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PowerFlex Response_Load Management RFI

Additional submitted attachment is included below.

December 20, 2024

California Energy Commission
Docket Unit, MS-4
715 P Street
Sacramento, CA 95814

Re: Docket No. 24-FDAS-04—PowerFlex Comments on Request for Information to solicit stakeholder feedback and responses to a range of questions that will inform staff development of a potential Flexible Demand Appliance Standard (FDAS) for electric vehicle supply equipment.

California Energy Commissioners and Staff:

PowerFlex appreciates the opportunity to comment on the California Energy Commission's (Commission's) October 18, 2024, Request for Information to solicit stakeholder feedback and responses to a range of questions that will inform staff development of a potential Flexible Demand Appliance Standard (FDAS) for electric vehicle supply equipment (RFI). PowerFlex is a leading installer, owner, and operator of distributed energy resources (DERs) including electric vehicle supply equipment (EVSE). PowerFlex has more than 20,000 EVSE in California, all of which perform automated load management. With this perspective and experience, PowerFlex offers the following responses to the RFI.

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

PowerFlex agrees that the devices listed in Table 1 are sufficient at this time.

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.**

PowerFlex currently offers a solution which prioritizes driver experience by asking drivers how much energy they need and how long they are available to charge. Using this information, PowerFlex's automated load management (ALM) allocates power amongst drivers according to site infrastructure constraints. Unfortunately, gathering this information adds friction to the session initiation process and has led us to explore automated approaches to estimate driver needs. We expect that wider availability of ISO15118-compatible EVSEs and vehicles and use of artificial intelligence will help reduce this friction and provide the benefits of prioritizing driver needs without additional inputs from the driver.

While PowerFlex offers our sites options to minimize their emissions and energy costs, few have chosen to utilize this feature. This is likely because we are still at a stage of adoption when people are getting comfortable with charging vehicles and thus want their vehicle charged as quickly as possible. In many cases, the economic benefits are also not sufficient to justify the added complexity. We have begun to see some fleet customers and workplaces who are interested in minimizing operational costs while still meeting all driver needs. New, more highly variable tariffs, such as Pacific Gas & Electric's Hourly Flex Pricing may provide additional signals which will provide more incentive for sites to optimize against energy costs.

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.**

PowerFlex's initial analysis is that drivers are not knowledgeable enough about incentives to choose "charge by departure," and the preference therefore is typically immediate charging. However, PowerFlex does not gather a lot of data on this specific issue. PowerFlex believes that greater incentives and education for drivers on "charge by departure" could increase this choice among drivers.

a. How does using charge strategy balance factors as battery life, price, etc.?

PowerFlex supports optimization around price signals from utilities, but we do not consider battery life, which is typically more in the control of the vehicle itself. Managing charging around battery life implies that EVSE operators have a lot of information from all EV manufacturers. Rather, because we gather data from drivers and site constraints, we optimize charging around these needs.

However, with additional information available via ISO15118, it may be possible for charge point operators (CPOs) to optimize for battery life by reducing charging currents or limiting the length of time a vehicle is held at high state of charge (i.e., holding a vehicle at 80% state of charge until right before the driver needs to leave). But PowerFlex believes that more research is needed to determine if these optimizations will have a measurable impact on overall battery life.

b. What consumer data is available that provides customer charging habits such as: demographics and population percentages that prefer to charge at home, at work, or in public shared spaces? What times of day?

Data from a single CPO could help to uncover population level patterns, such as when people tend to use chargers at a certain location or type of location and how much energy they tend to draw when there. CPO data can also be used to discover trends in how drivers use chargers managed by that CPO. However, since drivers are likely to use chargers from different CPOs or combine public charging with private at home charging, data from a single CPO is unlikely to give a full picture of charging habits. To get a more comprehensive picture of driver habits, vehicle telematics data is likely the best data source, as it captures charging at both networked and non-networked chargers. A second option would be to combine data from multiple CPOs if drivers can be tracked across datasets.

c. What charger types are typically used?

The majority of the EVSE that PowerFlex operates are 32- or 48-amp chargers with J1772 connectors. However, in the past several years we are seeing more J3400 connectors.

For Level-3 direct current fast chargers (DCFCs), PowerFlex primarily installs 50 kW and 100 kW dual port EVSEs. Previously, CCS/CHAdeMO chargers were used, but now CCS/CCS are the most common.

d. How do charging patterns change as EV owners gain experience with their vehicle?

PowerFlex does not currently have any analysis on how charging behaviors change over time.

e. What percentage of battery capacity is typically charged per session?

The percentage of battery capacity charged per session is highly variable across drivers and sites. Factors that impact this are where and how often drivers charge, average daily commutes, vehicle type and battery size, and others. Given that these factors vary widely across individual drivers, the percentage of battery capacity charged per session varies widely across drivers as well.

f. How is this behavior expected to change as ownership of EVs expands beyond the early adopters?

As EV ownership expands beyond early adopters, PowerFlex expects that new EV drivers will likely have some initial anxiety around "charge by departure." These drivers will need to become comfortable with trusting the CPO to deliver the energy they need by the time they need it. We expect that this comfort will come with time and as incentives push drivers to choose "charge by departure" to save money.

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?**

The most likely use case for DC charging equipment in the home would be to facilitate bi-directional charging which currently requires DC coupling to meet Rule 21 in California. For unidirectional use cases, AC charging will be sufficient and more cost effective for most drivers.

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?**

Load management software can allow CPOs to share EV charging load according to grid signals. PowerFlex already supports utility load limits for several sites in California. At these sites, the utility has established time-varying signals based on expected distribution system congestion. Sites are then required to stay below these limits or be shut off. PowerFlex was one of the first systems certified for Southern California Edison's (SCE's) Load Control Management System (LCMS) pilot. Currently, these limits are set by season and time of day, but programs like PG&E's Flex Connect seek to make these limits dynamic based on day-ahead forecasts of congestion. PowerFlex is very supportive of programs like LCMS and Flex Connect, and we are excited to take part in them. However, these programs are seen only as temporary solutions while sites wait for utility upgrades.

We therefore suggest that similar permanent programs be considered which compensate impacted customers in exchange for deferring grid upgrades.

PowerFlex has also participated EVSEs in demand response programs, including the Emergency Load Reduction Program (ELRP) and voluntary Flex Alerts. Similar DR programs at the circuit level could also be possible as utilities adopt more sophisticated distribution system management platforms. Providing these signals over automated APIs such as OpenADR would be preferred so that CPOs can quickly integrate new signals from utilities.

Price signals are another mechanism that utilities can use to reduce congestion. PowerFlex is excited about programs like PG&Es Hourly Flex Pricing pilot and SCE's Dynamic Rates Pilot that will provide price signals which encode grid congestion as well as generation costs. These signals offer economic incentives for grid friendly charging behavior which is an important step in the right direction to ensure that transportation electrification is beneficial to all rate payers by putting downward pressure on rates.

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?**

In the case of single-family residences, a key challenge is getting access to granular signals and having the ability to optimize against them. Additionally, participation in load management programs will also require networked chargers, which could be difficult for single-family residences to join.

It is not clear how single-family homes could participate in load limit programs like LCMS or FlexConnect. Likely, this would require an aggregator which would jointly control all the EVSEs connected to a feeder. This type of control is possible (PowerFlex already supports limits via cloud-based control), but it requires changes to program design and incentives.

To access dynamic prices, most residential customers will likely prefer to submeter their EV charging load rather than have their entire load on a tariff which varies hourly. This will require software defined submetering, likely based on the meter built into the EVSE. This will also require optimization to minimize costs which will likely be cloud based. The cost of providing this optimization service will need to either be covered by the end customer or through partnership with the utility.

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)?**

All modern EVs are capable of load shifting based on the pilot signal generated by the EVSE. In this case, grid signals are first sent to a CPO which converts these signals into charging profiles for each EVSE. These profiles are then communicated to the EVSE, commonly using OCPP. Communication between the CPO and the EVSE can take many forms, including cellular, Wi-Fi, ethernet, or Zigbee. For AC level-2 EVSEs, this charging profile is then converted into a pilot signal which communicates to the vehicle's onboard charger via the J1772 standard. This pilot is an upper bound on the current the vehicle may draw from the EVSE. In the case of DC chargers, the charging profile is used by the charger itself as an upper bound to the power/current it delivers to the vehicle.

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?**

N/A to PowerFlex

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?**

MD EVs, such as last mile delivery vehicles, can often be charged overnight with 48A or 80A Level-2 EVSEs. We have found that despite their larger battery packs, most of these vehicles still have significant charging flexibility that can be used for load shifting. Consider the example of a delivery vehicle which arrives at 7pm and needs to receive 100 kWh by 7am. If this vehicle is using a 10 kW EVSE, that vehicle has 2 hours of flexibility. We can use that flexibility to delay charging to 9pm and avoid peak hours when the grid is stressed and the use of gas peakers often raise marginal emissions factors. In some cases, MDHD vehicles can be combined with bidirectional chargers to discharge the remainder of the battery at the end of the day during peak hours, further reducing peak load.

It may be possible to further reduce GHG emissions by opportunity charging MDHD vehicles during the day, especially when sites have onsite solar generation. This can be used to reduce the need to charge overnight or provide additional energy to feed back into the grid during peak hours if bidirectional charging is used. However, all of these use cases are highly dependent on the duty cycle and capabilities of the MDHD vehicle.

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.**

N/A to PowerFlex

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?**

N/A to PowerFlex

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 charging patterns for fleets depend a lot on the use case. For example, last-mile delivery fleets often use charge overnight depot charging. In this case, AC level-2 charging is typically sufficient. The most common power levels are 10 kW (48 A) or 16.6 kW (80 A). The best solution for these fleets is to install a dedicated EVSE per EV. If a site is power or constrained by the utility, or the fleet wants to reduce capital costs, software load management can be used to automatically allocate power to each vehicle while staying below local and grid level infrastructure constraints. While DCFC is not needed for normal operations, we encourage fleets to install a small number of DCFCs for emergencies or opportunity charging.

Other fleets, such as light duty municipal fleets, are often left plugged in whenever they are not in use. We find a one-to-one ratio of EVSEs to EVs is also beneficial in this use case to ensure that the vehicles are always charged without requiring manual vehicle swaps. Load management can be used to install enough chargers for a one-to-one ratio without requiring expensive infrastructure upgrades or incurring high demand charges.

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?**

Current communication protocols between CPOs and utilities include OpenADR, IEEE 2030.5, custom APIs, emails, text messages, and MIDAS. Unfortunately, many DR programs still use emails and text messages.

From the CPO to the EVSE, the OCPP protocol is the widely accepted standard.

From the EVSE to the EV, the control pilot defined in the J1772 standard is the widely accepted standard.

ISO15118 for communication between the EVSE and EV will allow for additional information exchange including energy needed, state of charge, identity, payment information, estimated stay direction, willingness to pay, etc.. This will enable more advanced load shifting capabilities and reduce friction for drivers by providing accurate information without direct user input. ISO 15118 is a widely accepted standard, but support on both the EV and EVSE side has been slow.

PowerFlex suggests that the Commission coordinate internally on this question as there is currently an open proceeding at the Commission regarding EVSE/EV communication standards.

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?

PowerFlex does not have this data.

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

EVSEs/EVs can respond to generic signals such as prices, demand response events, or grid limits. However, it is important to note that the actual control of EVs/EVSEs must be done in a way which accounts for driver needs. Direct control of EV charging without considering the mobility needs of the driver are likely to cause poor user experience and result in low enrollment.

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?**

Data points include:

- kWh needed (or current SoC, target SoC, and battery size)
- estimated departure time
- max charging rate of the vehicle (optional)

PowerFlex currently collects this information via a mobile app. This approach works for any EVSE or EV but requires driver input. PowerFlex believes that ISO 15118 will allow us to collect this information directly from the vehicle, but this requires support on the vehicle and the EVSE side. Vehicle telematics is another option, but this requires support by the vehicle manufacturer.

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

The added energy consumption for a networked, OCPP-based EVSE is likely marginal. Adding networked capabilities to a non-networked EVSE would likely increase its energy usage.

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? More detail can be found here: Market Informed Demand Automation Server (MIDAS) (ca.gov).**

MIDAS data can be ingested by the CPO and combined with session requirements (energy request, estimated departure time, max charging rate) to form an optimization problem. Solving this problem results in an optimal charging profile for each EVSE which minimizes costs while ensuring each vehicle gets the energy it needs by its departure time. GHG signals can be assigned a carbon price and Flex Alerts can be assigned a dollar value to incorporate these into the optimization. In some cases, DR events can also be treated as hard constraints which will not be violated even if this means that driver's energy requests are not met. This is how PowerFlex currently supports energy cost optimization, DR events, and GHG emissions signals. Once charging profiles are calculated by the CPO, they are sent to EVSEs via OCPP.

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?

PowerFlex does not comment on this question at this time.

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

Access to load shifting programs will likely require networked EVSEs and monthly fees to CPOs for providing these services. Wealthier drivers are more likely to have these networked EVSEs. Incentive programs which help offset the difference in cost between networked and non-networked EVSEs may help offset this gap. In addition, utilities may be willing to cover the CPO network fees in exchange for participation in load shifting programs.

Lower income drivers may be more price sensitive, making them more likely to opt in to load shifting programs if they offer lower charging costs. Lower income drivers may also rely more on public charging stations which could limit their access to load shifting programs if these public chargers are not participating in load shifting programs.

Additionally, residents of multi-unit dwellings may have less access to load shifting programs since participation may be centrally managed. This may be mitigated if submetering is used to disaggregate utility bills for charging.

PowerFlex appreciates the opportunity to provide responses to the RFI and looks forward to collaborating with the Commission on this topic in the future. Respectfully,

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