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Tesla, Inc's Responses to Questions related to DER Strategies for MD and HD BEV Charging Infrastructure Integration

Additional submitted attachment is included below.

January 7, 2020

California Energy Commission
Re: Docket No: 19-ERDD-01
1516 Ninth Street
Sacramento, CA 95814

RE: Grant funding opportunity concept re- targeting the use of distributed energy resource (DER) technologies and strategies to enable the faster and more cost-effective integration of charging infrastructure for medium- and heavy-duty battery electric vehicles

Dear Energy Commission staff:

Tesla appreciates the opportunity to provide feedback on the various questions posed in the recently issued concept document soliciting input on a forthcoming grant opportunity related to the use of distributed energy resources (DERs) to facilitate the integration of charging infrastructure for medium and heavy duty vehicles. Tesla applauds the Commission's interest in this emerging area, which will become increasingly important as customers begin adopting electrified medium and heavy duty vehicles in significant numbers. Providing convenient and rapid charging solutions is of paramount importance to those entities that rely on medium and heavy duty vehicles. Recognizing this, identifying and evaluating strategies that can ease the integration and by extension the costs of deploying this infrastructure is an area worthy of Energy Commission support. Below we offer Tesla's thoughts on the various questions posed by Commission staff:

1. **Of the candidate use-cases and vehicle types listed above, which ones should we prioritize in this solicitation and why?**

Tesla observes that the use cases enumerated in the concept document do not appear to include those involving the delivery of materials and products at a larger scale, for example as would be the case for heavy duty vehicles used to deliver manufacturing or industrial inputs. Although this application could potentially fall under the current candidate use-case focused on delivery vehicles, as drafted, this use-case appears to be specific to beverage and parcel delivery rather than being more broadly open to all types of delivery vehicles, including those hauling heavier cargo. Tesla strongly encourages the Energy Commission to ensure that this scenario and the associated charging needs are considered eligible for participation, if not prioritized, for funding allocations pursuant to this grant opportunity.

Under certain use-cases such as the scenarios where vehicles are used to deliver manufacturing or industrial inputs, these vehicles will sometimes require a great deal of power to support rapid charging (which could be upward of 1MW). As such, it can be reasonably anticipated that, absent the deployment of local sources of power, charging systems deployments to serve this segment face a higher probability of triggering the need for distribution upgrades to integrate into the electric grid. These upgrade costs can, when incurred, be substantial and materially impact the economics and practicality of pursuing electrification.

Additionally, Tesla believes these types of facilities would also greatly benefit, and in some cases require, resiliency capabilities to the degree they are located in areas at risk of Public Safety Power Shutoffs (PSPS) or otherwise face outage risks. Some business will hesitate to move to electrified

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transportation solutions unless they can be assured that these facilities can operate through grid outages such as those triggered by PSPS events.

Tesla recognizes that the Energy Commission may already be considering funding heavy-duty electric trucks and charging infrastructure via the Clean Transportation Program funds. Specifically, Tesla provided comments regarding the early concepts for MD/HD infrastructure funding noting that including grid integration strategies would be useful for fleet operators. However, combining DER integration via solar and storage with this particular subsector of heavy-duty electric trucks is likely not a priority for those program funds. Therefore, Tesla recommends the Energy Commission include Class 8 electric trucks used for business-critical deliveries under the use-cases eligible for this grant funding opportunity. This would provide a means of supporting investments in and validating the efficacy of solutions like solar and storage to reduce the cost of deploying charging infrastructure for the heavy duty segment.

a. Will distribution capacity constraints be a major barrier to the deployment of the charging infrastructure needed for that use-case in the short- to medium-term?

As noted above, given the magnitude of the power needs required for some medium and heavy duty electric vehicle applications, it is reasonable to anticipate that a non-trivial number of deployments could trigger the need for distribution system upgrades. For example, we anticipate that many customers adopting Tesla's full battery-electric Class 8 Semis would often require aggregated charging capability of 3 MW or more on a given site. These large power needs could be served in part or in full through the deployment of solar and storage systems. The frequency with which distribution system upgrades will be implicated is difficult to predict at this point as it depends on site and project specific factors. These include, but are not limited to the size/power of the charging infrastructure being deployed, the load profile of the vehicles using that charging infrastructure, and the hosting capacity of the utility's distribution system, among other factors.

On some parts of the grid, the maximum rating of distribution lines is low relative to the power required to serve a fleet of heavy-duty electric trucks. For example, on a circuit intended to serve 9 MW of load, a new 3 MW service would consume a third of the capacity, which may not available due to preexisting load. This would lead to the need for a new distribution circuit or even dedicated circuit for a large load site. Once it is determined that a dedicated circuit is needed, it usually makes sense to have a larger circuit built once (rather than many 3MW circuits built out). The lead time for these buildouts is non-trivial, frequently measured in years.

b. Will vehicles and charging equipment be readily commercially available in the short- to medium-term?

In the development of the Advanced Clean Truck Rule, the California Air Resources Board has developed a lot of material demonstrating that dozens of medium and heavy duty EV models are already commercially available today.[1] For Tesla specifically, our Semi, a Class 8 heavy-duty electric truck, is expected to enter production in 2020.[2] In tandem with this, Tesla will be developing and deploying charging infrastructure at customer host sites to support vehicle operations.

[1] See, e.g. California Air Resources Board, "Proposed Advanced Clean Trucks Regulation," December 12, 2019, pg. 5, available at https://ww3.arb.ca.gov/board/books/2019/121219/pres19-12-4.pdf.
[2] Vehicle Attributes Forecast, Slide 15, available at https://ww2.energy.ca.gov/2019_energypolicy/documents/2019-07-22_workshop/2019-07-22_presentations.php

c. Are there market and policy influences driving electrification in the use-case now?

There are a number different policies and programs in California that are focused on promoting heavy-duty truck electrification. This includes the investor-owned utilities MD/HD infrastructure programs approved by the CPUC, the Energy Commission Clean Transportation Programs funds, Advanced Clean Truck Rule recently approved by CARB, the HVIP program, the VW Mitigation Trust Appendix D funds, the Carl Moyer Program and more regionally focused programs via the Air Quality Management districts and other local agencies. Combined, all of these programs will certainly accelerate transportation electrification in the MD/HD sector.

However, many of these programs are focused on long-term electrification and funds are still expected to be much less than what is needed to accelerate deployment on a continued basis. At the same time, these programs do not exclusively focus on DER integration, as is proposed via this solicitation. DER integration will have a critical role to play in helping accelerate even the most difficult to electrify sectors such as Class 8 trucks.

In addition to policy and programmatic support, there are important market factors driving the shift toward vehicle electrification including within the heavy duty segment. In particular operational costs associated with electrified transport are expected to be significantly less than conventional vehicles, offering attractive economics which should drive adoption. Tesla also believes that there are important performance advantages enjoyed by electrified heavy duty vehicles to the degree manufacturers take advantage of certain innate properties, like the instantaneous torque offered by electric motors, which allows for greater acceleration and superior ability to maintain speed on steep grades. In the case of the Tesla Semi, electrification will be paired with advanced safety measures like Tesla's Autopilot and other features that will enhance the driver experience and road safety.[3]

d. Are there use-cases that would particularly benefit from the reliability and resiliency value of the DER strategy?

Entities that employ just-in-time manufacturing approaches or those shipping products with high spoilage rates are among those whose operations that are least able tolerate transportation disruptions and are therefore unlikely to consider transitioning to electrified transport if vehicle electrification does not offer comparable or superior levels of reliability as compared to current conventional vehicles. This is regardless of whether or not electrified transportation solutions would otherwise would make sense from the perspective of total cost of ownership. For these entities, Tesla believes that a DER-supported reliability and resiliency approach will be particularly beneficial recognizing the high cost of operational down time.

e. What incentive or funding mechanisms already exist to support MDHD fleet operators looking to electrify?

As mentioned above, there are a number of funding programs available today that can help spur the electrification of MD/HD fleets focused both on vehicle as well as infrastructure incentives. While these programs will help propel electrification in these areas, they are broadly focused on a number of vehicle types and uses cases and alone will not be sufficient to scale electrification across the entire sector. At the same time, there are no current programs focused exclusively on DER integration for these fleet operators, which represents a need as well as an opportunity.

[3] https://www.tesla.com/semi

f. What is the total potential market size in California for the use-case?

At this point, Tesla does not have an estimate for the market size of DER-paired vehicle charging in California but it is undoubtedly significant.

g. Which use-cases have the most potential to replicate the DER package and achieve a meaningful scale?

Tesla does not have a response to this question at this time.

2. What is the best way to characterize the grid impacts and other costs associated with deploying MDHD BEV charging infrastructure without a managed charging/DER strategy

The grid impacts and costs associated with deploying MD/HD electric vehicle charging infrastructure will depend on several factors including use case/application, location and time of day of charging, as well as the existing hosting capacity of the utility infrastructure in the locality where a system is being deployed, among other factors. It is therefore difficult to generalize the impact across an entire sector of different vehicles and use cases. For instance, a site may have limited hosting capacity, require constant and consistent access resulting in limited flexibility to schedule charging. In this case, a solar and storage solution may offer compelling advantages. Another site, however, could have access to excess capacity on the utility system and have operations that are compatible with lower power, overnight charging. In this case, the value provided by a DER solution may not be as impactful. In short, each site across each sector will have specific characteristics that influence the costs, impacts, and value provided.

a. What metrics should be used to evaluate the cost and performance of the baseline incumbent technology? Metrics currently under consideration include:
i. Itemized balance of system costs considering both site host costs and utility costs,
ii. Carbon intensity,
iii. Cost of delays associated with upgrading upstream distribution systems/substations, and
iv. Risks associated with long-term investments in permanent upgrades.

In addition to the metrics identified above, Tesla recommends tracking the following metrics:

i Levelized cost of charging inclusive of distribution system upgrades costs and/or integration solutions costs.
ii Overall deployment timelines
iii Ability to continue to provide charging services during an outage (e.g. amount of energy available, incremental miles of range supported, etc.)
iv Charging performance (e.g. power rating of deployed charging solution)

b. What information about existing grid infrastructure, beyond the Integration Capacity Analysis (ICA) maps, is needed to evaluate capacity constraints that could limit deployment of MDHD BEV charging infrastructure?

With respect to the ICA maps, it may be worthwhile to consider how those maps need to be adjusted/expanded to reflect the need to support additional loads and where there is sufficient capacity for this. As Tesla understands the current ICA maps, they were designed more with distributed generators in mind and thus are oriented around providing information about where, for example, solar generation can be deployed given expected exports, as opposed to considering where incremental load can be supported given existing capacity.

In addition to the ICA maps, other information that would be useful in helping evaluate constraints include the following:

- Planned utility distribution and transmission systems investments, including new substation locations. As the utilities develop their infrastructure investment plans they should be collaborating with stakeholders to ensure those plans are appropriately reflecting and supportive of MD/HD electrification.
- Better visibility into utility service extensions and associated upgrade timelines and reasons for the high level of variability that Tesla has observed. Project developers, generally have no practical insight in to why some sites require just a few months for new service infrastructure to be deployed and some sites take as long as 2 years. In particular, anticipating construction timelines post load study is hard to predict.

3. How does the target technology need to improve?

a. What are the current balance of system costs associated with deploying DERs as a non-wires solution for integrating MDHD BEV charging equipment?

In many cases where a customer decides to install greater than 3MW of new service, the presiding utility/municipality will require the user becomes a “primary customer,” meaning they will own a meter at the primary voltage line (typically 12kV) rather than the secondary voltage line (480V). When this happens, there is a lower tariff cost, however capital costs increase significantly. Where typically the user will own their low voltage switchgear, they now need to own and operate additional hardware, including: a stepdown transformer and medium voltage switchgear. This can increase the capital cost of a project by $200k-$300k (dependent on site conditions).

Additional system cost outside of the DER and MDHD BEV charging equipment may include redundancy equipment, to harden the reliability of the chargers. As fleets move to a higher share of electrification, the outage of a single charger will disrupt operations in a ways that significantly impacts a customer’s operations. Hardening technologies may include secondary utility services from alternative substations. This becomes a critical consideration especially for customers with dedicated circuits. Redundancy for utility distribution services requires significant utility planning and cost assessment of risks. Customers may also consider the benefits of a backup battery storage systems should the grid go down. A customer will also consider warehousing replacement equipment for hardware that could fail, by stocking these items they reduce the downtime and by eliminating the long lead shipping for large equipment such as transformers.

b. What publicly available resources provide visibility into these costs?

Tesla does not have a response to this question at this time.

c. What types of costs can be further reduced through innovation and require demonstration (e.g., soft costs, software, design, hardware, permitting, interconnection, etc.)?

Tesla does not have a response to this question at this time.

d. What is the revenue-generation potential and business model for the targeted technology (e.g., customer bill savings, low carbon fuel standard, wholesale market participation, distribution grid services, resiliency, etc.)?

While we would anticipate there being some opportunity to leverage DERs to provide additional services beyond supporting charging activity, the ability to access these additional value streams is likely to be very case specific and depend fundamentally on how intensively DERs are used for the charging use case, the timing and frequency of charging, etc. Fundamentally, we expect the charging use case to be the primary use and thus prioritized above other revenue generating activities.

e. What metrics can be used to evaluate cost and performance attributes of the targeted technology?

To allow for comparability relative to conventional, wires-based approaches, metrics for the targeted technology should mirror those used to assess the performance of the incumbent solution. Thus, Tesla recommends the following metrics to evaluate the cost and performance attributes of the targeted technology:

i. Avoided distribution upgrade costs
ii. Levelized cost of energy (LCOE) for charging
iii. Carbon intensity per delivered kWh of energy
iv. Charging rate (e.g. power capacity)
v. Overall deployment timeline
vi. Ability to continue to provide charging services during an outage (e.g. amount of energy available, incremental miles of range supported, etc.)

f. How can those metrics be normalized across different use-cases and project sizes (e.g., ratio of PV size to stationary energy storage size, ratio of soft costs to hardware costs, load factor on the utility distribution system, resiliency/reliability metrics)?

Tesla believes most of the proposed metrics above are normalized in the sense that each metric proposed is generally comparable across projects of different types/sizes. For example the LCOE provides a relatively straightforward measure that can be reasonably compared regardless of project scale or use case.

g. How well can the targeted technology meet the operational requirements of the priority use cases?

Tesla does not have a response to this question at this time.

4. What level of investment would be needed from EPIC to make a meaningful difference on this issue?

a. What size of a project should we be targeting (MW, MWhs, number of charging ports, number of vehicles, etc.)?

Tesla generally believes the CEC should be targeting projects in the range of 1 to 3 MW of vehicle charging capability.

b. What portion of the DER equipment costs should be covered by EPIC in order to appropriately incentivize site host participation?

Given the 1-3 MW size range that Tesla recommends targeting with this grant opportunity, Tesla further recommends providing funding of up to $1 million per MW of charging capability. Tesla estimates this amount would be roughly sufficient to ensure projects achieve a compelling payback (3-4 years) to support investment. Tesla notes that this estimate does not attempt to quantify potential opportunities to deploy funds from other programs (e.g. the Self Generation Incentive Program) to reduce the amount that would be needed from EPIC, however we would fully expect the CEC to look favorably on applications that seek to leverage such funds if available.

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Tesla appreciates the opportunity to provide feedback on the initial concepts for utilizing EPIC funds to demonstrate the use of DERs to integrate charging infrastructure for medium and heavy duty vehicles across a variety of use cases. We look forward to continuing to work with staff and other stakeholders to further refine the proposal prior to issuance of this grant opportunity.

Sincerely,

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