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Derapi Response Docket 25-FDAS-01 BESS Appliance Standards

Additional submitted attachment is included below.

350 California St, 4th Floor
San Francisco, CA 94104

California Energy Commission
715 P Street
Sacramento, CA 95814

December 12, 2025

Re: Docket: 25-FDAS-01 Flexible Demand Appliance Standards for Battery Energy Storage Systems (BESS)

Derapi, Inc. is pleased to submit the following response to the Commission's Request for Information regarding appliance standards for battery energy storage systems.

About Derapi

Derapi (www.derapi.com) is a California-headquartered startup that provides software data infrastructure services to the Distributed Energy industry, including solar and battery storage installers, demand flexibility providers and energy management firms. Our software application programming interface (API) streamlines communication with behind-the-meter (BTM) distributed energy resources (DER) such as solar inverters, battery storage systems, and other smart energy devices. Our goal is to accelerate electrification and decarbonization by enabling energy consumers to unlock the full value of their investments through the use of data and communication technologies.

Executive Summary

We appreciate the CEC's efforts to support expanding flexible demand resources. However, the device capabilities the CEC seeks already exist—requirements and standards for BESS to provide grid flexibility are already in place for new installations in California. The CEC should avoid issuing duplicative device-level requirements. More critically, the absence of program-level standards poses a greater barrier. While device capabilities for grid flexibility are common, no standards exist for how load flexibility programs operate, resulting in significant variation across rate structures, signal types, and participation requirements. As highlighted in the Department of Energy Virtual Power Plant (VPP) Liftoff report[1], the biggest obstacles to BESS participation stem from variations in program design, operation, and valuation of flexibility—not device capabilities. Setting prescriptive device requirements prematurely risks creating specifications that are not aligned with future program designs, potentially requiring costly retrofits or constraining program flexibility. Standardizing how programs communicate requirements and compensate participation will allow the market to develop capabilities that efficiently meet those needs.

Responses to Questions

- Question 1: Scope

Should the CEC consider expanding the scope of FDAS to include commercial-scale, greater than 20kWh, BESS? What are the potential benefits, limitations, and challenges of including commercial BESS alongside residential systems in this regulation? Are there specific market

[1] DOE "Pathways to Commercial Liftoff: Virtual Power Plants 2025 Update"
https://www.smartenergydecisions.com/wp-content/uploads/2025/04/liftoff_doe_virtualpowerplants2025update.pdf

segments, system sizes, or control capabilities that would make commercial BESS appropriate for inclusion?

Response: We recommend that the CEC not expand FDAS to include commercial-scale BESS, because the demand flexibility capabilities already exist. Additionally, commercial-scale systems employ a wide range of hardware architectures and design approaches, making it impractical to design a single appliance standard that covers all permutations. Battery energy storage systems are fundamentally distinct from controllable loads due to their bidirectional capability. Including BESS in the Flexible Demand Appliance Standards, which are designed primarily for load control, risks inappropriately constraining these diverse use cases.

- Question 2: Control Point Definition

Should the CEC consider defining the "controllable node" as the point of regulation for residential BESS instead of focusing on multimode inverters? The controllable node refers to the component within a system that manages battery charging and discharging in response to external signals and user preferences. Would this approach better reflect the diversity of system designs and control architectures currently in use? What benefits or challenges might this shift present?

Response: Defining a controllable node is a more sound approach than defining a device-level standard. Device-level control precludes the ability to optimize across multiple devices at a customer site. However, such a standard would be redundant to and could conflict with existing standards, specifically IEEE 1547, which defines requirements at a Reference Point of Applicability (typically the Point of Common Coupling) rather than at specific devices. Industry discussions further caution that uncoordinated, device-centric control may concentrate curtailment or operational impacts on particular customers rather than enabling flexibility across all participating DER[2,3].

- Question 3: Capabilities

What software and hardware capabilities could enable residential BESS to relieve/eliminate grid congestion? How can control software be configured to respond to automated and/or manual override signals from the customer's BESS?

Response: Modern residential BESS already possesses the hardware and software capabilities needed to address grid congestion. These systems can monitor grid signals, respond to automated demand response programs, optimize charge/discharge schedules based on multiple objectives, and adjust behavior in real-time. The barrier is not in device capabilities—it is in providing BESS with proper control signals and mechanisms to be compensated for the services they provide.

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[2] IREC "Decision Options Matrix for IEEE 1547-2018 Adoption" https://irecusa.org/wp-content/uploads/2022/10/Decision-Options-Matrix-for-IEEE-1547-2018-Adoption.pdf

[3] EPRI "Getting Flexible about Interconnection" https://eprijournal.com/getting-flexible-about-interconnection/

- Question 4: Technology

How can a standard that integrates battery operation with grid conditions account for different BESS (AC coupled versus DC coupled) and use cases (self-consumption, backup power, and DR events)? What technical constraints could limit a BESS's ability to participate in flexible demand programs? What are the various operational modes (ex. backup, self-consumption, etc.) used for BESS, and how does BESS software prioritize between modes? What hardware and software are needed to enable BESS to provide grid services and optimize costs for customers? What percentage of residential BESSs currently receive grid signals (e.g., electricity prices, GHG emissions, and California Independent System Operator Flex Alerts) to schedule load shifting, demand response?

Response: BESS already possess the technical capabilities needed for these programs—the barriers to participation are regulatory and economic, not technological. At the system level, all flexible demand resources should be held to the same functional requirements, regardless of underlying architecture. Modern BESS software manages multiple operating modes through configurable hierarchies, including backup power, self-consumption, time-of-use optimization, demand response, and grid services. These systems typically prioritize maintaining minimum backup reserves first, then optimize for customer economics, and respond to grid signals when conditions and incentives warrant.

California's experience demonstrates this capability at scale. The state now has more than 200,000 behind-the-meter home battery systems, totaling over 2,000 MW of residential storage capacity[4]. Recent virtual power plant events have shown that over 100,000 of these batteries (more than 50%)—providing over 500 MW of capacity—actively respond to grid signals through programs such as the CEC Demand Side Grid Support (DSGS) initiative[5]. This percentage continues to grow rapidly. Therefore, the technical capabilities already exist; policy should focus on removing regulatory and economic barriers to participation.

- Question 5: Connectivity

What are the most common methods for communicating grid signals to BESSs (e.g., Ethernet, Wi-Fi, Cellular)? What are the costs and benefits of these methods that are identified? What are the strategies and technologies employed to enhance communication and connectivity for BESS in areas with limited infrastructure, poor communication, and connectivity?

Response: Derapi recommends **against** requiring specific connectivity methods. The choice of communication medium and link layer protocol is often determined by the physical circumstances of the site at which the equipment is installed. This includes existing

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[4] CEC "California Energy Storage System Survey"
https://www.energy.ca.gov/data-reports/energy-almanac/california-electricity-data/california-energy-storage-system-survey

[5] Brattle DSGS Press Release
"https://www.brattle.com/insights-events/news/brattle-report-finds-californias-distributed-power-plant-program-could-deliver-hundreds-of-millions-in-cost-savings-while-supporting-grid-reliability/"

infrastructure, building construction, geographic location, budget constraints, and reliability. A standard that prescriptively mandates specific connectivity methods would create unnecessary burdens in some scenarios (e.g., requiring wired Ethernet in homes without existing wiring) while potentially excluding viable solutions in others (e.g. prohibiting cellular in areas with poor fixed broadband). We recommend that the CEC focus on functional requirements—such as the ability to receive signals within specified timeframes and maintain communication reliability thresholds—rather than mandating specific prescriptive connectivity requirements. This outcome-based approach allows installers and customers to select the most appropriate and cost-effective solution for each installation's unique circumstances.

- Question 6: Protocols and Interoperability

What are the communication protocols or components of existing communication protocols that are used to enable load shifting capabilities for residential BESSs? What are the advantages and disadvantages of each of the communication protocols? What is the implementation status of these communication protocols? What are the industry-wide standard communications protocols currently in use or planned for BESS? What are the gaps and challenges to implementing load shifting capabilities? How can the standard ensure interoperability between BESS and other flexible demand appliances (e.g. EVSE, space conditioning and electric water heating), and various control systems (such as home management systems)?

Response: The CEC should avoid creating duplicative requirements when communication protocols are already addressed by CPUC Rule 21. The CPUC requires IEEE 2030.5 for communication with California IOUs as part of Rule 21. IEEE 1547-2018 requires DER equipment to support at least one of three standardized communication protocols: IEEE 2030.5 (SEP 2.0), IEEE 1815 (DNP3), or SunSpec Modbus. OpenADR is an additional open standard for automated demand response and flexibility services, but has experienced challenges when applied to BESS due to its cost, complexity and variations between implementations, and lack of backward compatibility between versions. Many BESS manufacturers provide their own cloud-based Application Programming Interfaces (APIs) that provide load flexibility functions as well as other features needed to monitor, maintain, and operate BESS equipment. These APIs can provide reliable communication that can be implemented quickly and adapt to the rapidly changing needs of the market. Furthermore, these cloud-based methods can be implemented without the cost and complexity of deploying additional hardware such as communication gateways. The main barrier is not communication capability, but rather the lack of a viable program structure and compensation mechanism that makes use of these capabilities.

Regarding interoperability between BESS and other flexible demand appliances: different flexible demand devices operate differently and are used for different purposes. It is impractical to impose a single standard across all devices, as accommodating the needs and capabilities of one device type could impose undue burdens on those of another type.

- Question 7: Cost Optimization and MIDAS Integration

How can a residential BESS best minimize customers' electricity costs both with and without self-generation (such as solar PV)? How can residential BESSs best utilize the CEC's Market Informed Demand Automation Server (MIDAS), which provides free access to utilities' time-varying rates, GHG emission signals, and California Independent System Operator (California ISO) Flex Alerts? More details can be found here:

Market Informed Demand Automation Server (MIDAS) (ca.gov).
a. Are there options for BESS systems to leverage signals from CEC MIDAS? What are the key functionalities that are required for BESS to respond to CEC MIDAS signals? Are there changes to MIDAS that would better support BESS load flexibility than the existing configuration?
b. Are there any strategies to best utilize BESS with Demand Response events? What is the role of BESS charging and discharging from the grid?

Response: Price signals should not be provided directly to devices, but rather to software systems that optimize across a customer's multiple objectives and preferences—and across multiple devices—and respond accordingly. This approach allows for coordinated control that balances cost minimization with other customer priorities, while accounting for the interaction between battery storage, solar generation, and other loads at the site.

The critical barrier to BESS participation in load flexibility is not technical capability, but rather the absence of adequate compensation mechanisms. There needs to be an efficient market mechanism to communicate the value of flexibility and provide full and fair compensation to the BESS owner and/or electricity customer. Without clear compensation structures, customers have limited economic incentive to prioritize grid-responsive behavior over self-optimization.

- Question 8: Cybersecurity

What are the cybersecurity challenges and needs associated with communicating signals from the grid or a third-party, and interacting with BESS? How would these cybersecurity protocol challenges be used to address the risks to both customer data and grid reliability? What are the risks and benefits of enabling remote software updates to incorporate new standards, and what processes can be used to mitigate these risks?

Response: The primary cybersecurity risk is signal interception and spoofing—unauthorized parties intercepting or falsifying grid signals to manipulate BESS behavior. The consequence of penetrating an individual BESS is limited given the relatively small scale of each device. The critical vulnerability lies at aggregation points where attacks could influence large numbers of BESS simultaneously: utility systems, aggregator platforms, SCADA infrastructure, program managers, and manufacturer cloud services. Existing industry best practices can mitigate these risks. Furthermore, Cybersecurity is addressed into standards IEEE 1547.3 and IEEE 2030.5. We recommend the CEC follow existing industry standards and practices rather than creating additional requirements.

- Question 9: Resilience and Vendor Lock-in

In the event of a loss of communication and/or connectivity, how should the residential BESS function? What are the potential risks and benefits of each approach, especially in terms of grid reliability, user experience, and long-term sustainability? What is the current status of interoperability standards that would allow previously installed BESS to point to a different cloud-software control layer if the original control layer is disbanded for business reasons?

Response: In the event of temporary loss of communication or connectivity, residential BESS should rely on default autonomous functions and/or follow the most recently issued commands. This ensures continued operation and prevents grid instability from communication failures while maintaining customer backup capabilities. Regarding vendor lock-in and cloud service discontinuation, multiple technical solutions already exist for previously installed BESS to point to a different cloud control layer:

1. Firmware updates enabling the device to point to a different cloud service
2. Acquisition of the relevant internet domain(s) and software licenses to maintain connectivity
3. Deployment of an on-site gateway connecting to a Modbus or IEEE 1547-compliant Local DER Communication Interface to bridge to a new cloud-based service

These capabilities are already required by IEEE 1547-2018 (and by extension UL1741 Supplement B and CPUC Rule 21). The standard mandates local communication interfaces that enable device control independent of manufacturer cloud services, providing protection against vendor lock-in.

- Question 10: Valuation Tools

Staff is considering using the California Public Utilities Commission's (CPUC) Avoided Cost Calculator (ACC) for internal data evaluation while CEC continues to draft a standard for residential BESS. To what extent is the ACC a reliable and valuable tool for forecasting hourly value for electricity import or export to the grid? Are there specific strengths or limitations in the ACC's methodology or assumptions that should be considered when valuing Net Billing Tariff for BESS? Are there other sources that CEC staff should consider in valuing or forecasting hourly value for electricity imports or exports to the grid?

Response: The ACC has significant limitations for valuing BESS flexibility. The ACC was designed to set compensation rates for net billing by calculating the avoided cost of generation—a fixed quantity intended to reflect utility cost avoidance, not the dynamic value of controllable flexibility. It reflects fixed export value rather than the controllable, dispatchable nature of BESS, and does not capture flexibility services such as load shifting, demand response, or strategic grid response. For valuing BESS flexibility, the CEC should consider alternative approaches including CAISO day-ahead and real-time market prices, utility distribution-level value signals, and capacity and ancillary service values. A framework should be developed to evaluate BESS on par with other grid resources based on the services they can deliver.

- Question 11: Customer Experience

What types of information or awareness campaigns do the Load Serving Entities (LSE) or other entities provide participants in the BESS installation program to help customers understand the benefits BESS provides? What percentage of customers have a residential BESS? What reasons do customers give for installing BESS at their residence? Do customers with residential BESSs have options for more than one rate structure? What tariff structure or options are utilized by the installed stock of BESS? Do customers with a residential BESS prefer a specific rate structure that LSEs or other entities provide? Do customers who add a BESS to their residence stay with their previous rate structure? What financial incentives or rate structures are most effective in encouraging customers to adopt and use for BESS? What are the estimated costs and benefits for customers of participating in the flexible demand program for BESS, including potential bill savings and the impact on BESS lifespan?

Response: Derapi does not have a position on this question.

- Question 12: System Design

When developing policy for residential BESS, should the CEC define all-in-one battery, controls, and inverter systems as distinct from systems where these components are housed separately? What are the benefits and challenges of each configuration in terms of installation flexibility, system scalability, maintenance, and overall cost-effectiveness, and should all-in-one systems be handled differently in regulation?

Response: No, the CEC should not define all-in-one battery systems as distinct from multi-component systems for regulatory purposes. Both configurations should receive equal treatment under any BESS standard. Creating regulatory distinctions between these configurations would impose unnecessary complexity without providing meaningful benefit. Both architectures can achieve the same functional outcomes for grid flexibility, cybersecurity, and communication capabilities. Further, existing standards such as IEEE 1547 do not distinguish between all-in-one and multi-component systems.

- Question 13: Data Sources

CEC staff based their California residential BESS stock estimates, growth rates, and load shapes on data provided by the CEC 2024 Integrated Energy Policy Report. Are there other California-specific information sources that staff should consider?

Response: Yes, the CEC should consider the CPUC's Distributed Generation Statistics (DGStats) database[6]. DGStats provides comprehensive, regularly updated data on distributed energy resources in California, including residential BESS installations, system sizes, interconnection dates, and geographic distribution.

- Question 14: Multifamily Access

What options are available for tenants and occupants in multifamily buildings to access financial benefits from BESS? How would the control software need to change to support load flexibility in this configuration? What, if any, BESS software options exist to allow building owners or operators to manage demand as well as provide grid services? Are there examples of tenant-or resident-owned BESS that could provide these services and could be cost-effectively moved with residents to future residences?

Response: Plug-in solar and storage systems offer a promising solution for multifamily tenants. These small, portable systems (typically 800-1,200 watts) plug into standard wall outlets without requiring utility interconnection or permanent installation. Utah became the first US state to enable these systems in 2025[7], and they are already widespread in Europe and gaining traction in New York, Pennsylvania, Vermont, and New Hampshire. For tenants, plug-in systems require no landlord approval, can offset electricity costs, and are portable—allowing residents to take them when moving to future residences. This addresses a major equity gap, as renters have historically been excluded from the benefits of rooftop solar and BESS. Building owners can install traditional shared BESS systems to manage whole-building demand and provide grid services, but the regulatory and billing complexity of allocating costs and benefits across individual units often creates barriers. The plug-in approach represents a simple, accessible pathway for multifamily residents to participate in distributed energy and grid flexibility without requiring complex building-level coordination or landlord cooperation.

- Question 15: Equity

What are the equity considerations for BESS, and how can FDAS address these issues in regulation? For example, are there concerns that flexible demand will be disproportionately accessible based on income level? Are there other factors or impacts that should be considered if there were to be disproportionate accessibility?

Response: The primary equity concerns for BESS are cost and access. The upfront cost of residential BESS remains a significant barrier, limiting participation to higher-income households. Additionally, renters and multifamily dwellers typically lack the authority to install BESS or do not directly benefit from such investments. FDAS standards would not address these equity issues. Device-level standards specifying technical capabilities or performance

[6] https://www.californiadgstats.ca.gov/
[7] "Plug-In Solar Power Could Be Coming to a Balcony Near You" https://www.sierraclub.org/sierra/plug-solar-power-could-be-coming-balcony-near-you

requirements do not reduce costs or expand access for disadvantaged communities. These are economic and structural barriers, not technical ones.

- Question 16: Miscellaneous

After reviewing the scope and questions posed in this request for information, are there additional issues or considerations that should be addressed by CEC staff?

Response: Barriers to BESS participation are not technical but stem from regulatory structure, policy design, and economics—specifically gaps in program standardization, valuation and compensation mechanisms, and market structure. Device capabilities will respond to program design and economic signals without needing explicit specification. Derapi recommends the CEC focus its efforts on developing these programs and market mechanisms before seeking to develop appliance standards.

Respectfully submitted by:

Thomas Lee, Founder & President

Caroline Hung, DERMS Policy Fellow