipal utilities such as LADWP, who are subject to their own IRP planning and procurement processes, active efforts are underway to pursue commercial LDES projects in line with their LA100 Study findings. As part of the annual Southern California Public Power Authority ("SCPPA") Request for Proposals ("RFP"), LADWP is specifically looking to procure standalone energy storage resources that can meet their unique in-basin generation and fast-responsive storage needs, where solicitation requirements have been customized to highlight the need for LDES resources.[9] 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.

All in all, to our knowledge, no other state has done more to model LDES resources and/or 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 DOE's LD ESEE Initiative. 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 DOE's LD ESEE Initiative 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 California LSEs and municipal utilities, to CESA's knowledge, did not receive a significant number of 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 DOE to bridge the valley of death and achieve commercialization.

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[7] *Ibid* at 36 and Conclusion of Law 8.

[8] Colthorpe, Andy. "226 MWh 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-energygroup-ccce/

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

II. SUMMARY OF BARRIERS AND OPPORTUNITIES.

Recognizing the need to spur commercialization of LDES resources to simultaneously meet the mid- and long-term grid needs while diversifying supply chains into non-lithium alternative storage technologies, Governor Newsom allocated $380 million to advance the commercialization of LDES technologies – heretofore referred to as the LDES Commercialization Program – in the Governor's budget proposal in January 2022 and retained in the revised budget proposal prepared in May 2022.[10] The funds would be allocated to the California Energy Commission ("CEC"), one of the major state energy agencies focused on, among other things, clean and climate technology R&D, pilots, and demonstrations such as through the Electric Program Investment Charge ("EPIC") Program, to administer and operate. If California's legislature approves the Governor's clean energy package, a once-in-a-lifetime opportunity presents itself to leverage and synergize federal infrastructure funding approved through the Infrastructure, Investment & Jobs Act ("IIJA") of 2021 to multiply the impact of federal and state investment dollars and push a number of LDES technologies and resources over the "tipping point" to commercialization.

DOE's LD ESEE Initiative and the CEC's LDES Commercialization Program, if approved, would support several known challenges and barriers to bridging the valley of death to commercialization. LDES technology providers and manufacturers 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.

First, 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. These are risk mitigation strategies that good governance and regulator oversight require that utilities and LSEs manage. DOE support could help address these risks. Some of these barriers include the following:

- **Technology readiness:** Some off-takers may look to specific readiness levels of the underlying LDES technology to be commercially deployed for previous projects at similar sizes. Technology Readiness Level ("TRL") scales have been developed to set minimum standards in some cases.[11]

- **Experience requirements:** LSE and municipal utility 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

[10] *See* 2022-2023 Budget: Clean Energy Package. https://lao.ca.gov/reports/2022/4554/Clean-Energy-Package-022222.pdf

[11] TRL is a concept that emerged and was developed by the National Aeronautics and Space Administration ("NASA") and has been adapted to assess various innovative technologies, including generation and energy storage technologies. *See* https://www.nasa.gov/directorates/heo/scan/engineering/technology/technology_readiness_level

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, some LSE and municipal utility 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, some LSEs and municipal utility have increasingly imposed higher minimum project sizes for any bids, offers, or proposals as compared to past solicitations. In California, for example, 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.[12] 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 procurement teams, and likely in some parts, to pursue projects with higher economies of scale and thus lower costs. Utilities and LSEs, for their own reasonable desire, seek to take advantage of economies of scale and/or minimize the number of counterparties and contracts to manage when faced with significant capacity procurement requirements. However, for LDES providers, this presents a higher bar to entry. Put in the context of how 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 statutory requirements to solicit and procure new renewable resources under long-term contracts of no less than 10 years duration,[13] LSE and municipal utility 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 or less financeable 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.

[12] *See, e.g.*, PG&E MTR RFO Phase 1 Protocol at 8. https://www.pge.com/pge_global/common/pdfs/for-our-businesspartners/energy-supply/electric-rfo/wholesale-electric-power-procurement/Mid%20Term%20RFO%20-%20Phase%201/Mid-Term%20Reliability%20RFO%20Protocol_Phase%201_8-17Update.pdf
[13] SB 350 Section 399.13(a)(6). https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB350

- **Cost recovery:** Whether due to affordability considerations or uncertainty about the ability to recover potential stranded costs, some utilities and LSEs also report the difficulty in pursuing higher-cost, riskier emerging technology investments unless mandated to do so through a procurement order.

Second, 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 requires 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 DOE and CEC funding opportunities are needed today for projects that can come online by 2026 or earlier.[14] A focus on technologies that are at their "tipping point" and projects that are on the "verge of commercialization" is timely for these dual opportunities since advancing from research, development, and demonstration ("RD&D") activities and proof-of-concept projects to full-on commercialization represents the most challenging part of the innovation process. 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, yet many of these pre-commercial technologies struggle to compete in all-source solicitations for commercial opportunities for a variety of reasons. To meet the Long Duration Storage Shot's cost targets goals by 2031, several LDES technologies will need to have deployed first- or second-of-a-kind systems within the 2026-2028 timeframe in order to be truly commercial ready without government support and begin to scale manufacturing capabilities in the following years.

Importantly, the DOE should view the funding available in California from the surplus state budget as a once-in-a-lifetime opportunity where the "stars aligned" to catalyze an LDES market that has shown to be crucial to addressing our mid- and long-term grid needs and in promoting diversity and resiliency into the energy storage portfolio and supply chains. While the California dollars appear large in aggregate and on paper, the funds could go a much longer way if co-leveraged with federal funds, thereby becoming a true difference maker for commercial-ready LDES projects

[14] To meet the cost targets and commercial readiness by 2031, an operational track record must be built prior to 2030. If second- or third-of-a-kind projects involve redesigns or changes, there may need to be earlier commercial deployments so that additional operational track record is built, to the point that it is ready for manufacturing scale. Given the lead times for scaling manufacturing processes, technologies must be manufacturing ready prior to 2030 as well.

that require a certain minimum scale. From this view, the co-funding of federal and California dollars presents a unique opportunity to increase the viability of LDES projects and to make a difference for a larger number of projects – something that would be difficult to achieve with these funds being dispersed in isolation.

In sum, California is at the forefront of supporting the goals and objectives of the LD ESEE Initiative since state regulators, planners, and market participants have recognized the significant need and value of LDES resources and have taken more actions than any other region in the world to realize this potential. Nonetheless, as discussed above, challenges and barriers remain, which can be overcome with synergistic funding from the LD ESEE Initiative. With California acting as first movers in this space, the DOE should therefore view investments in LDES projects in California as not only supporting California's own needs but also in positioning LDES technologies and resources for all other parts of the U.S. The successful commercialization of LDES projects in California will generate the development experience and operational track record to give developers, customers, and utilities in other states to move forward more immediately with LDES projects as they identify similar needs and take actions to procure LDES resources accordingly.

III. RESPONSES TO QUESTIONS.

Given the length of the RFI questions and for the sake of understandability, in these responses, CESA summarizes our comments and recommendations as follows:

- Certain clarifications are needed to the requirements and expectations of Demo Projects, which includes how projects at this stage should focus on demonstrating first-of-a-kind, grid-connected full balance of system, whereas Pilot Grants should be designed to focus on second-of-a-kind or scaled project.

- For both Demo Projects and Pilot Grants, an efficient cost-share grant mechanism or competitive grant program should be used to facilitate timely commercialization support, invite and secure follow-on investors or purchases by off-takers, and be used for real grid obligations or needs where possible; time is of the essence, so "tried-and-true" funding mechanisms and approaches should be used to quickly deploy LDES technologies on the verge of commercialization and ensure that DOE achieves its Long Duration Storage Shot targets within the decade.

- The sufficiency of award and project size and optimal portfolio of projects in the Demo Projects or Pilot Grants programs will depend on the pool of applications, but the DOE should closely and flexibly look at "making a difference" when assessing which projects to award.

- Regional factors can advance equity and environmental priorities, but regional diversity should not be pursued for its sake; California is a first-mover market where

Demo Project and Pilot Grant projects located here can serve the national interests and position LDES technologies for commercial readiness in other regions when they identify LDES needs, while leveraging significant clean energy generation to charge the LDES resources, consistent with the nation's climate goals.

- Any analysis required to achieve levelized cost of storage targets, diversify and scale manufacturing, meet equity objectives, reduce emissions, should be done qualitatively through a concept paper rather than a rigorous and burdensome analysis.

In addition to the above, we also offer our perspectives on key barriers to second-life, seasonal storage, and LDES at large; use cases and applications of LDES resources; reasons against certain proposed funding mechanisms; cybersecurity considerations; equity and environmental justice considerations; and workforce considerations.

As requested in the RFI, CESA aims to use the bolded category numbers and sub-numbers as headings in our response to the greatest extent possible to ease review by the DOE. For purposes of brevity, many of the questions are paraphrased below. Overall, we focused our detailed responses to questions in Category 1 (BIL 41001 Energy Storage Program-Specific Requirements and Implementation Strategy) and Category 2 (BIL 41001 Energy Storage Program Crosscutting Topics), touching only lightly upon the other (nonetheless important) categories of questions.

Category 1: 41001 Energy Storage Program-Specific Requirements and Implementation Strategy

Category 1A. Long-Duration Demonstration Initiative ("Demo Initiative")

1. **Demo Initiative: The goal of this program is to prepare a cohort of promising technologies for eventual utility-scale demonstration. Please comment on the appropriate criteria for technology maturity at this stage.**

Since projects funded in this initiative will be small (*i.e.*, less than 100 kW) lab-scale systems that have proven operation in a controlled, behind-the-meter environment, CESA does not have specific recommendations on the Demo Initiative at this time. Given the stage of renewable and energy storage penetration in California and the imminent risks faced in the state's clean energy transition, our collective interest currently lies in commercializing larger- and utility-scale first-of-its-kind commercial opportunities for LDES projects. We do not deny the significant importance of funding lab-scale technologies, which play an important role in the technology development and maturity process and position the suite of energy storage tools for future and long-term needs. Similar funding programs exist in California via the aforementioned EPIC Program, underscoring their importance and highlighting yet another area for synergizing grant funding at the federal and state levels. Notwithstanding such importance, CESA believes that the LD ESEE funds would be most impactfully spent on bridging the valley of death in commercializing LDES technologies and projects.

Due to the clean energy initiatives that are mandated by states and local authorities, utilities and other LSEs are under statutory deadlines in achieving those set goals. In order to meet clean energy goals, we believe it would be more resource effective to combine funding for 41001(a) and available 41001(b) categories and prioritize funding for "Pilot Grants" and "Demo Projects" that are closer to utility-scale projects. Scaling kW-level projects ("Demo Initiative") to MW-level projects carry significant challenges and risks. Hence, we believe there should be an accelerated path built into the process for additional funding for Stage IV and V for the successful projects from Stage III ("Demo Initiative").

Category 1B. Energy Storage Demonstration Projects ("Demo Projects")

2. **Demo Projects: The goal of this program is to utilize BIL funding to deploy first-of-a-kind technologies at utility scale which might not otherwise proceed given potential technology risk. Please comment on the appropriate criteria for technology maturity at this stage.**

According to the DOE's proposed Storage Technology Opportunity Readiness Evaluation ("STORE") scale, Demo Projects aim to validate utility-scale first-of-a-kind system, generally deployed at sizes greater than 5 MW and deployed in the field or grid-connected. Such a system, at the end of this stage, has been tested and integrated in a limited commercial operational environment after previous validation in a controlled environment. In contrast to the Demo Initiative stage, this step is the first in the commercialization process.

CESA generally views the Demo Project to be appropriately defined, but additional detail is likely needed to clarify what is being validated. Specifically, the DOE should specify that technologies being validated at this stage are for the full balance of system ("BOS"), not just a component of what would be the full BOS when commercially deployed. This distinction can be a threshold matter for commercial off-takers, insurers, and financiers who can more readily extrapolate the operational and performance data generated from a Demo Project to subsequent stages of commercialization and scale. In other words, a component-level validation would likely have limited utility to advancing the technology to the next stage of commercialization. As the DOE acknowledges in the RFI, this utility-scale validation is intended to yield data describing realistic operating conditions; while hinting at how Demo Projects should be tested as a full BOS, the RFI describes how "[p]roposed systems at this stage should include *plans for sufficient integration, controls, and power conversion equipment* (if applicable) for medium voltage (up to 20 kV) AC input and output to the bulk power system (or aggregated equivalent), and be prepared to comply with all applicable reliability, market, and operational requirements" [*emphasis added*]. Plans alone to include the full BOS falls short of what may be necessary to progress to the next stage of commercialization.

Furthermore, whether a Demo Project is field tested or grid connected is a key clarification needed as part of this stage. To progress to the next stage of commercialization, operational data as a grid-connected resource will increase the bankability of LDES technologies and projects. Rather than subjecting projects to just field tests, the DOE should consider potential Demo Projects that can quickly pivot to operating as grid-connected resources, with the ability to synchronize to wholesale market models and signals (where they exist) and meet various interconnection requirements expected of other grid-connected resources. As part of any commercial energy storage deployment, testing and commissioning are routine steps taken prior to delivery of grid services and/or participation in wholesale markets. Unlike lithium-ion BESS projects that take 1-2 months of testing and commissioning prior to initial deliveries, an LDES Demo Project will likely require additional time (*e.g.*, more months, maybe a year) at this step to build confidence in the reliability and performance of the underlying LDES technology. Yet, the DOE should avoid keeping Demo Projects under field tests because, as just previously mentioned, bankability of the LDES project to the next stage will need to involve the full BOS, which includes the controls and management systems, as well as how all the components interact together and in response to utility or wholesale dispatch signals in commercial operations. In so doing, the DOE will be able to advance LDES projects to the next commercialization stage with a track record of the technology and BOS meeting all applicable reliability, market, and operational requirements.

Finally, as detailed further in our responses on the STORE scale, it would be helpful for the DOE to approximately map the more widely familiar TRL scale to the DOE's proposed STORE scale.

a. **DOE is evaluating funding mechanisms for Demo Projects in accordance with the BIL. Please comment on the ways different funding mechanisms may contribute to equitable selection and community engagement for Demo Projects.**

Regarding Question 2.a.i on the effectiveness of cost-share grants and cooperative agreements, they can be a generally effective means to advance innovations, demonstrations, and first-of-its-kind commercial deployments. In terms of process, grants involve more comprehensive technical review of the merits of a given application and allow for co-optimization across multiple "best-fit" criteria. Despite potentially extensive evaluation processes that can be administratively burdensome, CESA recommends that the DOE use cost-share grant awards as the "tried-and-true" mechanism that the DOE, industry, and communities are most familiar with. Based on the DOE indicating in its June 7, 2022, webinar that it wishes to award grants before September 2023 and the CEC's LDES Commercialization Program targeting projects that can be commissioned by 2026, the grant funding mechanism would best enable project development and selection by DOE to proceed quickly, compared with the other proposed funding mechanisms. While presenting opportunities for cost sharing, some flexibility may be warranted to pursue an expedited or efficient grant application review, evaluation, and selection process if possible.

Moreover, the effectiveness of grants in supporting Demo Projects may be contingent on the specific terms and conditions tied to grant awards, such as those around royalty payments and retention or transfer of intellectual property. To the degree that equity in the allowable maximum dollar amount of any grant to any awardees, this type of funding mechanism could also bias against certain types of applicants, such as those that can reach the Demo Project stage at a larger scale or size.

Overall, it is advisable to consider more favorable cost-sharing grants for the technology developers with DOE shouldering the larger portion of the project cost. This cost-share structure will ensure that the technology developer is committed to doing everything to ensure a successful deployment of LDES while DOE is enabling the project by providing the needed funding.

Regarding Question 2.a.ii on the effectiveness of funding an "adder" to incremental market payment with respect to offtake agreement mechanisms, there is potential that such a mechanism could be developed to value some of the "uncompensated" incremental value and benefits that LDES projects can provide due to existing policy, regulatory, or market barriers or yet-to-be-developed market products. For example, the lack of consensus around a resiliency value for prolonged and/or frequent unplanned outages, or the lack of incremental value for incremental durations of energy storage under capacity frameworks can present "missing money" gaps that an "adder" could address. Similarly, there are real first-mover risks and costs that are unquantified yet known, posing barriers to their commercialization. Along these lines, as an alternative to providing an "adder" on the supplier or technology provider side, an "adder" could be explored to support buyers who make these "first moves" and test/procure Demo Projects. This is a common feature across state clean energy programs that have a market transformation objective, where adders are provided to "new market entrants."[15]

However, while this mechanism can be administratively efficient once up and running, an adder as an incremental market payment has too many questions around the structure and implementation details that make it a less favorable approach. Though an "adder" could be developed based on a key LDES attribute (*e.g.*, $/kWh) could be developed, this approach may present significant startup costs and raises questions about how any adder could be calculated. Furthermore, this approach may also have fewer upfront controls in place and may narrowly focus on one LDES attribute over other criteria. Notably, this approach would also be limited to projects

[15] To varying effects, this approach has been used in California's Self-Generation Incentive Program ("SGIP"), Demand Response Auction Mechanism ("DRAM"), and others.

with a specific offtake agreement, which pose a barrier from the start in having to secure an offtake agreement in the first place.

Importantly, there is no standard market cost for the same technology since LDES technologies are currently emerging technologies with little or no precedents. The project will require DOE funding even if the cost of new LDES technologies is projected to be lower than lithium-ion BESS or pumped hydro technology. DOE funding can serve as a mechanism to lower overall project cost and barrier to entry (especially for first-of-a-kind projects), which helps with minimizing rate impact(s) to an off-taker utility, while lowering certain risks and increasing appetite for other financial institutions to provide funding. Since it is an emerging technology, there is an inherent risk that the project may not be successful even if funded. This first mover risk remains one of the single biggest challenges to the development of LDES.

Regarding Question 2.a.iii on the effectiveness of an "anchor tenant" mechanism, this innovative and creative approach may present the most unique means to advance LDES Demo Projects to the next stages of commercialization. Under an anchor tenant approach, the DOE purchases "capacity" of a new resource, enabling companies to afford the upfront cost of a project, then resells once fully operational. As we understand it, similar to DOE's proposed approach to the Transmission Facilitation Program, this approach would have the DOE "buy down" the resource and take on the initial and upfront risk of a new resource. Parallels exist in other areas in the energy industry. Typically, some third-party developers build energy storage projects at higher risk in order to generate high returns for later investors who buy equity into or purchase the entire project altogether ("develop and flip"). Likewise, for community solar projects that require multiple customer subscribers in a project to "buy" its outputs, a lower-risk entity that serves as the long-lasting and stable anchor tenant for the full length of the long-term off-take contract can facilitate the financing for the community solar project by purchasing a substantial portion of the project's outputs and invite smaller subscribers to buy the residual outputs of the risk-mitigated project.

In similar ways, the anchor tenant model for the LD ESEE Initiative could be a game changer since it provides a guaranteed off taker for the emerging technology before it is built, addressing the "chicken-and-egg" difficulty of signing customers. It would then invite follow-on investment or transactions by reducing or removing the first-mover risk. In particular, given the mid-term needs and obligations of California's LSEs and municipal utilities, the anchor tenant model has significant potential to not leave the DOE "holding the bag" if no follow-on transactions or investments occur because they have an incentive to directly contract for these resources to align performance and operation of the resource for their specific needs and/or compliance obligations. To mitigate the risk of the DOE being "stranded" as the anchor tenant of Demo Projects, the DOE should seek various information regarding collective support and need for Demo Projects funded through the LD ESEE Initiative from the integrated project team, potential project sponsors or off-takers, and local communities – all in an effort to have some indication that projects can eventually be resold once fully operational. Several California LSEs and municipal utilities have indicated interest in this concept as a means to procure Demo Projects, whereby they can run commissioning tests for some limited period of time when the DOE is the anchor tenant and produce an operational track record that instills confidence to buy the capacity from the DOE and negotiate a separate off-take contract directly with the LDES project.

Despite this potential, there are many mechanics and implementation details that will likely need to be worked out, such as the underlying terms and conditions of the contract with DOE as the anchor tenant. For example, it is unclear if the contract could be structured in a way to allow a potential follow-on investor or buyer of the project to require certain operational and performance tests to be run when they are not a counterparty to the contract between the LDES project owner/applicant and the DOE as the anchor tenant. In addition, to protect DOE's initial investment, there may be some specific criteria by which DOE may want to meet prior to reselling the project, which would need to be defined. Presumably, under this model, there is also the opportunity to replenish the pool of funds, but it is unclear if DOE would seek a certain level of margin off any reselling of the project, or if they would be open to maintaining some equity stake in the project (*e.g.*, not reselling the full project but maintaining the asset on its books). The resell aspect of this anchor tenant relationship can put undue burden on the technology developer as well. We believe the focus should be on minimizing the financial burden to the developer or technology provider so more projects can be commissioned. A longer operations track record will be key to getting non-DOE investors to participate more actively so the LDES industry becomes self-sufficient in terms of funding, like present-day solar and BESS projects

While innovative, CESA does not recommend the anchor tenant mechanism to be used for Demo Projects at this time because of the many uncertainties around how it would work. Since time is of the essence to get LDES projects funded, deployed, and commercialized to leverage opportunities in California but also to meet the Long Duration Storage Shot targets by 2031, a proven and more efficient mechanism is needed (*i.e.*, cost-share grant mechanism). As shared in the webinar on June 7, 2022, DOE staff indicated that a template or *pro forma* is not currently available for review, suggesting that using this mechanism, however innovative, would present complexities and upfront challenges in developing for use in this program. Yet, we see potential in developing this mechanism through a separate/future DOE initiative because of its ability to close funding gaps, de-risk projects, and replenish funds available through the DOE.

Regarding Question 2.a.iv on other potential funding mechanisms, alternative mechanisms beyond the ones listed in the RFI are being proposed at this time. Other areas where support through either the LD ESEE or other appropriate DOE programs could be to provide loan guarantees and help pay for some of the insurance premiums associated with backing new and emerging technologies. Innovation or investment related tax credits could also be highly transformative for LDES technologies, but such mechanisms are outside the scope of DOE programs.

Regarding Question 2.a.v on the effectiveness of Technology Investment Agreements ("TIAs"), there may be limitations associated with the use of TIAs[16] that are likely more appropriate for early research, development, and demonstration ("RD&D") programs or proof-of-concept projects. A TIA requires substantial federal involvement and may be either a type of cooperative agreement or a type of assistance transaction other than a cooperative agreement, providing private commercial firms an opportunity to define and develop the funded technologies and projects. However, technologies at the Demo Project stage likely need less of cooperative research to develop the technology itself but rather a large and powerful agency such as DOE that can facilitate the de-risking of LDES technologies underlying commercial-ready projects. In some cases, TIAs involve the DOE retaining the intellectual property ("IP"), which would be untenable for technology providers or other commercial entities that put in significant time and resources into developing the original IP only to transfer ownership to the DOE. Other requirements of TIAs to maximize cost sharing, for example, could pose structural flaws to this type of mechanism.

Regarding Question 2.a.v on the effectiveness of Partnership Intermediary Agreements ("PIAs"), there are again limitations associated with the use of PIAs that are likely more appropriate for early research, development, and demonstration ("RD&D") programs or proof-of-concept projects, where facilitation of technology transfer and licensing between academia and industry are sought. As explained in the RFI, using this mechanism, a federal laboratory can authorize a partnership intermediary to perform services for the federal laboratory that increase the likelihood of success in the conduct of cooperative or joint activities of such federal laboratory with small business firms, institutions of higher education. Similar to TIAs, there is less of a need for this type of facilitation service for LDES technologies underlying commercial-ready projects than a mechanism that de-risks projects for commercial deployments.

Regarding Question 2.a.vi on the listed funding mechanisms that may impede removing technology barriers to broader deployment and Question 2.a.vii on the optimal funding mechanisms, CESA favors cost-share grants as means to quickly deploy projects and facilitate transactions with off-takers who have real grid needs and obligations. As discussed above, there are some concerns or limitations associated with other proposed mechanisms, such as an adder, anchor tenant, cooperative agreement, or TIA/PIA.

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[16] *See, e.g.*, https://www.ecfr.gov/current/title-10/chapter-II/subchapter-H/part-603

b. What are the key barriers (technical, institutional, regulatory, etc.) and opportunities associated with a demonstration of [weekly, monthly, or seasonal durations], and which funding mechanisms can DOE use to overcome these barriers?

According to BIL 41001(a), the DOE plans to include least 1 project that must be designed to further the development of technologies for weekly or monthly durations, which have the capacity to discharge energy for 10 to 100 hours, at a minimum, or for seasonal durations, which have the capability to address seasonal variations in supply and demand. CESA is supportive of this opportunity to demonstrate 10- to 100-hour energy storage solutions. There are several known barriers associated with these LDES solutions:

Continued improvement to capacity expansion and other planning 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. Improvements are still needed to the current suite of modeling tools to capture LDES operations. Most models used today in public proceedings and dockets often overlook multi-day reliability events with simplifying approaches (*e.g.*, 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. However, CESA is aware of new and improved modeling tools in place today yet are still limited in their use for official planning purposes. For example, LADWP engaged with the NREL to conduct modeling as part of their LA100 Initiative, which took an iterative modeling approach to capture local transmission contingencies and, despite using a "representative-days" and hourly dispatch approach in capacity expansion modeling, they explicitly had dedicated one of the representative days to capture low variable resource renewable generation days. Until improved modeling functions and capabilities are built and widespread, a key barrier to 10- to 100-hour storage solutions is in identifying and recognizing the need for them in the first place.

Another barrier related to modeling tools and processes is the lack of publicly available information regarding various cost components and performance characteristics for 10- to 100-hour storage solutions and LDES technologies at large. Instead, proxy candidate resources are used as inputs to any capacity expansion or production cost model, often using, for instance, the publicly known costs and characteristics of pumped hydro storage, concentrated solar power with thermal storage, and sometimes flow batteries.[17] However, the use of proxy inputs fails to

[17] See for reference *Proposed Decision Adopting Local Capacity Obligations for 2023-2025, Flexible Capacity Obligations for 2023, and Reform Track Framework* issued in CPUC Rulemaking 21-10-002 on May 20, 2022: https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M478/K084/478084163.PDF

capture the various tradeoffs, such as in roundtrip efficiency, duration, minimum project size, charge and discharge (ramp) rates, and costs associated with any of these traits. Until such information becomes publicly available for use in public review and decision-making processes, this issue will continue to pose a barrier, just as with modeling the need for any emerging technology (*e.g.*, electrolytic hydrogen storage, carbon capture and sequestration, advanced nuclear). Successful outcomes in the LD ESEE Initiative could advance public knowledge and information that can feed into these IRP modeling processes, proving further useful to recognize the need to continue to advance and deploy LDES resources.

Reforms to resource adequacy ("RA") capacity 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, but similar durations are observed in many other jurisdictions where energy storage is being deployed first to replace peaking fossil capacity. As a result, absent specific procurement requirements, LSEs and municipal utilities have little 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. This incremental capacity must be recognized. California is moving toward RA reforms that make incremental progress in recognizing incremental duration of energy storage resources using a "slice-of-day" accounting approach, while some Independent System Operators ("ISOs") and Regional Transmission Operators ("RTOs") are developing effective load carrying capacity ("ELCC") curves for different durations of energy storage resources.[18] Each of these developments represent improvements upon previous capacity valuation methods and constructs, but continued progress is needed to increase the granularity of these valuations, measure multi-day or seasonal capacity value, capture the value of resiliency, etc. With capacity payments representing the long-term revenue stream in many jurisdictions and for most, if not all, LDES resources, errors or limitations in capacity valuation will pose a barrier to their commercial viability.

Energy storage market participation models and products may need to evolve to accommodate and value different LDES technologies and projects. There will likely be additional refinements and enhancements to existing ISO and RTO market participation models that will be needed to operationalize LDES resources. 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. Market optimization is also not done on a charge-discharge time horizon beyond 24

[18] See for reference *Order Accepting Tariff Revisions and Terminating Section 206 Proceeding* issued in FERC Docket Nos. ER21-2043-000, *et al*. on July 30, 2021: https://energystorage.org/wp/wp-content/uploads/2021/08/2021.07.21_FERC_ER21-2043-Order_Acceptance-of-PJM-ELCC-Filing.pdf

operating hours, leading to capacity contracts needing to fill these gaps and existing markets only conducive to daily diurnal storage cycles. 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 and not applicable in non-ISO/RTO areas, 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.

Lack of operational track record creates unknowns, and gaining that record may differ based on the duration of the storage asset. Currently, there is no empirically proven deployment of such weekly/monthly energy storage at a large MW and duration scale, hence the many risks and unknowns of not meeting expected performance would still need to be addressed, such system and equipment reliability, degradation, optimal operating profile, etc. Emerging technologies will require a sufficient amount of time for performance testing before and after commissioning. If it is expected that 8- to 10-hour LDES would take months to commission due to their cycle duration, seasonal LDES commissioning could be measured in years for the same reason.

Time required for regulatory approval of emerging technology projects and contracts may impact deployment timelines. Like for any new resource procurement contract, regulatory approval from state commissions, city councils, and/or local governing bodies will be required, taking into account ratepayer interests, reliability impacts, and the relative costs and benefits of projects. Project approval processes may include many stakeholders: financial, technical, community engagement, legal, risk management, ratepayer advocate, procurement supply chain services, etc. For emerging technologies that would be reviewed for regulatory approval for the first time, there may be learning curves or process required beyond the routine review and approval timelines.

c. What are the key barriers (technical, institutional, regulatory, etc.) and opportunities associated with a demonstration of [second-life applications of electric vehicle batteries as aggregated energy storage installations], and which funding mechanisms can DOE use to overcome these barriers?

According to BIL 41001(a), the DOE plans to include at least 1 project that must demonstrate second-life applications of electric vehicle ("EV") batteries as aggregated energy storage installations to provide services to the electric grid. CESA is supportive of this opportunity because it represents a high-potential pathway to advance a circular economy for cost-effective stationary grid-connected energy storage systems. Many of the considerations of second-life applications of EV batteries are technical in nature, where refurbishing EV batteries for second life in stationary storage is more commercially promising than refurbishing ESS batteries, and battery state of health ("SOH") generally is higher for discarded EV batteries than for ESS batteries no longer performing useful services. Controls are another technical factor for cost-effective deployment of second-life EV batteries.

Technical standards therefore play a critical role in ensuring the safe and reliable operation of these repurposed systems for grid applications since the batteries must be assembled into modules suitable for stationary service and because coupling batteries of varying states of health can require more advanced control systems.[19] To this end, where disassembly and re-assembly is required, UL 1974 supports this use case as a "manufacturing process" standard on the methods to determine the safety and performance of batteries, modules, and cells from used EV systems. Under UL 1974, an important first step is understanding the SOH of battery, modules, and cells based on, for example, battery management system ("BMS") data, service records, and visual inspection for any damage, and a determination of whether the battery meets end-use standard requirements for the application (*e.g.*, pursuant to UL 1973 or UL 2580). Consequently, repurposed batteries undergo performance assessments and grading. At the end of the day, repurposing manufacturers must use safe operations in accordance with local fire and building codes,[20] have demonstrated aptitude in assessments of cells, modules, etc., and have a suitable documented quality control program.

Like with any grid-connected energy storage deployment, second-life batteries for a stationary storage application will also need to be certified to UL 9540 and UL 9540A, which is the prevailing standard for the safety of energy storage systems and equipment, including their electronics and software controls. Through its alignment with NFPA 855 and the latest International Fire Code ("IFC"), UL 9540/9540A certification of a project using second-life EV batteries will support interconnection and permitting approval for grid-connected purposes.

Given that the technical potential is known, and many of the technical standards are in place, one of the key barriers to this use case is in building an ecosystem that define end-of-life management responsibility for car batteries and secure commercial agreements among automotive original equipment manufacturers ("OEMs") and repurposing manufacturers. In support of this ecosystem development, for example, UL and Hyundai announced a memorandum of understanding ("MOU") to collaborate on second-life initiatives, including safety

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[19] Curtis, Taylor L., Ligia Smith, Heather Buchanan, and Garvin Heath. 2021. *A Circular Economy for Lithium-Ion Batteries Used in Mobile and Stationary Energy Storage: Drivers, Barriers, Enablers, and U.S. Policy Considerations*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-6A20-77035. https://www.nrel.gov/docs/fy21osti/77035.

[20] *See, e.g.*, NFPA 70 Article 110 that contains general requirements for reconditioned equipment that apply through the National Electric Code.

testing and assessment.[21] Notably, as part of a multi-year effort via the Lithium-ion Car Battery Recycling Advisory Group and in collaboration with the Department of Toxic Substances Control (DTSC), the Department for Resources Recycling and Recovery (CalRecycle), automotive OEMs, auto dismantlers, and other public and private representatives, the California Environmental Protection Agency ("CalEPA") published the Final AB 2832 Policy Recommendations Report,[22] which was transmitted to the California Legislature in April 2022. Two policy proposals that defined end-of-life management responsibility for car batteries, including a core exchange with a vehicle backstop, as well as a producer take-back policy, wherein the auto manufacturer is responsible for ensuring proper repurposing, reuse, or recycling of its EV traction batteries by a licensed facility at no cost to the consumer if and when they are no longer wanted by the owner, and in the event no other entity has taken possession of the battery. While these policy proposals have yet to be enacted, the majority support from a broad cross-section of the industry as represented in the advisory group highlights opportunities to advance and incentivize growth of the re-use and repurposing applications.

Being at the early stages of EV adoption, the current scale of EV retirement is low/small, limiting the supply of second-life EV batteries and the opportunity for these applications. However, soon enough, the market opportunity should grow as the nation surges ahead with EV adoption – with one estimate showing the second-life EV battery supply increasing from 15 GWh/year in 2025 to 112 GWh/year in 2030.[23] As such, the DOE could play a big role in creating a national ecosystem and regional clusters for consolidating and streamlining the reverse logistics process and acquisition routes for the second-life industry, which is currently fragmented and dispersed. Rules and incentives could be established as well to assist with binning EV batteries as to whether they should be refurbished, recycled, or reused. Incentives or grants could be used to support facilities and firms that specialize in assessing battery type and SOH and make information available on battery history and condition. Most of all, the DOE can play a major role in reducing or defraying the additional costs associated with repurposing batteries, which must compete with new batteries that, until recently, experienced rapidly declining costs. Given the aforementioned added costs of diagnostics and reverse logistics and being tested/certified to certain safety and reliability standards, repurposed EV batteries will face difficulty in competing with new batteries using virgin materials to meet grid-scale needs. A national incentive program that offsets or covers a certain

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[21] "UL and Hyundai Join Forces to Advance Second Life Battery Energy Storage System Safety and Performance," UL Press Release on August 5, 2021. https://www.ul.com/news/ul-and-hyundai-join-forces-advance-second-life-battery-energy-storage-system-safety-and-0

[22] Lithium-ion Car Battery Recycling Advisory Group Report published by CalEPA on March 16, 2022. https://calepa.ca.gov/wp-content/uploads/sites/6/2022/05/2022_AB-2832_Lithium-Ion-Car-Battery-Recycling-Advisory-Goup-Final-Report.pdf

[23] Engel, Hank, *et al*. "Second-life EV batteries: The newest value pool in energy storage," published by McKinsey Center for Future Mobility in April 2019 at 3. https://www.mckinsey.com/~/media/McKinsey/Industries/Automotive%20and%20Assembly/Our%20Insights/Second%20life%20EV%20batteries%20The%20newest%20value%20pool%20in%20energy%20storage/Second-life-EV-batteries-The-newest-value-pool-in-energy-storage.ashx

percentage of these added costs will foster a more robust market for repurposed EV batteries.

In addition to the above policy barriers, certification and permitting considerations, and supply constraints of potential second-life batteries that are retired from use in EVs, the key issue that the DOE can solve through this dedicated Demo Project is to advance the bankability of stationary storage projects using second-life EV batteries. Once some of the policy and supply issues are sorted out and made more certain, the key question for the broad use of second-life batteries will be making these systems bankable to reduce financing and capital costs, which are currently more weighted toward equity capital. Along many of the same points related to the bankability of LDES technologies, an operational track record for a grid-connected stationary storage projects using second-life EV batteries will be critical, where financiers will have visibility and confidence that these batteries can reliably perform to support monetizable wholesale grid services or off-take contracts. Increased bankability, in turn, will lower the cost of capital over time and better position stationary storage projects using second-life EV batteries to compete in programs, solicitations, and auctions.

d. What are the key barriers (technical, institutional, regulatory, etc.) and opportunities associated with a demonstration of [energy storage projects that are US-controlled, US-made, and North American sourced and supplied], and which funding mechanisms can DOE use to overcome these barriers?

The 2022 Consolidated Appropriations Act provided DOE with $20 million for implementation consistent with "section 3201 of the Energy Act of 2020 for energy storage projects that are U.S-controlled, U.S.-made, and North American sourced and supplied. The Department is directed to include in this program large scale commercial development and deployment of long cycle life, lithium-grid scale batteries and their components."

CESA is generally supportive of the intent of these funds. Historically, with procurement done on a least-cost basis in support of ratepayer interests, the origins of the sourcing and supply chain have played a lesser role in building and optimizing electric portfolios for decarbonization and reliability. However, project viability and timelines are becoming an increasingly important factor as California and many other states set aggressive renewable energy (and energy storage) targets. Whether such factors outweigh potential lower costs from a global supply chain bears to be seen.

Some form of federal subsidies and significant long-running investments will likely be needed to increase the diversity, resiliency, and security of the battery supply chain. As the DOE is well-aware, key efforts are already underway. Strategies have been developed to, among other things, expand domestic manufacturing capabilities.[24] Vulnerabilities in the supply chain are being or have been assessed.[25] Executive action through the Defense Production Act ("DPA") is already making funds available for purchase commitments and other funding means associated with battery minerals production and processing[26] that is critical national security. In this context, it appears that many of the technical, institutional, and regulatory barriers have been identified, with certain actions already being taken.

With this $20 million allocated by Congress, if the DOE proposes to support U.S.-controlled, U.S.-made battery storage projects as a demand-side measure, there are open questions about whether eligibility should be tied to U.S. materials content percentage of the battery storage module, or whether it should be based on the value-add to the balance of system given the complexity of supply chains. Some level of flexibility should be allowed (*e.g.*, corporate owner can be outside the U.S. so long as majority of value-add of supply chain is in the U.S. or North America). Alternatively, in light of the potential and significant investments being made to develop Lithium Valley in California, the DOE could also co-leverage this funding with those available from the state[27] to support an energy storage project that emerges from efforts to boost lithium recovery and production from the Salton Sea region. Since Lithium Valley will not come to full fruition until later in the 2020s, these funds may be better used for other potential projects in the near term, but there may be opportunities for the DOE to be the "first buyer" of energy storage projects from Lithium Valley-sourced materials.

e. What is a sufficient individual award size to make a significant difference for its targeted technologies?

The sufficiency of any individual award size will depend on a number of different factors. First, the minimum size and scale of LDES projects can differ, where certain technologies require a certain "infrastructure-like" size and scale to be economic. Unlike containerized storage systems or ones that leverage existing

[24] *America's Strategy to Secure the Supply Chain for a Robust Clean Energy Transition*, U.S. Department of Energy Response to Executive Order 14017, "America's Supply Chains" published on February 24, 2022. https://www.energy.gov/policy/articles/americas-strategy-secure-supply-chain-robust-clean-energy-transition

[25] *Grid Energy Storage: Supply Chain Deep Dive Assessment*, U.S. Department of Energy Response to Executive Order 14017, "America's Supply Chains" published on February 24, 2022. https://www.energy.gov/sites/default/files/2022-02/Energy%20Storage%20Supply%20Chain%20Report%20-%20final.pdf

[26] "Memorandum on Presidential Determination Pursuant to Section 303 of the Defense Production Act of 1950, as amended." Presidential Determination No. 2022-11 on March 31, 2022. https://www.whitehouse.gov/briefing-room/presidential-actions/2022/03/31/memorandum-on-presidential-determination-pursuant-to-section-303-of-the-defense-production-act-of-1950-as-amended/

[27] In addition to the ongoing Lithium Valley Commission proceedings, which will produce a report to California's Legislature in October 2022, California's Governor included $130 million in his latest budget proposal in May 2022, $5 million to support geothermal development and lithium recovery in Salton Sea, sales and use tax exemption for projects involved in lithium production ($45 million over 3 years), and $80 million for workforce training.

infrastructure and/or geological formations (*e.g.*, existing cavern or well), LDES projects in certain cases and for certain technologies entail upfront fixed costs associated with site development but could involve smaller incremental costs to add energy capacity, such that projects only become economic at certain minimum sizes and scales. In other cases, minimum sizes or scales may be necessary to justify the investments needed to build-up of manufacturing capacity for LDES technologies at a commercial scale. There are incremental investments required when advancing from a one-off production line (proof-of-concept or prototype) to a pilot production line, concluding in achieving a low-rate or full-rate production stage.[28]

Second, the sufficiency of an individual award size will depend on the availability of co-funding opportunities from other state, federal, or foundation sources, such as the aforementioned funding potentially appropriated by the California Governor and allocated to the CEC. Along the same lines, "co-funding" could come in the form of expected or potential contract or market revenues, if funds or support through the LD ESEE Initiative are able to facilitate follow-on investments and off-take contracts. Finally, whether the funding or support mechanism used is a grant versus an anchor tenant capacity contract or technology backstop guarantee can impact the size of any individual award size. If an anchor tenant mechanism is used, there could be more flexibility to use higher award sizes than you would for a grant due to the potential for reselling the contract and recouping the value of the DOE's investment.

Despite the various factors above, CESA believes that the DOE is asking the right question in seeking to understand the funding amount necessary to "make a significant difference." Rather than applying a blanket approach where, for example, all projects are eligible for a certain capped amount of funds or subject to the same maximum project size, the DOE should invite applications to submit information on the amount of funds that could "make a significant difference" in commercializing the project and technology.

f. What portfolio of projects (technology, use case, location, community engagement, etc.) would constitute successful implementation? How can success be measured?

In developing a portfolio of projects, the DOE should focus on a portfolio of technologies and for grid-connected use cases more than other criteria around location. At the end of the day, if the DOE is able to facilitate a first-of-a-kind commercial deployment of an LDES technology, the DOE will have already achieved a major milestone in itself, helping to make the LDES technology available and commercially proven at any location or community and for most use cases. With

[28] *See* Manufacturing Readiness Level as one way to measure this factor.
http://www.dodmrl.com/MRL_Deskbook_V2.pdf

DOE-supported LDES technologies in the toolkit for planners, regulators, customers (utilities, end users), and grid operators, federal and state policies and procurement mechanisms can facilitate their use for specific policy priorities (*e.g.*, community resiliency, DAC benefits). Given the range of LDES technology and project types and needs and the national benefit of any successful commercialization of LDES technologies, CESA recommends a flexible approach to solicit information on the amount of funds that could "make a significant difference" in commercializing the project and technology.

In turn, the DOE could be presented 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, whereas a rigid design with capped funding amounts would be unclear on whether the amount would be sufficient to overcome commercialization barriers. Armed with this information, the DOE could be better informed on how to best construct a portfolio of LDES projects, which may yield a combination of larger projects (*e.g.*, 50-200 MW) and smaller projects (*e.g.*, 5-10 MW). If structured correctly, this design could help close funding gaps of projects for different use cases (*e.g.*, RA, resiliency) and could cover a portion of projects costs where other funding sources (*e.g.*, state funds, contract revenue). If structured competitively, applicants will also not have an incentive to claim excessive funds, which only poses greater risk of not being awarded.

Finally, in evaluating the portfolio of projects that could be potentially supported through this program, California is uniquely positioned to need and extract significant value from LDES resources as a result of the growing curtailments and flexible ramping needs, as well as near- and mid-term capacity shortfalls in the face of extreme weather events. LDES resources will advance the state's and nation's climate goals.

g. DOE is considering evaluating technologies for use on a daily, diurnal cycle (i.e., charging during the daytime and discharging at night). Which other use cases and application areas could be relevant for an applicant applying to Demo Projects with a proposed large-scale, mid-maturity, long-duration technology demonstration?

Like traditional lithium-ion BESS, LDES resources can provide energy time-shifting of renewables during low peak demand to high peak demand periods on a daily schedule, as well as load following, frequency regulation, spinning and non-spinning reserves, voltage control, and black-start capability. Beyond daily diurnal cycling, LDES technologies can provide a number of different use cases and applications, with some of the key ones highlighted below that may be more unique to LDES resources:

- **Local contingencies and/or offsetting or replacing 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.[29] Similar results were highlighted in the LA100 Study that identified the need for firm clean generation capacity or LDES currently provided by existing gas generation facilities to provide local capacity in the case of transmission contingencies.[30] Similar use cases are likely applicable to other states and regions where transmission and distribution infrastructure is limited to serve dense urban load pockets.

- **Infrastructure deferral and resiliency:** As part of ongoing grid infrastructure planning processes and procurement frameworks, California's 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.[31]

- **Frequency response and other ancillary services:** As different bulk grid systems move toward significant penetrations of inverter-based generation and storage resources, the loss of inertia on the system (*i.e.*, mostly from thermal resources and other resources that have rotating masses in their turbines and generators) will create needs to ensure sufficient frequency response is procured to meet compliance requirements. Certainly, inverter-based resources can provide these capabilities, but it may not represent the most efficient use of these resources in maintaining significant headroom.[32] Certain LDES technologies provide inertia and can provide these capabilities, which will become an increasingly value service as renewable and storage penetrations increase.

- **Multi-sector applications:** Certain LDES technologies present a unique opportunity to support the decarbonization of multiple sectors.

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[29] *See, e.g.*, 2021 Final Local Capacity Technical Study at 27-29. https://www.caiso.com/Documents/May1-2020-Final2021-LocalCapacityTechnicalStudyReport-R19-11-009.pdf
[30] *See* LA100 Study Chapter 6 at 101-103.
[31] *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.
[32] CAISO 2021-2022 Transmission Plan at 346-349. http://www.caiso.com/InitiativeDocuments/ISOBoardApproved-2021-2022TransmissionPlan.pdf

> For example, some LDES technologies are able to not only provide long-duration storage capacity for the electric sector, but also provide clean electricity-derived industrial heating used in manufacturing and heavy industry processes, replacing fossil-derived industrial heating.[33]

The above is not an exhaustive list of potential use cases and applications; there may certainly be additional innovative ones.

h. What level of analysis is appropriate for applicants to provide in order to show the likelihood, timeline, and major milestones for achieving the [$0.05/kWh-cycle by 2030] LCOS goal? What alternate approaches exist, not based on LCOS, that enable the development of robust storage market?

A detailed analysis demonstrating the likelihood, timeline, and major milestones to reach the levelized cost of storage ("LCOS") goal should be avoided at this time since any analysis will likely be conceptual or speculative in nature, and may be interpreted in different ways by different applicants. Most likely, after a first- or second-of-a-kind deployment, there will be design improvements and adjustments that lead to lower costs after utility-scale deployment, which can be difficult to confidently predict at the time of application. Rather, the DOE should seek business plans that are indicative of their path to commercial manufacturing scale, supply chain development, and technology maturity. A reasonable level of confidence in the indicative analysis and the ability for the project team to execute on a successful commercial deployment should be sufficient for these purposes.

i. What project sizes and power ratings should be targeted for optimal demonstration under Demo Projects?

Like with the sufficiency of any individual award, optimal project size or power rating for Demo Projects will depend on the type of LDES technology and project. Given the range and variety of LDES technologies, the DOE maintain its current proposal that does not set a project size cap and should not set a target project size or power rating and instead invite a diverse range of responses on optimal project sizes or power ratings appropriate for their technology. On project size, however, we urge the DOE to not be averse to looking at larger-scale projects since the need for LDES resources is significant and fast approaching, as we showed in our CESA 2020

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[33] Spector, Julian. "This startup's energy storage tech is 'essentially a giant toaster'" published in Canary Media on April 13, 2022. https://www.canarymedia.com/articles/energy-storage/this-startups-energy-storage-tech-is-essentially-a-giant-toaster

LDES Study. Incremental innovation may not suffice to meet our urgent decarbonization goals and reliability needs.

Any consideration of individual award or project size should be cognizant of the financial perspective as well. Since transaction and due diligence costs are usually the same for a 5 MW project as it is for a 50 MW project, for example, financiers typically favor larger commercial projects or portfolio of projects given the opportunity costs for doing so. In this sense, scale and future potential for scalability should be factored into commercializing LDES technologies and projects.

j. Which technology families or types are most applicable for consideration under Demo Projects?

Like with the sufficiency of any individual award or the optimal project size and power ratings, the DOE should not limit the technology families or types under consideration for Demo Projects, with the exception of LDES technologies that may have significant alternative DOE funding opportunities (*e.g.*, regional hydrogen hubs) or are clearly mature technologies (*e.g.*, lithium-ion batteries, traditional pumped hydro storage). Other than the Congressionally-mandated two lithium-ion technology requirements, we stress that lithium-ion technology does not meet the goals of the proposed technology stage, which is to advance first-of-a-kind technologies at utility scale.

k. What regional factors should be considered when identifying and selecting applicants?

CESA recommends that the DOE strive to advance the Justice40 policy goals, which favor projects that are located in disadvantaged communities ("DACs") and/or benefit minority, low-income, and underserved communities through stakeholder engagement, workforce development, and rectification of environmental injustice. At the same time, we recommend against forcing regional diversity for its sake. In commercializing a wide range of LDES technologies and projects, the DOE will equip LSEs, utilities, and grid planners with a technology and resource type well-equipped to address reliability, resiliency, and emissions/pollutant reduction needs of these communities.

California is uniquely positioned to host LDES projects as part of the Demo Projects and Pilot Grants programs given the identified and required needs and obligations in the state. In addition to these needs- and obligations-based drivers, the CEC, California's state energy agency focused on RD&D and commercialization, has already made over $100 million in investments in LDES technologies and pilots and may soon have available additional funds to support near-term LDES commercialization. To our knowledge, no other state has identified the needs, directed the actions, or made funds available to support LDES commercialization, making California a ripe proving ground to transform the LDES market for all Americans. Even if the majority of LD ESEE Initiative funds are directed to projects located in California, the DOE would have made an investment in California that would soon reap returns and benefits to all Americans when LDES technologies are commercialized and made ready for other states to more immediately procure, contract, and deploy them for their needs – all without the risks associated with being the first mover in this space. If the Governor's clean energy package is approved in late Summer 2022, then the DOE will also be presented with an opportunity to have limited federal dollars go a longer way through cost shares or co-investment, thereby supporting larger and/or more projects.

Finally, CESA encourages the DOE to assess regional considerations based on the underlying clean generation mix of resources on the grid that would better ensure that the charging of the LDES resource is clean or low-emissions, in addition to being premised on competitive and demonstrated off-take interest, potential, or contract. These two factors would advance the Biden Administration's climate goals and support the commercialization of viable and real LDES technologies and projects.

l. To maximize the impact of a technology, what partnerships (directly or indirectly on the project team) are most essential? Who are the most appropriate labor unions or other workforce organizations to engage in this work (federal, state, or local)? Which organizations effectively engage with innovators and entrepreneurs in DACs related to projects under Demo Projects?

To maximize the impact of a technology, it will be critical for the applicant to have assembled a complete project team that includes a technology vendor, system integrator, and engineering, procurement, and construction ("EPC") vendor, who together will be able to prepare a complete BOS. We note that the applicant could potentially serve each of these functions as well. A community sponsor or supporter would also be beneficial and should be a critical qualitative assessment criterion. At the time of application, it is not absolutely necessary to have an off-taker, developer, and/or labor union workforce in place at the time of application since those activities (*e.g.*, interconnection, specific site) can be secured at a later time, though they can be beneficial for project viability; as such, these factors are ideal and should be favored but should not be used to screen out applications. Along the same lines, the DOE should allow for applicants to potentially submit multiple potential vendors and contractors for a potential grid-connected project, which may take time to completely build out the project team, though complete project teams could be favored in the evaluation process against the project viability criterion.

m. What considerations should be given to the manufacturing/supply chain needs, challenges and RD&D opportunities for a technology? What level of analysis would an applicant be able to provide to demonstrate the supply chain criteria listed above?

DOE proposes giving priority to technologies that leverage a secure supply chain. For example, the availability of a domestic, secure, and ethical source of materials; the ability to use underutilized manufacturing capacity, and/or the speed at which manufacturing can be scaled to meet future demand. The level of analysis to this end should be indicative and ensure that a plan is in place, with evidence of materials and supply agreements as one means to demonstrate these ends. A complete and comprehensive analysis, however, may prove burdensome and overly complex.

n. What cybersecurity considerations, opportunities, barriers, and metrics are most relevant for Demo Projects?

To our knowledge, there are no unique cybersecurity considerations for grid-scale LDES projects. The same applicable cybersecurity standards from the North American Electric Reliability Corporation ("NERC") should be used for LDES technologies and projects as it does for more widely deployed solar PV and BESS projects. However, there is currently some uncertainty around cybersecurity considerations for behind-the-meter applications, where many jurisdictions and utilities are developing pathways for secure communication protocols, such as through work underway via IEEE 2030.5, SunSpec CSIP, and others.

o. What selection criteria can be established and what data can be collected throughout the life of a project to understand progress towards the Justice40 policy priorities?

See our responses to Question 38 focused on selection criteria to advance Justice40 policy priorities.

p. In establishing its application process, what approaches can DOE most usefully take to solicit and evaluate information relating to a – o above?

CESA supports the use of a "concept paper" element to the application to be useful in presenting the integrated view of the value of the proposed Demo Project. Other supporting documents and a standard application form can be used to collect certain specific and more straightforward information, but much of the information sought by the DOE, as suggested in the RFI, likely require a comprehensive narrative and qualitative description of the merits of the project for funding and support from the DOE, as well as how equity and justice are advanced. Any milestones can be reported through progress reports submitted to the DOE if selected and funded.

Additionally, since time is of the essence, CESA recommends that certain metrics or information submitted to and validated by the DOE take into consideration the same categories of information that may be useful to off-takers of LDES projects, which may shorten and expedite the process for off-takers in securing contracts or agreements with LDES technology vendors and developers. Rather than duplicating the information and data gathering process, the DOE could play a role in facilitating these follow-on commercial transactions.

Category 1C. Energy Storage Pilot Grant Program ("Pilot Grants")

3. **Pilot Grants: The goal of this program is to build enduring capabilities for targeted communities to invest in storage resources that provide local benefits (including resilience, decarbonization, and financial). Please comment on the appropriate criteria for technology maturity at this stage.**

In the RFI, the DOE describes how the Pilot Grants program is intended to address institutional barriers to technology adoption in the marketplace and address a market need, with systems that either demonstrate a first-of-a-kind system or improve upon a first-of-a-kind system with next-generation systems at a larger scale between 1-100 MW. The focus here appears to be on de-risking technologies through comprehensive validation, furthering technology development, and sustaining investment, as well as making a wider range of entities eligible for Pilot Grants, including a state energy office, Indian Tribes or organizations, higher education institutions, an electric utility or cooperative, or a private energy storage company. As discussed earlier, the distinctions made between Demo Projects and Pilot Grants are not sufficiently clear, other than the fact that Pilot Grants are meant for larger scales or for those ready to move to a successive commercialization stage. For clarity, it may be helpful to differentiate Pilot Grants as one that focuses on follow-on support and funding for projects that have demonstrated a first-of-a-kind commercial system.

a. **What portfolio of projects (technology, use case, location, community engagement, etc.) would constitute a successfully implemented pilot project? How can success be measured?**

See our response to Question 2.f. regarding Demo Projects. There does not seem to be a reason to necessarily differentiate the consideration of a portfolio of projects that are different from those specific to Demo Projects. CESA reiterates our recommendation that the DOE minimize focus on funding at this stage on technologies that have already been deployed in commercial markets, and concentrate on initial deployments of new technologies. Commercial and regulatory stakeholders can manage and assimilate the risk of transitioning deployed technologies to new use cases with existing financial mechanisms. This strategy would maximize the flow of new technologies into the commercial marketplace.

b. DOE is required to establish a "competitive grant program … to carry out demonstration projects for pilot energy storage systems." Please comment on the ways different funding mechanisms may contribute to equitable selection and community engagement for Pilot Grants.

With a focus on first-of-a-kind system, Demo Projects likely represent the largest gap or leap in the commercialization process. By contrast, with a different focus on advancing projects to a second-of-kind or next-generation system, Pilot Grants may warrant a different funding mechanism in the future that may be catered to the specific purpose of seeking funding or support from the DOE. However, like with Demo Projects, it will be important to utilize a streamlined and proven mechanism (*i.e.*, competitive grants) to meet timelines to commercial LDES technologies by 2031 and particularly addressed identified grid needs for LDES resources, such as in California.

Regarding Question 3.a.i on the effectiveness of competitive grants program, CESA believes that this approach can be effective, but at this project stage and at large scales, the DOE should be willing to support higher grant amounts, with cost-share requirements that can ensure that the limited funds are stretched across the greatest number of projects. Like with Demo Projects, CESA similarly recommends a competitive grant program because it is a mechanism that industry and communities have the most experience with and will enable project development and selection by DOE to proceed quickly, compared with the other proposed funding mechanisms.

Regarding Question 3.a.ii on the effectiveness of Partnership Intermediary Agreements (PIA), see our response to Question 2.a.v., where we describe how PIAs are more appropriate for RD&D projects and opportunities more so than facilitating commercial deployments. As such, PIAs are likely not be a good fit for Pilot Grants.

Regarding Question 3.a.iii on the effectiveness of a credit enhancement mechanism, CESA does not find this approach to be ideal for the purposes of advancing first-of-a-kind system to the next stage of commercialization. As explained in the RFI, credit enhancement mechanisms may manage the high upfront cost of deploying proven technologies by targeting and improving an individual's creditworthiness, which can be achieved by providing seed funding to eligible entities (*e.g.*, states, Tribes, higher education) to use for raising credit to purchase more storage. However, this approach may pose barriers to taking advantage of this type of system since it would introduce additional (and perhaps unnecessary) bureaucracy layers of having the eligible entities secure seed funding from the DOE and then having project teams and partners work with the eligible entity to secure the credit enhancement benefits. Rather, a more nimble and efficient mechanism would involve project teams and partners work with the DOE directly.

Regarding Question 3.a.iv on the energy storage subscription model, this model may have several limitations for the purposes of commercializing LDES technologies and projects. The DOE describes an energy storage subscription model as enabling users to obtain energy storage functions on a trial or part-time basis and how this model could be particularly useful with the combination of mobile storage architectures and users that only have a seasonal need for storage. Typically, these models have been used for community solar projects, which have generated mixed results and benefit most from having a long-term anchor tenant in place to ensure the financeability of the project.[34] The lack of guarantee of an anchor tenant or reasonably certain off-take contract poses too much risk, especially as the RFI describes the subscriber as obtaining the storage functions and benefits on a part-time or trial basis. Compared to the grant or anchor tenant model, the energy storage subscription model would likely reduce the financial and deployment viability of any Pilot Grant projects.

Regarding Question 3.a.v on the effectiveness of institutional support, though there are many areas of institutional support that can increase the viability of a Pilot Grant, using DOE funds to these ends may not necessarily address the problem. The DOE explains that, even for a validated ("off the shelf") technology, a deployment and use case may represent a new application for storage, where institutional support can address regulatory or permitting restrictions to enable greater deployment of previously-proven technologies and building capabilities for that technology (and future ones) in a given use case. However, institutional support areas are likely matters that may be better addressed through regional or local funding sources since these are very much location-specific, and any success through this institutional support may not translate to broader national deployments. If there are common national tools, it could be considered, like a permitting tool, or a platform, but these funds may be better spent on technologies, BOS costs, and project development. For example, the environmental review process for electric

[34] "Sharing the Sun: Understanding Community Solar Deployment and Subscriptions." NREL webinar on April 28, 2020, at Slide 19. https://www.nrel.gov/docs/fy20osti/75438.pdf; *see also* "Community Solar in California: A Missed Opportunity." Center for Sustainable Energy report (February 2018): https://energycenter.org/sites/default/files/docs/nav/policy/resources/Community_Solar_in_California-A_Missed_Opportunity.pdf

infrastructure can take many years (*e.g.*, three years for transmission), which is more of a matter of organizational coordination across federal and/or state entities as opposed to one that can be solved with additional funding.

Regarding Question 3.a.vi on the effectiveness of a warranty backstop, there could be significant potential in this approach to de-risking LDES technologies and projects for first movers. DOE explains that a warranty backstop is a mechanism to guarantee the performance of a system and enable an affordable way to facilitate deployments of new technologies with limited operational records. The lack of BOS project-level operational track record presents one of the greatest barriers to off-takers executing immediate contracts with LDES projects and to securing insurance for the underlying LDES technology. With a warranty backstop on technology performance, it may facilitate more immediate off-take contracts and insurance that would be otherwise to secure given the inability to assess a baseline level of risk associated with having no or limited operational track record. In doing so, the DOE can more prudently facilitate the commercialization of LDES technologies through the Pilot Grants program, with any use of funds tied to the balance of the portfolio's risk profile.

While a potential enabler of new LDES technology and project deployments, there are too many questions about how this would be designed and implemented, and whether the DOE could take on this role, which may be a better fit for the DOE's Loan Programs Office ("LPO") or similar office. For example, how would DOE assess each technology in order to take on that risk? Insurance companies perform deep, time-intensive technical due diligence to price and offer this service. Is this type of research and financial service one that DOE would like to take on? Alternatively, could DOE fund existing insurance products? Given these questions and the need to act quickly, the use of a warranty backstop for the purposes of these BIL funds may not be ideal at this time, especially as the DOE staff indicated that awards must be made by September 2023.

c. What is a sufficient individual award size for a pilot project to make a significant difference for its targeted use and technologies?

See our response to Question 2.e. regarding Demo Projects. While the DOE expressed interest in understanding the award size required across several project sizes and durations that may be required for different applications, we do not see any need for differentiation for Demo Projects versus Pilot Grants, except for a potentially greater tolerance for larger projects and possibly larger awards when assessing Pilot Grant applications given the stage of commercialization.

d. Given the wide potential for creativity, DOE may consider developing an initial "prize" stage or a competition for ideas on how eligible entities could use funds for leveraged demonstrations. How can the prize competition be structured to maximize innovation in the proposed ideas? What eligibility requirements and design criteria are needed to increase participation and feasibility of ideas for DOE? What amount would be sufficient to allocate to the prize competition stage? How much does one prize award need to be to incentivize the most creative mechanisms?

CESA does not view a prize competition as the best means to support timely and effective commercialization of LDES solutions. Prize competitions are likely more suitable innovations that require complex ecosystems to coalesce and create synergies in policies, methodologies, standards, technologies, and commercial agreements.

e. Which use cases and application areas, including the objectives listed in 42 USC § 17232(c)(2)(D) and copied above in this section, are most relevant for Pilot Grants, which targets late-stage, mature technologies that predominately need to address non-technical barriers for wider deployment?

See our response to Question 2.g. regarding Demo Projects. There likely are few or no differences between Pilot Grants and Demo Projects in terms of use cases or applications that they can serve.

f. What are the major institutional and regulatory barriers preventing wider energy storage deployment? How can proposed projects under Pilot Grants be structured to address these barriers?

Overall, our "Summary of Barriers and Opportunities" and our responses to Question 2.b. address this question. Like with other projects that have longer lead times (*e.g.*, transmission, offshore wind, geothermal), LDES Pilot Grants may also need support in advanced procurement, interconnection, permitting, and siting processes that are likely unfamiliar to regulators, utilities, and local cities and counties, and/or require coordination across multiple agencies and stakeholders.

g. How might an entity create structures that address barriers to storage deployment in a leveraged manner, potentially enabling many repeatable deployments?

If the entity is a state energy office, LSE, or utility, there could be opportunities to create repeatable deployments in many different ways, including through policy changes to recognize the value or benefits that LDES technologies can uniquely provide, creating a revolving fund of loans and financing, streamlining processes for permitting and contract approvals, and preparing sites with interconnection capacity, to name a few.

h. Which technology families or types are most applicable for consideration under Pilot Grants?

See our response to Question 2.j. regarding Demo Projects. There likely are few or no differences between Pilot Grants and Demo Projects in terms of technology families or pilots that are most applicable.

i. What regional factors should be considered when identifying and selecting applicants?

See our response to Question 2.k. regarding Demo Projects. There likely are few or no differences between Pilot Grants and Demo Projects in terms of regional factors for consideration.

j. To maximize the impact of a technology, what partnerships (directly or indirectly in the project team) are most essential? Who are the most appropriate labor unions or other workforce organizations to engage in this work (federal, state, or local)? Which organizations effectively engage with innovators and entrepreneurs in DACs related to projects under Pilot Grants? How may small utilities be optimally engaged, either as recipients or project partners/stakeholders?

See our response to Question 2.l. regarding Demo Projects. There likely are few or no differences between Pilot Grants and Demo Projects in terms of partnerships.

k. What considerations should be given to the potential supply chain for a technology? What level of analysis would an applicant be able to provide to demonstrate the supply chain criteria listed above?

See our response to Question 2.m. regarding Demo Projects. There likely are few or no differences between Pilot Grants and Demo Projects in terms of potential supply chain considerations and analysis.

l. What cybersecurity considerations, opportunities, barriers, and metrics are most relevant for Pilot Grants?

See our response to Question 2.n. regarding Demo Projects. There likely are few or no differences between Pilot Grants and Demo Projects in terms of cybersecurity considerations, opportunities, and barriers.

m. What selection criteria can be established and what data can be collected throughout the life of a project to understand progress towards the Justice40 policy priorities?

See our response to Question 2.o. regarding Demo Projects, as well as Question 38 focused on selection criteria to advance Justice40 policy priorities. There likely are few or no differences between Pilot Grants and Demo Projects in these regards.

n. In establishing its application process, what approaches can DOE most usefully take to solicit and evaluate information relating to a – m?

See our response to Question 2.p. regarding Demo Projects. There likely are few or no differences between Pilot Grants and Demo Projects in terms of approaches to the application process.

Category 1D. Rapid Operational Validation Initiative (ROVI)

4. DOE seeks comment on the how the ROVI program could be structured or revised to maximize the objective of enabling commercial financing and adoption of technologies that would not otherwise have robust performance projections.

In the RFI, the DOE explains that it is required to report to Congress every three years describing the performance of its energy storage programs, with priority consideration of making LDES project information publicly available. To fulfill these requirements, DOE proposes leveraging a program known as the Rapid Operational Validation Initiative (“ROVI”), which will look at least a 15-year technology life and performance prediction using 1-year or less of data. ROVI is envisioned as a cross-cutting analytical framework that can support faster validation of technologies currently being developed within DOE's Office of Electricity as well as the other relevant DOE and BIL programs.

Based on this description, CESA is concerned that the ROVI methodology is not well suited for technologies that are being deployed for demonstration purposes, as the first or second version at multi-MW scale – the types of technologies that much of this RFI is targeting. ROVI would work well if there were many instances of a technology, produced through a relatively mature manufacturing process, and operating under different duty cycles in different environmental conditions, as in the case of lithium-ion battery storage systems. However, for a first-of-a-kind LDES based on a new technology, many of the issues observed in the installation will be discovered and then resolved and thus not suitable for predicting inherent lifetimes of a given technology. The ROVI methodology should be proved effective before being used to characterize and publicize brand-critical data about new energy storage technologies. Private companies that are endeavoring to take a new product/technology up the steepest portion of the "technology commercialization curve" may be reluctant to publicize the design and operational issues they will uncover during a first project. Making this data public presents a risk that the expected and resolvable design issues present in the first instances of a product could cause long-lasting harm to the products reputation around reliability and durability.

Taking the above into account, the use of ROVI should be optional and not required of participants or awardees of the DOE's BIL funding programs. While potentially a helpful tool for some, it may not be appropriate for first- or second-of-a-kind LDES technology in all cases. For similar reasons for those who opt-in to participate, any resulting outputs should be used at the discretion of the participant(s) since they may pivot or evolve their technology or approach based on experiences and data gained from first- or second-of-a-kind deployments. Generally, too, concerns or questions about the ROVI methodology and validation of its use should be addressed first.

a. Please comment on the kinds of data that project performers would be required to provide, as well as any necessary safeguards.

So long as the use of ROVI is optional, there are several areas related to technical performance of the LDES technology and project that would be helpful for the DOE and future commercial partners and off-takers with respect to the various objectives, policy priorities, and institutional barriers and challenges. Some of these include:

- Expected duty cycle, useful life, degradation, etc.
- Roundtrip efficiency

- Usable depth of discharge
- Charge capacity, rates, and range (max/min continuous operating charge level)
- Discharge rates and range (max/min continuous operating discharge level)
- System response time and ramp rates (idle to Pmax, Pmin to Pmax, startup time)
- Max/min range of spinning reserves, regulation, etc.
- Operating temperature
- Autonomous function capabilities (frequency response, fault response, voltage control, SOC management, load/gen following)

In considering the data collection, the DOE should specify the frequency of data collection (real-time, weekly, monthly, automatic data transmission) and clearly differentiate, among other things, periods where the project is undergoing scheduled maintenance and calibration versus an unscheduled shutdown or poor performance. Overall, the DOE should strive to also ensure best methods to protect proprietary data while providing anonymized or aggregated technical performance specifications needed for ROVI development tools.

b. Please comment on how the tools and technical outputs from ROVI could be made most useful for US industry. How could ROVI tools and advances impact commercial transactions, such as for use in determining power purchase agreement performance parameters, establishing warranty backstops, or facilitating debt financing? How could ROVI tools facilitate better informed resilience planning and future grid design?

As noted in our response to Question 4.a., the above data categories are typically sought as part of a typical resource solicitation. However, we reiterate our view that ROVI should not be required at this time until the methodology has been demonstrated as effective. Even if effective, the ROVI data should be used with caution and strategically only if helpful to attract financing and insurance in the future and not made broadly public and available.

c. **How may the outputs from ROVI track or facilitate achievement of DOE policy priorities for Justice40, including increasing access to clean energy, low-cost capital, enterprise creation, and clean energy jobs and training?**

The outputs discussed in our responses to Questions 37-54 should inform the type of outputs that should be tracked as part of ROVI, only if and upon demonstration of the effectiveness of the ROVI methodology.

d. **Please comment on any other considerations with respect to ROVI.**

We have no further comment at this time.

<u>Category 2: BIL 41001 Energy Storage Programs Crosscutting Topics</u>

Category 2A. Storage Technology Opportunity Readiness Evaluation (STORE)

5. **DOE is seeking input on the clarity of the STORE scale as it relates to the energy storage programs described above and additional metrics to further define the technology and community acceptance landscape for long-duration storage.**

To define each area of interest, DOE uses a "Storage Technology Opportunity Readiness Evaluation" or STORE scale. In some ways, the scale can be intuitive, except for the need for some clarifications around the "Utility-Scale Validation – Demo Projects" and "Market Creation – Pilot Grants" stages as discussed above. To this end, the DOE should make it explicitly clear on how the BIL funding opportunities match or fit into the STORE scale. Moreover, given the greater and wider familiarity with the TRL scale used in this and other industries, the DOE should consider mapping the TRL scale to the STORE scale (or vice versa) to facilitate greater understanding of and translate what is intended or targeted at each stage. Specifically, it would be useful for DOE to prepare a table with STORE stages and different metrics including:

- TRL level
- Expected system components included
- Expected types of operation
- Expectations for level of market participation
- Expected number of systems fielded prior to reaching this stage

However, CESA notes that energy storage power sizing may not be a useful metric in the STORE scale, as power and energy sizes differ by type of system and end customer. Some smaller system sizes may be commercially ready, and some larger sizes may need more validation. Instead, it would be useful for DOE to provide the target power and energy ranges for each relevant DOE funding opportunity.

a. **Please comment on how effectively or thoroughly the STORE scale can be used when describing the major barriers to commercialization of new innovative storage technologies.**

The STORE scale generally does an effective job of describing the various stages and barriers at each stage of commercialization. To aid understanding, however, we recommend certain mapping and clarifications as discussed in our response above.

b. **Based on the STORE scale described in the section DOE's Draft Strategy for BIL 41001 Implementation and summarized in Figure 2, how clearly can an applicant find and know which program or solicitation to apply to.**

The DOE should provide examples of projects at each scale and clearly define "first-of-a-kind" as a term that helps to illustrate what would qualify. For example, as discussed above, there may be confusion about pilots and demonstrations for components of a novel LDES technology rather than the full BOS, which can lead to frictions to commercialization. With a clear "first-of-a-kind" definition, applicants will avoid confusion about what type of technology or project would qualify.

c. **What additional details could be present in a funding opportunity announcement to increase applicant confidence in which program to apply to?**

We have no further comment at this time.

6. **What specific metrics or criteria should be added to the STORE scale for further robustness and clarity about which technologies and maturity levels fit into which provisions?**

We have no further comment at this time.

Category 2B. BIL Provision, Requirements and Proposed Implementation

7. What policies, infrastructure, or other considerations could be put in place to enable implementation of the energy storage programs to be more successful?

One potential consideration for the DOE to enable implementation of the programs would be to provide resources, tools, and/or technical assistance in reviewing and understanding new and emerging LDES technologies when it comes to permitting approvals. Many local cities and counties are unfamiliar with the range of new technologies, which will likely pose a barrier to the implementation and deployment of any given LDES project. Other considerations could be:

- Funding and development of new grid planning tools to better recognize the value of LDES, particularly for multi-day and seasonal reliability
- Leveraging federal procurement authority to transition federal buildings, bases, and facilities to 24x7 time-matched clean sourcing, where LDES could play a significant role
- Establishing a baseline value of resiliency and refinement of tools to ascertain these values (*e.g.*, LBNL's Interruption Cost Estimator ["ICE"] Calculator Power Outage Economic Tool ["POET"] Calculator) where LDES can provide unique value
- Funding and development of permitting guidebooks to recognize different LDES technologies
- Support for repurposing existing infrastructure where applicable for certain LDES technologies (*e.g.*, wells, caverns, mines)
- Continued support and development of federal lab facilities supporting performance validation (*e.g.*, PNNL's Grid Storage Launchpad)
- Continued support for RD&D activities through existing or new DOE programs and initiatives

Most importantly, the greatest transformational change for energy storage at large would be to establish a standalone energy storage tax credit, similar to the investment tax credit ("ITC") in place today. Short of a new standalone storage ITC, which would require Congressional approval, the DOE could also explore ways to utilize future funds like a tax credit or adder that provides transparency to both buyers and sellers on the subsidy amount being received by the project that will flow to ratepayers.

8. How should the teams be asked to describe how their projects are consistent with and support the Administration's goal of transforming the economy by 2050 to achieve net-zero emissions goals (e.g., measuring clean energy deployments, emissions reductions, etc.)? Please be as specific as possible.

Considering energy storage systems generally do not have point-source emissions and because operational modeling of emissions impact can be difficult, we caution against an overly burdensome approach to substantiating emissions reduction measurement. Rather, if the applicant can point to state policies advancing clean generation through Renewable Portfolio Standards ("RPS") or other targets, goals, and policies, this should be sufficient since energy storage have a clean supply of resources to charge and plays a critical role in integrating these resources and in transitioning away from the current fossil-fueled fleet. At the same time, the DOE should neither "force" sequencing of clean generation and energy storage because, so long as sufficient clean generation is either online or expected, it can be reasonably assumed that LDES projects will support this transition toward lower electric grid emissions.

9. How should the climate benefit of different aspects of long-duration energy storage, and the demonstrations possible under 41001, be considered?

Other DOE metrics of interest may include air emissions and environmental impacts of deployments. Sustainable supply chains and sourcing of materials involved in LDES technologies and projects could also be considered.

10. DOE is evaluating funding mechanisms for the energy storage projects covered in this RFI. Across all the programs, what applicable funding mechanisms are best suited to achieve the purposes of the energy storage programs (e.g., cooperative agreements, grants, Other Transactions Authority, prize competitions, technical assistance, etc.)? Any comments on program-specific mechanisms should be submitted within the appropriate section of this RFI?

As discussed above, either the cost-share grant or the anchor tenant mechanism may be well-suited for the Demo Projects program while the warranty backstop may be the best fit for the Pilot Grants program.

11. What environmental reviews and permitting challenges might the projects funded under the energy storage programs encounter?

Each jurisdiction will be different. In California, projects are typically subject to the California Environmental Quality Act ("CEQA") environmental review process, which will entail extensive review for environmental impacts, unless categorically exempt. Such processes can pose challenges for the commissioning of LDES projects that aim to come online and connect to the bulk power system. For LDES projects in California, for example, CEQA permitting approval or exemptions will be needed, limiting the scope of grid-connected projects to: (1) those that can come online with sufficient lead time to secure CEQA approval (and accounting for procurement, interconnection, and upgrade timelines where applicable); (2) those that are sited at locations on existing facilities, land, and rights of way that already have CEQA approval (*e.g.*, utility-owned sites and land); or (3) those that qualify for CEQA exemptions (*e.g.*, under a certain MW size threshold or are located behind the customer meter). Presumably, similar circumstances may apply in other states and jurisdictions. Given these permitting challenges that are local in nature, the DOE will be challenged in funding Demo Projects and Pilot Grants that can come online in the "near term" (*e.g.*, 2024-2026), unless projects qualify for exemptions, have approval, or are located behind the customer meter.

As a result, utility-owned or utility-sited LDES projects will likely play an outsized role in the success of these programs, especially if the DOE agrees that one of the key goals of the programs is to get LDES commercialized and ready by the decade-ahead Long Duration Storage Shot goal. As discussed above, getting projects commissioned and online by 2025/2026 is therefore critically important, and as such, utilities should be closely allied and active in supporting these programs and DOE-funded projects in order to achieve these goals.

12. Based on EPAct 2005, Section 988, the cost share requirement for demonstration and commercial application projects is 50% cash and/or in-kind and must come from non-Federal resources (i.e., the total project cost includes both a 50% DOE share and a 50% recipient cost share). Is it feasible for projects to meet this 50% cost share requirement on an invoice-by-invoice basis?

This 50% cost-share requirement can be difficult and challenging to meet on an invoice-by-invoice basis given the nature and form of the cost share. There are very few programs (to our knowledge) that support LDES pilots and demonstration projects, outside of those that have supported projects in California and New York, but it will be difficult to time the availability of the aforementioned state funds on an invoice-by-invoice basis. Projects with approved in-kind contributions may also be unevenly delivered over the life of the project, which would be challenged to meet an invoice-by-invoice requirement. Furthermore, if the "cost share" comes in the form of off-take contract revenue, the timing of contract execution and payment schedules will pose challenges to align exactly on an invoice-by-invoice basis. In sum, any DOE grants/funds should only cover up to 50% of project costs, with any non-Federal sources of funding being "matched" and delivered at the overall project level over the expected lifetime of the project.

13. How could funding under other BIL provisions be leveraged to maximize the impact of BIL funding for the energy storage programs?

Potential areas of synergies with other BIL provisions include:

- **Grid Infrastructure, Resilience, and Reliability (Section 40101):** LDES can support a grid resiliency use case against extreme weather, wildfire, and natural disaster. As described above, LDES resources are well-positioned to address infrastructure contingency risks as well as multi-day variability weather events.

- **Program Upgrading Our Electric Grid and Ensuring Reliability and Resiliency (Section 40103):** LDES can support a grid resiliency use case similar to Section 40101 programs. This can come in the form of microgrid and islanding, infrastructure deferral, or local contingency capacity.

14. Are the proposed funding levels for the various phases appropriate/adequate?

CESA is not clear on what is meant by "phases" in this question, but if the DOE is referring to the breakdown of funding between the BIL 41001(a) and BIL 41001(b) programs and sub-programs, we find the proposed split in funding at $355 million and $150 million, respectively, to be a reasonable starting point. A strong case could be made, however, that more funds could be allocated to the BIL 41001(a) programs due to the scale and stage of LDES technologies or projects that would be supported, which may necessitate larger project sizes and funding needs to support grid-connected functions and cover certain project development considerations. Supporting a larger range of projects within BIL 41001(a) would also better position the nation's electric grid to have an array of commercial-ready LDES technologies within the next decade in line with the Long Duration Storage Shot goals. By contrast, the nature and focus of BIL 41001(b) programs are likely smaller in scale, with DOE describing Demo Program field demonstrations of 100 kW or less and DOE/DOD facility demonstrations focused on grid resiliency applications of comparable scale. Even with fewer dollars than proposed by DOE in the RFI, the BIL 41001(b) programs therefore can still "stretch" a long way across many LDES technologies and projects. With this in mind, CESA recommends that the DOE modestly modify the split across the two "phases" or BIL program categories by $50 million, resulting in $405 million for BIL 41001(a) programs and $100 million for BIL 41001(b) programs.

15. For a given technology demonstration, what draft or final federal NEPA documents (e.g., environmental assessments or environmental impact statements) could inform DOE NEPA reviews for the energy storage programs?

We have no comment at this time.

16. What supportive activities would make energy storage programs successful and sustainable?

The DOE should pursue "all of the above" with respect to the supportive activities listed as examples in the RFI, which include efforts to advance workforce development, engage and make available technical assistance to community-based organization engagement, and incentivize domestic manufacturing through federal incentives.

17. What types of outreach and engagement strategies are needed to make sure all relevant project stakeholders are involved for each provision? Are there best practices for equitably and meaningfully engaging stakeholders?

The DOE should identify and work with community-based organizations to connect them with information delivered via multiple and accessible channels (*e.g.*, language translation, laymen's explanation, webinars). By structuring the application requirements and evaluation criteria to include opportunities for community support or sponsor letters to be included in the application package, the DOE may be able to more easily engage communities by having applicants to do so in order to more competitively position their application.

18. What policies, infrastructure, or other considerations could be put in place to enable implementation of the energy storage programs (of a specific program or general across the programs) to be more successful?

See our response to Question 7.

19. What incentives/programs exist or can be put in place to encourage and foster US supply chain development and manufacturing for different energy storage technologies? What potential challenges or opportunities might exist to meet the new Buy American requirements in the BIL?

The new Buy American requirements[35] should be smartly designed to balance supply chain resiliency with the speed and cost at which the nation and states achieve their

[35] New Buy American requirements are located in Division G – Other Authorizations; Title IX – Build America, Buy America of the Infrastructure Investment and Jobs Act (IIJA), Public Law 117-58, which was enacted into law on November 15, 2021. https://www.congress.gov/bill/117th-congress/house-bill/3684

decarbonization goals and reliability needs. Carrots rather than sticks should be used to support Buy American requirements. Using the federal procurement authority or incentives could support the greater manufacturing and supply chain capacity in the U.S.

20. What types of cross-cutting support (e.g., technical assistance) would be valuable from the DOE/national laboratories, and/or from other federal agencies, to provide in proposal development or project execution? Are there other entities that DOE could fund to provide technical assistance for the energy storage programs?

The national laboratories could provide technical assistance by offering their data and tools to applicants, which include those that can be used to estimate performance, run financial models, provide weather forecasts, etc.[36]

21. What data should DOE collect from the energy storage recipients to evaluate the impact of the programs? How should this data and the program outcomes be disseminated to the public?

See our response to Question 4 related to the ROVI provisions, where we discuss how ROVI data-sharing requirements may not be appropriate for Demo Project or Pilot Grant projects.

22. What cybersecurity considerations, opportunities, barriers, and metrics are most relevant for long-duration storage demonstrations under 41001?

See our response to Question 2.n. regarding Demo Projects and 3.l. regarding Pilot Grants. There likely are few or no differences relevant for LDES demonstrations under 41001 in terms of cybersecurity considerations, opportunities, and barriers.

23. While Energy Storage Grand Challenge technologies can include Hydrogen-based technologies, DOE proposes to redirect such technologies to Hydrogen-specific provisions in the BIL (including sections 40313, 40314, and 40315). Please comment on the impacts of excluding such technologies from the 41001 energy storage programs discussed in this RFI?

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[36] Some of these may include, *e.g.*, NREL's System Advisor Model ("SAM").

The exclusion of hydrogen-based technologies is appropriate given the availability of funding programs and support mechanisms elsewhere, such as BIL's programs to fund Regional Hydrogen Hubs.

24. While Energy Storage Grand Challenge technologies can include non-bidirectional storage technologies that increase flexibility for generating stations (such as nuclear or fossil energy), DOE proposes to redirect such technologies to generation-specific provisions in the BIL (including sections 41002 and 41004). Please comment on the impacts of excluding such technologies from the 41001 energy storage programs discussed in this RFI?

The exclusion of flexible generation technologies is appropriate given the availability of funding programs and support mechanisms elsewhere. While the DOE defines these technologies as "non-bidirectional storage" technologies, LDES and other bidirectional storage technologies should be differentiated because of the unique synergies that these technologies have in complementing generation resources on the grid (*e.g.*, synergies with solar or wind resources), such that they are not substitutable when planning for a system portfolio.

25. As relevant to Demo Projects and the Demo Initiative, for a cost-shared grant or cooperative agreement, DOE retains a property interest in property acquired under the project. To what extent would DOE's property interest create barriers to project financing or otherwise?

To our knowledge, the DOE's retention of property interest in a funded project may not pose significant barriers, but if the project could be sold to an entity to be fully committed and obligated to meet a specified grid need or compliance obligation, it may be more beneficial to transfer these rights to such an entity. However, there are questions about how DOE would be impacted when operating LDES projects in wholesale markets and pursuant to off-take contracts, such as liabilities, performance requirements, market bidding, etc.

Category 3: Expanding Union Jobs and Effective Workforce Development

26. In what ways, if any, do you anticipate 41001 energy storage programs could impact the workforce?

Workforce and jobs impacts of LDES projects will differ by technology, which will have varying impacts on engineering, procurement, and construction ("EPC") activities in terms of the number and nature of construction jobs and different operations and maintenance ("O&M) requirements. The size of the LDES project will also lead to differing levels of construction jobs.[37] Furthermore, depending on the nature of the technology, there could be opportunities to utilize and/or repurpose the existing labor force for legacy industries or clusters at the project location.[38] As a result, it is difficult to specify a specific direct and indirect job impact, but such information (*i.e.*, upfront, short-term construction jobs and ongoing O&M jobs) is typically solicited in the commercial procurement process for new energy storage projects. In some cases, executed contract or project announcements may also include information on whether prevailing wages are used. In other words, in soliciting applications for the 41001 energy storage programs, the DOE could specify that applicants provide responses on estimated jobs and wages for projects supported through its funding programs.

Beyond the direct construction and O&M jobs created by a specific project, there could be additional manufacturing and assembly jobs created for LDES technologies that spur the development of facilities and supply chains in the U.S. or North America for parts or the entirety of the LDES technology and balance of system.

27. What tools should the energy storage programs utilize to meet the goal of creating work opportunities for local residents in the construction phase and long-term operations phase of the project (e.g., Project Labor Agreements, Community Benefits Agreements, etc.)? How should short-term build-out (i.e., construction phase) employment and long-term operational employment opportunities be measured and evaluated?

Similar to our response to Question 26, the use of different tools will be specific to the LDES technology, nature of the EPC activities, and location of the community. Information on the number and nature of jobs could be included in the application as well as updated in progress reports to the DOE. Project Labor Agreements ("PLAs") or Community Benefits Agreements ("CBAs") are one means by which local benefits are assured, but it may also come from the payment of property and sales tax that all standalone energy storage projects pay by virtue of their location in particular cities and counties.

28. What specific labor unions do you recommend that DOE engage with in implementation of 41001 energy storage programs?

[37] As a rule of thumb based on member survey results, CESA estimated 1 direct job created for every 10 MW of energy storage procured and installed. However, at larger sizes, energy storage projects likely benefit from economies of scale such that the expected number of jobs created do not necessarily linearly increase with MW of deployment. *See, e.g.*, CESA white paper available at: https://static1.squarespace.com/static/5b96538250a54f9cd7751faa/t/5ec857f92dd571390c0d1563/1590188026152/2020-05-01+Energy+Storage+Jobs+White+Paper.pdf

[38] For example, compressed/liquid air energy storage and underground pumped hydro storage technologies can leverage and repurpose the existing workforce in the oil and gas industry where wells are prevalent. Mechanical energy storage technologies may be able to leverage workforce skills in legacy gas-fired generator industries. Certain materials, such as gravitational energy storage using cement blocks, may be able to leverage existing local supply chains for these typical construction materials.

We have no comment at this time.

29. What activities and engagement would make 41001 energy storage programs successful and sustainable in terms of workforce development; worker recruitment; improved diversity, equity, and inclusion across the workforce; and the creation of good union jobs?

We have no comment at this time.

30. What labor standards be incorporated in project planning stages to support the creation of high-quality, good-paying jobs?

We have no comment at this time.

31. In a competitive labor market, what will energy storage projects need to do to attract, train, and retain a skilled workforce?

CESA is supportive of policies and programs to attract, train, and retain a skilled workforce. Broadly, there is a growing need for electrical engineers to support interconnection of energy storage projects at large, especially as California and a number of other states and jurisdictions face interconnection queue backlogs and the prospect of historic levels of new clean resource buildout to achieve state and nationwide decarbonization goals. Importantly, some LDES technologies present an opportunity to transition existing or legacy workforces in fossil-fueled generation (*e.g.*, repurposing wells or caverns, using turbine-based technologies) and/or leverage significant existing local workforce bases in construction (*e.g.*, non-containerized technologies) and materials suppliers (*e.g.*, cement).

32. If you are a potential applicant, would you consider signing a card-check labor neutrality agreement, collective bargaining agreement, and/or establishing a labor-management partnership? Why or why not?

We have no comment at this time.

33. What existing workforce education and training efforts are preparing workers for this industry? How can those efforts be best supported or augmented for ensure success of 41001 energy storage programs?

We have no comment at this time.

34. What tools should 41001 energy storage programs utilize to meet the goals of providing opportunities for workers displaced from fossil industries and resource-based industries in decline?

We have no comment at this time.

35. What would be the most effective workforce development activities to both ensure employers have access to qualified workers and ensure that workers are broadly qualified for good-paying jobs across the industry?

We have no comment at this time.

36. How should the quality of and access to construction phase employment and operations and maintenance phase employment be measured and evaluated?

We have no comment at this time.

Category 4: Equity, Environmental and Energy Justice (EEEJ) Priorities

37. How could the 41001 energy storage programs show progress towards the Justice40 policy priorities? What data could be tracked?

President Biden's Executive Order ("EO") 14008 established the Justice40 Initiative, which directs 40% of the overall benefits of certain federal investments, including investments in clean energy, to flow to DACs. For the purposes of this RFI, DOE identified the following non-exhaustive list of policy priorities as examples to guide DOE's implementation of Justice40 in DACs: (1) decrease energy burden; (2) decrease environmental exposure and burdens; (3) increase access to low-cost capital; (4) increase clean energy jobs, clean energy job pipeline, and job training for individuals; (5) increase clean energy enterprise creation and contracting (*e.g.*, minority-owned or diverse business enterprises); (6) increase energy democracy, including community ownership; (7) increase parity in clean energy technology access and adoption; and (8) increase energy resilience.

Given the above, some example metrics that could be tracked include the number and size of projects located in DACs or low-income communities and number of jobs created for low-income and minority groups, among other potential data categories.

38. How can selection criteria prioritize benefits to Justice40 communities?

In line with Justice40 objectives, CESA recommends prioritization of projects that are located in a disadvantaged or low-income community, or can be demonstrated to directly support low-income or vulnerable customers in the case of LDES technologies used in a community or behind-the-meter microgrid. Especially as LDES technologies typically have no point-source emissions and can reduce or offset the use of fossil-fueled generation that is often located in disadvantaged communities, these criteria should be used as scoring rather than screening criteria to prioritize projects that have the incremental benefits by virtue of their specific location. Beyond the benefits of the project outputs themselves, the economic and workforce benefits should factor into the scoring of projects that advance the Justice40 objectives. For example, the use of local workforce for all or any phase of the project development process, and the ongoing employment associated with the operation of the LDES facility should factor into their scoring. Finally, selection should be based on project viability since affordability to ratepayers is critically important, such that DOE investments should not be wasted on clearly unviable projects, especially for funds used for the Demo Projects and Pilot Grants.

39. How can DOE incentivize partnerships with community-based organizations, who may have been historically excluded from energy investments in their space?

The DOE can incentivize partnerships with community-based organizations by encouraging support letters from local community-based organizations, which point to receptivity to the local LDES project and their associated benefits. The submission of these support letters as attachments to an application can be used as a qualitative criterion for awarding projects.

40. What barriers face minority-owned businesses in this circumstance, and how can DOE facilitate their/your participation?

The DOE can facilitate the participation of minority-owned businesses through the establishment of clearinghouses for certified minority-owned businesses that developers and applicants can use to advance supplier and contractor diversity.[39] In addition, the DOE can

[39] *See, e.g.*, CPUC Supplier Diversity Program that supports similar ends through clearinghouses, certifications, databases, and expos: https://www.cpuc.ca.gov/supplierdiversity/

include a qualitative criterion for applicants and project teams owned and operated by minority groups and/or use minority-owned businesses among its suppliers and/or project team (*e.g.*, EPC contractors).

41. How can DOE improve partnerships with, and accessibility to, MSIs, HBCUs, community colleges, and Tribal Colleges? How can DOE better support these institutions in applying for funding and shaping the funding process?

The DOE can incentivize partnerships with MSIs, HBCUs, community colleges, and tribal colleges by encouraging support letters from these groups, either as direct beneficiaries or as indirect supporters of the local project. For those who wish to develop LDES projects for the benefit of their college(s), the DOE can provide technical assistance in developing projects and/or facilitate matchmaking with potential applicants.

42. What EEEJ concerns or priorities are most relevant for 41001?

Engagement and funding of projects to meet the Justice40 objectives can address some of the key Equity, Environmental and Energy Justice ("EEEJ") concerns and priorities. To facilitate this alignment, DOE should make information about qualifying DACs available to applicants in an accessible tool.[40]

43. What strategies, policies, and practices can 41001 energy storage programs deploy to support EEEJ goals (e.g., Justice40)? How should these be measured and evaluated?

Accessible tools, technical assistance, and EEEJ-related qualitative evaluation criteria can help ensure that the program achieves the Justice40 goals. Potential measurable benefits from federal investment in energy storage include grid resilience, reduced energy prices, equitable access to clean energy, and job opportunities.

44. How can applicants ensure community-based stakeholders/organizations (especially underserved communities) are engaged and included in the planning,

[40] As we understand it, the Climate and Economic Justice Screening Tool ("CEJST") was recently released by the White House Council on Environmental Quality ("CEQ") that aims to help federal agencies identify DACs as part of the Justice40 Initiative. Pending public feedback, the final tool should be made available and noticed to applicants to encourage the siting of LDES technologies and projects that align with EEEJ priorities of the program: https://screeningtool.geoplatform.gov/en/#3/33.47/-97.5

decision-making, and implementation processes (e.g., including community-based organizations on the project team)?

The DOE should engage local communities through community-based organizations in informing them of the program opportunities and in making information related to these opportunities more accessible by translating "industry speak" to real, understandable terms and benefits. Community-based organizations and local advisory committees can play a major role in serving as a conduit to these communities and a marketing, education, and outreach ("ME&O") channel regarding these program opportunities. To the degree feasible, having community-based organizations on the project team can signal buy-in and support from the local community in deploying the LDES technologies and projects that are the subject of any given application.

45. If DOE asks for a market analysis as part of the application process, what community attributes, proposed community benefits, or stakeholder engagement activities should the analysis include so that DOE can be confident that a proposed project will be successful?

To balance against overburdening the application process, a market analysis should not be required. Evidence of support or sponsors from communities or community-based organizations can serve as a reasonable proxy of engaging stakeholders and the buy-in to the community benefits that any given LDES project can provide. Success in delivering these community attributes and benefits will be ultimately tied to the successful execution, development, deployment, and operation of LDES projects. Plans to secure state or local permits could also be provided, which embeds a component of state or local approval of projects for various environmental, community economic benefit, labor, and/or cultural considerations.

46. What can DOE provide/do that would be helpful to a project to facilitate its collaborations with potential financing partners?

As discussed above, measures by the DOE to "buy-down" the risks or upfront costs of LDES projects can invite financing and insurance partners, especially as operational data is produced, and a bankable track record is built.

47. How can DOE support the applicants in working together to increase competitiveness and scale?

The DOE can support collaboration by requesting that applications detail the project team or co-applicants to potential LDES projects. These details could include the technical project development and EPC teams, coordination or contracting with a utility or off-taker, and buy-in from local community organizations and representatives.

48. Which regional and location-specific metrics should DOE track to estimate the environmental, social, and economic impact related to 41001 energy storage programs?

Some key metrics to estimate the environmental, social, and economic impact could include local jobs created (construction, operations, O&M) and local tax revenue generated. Since the vast majority of energy storage resources have no point-source emissions, the environmental impact is primarily driven by the charge-discharge operations of the resource and the system and local grid mix. Operational emissions impact can be challenging and complex to quantify and report directly from the applicant, but data submitted to the DOE can facilitate this analysis by DOE staff, if so desired, to calculate the marginal greenhouse gas ("GHG") emissions associated with the time of charge and discharge, or more systematically looking at run time of fossil-fueled generation resources.

49. Other than greenhouse gas emissions, what sustainability metrics (e.g., air emissions, pollutants) should DOE include in evaluating 41001 energy storage programs?

As explained in our response to Question 48, the vast majority of energy storage resources have no point-source emissions, including as it relates to local air quality and criteria pollutants (*e.g.*, NOx), so the environmental impact is primarily driven by the charge-discharge operations of the resource and the system and local grid mix. Again, operational emissions impact can be challenging and complex to quantify and report directly from the applicant, but data submitted to the DOE can facilitate this analysis by DOE staff, if so desired, to calculate the impact to starts and stops of fossil-fueled generation, if LDES operations can be attributed as impacting fossil-fueled generation in this way. More simply, if LDES resources can be aligned with their selection in grid planning processes that use capacity expansion and/or production cost models that optimize for GHG targets and other air quality and local pollutant considerations, then it should suffice for DOE's evaluation of environmental sustainability, where LDES generally supports renewables integration, helps displace fossil generation, and facilitates greater end-use electrification.

50. To what extent will the storage technologies be capable of demonstrating a path to economic viability after the BIL funded phases, and how should the FOA and project (once awarded) be structured to ensure this outcome?

DOE's goal is for clean energy technologies that it supports is to be sustainable beyond the BIL funding (*i.e.*, without additional government funding). In successfully achieving a first-of-its-kind commercial deployment at sufficient size and scale, an operational track record will be developed to support the LDES technology to be more bankable for follow-on 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,[41] modular LDES technologies that can achieve economies of scale and facilitate learning/cost curve opportunities[42] may represent a smart use of limited federal 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. Evidence of materials supply agreements and manufacturing plans could be used to demonstrate to this criterion.

51. What criteria can be used to ensure ethical sourcing of materials used in storage?

To prioritize LDES technologies and providers that use ethical sourcing of materials used in their energy storage systems, the DOE can seek documentation of pledges or commitments to avoid or reduce adverse outcomes from supplier behavior, and/or supplier codes of conduct[43] used by the LDES technology manufacturer for their upstream suppliers to utilize labor under safe working conditions, use environmentally-responsible practices, and act ethically in general. While pledges, commitments, and codes are only as good as how it is implemented and/or enforced in practice, they minimally demonstrate corporate alignment on the importance of corporate sustainability governance toward ethical sourcing.

While lithium-ion battery recycling and second-life use is improving and actively being developed, certain LDES technologies may also 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

[41] *See, e.g.*, Castaic Power Plant has been a reliable and long-lived (since 1973) asset for 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).
[42] 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/innovationin-energy-storage/
[43] This is a common practice in corporate sustainability governance. *See, e.g.*, Apple Supplier Code of Conduct: https://www.apple.com/supplier-responsibility/pdf/Apple-Supplier-Code-of-Conduct-and-Supplier-Responsibility-Standards.pdf

(including without degradation), thereby reducing the replacement or augmentation of storage units over time.

52. What might make 410001 energy storage programs more accessible to rural & remote communities?

To be more accessible to rural and remote communities, the program could make DOE staff available to provide technical assistance in developing LDES projects and in submitting applications or proposals for funding opportunities. In addition to facilitating access to the program, LDES projects that are physically located in rural and remote communities could provide direct benefits in the form of construction and/or ongoing operational jobs and the enhanced reliability and resilience provided by the LDES project itself. There may be specific use cases and applications where LDES projects can directly support these communities. In California, for example, rural communities are particularly vulnerable to Public Safety Power Shutoff ("PSPS") events to mitigate wildfire risks as well as other outage events.[44] Microgrids and LDES technologies can play a key role in supporting these communities directly.

53. How can 41001 energy storage programs be strategically deployed to best support communities or regions transitioning from fossil fuels?

The lowest-hanging fruit is for energy storage technologies to target peaking fossil-fueled capacity using the commercially available and deployed shorter-duration BESS technologies today. California and several other states and regions are already undergoing this transition.[45] As discussed above, LDES technologies present the next-stage opportunity to offset, replace in part or in entirety, and/or retire fossil-fueled generation serving more frequent 24x7 or contingency needs in certain cases and locations, where polluting assets require replacements from longer-duration assets and have shown a historical correlation of being located in low-income and disadvantaged communities as well as communities of color.[46]

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[44] *Rural County Representatives of California Comments on the Proposed Decision Adopting Phase 3 Revised and Additional Guidelines and Rules for Public Safety Power Shutoffs (Proactive De-Energizations) of Electric Facilities to Mitigate Wildfire Risk Caused by Utility Infrastructure* filed in Rulemaking 18-12-005 on June 10, 2021: https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M387/K561/387561689.PDF

[45] *See, e.g.*, Denholm and Margolis. *The Potential for Energy Storage to Provide Peaking Capacity in California under Increased Penetration of Solar Photovoltaics*, National Renewable Energy Laboratory report prepared under Task No. SETP.10310.11.01.14 for the U.S. Department of Energy (March 2018): https://www.nrel.gov/docs/fy18osti/70905.pdf; *The Fossil Fuel End Game: A Frontline Vision to Retire New York City's Peaker Plants by 2030*, PEAK Coalition Report (March 2021): https://www.peakcoalition.org/_files/ugd/f10969_e27774865535495598a21be0242560a8.pdf

[46] *See, e.g.*, Krieger, et al. "California Peaker Power Plants: Energy Storage Replacement Opportunities," PSE Healthy Energy (May 2020): https://www.psehealthyenergy.org/wp-content/uploads/2020/05/California.pdf

54. How can 41001 energy storage programs be more accessible to community-owned microgrids, publicly owned utilities, and utility cooperatives? What are the specific needs of community ownership models?

In California, many utilities or power purchasing programs are municipally-owned and/or integrated heavily within the local community it serves. Publicly-owned utilities, such as LADWP, and community choice aggregators ("CCAs") governed by local boards and/or city councils are generally very engaged with their respective local communities and stakeholders. By making program funds accessible to these entities will advance this objective of the DOE. We have no specific recommendations or comment on cooperatives and pure community ownership models.

Category 5: Additional Input

55. Please provide any additional information or input not specifically requested in the questions above that you believe would be valuable to help DOE develop 41001 funding announcements and opportunities, including any specific criteria that DOE may take into consideration in implementing 41001 energy storage programs.

We have no further comments at this time.

IV. CONCLUSION.

CESA appreciates the opportunity to provide these responses to the RFI and look forward to collaborating with the DOE in advancing LDES technologies and projects. Please do not hesitate to reach us at any time for further follow-up or questions.

Respectfully submitted,

Jin Noh
Policy Director
California Energy Storage Alliance

Sergio Dueñas
Policy Manager
California Energy Storage Alliance