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Addendum StartPage: 0

BEFORE THE PUBLIC UTILITIES COMMISSION OF TEXAS

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PUBLIC NOTICE OF REQUEST FOR COMMENTS	)	
REVIEW OF ISSUES RELATING TO ELECTRIC	)	PUC PROJECT NO. 49125
VEHICLES	)	

COMMENTS OF THE ALLIANCE FOR TRANSPORTATION ELECTRIFICATION

The Alliance for Transportation Electrification is pleased to provide comments to the Texas Public Utilities Commission in response to questions posed by the Commission in Project No. 49125 in the public notice issued on December 13, 2019.

Background

The Alliance for Transportation Electrification, a 501(c)(6) non-profit corporation, is led by utilities, electric vehicles (EV) infrastructure firms and service providers, automobile manufacturers, and EV charging industry stakeholders and affiliated trade associations. We started with 20 organizations at the launch just over a year ago. By taking a "big tent" approach to advance the industry, we have grown rapidly to include about 45 national members today and are actively engaged in regulatory proceedings such as this across the country.

Our goals are to engage with Public Utility Commissions and other state agencies to remove barriers to EV adoption by encouraging a collaborative and open approach to accelerate the deployment of EV charging infrastructure in states like Texas. We do this by advocating for a strong and robust utility role while recognizing the importance of non-utility service providers in market development, by developing effective outreach and education measures, and by promoting interoperability and open standards in all parts of the EV charging ecosystem.

Response

Many of the questions posed in the Commission's December 13th notice relating to electric vehicles ask for data and information, which is specific to the current status of charging infrastructure and electric utility plans and forecasts. As a national policy organization, the Alliance does not have access to much of the information and does not perform forecasting of loads and resources either at the state level or at the level of a distribution utility. The utilities have such data derived from customers and host sites who are currently engaged in EV charging in this stage of nascent market development in Texas, and accordingly, the Commission may request this data, which may include both public data and confidential customer-specific data. Moreover, there are a number of economic consulting firms which have performed studies, based on certain assumptions and scenarios, for several States on an aggregated level using forecasting models. Thus, we are not going to focus on the bulk of the questions but do plan

6

to participate in this proceeding as policy issues are considered further by the Commission in future information requests. At this time, the Alliance wishes to provide information in response to questions 8 and 9 of the commission's request where we can provide some perspectives on what has been happening around the country.

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

Vehicle-to-grid (V2G) technology is simply the ability of an electric vehicle connected to a charging station to either charge taking electricity from the grid or discharge and sell or provide electricity back to the grid, in response to a command signal that is given to the vehicle batteries – usually by a software program. V2G requires communication between the vehicle (or connected charging station) and the entity that is using the vehicle's battery to buy and sell from the grid. Use of the vehicle's batteries to reduce load or peak shave based on a signal is more common, and commonly referred to as V1G to denote one-way power flow. V1G constitutes managed charging of vehicles by determining when to withdraw power from the grid to charge the battery but does not rely on the battery to provide power back to the grid operator in a bi-directional flow. The Alliance and Atlas Public Policy have published a primer on EV and grid integration, which is generally called VGI or vehicle to grid integration, that explains these concepts in more detail and is attached to these comments.[1]

Once connected to the grid in a V2G arrangement, there are several services that EV batteries can provide. In some cases, power withdrawn from the batteries might be used for load reduction during peak periods or peak shaving. At other times, or even in conjunction with peak shaving, battery power can be used to provide ancillary services such as voltage control, frequency regulation or spinning reserves that are necessary components of maintaining a reliable grid. V2G not only can enhance reliability and resilience of the grid, it can provide an additional revenue stream for electric vehicle owners and fleets. In a simulation study, researchers at American Honda and the University of Delaware have estimated that a V2G arrangement could generate between $623 and $1,014 in annual V2G revenue streams in the PJM market.[2] NREL has also developed an excellent study of V2G economics, including costs and benefits that may be of interest to the Commission.[3] But even with the potential benefits of V2G, for the reasons cited below, it is still in the testing, pilot stage and it will likely be several years before it represents a significant potential savings to the grid and EV owners. And, vehicle owners may not want to participate at all for certain behavioral and other reasons cited below.

Vehicle-to-grid (V2G) technologies do have the technical capability to participate in wholesale markets in Texas and elsewhere. There are many unanswered questions as to whether such markets will be viable in the near future, due to operational complexities and a challenging value proposition. At

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[1] Smith, Conner and Nigro, Nick, "Vehicle - Grid-Integration: A Review of Available Approaches and Existing Programs," Atlas Public Policy and the Alliance for Transportation Electrification, October 2019.
[2] Shinzaki, S., Sadano, H., Maruyama, Y., and Kempton, W. "Deployment of Vehicle-to-Grid Technology and Related Issues" (0148-7191), 2015. https://www1.udel.edu/V2G/resources/Shinzaki-et-al-2015-01-0306.pdf
[3] Steward, Darlene, "Critical Elements of Vehicle-to-Grid (V2G) Economics," National Renewable Energy Laboratory, September 2017. https://www.nrel.gov/docs/fy17osti/69017.pdf

present, there are limitations on many fronts. First, some auto manufacturers void battery warranties if customers try to sell power from their EVs. Second, wholesale markets such as ERCOT do not currently have the capability to account for V2G power, which will be transacted at the distribution level much as rooftop solar PV. Third, it will be almost impossible for wholesale markets to accept individual EV sellers – they will have to be aggregated and controlled by intermediaries to be of real value to a wholesale market. Fourth, is the problem of measuring input and output from individual EVs, which will have to be separately metered and with two-way meters (AMI). Such metering arrangements do not generally exist today and will be expensive to implement. Fifth, vehicles must be equipped with two-way inverters to allow the two-way flows of electricity required by V2G. None of these are insurmountable barriers, but suggest that such capabilities will take significant time to develop and test adequately in an operational environment.

But, perhaps one of the biggest questions is customer behavior and whether EV owners will be interested in having others (the wholesale market entity, third-party aggregators, or utilities) control their battery charging and discharging when their EVs are not in use and connected to chargers. EV owners may want to be assured that their batteries will be fully charged when they want to use their cars and not be subject to uncertainty. Some workarounds may be possible, such as owners being able to limit the hours in which their batteries are discharged, but this is an additional complication. EV owners are also likely to be concerned about degrading the life of their vehicle batteries, and whether the potential revenues achieved will outweigh these added costs. All of these limitations are reasons why experience to date around the country on V2G has been limited to pilots that are testing whether V2G sales into wholesale markets are viable.

One of the first pilot tests of V2G was in the PJM market. In one pilot, PJM partnered with the University of Delaware, beginning in 2007 to test the concept. Based on signals from the PJM control room used to stabilize the power grid, the cars both charged and discharged in response to the PJM frequency regulation (FR) signal and were able to earn approximately $100 per month per car for their services.[4] In a second pilot, PJM partnered with BMW North America. PJM had to initially change its rules to allow smaller loads to bid into the wholesale market and also to split its FR signal to take advantage of the faster response time of batteries. But ultimately the pilot was successful in demonstrating that EVs could aggregated and bid into a wholesale market to provide, in this case, FR services, which can certainly provide value in organized wholesale markets like PJM and ERCOT. But while PJM still allows aggregation of EVs and sales into its market, there have been few takers beyond the vehicles in the initial pilots.

A much larger pilot study was initiated by Southern California Edison (SCE) in conjunction with the Department of Defense (DoD) in December 2015. The pilot was intended to test whether the DoD facilities management could use its electric vehicles at the Los Angeles Air Force Base (LAAFB) to bid energy and ancillary services into the California ISO market. The LAAFB was designated by DOD in 2011 to serve as the first host of the Department's plug-in electric vehicle (PEV) program, and as such, it was designated to replace its entire fleet with PEVs and participate to the extent possible in V2G technologies. In addition to providing frequency regulation services to the CA ISO, the pilot was

[4] https://learn.pjm.com/energy-innovations/plug-in-electric.aspx

designed to a lesser extent to provide vehicle-to-building services (sometimes called V2B) for peak shaving as part of its overall load management techniques for its substantial load of its facilities.

The V2G Pilot ultimately consisted of 41 fleet vehicles of various classes and configurations, 29 of which were equipped to participate in the V2G market. Procurement and delivery of vehicles was slated to begin by December 2012 but was delayed due to the lack of off-the-shelf technology to make the V2G pilot work. CAISO certified the planned equipment in October of 2015 after a long testing period and the pilot was permitted to proceed in December of 2015. The pilot lasted through September of 2017.

Both SCE and Lawrence Berkeley National Laboratory (LBNL) for the California Energy Commission developed reports analyzing the Pilot experience[5], including SCE's observations on key lessons learned. First the testing period took about a year longer than expected, and numerous changes were required to the markets, procedures and software of the ISO to accommodate the EV pilot. Numerous issues were also found with the vehicles and chargers that needed to be resolved for the Pilot to proceed. While it was expected to take six months, the testing period lasted two and a half years. In addition, during the Pilot, additional problems were found that resulted in the decertification of the Pilot function to provide regulation down (consuming energy to affect frequency) services, which resulted from some of the original assets no longer being operational. While the Pilot earned positive gross revenues of $7,600 during its operation, fees paid for the necessary duties of a scheduling coordinator and to the ISO and others resulted in net negative revenue of about $17,000 for the Pilot period December 2015 to September 2017.

In its report to the Commission, SCE also discussed some of the broader lessons learned. The Company suggested that customers will need to have well-conceived energy management and charging plans that consider the costs, benefits, and the cross-over impacts between the retail and wholesale markets. It found that the Pilot was not cost-effective given the fees that had to be paid (which were not reduced for smaller size suppliers such as EV aggregations) and the small size of the Pilot. However, it found that the fast-responding energy storage capability in vehicle batteries can provide valuable services to help meet building and facility energy requirements. And, it suggested that a larger aggregation of vehicles could successfully and profitably bid into wholesale markets to provide energy and ancillary services. In other words, the pilot did not demonstrate cost-effective operations at this small scale but it did prove overall technical feasibility of such a V2G scheme. The Pilot was also successful in evaluating key factors important to future efforts, such as assessing degradation of battery life, communication protocols, and vehicle aggregation methods and software.

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[5]"Southern California Edison Company's Department of Defense Vehicle to Grid Final Report", undated, https://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=6442455793 and Black, Douglas, Jason MacDonald, Nicholas DeForest, and Christoph Gehbauer. Lawrence Berkeley National Laboratory. 2017. Los Angeles Air Force Base Vehicle-to-Grid Demonstration. California Energy Commission. Publication Number: CEC-500-2018- 025. http://www.energy.ca.gov/2018publications/CEC-500-2018-025/CEC-500-2018-025.pdf

The California Energy Commission (CEC) report prepared by LBNL focused on the control software and market interactions, the significant challenges faced and solutions devised to address them, and examines the potential of using the electric vehicle fleet as an energy storage resource for the base buildings, an application known as vehicle-to-building, in providing demand response and emergency backup power. This report describes the complexities of developing software that logs use of the vehicles and manages them so as to know when they are available for V2G operation. LBNL developed optimization software to interact with the fleet management program to take account of the power and energy available from the vehicles given their upcoming travel requirements. As did Southern California Edison, the California Energy Commission report concludes that the Pilot successfully provided regulation services to the CA ISO market. But it also found that the revenues collected were not sufficient to make V2G cost effective for fleet owners at the scale of this particular Pilot.

It should be noted that the DOD suspended its PEV V2G programs at the Los Angeles base and two bases outside of California. There are a few additional pilots underway in California that are testing various market models, but nothing of any scale.

The two case studies described above point to many of the issues and constraints in trying to establish V2G programs in wholesale markets such as ERCOT. Market rules, practices and software systems have to be redesigned to accommodate bidding for the types of services vehicles can provide. There are currently no fleet aggregators that can provide the kind of services that were provided to the DOD fleet in the California Pilot, and vehicles will need to be modified to be able to participate in markets. Communication systems are needed to allow vehicles to respond to price signals and control software needed to balance the travel needs of the vehicles with available markets for energy and ancillary services.

An interesting use case, which Dominion Energy in Virginia and Duke Energy in North Carolina have both proposed for Pilots is the use of electric school buses for V2G operation after morning and afternoon runs of the vehicles. This may be a fruitful area of research, as the buses have low utilization rates and can be available for discharge during system peaks of the utilities. Both of these Pilots are pending before the respective state commissions at this time, and the Texas Commission may want to monitor these programs.

Thus, the conclusion is that V2G for sales into wholesale markets, while technically feasible, is not quite ready in either an organized market structure like Texas or vertically integrated utility markets in many other States. The systems needed to be successful are still years away from development, and it will take some time for ERCOT (and other ISOs) to develop the capability for these resources to bid into the wholesale market. And, as mentioned earlier, we still know little about whether individual EV or fleet owners will be willing to have the charging and discharging of their vehicles controlled by third parties. But it should be an issue that remains on the radar of the Commission, although we urge the Commission to give more focus in this early stage of market development to increasing EV adoption overall and testing out V1G managed charging mechanisms using either dynamic rates or innovative technology solutions to move EV load to off-peak hours.

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

The soft costs associated with siting and permitting commercial (public) charging stations have turned out to be a significant part of their total costs. Determining locations (siting), particularly for DC fast chargers, requires close coordination with utilities to assess locations that have sufficient capability within the local distribution system. Little has been published regarding siting best practices. The Rocky Mountain Institute recently published a report that looks at the costs of charging stations with a particular emphasis on soft costs[6]. "Reducing EV Charging Infrastructure Costs" looks at the non-hardware costs of installing charging stations and contains recommendations for reducing these portions of costs based on literature, publicly available information on utility procurements (best practices), and two dozen original interviews conducted under nondisclosure agreements with utilities, hardware providers, software providers, operators of charging networks, transit agencies, states, laboratories, contractors, and consultancies. We commend this report to the Texas Commission's attention.

The Alliance also reviewed reports regarding two charging station pilots involving Southern California Edison (SCE)[7] and Avista Corporation[8]. The SCE pilot was designed to provide Level 2 charging at non-residential locations where EV owners were likely to park for 4 hours or more, including workplaces, multi-unit dwellings (MUDs), fleet depots, and destination centers such as malls and arenas. In the Pilot, SCE deployed 961 charging ports at 60 customer sites. SCE focused its efforts on disadvantaged communities (DACs), which are disproportionately affected by low EV adoption and the negative environmental impacts of gasoline- and diesel-powered vehicles. SCE managed the Pilot to ensure a minimum of 10% of all charge port installations were deployed in DACs. By March 2018, 50% of the charging ports were located in DACs.

Some of the key findings of SCE with respect to the siting and installation of these non-residential charging facilities included for commercial locations:

- with respect to siting chargers at parking facilities, while facility owners may understand the benefits of offering EV charging to their tenants, they may not envision an obvious return on investment resulting in a barrier to such installations. Education was key;
- for infrastructure safety, all site plans were submitted to the appropriate Authority Having Jurisdiction (AHJ) for approval and permitting. Some AHJs required approval from multiple agencies, such as Building and Safety, Electrical, and Fire Department Planning. For charging station safety, all installations were per AHJ-approved plans, and were inspected by AHJ inspectors;

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[6] Nelder, Chris and Emily Rogers, "Reducing EV Charging Infrastructure Costs," Rocky Mountain Institute, 2019. https://rmi.org/insight/reducing-ev-charging-infrastructure-costs/

[7] Southern California Edison. "Charge Ready and Market Education Programs Pilot Report, May 2016 – March 2018," Submitted April 2, 2018, Amended July 9, 2018.

[8] Avista Corporation, "Electric Vehicle Supply Equipment Pilot Final Report," October 18, 2019.

- there were seasonal issues encountered. For example, many businesses had already completed their following year budgets by the time the pilot was initiated. SCE addressed this issue by proposing a five year program;
- initially, SCE required a two-step process to obtain easements. First, property owners were asked to sign contingent easements that provided "blanket" easements over their entire properties. The intent of contingent easements was to move applications through the design and construction processes. Once the final design was complete and accepted by the customer participants, SCE amended the contingent easements to encompass only the charging station infrastructure locations. Several customers were resistant to executing contingent easements over their entire properties. Additionally, the contingent easements caused delays in receiving the customers' signed program agreements, due to additional time needed for customers' legal review. SCE ultimately addressed the issue by eliminating the contingent easement part of the process.
- SCE experienced significant delays in obtaining easements. In many cases, customers needed more time to review documents. SCE committed that in the future phases, it will ensure customers thoroughly understand the easement process during the early application stages and will recommend customers' management and legal team review easements early in the process;
- customer requested redesigns of alternatives caused delays at some sites. SCE plans to consider the number of redesigns allowed;
- the Pilot required a separate panel and separate service for the charging stations. SCE plans to evaluate the feasibility of using customers' existing panels and service lines where feasible;
- SCE did not contemplate coordinating with new or upgraded infrastructure at charging sites; and,
- construction delays occurred as well. In some cases, general contractors were awarded more projects than they were capable of handling, in some cases customers requested specific start dates or delays, there were delays in meter panel manufacturing, and in one case there was a challenge to the infrastructure that SCE had provided.

For Multi-unit Dwellings or MUDs, some of the siting and installation issues encountered included:

- the most pervasive problem was parking availability in the buildings, with most spaces already assigned to residents. SCE suggested allowing parking spaces adjacent to the MUD to be eligible;
- for large complexes, the MUDs often wanted chargers spread throughout the complex, resulting in increased infrastructure costs. SCE pledged to work with the MUD developers to better understand their needs; and,
- MUDs with parking structures faced issues with meeting accessibility requirements. SCE decided to look at curb-side charging options.

These represent some of the major findings from the SCE Pilot. In these comments we have covered only the components of the SCE Pilot that relate to siting, design and permitting of charging stations. We commend the entire report to the Commission's attention as there is a lot of valuable information regarding many other aspects of the Pilot program that will be useful as programs in Texas are considered.

The Avista Electric vehicle Supply Equipment (EVSE) Pilot was launched in 2016, with the main objectives of understanding (1) light-duty electric vehicle (EV) load profiles, grid impacts, costs, and benefits, (2) how the utility may better serve all customers in the electrification of transportation, and (3) begin to support early EV adoption in its service territories. The pilot lasted three years, through June of 2019, and resulted in 439 charging points in residential, commercial, MUD workplace and fleet locations, and included seven DC fast chargers. Avista's Pilot differed from SCE's in that residential premises were included. But Avista found in its Pilot that workplace charging can be a powerful catalyst for EV adoption and deployments.

Also, unlike SCE, Avista used both "EVSE Only" models where the existing customer premises wiring and metering was used (where feasible) and a utility-owned charger attached and a full utility ownership model where new wiring and equipment and a charger was installed. It was felt that by utilizing existing supply panels and other supply infrastructure in residential and commercial locations in the "EVSE Only" model, costs could be much lower than comparable "make ready" installations with new dedicated services and infrastructure. It should be noted that because Texas prohibits behind the meter investments, such a model may not be allowed in Texas.

Avista also required the development of a single open standards network to integrate its charging stations. It was important to Avista that its hardware and software be interoperable using industry standard communication protocols (such as the OCPP standard version 1.6), so that risks and operational flexibility could be well managed.

As was the case with SCE, Avista found that significant outreach and education is required to inform and assist commercial customers to install Level 2 chargers on their property. Some of the concerns cited by Avista included the projected cost of electricity billing, liability risks, and potentially adverse impacts on parking areas that are highly utilized. In some cases, contract negotiations and revisions to the customer site agreement resulted in significant legal work and delays. In the case of public installations, the proximity of amenities for drivers and geographic location was taken into consideration in the application and approval process, as well as guiding outreach efforts. For example, charging at urban shopping centers and the smaller towns throughout eastern Washington were identified as highly desirable locations, in order to establish an effective regional network of public charging.

Avista also found a high rate of withdrawal of applicants in most cases due to higher than expected costs. The withdrawal rate at public stations where significant trench work and electrical upgrades was 55%. Of course, it would have been difficult to know in advance what costs would be so this situation may be difficult to avoid. In order to minimize costs where practical, the Company advised customers to utilize wall mounted EVSE, and to minimize trenching and conduit lengths by locating the EVSE as close as practical to the nearest power source. Other factors, such as desired location, accessibility, communication signal strength, and safety concerns were also found to be of high importance when performing siting and configuration.

The Company noted some additional challenges with respect to DC fast chargers (DCFC) that were a part of the Pilot. This was mostly due to the need for the site host to commit to long-term easement and access agreements. The site acquisition process also took much longer than expected. Lead times for DCFC site design, equipment procurement and construction were generally under two months, while site acquisition including contracts and property easements typically took six months or longer to complete. The availability of nearby three phase power and minimized construction disturbances, such as asphalt and concrete tear-out and restoration were the most important factors in reducing costs.

As was the case with the SCE Pilot Report, we commend the Avista Pilot evaluation to the Texas Commission's attention for the many areas it covers, in addition to those summarized above. For example, the Avista report looks at impacts on the grid, including local distribution and finds that the incremental costs associated with a modest level of EV market penetration is very low, at least over the next decade. And, based on a modeling study through 2038, the Company found a net benefit (taking into account benefits to the user and the Company) of $1,661 per EV without managed charging, and $2,125 with managed charging. This does not include carbon reduction or other societal benefits.

The above two case studies provide some information on siting and design issues that affect EV charging infrastructure costs. While there are currently no standards for siting and design of charging stations, we do believe it is important that operating and network standards be at the forefront of Commission consideration of EV market development. Open standards for charging, and interoperability of charging stations and networks are key to ensuring that customers who adopt EVs have a smooth and trouble-free experience. While a full discussion of open standards and interoperability is beyond the scope of these comments, we call the Commission's attention to a report published by the Electric Power Research Institute (EPRI) with the Alliance, EEI, and other organizations, which provides an introduction to the issues.[9] Also, we bring to the Commission's attention a separate EPRI report which discusses ways of valuing the costs and benefits of electric vehicle and other electrification programs through a total value test[10]. We strongly encourage the Commission to explore these reports and delve into the issues presented in further requests for comment as this Docket proceeds.

Conclusions

With respect to V2G feasibility, there is no doubt that in the future, the ability of aggregated electric vehicles to provide energy and ancillary services into wholesale markets will provide value to both the market and to EV owners and their aggregator. However, pilots to date have shown significant challenges that must be overcome. It may make sense for the Texas Commission to approve pilot programs that begin to address these issues in Texas. It is not too early to start, and gaining experience through pilots has proven valuable in other parts of the country.

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[9] Electric Power Research Institute, "Interoperability of Public Electric Vehicle Charging Infrastructure", undated. https://www.eei.org/issuesandpolicy/electrictransportation/Documents/Final%20Joint%20Interoperability%20Paper.pdf

[10] Electric Power Research Institute, "The Total Value Test: A framework for Evaluating the Cost-Effectiveness of Efficient Electrification", EPRI and the Brattle Group, August, 2019. Available via https://www.epri.com/#/pages/product/3002017017/?lang=en-US

In summary, while there are no standard protocols across the varying local government regulations dealing with issues such as permitting and site acquisition, we believe there are a number of valuable lessons learned from these two utilities and others around the country. In these comments, we have provided some observations made by two of the larger pilots to install charging stations, both in the Western United States. Recognizing the utility and case-specific nature of these deployments, we think that an examination of these lessons learned is probably the best way the Commission can gather information on issues that may arise and how to overcome them in Texas. We expect that over the next few years, more case study and expert reports will address these issues and provide practical advice, but again gaining practical experience may be the best path forward for the Commission, regulated utilities, and EV stakeholders in Texas.

Respectfully submitted this 30th day of January, 2020,

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