PUC PROJECT NO. 49125

REVIEW OF ISSUES RELATING TO ELECTRIC VEHICLES	BEFORE THE PUBLIC UTILITY COMMISSION OF TEXAS

RESPONSE OF TESLA TO PUBLIC NOTICE OF REQUEST FOR COMMENTS

Pursuant to Public Utility Commission of Texas (Commission) procedural rules, Tesla, Inc. (Tesla) files this response to public notice of request for comments filed on December 13, 2019 regarding Project No. 49125, Review of Issues Relating to Electric Vehicles. Tesla's comments below provide responses to the questions posed by the Commission and staff regarding general data on electric vehicles (EVs), charging infrastructure, and load in Texas and potential grid impacts.

Tesla's mission is to accelerate the adoption of sustainable energy by developing and manufacturing the world's safest and most advanced electric vehicles, and electric vehicle charging stations, among other clean energy products and services. In Texas, Tesla's presence includes 18 location, 46 Supercharger stations[1] with a total of 399 Superchargers, and nearly 550 Level 2 Tesla Wall Connectors[2] as part of our Destination Charging network.

Today, Tesla represents a significant portion of the EV market in Texas and has gathered valuable experience over the past eight years operating its own infrastructure network. Tesla has gained insights about the challenges and opportunities to deploying, owning and operating direct current fast charging (DCFC) infrastructure. Creating a seamless and convenient charging experience is key to enabling mass market EV adoption because it ensures people do not need to compromise to drive electric. We are happy to share this expertise with the Commission and other stakeholders and help the Commission as it evaluates the potential impact of EVs on the grid.

[1] Supercharging is a form of Level 3 Direct Current Fast Charging, which utilized for dwell times of less than 1 hour and provided as a service to Tesla customers. There are three versions of Supercharger at 72kW, 150kW and 250kW. Each of these Supercharger versions includes a different design. Some customers pay a fee for Supercharging while others receive free charging access or credits as an incentive to purchase the vehicle.

[2] Level 2 charging is typically utilized for medium to long dwell time use-cases (2 - 8 hours) providing between 23 and 52 miles of charge per hour and a full charge overnight. Today, the Destination Charging network is free for Tesla customers to utilize.

I. Responses to Questions

General Data

1. ***The Commission requests that parties provide current data sources and projections for the expected deployment of electric vehicles in Texas over the next ten years. If available, the data sources should attribute the projections by vehicle class (i.e., personal, commercial short-haul including fleets and buses, and commercial long-haul electric vehicles).***

There are a number of different factors that will influence the expected deployment of EVs in Texas over the next decade, which include policy mechanisms, charging infrastructure access, battery costs, customer experience, and vehicle availability, among other items. For a current snapshot of EVs registered in Texas, the Commission can utilize the 2019 Alternatively Fueled Vehicle Report provided by the Department of Motor Vehicles.[3] Appendix F provides a relevant overview of year-over-year change in EV deployment since 2016.[4] Additionally, a number of different organizations have developed forecasting scenarios that the Commission could utilize as a basis for evaluating expected EV growth going forward. These include ERCOT's 2018 Long Term System Assessment (LTSA),[5] Bloomberg New Energy Finance's (BNEF) 2019 Electric Vehicle Outlook,[6] National Renewable Energy Laboratory's (NREL) Plug in Electric Vehicle Infrastructure Analysis[7] and International Energy Agency's (IEA) Global EV Outlook,[8] among others. Each of these assessments includes different scenarios and assumptions including low and high growth projections looking at various classes of vehicles. For instance, ERCOT under its Emerging Technologies scenario predicts three million passenger, 80,000 short haul/buses and 200,000 long haul EVs by 2033.[9] NREL's analysis, on the other hand, focuses on pairing plug-in EVs (PEVs) with supporting charging infrastructure and estimates roughly 835,000

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[3] Texas Department of Motor Vehicles, 2019 Alternative Fueled Vehicle Report, Fiscal Year 19.
[4] *Id.*
[5] Electric Reliability Council of Texas, 2018 Long Term System Assessment, December 2018. Available at: http://www.ercot.com/content/wcm/lists/144927/2018_LTSA_Report.pdf
[6] Bloomberg New Energy Finance, 2019 Electric Vehicle Outlook. Available at: https://about.bnef.com/electric-vehicle-outlook/
[7] U.S. Department of Energy, Plug-in Electric Vehicle Infrastructure Analysis, September 2017. Available at: https://www.nrel.gov/docs/fy17osti/69031.pdf.
[8] International Energy Agency, Global EV Outlook, May 2019. Available at: https://www.iea.org/reports/global-ev-outlook-2019.
[9] ERCOT, 2018 Long Term System Assessment, December 2018 at 10.

passenger PEVs by 2030, along with charging infrastructure needs that include 18,000 plugs for Level 2 workplaces, 12,400 plugs for public Level 2 and 1,720 DCFC plugs.[10] While Tesla does not have a position on which of these scenarios is most likely to be most accurate, Tesla suggests the Commission assess these various outlooks and potentially work with utilities and other stakeholders to develop its own forecasts or growth scenarios. Any initial estimates can be refined over time and must reflect the policy environment under which it operates. It is also important to relate any EV deployment projections to associated charging infrastructure targets and requirements.

2. ***Please provide any current data sources and information on the expected amount of new load attributable to electric vehicles over the next ten years. If available, the data sources should attribute this load by vehicle class (i.e., personal, commercial short-haul including fleets and buses, and commercial long-haul electric vehicles).***

We are not aware of a current comprehensive data source that has analyzed the expected amount of new load attributable to EVs over the next decade for Texas. Similar to the first question above, this is likely because there are a number of factors that will influence the amount of new load that could be expected from EVs. ERCOT in its 2018 LTSA does provide estimates for the total peak charging demand, which it estimated to be over 18,500 MW by 2033 under a high EV penetration scenario, which also includes 9,000 MW more new generation capacity.[11] This conclusion, however, is based on a number of different scenarios and assumptions and does not fully account for the opportunity to manage any new EV load and the diversity of charging characteristics and behaviors that will likely impact EV usage. For instance, roughly 80 percent of charging today occurs at home for passenger vehicles and DCFC still represents a relatively small portion of charging today. Residential charging load is inherently more flexible given it involves a vehicle sitting for several hours and customer diversity in that not everyone will likely charge every day and there are opportunities to stagger overnight charging with different price signals or mechanisms. It is therefore important to distinguish between residential and commercial charging operations when evaluating any new load from EVs, as well as the various types of vehicle use cases and applications including light-, medium- and heavy-duty EVs.

[10] U.S. Department of Energy, Plug-in Electric Vehicle Infrastructure Analysis, September 2017 at 52.
[11] ERCOT, 2018 Long Term System Assessment, December 2018 at 10.

Utilities, of course, have a key role to play in helping forecast and evaluate any new potential load from EVs in the next decade. In a residential setting, utilities can utilize data analytics to identify whether someone is charging based on load profile characteristics, and thereby assess potential new capacity needed to serve passenger EVs. From a commercial perspective, public charging is much more likely to happen during the middle of the day with peak usage occurring around travel holidays. Utilities will be able plan ahead for this new load given that new commercial sites, whether DCFC for passenger vehicles or short or long haul applications, more often than not have to go through a new service connection process similar to other commercial customers given the power requirements.

3. ***Please identify any anticipated load "hot spots" in the state for electric vehicle charging. Please specify whether these hot spots are expected to result from personal, commercial short-haul, or commercial long-haul electric vehicle deployment and charging.***

Prior to discussing the need for consideration of "hot spots," it is important to clarify the term. Hot spots could be defined as clusters of EVs charging in close proximity at high power levels or where there is limited grid capacity. While there will always be outliers in terms of predicting EV charging station deployment, for commercial applications utilities will have insight into where EV charging stations will be located either through new service requests from charging developers, or through proactive identification of commercial fleet locations that may electrify in the future. This provides a certain level of predictability for utilities and the ability to mitigate any potential issues prior to the creation of hot spots.

The location of personal passenger vehicles is largely driven by customer purchases of EVs. As discussed previously, utilities will have some insight into which residential customers are charging an EV at home given load profiles and can provide incentives for customers to disclose when they purchase an EV. Likely, clusters of passenger vehicles with have more limited impact, if any, on the distribution grid until much higher levels of EV penetration are reached and even then, utilizing policy mechanisms such as time of use price signals and the fact that not all residential customers will charge every day, can help manage this load to be off-peak. In California for instance, the utilities' annual load research reports over the past seven years indicate that just 1 of every 670 EVs results in a distribution system or service line upgrade for residential EVs.[12]

Locations for commercial DCFC will be known to the utility prior to build out given that these providers have to go through the same service connection process as any other commercial customer. The process involves an assessment of whether there is sufficient capacity to serve the customer, or whether system upgrades will be required. Utilities can get ahead of this also by providing charging developers with hosting capacity maps that identify available capacity on certain areas or feeders. While many factors go into where to site DCFC stations, this could help save time and site project costs if there are areas of the grid where additional capacity is available for charging stations.

Commercial fleets will likely have the highest power levels in certain applications to meet charging needs and could be located in close proximity to other fleets given zone and land use considerations that tend to result in warehouses or distribution centers being clustered in the same area. While these types of service requests may require longer timelines, the utilities will be able to work with commercial operators to better understand future site needs. Reliability and total cost of ownership will be key factors for enabling commercial fleets to go electric and therefore, these types of projects will naturally have a longer planning timeline that can help mitigate any potential opportunities for hot spots.

Regardless of which use case and charging application is discussed, hot spots will likely be outliers rather than the norm and there will be opportunity to utilize technology, policy and planning to mitigate potential challenges prior to those arising at scale given EVs currently still represent a fraction of a percentage of the vehicle market in Texas today.

4. ***Describe the observed or anticipated load profiles and impacts of various types of electric vehicle charging stations (e.g., residential Level 1, Level 2, and Level 3 DC Fast charging) and the class of the vehicle charging (i.e., personal, commercial short-haul including fleets and buses, and commercial long-haul electric vehicles).***

As discussed in response to Question 3, Level 2 charging load tends to be more flexible in that it takes place over several hours and customers are expecting to stay in a certain location for a longer period of time. Depending on where the charging is taking place (home, work, or around

[12] Synapse Energy, Electric Vehicles are Driving Electric Rates Down, June 2019, at 2. Available at: https://www.synapse-energy.com/sites/default/files/EV-Impacts-June-2019-18-122.pdf.

town), this charging can either occur at night or during the day. There are different strategies and technologies that can help manage the time of charging for Level 2 to be off-peak or assist with renewables integration while still maintaining a seamless customer experience. DCFC for passenger vehicles is much more likely to take place during the day depending on which use case it is being utilized for (urban versus corridor charging). It is important to recognize that DCFC represents a relatively small portion of the overall charging needs for passenger vehicles as a majority of charging today takes place at home and in general, it is preferable for customers to charge where they park, which provides a more seamless customer experience and is more aligned with grid needs.

Finally, for commercial long and short haul vehicles and fleets, there will likely be several different charging scenarios including overnight charging for several hours or during the day between driver shifts at much high power levels. These scenarios will depend on the operation and use case of the commercial vehicle.

5. ***What, if any, emerging vehicle charging technologies are anticipated to be commercially available in the next ten years that could impact electricity markets in Texas?***

Technology in the EV and charging space is rapidly evolving and competition will continue to help drive innovation in this space. While there are a number of technologies that will likely evolve over the next decade, the following represent a snapshot of near-term opportunities:

- Load management tools that focus on aggregation of different products and services
- Power sharing for multifamily and workplace charging
- Scheduled charging via vehicles and charging stations

At the same time, waiting for newer technologies to become commercially available should not serve as a barrier to EV deployment but rather should provide confidence that as higher levels of EV penetration are reached that may require more active management, the technology solutions along with the policy mechanisms designed to support these solutions will be available.

Grid Impacts

6. **The Commission requests that parties provide a detailed explanation on the following items:**

a. The anticipated impacts of electric vehicle charging, including residential and commercial charging stations on the distribution system in the next ten years;

In the comments above, Tesla has already discussed different considerations for evaluating the impact of charging stations on the distribution system. Prior to reiterating some of these points, however, it is important to ensure that any discussion on anticipated impacts of EV charging holistically assess both the costs and benefits of EVs. EVs and charging infrastructure have the opportunity to not only serve as grid assets, but also provide benefits to all ratepayers. While a Texas specific study is not available yet, Rocky Mountain Institute (RMI) and MJ Bradley and Associates[13] have both provided data driven analysis regarding the significant benefits to all ratepayers that EVs can provide. For instance, RMI estimated ratepayer savings per EV ranged from $744 to $9,607 over the lifetime of the vehicle.[14] At the same time, EVs also provide air quality and economic development benefits that must be considered in any impact assessment.

For residential EV charging, there will likely be minimal grid impact in the near term. As more vehicles are deployed, charging can be scheduled to be staggered and take place over night recognizing that not every vehicle will need to charge every night. For instance, a survey by Austin Energy found that "the most efficient mechanism to influence behavior is arguably through rates, which create clear price signals that consumers can respond to."[15] If problematic peak hours are between 7pm to 11pm for example, then price signals can be sent to customers to not charge at this time. This can be combined with opt-in demand response (DR) strategies for residential EV customers.

For commercial charging, as discussed in detail to Question 3 above, customers will go through a new service connection process similar to all other commercial customers and utilities will be able to determine whether there is a need for infrastructure upgrades on the distribution system prior to building that site. If the costs exceed the utility allowance based on expected load provided by a site, a site will need to cover these costs.

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[13] MJ Bradley and Associates, Electric Vehicle Cost-Benefit Framework. Available at: https://www.mjbradley.com/content/electric-vehicle-cost-benefit-framework

[14] Rocky Mountain Institute, From Gas to Grid: Building Charging Infrastructure to Power Electric Vehicle Demand, Rocky Mountain Institute, 2017, at 9. Available at: https://www.rmi.org/insights/reports/from_gas_to_grid.

[15] Austin Energy, EV 360 Whitepaper, at 6. Available at: https://austinenergy.com/wcm/connect/b216f45c-0dea-4184-9e3a-6f5178dd5112/ResourcePlanningStudies-EV-Whitepaper.pdf?MOD=AJPERES&CVID=mQosOPJ

b. ***The anticipated impact of electric vehicle charging stations on the transmission system in the next ten years; and***

Initial anticipated impacts on the transmission system will likely be related to large commercial fleets operating at higher power levels and likely seeking to take transmission level service. Given the long timeline for such projects, however, there will be an opportunity for utilities and customers to work together to evaluate and mitigate potential impacts, and provide upgrades as needed, well in advance of the deployment of any infrastructure at a particular site.

c. ***The anticipated impact of electric vehicle charging stations on long-term system planning at the regional transmission organization level, given a widespread adoption scenario.***

Similar to other types of new load, utilities and ERCOT will be able to plan in advance for any potential impacts of EV charging on the system in the long term. Prior to contemplating a widespread EV adoption scenario, barriers, like general lack of access to EV charging, need to be overcome to drive EV growth.

7. ***What is the overall anticipated impact of electric vehicle charging in the next ten years in terms of energy and peak demand? What changes, if any, should be made to energy and peak demand forecasts to incorporate this impact?***

The impact of EV charging will depend on the scale of EV deployment in Texas and whether or not customers are encouraged to charge off-peak for a majority of the anticipated charging load. However, EV charging does have the opportunity to increase the load factor of the electric system by increasing consumption in off-peak periods through night-time charging for residential customers and some commercial EV fleets. As discussed, not all types of charging will be controllable load, but to a large extent, technology solutions, market competition and policy mechanisms can help ensure a majority of charging is controlled to the extent it needs to be. Forecasts should therefore take into consideration that charging load will be manageable and scenarios where every customer plugs in every day at the exact same time are unlikely. At the same time, forecasts should also incorporate the potential benefits of EVs to all ratepayers and Texas.

8. ***What are the capabilities of electric vehicle related technologies, such as vehicle-to-grid, to participate in wholesale electricity markets?***

First, it is important to recognize that EVs still represent a small portion of the total vehicle market in Texas today. Thereby, prior to focusing the discussion on vehicle to grid or other advanced capabilities, it is important to focus on driving EV adoption first and foremost. Vehicle to grid benefits can be recognized much more efficiently when EV deployment is at scale rather than in the early adopter phase. At the same time, any discussion regarding the capabilities of EV related technologies must recognize as a first principle that customer experience and willingness for participation is key. There certainly may be an opportunity for future projects and programs that focus on advanced technological integration, such as the eventual aggregation of EVs in the future to provide grid services in wholesale markets. In any setting, it is important to remember that EVs are modes of transportation first and foremost for customers. There is also an opportunity to evaluate stationary storage assets first to provide similar grid services capabilities from a wholesale electricity market perspective.

9. ***Please explain any preferred or best practice facilities siting and design standards for commercial electric vehicle charging stations and why such standards are recommended.***

Many factors go into the site design and siting of commercial EV charging stations. This includes space constraints, application (urban or corridor), service cost, and amenities among other items. Additionally, for DCFC used for passenger vehicles, it is important to deploy enough chargers at a site to satisfy customer demand on peak travel days to ensure a good customer experience, and to provide redundancy in case of an equipment outage. While there are certain best practices that can be considered when designing commercial EV charging sites, it is not necessary for the Commission to determine these recommended standards unless it specifically applies to programs where charging stations that are being funded by public funds via ratepayers as part of a regulated utility infrastructure deployment program. For both public and private investments, it is important for charging operators to work with utilities to develop best practices on the utility connection side and create a streamlined service connection process to ensure that sites can be built in a timely manner. Best practices for utilities working with charging providers to bring service can include: dedicated EV account representatives, clearly defining a process for how to obtain a service connection online that is transparent, identifying available commercial rates for customers, and providing details regarding potential utility line extension allowances that may cover a portion of the connection costs on the utility side of the meter costs. At the same time, utilities can also provide charging providers with hosting capacity maps to try to provide insight early on in the site design process. Fleets, in particular, can additionally benefit from having conversations early on with utilities to discuss charging needs, specifically for heavy-duty vehicles given the potential size of power required to meet a site's needs.

One area that the Commission should evaluate further and that can help facilitate a more seamless charging experience for commercial EV stations is determining that third-party owners of EV charging infrastructure are not public utilities or retail energy providers and should not be regulated as such. Tesla believes that the fairest way to bill customers for charging services is on a $/kWh basis because the driver is paying for the energy they receive. The predominant alternative approach to billing for charging services is on a $/minute basis. The pitfall of the $/minute approach is that two drivers that are parked for the same duration will be billed the same amount, yet they can receive two completely different quantities of kWh in that time because the rate of charge is dependent on a variety of factors. These factors include the vehicle's charging capabilities, state of charge, battery temperature, and others. However, given the regulatory uncertainty as to whether non-utility charging operators are authorized to bill drivers on a $/kWh, drivers tend to be billed on a $/minute basis in Texas.

Tesla therefore recommends that the Commission further evaluate and seek additional written comments on this topic in this docket, with the goal of issuing guidance about the Commission's treatment of third-party charging operators in its recommendations and findings to the Legislature for consideration. A similar approach has been taken by Commissions in other states, including Alabama, Arizona, Delaware, Kentucky, New York, Oklahoma, and Pennsylvania.[16]

II. Conclusion

Tesla appreciates the opportunity to provide feedback to the Commission and staff regarding the initial questions posed on expected EV load in the next decade and potential grid impacts. While these are important initial questions to pose to stakeholders, Tesla looks forward to providing additional feedback on future questions that may be considered by the Commission

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[16] Alabama Docket No. 32694. Arizona Docket RU-00000A-18-0284 Decision No. 77289. Delaware Docket No. 19-0377. Kentucky PSC Case No. 2018-00372. New York Case 13-E-0199. Oklahoma OAC 165:35-13-1(C). Pennsylvania PUC Policy Statement Order M-2017-2604382. Thirty states in total have exempted electric vehicle charging equipment from the definition of public utility. The majority of the states have addressed the issue through revisions to statutes or legislative action.

regarding a broader spectrum of issues related to EV charging infrastructure deployment in Texas.

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