enel x

PROJECT NO. 49125

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

RESPONSE OF ENEL X TO PUBLIC NOTICE OF REQUEST FOR COMMENTS

I. Introduction

Pursuant to the Public Utility Commission of Texas's (Commission) *Public Notice of Request for Comments* issued in PUC Project No. 49125 on December 13, 2019, Enel X North America, Inc. (Enel X) respectfully provides the following comments pertaining to the Commission's *Review of Issues Relating to Electric Vehicles* (EVs).

Enel X e-Mobility, formerly known as eMotorWerks and a subsidiary of Enel, the global utility company, is a market-leading provider of EV charging technologies. Enel X manufactures and sells the JuiceBox, the best-selling smart Level 2 residential EV charger on Amazon, along with a comprehensive line-up of commercial Level 2 hardware solutions for workplace, fleet, and public destination charging applications. These products run on JuiceNet, Enel X's cloud-based software platform used for asset management, EV charging submetering and data transfer, and flexible control for managed EV charging. Enel X's e-Mobility offerings complement a broad portfolio of customer-facing clean energy offerings including demand response (DR), customer-sited and front-of-the-meter energy storage, solar photovoltaic, and advisory services.

Enel X commends the Commission for its renewed focus on transportation electrification (TE). The transition to an electrified transportation sector in Texas promises to produce multiple benefits that accrue to drivers, ratepayers, utilities, and the environment, and the proactive inquiry in Project No. 49125 will help ensure that the state delivers on this promise.

We appreciate the spirit of the Commission's requests throughout these questions to estimate the impact of EV charging over the next ten years. However, as noted in our response to Question 1, Enel X is not aware of ten-year EV market outlooks, and as such, any attempt to estimate the impacts of new EV charging load would be speculative. We posit that specific, quantitative responses to these questions would be best served by soliciting a consultant study to develop a ten-year EV market outlook for the state of Texas across different vehicle types. This could be translated into expected EV charging load and used to estimate the impact of EV charging on things like transmission and distribution (T&D) planning, regional transmission organization (RTO) operations, and energy and peak demand forecasts. Such a scenario analysis could prove useful to the state's transmission-distribution utilities (TDUs) and ERCOT as they consider planning for an increasingly electrified future.

In these comments, we strive to respond to the overarching thrust of the questions and provide the Commission with helpful and illustrative ways to consider EV charging's impact on the electric system. We also provide a handful of recommendations that are geared towards ensuring the efficient and optimal integration of new EV charging load into the system, such that the Commission can ensure that the transition to EVs maximizes benefits, minimizes costs, and ensures that investments in EV charging infrastructure drives down rates for all ratepayers.[1]

II. 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).**

Enel X is not aware of any data sources that provide ten-year, state-level EV deployment forecasts broken down by vehicle class. There are online sources that provide historic light-duty EV sales data by state,[2] but this of course only establishes a baseline and cannot predict future trends. Various sources also exist for sector-wide EV adoption forecasts[3] over several decades

[1] https://www.synapse-energy.com/sites/default/files/EV-Impacts-June-2019-18-122.pdf

[2] E.g., https://evadoption.com/ev-market-share/ev-market-share-state/

[3] E.g., https://about.bnef.com/electric-vehicle-outlook/

that could theoretically be normalized to Texas's automobile market to provide a rough estimate of EV adoption in the state.

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).**

Enel X is not aware of any data sources that provide information on new electric load attributable to EVs over the next ten years. Once a forecast of EV deployment by class is available, it is relatively straightforward to estimate new load volumes, and even load profiles of this new load based on vehicle class and assumptions of expected electric rate structures.

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.**

Anticipating EV load hot spots from EV charging should be considered for different customer segments and charging use cases, through the lens of utility distribution planning and interconnection processes.

For instance, higher-capacity commercial or public charging installations can represent significant spot loads on the distribution grid and can take anywhere from 6-to-12 months to complete, after or in parallel with TDU interconnection studies. Such charging infrastructure projects require up-front and ongoing communication with the local TDU for interconnection, as they can entail upgrades to the customer's electric service and primary distribution system.

TDUs should identify customers in their service territories that have the potential to develop high capacity charging applications – e.g., fulfillment centers, commercial fleet depots, transit or school bus yards, ports, office campuses, shopping malls, etc. – and conduct proactive outreach to these customers through their local field planning offices and / or account executives. In this way, TDUs can ensure that high-impact electrification projects are identified early and adequately reflected in the annual distribution planning process to plan any necessary primary system upgrades. Further, TDUs should develop robust business practices and process flows around project onboarding, interconnection studies, and construction of customer upgrades to ensure timely commercial operation of charging projects.

On the other hand, light duty EV charging for residential customers is typically much lower capacity and easier to install. Depending on the characteristics of the existing service, a residential EV customer might be able to install and operate a Level 2 EV charging station – which can double or triple a residential customer's peak load – without even notifying the TDU. Light duty EV adoption is typically concentrated in certain neighborhoods, and over 80% of all EV charging currently occurs at home.[4] TDUs should strive to reflect these adoption patterns and associated load curves in their distribution planning assumptions, while recognizing that grid impacts from residential EV charging can be highly localized, down to a dedicated or shared service transformer.

TDUs, in their planning and interconnection processes, must also consider the future availability of any TDU-offered DR programs that directly work to mitigate the localized and system-level impacts of EV charging, which can obviate the need for service or system upgrades. TDUs should also consider any expectation of rate structures from retail electric providers that target EVs and EV customers that may decrease, or increase, the incidence of load "hot spots" and thus affect new infrastructure needs. These are explored further in Enel X's responses to Questions 7 and 8 below.

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).**

Power levels, recharge times, and the typical customer segments and charging use cases associated with the three levels of EV supply equipment (EVSE) are briefly summarized in the table below. Anticipated load profiles associated with these three charging levels depend entirely on the specific customer segment and charging use case to which a charging technology is applied, as well as the underlying rate schedule and / or other price signal(s) to which different types of customers are exposed.

[4] https://www.energy.gov/eere/electricvehicles/charging-home

For instance, based on the below table, residential EV charging on a time-of-use (TOU) rate would likely result in a 2-to-7.7 kW load increase sustained from 2 to 12 hours, depending on the battery recharge need and whether that customer is charging at Level 1 or Level 2. Different fleet charging applications can use Level 2 or DCFC EVSE and will see consistent loads at certain times of the day depending on the vehicle type, fleet vehicle use case, and daily vehicle duty cycle. Public DC fast charge (DCFC) applications will see stepwise spikes up to the charger capacity, distributed relatively stochastically throughout the day.

EVSE Charging Level	**Voltage / Amperage**	**Recharge Time from Empty (60 kWh battery)**	**Estimated Cost of Unit**	**Primary Use Cases / Customer Segments**
Level 1	120 V, 12-16 A	**31.25 hours** @ 16 A / 1.92 kW	$0 - $400	Residential
Level 2	240 V, 32-80 A	**7.8 hours** @ 32 A / 7.68 kW	$500 - $10,000	Residential, Workplace, Public / Commercial, Medium-Duty Fleet (e.g., small shuttles, delivery vans)
Level 3 (DCFC)	480+ V or 3-Phase, 100+ A	**1.2 hours** @ 104.2 A / 50 kW	$20,000 - $50,000+	Public / Commercial, Heavy-Duty Fleet (e.g., transit buses, long-haul semi-trucks)

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?**

Enel X has no comment on this at this time.

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

The impacts of EV charging on T&D systems and long-term system planning at the RTO level depend on the assumed load forecasts from different classes of EVs in different customer segments, and how those load forecasts are allocated across the existing T&D systems for planning purposes.

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?**

Energy and peak demand forecasts associated with EV charging load can be developed from an outlook or forecast of EV adoption across different vehicle types. In developing energy forecasts that feed into T&D capacity planning, the Commission must consider the impact of various load management strategies that might be in place, such as time-varying rates or smart EV charging schemes, on the aggregate load curves that result from different vehicle types and charging use cases adopted by different customer segments. These load management strategies incentivize charging to occur during the lowest-impact times on the grid, increase overall utilization of available grid capacity, and should be a first principle of any Commission-jurisdictional EV infrastructure policy or program.

TOU rates are an easily understandable first-order measure for EV charging that have been demonstrated to effectively incentivize EV charging to occur during off-peak hours and avoid peak demand periods, especially for residential customers.[5] As EV penetrations grow, higher-order smart EV charging schemes, as detailed below in the response to Question 8, can become increasingly important to minimize the grid impacts of EV charging.

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

"Vehicle-Grid Integration" (VGI) is an umbrella term for altering the time or level at which an EV charges or discharges in a way that provides benefits to drivers, site hosts, TDUs, grid operators, and the environment. VGI spans both smart EV charging ("V1G"), which entails scheduling charging times or ramping charging rates up or down, similar to other DR resources, as well as bi-directional EV charging, which entails discharging the EV battery to serve on-site load ("V2-building" or "V2-load") or exporting electrons past the customer meter to the grid ("V2G"), similar to stationary energy storage resources.

Both V1G and V2G can theoretically take advantage of any program, tariff, or market participation pathway that is available to any other type of DR or energy storage resource. Enel X currently manages a V1G aggregation of residential smart EV chargers in California ISO day-ahead and real-time energy markets that solely consists of shifting the schedule of EV charging load against an expected baseline.[6] Enel X utilizes the same Proxy Demand Resource market participation model that is used to directly integrate traditional commercial and industrial DR resources into CAISO markets. Similarly, many V2G pilots in the United States[7] and Europe[8] have demonstrated the ability of aggregated EV discharging to provide wholesale ancillary services such as frequency regulation.

Similar participation in the wholesale market by non-load serving entities would require the integration of "loads in schedule" for ERCOT. Otherwise, retail electric providers could

---

[5] https://sepapower.org/resource/residential-electric-vehicle-time-varying-rates-that-work-attributes-that-increase-enrollment/

[6] https://www.greentechmedia.com/articles/read/emotorwerks-wholesale-markets-ev-charger-network

[7] E.g., https://nuvve.com/2011/06/22/forbs-the-cash-back-car-monetizing-electric-vehicles/; https://ww2.energy.ca.gov/2018publications/CEC-500-2018-025/CEC-500-2018-025.pdf

[8] E.g., https://www.enel.com/media/press/d/2019/05/electric-mobility-enel-x-nissan-and-rse-launch-italys-first-test-of-vehicle-to-grid-technology-applied-to-innovative-services; https://nuvve.com/2017/06/05/nuvve-enabling-vehicle-to-grid-services/

deliberately engage with EV service providers to manage EV charging demand in concert with ERCOT positions.

Beyond wholesale market-integrated services, VGI can be implemented to drive value to site hosts and TDUs. For instance, dynamic load balancing across a portfolio of EV chargers can help site hosts manage demand charges or avoid customer-facing upgrades. Or, load balancing schemes across a portfolio of residential Level 2 chargers in a neighborhood can avoid primary transformer upgrades, in the instance where TOU rates increase the likelihood of localized "timer peaks" upon the onset of the off-peak TOU period.

Smart EV charging can also be used to maximize the utilization of available renewable energy and the low or negative wholesale energy prices that can result. Enel X offers a service called JuiceNet Green that schedules EV charging to occur during the lowest carbon intensity hours on the grid. This can be especially impactful in Texas given the state's abundance of overnight wind energy that leads competitive retailers to offer plans with free overnight electricity consumption.

VGI services are provided by EV network service providers or third-party aggregators through the networked communication capabilities of "smart" infrastructure, such as smart EVSE or EV telematics, each of which lend themselves to the implementation of different types of VGI use cases. V1G charging schedules for load shifting or shaping can be pushed to a fixed EVSE or to the EV. On the other hand, an automated generator control (AGC) signal for primary frequency response is tailored to a fixed location on the grid and requires near-real-time communication and telematics, making a fixed EVSE the only feasible pathway for implementation. Smart EVSE also have embedded, revenue-grade submeters that can be used for baselining, metering, and settlement of different VGI services with the TDU or RTO.

In general, the technology to achieve different V1G use cases is fully mature today, both in terms of the EV and EVSE. Different V2G technologies, however, are in different states of maturity. "Direct current" (DC) V2G systems that utilize an off-board or stationary inverter to initiate EV discharge is a mature technology that is commercially available today. DC V2G systems appear to the grid essentially the same as standalone energy storage and can be interconnected and operated through existing or emergent TDU interconnection procedures. However, "alternating current' (AC) V2G systems that utilize an "on-board" or mobile inverter (integrated in the EV) to initiate discharge of the EV battery to a site or to the grid are being piloted by various automotive and EVSE manufacturers but are not yet widely commercially available. AC V2G systems promise to provide V2G capabilities to the mass market, given that AC V2G systems require minimal incremental hardware or software components beyond what is required for one-way charging, and do not require an off-board inverter that can cost many thousands of dollars. In other words, AC V2G systems present a much more streamlined technology solution at a much cheaper cost, meaning it will likely see greater adoption as a mass-market product. However, it is likely that AC V2G-capable EVs are still a few years away from widespread commercial availability.

Finally, it must be mentioned that the ability to provide VGI is conditioned by the fact that EVs are first and foremost mobility resources, and that drivers will not provide VGI services if they conflict with their mobility requirements. That said, drivers can determine the price points at which they are willing to offer up their available flexible charging or discharging capacity to provide various services, which in turn maximizes the overall value they are able to extract from their EV and EVSE purchases.

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.**

In general, assigning designated parking stalls for EV charging as close as possible to the electric service panel from which the charging stations draw power can help minimize installation costs. Similarly, mounting EV charging stations to a wall, if available, can also lower installation costs by avoiding the need to dig trenches through concrete or landscaping to run conduit and wiring.

Another best practice is to avoid installing excessive signage leading up to a site that notices the availability of EV charging stations. This recommendation stems from the fact that most EV drivers locate charging stations via smartphone applications, such as PlugShare or from individual EV service providers. Enel X has worked with site hosts that have spent significant sums of money on signage far from the parking stalls. Signage located close to EV parking stalls can be helpful (or, depending on the jurisdiction, required) for detailing rules for a driver access and usage. Parking lot re-striping or stall painting should also be considered as an explicit line item when gathering all make ready costs.

Finally, depending on the requirements of any make-ready infrastructure programs that might exist, one best practice is to allow site hosts the option of pre-building certain components (e.g., trenching and conduit, but not wiring) of make-ready infrastructure to accommodate future expansion plans of EV charging stations, even if a site host only plans to install a lower number of stations in the near-term. This of course must be balanced with concerns over stranded assets, but in principle, such an option can help avoid the need to perform redundant construction work in the future.

III. Conclusion

Enel X appreciates the Commission's consideration of these comments and looks forward to further collaboration with the Commission, industry participants, and other interested stakeholders in the development of a robust EV charging market in the state of Texas. Please do not hesitate to reach out with any questions on the foregoing comments.

Respectfully submitted,

/s/ Marc Monbouquette

Marc Monbouquette
Regulatory and Government Affairs Manager
Enel X North America, Inc.
(415) 488-6035
marc.monbouquette@enel.com

Dated: February 3, 2020