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## CA IOU Comments for FDAS EVSE RFI

*Additional submitted attachment is included below.*

December 20, 2024

Efficiency Division, Load Flexibility Branch
California Energy Commission
715 P Street
Sacramento, CA 95814

**Topic:** Request for Information (RFI) on Flexible Demand Appliance Standards for Electric Vehicle Supply Equipment

Docket Number: 24-FDAS-04
TN Number: 259603

Dear Commission Staff,

This letter comprises the comments of the Pacific Gas and Electric Company (PG&E), San Diego Gas and Electric (SDG&E), and Southern California Edison (SCE), collectively referred to herein as the California Investor-Owned Utilities (CA IOUs), in response to the California Energy Commission request for information (RFI) regarding flexible demand and load shifting opportunities for electric vehicle supply equipment (EVSE).

The CA IOUs comprise some of the largest utility companies in the nation, serving over 32 million customers in the Western United States. We are committed to helping customers reduce energy costs and consumption while striving to meet their evolving needs and expectations. Therefore, we advocate for standards that accurately reflect the climate and conditions of our respective service areas.

We respectfully submit the following comments to the California Energy Commission (CEC).

**The CA IOUs support the CEC's investigation of flexible demand appliance standards for electric vehicle supply equipment (EVSE) and will provide additional research by end of Q1 2025, in response to the RFI.**

This response focuses on a subset of questions. We intend to submit additional comments in response to other questions by end of Q1 2025. This additional time is necessary to effectively engage with a variety of key stakeholders.

The CA IOUs have ambitious targets to support California's clean transportation goals:

- PG&E intends to electrify a significant portion of its vehicle fleet and support the fueling of at least three million electric vehicles (EVs) within its service area by 2030. This initiative includes preparing the grid for 12,000 GWh of EV load and unlocking customer potential to participate in vehicle-grid integration (VGI) applications with the goal of enabling 550 MW of flexible load from those 3 million EVs.[1]

- SCE's Pathway 2045 White Paper commits to supporting electrification of 26 million light-duty vehicles, 900,000 medium-duty vehicles, and 170,000 heavy-duty trucks and buses by 2045.[2]
- SDG&E has set goals to support California's adoption of five million zero-emission vehicles by 2030 by expanding the charging network in its service area to accommodate cars, buses, trucks, shuttles, and more. They also aim to operate a 100% zero-emission fleet by 2035.[3]

Flexible EVSE is expected to significantly contribute to achieving 7 gigawatts of flexible demand by 2030[4], and will benefit customers throughout the state. The CA IOUs offer time-of-use rate plans for electric vehicles, allowing customers to save money by charging when electricity generation costs are lowest. We are piloting vehicle-grid integration opportunities to improve customer experience and grid stability and minimize grid upgrades needed to support the increased electric load from EVs.[5] We support an equitable energy transition by siting a substantial portion of our electric vehicle charging infrastructure (EVCI) investments in disadvantaged communities and providing support for multi-family housing residents with onsite, workplace, and public-destination charging ports.

At the same time, the CA IOUs are sensitive to potential increased costs associated with electric vehicle charging as EVs vie for market share against internal combustion engine vehicles. Supporting California ratepayers and ensuring low-income communities have access to an equitable share of EVs and EVSE is essential. Therefore, the CA IOUs emphasize obtaining accurate, current information about the capabilities, costs, and benefits of flexible EVSE and vehicle-grid integration capabilities. This guidance will help CEC policymakers develop flexible demand appliance standards for EVSE.

We respectfully submit the following information collected to date on several of the CEC's RFI questions. Upon completing our research on this topic, we will provide additional details that expand on the information below and respond to the remaining RFI questions.

1. **Please provide information to assist the CEC in determining whether the scope of devices in Table 1 of the RFI meets the needs of FDAS or if the CEC needs to consider revisions to the scope.**

While we intend to offer a more comprehensive response to the CEC's question regarding the potential scope of flexible demand appliance standards (FDAS) for EVSE, we highlight at this initial stage that considerable activity is currently underway in vehicle-to-grid (V2G) integration. This includes

[1] Pacific Gas & Electric, Inc., "PG&E Climate Strategy Report," June 2022, p. 20. https://www.pge.com/assets/pge/docs/about/corporate-responsibility-and-sustainability/pge-climate-strategy-report.pdf.

[2] Southern California Edison Corporation, "Pathway 2045," November 2019, https://newsroom.edison.com/_gallery/get_file/?file_id=5dc0be0b2cfac24b300fe4ca&ir=1.

[3] San Diego Gas & Electric, Inc., "SDG&E Clean Transportation Initiatives," SDGE, n.d., https://www.sdge.com/residential/electric-vehicles/electrification-projects-overview

[4] Brattle. 2024. "California's Virtual Power Potential: How Five Consumer Technologies Could Improve the State's Energy Affordability." Accessed Dec 19, 2024. https://gridlab.org/wp-content/uploads/2024/04/Californias-Virtual-Power-Potential-Vol-II-Technical-Appendix.pdf

[5] SDG&E Cajon Valley V2G Pilot: San Diego Gas & Electric Corporation, "Vehicle-to-Grid," sdge.com, n.d., https://www.sdge.com/business/electric-vehicles/power-your-drive-for-fleets/current-V2G-projects and SCE's Los Angeles Air Force base V2G pilot: Siddiq Khan and Shruti Vaidyanathan, "Strategies for Integrating Electric Vehicles into the Grid," *Aceee.Org* (American Council for an Energy-Efficient Economy, February 2018), https://www.aceee.org/sites/default/files/publications/researchreports/t1801.pdf.

developments in state and national policies, across numerous standards bodies, and research conducted by national laboratories and vehicle original equipment manufacturers (OEMs). Given these moving parts, we recommend that the CEC focus its scope by optimizing for simplicity, load-shift potential (by total kWh), and target market. Thus, we suggest that the CEC prioritize AC Level 2 EVSE, widely used in residential applications, for its first FDAS targeting this product and application.

2. **What is the current landscape of options for charging schedules that prioritize the driver experience, emissions reductions, financial savings, and/or other factors? Please provide information or data on customer receptiveness to various charging schedules, such as charge immediately, charge by departure, etc. and the entity who possesses such information.**

The CA IOUs recommend that the CEC engage vehicle OEMs and charging service providers for this data.

3. **Please comment on the various EVs or EVSE consumer charging preferences such as charge immediately or "charge by departure", where the EV is charged to a specified percentage with a set time to be ready.**

The CA IOUs recommend that the CEC work with vehicle OEMs and charging service providers to collect consumer data, including consumer charging patterns (e.g., a battery's state of charge before and after charging), charging duration time or charging speed, types of chargers, battery capacity, battery temperature before and after charging, weather conditions, time-of-day preference, and expected changes over time.

4. **When will DC charging equipment be available for residential installation? What are the expected use cases, penetration, price range and power level of DC equipment used in the residential sector? Would certain DC chargers installed at private residences require a Battery Energy Storage System to manage peak load?**

We will provide a more comprehensive response to the question of DC charging by end of Q1 2025. However, at this initial stage, we observe that DC charging comes with a significant incremental up-front cost relative to AC charging—approximately five times more expensive.[6] Some of this incremental cost is a result of additional functionality present in residential DC chargers, including bidirectional capability and integration with solar PV. As a result, DC charging is likely to be a low-volume premium product, appealing to customers seeking bi-directional (including V2G) capability[7] before bidirectional/V2G capability with AC charging is available.

5. **What software and hardware capabilities could enable public EVSEs to relieve/eliminate grid congestion at the Distribution (referring to Transmission and Distribution, T&D, for the grid) level? What control strategies are available to the grid operator and/or load aggregator to shift and/or curtail demand from EVSEs at the Distribution level to maintain grid reliability?**

We will provide a more comprehensive response proposing a definition of public EVSEs and the strategies, hardware, and software specific to that use case by end of Q1 2025. As an initial comment,

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[6] Svarc, Jason. "Bidirectional EV Chargers Review — Clean Energy Reviews." Clean Energy Reviews, October 28, 2024, https://www.cleanenergyreviews.info/blog/bidirectional-ev-chargers-review.

[7] "How Much Does the Home Energy Station Cost?" dcbel.energy, January 13, 2022. https://www.dcbel.energy/support/.

public and private chargers may use similar strategies, hardware, and software to implement flexible demand. However, public charging users may have less flexibility to shift or curtail charging sessions due to their shorter dwell time than overnight residential charging sessions.

6. **Similarly, what software and hardware capabilities are best suited to enable residential EVSEs to relieve grid congestion at the Distribution Level? What control strategies can be deployed by the grid operator and/or load aggregator to shift and/or curtail demand from residential EVSEs at the Distribution level to support grid reliability?**

Multiple pathways exist to enable residential EVSEs to relieve grid congestion at the distribution level. The options include, but are not limited to:

a) Networked EVSEs and automatic load management systems (ALMS) can connect to cloud-based services for grid-level and distribution-level events. To manage distribution-level congestion, the aggregator needs granular location data from the grid operator's cloud service to target specific EVSEs for demand curtailment. The cloud-based aggregator would use signals from the grid operator to determine when the local distribution network requires an EVSE to shift or curtail demand. The aggregator could then report on each EVSE's participation or opt-out behavior.
   - Standards are available for this connectivity, including OCPP, OpenADR, and IEEE 2030.5. We would like to note that the California Public Utilities Commission already ordered the CA IOUs to implement DERMS based on IEEE 2030.5[8,9]
   - A working example is MCE Sync,[10] an EV smart charging app that allows users to set charging needs (via a "ready-by" time) and allows MCE to schedule charging during off-peak times.

b) In the future, with the advanced metering infrastructure (AMI) 2.0 network, the grid operator could send address-level signals to EVSEs, either directly via AMI-communication capable EVSE[11] or via grid-edge applications[12] within the smart meter to communicate with connected EVSEs.

c) The message to shift or curtail can also come from aggregators. Aggregators could receive distribution-level grid signals from the operator and could then communicate to the vehicle OEM cloud. The OEM would use EV telematics and GPS information to confirm the location of a charging vehicle and send shift or curtail commands via the same interface. This would eliminate the need for a connected EVSE. Examples of this approach include:
   - PG&E's EPIC 4.04 pilot is described in a 2024 R&D Strategy report[13] as follows: "Working with WeaveGrid, PG&E launched a program that utilizes software to manage residential customers' EV charging. This program optimizes charging schedules based on grid conditions. The program, funded by EPIC 4.04, will evaluate if managing EV load can alleviate distribution grid constraints and extend the life of distribution assets while providing financial benefits to the customer."

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[8] California Public Utilities Commission. 2021. "Resolution E -5038." Accessed Dec 19, 2024. https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M401/K369/401369674.PDF

[9] Quality Logic. 2019. "IEEE 2030.5 Takes Off: The Latest News on the IEEE 2030.5 Standard." Accessed Dec 19, 2024. https://www.qualitylogic.com/knowledge-center/ieee-2030-5-takes-off/

[10] MCE, "MCE Sync: EV Smart Charging App," MCE – Community Choice Energy, November 19, 2024 https://mcecleanenergy.org/mce-sync/

[11] Aclara. "Aclara EV2c: Utility Controlled EV Charging." Website, 2024, https://www.hubbell.com/aclara/en/products/ev2c-level-2-evse/p/15655864.

[12] Itron, Inc. "Itron and PG&E Collaborate to Enable Real-Time Control of Electric Vehicle Charging With Grid Edge Intelligence," Iron.com, n.d., https://na.itron.com/w/itron-and-pge-collaborate-to-enable-control-of-ev-charging.

[13] Pacific Gas & Electric, Inc. "*R&D Strategy Report*," 2024, https://www.pge.com/assets/pge/docs/about/pge-systems/pge-rd-strategy-report-2024.pdf.

- BMW's ChargeForward program uses a similar approach.
- ChargeScape[14] builds upon the earlier Open Vehicle-Grid Integration Platform (OVGIP) collaborative effort led by the Electric Power Research Institute (EPRI) to create a software application that can connect various nodes and enable utilities to manage charging activity for a variety of grid needs.

d) Several "autonomous" functions could deliver load shifting without new hardware, software, or communication added to the EVSE or the vehicle. Many EVs and EVSEs offer scheduled charging features that are not connected to time-of-use (TOU) utility rates or real-time demand response signals. Instead, they can schedule charges to minimize consumption during known peak times (e.g., 4 pm to 9 pm daily). On-board EV or EVSE controls that manage charging by the "complete by departure time" settings are especially important to avoid so-called "snapback" effects, where new local peaks are created by timer-based charger control coming on at the same time, for example directly at the 9 p.m. rate change. Many OEMs offer this control, and it can autonomously manage charging to incorporate the added diversity inherent in driver and EV conditions and operations. This method can effectively reduce grid impact and ensure EVs are charged as desired without the cost of network control systems.

Generally, addressing grid congestion at the distribution level will require more geographically granular signaling of EVSEs than when addressing opportunities to reduce GHG emissions or relieve transmission and distribution congestion by managing EVSE operation. Furthermore, some distribution circuits' peak hours may not coincide with California ISO's peak hours. Responding only to price signals or greenhouse gas signals from the Market Informed Demand Automation Server (MIDAS), without having distribution circuit-specific capacity considerations, may inadvertently challenge the distribution circuit's reliability.

7. **What hardware and software are needed on the EV's Onboard Charging System to enable load shifting? What percentage of EVs currently receive grid signals (e.g., electricity prices, GHG emissions and California Independent System Operator Flex Alerts) to schedule load shifting, demand response, and/or bi-directional charging? What percentage of EVs require the EVSE to receive grid signals to schedule load shifting, demand response, and/or bi-directional charging? What are the most common methods for communicating signals to EVSEs and EVs (e.g. Ethernet, Wi-Fi, Cellular, AM/FM broadcast)?**

Multiple hardware and software combinations would yield the desired demand flexibility in EVSEs. In many cases, no specialized hardware is needed on the vehicle side to enable load shifting. The EVSE can orchestrate the load shifting on its own. The simplest way to do this may be to place an on/off relay into the AC supply side of the EVSE circuit that accepts the load shifting signals (e.g., via OpenADR, or IEEE 2030.5).

Load shifting can also occur without grid communication (via fixed scheduling). This method could achieve some of the benefits of grid-connected devices via TOU rates, as peak times for the California ISO tend to be predictable, with little change from day to day.

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[14] ChargeScape, LLC., "A Global Vehicle-grid Integration Platform," chargescape.com, 2024, https://chargescape.com/.

The latest EV models from most vehicle OEMs can receive and act upon grid signals via telematics (cellular connection). However, vehicles' telematics systems do not engage directly with utility programs at this moment. Instead, cloud service providers "connect" the vehicle back-office with the utility back-office to pass the information along. Likewise, EVSEs may connect to these cloud service providers via wireless/wired Ethernet or cellular connections.

Finally, almost all newer model EVs use 4G or 5G modems and have telematics capability, but none directly receive grid signals in the market. Customers must opt-in to utility programs that offer incentives for load shifting. Program participants may need to pay monthly for telematics coverage through their vehicle manufacturer. There may also need to be a cloud service (e.g., WeaveGrid, ev.energy) configured to transfer vehicle information between the utility and vehicle manufacturers' cloud. One key challenge in shifting or curtailing EVSE charging is receiving urgent customer priorities including departure time and required energy level (which would potentially override grid signals) to ensure customer satisfaction. Some EVSEs, including those with grid connection, may lack a data connection to the vehicle to confirm that charging can be delayed without adverse customer impacts (based on the current vehicle state of charge and future range needs). However, standards exist to support this communication. ISO 15118 is composed of a set of standards for communication between the EV and EVSE, utilizing power line communications (PLC) for Level 2 AC charging and DC Fast charging.

8. **(Focused on EV manufacturers) Is the EV telematics system used to receive grid signals (e.g., electricity prices, GHG emissions, and California Independent System Operator Flex Alerts) and schedule charging in response to those grid signals? If so, what is the monthly cost charged to the customer for these capabilities?**

The CA IOUs recommend that the CEC engage EV manufacturers and other stakeholders for this information.

9. **How can medium-duty and heavy-duty (MDHD) EVs and their EVSE fit into the CEC's goal of load shifting to avoid GHG emissions?**

Some MDHD fleets may take advantage of different electric rate schedules or price signals to maximize cost savings. These rates, whether available now or in the future, could signal the vehicles to charge when the grid's GHG emissions are low or to delay or curtail charging when the grid is constrained. However, other fleets, especially those with high volume or continuous operations, have a limited opportunity to delay charging.

A table from NYSERDA's *Managed Charging for Electric Vehicles White Paper*,[15] assumes a relatively slow uptake of TOU rates for many MDHD vehicle types. School buses, refuse trucks, and transit buses, are assumed to enroll in TOU rates more quickly than other MDHDs because they are better suited for load shifting due to their predictable schedules and long dwell times. Although California non-residential customers have already moved to TOU rates, this example illustrates how the willingness of different

[15] Adam Ruder et al., "Managed Charging for Electric Vehicles," *NYSERDA's Promise to New Yorkers* (New York State Energy Research and Development Authority, April 2022), https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Publications/Research/Transportation/22-09-Electric-Vehicle-Managed-Charging-White-Paper.pdf.

MDHDs to enroll in future dynamic rates or to opt-in to load flexibility signals might vary based on vehicle type.

**Table 11. MHDV Managed Charging Modeling Assumptions: Take-Up Rates**

| Vehicle Category | TOU Take-Up Rate 2020 | TOU Take-Up Rate 2030 | TOU Take-Up Rate 2040 | TOU Take-Up Rate 2050 |
|---|---|---|---|---|
| Light Commercial Trucks | 20% | 40% | 60% | 60% |
| Transit Buses | 50% | 80% | 95% | 95% |
| School Buses | 50% | 80% | 95% | 95% |
| Refuse Trucks | 50% | 80% | 95% | 95% |
| Single Unit Short Haul Truck | N/A | 20% | 40% | 60% |
| Combination Unit Short Haul truck | N/A | 20% | 40% | 60% |
| Single Unit Long Haul Truck | N/A | 20% | 40% | 60% |
| Combination Unit Long Haul truck | N/A | 20% | 40% | 60% |

MDHD applications with the greatest potential demand response impact have a typical dwell/connected time that is significantly longer than their charge time, allowing a shift inside the dwell window without impacting asset utilization. One area to evaluate is the number of chargers per MDHD EV. When vehicles are rotated for charging, the EVSE typically charges continuously, making it unsuitable for a load shift program.

While not a focus of this RFI, there are many electric powered vehicle accessories using shore power that could participate in flexible demand. As an example, hybrid-electric transportation refrigeration units (eTRUs) are increasingly used by internal combustion engine trucks and electrified trucks and trailers, replacing diesel cooling in some cases. An eTRU with battery backup or one that can precool the trailer and an incorporated thermal storage system using electric power could participate in short-term Flex Alerts. Each eTRU could reduce power consumption by 6 to 20 kW. However, one risk associated with load-shifting with eTRUs is the potential operation of the diesel engine and related emissions, so safeguards must be put in place to prevent this type of use.

Some overlap exists in light and MDHD charging equipment, with DC fast chargers used in both sectors. Thus, regulating DC fast chargers for one market segment may cause unintended consequences for another.

10. **Should the scope of this regulation include load shifting criteria for EVs such as forklifts, boats, and other off-road vehicles? Do off-road vehicles typically have a defined use-cycle that fits the need for load shifting? If so, which types of off-road vehicles? Please provide off-road EV counts, types of EVSE for off-road EVs, and charging strategies for off-road EVs.**

In a later response, we will provide estimates on the market scale for off-road EVs. However, our initial comment is that the CEC should exclude applications, such as forklifts, boats, and other off-road vehicles, from the scope of the first iteration of this regulation because of the small size of these segments in comparison and the operational business constraints presented by their operations.

11. **There are currently some buses that use wireless charging to top off batteries at bus stops. What are other applicable uses for wireless charging, and is wireless charging planned in your product roadmap? If so, when is wireless charging expected to be more widely available?**

We will offer a more comprehensive response to the CEC's question regarding current wireless charging applications and the timeline for further adoption. We note that wireless charging is available and has been demonstrated in the field and is in commercial use in some areas such as transit buses. We anticipate that wireless charging for autonomous vehicles will grow significantly, particularly among users of taxi and rideshare lines at airports, hotels, and other high-density areas. However, demonstrations of this technology are currently limited.[16]

12. **What are the charging practices for commercial fleets? Bus fleets? Overnight depot level charging? What power levels? How is the charging of the fleet managed? Manually rotated? Management software?**

The CA IOUs recommend that the CEC engage with fleet owners to obtain this data.

13. **Which communication protocols or components of existing communication protocols are used to enable load shifting capabilities for EVs and EVSE? What is the implementation status of these communication protocols? Are industry-wide standard communications and control protocols currently in use or planned? Are there remaining gaps to enabling load shifting capabilities?**

The CA IOUs participated in VGI Working Group #1, which conducted an extensive evaluation of communication protocols for VGI. Much of the analysis and conclusions there remain valid, but they could be updated with additional detail and could be enhanced with respect to new pathways, for example, in premise-based energy management systems and grid-edge AMI. We will detail relevant communication protocol advice further in our subsequent response. However, we believe that FDAS for EVSE should avoid tightly controlling potential communication standards. Technology is developing quickly, and manufacturers should not be constrained to specific versions of communication standards that could soon become obsolete.

[16] Florian Nägele and Shivika Sahdev, "Perspectives on Wireless and Automated Charging for Electric Vehicles," McKinsey & Company, April 3, 2023, https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/perspectives-on-wireless-and-automated-charging-for-electric-vehicles.

Lawrence Berkeley National Laboratory's (LBNL) *Survey and Gap Prioritization of U.S. Electric Vehicle Charge Management Deployments*[17] includes this graphic of the communication protocols at each stage, which is consistent with CA VGI Working Group #1 reports.

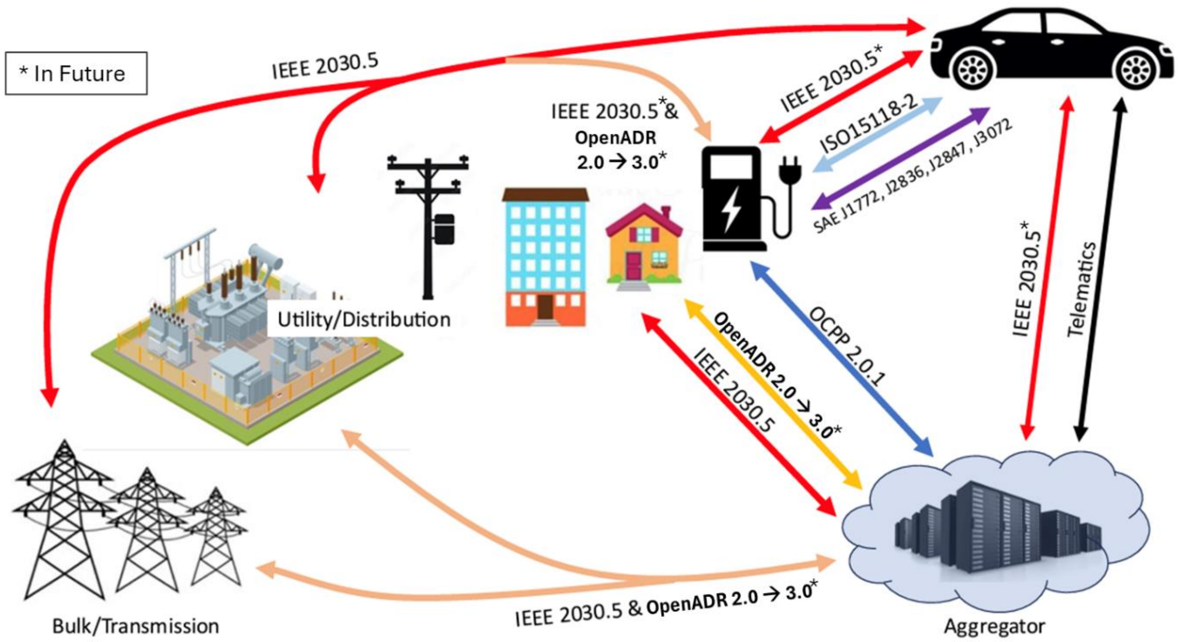


**Figure 8. Multiple communication pathways and protocols between EVs, EVSEs, aggregators, buildings, distribution systems, and bulk power transmission systems. This figure is not exhaustive, with several other possible pathways and configurations.**

14. **Does data exist on the effect of bidirectional charging on EV battery life? How is battery capacity affected by the frequency and level of bidirectional charging (for example, power level, total energy discharge, and so on)? Does this affect the warranties or insurance of the EV owner? If so, can the loss in value, if any, be quantified over the life of the battery?**

The CA IOUs recommend that the CEC engage with vehicle OEMs and battery manufacturers for this data. EPRI and NREL conducted a thorough study on this topic, which showed significant battery degradation from V2G. Further research is needed to validate this finding, especially regarding broader V2G applications. We note that a new report by P3 and AVILOO indicates that the battery life of popular EVs is longer than expected.[18]

15. **Can a load shift program work with EVSEs/EVs responding to generic signals, or must signals be tailored for each EVSE/EV?**

We will provide information to address this question in a subsequent response.

[17] Douglas R. Black et al., "Survey and Gap Prioritization of U.S. Electric Vehicle Charge Management Deployments | LBL ETA Publications," *Eta-Publications.Lbl.Gov*, 2024, https://eta-publications.lbl.gov/publications/survey-and-gap-prioritization-us.

[18] P3 Group GmbH, "Battery Aging in Practice," P3 Group GmbH, November 19, 2024, https://www.p3-group.com/en/p3-updates/battery-aging-in-practice/.

16. **What data or information is needed from the EV and/or EVSE to enable load shift while ensuring driver mobility and range needs are not compromised (for example, kWh needed by the vehicle)? How could this data or information be communicated across all vehicle and supply equipment models, regardless of the manufacturers' involvement?**

As discussed in question seven, ensuring driver satisfaction with load shifting is crucial for its effectiveness; otherwise, drivers may opt out of load-shifting features. Current VGI features in the market, including load shifting, typically rely on drivers to set preferences in the vehicle settings menu, including:

- Maximum state of charge (typically 80% to preserve battery life for NCM chemistry batteries, 90% for LFP, and noting that displayed SOC may differ from actual battery chemistry SOC).
- Minimum state of charge to enable charge scheduling (e.g., never defer charging if plugged in below 40% state-of-charge).
- Time/date and desired state of charge for departure (conservative use is recommended until drivers' preferences are better understood, though machine-learning can be a valuable tool for optimization).
- Desired preconditioning (i.e., cabin temperature for departure).

Although these variables are typically displayed to customers as "states of charge" for simplicity, they are processed as energy values (in kWh) in the vehicle's internal control system.

To ensure driver satisfaction with load shifting, the vehicle, vehicle OEM cloud, or vehicle OEM / EVSE mobile app must either:

1. **Communicate key information:**
    - Current energy level in kWh.
    - Desired energy level in kWh.
    - Intended departure time.
    - Customer minimum energy level in kWh.

   This information should be sent to an EVSE or another entity responsible for managing the charging session (e.g., ALMS controller). These energy levels are derived from the customer state-of-charge inputs, as described above.

   ***or***

2. **Manage the charging session:**
   - Use its on-board state of charge and customer preference data.
   - Combine this data with grid signals received from its telematics module.
   - Manage the charging session through the on-board charger.

Many EVs have these features fully developed and deployed. In many cases, vehicle manufacturers[19] and charging service providers have confirmed their support,[20] enabling customers to use their EVs to participate in utility demand management programs if they choose.

[19] Ford. 2024. "Ford Customer Experiences, Behaviors, and Performance in Vehicle - Grid (VGI) Integration Programs," DistribuTech 2024 Conference Panel.

[20] blink, "Demand Response Management for EVs," blinkcharging.com, February 21, 2024, https://blinkcharging.com/blog/demand-response-management-for-evs.

17. **What is the energy consumption impact from adding flexible demand capability to existing EVSE?**

While the potential to shift and curtail energy usage from EVSEs is significant, the energy penalty for this connectivity is negligible. In most cases, the incremental energy consumption is zero because many connected EVSEs already possess flexible demand capability, and energy is used for customer mobile app amenities.

When new communication equipment, such as a Wi-Fi module, needs to be added, the power consumption of these components is low, typically around 2 watts (W). For example, if a Wi-Fi module with a maximum power consumption of 2 W is added to an EVSE to enable load shifting, even if it operates at maximum power for 24 hours per day, it would account for only approximately 0.05% of the energy required to charge a mid-sized EV with a 100-kWh battery. This calculation is based on vehicle consumption data from the *ENERGY STAR Certified Electric Vehicle Chargers (AC-Output) Excel File Export*.[21]

*The ENERGY STAR Version 1.2 EVSE Specification*[22] has a "no vehicle mode power allowance" of 5 W for Wi-Fi or ethernet-connected EVSE and 7 W for cellular-connected EVSEs. Of the 192 AC EVSE without a cellular modem nor display listed in the ENERGY STAR® Certified List, the average "no vehicle mode input power" is 3.4 W.

18. **Please discuss strategies for EVSE to best utilize the CEC's Market Informed Demand Automation Server (MIDAS) which provides access to utilities' time-varying rates, GHG emission signals, and California Independent System Operator (California ISO) Flex Alerts?**

We will provide additional data in a subsequent response. Initially, we would like to note that an EVSE could integrate a software layer to communicate with the MIDAS API, enabling a daily data pull to optimize charge scheduling. Refer to LBNL's related response to questions nine and ten from the CEC FDAS Low-voltage Thermostat RFI that states, "…OpenADR 3.0 is so simple it could be put into a Wi-Fi light bulb," and "[t]he availability of dynamic prices may motivate thermostat manufacturing to build the capability to integrate with MIDAS."[23]

19. **What are the cybersecurity challenges and needs associated with communicating signals from the grid, or a third-party, to accomplish supplying energy to electric vehicles?**

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[21] U.S. Environmental Protection Agency (EPA) and U.S. Department of Energy (DOE), "ENERGY STAR Certified Electric Vehicle Chargers (AC-Output)," energystar.gov, n.d., https://www.energystar.gov/productfinder/product/certified-evse-ac-output/results.

[22] U.S. Environmental Protection Agency (EPA) and U.S. Department of Energy (DOE), "ENERGY STAR Program Requirements for Electric Vehicle Supply Equipment," *Energystar.Gov*, 2021, https://www.energystar.gov/sites/default/files/asset/document/ENERGY%20STAR%20Version%201.2%20EVSE%20Final%20Specification_0.pdf.

[23] Lawrence Berkeley National Laboratory, "Lawrence Berkeley National Laboratory Comments - Berkeley Lab Comments - CEC RFI Potential Flexible Demand Appliance Standards for Low-Voltage Thermostats (24-FDAS-03)," *Eta-Publications.Lbl.Gov*, November 27, 2024, https://efiling.energy.ca.gov/GetDocument.aspx?tn=260346.

As with most connected devices, the weakest link in the communication is the customer's Wi-Fi network. Authentication and end-to-end encryption of all signals are required to ensure cybersecurity for non-Wi-Fi systems,[24] which may involve building a "pass-through" capability in EVSE software. This action would prevent EVSEs from decrypting messages intended for direct transmission between the vehicle and the grid or vice versa. New endpoints (e.g., third-party servers or mobile apps) will introduce additional attack interfaces that the software developers for these entities must monitor.

On September 16, 2024, Southern California Edison, in work conducted under direction from the CPUC on behalf of California IOUs, filed a mid-term report on their progress towards completing a cybersecurity gap analysis "to identify potential gaps in existing cybersecurity protocols and EV charging equipment products used for transportation electrification (TE) programs, and to provide recommendations on how to address those gaps."[25] The report details ongoing collaboration between SCE and cybersecurity experts and organizations, including EPRI, national laboratories, and the United States (U.S.) Department of Energy (DOE) Vehicle Technology Office in advancing EV charging cybersecurity.

**20. Are there any considerations to ensure equity when developing a load shifting strategy for supplying energy to electric vehicles? For example, are there concerns that flexible demand will be disproportionately accessible based on income level?**

An intentional equity focus is vital when developing a load shifting strategy for EVs, especially as EV adoption is more prevalent in higher-income neighborhoods.[26] The maturing pre-owned EV market and substantial incentives for low- to moderate-income (LMI) households can help increase broader EV adoption. However, effectively targeting and ensuring inclusivity in flexible demand initiatives is crucial to equitable distribution of benefits.

We share the following equity considerations at this initial stage and note that regional and local stakeholder engagement can most effectively identify location-specific barriers and methods to increase equitable access and adoption.

*Housing and Household Characteristics*

- Single-family housing typically has charging equipment accessible to only one household, while multi-family housing often has shared charging equipment, making demand flexibility less feasible.
- California homeowners are three times as likely as renters to own an EV[27] and have autonomy over installing and operating their home charging equipment. Renters typically require approval to install any charging equipment, limiting access to associated flexible demand programs and

[24] "*V2G Cybersecurity: EVSE: DITM*" a presentation from EPRI at the V2G Business, Policy & Technology Forum (Oct 23-24, 2024).

[25] Southern California Edison, Inc., Janet S. Combs, and Rebecca Miers-De Pastino, "Southern California Edison Mid-Term Vehicle-Grid Integration Strategies Report," September 16, 2024, https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M540/K719/540719872.PDF.

[26] Nadia Lopez and Erica Yee, "Who Buys Electric Cars in California — and Who Doesn't?, CalMatters, March 22, 2023, https://calmatters.org/environment/2023/03/california-electric-cars-demographics/.

[27] Lucas W. Davis, "Evidence of a Homeowner-renter Gap for Electric Vehicles," *Applied Economics Letters* 26, no. 11 (September 24, 2018): 927–32, https://doi.org/10.1080/13504851.2018.1523611.

EV purchasing options. They are more likely to purchase an EV if they are assured access to charging at their future residence.

- Households with ad-hoc or inconsistent vehicle usage may not be able to participate in many flexible demand initiatives. For example, drivers with inconsistent or unpredictable shift work may not be able to realistically commit to charging their vehicle at specific times or to anticipate when it will need a full charge.

*Supporting Technology*

- Public charging availability can positively influence EV adoption, but as with shared multi-family charging, it may not allow for easy participation in flexible demand initiatives. Customers also strongly prefer at-home charging, and reliance on public charging could increase fuel costs.[28]
- Some equipment types may help lower barriers to EV adoption and flexible demand program participation. For example, AC V2G equipment is much more affordable than DC equipment, which increases its access to users and its likelihood to be used for flexible demand programs.

*Distribution of Benefits*

- Flexible demand solutions should be compatible with California Alternate Rates for Energy (CARE), Family Electric Rate Assistance (FERA), and other income-qualified discount rates and programs. Ensuring households can stack the benefits of their existing discount rate with EV load flexibility programs can reduce uptake barriers and more equitably distribute the benefits of these initiatives.
- Targeting specific geographic areas, such as disadvantaged communities as defined by CalEnviroScreen 4.0, may not effectively deliver load-shifting benefits at the household level.
- Gasoline "superusers" below the state median income comprise over one-third of high-gasoline consumption drivers.[29] These individuals may disproportionately benefit from EV adoption coupled with participation in flexible demand initiatives, though presumed shorter dwell times could limit participation.
- Involving priority customers, such as LMI consumers or households in geographically disadvantaged communities, in flexible demand programs may require tailored methods of consumer education and engagement.[30]
- Some publicly-owned utilities do not currently offer time-of-use rates, therefore load shifting of EVSE would not provide customer bill-saving benefit in those service areas.

Considering the characteristics of LMI EV drivers leads to the following design guidelines for an EVSE FDAS:

A FDAS focused on stand-alone EVSEs would be more accessible and beneficial to single-family homeowners, who do most of their EV charging with a single EVSE located at their home and under an

[28] "*EVI-Equity*" a presentation from NREL at the Vehicle Technologies Office Annual Review (Jun 21, 2022).
[29] Matthew Metz et al., "Cracking the Gasoline Code," *Coltura.Org*, 2024, https://coltura.org/wp-content/uploads/2024/01/Gasoline-Superusers-3.0-Full-Report-Coltura-2024.pdf.
[30] Union of Concerned Scientists. "Flexible Demand Opportunity," January 22, 2020, http://www.ucsusa.org/resources/flexible-demand-opportunity.

electric utility account in their name. LMI EV drivers are more likely to live in homes that cannot easily accommodate personal EVSE and are more likely to use public or shared chargers. These drivers can still take advantage of EVSE demand response programs. For example, Tesla maintains a network of 40,000 L2 "destination chargers" that can be used by any Tesla owner, including LMI drivers without EVSE at their homes. If the FDAS requires EVSE to accept and integrate user information, such as the planned connection duration, the destination chargers can adjust charging to take advantage of fluctuating rates and ensure the vehicle receives the desired charge.

LMI drivers are more inclined than non-LMI drivers to choose preowned vehicles, including EVs. As EV technology evolves, each model year brings advancements, including improved telematics and power train configurations. While these new technologies will eventually reach preowned EV drivers, non-LMI drivers will likely have moved on to the latest advancements. Consequently, the EVs driven by LMI and non-LMI drivers may differ in age and technological sophistication. Therefore, to serve LMI drivers as well as non-LMI drivers, the FDAS should accommodate older EV technologies in addition to new products.

The CA IOUs appreciate the opportunity to provide these comments regarding the Flexible Demand Appliance Standards on Electric Vehicle Supply Equipment. We thank the California Energy Commission for its consideration and look forward to the next steps in the process.

Sincerely,

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