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REVIEW OF ISSUES RELATING TO ELECTRIC VEHICLES	§ § §	**PUBLIC UTILITY COMMISSION OF TEXAS**

INITIAL COMMENTS OF AEP TEXAS INC. AND SOUTHWESTERN ELECTRIC POWER COMPANY

FEBRUARY 3, 2020

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I. INTRODUCTION

AEP Texas Inc. (AEP Texas) and Southwestern Electric Power Company (SWEPCO), (collectively, AEP Companies) are each wholly owned subsidiaries of American Electric Power Company, Inc. (AEP). The AEP Companies appreciate the opportunity to jointly provide comments regarding the issues relating to electric vehicles (EVs). Adoption of electric transportation options has been accelerating since 2010. During 2018, the United States eclipsed the one-million EV mark; and by 2021, more than two million EVs are expected to be on U.S. roads.[1] Although EV sales are accelerating substantially, they still represent less than 2% of new car sales nationally in 2018.[2] Looking back to 2013, only 0.61% of national new car sales were EVs – market share has continued to accelerate toward EV models even as the quantity of new car sales has contracted slightly. [3]

Texas ranks fifth nationally in the number of new EVs sold annually. EVs as a percent of new car sales in Texas is 0.8%, while the national average is 2%.[4] The variety of EVs now produced is growing rapidly. While only three models within limited segments were available to purchase in 2011 there are now over 30 models available nationwide spanning all major vehicle segments, with 132 models projected to be available by 2022.[5]

As EV efficiencies continue to improve with industry maturity and electric grid carbon intensity continues to decline, the sustainability advantage of electric transportation will continue to improve. It is important that load from electric transportation and related technologies are incorporated into the grid in a manner that minimizes additional system costs and complements grid optimization efforts. This additional load could be influenced by programs and rates that incent charging behavior to occur during off-peak times. When this happens, additional energy sales occur without requiring additional

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[1] Edison Electric Institute, "EEI Celebrates 1 Million Electric Vehicles on U.S. Roads", available at: http://www.eei.org/resourcesandmedia/newsroom/Pages/Press%20Releases/EEI%20Celebrates%201%20Million%20Electric%20Vehicles%20on%20U-S-%20Roads.aspx

[2] Auto Alliance, "Advanced Technology Vehicle Sales Dashboard", available at: https://autoalliance.org/energy-environment/advanced-technology-vehicle-sales-dashboard/

[3] Id.

[4] Id.

[5] Electric Power Research Institute (EPRI), "Consumer Guide to Electric Vehicles", available at: https://www.epri.com/#/pages/product/000000003002015368/?lang=en-US

fixed assets to be deployed. Incentivizing EVs to charge off-peak not only benefits those who drive electric, but each and every customer. Furthermore, technological aspects of charging infrastructure can assist utilities balance load capacity and demand in the form of managed charging (V1G) systems or demand response applications.

V1G[6] can help avoid a requirement to deploy additional fixed assets by increasing the utilization of those already in place. V1G is composed of passive and active management practices. Passive management practices influence charging behavior using programs and incentives to motivate off-peak charging. Active management practices use communication signals to connect with chargers or vehicles and remotely adjust load characteristics to fit and/or complement system conditions.

AEP Companies support the adoption of electric vehicles in our service territories and are interested in exploring ways to ensure that charging options optimize the use of the grid for the benefit of all in our role of providing safe and reliable transmission and distribution electric service.

II. 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).

RESPONSE: AEP Companies have reviewed several overall EV forecasts from respected sources such as Energy Information Administration (EIA), Bloomberg New Energy Finance (BNEF), National Renewable Energy Laboratories (NREL), and Electric Power Research Institute (EPRI). AEP Companies have developed an initial forecast regarding the adoption of EVs by customers in our service territories. For AEP Texas and SWEPCO's Texas service territories, the initial baseline forecast for all EVs by 2030 is 20,360 EVs, with a low-high scenario of approximately 14,782 – 46,789 EVs. AEP Companies did not forecast the EV adoption by vehicle class but rather by technology that includes Plug-in Hybrid electric vehicles (PHEV) and battery electric vehicle (BEV).

These forecasts are based on the current level of EVs registered in our service territories[7] and estimates of how these broad macro forecasts could apply in the service territories we serve. These

[6] Smart Electric Power Alliance, May 2019, "A Comprehensive Guide to Electric Vehicle Managed Charging," Myers, Erika, Principal, Transportation Electrification.

[7] The current EVs registration data in our service territories is provided to AEP through our membership in EPRI. The data is provided to them by RL Polk and is sourced by state Bureau of Motor Vehicle (BMV) registrations.

forecasts could change substantially. Currently, the adoption levels are low, but the technology is evolving quickly; costs continue to decline; tax incentives and other policy continues to evolve; and product availability and customer acceptance will likely change over time.

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).

RESPONSE: Please refer to the response found in Question No. 1 for data sources. Based on the various scenarios, the incremental load attributable to electric vehicles in 2030 is between 51-161 GWh, which is between 0.1%-0.4% of total AEP load served in Texas.

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.

RESPONSE: AEP Companies have not performed a detailed assessment of the impact that EV adoption would have on the electric grid. Grid impacts will depend largely on EV adoption levels, demand driven by various applications and usage characteristics, and effectiveness of V1G efforts.

Approximately 80%[8] or more of customer EV charging is done at home, typically after traditional work hours, in the late evening and/or through the night. Due to the relatively low adoption rates, the AEP Companies do not anticipate near-term distribution system impacts. However, as adoption increases, it becomes more likely that the distribution system could experience additional service transformer stress.

In a best-case scenario, the utility will know when individual charging stations are about to be or have been added. AEP Companies are currently considering relevant options for working with customers to manage those potential impacts (e.g., TOU rates, DSM programs). If utilities are allowed the flexibility to thoughtfully address this anticipated increase in load on the distribution system through V1G programs, the distribution system can potentially absorb an increase in EV adoption by normalizing and increasing the utilization of assets already in place. This would benefit the entire customer base in the process by shifting load to off-peak hours, increasing the efficiency of all grid resources, and ultimately achieving downward pressure on electricity rates.

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[8] *Electric Vehicle Driving, Charging, and Load Shape Analysis: A Deep Dive Into Where, When, and How Much Salt River Project (SRP) Electric Vehicle Customers Charge.* EPRI, Palo Alto, CA: 2018. 3002013754.
http://mydocs.epri.com/docs/PublicMeetingMaterials/ee/000000003002013754.pdf Page 5-4.

Regarding Level 2 EV charging on circuits serving more commercial areas (workplace, retail, government), many of these customers are on tariffs with some type of demand rate component, and many of these EV chargers may have load management capabilities to mitigate the concurrent increased demand. Therefore, we do not anticipate significant near-term challenges in absorbing the demand of EV charging if load management capabilities are fully utilized.

The relative impact of increased EV charging on the 'upstream' distribution and transmission system would be minimal for the foreseeable future. We do not anticipate circuit, substation, or bulk power system issues, as there is adequate capacity to absorb incremental load form EV charging over time.

Regarding commercial short-haul and long-haul, transit buses, and personal travel corridor charging, these applications typically require Level 3 Direct Current (DC) Fast Charging support to fulfill the application need. The demand requirements for these applications are addressed as a normal part of the process in establishing/upgrading service with our customers. Any distribution system impacts and related work are addressed just as any other addition of customer load on the grid.

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).

REPONSE: Load profiles of EV charging is less dependent on the type of charging than the application (e.g., location). That said, since Level 1 charging is conducted at 120V (1.44 kW), the load profile is largely irrelevant.

Level 2 charging (up to 19.2 kW) occurs most often at home and work, and the actual demand is determined by the lesser of either the Electric Vehicle Supply Equipment (EVSE) (commonly called a 'charger') hardware or the EV onboard charger. The effective EV demand is most commonly approximately 7 kW.[9] Residential load profiles depend entirely on the patterns of those using the EV but occur between afternoon/evening home arrival and morning home departure.
Level 2 charging in commercial sectors often occurs during more traditional 'peak' periods; however, it also is more likely to be spread over a broader base of hours, with workplace charging occurring over traditional working hours and retail charging occurring over shopping and dining

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[9] *Electric Vehicle Driving, Charging, and Load Shape Analysis: A Deep Dive Into Where, When, and How Much Salt River Project (SRP) Electric Vehicle Customers Charge.* EPRI, Palo Alto, CA: 2018. 3002013754.
http://mydocs.epri.com/docs/PublicMeetingMaterials/ee/000000003002013754.pdf page 1-6.

hours. Therefore, the related load profiles are varied reflecting the specific application. As previously indicated, these electric service locations are often placed on tariffs with some type of demand rate component and many of these EV chargers have load management capabilities to mitigate the concurrent increased demand.

Level 3 Direct Current Fast Charging (L3 DCFC) load profiles, similar to Level 2 profiles discussed previously, correlate to the driver or logistics applications. Corridor fast charging for passenger vehicles can occur at up to 270kW today, with usage correlating to regional traffic patterns. Transit buses with on-route charging can charge at up to 500 kW, which will occur at regular intervals based on route schedules. Future individual DCFC charger demands are likely to continue to increase over time. The unique aspect of L3 DCFC is that the precise reason for the large demand is driven by the fundamental need (i.e., fast charging), and therefore not relatively amenable to load-shaping efforts.

The typical load profile for these applications also can vary dramatically based upon the specific type of application (transit bus vs. transportation corridor).

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?

RESPONSE: Vehicle charging technology certainly will continue to evolve over the next ten years. Specifically, we anticipate that the need for ever-faster DCFC charging rates to support transit buses and long-haul trucking fleets will require even higher MW-scale demand service levels. Vehicle-2-Grid (V2G) technology (i.e., utilizing batteries in vehicles to support grid needs) will continue to develop presenting opportunities for various grid applications such as frequency regulation, energy, capacity, and demand response. Communication and interactive aspects of EVs and charging technology are also likely to improve facilitating the deployment of V1G programs.

Further study and trial of V1G programs is encouraged to prepare stakeholders for future V2G opportunities. As previously stated, V1G programs may help avoid a requirement to deploy additional fixed assets by increasing the utilization of those assets already in place. V1G is composed of passive and active management practices. Passive management practices influence charging behavior and active management practices remotely adjust load characteristics to fit and/or complement system conditions.

III. 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.

RESPONSE: See responses to Question Nos. 2-4. In addition, the Southwest Power Pool (SPP) recently completed a study[10] on EV adoption. Assuming a 40% increase in EV adoption by 2031, they estimated approximately a 2% increase in energy requirements in the SPP system as a whole.

If utilities are allowed the flexibility to thoughtfully address this anticipated increase in load on the distribution system through V1G programs, the distribution system can potentially absorb an increase in EV adoption by normalizing and increasing the utilization of assets already in place. This would benefit the entire customer base in the process by shifting load to off-peak hours, increasing the efficiency of all grid resources, and ultimately achieving downward pressure on electricity rates.

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?

RESPONSE: See response to Question No. 2. AEP Companies are not making any explicit adjustments at this time to the load forecast due to electric vehicles. The current penetration level and associated load of electric vehicles is too small to confidently adjust the overall load forecast. However, AEP Companies will continue to monitor the trends very closely and will adjust the forecast as warranted.

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

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[10] *Southwest Power Pool - 2021 ITP Future Drivers: Electric Vehicles (EV); Jason Speer and Jake Pannell.*

RESPONSE: See response to Question No. 5.

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.

RESPONSE: AEP Texas and SWEPCO's Texas service territories have not seen the saturation of commercial electric vehicle charging stations compared to other utilities in the state. AEP Texas is collaborating with a few cities in our service territory in suggesting facility siting and load needs. By collaborating with the cities, AEP Texas cannot specifically state that we have best practices but rather lessons learned and preferences regarding commercial electric vehicle charging stations.

Facilities siting: Customers usually approach AEP Companies with a specific site for the charging station. We provide a cost to serve and if it is too high (infrastructure not in place), we then provide alternate locations that are lower cost and with more available power. AEP Companies would prefer to be involved earlier with the customer to aid in site choice. Main highways in urban areas and industrial parks have the utility infrastructure to serve commercial charging stations. Most sites are coupled to fuel stations on major highways, hotels, or shopping malls. If this is not the case, AEP Companies can provide a map with locations that have available power.

Design standards: The AEP Companies do not have a written design standard, but installations require a pad mounted transformer and "wye" connected service to handle the larger charging loads. The wye connection is safer because it limits the phase to ground voltage to 277 volts on a 480-volt service, which is the level used by fast chargers. The size of the service entrance is too much for an overhead service. We also request that the customer adhere to the IEEE 519 harmonic standard, which is the industry standard for limits on harmonic distortion caused by non-linear loads such as chargers.