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Response to the RFI

Additional submitted attachment is included below.

Response to CEC RFI for Electric Vehicle Supply Equipment

Provided by MOEV Inc.
http://www.moev.ai
Dec 17, 2024
(Responses are in dark blue)

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.

Table 1: Examples of In and Out-of-Scope Electric Vehicle Supply Equipment

Potential In-Scope Devices	**Potential Out-of-Scope Devices**
Level 1 Electric Vehicle Supply Equipment Level 2 Electric Vehicle Supply Equipment DC-output Electric Vehicle Supply Equipment Wireless Electric Vehicle Supply Equipment Medium voltage AC input supply Electric Vehicle Supply Equipment Power electronic components inside the vehicle	Pantograph Electric Vehicle Supply Equipment Equipment with an automated connection system

Source: California Energy Commission

No response.

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 current landscape for charging schedules is divided into basic approaches like **charging immediately** and **charging by departure**. Charging immediately is simple and ensures the vehicle is fully charged but may not optimize for cost or grid needs. Charging by departure offers flexibility, optimizing for factors like energy costs and emissions reductions, while ensuring the vehicle is ready for service.

However, to balance competing needs such as driver experience, financial savings, and emissions reductions**, software solutions** are needed. Software especially the use of Artificial Intelligence (AI) can dynamically optimize charging schedules based on real-time data, such as electricity prices, demand charges, and vehicle readiness. By using predictive algorithms, it can prioritize low-cost, low emission charging windows, improving both operational efficiency and sustainability. We at MOEV.AI™ have experience and installations at medium duty and heavy duty (MDHD) fleets where charging by departure has been piloted and implemented successfully.

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.

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

To effectively manage factors like **battery life, price, and efficiency**, a charging strategy must be highly dynamic. Simply scheduling for immediate charge or fixed-time charging doesn't account for the trade-offs in these factors. For example, charging until the battery reaches a specified level based on the predicted route requirements for the day ensures that battery life is preserved, energy costs are minimized, and fleet availability is guaranteed.

   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?

It's crucial to have access to data that reflects **charging behaviors**, including where and when people prefer to charge—whether at home, at work, or at public locations. With **software tools** that integrate with telematics and external data sources, charging can be optimized for various locations and usage patterns, ultimately ensuring the vehicles are charged when and where they need to be, at the lowest cost, with minimal impact on the grid.

   c. What charger types are typically used?

The types of chargers used depend largely on the context, with **Level 2 chargers** being prevalent for residential and small-scale fleet applications, and **DC fast chargers** being more suitable for fleet operations that need rapid turnarounds. The right software can manage the transition between different charger types, ensuring an optimal strategy is used for each scenario.

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

No response.

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

No response.

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

Currently, DC fast chargers are not widely available for residential installations due to high costs and substantial power requirements. However, **software solutions** can help manage the use of these chargers in a residential context by coordinating charging schedules to avoid grid congestion and ensuring that charging takes place during low-demand hours.

Additionally, when installed, **Battery Energy Storage Systems (BESS)** could play a significant role in managing peak loads. The integration of BESS with **software** solutions would ensure that power is stored efficiently and used optimally, balancing household energy needs with EV charging demands.

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?

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   Additionally, when installed, **Battery Energy Storage Systems (BESS)** could play a significant role in managing peak loads. The integration of BESS with **software** solutions would ensure that power is stored efficiently and used optimally, balancing household energy needs with EV charging demands.

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?

   To mitigate grid congestion, **software-based** solutions that enable real-time monitoring and scheduling of EVSE can be key. By prioritizing charging during off-peak hours or utilizing grid signals to adjust charging times, software can optimize energy consumption, reduce grid strain, and lower operational costs for users.

   Grid operators could deploy **demand response strategies** integrated into the EVSE management software, enabling them to shift or curtail charging at times of peak demand while maintaining the reliability of EV fleets.

6. Similarly, what software and hardware capabilities are best suited 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?

   No response.

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)?

No response.

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?

   Many EV telematics systems can receive grid signals, but not all EVs support this functionality. **Software solutions** that integrate telematics with grid signals are essential for enabling scheduled charging and load shifting – especially for MDHD EV fleets such as bus and truck. This approach would help fleets and consumers manage their charging needs more efficiently, without requiring deep integration into the vehicle's hardware. Most third-party EV Telematics systems offer uni-directional data movement only from the vehicle out to the cloud software. If bi-directional data transfer is enabled substantially more can be done when it comes to scheduling charging via cloud-based software.

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?

   Medium-duty and heavy-duty EVs can benefit significantly from load-shifting strategies:

   - **Transit bus and school bus fleets**: These fleets operate on highly predictable schedules with fixed routes and stops. This predictability makes it easier to optimize charging during off-peak hours, ensuring readiness for daily operations while minimizing costs and grid impact.
   - **Truck fleets**: Truck fleets, particularly those involved in goods transportation, often have less predictable operating schedules due to dynamic pickup and delivery demands. In these cases, **AI-based software solutions** are needed to analyze real-time operational data and identify behavioral patterns. By learning from fleet operations, AI can generate refined charging schedules that adapt dynamically to fleet behavior, ensuring trucks are charged efficiently without disrupting their operations.

   Software solutions that leverage AI and real-time data play a crucial role in enabling load shifting for truck fleets while addressing the unique operational challenges of less predictable schedules. Our MOEV.AI™ platform using Machine Learning technology has been tested commercially with Transit Bus fleets with active and dynamic load shifting, with significant benefits to our customers.

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.

    Off-road vehicles, such as forklifts and construction machinery, operate on defined usage cycles, making them ideal candidates for load-shifting strategies. These vehicles often require large amounts of energy, leading to the use of **high-capacity batteries** and **DC fast chargers** to minimize downtime. However, this results in significant **demand charges** for operators during peak energy usage periods.

    To address this, **software solutions** are critical for managing and optimizing charging schedules. Smart charging management can coordinate between the vehicles' operational requirements and grid capacity, shifting charging to off-peak hours to reduce demand charges. By aligning charging with grid availability and operational needs, off-road vehicles can contribute to load-shifting strategies, lowering energy costs and minimizing their environmental impact

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?

    Wireless charging is increasingly being explored for applications such as **transit buses** that need to quickly top off their batteries during layovers or short stops. This technology could also extend to **fleet depots**, where vehicles are charged during idle periods, reducing downtime and improving operational efficiency.

    To maximize the benefits of wireless charging, **software solutions** are essential. Software can optimize charging schedules by accounting for critical factors such as **battery state**, **energy availability**, and **time-of-use pricing**, ensuring that charging occurs efficiently and cost-effectively. Additionally, for **on-route wireless chargers**, software plays a vital role in managing schedules to avoid congestion or traffic bottlenecks, ensuring seamless operation and flow of vehicles.

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?

    Commercial fleets, including **truck fleets** and **private bus fleets**, rely primarily on **overnight depot charging** to prepare vehicles for the next operational cycle. For **private bus fleets**, which follow predictable schedules, software solutions optimize charging by prioritizing vehicles based on route lengths and battery needs, ensuring readiness while minimizing energy costs.

    For **truck fleets**, which operate on less predictable schedules, software plays a crucial role in dynamically managing charging. By analyzing real-time delivery data, it ensures trucks are charged efficiently during breaks or idle times, aligning with route demands and avoiding peak demand charges. Advanced charging management systems help reduce operational inefficiencies, prolong battery life, and balance fleet energy needs with grid capacity.

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?

    Effective load shifting requires standardized communication protocols such as **OCPP**, **ISO 15118**, and **OpenADR** to ensure seamless integration between EVSE, vehicles, and grid systems. These protocols enable interoperability, allowing software to manage charging operations efficiently. However, achieving full compatibility across the wide range of EVs and EVSEs remains a challenge, underscoring the importance of open, industry-wide standards.

    Protocols like **ISO 15118** also enable **Vehicle-to-Grid (V2G)** capabilities, where EVs can discharge energy back to the grid during peak demand. V2G supports load balancing by acting as a distributed energy resource, reducing grid strain and enhancing reliability. Agencies like the **CEC** can provide **incentives** in grant programs to promote open standards, particularly **OCPP**, which allow fleet operators to choose the best hardware and software solutions independently. Open standards also ensure systems can be upgraded easily over time as technology evolves, fostering innovation and maximizing long-term investments.

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?

    Bidirectional charging impacts battery life, particularly in terms of depth and frequency of discharge. It is important to monitor how often this capability is used, as it may affect warranties and battery health. **Software solutions** can help manage the frequency and intensity of bidirectional charging, balancing operational needs with battery longevity.

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

    Tailored load-shifting signals provide more precise control over when and how EVs charge. While **generic signals** may be sufficient in some cases, more complex operations (like **MDHD fleets**) require tailored schedules that consider real-time data. **Software solutions** are key in making this customization feasible.

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?

For effective load shifting, **accurate and timely data** is essential. Critical data includes **kWh required**, **time of departure**, **route schedules**, and **real-time vehicle status**. This information allows software to align charging with operational requirements while balancing grid capacity and cost.

In certain bus and most truck fleets, where strict schedules are enforced, penalties can arise if vehicles are not ready to complete routes on time. Software solutions that leverage **AI** and telematics data can predict energy needs and optimize charging schedules accordingly. By analyzing historical operational patterns, vehicle state-of-charge, and grid signals, these systems ensure that load shifting is not only effective but also reliable. Integration of data such as **traffic conditions**, **expected mileage**, and **charging infrastructure availability** further refines predictions and ensures smooth fleet operations without compromising performance or deadlines.

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

    Adding flexible demand capabilities to existing EVSEs will require more energy-efficient systems and will optimize the energy consumption across a fleet. **Software tools** are crucial for monitoring and optimizing this consumption, ensuring that flexible demand is managed efficiently.

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).

    Software solutions integrated with MIDAS could optimize fleet charging schedules based on time-varying rates and GHG emission signals. By ensuring that charging happens during low-carbon and off-peak periods, these systems can contribute significantly to the CEC's energy and environmental goals.

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?

    As EVSEs and grid systems become more interconnected, cybersecurity will be a critical challenge. Solutions should employ robust encryption and adhere to standards such as (but not limited to) ISO/IEC 27001 to secure data and prevent unauthorized access to sensitive charging and grid information.

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?

To ensure equity, software solutions must be accessible to a wide range of income groups. This includes offering scalable charging infrastructure and scheduling software that doesn't disproportionately benefit wealthier communities. Solutions should be affordable and flexible to address the needs of all demographics.