DOCKETED	
Docket Number:	24-FDAS-04
Project Title:	Flexible Demand Appliance Standards for Electric Vehicle Supply Equipment
TN #:	260786
Document Title:	Vehicle-Grid Integration Council (VGIC) Comments - Response to Flexible Demand Appliance Standards EVSE RFI
Description:	N/A
Filer:	System
Organization:	Vehicle-Grid Integration Council (VGIC)
Submitter Role:	Public
Submission Date:	12/20/2024 6:46:18 PM
Docketed Date:	12/23/2024

Comment Received From: Vehicle-Grid Integration Council (VGIC)
Submitted On: 12/20/2024
Docket Number: 24-FDAS-04

Response of VGIC to Flexible Demand Appliance Standards EVSE RFI

Additional submitted attachment is included below.

December 20, 2024

Email to: docket@energy.ca.gov
Docket Number: 24-FDAS-04
Subject: Flexible Demand Appliance Standards for Electric Vehicle Supply Equipment

RE: Comments of the Vehicle Grid Integration Council on the Request for Information (RFI) Flexible Demand and Load Shifting in California for Electric Vehicle Support Equipment

Dear Sir or Madam:

The Vehicle-Grid Integration Council (VGIC) appreciates the opportunity to provide comments on the California Energy Commission's (CEC) Request for Information (RFI) on setting a Flexible Demand Appliance Standard (FDAS) for electric vehicle supply equipment (EVSE).

INTRODUCTION

There are many factors to consider when setting a Flexible Demand Appliance Standard (FDAS) for Electric Vehicle Supply Equipment (EVSE). The increasing adoption of electric vehicles (EVs) will create significant opportunities for California to unlock the grid benefits provided by EVs.

At the same time, EVSE and EV load shifting are distinct from other flexible loads currently addressed or under consideration for FDAS standards, such as pool pumps, water heaters, and HVAC/thermostats. Unlike these appliances, which are stationary and used in similar ways by large groups of customers, EV charging behavior varies widely. For example, the FDAS standard for pool controls includes a default schedule for equipment operation, which works well because most pool equipment is used in a predictable and uniform manner. Setting a default schedule therefore does not significantly impact the consumer experience.

In contrast, EV charging needs are much more diverse. For instance, some customers, such as business fleets, may charge daily on predictable schedules, while others charge sporadically every few days at public charging stations. Most customers will also face specific occasions, such as road trips, that dramatically alter typical charging patterns. These varied and dynamic needs make it unlikely that a single "default schedule" would work for all customers. To maintain a positive charging experience, the CEC must ensure that any FDAS standard accommodates these nuances.

Furthermore, the FDAS team should be mindful of the risk associated with imposing duplicative standards or standards that fail to consider broader discussions already underway within the CEC and other agencies. For example, the CEC's vehicle-grid integration docket (22-EVI-06) addresses interoperability standards between EVs and EVSE. Similarly, the CEC's Reliability, Renewable

Energy & Decarbonization Incentives (RREDI) Division has developed the Demand Side Grid Support (DSGS) program to explore leveraging EVs for emergency demand response. The California Public Utilities Commission (CPUC) has a Transportation Electrification team examining all aspects of the EV transition and its impact on California's electric grid. The CPUC currently oversees a wide range of pilots and programs that seek to unlock load flexibility from EVs. The CPUC is also working on implementing communication standards for EVs, EVSE, and other distributed energy resources (DERs) to enable these technologies to provide grid benefits, including through smart inverter standards and power control systems. Extensive discussions have already taken place in these venues. FDAS developments related to EVs should seek close coordination with these efforts.

In the following comments, VGIC responds to the outlined questions, drawing on information and insights from VGIC members and other stakeholders.

RESPONSES TO QUESTIONS

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.

Customers in California are currently able to conduct their charging in the way that best suits their driver experience and related factors. However, certain measures have been implemented to optimize charging around times of low system costs through time-of-use rates, dynamic pricing pilots, and managed charging programs, as detailed below. Notably, most existing utility rates are limited in their design as they shift charging load away from times of high bulk system demand and/or low supply on the electric system, but do not address more localized distribution system constraints.

Available customer managed charging programs are typically separated into two broad categories, which have been outlined by the Smart Electric Power Alliance (SEPA):[1]

- **Passive Managed Charging:** This charging method, also known as behavioral load control, relies on customer behavior to affect charging patterns. Price signals are often utilized in passive managed charging programs to influence customer charging behavior,

[1] Smart Electric Power Alliance (SEPA), *The State of Managed Charging in 2024*, September 2024. Available at: https://sepapower.org/resource/state-of-managed-charging-in-2024/

but ultimately, the customer remains in control of the vehicle charging.

- **Active Managed Charging:** This form of managed charging, also known as direct load control, supersedes customer charging behavior and imposes utility preferences on charger functionality. Charging is controlled by communication signals sent from a utility, solution provider, or aggregator to a vehicle or charger. Active managed charging can be event based, where load is controlled during a limited number of events in a given time period. Active managed charging can also be continuous, which enables more constant control that is responsive to grid conditions on a more granular scale.

Static time-of-use (TOU) rates, the most popular passive managed charging tool, are available to most customers in California. Most load-serving entities offer some form of TOU rate with an evening peak period and seasonal differences, with summer and winter having different rates. The California investor-owned utilities also offer TOU rates marketed specifically to EV customers that have a larger peak to off-peak price differential to further encourage off-peak charging. Some of these rates are applied solely to the EV load, especially for separately metered commercial EVs or public charging stations, in order to prevent those rates from being placed on loads that are not as flexible.

California is also making investments to implement dynamic rates that include hourly prices (instead of longer peak/off-peak periods) that are published daily. As envisioned by the CPUC's *CalFUSE* framework, automation service providers (ASPs) would optimize a customer's charging load in response to these price signals once the updated prices are received.[2] These dynamic rates are still in the early pilot stage. PG&E and SCE both have technology neutral hourly dynamic rate pilots that are offered to all bundled customers and CCAs can opt-in to participation.[3] VGIC is not aware of any EV ASPs or EV charging customers participating in either of these pilots.[4] PG&E recently launched an EV-specific hourly rate pilot as part of its Vehicle to Everything (V2X) Pilots: Phase II.[5] These approaches, although they have experienced limited customer participation to date, offer a potential path to comply with the CEC's Load Management Standards, which require the large load-serving entities to offer hourly rates to customers. In the rollout of these *CalFUSE* dynamic rates, it is expected that automation and active control of devices will play an important

[2] CPUC, Advanced Strategies for Demand Flexibility Management and Customer DER Compensation, June 22, 2022. Available at: https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/demand-response/demand-response-workshops/advanced-der---demand-flexibility-management/ed-white-paper---advanced-strategies-for-demand-flexibility-management.pdf

[3] See more information on the "Expansion of PG&E and SCE System Reliability Dynamic Rate Pilots" here: https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/demand-response/demand-flexibility-oir/pilot-expansion-2024.pdf

[4] SCE recently requested an extension to implement its pilot due to implementation barriers related to the underlying billing system.

[5] See PG&E's Vehicle-to-Everything (V2X) pilot program at: https://www.pge.com/en/clean-energy/electric-vehicles/getting-started-with-electric-vehicles/vehicle-to-everything-v2x-pilot-programs.html

role in customer participation in these rates. However, it is important to note that most customers will not be equipped to process hourly rates and optimize their charging behavior without the assistance of third-parties that will help customers schedule their charging to minimize bills.

There are also other types of active managed charging programs which have been piloted in California and implemented at scale in other states. For example, PG&E's long-running BMW ChargeForward Pilot allows BMW to send out signals to EVs to shift charging to times with higher renewable energy on the grid.[6] PG&E's new Charge Manager program, launched in partnership with WeaveGrid, actively manages EV charging load in areas with high EV penetration.[7] Baltimore Gas and Electric's (BGE) Distribution-Level Managed Charging Program shows the significant benefits of active managed charging programs and is discussed further below in response to question 6. At this time, active managed charging programs are not available to all California customers. However, going forward, VGIC anticipates that utilities, including California utilities and load-serving entities, will continue expanding active managed charging programs given the benefits relative to the above-noted *CalFUSE* approach and TOU rate designs.

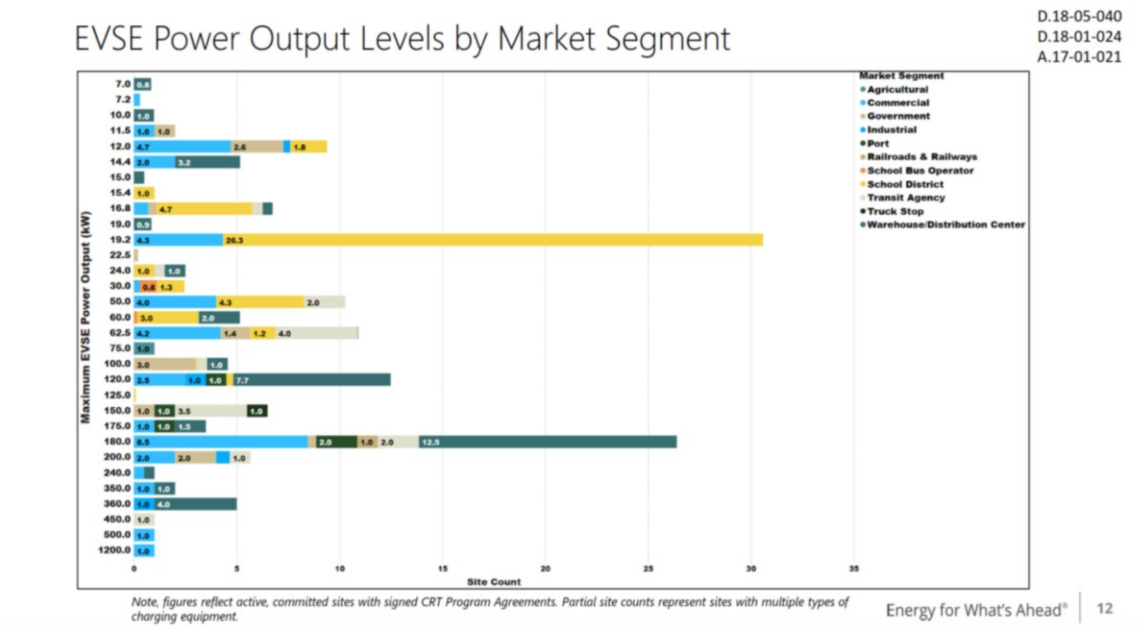
3. Please comment on the various EVs or EVSE consumer charging preferences such as charge immediately or "charge by departure", where the EV is charged to a specified percentage with a set time to be ready.

There are many entities looking at customer mobility needs and driving habits and associated preferences for different charging schedules to meet those mobility requirements. Some reports on consumer charging habits and preferences have been released by Plug In America,[8] Escalent,[9] and Consumer Reports.[10]

VGIC reiterates that EV charging preferences are *diverse* and VGIC expects that preferences will change over time as EVs become more common and consumers become more familiar with the technology. For example, the EV market is currently dominated by consumers that have access to private charging at home, and, notably, most charging is currently done at home.[11] However, most Californians are renters or may never have access to at-home charging and may rely more on public chargers. Small, medium, and large business and municipal fleets across light-, medium-, and

[6] BMW ChargeForward: https://www.bmwchargeforward.com/
[7] EV Charge Manager: https://www.pge.com/en/clean-energy/electric-vehicles/ev-charge-manager-program.html#accordion-73ce7b7a8a-item-6b1709a091
[8] See Plug In America, 2024 EV Driver Survey at: https://pluginamerica.org/survey/
[9] See Escalent EV consumer studies at: https://escalent.co/industries/automotive-and-mobility/evforward/
[10] See work by Consumer Reports on EV charging experience at: https://advocacy.consumerreports.org/press_release/consumer-reports-launches-effort-to-better-understand-ev-charging-experience/
[11] Plug In America, 2024 EV Driver Annual Survey Report, pg. 15. Available at: https://pluginamerica.org/wp-content/uploads/2024/09/2024-Plug-In-America-EPRI-EV-Driver-Survey-Report_Final.pdf

heavy-duty classes are all currently exploring how to best manage charging for their own needs. These mobility needs are very different from private passenger vehicles and extremely diverse across sectors. For example, Southern California Edison has shared the below range of EVSE power levels by sector, which ranges from 7 kW to 1,200 kW.[12] Note this is the largest nonresidential make-ready program in the country, offering a relatively large sample size demonstrating the immense variation in site characteristics.



Given the considerable diversity of mobility needs across consumers, it will be most beneficial for customers to be given a wide range of charging schedules and managed charging programs to find what best fits their specific needs and internal cost-benefit calculations. Offering a variety of options can enhance public acceptability and feasibility by tailoring approaches to the diverse needs of customers and stakeholders.

By offering a portfolio of charging schedules and managed charging options, the CEC and other stakeholders can experiment with more innovative rate schedules (like LMS-compliant rates and CalFUSE pilots), utility managed charging programs, and customer engagement strategies. All of this will provide real-world data on consumer preferences and needs to drive long-term EV policy.

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

[12] Southern California Edison, Transportation Electrification Program Advisory Council, March 8th, 2024, pg. 12 (Charge Ready Transport).

residential sector? Would certain DC chargers installed at private residences require a Battery Energy Storage System to manage peak load?

DC EVSE for the residential sector already exists and is being deployed at homes. In particular, existing bidirectional EVSE is almost exclusively leveraging DC equipment to enable the discharging pathway. Today's residential bidirectional DC EVSE equipment is unique as it charges the EV battery using an AC configuration and uses DC configuration to discharge via a separate inverter. Examples of these residential bidirectional DC EVSE are:

- Ford Charge Station Pro: 19.2 kW, $1,310[13]
- GM Energy Powershift Charger: 19.2kW, $949[14]

Outside of the bidirectional charging use case, it is uncommon for DC chargers to be installed in residential settings at this time, since electric upgrades needed in most homes to unlock this capability are often lengthy and cost prohibitive.

Residential DC EVSE do not necessarily require the installation of onsite energy storage to manage peak load. However, customers may choose to install battery energy storage in conjunction with their bidirectional DC EVSE, and unidirectional DC or AC EVSE, to help reduce their electric bills and to provide backup power to charge their vehicles during outages. Automakers, EVSE providers, and solar + storage providers are beginning to offer comprehensive solutions to residential customers that include solar, stationary storage, and bidirectional EVSE. These can be operated to create optimized residential systems that can minimize electric bills, greenhouse gas emissions, and have extended backup power capabilities.

Ensuring that bills are properly managed when installing bidirectional charging equipment is especially important because these systems are more expensive than standard, unidirectional AC EVSE. The bidirectional DC EVSE price points above exceed the typical unidirectional Level 2 EVSE price points.[15] This is before installation costs or other electrical upgrade costs needed to install the equipment.

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?

[13] See the Ford Charge Station Pro: https://chargers.ford.com/ford-charge-station-pro
[14] See GM Energy PowerShift Charger: https://gmenergy.gm.com/for-home/products/gm-energy-powershift-charger
[15] https://blog.carvana.com/2021/07/how-much-does-it-cost-to-install-an-ev-charger/

VGIC notes that there is considerable work underway related to flexible EVSE service connection, which specifically supports T&D deferral/avoidance, including at public charging stations. This work is spread across ad-hoc pilots from PG&E (Flex Connect pilot) and SCE (Load Control Management Systems pilot) and procedural references (i.e., in CPUC's High DER proceeding, Energization Timelines proceeding, Transportation Electrification proceeding, and Rule 21 proceeding). VGIC recommends the CEC and CPUC coordinate closely to identify a venue to define the required capabilities, develop the processes and tools needed for implementation, and adopt any resulting utility tariff changes.

Aside from PG&E and SCE's emerging flexible service connection pilots, broad time-of-use signals and demand response events are used to discourage EV charging at times of system-wide peak. General time-of-use periods provide signals to increase or reduce charging loads that may coincide with times of congestion at the distribution level, but not always. Critically, different distribution substations and circuits can have local peak times outside of the typical 4-9pm time-of-use peak. Similar to time-of-use rates, demand response programs signal events to participating customers to reduce load, but events are typically based on broad times of stress for an entire utility or the California grid as a whole.

The ability of EVs and other distributed energy resources to provide more localized congestion relief and additional distribution grid services has been discussed in the Smart Inverter Operationalization Working Group.[16] The Working Group found that enabling operational flexibility in charging (and potential bidirectional charging) will best unlock distribution services for EVs. This means allowing for both firm and non-firm/dynamic electric import limits and more granular grid signals. The CPUC has yet to identify how to enable this through flexible service connections that allow EV chargers to connect to the electric grid without using their full import capability on a 24x7 basis. These flexible service connections could allow for a static import limit schedule to be set or for dynamic (i.e., daily, weekly) schedules to be sent, both based on local grid conditions.

Additionally, dynamic rates can provide more granular signals for distribution congestion management, specifically dynamic distribution capacity price signals based on current or forecasted grid conditions. The CEC's Load Management Standards require that load-serving entities implement dynamic distribution components within the LMS-compliant optional rates. As detailed in VGIC's response to question 3 above, the CPUC has authorized *CalFUSE* pilots that include dynamic distribution components. Many of these rates are broadly applicable to different

[16] Xanthus and Verdant, Smart Inverter Operationalization (SIO) Working Group Report, February 1, 2024, prepared for CPUC Rulemaking 21-06-017. Available at: https://gridworks.org/wp-content/uploads/2024/02/Smart-Inverter-Operationalization-Working-Group-Report-Feb.1.24.pdf

customer types or technologies, but PG&E's Vehicle-to-Everything (V2X) pilot programs include Hourly Flex pricing and are specifically available to EV charging customers.

In order to unlock these local dynamic responses for T&D value, the following technical solutions can be used:

- Power Control Systems (PCS): PCS describes software functionality that dynamically manages loads by sensing site-level demand and autonomously adjusting connected devices to remain within a specified limit, thus allowing a customer to operate within the rated capacity of their service connection.

- Automated Load Management (ALM): ALM systems help manage the electrical load of public charging stations by automatically allocating power across multiple chargers to reduce the amount of power being drawn from the grid. Multiple companies offer these types of solutions, and different software solutions can help to better optimize power distribution to prioritize different customer needs, etc.

- Energy Management Systems: Similar to ALM, energy management systems help to optimize power draws, but instead of focusing solely on EVSE, the system is focused on managing load at the entire site. Broader energy management systems are often used to manage onsite DERs, such as energy storage to reduce power draw from the grid when needed.

- Distributed Energy Resources Management System (DERMS): DERMS is a platform which helps distribution system operators, typically utilities, manage their grids that include significant numbers of distributed energy resources (DER). DERMS are not a part of EVSE internal functioning but EVSE may be enabled to communicate with DERMS platforms to receive grid signals or send data to the utility.

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 support grid reliability?

Some of the software and hardware capabilities discussed above apply to residential use cases, including energy management systems. Smart electrical panels that allocate power between different circuits or large loads in the home can also be used to balance load between EVSE and other home needs. Utility DERMS and software to communicate grid signals may also facilitate distribution system congestion relief. As discussed below, software to orchestrate charging behavior may be particularly high-value in the residential context, even where this software will not be located on each individual EVSE.

Similar to control strategies for public chargers, time-of-use rates are still the most common control strategy used to reduce EV demand. Dynamic rates with a dynamic distribution component are also being piloted for residential customers through PG&E's V2X Pilot: Phase 2, which can create more localized price signals for distribution grid management, although participation is limited to customers with bidirectional charging equipment. Additionally, demand response programs are available for residential customers, such as the Emergency Load Reduction Program (ELRP) and Demand Side Grid Support Program (DSGS). These demand response programs are focused on alleviating system peaks, but programs can be targeted to more localized distribution system needs.

Active managed charging programs are proving highly valuable in unlocking the full potential of residential EV charging flexibility to manage distribution congestion. As TOU peak periods shift EV charging away from system peak times, the risk of distribution congestion from EV charging increases as "secondary peaks" emerge (often referred to as "timer peaks" or "snapback peak"). For example, using a high time-of-use rate from 4-9pm may result in managed EVSE load that avoids charging during this period. However, when the 9pm off-peak period starts, charging demand may surge as pre-programmed EV/EVSE devices begin charging. At a system level, this increase in demand is relatively minimal, but it can have outsized impacts on individual distribution circuits. This problem can be particularly acute given the geographic clustering of EV charging. In the residential sector, EV adoption has been clustered in specific neighborhoods.[17] For commercial MDHD fleets, charging is expected to also cluster, for example in warehouse parks and commercial corridors, with the potential for even more outsized distribution impacts given the size of MDHD charging depots compared to residential charging. Given California's broad EV adoption goals, secondary peaks may also have system-wide impacts in the long-term.

To manage these secondary peaks, different jurisdictions are developing staggered charging approaches. These send tailored signals to individual EVs / EVSE to distribute charging load more evenly across a given time period. PG&E's new Charge Manager program, launched in partnership with WeaveGrid, actively manages EV charging load in areas with high EV penetration.[18] Baltimore General Electric (BGE) has also partnered with WeaveGrid to deploy a managed charging program specifically focused on distribution asset protection. The BGE pilot has shown

[17] Smart Electric Power Alliance (SEPA), *The State of Managed Charging in 2024*, September 2024, pg. 20. Available at: https://sepapower.org/resource/state-of-managed-charging-in-2024/
[18] EV Charge Manager: https://www.pge.com/en/clean-energy/electric-vehicles/ev-charge-manager-program.html#accordion-73ce7b7a8a-item-6b1709a091

promising results, reducing peak demand on individual circuits by 33% and yielding a benefit-cost assessment score of 1.58.[19]

There are many automakers, EV / EVSE / energy management platforms, utilities, and others working to advance managed charging for distribution management. These include individual OEMs as well as third-parties like WeaveGrid, Energyhub, Kaluza, ev.energy, and ChargeScape. VGIC encourages California to create managed charging programs with tailored signals to optimize distribution systems.

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 bidirectional 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)?

All modern electric vehicles come with onboard charging systems and telematics with significant technical capabilities. Telematics systems commonly collect data on driving patterns, battery state of charge/conditions, charging patterns, and other data that can be used to manage charging. These systems can also receive grid signals from different entities. Some examples of programs that utilize telematics to receive program signals are:

- BMW ChargeForward Program:[20] The BMW ChargeForward Program is specifically focused on optimizing charging based on grid electricity carbon intensity but can also consider local grid conditions and electricity costs.
- SMUD Managed EV Charging Program:[21] SMUD's program is designed to reduce grid congestion and greenhouse gas emissions.
- Ford Energy Rewards (Emergency Load Reduction Program):[22] Although Ford's Energy Rewards Program only curtails charging at a designated location, event signals are sent to the vehicle.

[19] BGE. *Case No. 9478 – BGE Smart Charge Management Program Proposal.* June 4, 2024. Page 9. https://webpscxb.psc.state.md.us/DMS/case/9478
[20] BMW ChargeForward Report, 2020. Available at: https://www.bmwchargeforward.com/assets/BMW-ChargeForward-Report-667376fa.pdf
[21] See more information on SMUD's Managed EV Charging Program at: https://www.smud.org/Going-Green/Electric-Vehicles/Residential/Managed-EV-Charging
[22] See more information on Ford Energy Rewards at: https://www.ford.com/grid/capr

- PG&E Charge Manager:[23] Launched in partnership with WeaveGrid, Charge Manager actively manages EV charging load in areas with high EV penetration, including via integration with Tesla vehicles, as well as chargers from Emporia, ChargePoint, and Wallbox.

Even in programs that send grid signals to EVSE, on-vehicle telematics can be used to verify responses to particular demand response events or general load shift. Most onboard charging systems already have the technical hardware/software capabilities to enable load shifting. Instead, the biggest barrier to the utilization of these capabilities is access to programs that provide sufficient value to the customer for shifting their load.

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?

Yes, the telematics is used to receive grid signals and schedule charging in response to those signals. See the answer to question 7 above.

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?

VGIC believes that MDHD EVs should have ample opportunities to support the CEC's goal of load shifting. In order to meet California's broader climate and air quality goals, the transition away from fossil fuel MDHD vehicles will be critical. CARB estimates that roughly 350,000 MDHD battery EVs will be operated in California by 2037 to meet Advanced Clean Fleets requirements.[24] Given the very large power draws of MDHD charging depots, the CEC should specifically consider how this load can be incentivized to lower system-wide GHG emissions and prevent overloading of the distribution system.

The Flexible Service Connection frameworks described above can help MDHD fleets seeking to shift their charging schedules to times where grid capacity and generation supply exists. To date, flexible service connections have served as important bridge solutions to partially energize sites that would otherwise face lengthy energization timelines. PG&E's Flex Connect pilot and SCE's

[23] EV Charge Manager: https://www.pge.com/en/clean-energy/electric-vehicles/ev-charge-manager-program.html#accordion-73ce7b7a8a-item-6b1709a091

[24] CARB, *Proposed 2022 State Strategy for the State Implementation Plan*, August 12, 2022, pg. 150. Available at: https://ww2.arb.ca.gov/sites/default/files/2022-11/Proposed_2022_State_SIP_Strategy.pdf

Load Constraint Management System (LCMS) pilot could both allow MDHD EV charging at sites that typically face long energization timelines.

Fully utilizing bidirectional charging and V2G exports for customers interested in doing so can avoid GHG emissions by mitigating the need for peaking electrical generation capacity. Some MDHD fleets may be some of the best-positioned vehicles to provide V2G exports given the large batteries and specific, set charging schedules. For example, school buses, tour buses, and refuse trucks that operate during the daytime and are parked during the evening net peak are well positioned to be grid resources. School buses are the earliest adopters of V2G equipment and programs and can provide significant grid power. For example, Oakland Unified School District's all-electric fleet can provide 2.1 GWh of flexible power a year.[25]

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?

VGIC discusses consumer charging preferences in response to question 3. Overall, charging preferences for commercial fleets are exceptionally diverse.

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?

There are a wide variety of communication protocols that can be used to enable load shifting capabilities. These protocols generally allow EVSE or EVs themselves to receive grid signals from other parties, such as the utility. Some of these protocols include:

- **APIs / Proprietary Protocols:** Many technology providers, aggregators, utilities, and others are using unique or proprietary communication protocols and systems to share grid signals with EVs and EVSE. Given different legacy systems that have been in place for utilities and aggregators, a significant transition is still required to create a universal communication system.

[25] The EV Report, First All-Electric, Bidirectional V2G School Bus Fleet Launches in Oakland" May 16, 2024. Available at: https://theevreport.com/first-all-electric-bidirectional-v2g-school-bus-fleet-launches-in-oakland

- **OpenADR 2.0 / 3.0:** Open standard maintained by the OpenADR Alliance that supports fully automated responses to demand response signals. The standard works for many different devices, including EVSE, but also HVAC systems, and energy storage.

- **Open Charge Point Protocol (OCPP):** Open standard developed by the Open Charge Alliance (OCA) to allow EVSEs from different manufacturers to communicate with various back-end management systems. This standard is solely focused on EV charging.

- **IEEE 2030.5:** Communication protocol designed to enable secure, standardized, and interoperable communication between energy devices and utilities. Inverter manufacturers seeking to comply with IEEE 1547-2018 must design devices to speak either IEEE 2030.5, DNP3, or Sunspec Modbus.

- **Open Field Message Bus (OpenFMB):** Framework developed by the Smart Electric Power Alliance (SEPA) to enable interoperability and secure, real-time data exchange between DERs and grid systems. OpenFMB acts as a data exchange framework and can use various communication standards with devices (such as DNP3).

- **ANSI/CEA 2045:** Communication standard defining a "port" or "plug" interface that could be incorporated into off-the-shelf appliances during manufacture in order to make appliances ready to receive and respond to utility signals. Specifies both a physical and communication interface. It can be used for EVSE but also for a variety of appliances, such as water heaters, HVAC systems, and pool pumps.

- **Matter:** Open-source protocol designed to connect compatible smart home devices and systems with one another to bridge issues with ecosystem-specific devices. EVSE can use Matter, as well as other devices such as appliances, thermostats, smart lights, and a wide variety of home devices.

- **SunSpec Modbus:** Open communication standard that specifies common parameters and settings for monitoring and controlling DERs. SunSpec Modbus is fully interoperable with IEEE 2030.5 and IEEE 1815 communication protocols.

- **Distributed Network Protocol 3 (DNP3):** DNP3 is a TCP/IP-based communications protocol. It is often used in utility Supervisory Control and Data Acquisition (SCADA) and remote monitoring systems.

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?

Data is beginning to be released on the effects of bidirectional charging on EV battery life. There is some research on the effects of V2G on battery life:

- Vehicle-to-grid impact on battery degradation and estimation of V2G economic compensation[26]
- Impact of V2G service provision on battery life[27]
- Impact of Vehicle-to-Grid (V2G) on Battery Degradation in a Plug-in Hybrid Electric Vehicles[28]
- How long do electric car batteries last? What 10,000 electric vehicles tell us about EV battery life[29]

Overall, different studies show different impacts of bidirectional charging on battery degradation. There is evidence that bidirectional discharge can marginally impact battery degradation. However, overall battery degradation for any vehicle depends on a variety of factors: overall calendar aging, driving behavior, outdoor temperature, charging speeds, charging behavior, and bidirectional charging. Notably, vehicles that frequently charge using DC fast chargers have *significantly* higher battery degradation rates.[30] Even within battery degradation due to bidirectional charging, different bidirectional behaviors for different grid services such as summer demand response versus daily real-time frequency regulation.

VGIC respectfully urges the CEC to avoid addressing battery degradation concerns related to bidirectional charging through the FDAS effort. The CEC should instead collaborate across agencies, including the CPUC, to ensure a robust menu of compensation mechanisms for grid services that can be provided. Customers can then choose which programs they would like to participate in based on the benefits and costs, including the cost of battery degradation and the battery warranty terms available to them. The CEC should also coordinate with CARB as it relates to the battery durability and warranty requirements referenced in Advanced Clean Cars II.

---

[26] https://www.sciencedirect.com/science/article/pii/S0306261924019299
[27] https://www.sciencedirect.com/science/article/abs/pii/S2352152X21008781
[28] https://www.sae.org/publications/technical-papers/content/2024-01-2000/
[29] https://www.geotab.com/blog/ev-battery-health/
[30] Geotab, "How long do electric car batteries last? What 10,000 electric vehicles tell us about EV battery life", October 30, 2024. Available at: https://www.geotab.com/blog/ev-battery-health/

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

Overall, VGIC believes that a menu of program options using both generic and tailored signals should be developed and offered to customers at this time. As discussed above in response to question 3, customers have different charging needs and consumer preferences are still evolving. A wide variety of programs will allow for different types of signals to be tested, and VGIC does see benefits to both generic and tailored approaches.

System-wide generic signals, such as time-of-use rates or traditional demand response events, are relatively easy to deploy and do provide important daily shifting and emergency capacity. These generic signals are currently shifting EV charging load, and given the growing frequency of grid emergencies, continue to expand as new programs emerge such as the Emergency Load Reduction Program (ELRP) and Demand Side Grid Support (DSGS) program. There are also programs that send generic signals to certain customer groups, but are not yet individualized for each customer. One example of this type of signal is PG&E's dynamic pricing pilot that groups customers into representative circuit "clusters," where different signals are being sent to different representative circuit groups, but all customers on the same representative circuit group are receiving the same price signal. These types of signals can provide additional distribution management benefits, but are not tailored to individual EVs.

Tailored signals for individual EVs will likely play an important role in preventing expected secondary peaks or snapback effects. VGIC discusses current work being done by PG&E and Baltimore Gas and Electric (BGE) on active managed charging for distribution congestion management in response to question 6.[31] This type of active managed charging program can send unique signals to different EVs, for example those on the same distribution circuit. These unique signals can maximize grid benefits, especially at the distribution level, compared to generic signals.

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?

[31] See, for example, Smart Electric Power Alliance (SEPA), *The State of Managed Charging in 2024*, September 2024, pg. 20. Available at: https://sepapower.org/resource/state-of-managed-charging-in-2024/ and Jeff St. John, *How to make EVs get along with the grid*, December 13, 2024. https://www.canarymedia.com/articles/utilities/how-to-make-evs-get-along-with-the-grid

There is an immense amount of information that needs to be considered to shift EV charging load and ensure that mobility needs are not compromised. Knowledge of driving patterns, departure times, battery state of charge, battery health, and related data points can help to optimize charging in ways that meet mobility needs, reduce grid impacts, and ensure longer lasting batteries and EVSE. At the same time, permitting access to this data on individual drivers and vehicles must be done thoughtfully given the customer privacy and data security concerns and regulations.

Automakers and other third parties may be given permission to access this data from customers to enable EV charging optimization. There are currently ongoing discussions about how to collect and share data from DERs, including EVs, with utilities via the CPUC's Data Working Group on this topic.[32] Data sharing arrangements will continue to develop to ensure that this information is shared reliably, securely, efficiently, and in strict compliance with all relevant data sharing and privacy laws and regulations.

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?

To date, VGIC understands the primary focus of MIDAS has been to communicate dynamic rates, given the CEC's Load Management Standards requirements and the CPUC's authorized investments in *CalFUSE* pilots. There are also other software tools that have been used (or attempted) to communicate price signals to DERs in the dynamic rate pilots, such as the TeMix, Polaris, and Grid X platforms, as well as custom utility APIs. To date, there has been little enrollment of EVs / EVSE in dynamic rate pilots approved by the CPUC, with the exception of PG&E's Vehicle-to-Everything (V2X) Pilot: Phase II, which is specifically targeting bidirectional EVSE.[33] PG&E and SCE are both launching expanded dynamic rate pilots that are technology neutral.[34] Both utilities are seeking to choose Automated Service Providers (ASPs) to enroll customers into the pilots, automate management of customer end use devices in response to price signals, and generally handle customer experience and payments of any incentives. ASPs have not yet been chosen for these pilots, but the selection of ASPs that work with EV customers and are familiar with those technologies and use cases will be critical to ensuring significant EV participation in the pilots. If ASPs more familiar with different devices are chosen (i.e.,

---

[32] See more information on the Data Working Group at: https://www.laregionalcollaborative.com/data-working-group

[33] See PG&E's Vehicle-to-Everything (V2X) pilot program at: https://www.pge.com/en/clean-energy/electric-vehicles/getting-started-with-electric-vehicles/vehicle-to-everything-v2x-pilot-programs.html

[34] See more information on the "Expansion of PG&E and SCE System Reliability Dynamic Rate Pilots" here: https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/demand-response/demand-flexibility-oir/pilot-expansion-2024.pdf

thermostats, water heaters, agricultural equipment, etc.), EV customers may not have a pathway to enroll.

Currently, there are demand response programs, such as ELRP and DSGS, that have EVs enrolled and use CAISO Flex Alerts, Energy Emergency Alerts (EEA), or day-ahead market price thresholds as event triggers. VGIC believes that MIDAS could be a valuable tool for communicating Flex Alerts and we encourage the CEC to think about how MIDAS could provide signals for demand response participation. However, in order to unlock the full potential of EV load shifting, compensation mechanisms must be in place that are commensurate with the grid service provided. Demand response programs are one mechanism to compensate customers for responses to event signals.

At this time, VGIC is aware of only one utility program in California communicating GHG data or signals to EVs / EVSE: SMUD's Managed EV Charging Program.[35] The only other utility program that VGIC knows of that requires response to a real time GHG signal is the Self Generation Incentive Program (SGIP), which EVs are not eligible for participation. The CPUC's Avoided Cost Calculator (ACC) also includes avoided GHG costs. This signals Net Billing Tariff customers to export during times that avoid more GHGs and to save energy when the grid is cleaner. SCE is also exploring an EV export rate that may include portions of avoided GHG costs.[36] Overall, compensation mechanisms are needed to incentivize EVs to respond to GHG signals. The translation of GHG signals to avoided costs is one way to do this, but the CEC could also work within other compensation frameworks to incentivize responses to GHG signals. VGIC posits that only once adequate compensation frameworks are in place will widespread communication of GHG signals through MIDAS be utilized by EV customers.

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?

VGIC does not have information to provide on this topic at this time, but looks forward to working with its members, utilities, CEC staff, and other stakeholders in the future on this important topic.

---

[35] See more information on SMUD's Managed EV Charging Program at: https://www.smud.org/Going-Green/Electric-Vehicles/Residential/Managed-EV-Charging

[36] SCE is currently exploring an EV export rate that compensates customers for avoided Cap & Trade compliance costs. See more information on SCE's proposed V2G rate in SCE-04 "Phase 2 of 2025 General Rate Case Amended Rate Design Proposals". Available at: https://edisonintl.sharepoint.com/teams/Public/regpublic/Regulatory%20Documents/Forms/RIMS%20Doc%20Set%20View.aspx?id=%2Fteams%2FPublic%2Fregpublic%2FRegulatory%20Documents%2FPD%2FCPUC%2F22166

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?

One of the most impactful equity outcomes of leveraging load flexibility is retiring fossil fuel electric generation that would otherwise be needed to charge EVs. Load flexibility that provides cost savings to EV drivers and fleets can also accelerate adoption of EVs, yielding significant air quality improvements. In particular, MDHD fleets are sensitive to charging costs, and if a managed charging program or rate could reduce costs of transitioning to EVs, businesses would be more likely to electrify their fleets. Retiring fossil fuel electric generation and diesel trucks will contribute significantly to addressing environmental justice by improving air quality in communities disproportionately affected by pollution, including those located nearby ports, fleet corridors, and warehouses.

CONCLUSION.

VGIC appreciates the opportunity to provide these comments on the RFI and looks forward to collaborating with the CEC and other stakeholders in this docket.

Respectfully submitted,
/s/ Zach Woogen
Zach Woogen
Interim Executive Director
Vehicle Grid Integration Council
vgicregulatory@vgicouncil.org