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Tesla Comment #24-FDAS-04 RFI on FDAS for EVSE

Tesla appreciates the opportunity to provide comments on these questions and the Commissionâ€™s consideration of the industry perspective on this matter.

Respectfully Submitted,

Bill Ehrlich
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Additional submitted attachment is included below.

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December 20, 2024

BE ELECTRONIC FILING

Matthew Flynn
California Energy Commission
715 P Street
Sacramento, CA 95814

RE: Docket # 24-FDAS-04 – Request for Information (RFI) on Flexible Demand Appliance Standards for Electric Vehicle Supply Equipment

Dear Mr. Flynn:

Tesla respectfully submits the following comments in response to the California Energy Commission (CEC) on its recent request for information (RFI) to inform development of a potential Flexible Demand Appliance Standard (FDAS) for electric vehicle supply equipment (EVSE). Tesla appreciates the opportunity to provide direct written input through comments and looks forward to continued engagement with the Commission on this evolving topic.

About Tesla

Tesla is a manufacturer of electric vehicles, energy storage equipment, EV charging equipment, and is also a charging network owner and operator. Tesla operates 62% of the DC fast charging ports in California.[1] Tesla's mission is to accelerate the world's transition to sustainable energy through the development, manufacture and sale of all-electric vehicles and clean energy products, including photovoltaic solar and battery storage. All Tesla vehicles sold in the United States are currently manufactured in Fremont, CA and Austin, TX. Tesla's vehicle line-up includes the Model S sedan, Model X crossover vehicle, Model 3 sedan, and Model Y crossover vehicle. The vehicles have an all-electric range of up to 405 miles per charge (Model S) and industry-leading performance and safety ratings. In 2023, Tesla delivered more than 1.8 million vehicles globally[2] and in December 2022, the company delivered its all-electric Class 8 Semi trucks to the first customer.[3] Additionally, in November 2023, Tesla completed the first deliveries of its newest vehicle, the Cybertruck pickup truck.[4]

[1] https://afdc.energy.gov/stations#/analyze?tab=location
[2] https://ir.tesla.com/press-release/tesla-vehicle-production-deliveries-and-date-financial-results-webcast-fourth-quarter-2023
[3] https://www.cbsnews.com/news/tesla-electric-semis-delivered-to-pepsico-nevada-factory/
[4] https://www.tesla.com/cybertruck-delivery-event

Comments

Category #1: Unique EV Charger and Station Needs

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.**

CEC 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	Pantograph Electric Vehicle Supply Equipment
Level 2 Electric Vehicle Supply Equipment	Equipment with an automated connection system
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	

Response:

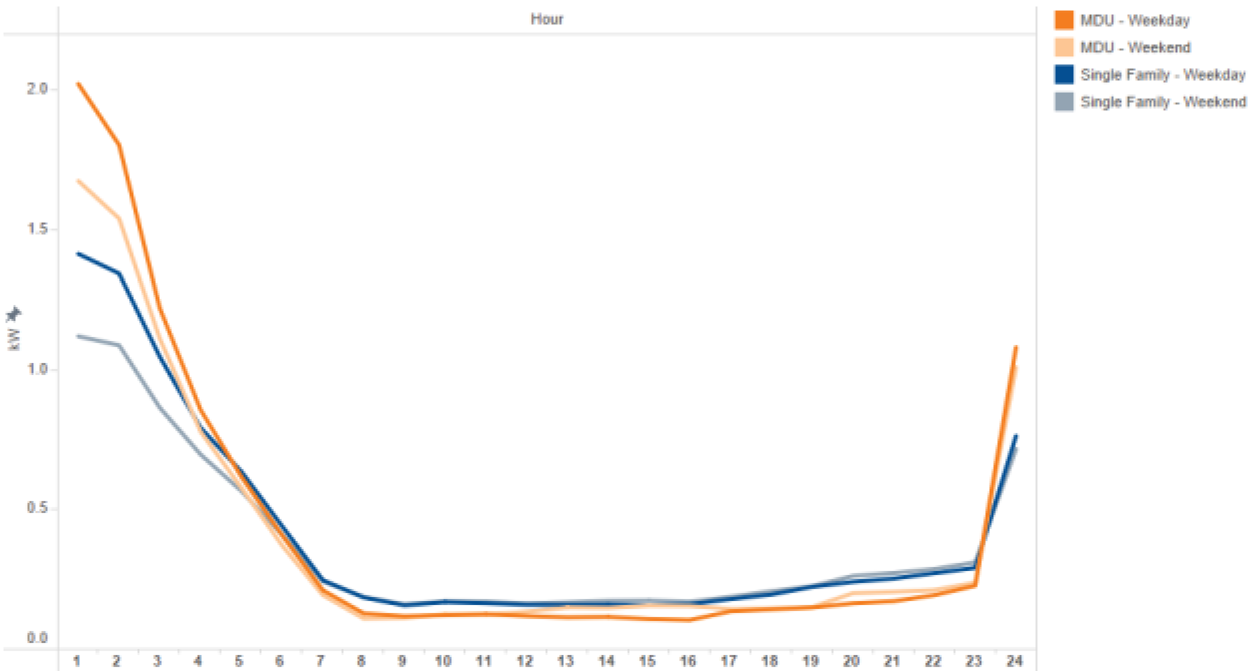
Tesla recommended categorization of potential in-scope devices:

Potential In-Scope Devices	Potential Out-of-Scope Devices
Level 1 Electric Vehicle Supply Equipment	Pantograph Electric Vehicle Supply Equipment
Level 2 Electric Vehicle Supply Equipment	Equipment with an automated connection system
	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

Of the devices listed in the CEC's Table 1, Tesla strongly recommends that only Level 1 and Level 2 EVSE are considered for FDAS. The progress achieved in the public DC fast charging realm over the past few years has been tremendous and introducing new appliance standards at this stage is challenging at best, in particular given the on-demand DC fast charging use case in most instances. There is enormous potential to shift load in the context of Level 1 and Level 2 charging and to a large extent basic scheduling functionality combined with EV time-of-use (EV TOU) rates across California have already helped to encourage exactly that behavior.

This is well illustrated in a recent report from California's three major IOUs on EV charging load profiles:[5]

Chart PG&E-7: Average Load Profile for SF and MDU Separately-Metered by Weekday and Weekend (2023)



Per the chart above provided by PG&E, separately-metered EV customers with the assistance of scheduling and price signals are able to adequately shift their charging load off peak given existing incentives and technology. Scheduling capabilities do not necessarily need to be enabled through the charger equipment itself and are oftentimes easily scheduled through a phone-based app or through the in-vehicle display itself. Placing additional cost and complexity on charging equipment through additional equipment standards largely does not move California closer to its ambitious EV, charging infrastructure, nor greenhouse gas (GHG) reduction goals. Rapid progress is currently happening across all aspects of charging infrastructure and Tesla strongly encourages the CEC to continue to support this progress rather than hinder it with additional equipment standards, the value of which is unclear and may even slow down the deployment of safe, reliable, charging equipment. The existing equipment is largely already capable of achieving the stated aims of load shifting flexibility.

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[5] From page 22 of the **AMENDED JOINT COMPLIANCE FILING OF SOUTHERN CALIFORNIA EDISON COMPANY (U 338-E), SAN DIEGO GAS & ELECTRIC COMPANY (U 902 E) AND PACIFIC GAS AND ELECTRIC COMPANY (U 93 E) PURSUANT TO ORDERING PARAGRAPH 2 OF DECISION 16-06-011**, electronically filed with the CPUC's docket office and served to all parties on the official service lists for **R.23-12-008 and R.18-12-006** on **December 13, 2024.**

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.**

Response:

The IOUs have ample data on customer EV charging behavior that they report on regularly as mandated by the California Public Utilities Commission (CPUC) pursuant to D.16-06-011: [6]

> ***EV Cost and Load Report:*** *Pursuant to D.16-06-011, the three large IOUs jointly file the annual EV Cost and Load Report to examine EV customer charging behavior and service and distribution system upgrade costs related to EV load. This report illustrates the costs of infrastructure installed through the IOUs' EV charging programs, and infrastructure installed through their Electric Rule 15 and 16, and the impact EV rates have on driver charging behavior. Beginning with the report filed in 2023, the IOUs will additionally report on data related to their EV Infrastructure Rules.*

Given the California investor owned utilities (IOU's)_ harmonization of time-of-use schedules around the 4pm to 9pm on-peak period, there is a strong and consistent price signal being broadcast to the entirety of California residents about when **<u>not to charge</u>** their EVs. It is relatively straightforward once a customer understands how the time-of-use price structure works, to schedule their vehicle to not charge at that time. Charging outside of the 4pm to 9pm time window generally aligns all of the factors described:

- Driver experience
- Emissions reductions
- Financial Savings
- Ease of implementation

The most recent EV cost and load report provides an overview of the difference in customer behavior on EV (aka "PEV") rates between customers on whole-home meters (i.e. "Single-Metered") versus "separately-metered" customers where EV charging is metered separate from the rest of the electricity usage of the home.

> ***Average Load Profiles for PEV Rates*** [7]
> *Depicted below in Charts PG&E-6 and PG&E-7 are the average daily load profiles for the single-metered and separately-metered rate groups for each sector during 2023. In 2023, the load profiles demonstrate that for all rates and sectors, high off-peak usage corresponds to the PEV rate price signals, i.e., customers are largely responding to the price signal and primarily charging during off-peak hours (12:00 a.m. to 3:00 p.m. with the bulk of the load occurring from 12:00 a.m. to 5:00 a.m.). The load profile during 2023 for both SF and MDU customers shows a spike in demand at midnight with a second smaller*

[6] https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/infrastructure/transportation-electrification/resources-and-reporting
[7] Ibid, 2023 Annual Report in footnote 5, page 21.

spike during the peak-hour period 6:00 p.m. to 10 p.m. The response to price signals is more clearly depicted in the data from the separately-metered customers (Chart PG&E-7) where the majority of the usage occurs during off-peak hours during 2023.

Chart PG&E-6: Average Load Profile for SF and MDU Single-Metered by Weekday and Weekend (2023)

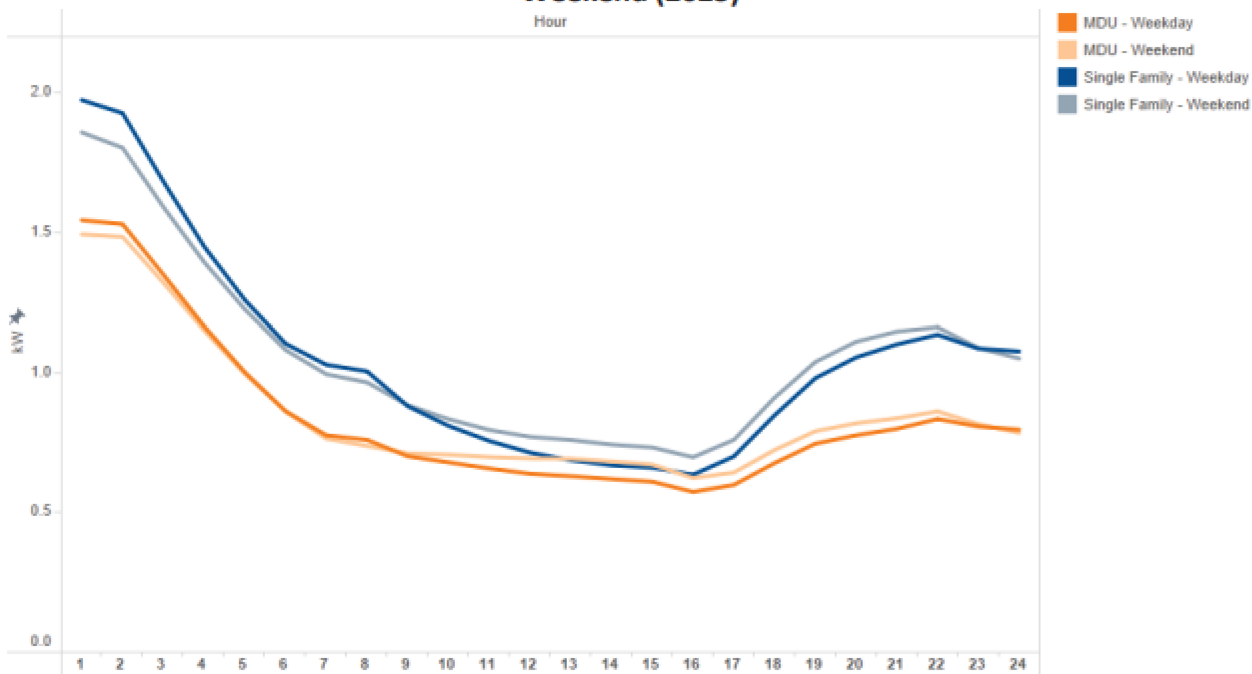
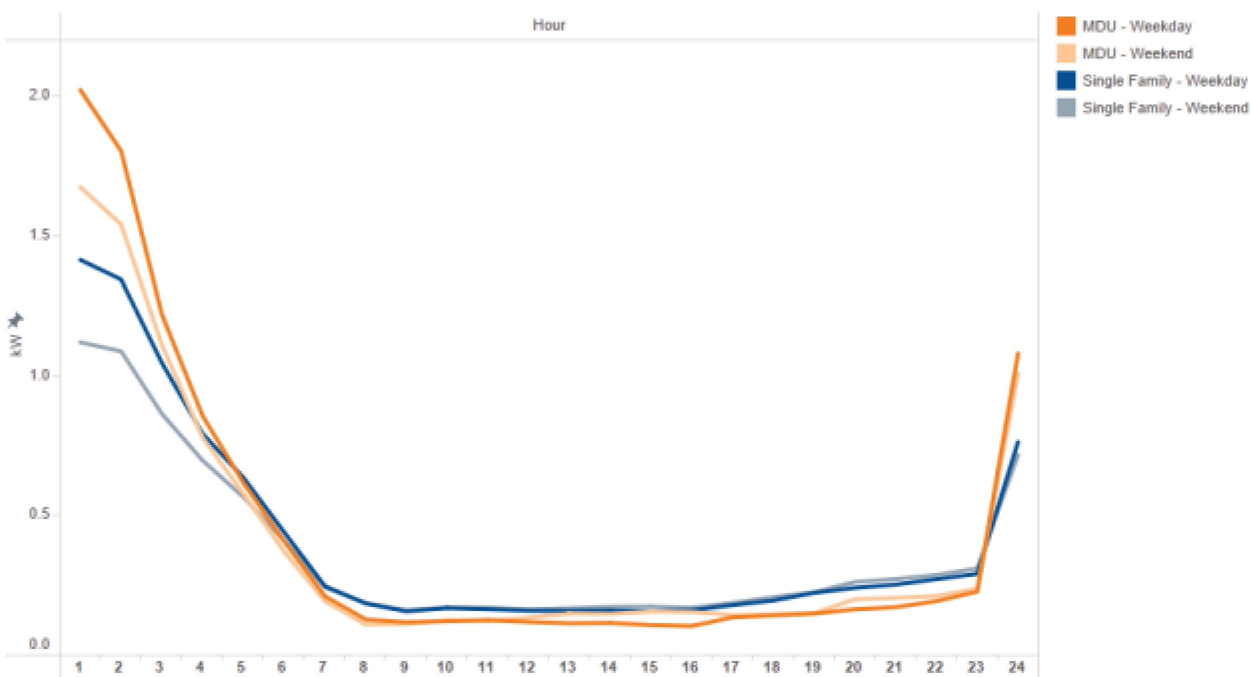


Chart PG&E-7: Average Load Profile for SF and MDU Separately-Metered by Weekday and Weekend (2023)



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.?**
    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?**
    c. **What charger types are typically used?**
    d. **How do charging patterns change as EV owners gain experience with their vehicle**
    e. **What percentage of battery capacity is typically charged per session?**
    f. **How is this behavior expected to change as ownership of EVs expands beyond the early adopters?**

Response:

Drivers will typically opt-in to time-of-use pricing schedules that offer lower electricity costs when charging during off peak hours, typically after 9PM and lasting overnight. These are usually done via Level 1 and Level 2 EVSE. This charging strategy can help extend battery life by charging a battery to 80%. By limiting the charge to 80% the battery is kept out of extreme ranges as a battery charged beyond 80% daily can more quickly wear out its cells. Charging patterns are expected to align with time-of-use signals as ownership of EVs expands beyond the early adopters given the best place for customers to charge is where they are already parked a majority of the 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?**

Response:

At this time DC charging equipment is expected to remain in the domain of public fast charging infrastructure. Residential charging equipment is expected to continue to be AC charging solutions for the foreseeable future.

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?

Response:

Tesla is working directly with IOUs in California to enable "flexible connections" for public fast charging stations, however, it is important to highlight that this seen as an interim measure enabling accelerated interconnection and does not obviate the need for an eventual grid capacity upgrade. Tesla's Supercharging hardware is architected to efficiently use all power available across an entire site. Power levels being requested from load-serving entities eventually need to be delivered in order to continue to provide drivers confidence in public charging infrastructure. Public fast charging is "on-demand" charging and should not be seen as a flexible resource to be throttled and shifted.

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?**

Response:

EV TOU price signals combined with scheduled Level 1 and Level 2 charging are the best tools readily available to residential EVSE customers. To the degree greater levels of responsiveness or control are desired, it is recommended that any "demand response" scheme be structured as an "opt-in" program for customers.

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)?**

Response:

EV onboard charging systems today are enabling load shifting through scheduled charging to align with EV TOU price signals. Tesla would like to emphasize how important it is for the EV onboard charging system to be considered part of the vehicle and not part of the "charging ecosystem" – meaning that, charging control signals, standards, and any other requirements considered should not be applied to the onboard EVSE system but should be enabled through communication directly with chargers or vehicle telematics. The most common method for communicating signals to EV drivers is TOU price signals and it has proven an effective method to drive beneficial behavior changes.

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?**

Response:

EV telematics systems are generally not receiving grid signals directly. To the degree EV telematics systems are responding to grid signals it is usually being enabled through a third-party aggregator intermediary (e.g. WeaveGrid, EnergyHub, ev.energy, etc.)

Tesla continues to believe in and fully support EV drivers having autonomy over their vehicle, their charging decisions, and their data. To the degree EV drivers would like to opt-in to more complex charging programs that may include real-time pricing, grid signals, or charging control being abdicated to a third-party for financial compensation, they are free to do so but Tesla does not support any of these schemes being made a mandatory requirement either through equipment standards nor customer's needing to actively "opt-out."

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?**

Response:

MDHD electric vehicles fit into the CEC's goal of avoiding GHG emissions by replacing polluting diesel trucks with clean electric vehicles thereby preventing the proliferation of harmful air pollutants, many times in those communities most adversely-affected by pollution historically.

Fleet charging load-shifting opportunities will be determined by individual customers use cases. There will likely be opportunities for many customers to shift MDHD depot charging into nighttime ("off-peak") hours similar to what residential customers do with light-duty vehicles today. However, similar to light-duty DC fast charging, on-route charging will be on demand and some fleets may want to optimize by running a fleet 24/7 to have the best possible total cost of ownership (TCO). This would mean charging would occur between driver shifts which may or may not align with off-peak signals.

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 offroad EVs, and charging strategies for off-road EVs

Response:

No. Tesla recommends that no load shifting criteria are mandated for any vehicles of any type across any use-case.

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?**

Response:

Wireless charging is a great solution for autonomous vehicles since it prevents the need for a mechanical operation to plug-in/plug-out the charger.[8]

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?**

Response:

The charging practices for commercial fleets will depend mainly on the use case. For public megawatt charging, charging sessions should be targeted to be approximately 30 minutes to fit within driver breaks. Tesla's V4 cabinet will enable Semi charging up to 1.2 MW.[9]

For overnight charging at private or shared depots, charge sessions will typically be 4-8 hours between shifts. Overnight charging needs can typically be addressed through a combination of high-power Level 2 charging (80A) as well as a low power DC charging infrastructure. These options offer lower operating and installation cost per charging port.

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?**

Response:

[8] https://www.youtube.com/watch?v=sDUOky6TYtw
[9] https://x.com/TeslaCharging/status/1857133221538148638

Today most of the load shifting that is happening is based on price-signals via EV TOU rates and specific use-case demands for charging. As mentioned previously for more advanced and grid responsive charging schemes, those are normally enabled through a third-party aggregator who is receiving some type of signal from the grid or utility. Tesla recommends at this time no communication protocol requirements are mandated while the industry continues to evolve through an already dynamic period of rapid development.

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?**

Response:

Tesla's Cybertruck is the first Tesla vehicle capable of bidirectional charging for the purpose of providing home backup. Cybertruck's warranty is listed on Tesla's website: [10]

> *8 years or 150,000 miles, whichever comes first, with minimum 70% retention of Battery capacity over the warranty period.*

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

Response:

EV TOU price signals could be considered generic and have been successful in driving load-shifting behavior among EV drivers with EVSEs/EVs.

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?**

Response:

Tesla continues to maintain the position that all load shifting behavior should be driven by customer "opt-in" permission with their consent. The EV driver's individually will each have different needs and opinions on when "range needs are not compromised" and should be empowered to be in charge of these decisions.

[10] https://www.tesla.com/support/vehicle-warranty

Tesla appreciates the opportunity to provide comments on these questions and the Commission's thorough consideration of the industry position on this matter. The Commission can continue to encourage EV adoption in California by removing barriers to charging infrastructure deployment. As shown in the data presented and reported on annually by California's IOUs, EV TOU rates broadcast a simple price signal that effectively shifts charging load into the grid-beneficial overnight period.

Respectfully submitted,

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