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ISSUE BRIEF

GUIDING PRINCIPLES FOR UTILITY PROGRAMS TO ACCELERATE TRANSPORTATION ELECTRIFICATION

The electrification of the transportation sector is not only a key pathway by which to meet air quality and climate goals, but also a singular opportunity for the electric industry. The United States spends more than $436 billion annually on gasoline and diesel.[1] Diverting a portion of that expenditure to the electric sector can spread the costs of the transmission and distribution grid over more sales, putting downward pressure on the price of electricity while also providing consumers relief from volatile gasoline and diesel prices.

The early electric vehicle (EV) market has been strong, and battery prices have decreased 70 percent in the past six years.[2] There are now more than 600,000 EVs in the United States alone, and in a period of about two weeks in April 2016, some 400,000 people put down $1,000 deposits for the Tesla Model 3, which will soon be available for $35,000 before incentives, and which has a range of 220 miles (with an option for a 310 mile version).[3] However, unless a growing charging infrastructure gap is closed, many of them may take back their deposits and the market could stall. Likewise, many consumers are simply unaware of the proliferation of affordable EV models that offer longer ranges and improved performance, such as the Chevrolet Bolt EV, Motortrend's "Car of the Year," which has a range of 238 miles and can be acquired for around $30,000 after a federal tax credit.

Electric utilities are uniquely situated to help overcome these barriers and meaningfully accelerate the adoption of light-, medium-, and heavy-duty EVs. In concert with environmental organizations and other relevant stakeholders, utilities can develop proposals that address gaps in charging infrastructure deployment, increase consumer awareness of the benefits of EVs, and improve the utilization of the electric grid to the benefit of all customers. The successful implementation of these programs can both accelerate transportation electrification and lower the cost of integrating renewable energy by leveraging the energy storage inherent in EV batteries to manage an increasingly dynamic grid.

GUIDING PRINCIPLES FOR UTILITY TRANSPORTATION ELECTRIFICATION PROGRAMS

To fully realize environmental, grid, and customer benefits, we present a non-exhaustive set of guiding principles to help frame utility proposals to accelerate transportation electrification:

Deploy Charging Infrastructure Strategically

A lack of access to charging stations is a critical barrier to consumer acceptance of EVs. Utilities should prioritize the deployment of charging stations at locations that maximize EV adoption. The National Academy of Sciences and other organizations have identified the following priority segments for infrastructure deployment:[4]

- **Residences.** The ability to charge an EV at home overnight is central to the decision to purchase an EV. Drivers who cannot plug in at home are unlikely to buy a plug-in vehicle. At-home overnight charging is also the main opportunity to utilize spare capacity in the grid, putting downward pressure on electricity rates. Utilities can offer programs that lower the costs of purchasing and installing charging stations at home; they can also require program participants to take service on time-variant rates and participate in smart-charging programs. Within the residential segment, multi-unit dwellings, such as apartment complexes, are demonstrably underserved, making them ripe for utility investment to move the market beyond single-family homes.[5]

For more information, please contact:
Max Baumhefner
mbaumhefner@nrdc.org

www.nrdc.org
www.facebook.com/nrdc.org
www.twitter.com/NRDCEnergy

- **Workplaces.** Outside of the home, vehicles are stationary for the longest period of time at work. Installing charging stations at workplaces can both extend range for drivers and spur additional vehicle sales. Nissan credits a workplace charging initiative with a fivefold increase in monthly EV purchases by employees at participating locations.[6] Workplace charging can also increase electric miles driven by alleviating "gasoline anxiety" for drivers of plug-in hybrid vehicles with shorter all-electric ranges. In addition, workplace charging can ensure EVs are available in the afternoon to serve as a form of energy storage to absorb peak production from solar energy.
- **Public Fast-Charging.** Nine days out of every ten that a car is driven, it is driven less than 70 miles, which is within the range of first-generation, pure-battery electric vehicles. Still, the lack of Direct Current (DC) fast-charging infrastructure needed to make that one-in-ten, long-distance trip remains a significant obstacle to the purchase of pure-battery EVs.[7] Drivers' purchase decisions are often disproportionately influenced by rare use cases; for example, the off-road capability of SUVs remains an important factor contributing to their market dominance, even though that capability is almost never used. Consumer research shows that the lack of "robust DC fast-charging infrastructure is seriously inhibiting the value, utility, and sales potential" of pure-battery electric vehicles.[8] The need for a fast-charging network akin to Tesla's Supercharger network, which the automaker reports was critical in order to enable sales of its Model S and Model X, will only grow with the availability of more-affordable EVs with comparable ranges that make intercity travel possible.[9]
- **Public Long Dwell Time.** Standard Alternating Current (AC) charging stations (typically less than 7kW) are appropriate at "long dwell time" public sites such as park-and-ride lots, fleet parking lots, and airport long-term parking garages, where the vehicles are parked for extended periods and the additional cost associated with DC fast-charging is not warranted. Visible public locations can also increase general consumer awareness and enable trips that would otherwise not be possible.

Increase Access, Foster an Equitable EV Market, and Improve Local Air Quality

Barriers to EV adoption are often highest in communities where residents are disproportionately burdened by air pollution and transportation fuel costs.[10] Increasing access to EV charging infrastructure in these communities can help address these challenges and enable a broader, more diverse, mass EV market. Utility support for the infrastructure needed to electrify trucks, buses, and other medium- and heavy-duty vehicles can also displace diesel pollution that disproportionately impacts low-income communities. Utility programs should look to complement other programs designed to increase access in low-income communities and to improve air quality. For example, if utility programs provide the necessary charging infrastructure, states could focus the resources they have pursuant to the Volkswagen Environmental Mitigation Trust on the incremental cost of zero-emission medium- and heavy-duty vehicles, increasing the associated air quality benefits.[11] Likewise, utilities can provide charging infrastructure to support EV car-sharing programs that increase access to clean vehicles without the burdens of car ownership.

Manage Load and Maximize Fuel Cost Savings

Smart charging of EVs is essential to ensure that the benefits upon which proposed utility transportation electrification investments are premised will materialize. Likewise, load management and consumer pricing protection provisions can also be critical to ensure that EV drivers realize the fuel cost savings numerous surveys reveal are the most important motivator of EV purchase decisions.[12] Utility programs that deploy utility-owned charging stations, as well as programs that support the deployment of charging stations owned by site hosts (who own or manage the property where the stations are located), should include provisions to ensure that EV drivers who charge in a manner consistent with grid conditions realize the fuel cost savings that drive EV adoption. Charging stations largely made possible with utility customer funding also run the risk of being underutilized if the pricing to EV drivers absorbs the margin between the price of electricity and the price of gasoline.

Time-varying rates, such as time-of-use rates, are a proven and foundational form of load management that can maximize fuel cost savings for EV drivers. Such rates also encourage charging that improves the utilization of the grid, putting downward pressure on electricity rates to the benefit of all utility customers. Utilities should also look to demonstrate more advanced forms of smart-charging to leverage the energy storage inherent in EVs to lower the costs of managing the grid and integrating variable renewable resources. The benefits associated with effective load management and more advanced forms of vehicle-grid integration can be decisive factors for regulators asked to authorize utility investments designed to accelerate transportation electrification.[13]

Foster Competition

Utilities should leverage the experience of third-party charging equipment and service providers in the development of charging infrastructure programs. This is equally true in the context of programs in which site hosts own the charging stations and in programs in which utilities own them. Who has title to the actual charging station, the last link in the infrastructure chain, is only one element of program design that relates to potential impacts on competition, though it may also affect reliability and fuel cost savings, especially in the public charging context.

Charging equipment and service providers have supported programs in which the utility owns all the electrical equipment, including the charging stations, but procures and qualifies charging stations and services through a transparent, competitive process, and programs in which the utility owns the electrical equipment up to, but not including, the charging stations and provides rebates to help site hosts purchase charging stations from a list of prequalified equipment. Regulators have found that both program design options are capable of fostering competition. Regulators have also looked to other program design features to mitigate the potential for anticompetitive impacts, such as the ability of site hosts to choose among prequalified equipment providers, site-host financial contributions, stakeholder advisory boards, and a choice of billing options.

Educate Customers

A comprehensive strategy to engage customers is a necessary component of a successful program. Identifying willing site hosts is one of the biggest challenges to infrastructure deployment. Likewise, engaging EV drivers and educating them as to the availability of utility infrastructure programs, tariff options, load management programs, and so on are critical to maximize participation.

To expand the EV market, a general lack of consumer awareness must also be overcome, and common misperceptions, often fueled by misleading press coverage, must be corrected.[14] Consumers in the market for a new car need to be educated about the benefits of driving on electricity and about applicable utility rates, incentives, and programs. Utilities are better positioned to conduct this type of broad customer education effort than individual automakers seeking to promote specific vehicles, or charging service providers seeking to promote specific products or business models.

Prioritize Safety

Accidents associated with the improper installation or use of charging equipment could undermine the nascent EV market. Safety is already a core principle of the electric industry, and it should remain a priority as utilities expand into the transportation space. In authorizing $200 million in investor-owned utility programs that will collectively deploy 12,500 charging stations at multi-unit dwellings and workplaces, the California Public Utilities Commission pointed to the safety benefits associated with the requirements that all electrical work be done by electricians who had gone through the Electric Vehicle Infrastructure Training Program.[15]

Learn by Doing

Utility-driven transportation electrification programs represent valuable learning opportunities for all stakeholders. For this reason, utilities should record, collect, and disseminate data and reports that assess the performance of their programs. Useful metrics include, but are not limited to:

- **Charging station deployment, by market segment**
- **Charging profile and utilization rates, by market segment**
- **Prices paid by EV drivers at charging stations**
- **Capital, operation and maintenance costs incurred, by market segment**
- **Additional qualitative feedback from program administrators and end users**

Sharing assessments of programs will allow stakeholders to gain insight on how to improve future proposals and adjust existing programs as needed. Expansions of existing programs may also be tied to performance and subject to regulatory approval informed by data collected during initial phases.

CONCLUSION

With more than 600,000 modern EVs in the United States alone, policymakers and utilities need not rely on conjecture to place transportation electrification on the right path to meet air quality, climate, and equity goals while supporting the grid and facilitating progress toward other clean energy goals. If regulators and the utilities under their jurisdiction fail to take timely action, the expansion of the EV market could stall or EV charging could strain the grid. However, with the right policies and programs, utilities can provide widespread benefits to all customers, reduce exposure to dangerous air pollution and the worst effects of climate change, and provide consumers with a viable alternative to the volatile global oil market.

ENDNOTES

1 U.S. Energy Information Administration, "Short Term Energy Outlook" and Monthly Energy Review, Table 3.7c, June, 2017.

2 Quain, John, "2017 Could Prove to Be a Turning Point for Plug-In Hybrids," *New York Times*, May 4, 2017.

3 Fehrenbacher, Katie, "Tesla's Model 3 Reservations Rise to Almost 400,000," *Fortune*, April 15, 2016.

4 Committee on Overcoming Barriers to Electric-Vehicle Deployment et al., *Overcoming Barriers to Deployment of Plug-in Electric Vehicles*. Washington, D.C.: National Academies Press, 2015.

5 More than 80 percent of EV drivers live in single-family detached homes. Center for Sustainable Energy, California Plug-in Electric Vehicle Owner Survey Dashboard, 2016.

6 White, Brandon, senior manager of EV Sales Operations, Nissan North America, "Taking the 'Work' Out of Workplace Charging," presentation at EPRI Plug-in 2014 Conference, San Jose, California, July 2014.

7 Electric Power Research Institute (EPRI), "Transportation Statistics Analysis for Electric Transportation," 2011, Figure 2-1.

8 Hajjar, Norman, "New Survey Data: BEV Drivers and the Desire for DC Fast Charging," California Plug-in Electric Vehicle Collaborative, March 11, 2014.

9 Lankton, Cal, director of EV Infrastructure, Tesla Motor Company, "Plenary Panel: Technology Marches On—The Impact of New Vehicle and Infrastructure Technologies," EPRI Plug-in 2014 Conference, San Jose, California, July 2014.

10 Song, C.C., "Electric Vehicles: Who's Left Stranded?" Greenlining Institute, August 2011.

11 Per the terms of a consent decree between VW, the federal government, and California, states are eligible to receive a share of $2.7 billion, based on the number of non-compliant diesel vehicles sold in the state, to be invested in vehicles and supporting infrastructure that improve air quality, largely by displacing diesel pollution.

12 Center for Sustainable Energy, California Plug-in Electric Vehicle Owner Survey Dashboard. Steele, David E., J.D. Power and Associates, "Predicting Progress: What We Are Learning About Why People Buy and Do Not Buy EVs," Electric Drive Transportation Association 2013 Annual Meeting, Washington, D.C., June 11, 2013. Maritz Research, "Consumers' Thoughts, Attitudes, and Potential Acceptance of Electric Vehicles," National Research Council meeting, Washington, D.C., August 13, 2013.

13 For example, the BMW-PG&E "ChargeForward" pilot has demonstrated the use of vehicle-based communications to enable smart charging that provides a 100kW resource to PG&E on a congested distribution circuit. See: BMW iChargeForward: PG&E's Electric Vehicle Smart Charging Pilot, Final Report, 2017.

14 *See* Krause, R.M., et al., "Perception and Reality: Public Knowledge of Plug-In Electric Vehicles in 21 U.S. Cities," *Energy Policy* 63 (December 2013): 433-440.

15 *See* California Public Utilities Commission, Decision 16-01-045, January 28, 2016, p. 114, footnote 30.