



November 5th, 2018

State of Vermont

Public Utilities Commission

112 State St, Montpelier, VT 05620

Re: Case No. 18-2660-INV - Investigation into promoting the ownership and use of electric vehicles in the State of Vermont – Order commencing next step of investigation

Tesla appreciates the opportunity to provide comments in the Public Utility Commission's investigation into Electric Vehicle (EV) charging infrastructure and associated rate structures, billing mechanisms and other related topics.

Tesla's mission is to accelerate the adoption of sustainable energy. Tesla is a developer and manufacturer of the world's most advanced electric vehicles, and electric vehicle charging stations, among other clean energy products and services. To support the accelerated adoption of electric vehicles, we have established a worldwide presence of sales centers, service stations and charging stations. As of October 2018, Tesla owns and operates 11,000 Supercharger connectors at more than 1300 stations globally.

Tesla respectfully submits responses to the questions posed by the Vermont Public Utilities Commission ("PUC") in its October 24, 2018 Order:

1. Describe how usage fees would be calculated for Vermont customers using public EV charging stations. Please identify each component used in determining the final fee, and if a component is not always used in determining the final fee, explain the circumstances under which it is used and the reasons why.

A variety of business models exist for operating charging infrastructure in order for charging vendors to remain in business and expand their networks. Some charging providers offer charging services for free in order to attract customers to their primary business, such as a store, restaurant or hotel. Other charging operators collect service fees from customers.

Tesla funds, builds and operates its own network of Superchargers worldwide, and operates the network as a service to its customers and the network is not intended to be a profit center for the company. Every Tesla customer is, at the time of vehicle purchase, effectively investing in both a car and in the Supercharger network. Some Tesla customers receive free unlimited access to the use Superchargers as a promotion to encourage the purchase of a vehicle. To minimize the purchase costs of vehicles and to cover ongoing operational and development costs of the Supercharger network, some Tesla customers pay for usage.

For fast charging infrastructure, the current utilization tends to be relatively low due to current EV penetration levels. Their operating costs can be relatively high due to the relatively low utilization and demand charges. Charging operators apply various fee structures to account for costs of site development, equipment CAPEX, and ongoing OPEX and maintenance costs.

Regarding the question of how usage fees would be calculated for Vermont customers using public EV charging stations, the Commission should delineate between oversight of public and privately funded infrastructure. Given the variety of business models, and ability of customers to choose where they charge (whether it is public, at home or at work), it would be inappropriate to regulate pricing of privately funded charging stations. Competitive charging operators are not operating as utilities and treating them as such would likely reduce further investment in publicly accessible charging stations. Encouraging private investment in charging stations is critical at this stage of EV deployments and in the public interest. It would allow operators to refine their business models, increase their service to cater to market demand and customer preferences.

On the other hand, it may be appropriate for the Commission to oversee pricing of publicly funded, or ratepayer funded charging stations. The Commission can undertake an assessment of development costs and expected operating costs to develop a rate that recovers the costs of service. Further oversight of infrastructure developed using public funds can include requiring usage reporting, specific reliability targets and equipment requirements.

2. Are usage fees variable based on factors such as time spent at the charging station, time of day when charging occurs, type of vehicle charging at the station, etc.? For example, if a kWh charge applies to the first hour of charging and a vehicle remains at the station charging beyond that hour, could or would an additional fee above and beyond the kWh fee apply to all subsequent hours? Please explain your company's approach to setting and applying fees at charging stations.

Tesla charges a fixed rate for billing customers within a specific state in order to cover certain operational and electricity costs. Billing for charging services is done on a \$/kWh or \$/min basis depending on the state and local laws and statutes. In Vermont, Tesla charges customers \$0.12 per minute when the charge is below 60kW and \$0.24 per minute when the charge is above 60kW. The different fees based on power level fees account for operating cost factors, primarily demand charges. Tesla believes billing customers by the kWh is the most fair and transparent method for customers', and it provides the best customer experience. Per kWh billing ensures that customers are not indirectly overpaying for uncontrollable factors such as battery chemistry, charging dynamics, site congestion etc. See Tesla's prior comments on October 15th that go into detail the benefits of billing by the kWh versus. minute.¹

¹ <https://epuc.vermont.gov/?q=downloadfile/314943/134378>

In order to relieve congestion at certain sites, Tesla also charges Idle Fees that apply to any car occupying a Supercharger if the station is at least 50% full and once the charge session is complete. If the station is 50% full, an idle fee of \$0.50/minute is applied. If the station is 100% full, an idle fee of \$1/minute is applied. If the car is moved within 5 minutes of the charge session completion, the fee is waived. This fee is purely to improve customer experience by relieving congestion and is not meant to be a revenue generator. Customers get notifications on their app about when their charge session is nearing completion, when the charge is complete, and whether the station is full and the customer could be subject to idle fees.

3. Describe any limitations imposed on the fee structures for EV charging station use in states other than Vermont.

No states impose limitations on EV charging fee structures besides the ability to bill customers on a kWh basis. There are generally no restrictions because EV charging is offered as a service to customers, and thus there is no need for price regulation.

4. Do or should the fees charged to consumers at public EV charging stations vary based on the electricity rates charged by the utility that serves the charging station?

Tesla does not currently vary fees at charging stations within a state based on what utility is providing electrical service to the station. Doing so could lead to customer confusion and negatively impact customer experience. Customers may not understand why electricity prices fluctuate from one area to the next. Tesla charges customers a fixed rate statewide to ensure pricing consistency wherever in the state the driver chooses to charge. Charging networks are complex and large, and we therefore think it is more appropriate to manage the portfolio of stations rather than toggle prices station to station.

5. Will or should variations in electricity rates due to time-of-use rate structures offered by the electric utility serving a public charging station be passed through to the users of public EV charging stations?

Passing through electricity rates through to customers can add substantial and unnecessary complexity when billing customers for charging. Tesla recommends that the commission allow charging station operators determine end-use pricing for their service since they are more closely integrated with customer demands and are incentivized to improve charging utilization at each site by offering simple fixed rates and/or session fees. The operators are also the utility account customer of record and ultimately pay the prevailing utility rates.

Tesla does not have a position or recommendation on whether TOU rate structures should be passed through at publicly funded or ratepayer funded stations since it can depend on the objectives of the State, utility and other stakeholders. For example, they may choose to price the service with time varying charges in order to encourage changes to customer charging behavior.

6. Can the charging capabilities (e.g., speed) of the EV affect the rates that a consumer will be charged at the EV charging station? Please explain and offer examples from your experience.

Differences in billing arise when operators can only charge by the minute. For example, a likely scenario could be that a vehicle that added 100 miles range (or kWh equivalent) during a charge session could get billed the same as a vehicle that added 150 miles during the same charge session, at the same location, and due to variables out of control of the driver or vehicle. Variables such as the power level of the charger, battery chemistry, temperature, load management algorithms and the state of charge of the battery will result in a different quantity of energy (kWh) being delivered (and paid for) in every charge session. This is true even if the vehicle models are the same. Tesla provided an example in in our October 15th comments², see the “Energy-based billing (by the kWh of EV charging services is fair and transparent” section.

The corollary to pumping gas would be if the velocity of the fuel being delivered, as well as the \$/gallon price, constantly fluctuated throughout a fueling session, but one would be charged for the time they are pumping, regardless of how much fuel was actually delivered.

When billing by the kWh, the rates customers pay will not be affected by the charging capabilities of the car or charging station. If one vehicle gets 10 kWh in 30 minutes and another vehicle gets 10 kWh in an hour, they would both be billed the same price. A \$/kWh rate disregards all external factors and allows customers to pay for exactly the amount of energy that is delivered to the battery, no matter how long it takes.

Tesla recommends that the commission allows charging operators to bill customers by the kWh since it is the most fair and transparent method.

7. How would drivers charging their vehicles at a public EV charging station pay for their usage (e.g., by credit card)?

Tesla recommends that the Commission only apply payment method recommendations for publicly funded or ratepayer funded charging stations. Setting payment requirements for privately funded charging stations can lead to unnecessary CAPEX and OPEX costs.

² <https://epuc.vermont.gov/?q=downloadfile/314943/134378>

For example, Tesla's Level-2 charging, the Destination Charging Network, does not require payment since the service is free. For Supercharging, Tesla drivers pay for charging using a credit card tied to their Tesla account that is accessible via an app in their smartphone, or in their car's user interface. This process is a one-time setup after which no further data entry is required to charge. This method is seamless and widely accepted by the general consumer base since smartphone access are ubiquitous.

EV Charging Station Technology

8. What factors affect the charging speeds for different EVs?

Two primary factors affect the time required to recharge a battery. The first is the basic structure of the battery, including its overall capacity, capacity of on-board chargers (the device that converts alternating current to direct current), and state of charge. The second is the level of electrical service (i.e., voltage and amperage) of the charging station. There are three industry-common charging levels used by EV-drivers to charge their vehicles, these are typically referred to as; Level-1, Level-2, and DC fast charging (Level 3). Level 1 is alternating current from a 110-volt outlet, typically found in most North American homes and offices today. Level 2 power comes from a 208/240-volt outlet typically operating between 20 and 90 amps and is generally equivalent to the power coming from a dryer outlet or electric stove. Finally, DC fast charging (Level 3) is a direct current charge typically occurring at over 400 volts.

The charge levels directly relate to the rate of electrical energy transfer and thus the time required to charge. For example, an EV with a 200-mile range charging at a DC Fast charger (50kW–120kW) can take anywhere from 30 to 90 minutes to fully charge. The same vehicle charging at a Level-2 outlet (3.3–19.2 kW) may take 8-10 hours to fully charge or can take several days if charged from a Level-1 outlet. This means that over a specific period, one hour for example, a driver charging his or her EV will see a wide range of possible recharge rates depending on whether he or she charged at a Level-1, Level-2, or a DC-fast charging outlet and depending on the capacity of their vehicle's battery. Thus, if customers are billed by the minute or by the hour, as opposed to by the amount of energy they receive, some drivers may end up paying more than others due to circumstances out of their control.

9. How will a utility determine the electricity usage of a charging station connected to its distribution grid?

Tesla and other 3rd party charging operators go through new utility service requests like all commercial utility customers. During the process, information is shared about expected consumption in order to

determine the appropriate size of utility service. Each Tesla Supercharging station in Vermont is separately metered and the utility has visibility into how much electricity is being consumed.

10. Would utilities prefer to install their own meters or rely on meters included in the EV charging stations?

Tesla Supercharger stations in Vermont have meters that are installed, owned and maintained by the utility.

11. If a utility relies on the meter in a charging station to measure electricity service to that charging station, will the utility be able to determine the time of sale for each kWh delivered to the charging station for the purpose of applying time-of-use-rates to the electricity delivered?

N/A

12. Can EV charging stations be configured so that more than one vehicle can charge at a single station at the same time (e.g., multiple cables or automatic disconnect when one car is fully charged) to avoid the need for one car to move to a new parking space in order for the second car to charge?

Supercharger stations consist of multiple charging posts. Each set of two adjacent supercharger posts are connected to a power electronic cabinet that powers both posts. This allows for power sharing between Superchargers when two vehicles are charged at once. Each post has a single cable that charges a single vehicle. Power sharing algorithms are developed and implemented to optimally balance charging between two vehicles charging from a single cabinet. Tesla's stations do not have automatic disconnects when the car is fully charged.

For home and workplace charging (i.e. Level-2 charging), automatic load management systems can be installed to share capacity and potentially account for TOU rates if the site owner desires. This is especially useful and recommended for parking lots with limited electrical capacity. Tesla's Level-2 charger ("Wall connector") can be installed in a network of connectors at a single site and share power simultaneously between vehicles.

Consumer Protection

13. Does any State of Vermont entity currently have the authority to verify the accuracy of the electricity meters in EV charging stations? If yes, which agency? Please describe an appropriate

regulatory oversight structure for that role. If no, what agency is best positioned to take on that oversight role and why?

It is too early to determine standards for accuracy of meters for charging. There are efforts underway by the National Institute of Standards and Technologies through Handbook 44 to develop code for systems used to measure electricity, but according to Section A.2 (Exceptions) of this tentative code:

A.2. Exceptions. – This code does not apply to:

“..The use of any measure or measuring device owned, maintained, and used by a public utility or municipality only in connection with measuring electricity subject to the authority having jurisdiction such as the Public Utilities Commission”³

Additionally, the code authors also caution that:

“..This tentative code has a trial or experimental status and is not intended to be enforced. The requirements are designed for study prior to the development and adoption of a final code”

It is recommended that the commission continue to follow the NIST HB44 for guidance on an industry accepted timeline for EV meter accuracy verification, by its own authority or by another pertinent entity.

14. What recourse would consumers have for complaints arising from public EV charging station usage absent Department of Public Service and Commission jurisdiction?

As it applies to all commercial businesses that operate in Vermont, EV charging station customers can file a complaint with the State’s Attorney Generals’ office or the Better Business Bureau.

15. What information should be available to the users of public EV charging stations at the time they are charging their vehicles (e.g., phone number for technical assistance from station operator, phone number for consumer protection assistance, etc. posted in plain view on the charging station)?

Tesla attaches a sticker with a phone number for technical service for the Supercharger, located on the charge post itself near the handle. This information is sufficient for maintenance crews to be notified and quickly arrive on site. Tesla monitors every supercharger in real-time and proactively rectifies any equipment that is not operating correctly.

³ <https://www.nist.gov/sites/default/files/documents/2016/11/10/3-40-17-hb44-final.pdf>

Utility Participation

16. Do third-party charge providers compete directly with utilities in any other states?

Tesla does not view utilities as competition as the Tesla Supercharger network is not intended to be a profit center. However, Tesla recognizes that other charging operators may view utilities as competition.

17. Do any Vermont utilities have an interest in offering their own charging facilities? If so, how would that arrangement be structured (e.g., facilities and services subject to traditional utility regulation or services provided by an affiliate subject to the same level of regulation applied to non-utility providers of charging services)?

N/A

18. Are there states that treat charging stations owned by utilities differently than they treat charging stations owned by non-utilities? If so, please identify those states and describe the differences in treatment and the reasons therefore.

The primary way that states have treated utility-owned charging stations differently from non-utility owned charging stations is by utility regulation. No State has made the determination that 3rd party charging providers are operating as public utilities. Therefore, non-utility owned charging stations are not subject to utility regulation, whereas PUC's have taken an active role in reviewing applications from utilities to own and operating charging infrastructure.

19. If a utility offers time-of-use rates to a residential customer for charging an EV at home, or to a business customer for charging employee EVs at work, would or should that utility also offer the same time-of-use rates to non-utility operator of a public EV charging station? What considerations would go into determining whether to tariff such an offering?

All charging station operators should be offered the same rates and tariffs, regardless of the technology, whether the stations are public or private, utility-owned or third-party owned. Having the same rates ensures that everyone is getting the same price signal and that all operators are on a level-playing field.

General

20. Are there other considerations that these questions do not reflect, and if so, what are they?

It is appropriate that the commission is conducting this fact-finding exercise. Tesla would like to reiterate that EV charging infrastructure development is still in its infancy and fast charging networks are not as ubiquitous as necessary to mitigate general range anxiety concerns by the public. EV adoption in the public interest from a grid benefit and environmental perspective.

The commission should allow private charging operators to develop business models that increase the access of their networks to all rate-payers and assist in the development of the network using levers available by the commission. Tesla recommends considering reducing or providing relief from demand charges for fast charging operators in Vermont for an appropriate period, during which networks are expanded and utilization increases. Current charging behavior at fast charging stations is sporadic, resulting in usage patterns that display spikes, and high demand charges which makes it costly to charging operators and therefore prevents the installation of further stations. A demand charge holiday like that recently implemented by Southern California Edison⁴ is appropriate to resolve this problem and is in the public interest.

⁴ CA PUC D.18-05-040, Ordering Paragraph 43

Tesla thanks the Commission for the opportunity to provide feedback on these questions and we look forward to continuing to participate in the discussion on the development of EV charging networks in Vermont.

Sincerely,

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