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Comments of the Texas Electric Transportation Resources Alliance on

Project Number 52373

Submitted by Tom 'Smitty' Smith, Executive Director

Executive Summary

Amended Comments, August 20, 2021

The Texas Electric Transportation Resources Alliance TxETRA is a Texas group of utilities, charging companies, OEMs, researchers, consumer and environmental groups that work together to develop policies that accelerate the deployment of electric vehicles in Texas.

Electric vehicles are mobile batteries on wheels that can be deployed to meet system needs in emergency situations, to routinely offset peaks on hot days or cold mornings or to provide grid stability if they are plugged in and if their responses are coordinated and rewarded. A market mechanism to harness these "storehouses" of distributed reserves needs to be developed by the PUC. The bi-directional charging and discharging capabilities of electric vehicles (EVs) for backup power and to reduce peak demand can have significant positive impact on the resiliency and stability of the grid.

For example, Ford's new all electric Lightning pickup truck advertises up to three days of back-up power for an average home or up to 10 days if power is rationed. This feature is the first attribute they advertise and is given more prominence than its carrying or towing capacities on Ford's website. Our family's Leaf could power our home for 6 days or longer if recharged by the solar generated off our rooftop.

EVs could be a significant source of back up storage soon as Ford, Volkswagen and other manufacturers join Nissan and Mitsubishi and enable bidirectional charging capabilities. These capabilities will become routinely enabled as national standards are finalized by the National Institute of Standards and Technology (NIST) in 2024.

Recently, seven major auto manufacturers announced they plan to have 40-50% of their sales electrified by 2030.[1] In docket 49125, TxETRA estimated that electric vehicle sales could hit 40% of the market in Texas and there could be as many as 3.8 million electric vehicles or 15% of the fleet by 2030. Today there are 575,000 EVs in Texas,[2] with an average capacity of 60 kWh.[3] 80% of the EV batteries that are removed from use in EVs are repackaged and reused as battery storage devices and those batteries are projected to last an additional 10 years.

Our January 2021 survey of EV owners found that 85% of EV owners charge at home at night when Texas has large amounts of renewable energy, so charging not only doesn't threaten the grid but can increase revenues for generators during off peak times. These batteries also represent a reliable distributed back-up source that will typically be parked at home more than 330 nights per year and/or at the office 200 days per year.

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[1] Major manufacturers including GM, Ford, Stelantis, Volvo, Jaguar, Volkswagen, Mercedes-Benz to have 50% or more of their sales be all or partially electric by 2030. Honda has pledged to be all electric by 2040. See https://www.reuters.com/business/autos-transportation/us-automakers-say-they-aspire-up-50-ev-sales-by-2030-sources-2021-08-04/.

[2] DMV data compiled by the DFW Area Cities Program, updated 8/5/21, https://www.dfwcleancities.org/evnt.

[3] Electric Vehicle Database. https://ev-database.org/cheatsheet/useable-battery-capacity-electric-car.

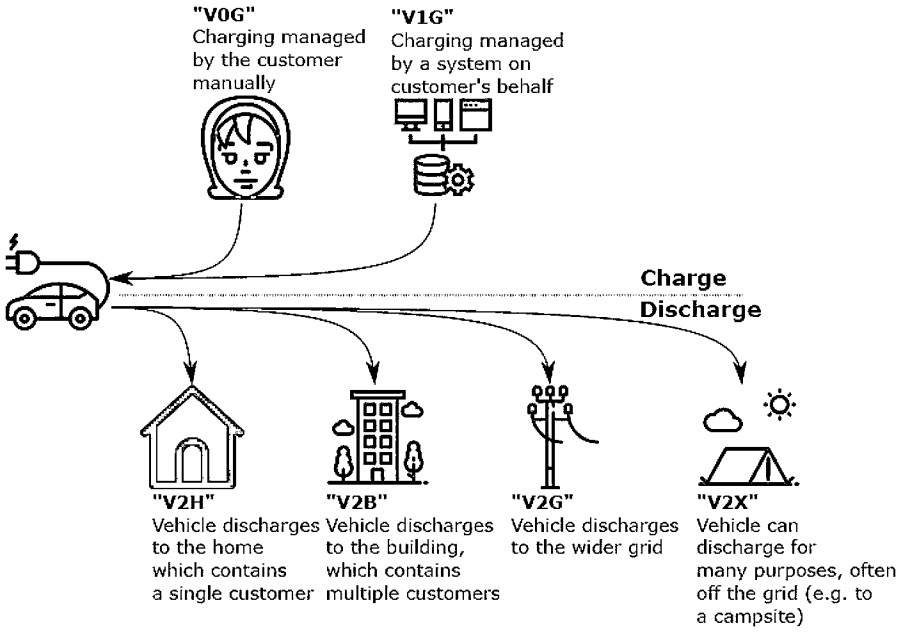
As more EVs are deployed, workplace charging will become common. If these vehicles and batteries are plugged in during the day into bi-directional chargers the energy in batteries can be deployed to reduce peak demand.

Electrified school and municipal busses and other medium and heavy-duty vehicles can provide mobile emergency back-up services to hospitals, water treatment facilities, emergency operations centers, grocery stores, gas stations, and other critical facilities or be deployed to community warming or cooling centers.

The Texas PUC should take the opportunities presented in this market redesign process docket to develop a way to track, integrate, and reward the use of this emerging and reliable source of energy storage.

3. What new ancillary service products or reliability services or changes to existing ancillary service products or reliability services should be developed or made to ensure reliability under a variety of extreme conditions?

New applications of existing ancillary service products can enable electric vehicles to provide valuable ancillary services in times of extreme conditions. The following chart helps to visualize how electric vehicles batteries can provide energy to homes, buildings, or to the grid and introduces commonly used terms.



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One recent study[4] found that EV battery storage can provide a variety of ancillary services.

> "Vehicle-to-Grid (V2G) presents a mechanism to meet key reliability requirements of the electric power system by using electric vehicles when they are parked and underutilized. While V2G is expected to have several applications, the most economic entry for this innovation is the market for ancillary services (A/S). The highest value A/S is frequency regulation (in many ISOs, including PJM, this service is simply called "regulation" and we will use that term subsequently). In PJM with deregulated electricity markets,

[4] Kempton W, Udo V, Huber K, Komara K, Letendre S, Baker S, Brunner D, Pearre N. A Test of Vehicle-to-Grid (V2G) for Energy Storage and Frequency Regulation in the PJM System Results from an Industry-University Research Partnership, Nov 2018. https://www1.udel.edu/V2G/resources/test-v2g-in-pjm-jan09.pdf.

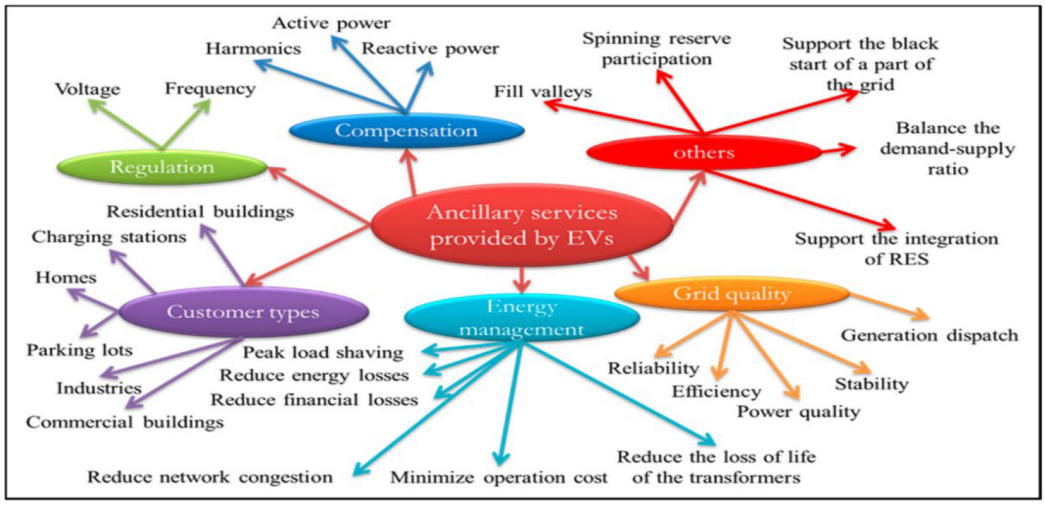
regulation can have average values of $30-$45/MW per hour, with hourly rates fluctuating widely around that average.

A second market of interest is spinning reserves, or synchronous reserves, with values in the range of $10/MW per hour, but much less frequent dispatch. The primary revenue in both of these markets is for capacity rather than energy, and both markets are well suited for batteries as a storage resource because they require quick response times yet low total energy demand.

Additionally, V2G can provide distribution system support when there is a concentration of parked V2G cars, (such a sin parking garages) to overload elements in the distribution system.

A later application, when parked V2G-capable vehicles, are connected and aggregated in large numbers, can be used would be to use them as dispersed energy storage to smooth out variable generation by charging when energy is abundant and discharging when it is scarce."

This chart shows the many different services electric vehicles can provide.[5]



Another study[6] found that:

"V2G enables EVs to contribute to 'peak shaving' by discharging power at peak times. Field trials of V2G have demonstrated peak shaving of up to 30% and utilities are now incorporating V2G into demand response markets. V2G can also improve power quality by providing reactive power support to manage voltage and improve power factors. These services are delivered by the power electronic converters within vehicles or chargers, without draining the battery and, when provided by chargers, without a dependence on vehicle availability. These services are naturally combined with broader decentralized energy integration strategies to reduce distribution losses. Finally, V2G can bolster system strength, being the power system's tendency to remain within safe operating conditions even under stressed conditions and to recover adequately after disturbances."

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[5] El-Bayeh, C.Z.; Alzaareer, K.; Aldaoudeyeh, A.-M.I.; Brahmi, B.; Zellagui, M. Charging and Discharging Strategies of Electric Vehicles: A Survey. *World Electr. Veh. J.* **2021**, *12*, 11. https://doi.org/10.3390/wevj12010011.

[6] Sturmberg, B., Jones, L., Lucas-Healey, K., Islam, M., & Temby, H. (2021). Niche to normality - an interdisciplinary review of Vehicle-to-Grid. *ArXiv, abs/2106.05837*, https://arxiv.org/pdf/2106.05837.pdf.

Austin Energy has partnered with the Pecan Street project in the Mueller neighborhood to try a V2G experiment. It is a perfect location for this experiment because it has a high concentration of homes with solar and of electric vehicles.[7]

Austin Energy, in collaboration with US Department of Energy, Pecan Street Inc, and other partners has been studying and piloting managed EV charging for years to understand the technical feasibility, business use-case/value, and customer experience. As part of the Austin SHINES Project, a bi-directional 10kW vehicle-to-grid (V2G) was deployed as a larger distributed energy resource (DER) ecosystem. The V2G performed well, although there still are barriers in cost-effective products for residential use today. Managed one-way charging (V1G) is currently being demonstrated by the Austin Energy EV360 pilot and previously by a federal grant with AutoGrid. What these pilots have demonstrated is a strong customer willingness to shift EV load off-peak with minimal opt-outs compared to traditional AC thermostat demand response programs.[8]

Austin Energy's preliminary analysis shows that there are 19 value streams that can come from deployment of V2G.[9]

A series of presentations during the NARUC 2021 winter meetings illustrated various V2G use cases for school buses which are briefly described below and are illustrative of how EVs can be generally deployed in the future.

- Getting Kids to School and Providing Grid Services
  In **New York**, Con Edison is sponsoring a School Bus V2G demonstration project. The goals of the program are to demonstrate the successful transportation of children to and from school while also providing grid services and maintaining battery health. The modest program is currently using five buses: 2 as a control group, 2 providing energy to the grid daily, and 1 bus providing demand response. *What Do These Utilities Know About V2G Programs That You Don't, But Probably Should (NARUC V2G), Sponsored by the NARUC Staff Subcommittee on Energy Resources and the Environment and NARUC Electric Vehicle State Working Group.*

- Managing Costs and Risks So Schools Can Use Electric Buses
  In **Virginia**, Dominion Energy is in the first phase of a school bus V2G program involving 15 school districts. Program goals include enhancing power grid operations, while reducing emissions, and improving air quality aboard buses. 50 buses were delivered to school districts by the end of 2020. Dominion is also experimenting with a business model designed to reduce economic risk to school districts through a cost sharing arrangement whereby the district pays $100,000 per bus (the price of a traditional diesel bus) while the utility pays for the difference in the overall $325,000 price of the electric bus. The schools keep the O&M, fuel and maintenance savings estimated at approximately $7,000 per year per vehicle. The utility which partnered with bus manufacturer Thomas Built Buses Inc. from North Carolina and California-based electric bus designer Proterra, retains ownership of the battery, and pays for (rate bases) the charging infrastructure and related equipment. *Presentation by Kate Staples, Manager, Electrification, Dominion Energy Virginia, NARUC V2G.*

- Reducing School Net Energy Costs and Overcoming Interconnection Challenges

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[7] Austin Shines: Innovation in Energy Storage, Austin Energy Website. https://austinenergy.com/ae/green-power/austin-shines/austin-shines-innovations-energy-storage.
[8] Communications with Karl Popham, Austin Energy, August 18, 2021.
[9] P. Maloney, American Public Power Association, February 15, 2019. Austin Energy Collaborates on Vehicle-to-Grid Project https://www.publicpower.org/periodical/article/austin-energy-collaborates-vehicle-grid-project.

In **California**, San Diego Gas and Electric is undertaking a V2G school bus pilot program to support local schools and the electric grid. The program is designed for six electric school buses to use their on-board batteries to discharge excess energy to the grid during peak demand hours as a strategy to avoid high utility rate demand charges. The program's goals are to provide value for the school by generating revenue and reducing net energy costs. Originally designed for L2 charging, however in order to surmount AC/DC charging limitations, the program had to adopt more expensive DC fast chargers. *Presentation by Jaron Weston, Manager, Clean Transportation Policy, San Diego Gas & Electric, NARUC V2G.*

Other states and utilities that have developed rate design to encourage V2G programs include: Georgia Power and Light; ECEL Energy in Minnesota and Baltimore Gas and Electric.[10]

Please articulate specific standards of reliability along with any suggested AS products.

Ancillary services develop to support specific grid needs. Ancillary services markets should be flexible enough to enable the various types of distributed energy resources that exist to compete to offer. Electric Vehicles can provide products such as: frequency regulation; spinning reserves; synchronous reserves; dispersed energy storage; harmonics; reactive power; black start capabilities, and any other ancillary service needs that will develop in the future. Electric vehicles, when aggregated, have the capability to provide the ancillary services listed above.

These services need not be delivered exclusively by REPs or charging companies but can also be provided via partnerships between TDUs and auto manufacturers who have a lot of data on the location of their vehicles, their dwell times and patterns and have the capacity and can contract to dispatch energy with the permission of the vehicle owner.

As mentioned above, these vehicle batteries represent a reliable distributed back-up energy source that will typically be parked at home more than 330 nights per year and/ or at the office 200 days per year. OEMs have data that show just how predictable EV owners are.

How should the costs of these new ancillary services be allocated?

Electric vehicles are unique in that the capital costs of the battery and the interconnection are borne by the vehicle owner. The costs of providing the ancillary service could thus include relatively fewer capital costs. EV owners should be compensated for the ancillary services they provide.

4. Is available residential demand response adequately captured by existing retail electric provider (REP) programs? Do opportunities exist for enhanced residential load response?

No. A study[11] funded by the Department of Energy found that battery storage capacity in electric vehicles can be harnessed to provide a variety of grid support services Electric Supply: electric energy time shift; capacity; ancillary services; load following; area regulation; voltage support; end user demand side services; time of use cost management; demand management; renewable energy integration; renewable energy time shift; capacity firming; and wind and solar integration.

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[10] Communications with Phil Jones of the Alliance for Transportation Electrification 8/16/21.

[11] Briones A, Francfort J, Heitmann P, Schey M, Schey S, Smart J.Vehicle-to-grid (V2G) power flow regulations and building codes review by the AVTA. Idaho National Lab., Idaho Falls, ID, USA, 2012. https://avt.inl.gov/sites/default/files/pdf/evse/V2GPowerFlowRpt.pdf

REPs could offer a time of use EV rate coupled with grid interconnection and a permission to integrate, dispatch and reward the use of this emerging source of energy storage or they could contract with aggregators to do so.

TDUs could offer time of use distribution rates to encourage off peak charging either at night or during peak distributed solar production. The NY variable distributed energy resource rate could be used as a model because it's a generally applicable as a marginal cost pricing system for exports from any technology.

5. How can ERCOT's emergency response service program be modified to provide additional reliability benefits?

ERCOT's emergency response service program could be modified to allow EVs to participate. Electric vehicles can be called upon to provide energy, grid and voltage support in emergencies. However, the rules and protocols and the EV owners' contracts with their aggregators will need to be adapted to allow for them to be geolocated and dispatched when plugged in.

6. How can the current market design be altered (e.g., by implementing new products) to provide tools to improve the ability to manage inertia, voltage support, or frequency?

Studies have demonstrated "V2G chargers acting as virtual synchronous machines (providing synthetic inertia and frequency control that enables seamless transition to islanded operation during outages on the grid) as well as providing fault current contributions and post-fault reactive power support."[12]

Summary

EVs are both an emerging load and battery backup for the grid that can provide a wide variety of ancillary services and highly responsive reserves to the grid. This restructuring debate is the right time to begin to integrate the growing number of batteries into your toolkit for meeting the future needs of the grid.

TxETRA has policy group members that are utilities, charging companies, OEMs, researchers, academics and national organizations that can offer their expertise to the Commissioners or their staff or serve as panelists at a workshop. We can plug in and provide our energy to the discussion when needed.

[12] Sturmberg op cit.