

## BRIEFING

---

DECEMBER 2017

# Expanding access to electric mobility in the United States

---

This briefing summarizes policies and actions that are expanding access to electric transportation in the United States. We highlight low-income and apartment dwellers where applicable and include actions to expand access to electric mobility more generally that are not explicitly targeting these groups. Practices that support electric vehicle adoption and broaden awareness about and access to electric mobility are included.

## INTRODUCTION

Growth in the electric vehicle market continues globally and in the United States. Global cumulative electric vehicle sales surpassed 2 million units in early 2017. The United States accounts for about one-quarter of the global market with more than half a million sales through 2016. Preliminary half-year 2017 data reflect continued growth in the United States with year-over-year sales growth of about 40%.<sup>1</sup> Several governments have aggressive electric vehicle adoption targets and continue to support the transition to electric drive to help achieve goals targeting oil reduction, industrial development, climate change, and local air quality. At the same time, many governments are committed to creating equitable mobility solutions across their entire resident populations.

As the electric vehicle market develops, proactive governments, utilities, and other stakeholders increasingly seek to capture a broader set of prospective consumers

---

<sup>1</sup> Alliance of Automobile Manufacturers. (2017). *ZEV Sales Dashboard*. Retrieved from <https://autoalliance.org/energy-environment/zev-sales-dashboard/>.

---

**Prepared by:** Peter Slowik and Michael Nicholas. This work was conducted for The 11th Hour Project of the Schmidt Family Foundation. Fanta Kamakaté, Nic Lutsey, Alvaro Sanchez, Clarrissa Cabansagan, and Brett Williams provided critical reviews on an earlier version of the report. Any errors are the authors' own.

beyond early adopters. Data show that innovators and early adopters of electric vehicles generally are educated, middle-aged, married, male, typically have higher incomes, and live in detached homes. As governments look to develop the broader mainstream market, they continue to take action that will reach prospective consumers outside of these categories.

City and state governments are developing innovative new programs to expand zero emission mobility beyond early adopters to be more inclusive of low-income buyers/drivers, low-income communities, residents of multi-unit dwellings (MuDs) such as apartments and townhouses, and other groups who typically have not been early adopters of electric mobility. These consumer segments face heightened barriers and greater challenges to adopting electric vehicle technology, including cost, practicality, and awareness. Lowering barriers to electric mobility for low-income drivers, low-income communities, MuD residents, and other consumer groups will unlock a greater share of prospective consumers, indicating the importance of government actions targeting these consumer segments as policymakers strive to meet electric vehicle adoption targets.

This briefing explores innovative programs that are designed to remove such barriers. We explore 10 categories of policies and actions that were in place in the United States in 2017 and discuss how they increase access to electrification. These policies and actions, including how they increase electric mobility and which key stakeholders are involved, are listed in Table 1. Each of these actions can expand access to electric mobility in at least one of three ways: by increasing electric vehicle awareness, by increasing electric vehicle affordability, and/or by increasing electric vehicle practicality and accessibility.

In this work, we highlight low-income buyers and apartment dwellers where applicable and include actions to expand access more generally that are not exclusive to those groups. Additionally, we highlight electric transportation beyond privately-owned vehicles, including shared mobility, public transportation, and infrastructure. This briefing lays the groundwork for a deeper understanding of the electric vehicle policy package needed to more equitably serve potential new markets. Further research is needed to assess specifically which individuals are taking advantage of the emerging innovative policies and programs.

**Table 1.** Key policies and actions designed to expand access to electric mobility

Policy or action	Mechanism to increase access to electric mobility			Key stakeholders			
	Affordability	Practicality	Awareness	State	City	Utility	Nonprofit
Offer electric mobility services to all residents	X	X	X	X	X		/
Heighten awareness of electric mobility options			X	X	X	X	X
Increase electric mobility experiences			X	X	X	X	X
Target incentives for lower-income buyers	X		X	X	/	/	/
Increase public and workplace charging options		X	X	X	X	X	/
Bring charging to everyone's home		X	X	X	X	X	/
Ensure electric driving is cheaper than gasoline (per mile)	X			X		X	
Have utilities serve as champions and educators	X		X			X	
Require high model availability and diversity	X	X	X	X	/		
Vest communities in the transition to electric drive			X	X	X	X	

"X" denotes intent of given policy or action and likely stakeholder or implementer.

"/" denotes possible stakeholder or implementer.

## OFFER ELECTRIC MOBILITY SERVICES TO ALL RESIDENTS

Local mobility services such as electric carsharing, ridesharing, and public transit help provide low-carbon mobility options to a resident population. These fleet services directly increase electric vehicle use while increasing overall visibility and exposure.

Electric vehicles are present in carsharing programs of various sizes in more than 15 major U.S. cities. The electric-carsharing program in Indianapolis, Indiana, for example, is expanding toward approximately 500 all-electric vehicles and 200 charge points. In an effort to bring electric mobility to all residents, cities including Portland, Oregon, and Sacramento and Los Angeles, California, are beginning to launch dedicated e-carsharing programs in low-income communities. The largest is in Los Angeles, where 100 vehicles and 200 charge points are being deployed in communities that have been identified as having greater socioeconomic challenges, a need for mobility options, and exposure to environmental pollution. The program offers discounted membership costs and usage rates for low-income users and is expected to provide electric mobility to thousands of residents. The project has established targets related to low-income members and will measure project impact. For example, the city seeks to recruit more than 6,000 members with annual household incomes below \$35,000, and for at least 50% of all trips to be made by members with household incomes less than \$35,000.<sup>2</sup>

2 City of Los Angeles. (2016). Inter-departmental memorandum. Retrieved from [http://clkrep.lacity.org/online/docs/2015/15-1227\\_rpt\\_DOT\\_11-23-2016.pdf](http://clkrep.lacity.org/online/docs/2015/15-1227_rpt_DOT_11-23-2016.pdf)



Electric carshare vehicles and charging stations along 7th Street in Los Angeles, CA. Photo: Streetsblog L.A./Joe Linton (<http://la.streetsblog.org/2017/06/09/ladot-and-blueLA-partner-for-low-income-electric-car-share/>)

An innovative grassroots effort is bringing electric vehicles to ridesharing networks in California’s San Joaquin Valley area. Enabled by a \$519,000 grant approved by the California Public Utilities Commission (CPUC), environmental community justice institution Valley LEAP will integrate electric vehicles into existing ridesharing networks to improve reliability and affordability, and reduce emissions. By improving mobility for low-income residents, executive director Ray León believes the pilot will grow to be a much larger vital resource for local poor rural communities.<sup>3</sup> Program funds are allocated to expanding outreach, education, and training for residents who may be unfamiliar with electric vehicles.

Procuring electric vehicles in public transportation also provides electric mobility to the broader resident population. As of 2016, more than 15 major cities had taken steps to procure electric buses in the local transit fleet. Louisville, Kentucky, is expanding toward 15 electric buses. In 2017, transit authority King County Metro in Seattle, Washington, studied the feasibility and other impacts of procuring electric buses, finding that the technology will reduce emissions, advance social equity, and minimally increase total costs. The authority announced it will procure 120 e-buses by 2020.

Looking forward, policymakers could broaden and expand electric mobility services across the entire resident population, prioritizing their deployment to low-income and underserved populations. For example, governments could prioritize replacing

<sup>3</sup> Valley LEAP. (2017). New Funds Boost Clean Car Ridesharing in Central Valley. Retrieved from <https://sjvleap.wordpress.com/2017/04/10/new-funds-boost-clean-car-ridesharing-in-central-valley/>

conventionally fueled public transit fleets with electric fleets. Cities could also leverage transportation network companies (TNCs) like Lyft and Uber for similar programs. Identifying mobility challenges and needs is important when considering local mobility services. For example, e-buses may be better utilized on key routes throughout the urban core whereas electric-carsharing, ridesharing, or on-demand ride hailing can provide mobility in lower-density areas that are less suitable for conventional transit.

Barriers may exist to broader accessibility and usage of electric mobility services. Outreach, education, and training are likely needed to inform residents of available technology, programs, methods of payment, and more. Program evaluation including consumer surveys that identify how and why residents of all consumer segments use (and do not use) electric mobility services can help inform future investment.

## HEIGHTEN AWARENESS OF ELECTRIC MOBILITY OPTIONS

The lack of consumer awareness and knowledge is a primary barrier to widespread electric vehicle adoption, and therein lies one key to broadening the market. State and local efforts to heighten awareness of electric mobility options include consumer-oriented informational materials and outreach campaigns.

About half of major U.S. cities provide some sort of informational materials about electric vehicles on their websites. However, there is a significant digital divide that makes this type of outreach less effective for low-income buyers. One particularly informative website, Drive Electric Chicago, provides information about electric vehicle technology and financial incentives, a fuel cost savings calculator to assess economic benefits, details for installing charging stations for single-family homes as well as MuDs, a map of public charging stations, and links to other resources.

Outreach campaigns can play a more active role in increasing awareness of electric mobility options. A new awareness campaign in the Northeast United States has developed customized messaging strategies for three target audiences likely to buy a car within 5 years: grown up millennials ages 25–35, Gen-X and Boomer men ages 40+, and women 45–60 approaching retirement and an empty nest. The campaign identifies and tracks key metrics to assess the impact on increasing consumer awareness, consideration, and acceptance of electric vehicles and to inform future strategy. Volkswagen’s Electrify America campaign includes investing in awareness programs across the United States. The first investment cycle includes \$2 million to \$3 million for education and awareness, with a significant share directed toward collaborating with reputable community organizations within low-income and disadvantaged communities in California.<sup>4</sup>

Understanding the mobility needs and resident population can enable more effective community engagement and awareness efforts. For example, an outreach event in Watts in Los Angeles, California, included information booths that highlighted the state’s electric vehicle financing options and increased rebates for low-income residents. Basic education on automobile loans and financing can augment community awareness programs.

<sup>4</sup> Electrify America. (2017). *Supplement to the California ZEV Investment Plan*. Retrieved from <https://www.electrifyamerica.com/downloads/get/1019583>



The Watts Electric Drive & Ride Event held in Los Angeles, California on September 18, 2016, was enthusiastically supported by the Watts Neighborhood Council, and engaged with the Watts Gang TaskForce and Much 62. The event featured an array of electric vehicles displayed by owners and by local car dealerships. Photo: Sierra Club (<https://driveelectricweek.org/event.php?eventid=751>)

In the future, policymakers could continue to steer support from investments like Electrify America toward underserved and low-income communities. Additional actions could include securing local or regional long-term funding for consumer awareness campaigns that designate resources to lower-income communities, residents in MuDs, or other groups beyond early adopters. Ensuring outreach and informational materials are available across a variety of platforms (city websites, television, social media, informational pamphlets, public engagement) and in the languages spoken by the local population are likely needed to broaden awareness. Throughout community engagement and awareness building, gathering information such as local mobility challenges, knowledge gaps, and other needs can inform electric mobility advocates and policymakers about opportunities to adjust state and local policy to more effectively and equitably serve residents in the future. Engaging with community-based organizations can greatly enhance this process.

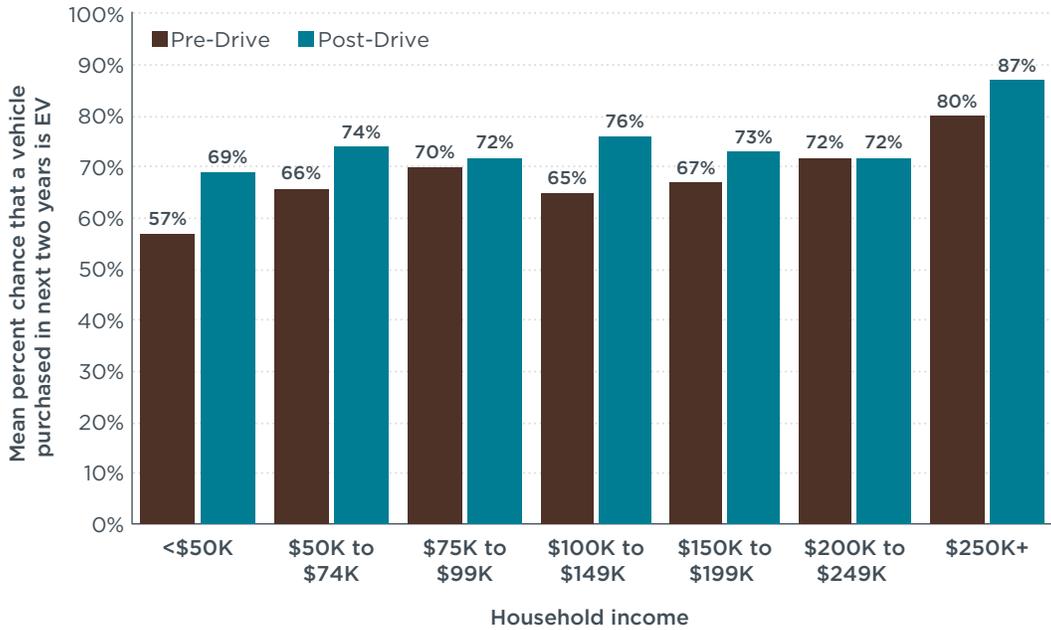
## INCREASE ELECTRIC MOBILITY EXPERIENCES

Experiencing electric vehicles firsthand such as through vehicle showcases and test drives, is one key to boosting consumer knowledge and understanding.

The electric vehicle showcase hosted by the advocacy organization Forth (formerly Drive Oregon) in Portland, Oregon, offers free test drives for several electric vehicle

makes and models. Prospective electric vehicle drivers sign up to reserve test drives, which are available 9 hours a day for 6 days a week in the downtown Portland area. In contrast, other major electric vehicle ride-and-drive events typically occur just a few times each year. Forth also has partnered with the rental car service Turo to facilitate short-term electric vehicle rentals.

National Drive Electric Week is a major annual event that enables communities across the United States to experience driving electric. At the regional level, the Experience Electric campaign was 18 months long and included an extensive evaluation report and metrics to understand the impact on improving electric vehicle perceptions and adoption. As reported by the Center for Sustainable Energy, Figure 1 shows the probability of a future electric vehicle purchase by household income, both pre- and post-drive. Consumers across all income levels were reportedly more likely to purchase an electric vehicle after a test-drive. These results suggest that firsthand experiences with electric vehicle technology increases the likelihood of future adoption for consumers of all incomes. The largest before-and-after probability increase was found for survey participants with household incomes below \$50,000, suggesting the opportunity of steering outreach and engagement efforts to lower-income consumers.



**Figure 1.** Percent chance that a vehicle purchased in the next two years is an EV by household income before and after EV ride-and-drive. From “Experience Electric—The Better Ride,” campaign evaluation report prepared by True North Research for the Metropolitan Transportation Commission, 2014. ([http://mtc.ca.gov/sites/default/files/MTC\\_EXEL\\_Final\\_Report.pdf](http://mtc.ca.gov/sites/default/files/MTC_EXEL_Final_Report.pdf))

A new collaboration in Portland among Uber, Forth, and utility Portland General Electric will bring electric vehicles into the Uber fleet. A key program element includes training drivers as “electric vehicle ambassadors” to educate riders, dispel myths, and generally expose the broader public in the Portland area to electric vehicles. The partnership provides small financial incentives to drivers who champion electric vehicles and educate their passengers about the technology, its benefits, and their electric driving experiences.

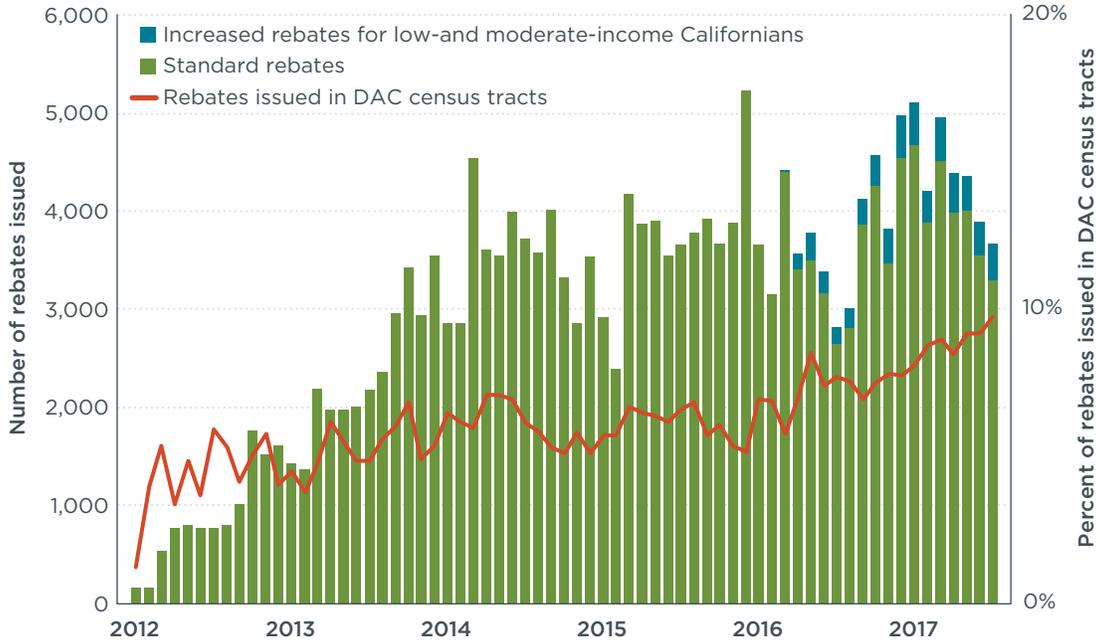
Looking forward, policymakers could secure long-term funding for electric vehicle showcases and test-drives that are available throughout the year. Initiatives like the electric vehicle showcase in Portland provide greater opportunities to experience electric mobility compared to events that occur infrequently. Local governments could also enlist TNCs like Lyft and Uber to use electric vehicles and educate riders. Policymakers can help ensure programs include dedicated resources for underserved and low-income communities. In addition, adopting equity-focused goals and metrics for program evaluation can help inform future investment and more equitably serve potential new markets.

## TARGET INCENTIVES FOR LOWER-INCOME BUYERS

State financial incentives are a key element of promoting electric vehicle adoption in the United States. Incentives accelerate the early market by helping to overcome consumer barriers related to higher upfront costs of electric vehicles, which typically range from a few thousand dollars to \$10,000 more than comparable gasoline options. As the market develops, proactive governments are taking steps to enhance program effectiveness and capture the broader market. Two unique incentive programs that target incentives for lower-income buyers are discussed here.

In 2016, California modified the state rebate program to offer increased rebate levels for low- and moderate-income consumers. Beginning in March 2016, an additional \$1,500 became available for prospective consumers who meet income criteria. The increased rebate levels were further modified in November 2016, increasing by an additional \$500. The increased rebate levels mean up to \$4,500 is available for battery electric vehicles (BEVs) and \$3,500 is available for plug-in hybrid electric vehicles (PHEVs). Rebate payments are prioritized for low-income consumers.

Figure 2 shows the number of electric vehicle rebates California issued from January 2012 through June 2017 in three categories: increased rebates for low- and moderate-income consumers, standard rebates, and rebates issued in disadvantaged community census tracts defined based on socioeconomic characteristics, pollution, vulnerability, and health status. Approximately 5,000 increased rebates for low- and moderate-income Californians were issued since the program's modification in March 2016. For context, these increased rebates amount to about 8% of all rebates—and about 14% of all rebate funding—issued from March 2016 through July 2017, showing the challenge and opportunity of steering additional rebate funding to lower income consumers.



**Figure 2.** Number of electric vehicle rebates issued in California. Source: Center for Sustainable Energy, 2017. Retrieved 10/30/2017 from <https://cleanvehiclerebate.org/eng/rebate-statistics>

The data show a slight uptick in the number of rebates issued in disadvantaged community census tracts since the program began in 2016. Although the percentage of rebates that are issued to DACs is approaching 10%, DACs account for approximately 17% of statewide light-duty vehicle sales; when normalizing to comparable light-duty vehicle sales, DACs account for more than 40% of electric vehicle sales.<sup>5</sup>

California has another pilot program that provides increased incentives for electric vehicles to low-income consumers. Depending on location, income, and vehicle type, up to \$12,000 is available for consumers who choose to scrap an old gasoline vehicle in exchange for a new or used electric vehicle. The pilot lowers the upfront cost barrier to electric vehicle adoption while removing old gasoline vehicles from the road, providing local clean air benefits to communities that have among the highest exposure to air pollution. The program has been allocated \$72 million and more than 1,100 old gasoline vehicles were replaced by electric vehicles between July 2015 and June 2017.

Looking forward, policymakers could consider options like establishing incentive eligibility criteria based on income and vehicle price, providing upfront incentives at the point of sale, making the incentive value crystal clear to consumers and auto dealers, securing long-term funding through polluter-pay schemes, reserving program funds for qualified lower-income applicants, or offering financing assistance programs for low-income buyers of new and used electric vehicles. Although many of these incentive design elements already are being adopted (e.g., in California, Connecticut, Massachusetts, and New York), none of the existing incentive schemes incorporate all of these program design considerations. Doing so could boost the program’s effect on increasing electric vehicle adoption, program cost effectiveness, and allocative

5 Center for Sustainable Energy, “Zero-emission vehicle (ZEV) markets in California—Disadvantaged communities & the state overall” (2017). <https://energycenter.org/sites/default/files/docs/ext/transportation/2016-02-03%20EUEC-J2-CSE-Williams-handout.pdf>

equity. For example, research by the University of California, Los Angeles assessed the effect of different rebate program designs and found that offering progressive rebate increases based on income with an income eligibility cap could increase the number electric vehicle sales to consumers with incomes below \$25,000 by 45% and by about 20% for consumers earning between \$25,000 and \$50,000, while also reducing total program cost.<sup>6</sup> Of course, policymakers will have to balance incentive design options with implementation and administration considerations such as program complexity and enforcement.

## INCREASE PUBLIC AND WORKPLACE CHARGING OPTIONS

Public and workplace charging infrastructure is considered to be a key factor in supporting electric vehicle adoption. Greater availability of public and workplace charging infrastructure increases driver confidence and expands vehicle operating functionality, thereby addressing key barriers regarding range and convenience. For drivers with limited or no home charging access, workplace and public charging can be a key enabler for the purchase of a vehicle. Broader deployment of charging infrastructure can increase the practicality of electric vehicles while also increasing visibility and general awareness of the technology.

Seattle, Washington, launched an innovative year-long pilot program in July 2017 to expand infrastructure access by allowing installation of electric vehicle charging stations on nonresidential streets in urban villages, urban centers, and commercial streets throughout the city.<sup>7</sup> Known as the Electric Vehicle Charging in the Public Right-Of-Way Program (EVCROW), the pilot includes an equity assessment to identify how public charging affects environmental justice, racial equity, and equitable development in the city.

In California, several utilities are directly deploying public charging infrastructure. The CPUC approved charging infrastructure rollout programs for Pacific Gas and Electric, San Diego Gas & Electric, and Southern California Edison. Table 2 highlights the program elements. As shown, key deployments include public and semipublic (multifamily, workplace) markets, and each utility has committed to installing 10% or more of the charging stations in disadvantaged communities as directed by the CPUC. These utility programs will more than double the current number of public charge points throughout California, expanding the network and increasing access to charging options, including in low-income, multifamily, and underserved neighborhoods. While these programs currently are in the early stages of development, their semi-regular reports will be submitted to the CPUC to assess progress toward program goals, achievements, and lessons learned.

6 University of California, Los Angeles, “Factors Affecting Plug-in Electric Vehicle Sales in California” (2016). <http://innovation.luskin.ucla.edu/sites/default/files/Factors%20Affecting%20Plug-in%20Electric%20Vehicle%20Sales%20in%20California.pdf>

7 “Seattle Gives Power to the People...in the Right-of-Way,” SDOT Blog, July 21, 2016, <http://sdotblog.seattle.gov/2017/07/21/seattle-gives-power-to-the-people-in-the-right-of-way/> and “Electric vehicle charging in the public right-of-way (EVCROW) program,” Seattle Department of Transportation (2017), [http://www.seattle.gov/Documents/Departments/SDOT/NewMobilityProgram/EVCROW\\_Program.pdf](http://www.seattle.gov/Documents/Departments/SDOT/NewMobilityProgram/EVCROW_Program.pdf)

**Table 2.** Major utility charging infrastructure programs in California

	San Diego Gas & Electric	Southern California Edison	Pacific Gas and Electric
<b>Program name</b>	Power Your Drive	Charge-Ready	EV Charge Network
<b>Scope</b>	3,500 charging stations	1,500 charging stations	7,500 charging stations
<b>Budget</b>	\$45 million	\$22 million	\$130 million
<b>Markets</b>	Multifamily and workplaces	Multifamily, workplaces, and public	Multifamily and workplaces
<b>Disadvantaged communities</b>	≥ 10% in disadvantaged communities	≥ 10% in disadvantaged communities	≥ 15% in disadvantaged communities
<b>Program start date</b>	Expected mid-2017	May 27, 2016	Expected mid-2017

Table adopted from California Energy Commission, 2017 ([http://www.energy.ca.gov/renewables/tracking\\_progress/documents/electric\\_vehicle.pdf](http://www.energy.ca.gov/renewables/tracking_progress/documents/electric_vehicle.pdf)).

Other stakeholders work to broaden access to public charging. California regulators have required that infrastructure deployment and investment from the Volkswagen Settlement include lower-income and disadvantaged communities. California also is providing funding toward targeting specific projects and gaps in charging availability, including \$4 million for the FresYES incentive project to bring Level 2 charging stations to eligible commercial, workplace, and MuD locations in Fresno County.

At the local level, a key element of Portland, Oregon's Electric Vehicle Strategy includes working with community partners and utilities to install public charging stations in strategic locations, prioritizing those that are available to low-income residents, areas with more multifamily housing and garage-free homes, and those with limited access to other transportation options. Doing so would directly increase access to viable charging options for residents in these communities.

The Workplace Charging Challenge program under the U.S. Department of Energy has been a catalyst in spurring the deployment of charging infrastructure at workplaces, enabling electric vehicle drivers to double their daily electric commute range. Utilities also are acting to broaden access to workplace charging. Sacramento (California) Municipal Utility District offers a \$1,500 rebate for the installation of each Level 2 charge port at workplaces. In Texas, Austin Energy offers from \$2,000 to \$10,000 in rebates for charging station hosts at workplaces and businesses. These actions grow the broader charging infrastructure network and increase the practicality and feasibility of driving electric to work.

Sustained efforts to make public and workplace charging more widely available are needed going forward. Several of the programs described above have strong evaluation criteria, and the results could inform future infrastructure deployment on how to optimize siting, costs, pricing, charger type and number, equity, and more. Equity assessments and reporting could be explicitly required in future programs. Continued efforts to identify gaps in the charging network and steer investment toward those who lack access are needed. For example, more extensive public infrastructure is likely needed in frequently visited public areas, such as grocery stores and medical locations, as well as in areas where private parking and charging are less common.

## BRING CHARGING TO EVERYONE’S HOME

Access to electric vehicle charging at or near home is crucial to the widespread adoption of electric vehicles because it provides a better guarantee of being able to charge sufficiently. Significant progress has been made to facilitate and expedite the installation of chargers in single family homes. Less work has been done to overcome barriers to bringing charging access to residents in MuDs, who often do not have a private garage.

States, utilities, and cities have each taken steps in that direction. At the state level, laws in California and Colorado help ensure unit lessees are able to install charging infrastructure at their places of residence. Publicly owned Austin Energy has a unique program to bring charging access to residents in MuDs. The utility offers increased rebates of \$4,000 or \$10,000 for hosting Level 2 or DC fast charging stations that must be available to all residents on a property. Private stations are eligible for a lesser rebate. The City of Berkeley, California, has a pilot program to bring curbside electric vehicle charging to residents who lack off-street parking in up to 25 curbside locations. The city will assess if the pilot removed barriers to electric vehicle adoption after the pilot’s termination in December 2017.



An Austin Energy charging station. Photo: Austin Energy (<https://austinenergy.com/ae/green-power/plug-in-austin/multifamily-properties/>)

Adopting electric-vehicle-ready building codes also helps make charging more accessible to current and future drivers of electric vehicles. A 2017 ordinance in San Francisco requires new residential, commercial, and municipal buildings to have at least 10% of parking be fully electric-vehicle ready, with additional capability to expand as needed. Other major cities that have adopted electric-vehicle-ready codes to support

the long-term transition to electric drive include Los Angeles, New York, Denver, and Salt Lake City.

Looking forward, policymakers could continue to offer programs that bring semipublic charging stations to all residences. Direct deployment and financial support for charging infrastructure both on property and at the curb will increasingly expand access to charging. Long-term planning through the adoption of electric-vehicle-ready building codes also can ensure more widespread charging is available in new or renovated buildings. These codes could be upgraded over time to require greater percentages of electric-vehicle-ready spaces to reflect market growth.

## ENSURE ELECTRIC DRIVING IS CHEAPER THAN GAS (PER MILE)

Lower total cost of ownership including lower maintenance and lower fueling costs is a key driver of electric vehicle sales. However, electricity prices vary significantly across the United States, and ensuring that driving on electricity is cheaper than driving on gasoline is crucial to promote broader adoption of electric vehicles.

Currently, many electric vehicle owners get the majority of their energy from home chargers. The primary way utilities are reducing the price of electricity at home is through time of use (TOU) rates that reduce the cost of electricity during certain times of day, but access to these rates is not universal. Table 3 provides a snapshot of how many customers have TOU options.

**Table 3.** Access to TOU rates in the United States

<b>Number of residential utility customers</b>	129,811,718
<b>Number of utilities</b>	2,057
<b>Number of utilities with TOU rates</b>	249
<b>Number of residential customers in utilities with TOU rates</b>	58,447,329
<b>Number of residential customers enrolled in dynamic pricing (including TOU)</b>	5,860,841

Derived from U.S. Energy Information Administration, 2017 (<https://www.eia.gov/electricity/data/eia861/>)

As shown, approximately 45% of U.S. residents live in areas where the utility has made TOU rates available, opening the possibility for differential electricity pricing. Some utilities also offer special electric vehicle TOU rates, which can provide an even lower rate for electric vehicle charging. Offering these rates typically requires a modern meter.

Smaller utilities in particular have not installed these types of meters, which is a barrier to lower rates. One small utility, Alameda (California) Municipal Power, handles this limitation by simply estimating how much power an electric vehicle will consume based on weight and range, and selling that amount of electricity at a reduced rate. No special metering is required and there is minimal change to the billing. Users are instructed to charge voluntarily between 8 p.m. and 8 a.m.

Offering a separate meter also can reduce driving cost, but a separate meter is often expensive. In California, Pacific Gas and Electric is experimenting with having third party chargers act as submeters to eliminate the separate meter costs. These

strategies work to more cost effectively offer TOU rates for electric vehicle charging and enhance the value proposition for electric vehicle drivers.

Workplace or public chargers can be the primary source of electricity for drivers without home charging and many locations offer free charging, directly lowering the cost of driving. Some workplaces offer charging at “home” prices to those with no home charging access regardless of cost recovery. Some public charging locations, such as those at Target stores, have innovative ways to ensure charger availability while lowering electricity costs for customers: The first two hours of charging are free and subsequent time requires payment.

Companies including Nissan, BMW, and Tesla offer fast charging free of charge for a period of time after vehicle purchase. Attractive lease rates and free charging help make acquiring and driving an electric vehicle possible, even for those in an apartment with no home charger. If a fast charger is convenient, a large amount of charging can be done for free, reducing vehicle charge times and lowering the cost of driving. Although these are industry incentives, any entity could subsidize an allotment of charging through an account credit or an offer of free charging for a period of time.

Driving on electricity is not always cheaper than driving on gasoline. Some utilities, even with the lowest off-peak electric vehicle TOU rate, make driving on electricity more expensive. Efforts must be sustained to bring lower home electricity rates to drivers through TOU rates and low-cost separate metering. Only 12% of utilities offer TOU pricing that could be applied to electric vehicle charging, highlighting the need to bring more electric vehicle friendly options to the broader population. To serve prospective consumers who have no access to home charging, workplaces and public locations can provide free or low-cost charging. Finally, entities can enhance the consumer proposition of driving electric by offering free or reduced charging prices for an introductory period.

## HAVE UTILITIES SERVE AS CHAMPIONS AND EDUCATORS

Electric utilities are involved in many of the actions mentioned above such as installing compatible Electric Vehicle Supply Equipment (EVSE), providing EVSE incentives, and offering low rates. They also can play an important role as a trusted source of information to broaden consumer knowledge and understanding about electric vehicles and their benefits.

Consumer awareness and knowledge about electric vehicles is significantly lacking across the United States. Few prospective car buyers are able to name even a handful of electric vehicle makes and models, and confusion grows when differentiating between a hybrid, PHEV, and BEV. Knowing what an electric vehicle is is a precursor to adoption. Increasingly utilities have information websites that explain the different types of electric vehicles, their potential benefits, how they operate, and available incentives.

Utilities are well suited to help consumers and landlords understand EVSE options at detached homes and MuDs, such as EVSE charging speed, installation costs, and purchase options. Although tenants cannot install EVSE without approval, this process starts the engagement between the landlord, the tenants, and the utility.

Utilities are also uniquely suited to help customers understand potential energy and cost savings from driving electric. Some offer sophisticated calculators that compare

two vehicles and provide per mile and annual savings based on user-defined gasoline and electricity prices, daily commute distance, and vehicle efficiency. Table 4 shows a range of electric vehicle informational materials available on select utility websites.

**Table 4.** Types of customer information available from select utilities

	Cost calculator					Vehicle education				Charging installation information					Public events	Federal and state incentives	Public charger location
	Daily distance	Gasoline cost	Comparable vehicle	Off peak charging	Maintenance	BEV	PHEV	EREV	Available models	Home charger	Public charger	MuD charger	Home rebate	Public charger rebate			
<b>Con Edison</b>	X	X	X	X		X	X	X									
<b>Georgia Power</b>	X	X	X	X		X	X	X	X	X	X		X	X		X	X
<b>Southern California Edison</b>	X	X	X	X		X	X			X	X	X				X	X
<b>Pacific Gas and Electric</b>	X	X	X	X		X	X			X	X					X	X
<b>San Diego Gas &amp; Electric</b>						X	X		X			X			X	X	X
<b>City of Palo Alto</b>	X	X	X		X				X	X	X	X		X		X	X
<b>Austin Energy</b>	X	X	X		X				X	X	X	X	X	X		X	X

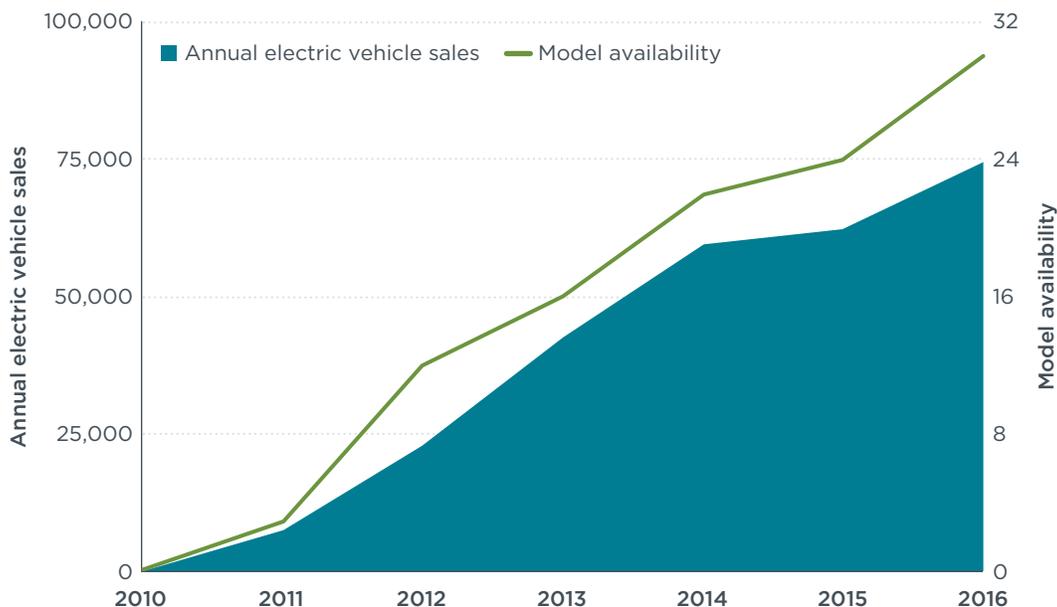
Consumers get information from many sources, but utilities can be a central place to inform the consumer throughout the buying process including vehicle purchase options, charger installation and public locations, available incentives, and potential savings over time. In general, larger utilities provide more detailed information than smaller ones and only some utilities provide information to specific groups such as apartment landlords and tenants. Utilities could improve by providing a broader range of consumer-friendly information and targeting underrepresented groups with tailored messaging. Several utility companies offer low-income payment programs, which may be a great venue for sharing more information related to electric vehicle costs and available incentives. In the future, utilities could also play a more active role in advancing consumer knowledge, for example through outreach emails, pamphlets, social media, or event participation.

## REQUIRE HIGH MODEL AVAILABILITY AND DIVERSITY

Lack of electric vehicle options is a key barrier hindering market growth. Households of various sizes and incomes need different vehicles. A wider range of electric vehicle types—from subcompact to large, and from low-cost to luxury—is a precursor to market growth based on meeting a broader range of consumer preference.

Many electric vehicle markets in the United States are constrained by an insufficient number of models and a lack of availability of those models at dealerships. About half the population has access to 10 or fewer models, whereas leading electric vehicle markets have 25 or more models available.

The primary driver for increasing model availability is California’s Zero Emission Vehicle (ZEV) regulation. The policy requires increased electric vehicle sales each year through 2025, pushing for greater model availability and marketing efforts by automakers. California and nine other states have adopted the ZEV regulation. Figure 3 plots annual electric vehicle sales and number of available models in California from 2011 to 2016. As shown, there has been a clear increase in model availability and annual electric sales in California.



**Figure 3.** Electric vehicle sales and model availability in California, 2011–2016.

As the number of electric vehicle models in California has increased, so has the number of electrified models available in different vehicle segments (e.g., mini, subcompact, compact, mid-size, large). Several electric vehicle models have not been for sale or have limited availability outside of California, such as the Chevrolet Spark, Toyota RAV4 EV, Fiat 500e, Honda Fit EV, Ford Focus EV, Volkswagen eGolf, Mercedes-Benz PHEV, and Kia Soul EV. A wider range of electric vehicle types is important to meeting the needs and preferences of a broader consumer base in these other markets.

Table 5 shows data on new electric vehicle sales and household income in eight cities in California. Each city shown has a median household income below the state average of \$62,000, based on five-year estimates from the U.S. Census Bureau.<sup>8</sup> Data linking electric vehicle sales to specific household income levels were not available. As shown, electric vehicle sales in several of these markets accounted for between 3% and 6% of new vehicle sales in 2016, compared to the state average of 3.7%. The table shows the most popular BEV and PHEV models in each market. Vehicle registration data are from IHS Automotive.

8 U.S. Census Bureau. (2017). *2011-2015 American Community Survey (5-year estimates)*. Retrieved from [https://factfinder.census.gov/faces/affhelp/jsf/pages/metadata.html?lang=en&type=dataset&id=dataset.en.ACS\\_15\\_5YR](https://factfinder.census.gov/faces/affhelp/jsf/pages/metadata.html?lang=en&type=dataset&id=dataset.en.ACS_15_5YR)

**Table 5.** Electric vehicle share, median household income, and most popular electric vehicles in example California cities

City	Electric vehicle share	Median household income	Most popular BEV and PHEV
Oakland	6%	\$55,000	Nissan Leaf; Chevrolet Volt
Glendale	4%	\$53,000	Fiat 500e; Chevrolet Volt
Fresno	3%	\$42,000	Fiat 500e; Chevrolet Volt
La Puente	3%	\$57,000	Fiat 500e; Chevrolet Volt
Long Beach	3%	\$53,000	Fiat 500e; Chevrolet Volt
Pomona	3%	\$49,000	Fiat 500e; Chevrolet Volt
Sacramento	2%	\$51,000	Nissan Leaf; Chevrolet Volt
Bakersfield	1%	\$57,000	Nissan Leaf; Ford Fusion
California average	3.7%	\$62,000	Tesla Model S; Chevrolet Volt

In these eight cities with median household incomes below the state average, the most popular electric vehicles were the relatively more affordable Nissan Leaf, Fiat 500e, Ford Fusion Energi, and Chevrolet Volt models. In contrast, expensive Tesla models were among the top sellers in many affluent cities with median incomes of \$100,000 or more. These data reflect the importance of ensuring relatively lower-cost electric vehicle models are available. As noted above, there are limitations in evaluating specifically which individuals are taking advantage of innovative policies and programs. However, even if purchases were made predominantly by higher-income households, electric vehicle exposure is broadening.

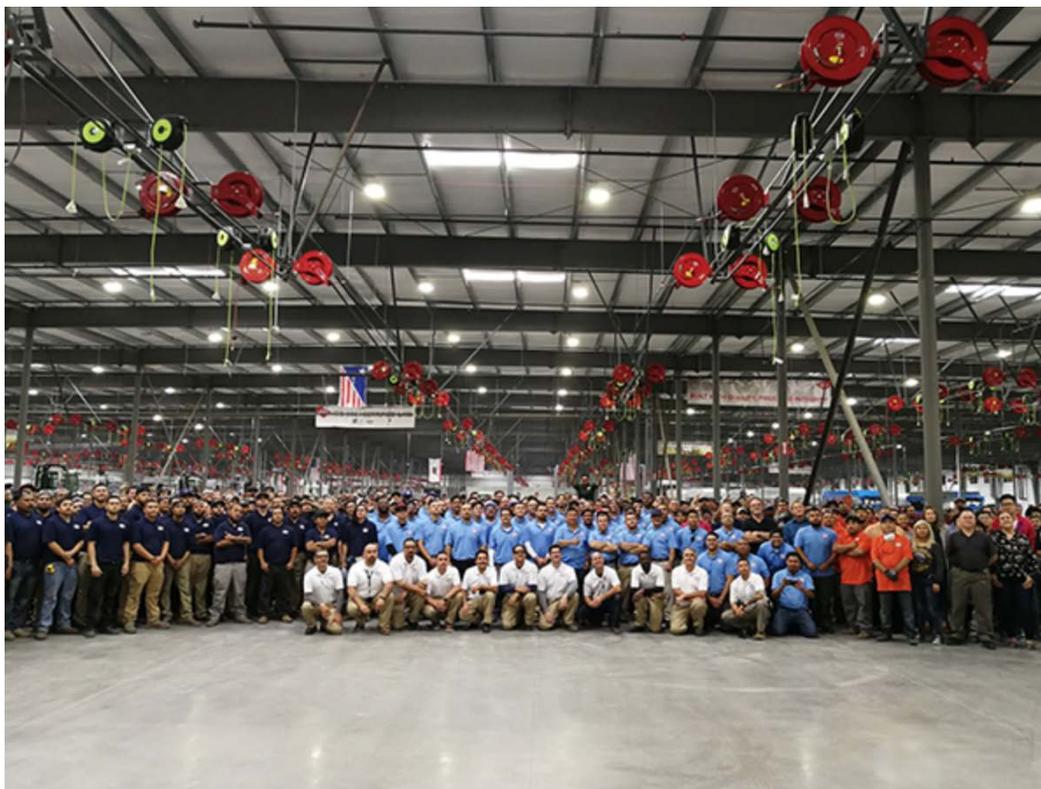
Looking forward, cities could push for their colleagues at the state level to adopt the ZEV program. Adopting and strengthening the ZEV program will continue to drive a wider variety of electric vehicle models into the market, meeting the needs of a broader set of prospective consumers. Ensuring a wider variety of models is available increases the likelihood that models are available in every segment.

## VEST COMMUNITIES IN THE TRANSITION TO ELECTRIC DRIVE

Low-income and underserved communities often have among the highest exposure to environmental pollution and stand to benefit the most from the clean-air benefits provided by expanded electric mobility options. Transportation electrification also can catalyze economic opportunity and growth in these same communities through greater employment options in light- and heavy-duty vehicle manufacturing, charging infrastructure installations, vehicle and infrastructure maintenance and repair, and other jobs in the supply chain or related industries, such as electric vehicle parts suppliers or electric utilities.

Several policies and actions have indirectly stimulated employment and economic growth in the transportation electrification sector across the United States. In California, the state ZEV program has spurred the rapid development of new vehicle manufacturing facilities by a handful of zero-emission vehicle manufacturers that now employ thousands. Industry reportedly has been attracted to operating in California, naming the state's forward-looking policies as a top reason for bringing business there.

Combining California's long-term vision toward clean transportation technology with strong local procurement targets—like Los Angeles METRO's and San Joaquin Transit District's commitment to 100% electric buses by 2030 and 2025, respectively—has attracted electric bus manufacturers like Proterra and BYD to the area, both of which operate large manufacturing plants in Southern California.



BYD staff at the unveiling of the BYD expanded battery-electric bus manufacturing facility in Lancaster, California. Expansion of the manufacturing facility will enable BYD to hire 1,200 full-time workers. Photo: BYD (<http://www.byd.com/news/news-417.html>)

Government policy also has spurred employment opportunity and economic growth in the related sector of charging infrastructure that is needed to support the transition. Several charge providers like Blink Network, EVgo, and ChargePoint employ electricians, charging station installers, technicians, sales staff, and more as they work to expand the charging network to more homes, workplaces, and public locations. At the federal level, programs like the American Recovery and Reinvestment Act catalyzed the growth of this sector through investment. Major utility charging infrastructure programs like those outlined in Table 2 also require many qualified installers, technicians, and other personnel.

Stakeholders have organized training programs to create the workforce necessary for a broad deployment of EVSE. The Electric Vehicle Infrastructure Training Program was created through a collaboration of stakeholders including automakers, utilities, EVSE manufacturers, and others. The program provides comprehensive training for installation, utility interconnection policies, automobile manufacturer charging requirements, distributed generation integration, electric vehicle customer relations,

National Electrical Installation Standards, and many other topics. This and other workforce development programs have the added benefit of increasing electric vehicle exposure and awareness to the broader market.

In the future, policymakers could consider requiring businesses that receive major public funding or tax benefits to track and report employment and workforce development data, which would allow governments to assess the employment benefits realized by target groups such as underserved communities. The more that state and local policymakers directly engage in electric-mobility-related economic and employment opportunities, the more vested communities will be in the electrification transition. Proactive encouragement promises to make communities more competitive in the burgeoning green job market. While the degree of action varies across governments, at a minimum they may not want to miss out on new sectors of the economy being born.

## CONCLUDING THOUGHTS

This briefing summarizes key policies and actions that are expanding access to electric mobility in the United States. It includes practices that support electric vehicle adoption and broaden awareness about, and access to, electric mobility. Several reflections from this preliminary assessment are noted here in closing.

**A growing number of policies and programs that are intended to expand access to electric mobility are emerging in pockets across the United States.** Access to electrified mobility is not equal across population groups. A handful of early actions are beginning to emerge that work to broaden electric vehicle access by increasing affordability, practicality, and awareness. Much of this early action has been concentrated in California, where strong state policy has ensured a portion of programs and investments directly benefit communities with greater socioeconomic and environmental burdens. Additional early innovative actions to expand the electric vehicle market were also identified in Seattle, Washington; Portland, Oregon; Austin, Texas; and select areas in the Northeast. Policy actions along these lines can expand access to electric vehicles across market segments that have lagged.

**More work is needed to expand access to electric mobility and will require coordinated and targeted actions by a range of players.** One action or one sector is not sufficient to effectively increase access to electric mobility. Simply lowering the cost to buy an electric vehicle may not be effective if consumers are not aware of the products offered. Similarly, lower cost for a vehicle does not guarantee that a user can charge at home or in public. Multiple solutions must be pursued simultaneously for greatest effect. Leading states, cities, utilities, nonprofit groups, and other stakeholders are beginning to lower barriers to electric mobility for the broader market. New and strengthened policies and initiatives are needed to expand the market—programs such as consumer purchase incentives, infrastructure deployment, local mobility services, awareness campaigns, utility policy, and other local actions that target low-income, MuDs, underserved communities, and other consumer groups beyond early adopters.

**Strong community engagement from local groups, including governments, nonprofit organizations, and community institutions, is needed to understand challenges and identify solutions.** Each of the policies and actions identified in this briefing may not be appropriate for all communities. Understanding the transportation needs of

target communities is crucial to identifying what policies and actions are needed and how to execute them. Many communities face heightened cost, convenience, and/or awareness barriers to electric vehicle adoption. The solutions needed to expand electric vehicle access differ across communities, and robust community engagement can more effectively identify solutions. Resources from nonprofit organizations such as The Greenlining Institute and TransForm provide additional context and considerations when designing and implementing programs in underserved communities, including community engagement, outreach, infrastructure, insurance, payment options, and other considerations for equitable program design.

**Outreach to improve awareness and understanding is needed to complement efforts to expand the market.** We identified several actions that work to improve electric vehicle affordability and practicality for the broader market, yet awareness remains a key barrier. Initiatives such as low-income rebates and scrappage programs, EVSE incentives for MuD residents, curbside charging programs, electric carsharing and ridesharing fleets, and low utility rate structures could be supported and enhanced through community outreach. Raising awareness of these types of emerging initiatives is likely needed to increase their usage.

**Expanding electric mobility access to underserved communities has significant and direct social, economic, and health benefits for residents in these communities.** The early actions discussed in this briefing are helping to make electric transportation more affordable and practical. They also are helping provide associated social, environmental, health, and economic benefits to resident populations who have so far not engaged fully in the electric vehicle market including low-income residents, apartment dwellers, and underserved communities. Action now helps advance the timeline for development in these groups and aids in the transition to zero emission transportation.

Several exciting programs that are intended to expand access to electric mobility are beginning to gain traction. Although there is some early evidence of success, there are limitations in evaluating specifically which individuals are taking advantage of each of the innovative policies and programs. Many of the programs discussed in this briefing include equity-focused goals and metrics for program evaluation, and this information can inform future action to more equitably serve potential new markets. A better understanding and evaluation of how these actions overcome barriers to electrification for low-income, apartment dwellers, and other groups that are not early adopters are rich areas for future research. This briefing focuses on near-term policy options to expand access to electrified transportation. How to more equitably offer electric mobility options is likely to remain a core question in a future where autonomous and on-demand mobility become integral in the transportation system. We leave this question for future research.