

Financing Models to Expand Access to Electric Vehicles in California

Financial Innovations Lab® Report



July 2017



MILKEN INSTITUTE



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Financial Innovations Labs® bring together researchers, policymakers, and business, financial, and professional practitioners to create market-based solutions to business and public-policy challenges. Using real and simulated case studies, participants consider and design alternative capital structures and then apply appropriate financial technologies to them.

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This report was prepared by Harlin Singh.

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Disadvantaged communities are disproportionately affected by environmental pollution and negative health consequences, low income, and high unemployment.

INTRODUCTION

Despite California's remarkable headway in green energy initiatives, gasoline-fueled automobiles still rule the roads. The exhaust pollutants they emit—including carbon monoxide, carbon dioxide, sulfur dioxide, hydrocarbons, and particulate matter associated with soot¹—are known to cause and exacerbate chronic disease, as well as certain cancers, and are responsible for the rise in greenhouse gases (GHGs) associated with ozone damage and climate change.

Nationwide, the transportation sector is responsible for more than 50 percent of emitted nitrogen oxides, 30 percent of volatile organic compounds like smog-causing hydrocarbons, and 20 percent of the particulate matter that forms soot and other metallic residue, according to the Environmental Protection Agency.² And in the Golden State in 2016, the transportation sector was the single largest contributor to GHG, at 36 percent, beating out agriculture and industry. This gloomy news, from the California Air Resources Board, an agency within the state's Environmental Protection Agency, comes with the additional information that cars, light trucks, and motorcycles account for 70 percent of that transportation-sector share.³

Auto manufacturers, and federal and state regulatory agencies, have set goals for more fuel-efficient and cleaner-running cars for decades, most recently setting goals for using fossil-fuel alternatives that reduce or eliminate toxic exhaust emissions. One such innovation in improving the fuel economy are electric vehicles (EVs). EVs have very low environmental impacts because they are battery operated, hence do not produce exhaust. Yet there remain issues of greenhouse gas emissions during the manufacture and transport to market of electric vehicles, as well as the GHG emissions from charging them via regional electrical grids that haven't converted to clean power-generating technologies.⁴

One factor used in pro-EV advocacy: the price of gasoline relative to electricity. In April 2017, the average cost of a gallon of gas in Los Angeles was \$3.00, while the average cost of electricity wasn't quite \$0.19 per kilowatt hour (kWh).⁵ Using these figures, it would cost about \$5.70 to charge the average EV for 100 miles of range, while fuel for an average car for the same distance would cost \$11.86.⁶

The people who may benefit most from lower fuel costs and emissions are California's lower- and moderate-income households who live in "disadvantaged communities," or DACs. According to California's Senate Bill 535, these communities bear the brunt of high environmental pollution and its negative consequences, which spiral into chronically poor health. They are also areas that have high numbers of people with low income, unsteady employment, and low levels of home ownership.⁷ The financial burden of rent is often significant, and education levels remain low.⁸

There are more than 2,000 DACs, according to the California EPA,⁹ generally located in the Central Valley and desert counties down to Los Angeles and pockets throughout Southern California. Yet these communities have often been underserved, with households and small businesses alike facing historical barriers to loans and credit, and to basic public awareness campaigns that would enable them to join the state's clean-energy efforts.

California introduced zero-emission vehicle regulations back in 1990, and after several modifications through the years and a 2012 executive order to enable their acceleration, they emerged as a mandate with which nine other states—New York, New Jersey, Connecticut, Rhode Island, Maine, Vermont, Massachusetts, Maryland, and Oregon—are collaborating. The mandate requires that a certain percentage of new vehicle sales in these 10 states be zero-emission vehicles, or ZEVs, defined by the Air Resources Board as "battery-electric vehicles, plug-in hybrid-electric vehicles, and hydrogen fuel-cell-electric vehicles," including cars, light trucks and buses for mass transit.

The goal is to bring the share up to 15.0 percent by 2025.¹⁰ These guidelines set forth by California are protected under the federal Clean Air Act of 1970, which granted California a waiver that allows the state to set stricter vehicle GHG emissions and allows other states to follow the stricter standards.¹¹

In 2016, California accounted for nearly 50 percent of all US plug-in electric vehicles (PEVs), which include plug-in hybrids; the nine other states collectively accounted for another 13.0 percent of sales.¹² While California's market share seems impressive, a close look reveals a harsher truth: the number of plug-in hybrids sold that year (34,818, as counted by new-car registrations) still account for just 1.7 percent of total state vehicle sales, and electric vehicles (40,347), just 1.9 percent. For Q1 2017, PEV sales (plug-in hybrids and battery electric vehicles) totaled 24,270, as counted by new-car registrations, not quite double from Q1 2016 (13,978). The PEV market share for Q1 2017 was 4.8 percent,¹³ compared to 2.7 percent for the same period in 2016.¹⁴

California's Department of Motor Vehicles issued some 22.6 million driver's licenses in 2016, a likely factor in the state's higher PEV sales relative to smaller and less populous states. And while the number of people obtaining drivers licenses nationally is declining due to the availability of car-sharing services and public transportation,¹⁵ there were still some 25.2 million automobiles and 5.2 million pickups and other lighter-weight commercial trucks registered with the California DMV in 2016.

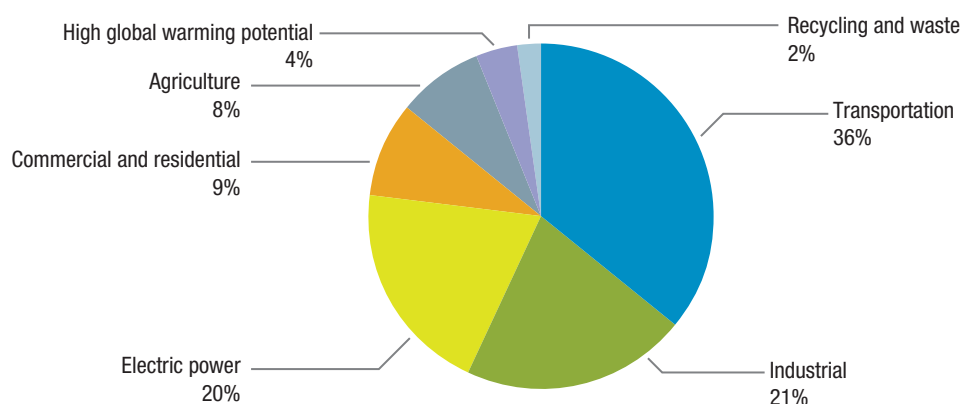
Access to alternative-energy cars would lower fuel costs and reduce toxic emissions, clear benefits to disadvantaged communities, but vehicles and charging station costs are often beyond their reach, even with the help of various state and federal rebate programs and the used-car market.

To surmount some of these barriers, the Milken Institute hosted a Financial Innovations Lab in April 2017 in Santa Monica, California. The Lab brought together community leaders and representatives of foundations, financial institutions, and corporations to identify potential financial, outreach, and educational models that could increase the accessibility of EVs and the supporting infrastructure for these communities.

ISSUES AND PERSPECTIVES

Policymakers have long recognized the negative impacts of vehicular pollution on climate change. While California's transportation sector is responsible for 36 percent of the state's greenhouse gas emissions, the nation as a whole isn't doing much better. According to the Department of Energy, transportation (at 27 percent) was the leading domestic contributor to GHG in 2015.¹⁶ Figure 1 shows the share of GHG emissions in California according to user type.

FIGURE 1 || GHG emissions by sector



Source: California Environmental Protection Agency.

And while climate change and pollution affect us all, disadvantaged communities face disproportionately high levels of pollution. Poor communities often lie close to freeways, railways, industrial shops, ports, and airports, according to a study cited in *Scientific American*, and (depending on which pollutants are poisoning their air) suffer higher rates of cardiovascular and respiratory disease, various cancers, and low birth weights.¹⁷

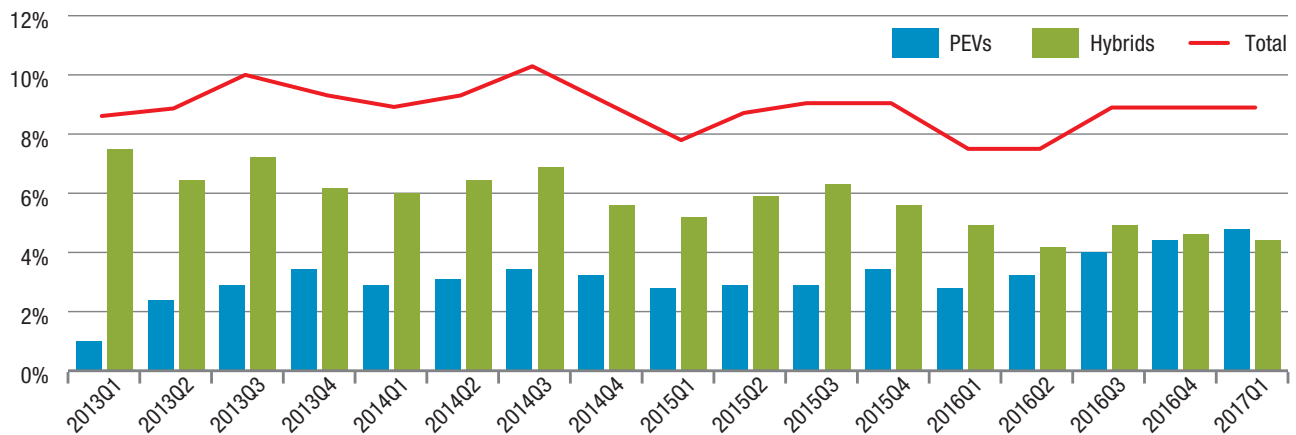
California has made strides toward reducing its carbon footprint over the past decade. In 2006, the state legislature passed a cap-and-trade bill (AB 32) signed by then-Gov. Arnold Schwarzenegger to bring GHG emissions back to their 1990 levels by 2020. Cap-and-trade essentially sets a price on pollution. The law, which finally went into effect in 2013 and has been expanded since, establishes caps on the allowable GHG emissions for the state's largest commercial GHG emitters and fossil-fuel distributors. Those caps by law drop 3 percent annually. Each year as well, the state issues "allowances," i.e., the businesses' allowable GHG emissions under that year's cap. Businesses that invest in technologies to lower their emissions can sell any leftover allowances to other qualifying companies. Some businesses buy more allowances to cover their excess emissions. It is assumed that as the cap drops, allowances will become more costly and companies more motivated to stop polluting rather than continue to purchase them.¹⁸

In California, where housing costs often exceed the 30 percent rule, transportation costs—the second-largest household expense—can push the costs to 50 percent of income.

Schwarzenegger's successor in office, Jerry Brown, also issued an executive order in 2012 to have 1.5 million zero-emission vehicles (battery electric and fuel-cell electric vehicles) on California's roads by 2025, along with thousands of public charging stations and plug-in units in place from San Francisco to San Diego.¹⁹ In early 2015,

in his fourth-term inaugural address, Brown announced a new goal: to cut in half the use of gasoline in cars and trucks by 2030.²⁰ The state's 2016 "GHG Emission Inventory," which has data through 2014, notes that California's overall emissions have dropped 9.4 percent since 2004.²¹ This is pretty good news; yet the number of new plug-in electric vehicle registrations still shows how wide the gap is between current circumstances and the 2025 goal, with just over 19 percent of the 1.5 million ZEV target being met between 2009 and March 2017.²² And as a percentage of total new registrations, PEVs are still a small percentage (figure 2).

FIGURE 2 || New vehicle registration: market share



Source: California New Car Dealers Association.

In March 2017, the California Air Resources Board voted to affirm stricter emissions standards for vehicles. The vote affirmed standards set in 2012 to require automakers to increase the average fuel economy in their vehicles to 54.5 miles per gallon by 2025.²³ A significant increase from current standards which require a fuel economy of 35.5 miles per gallon.²⁴ In recognition of the smog and pollution crisis facing the state, the Clean Air Act of 1970 gave California the power to set its own guidelines so long as they were at minimum as strict as federal guidelines. The state has to apply for a waiver each time it sets these guidelines, and historically they have been approved by the EPA. These higher standards can then be adopted by other states.²⁵

Electric vehicles provide substantial savings, in terms of both fuel and maintenance costs, as shown in figure 3. Annual charging costs generally total around \$540, compared to \$1,400 a year to keep the tank filled. EVs also eliminate the need for oil changes and other maintenance related to gasoline use, cutting those costs from an average of \$792 to \$450. These are important numbers in view of housing affordability, which is defined as housing costs that don't exceed 30 percent of income.

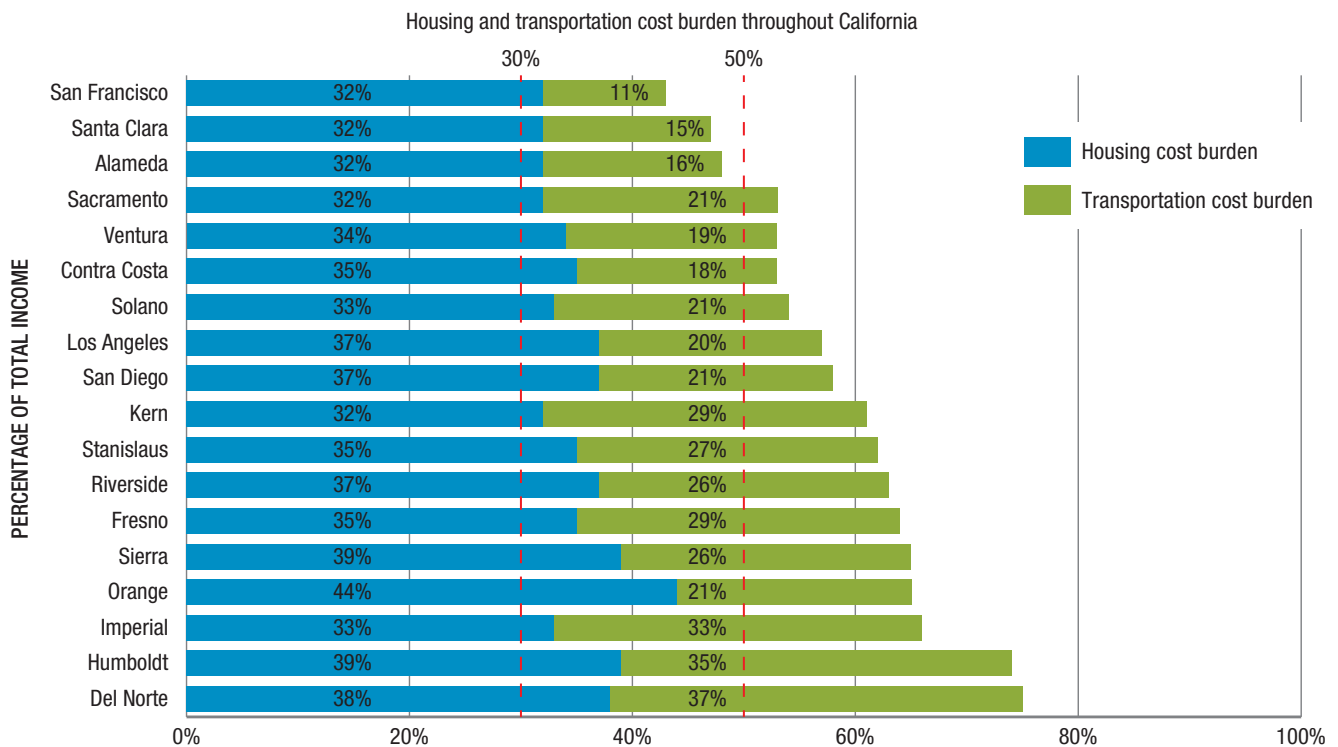
FIGURE 3 Maintenance and fuel costs for electric vehicles vs. gasoline-powered cars

ELECTRIC VEHICLES	
Energy	\$810 per year based on \$0.18/kWh and 15k mileage
Maintenance	\$450 per year
GASOLINE-POWERED CARS	
Fuel	\$1,778 per year based on \$3.00/gal and 15k mileage
Maintenance	\$792 per year

Source: Plug-In America, AAA, PluginCars.com.

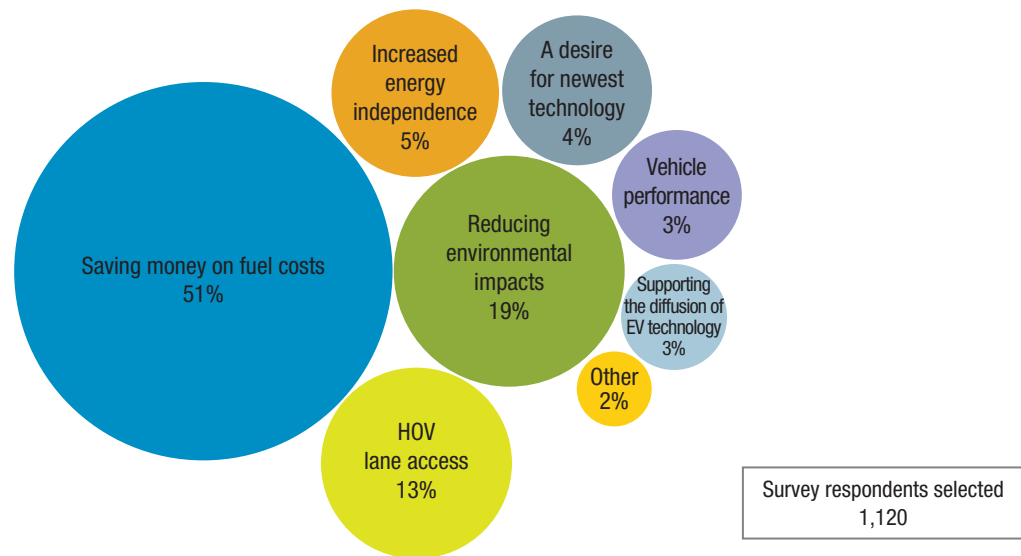
In California, where housing costs often exceed the 30 percent rule, transportation costs—the second-largest household expense—can push the combined costs to over 50 percent of income (figure 4), according to the Department of Housing and Community Development. This doesn't bode well for California's inland and disadvantaged communities, which the department also predicts will experience the most pressing population/housing growth. These communities suffer not just from fewer and lower-income jobs, and fewer public transit services, but also from higher environmental pollution and related health problems.²⁶

FIGURE 4 Lower transportation burden can lower overall household cost burden



Source: Center for Neighborhood Technology, Housing and Transportation Index. Average percent of income spent on housing and transportation for selected counties. Graphic by HCG.

So it's not difficult to hope that these communities can somehow enjoy the beneficial effects that ripple from clean-energy adoption. In a 2016 survey by the Clean Vehicle Rebate Project (CVRP) of 1,120 people who live in disadvantaged communities, and who had bought or leased EVs in the previous three years, 51 percent of responders said they considered fuel savings the most important factor in their choice of vehicle (figure 5).²⁷

FIGURE 5 | Survey responses on the most important reason to acquire an EV

Source: Clean Vehicle Rebate Project (CVRP).

However, a new EV model costs more than a comparably sized gas-powered car, and for many DAC residents, purchasing a new car is out of the question. A 2017 Nissan Leaf, for example, has a sticker price of \$30,680, while a comparably sized, conventional-fuel 2017 Nissan Sentra costs \$16,990. The price difference narrows significantly, however, in the used-car market, in some cases making electric vehicles more financially accessible. A recent search on the car vendor site Carmax.com turned up a 2014 Nissan Sentra with 13,000 miles at \$14,000, and a 2014 Nissan Leaf with similar mileage for \$10,000.²⁸ The reason for the dramatic price drop is partly due to the fast pace of innovation in driving range.²⁹ The 2014 Leaf gets 84 miles per charge, but the 2017 Leaf can reach 107 miles on a charge.³⁰ While this may not make a huge difference for consumers with shorter commutes or easy access to charging stations, it is likely a make-or-break factor others.

In addition to the car's sticker price, the costs associated with charging the EV battery may be prohibitive. Some cars can be plugged directly into a wall socket, though for faster and more efficient charging, consumers buy chargers made for specific auto use. Plugging a car into a standard household's 120-volt outlet is called Level 1 charging, and can take anywhere from 12 to 16 hours for a full charge, based on three to five miles per hour of charging. New PEVs include the Level 1 charging device as standard equipment, according to California's "DriveClean" buying guide, published online by the Air Resources Board.³¹

Using a Level 2 charger upgrades the electricity output to 240 volts, making a charge possible in four to six hours, or 10 to 20 miles per hour of charging, but the consumer must buy and install equipment that can cost up to \$1,500, including installation. Costs depend on the home's age and electrical load capacity, and there are permit fees for homeowners as well, ranging from \$50 to \$600, according to the buying guide.³²

More than a thousand public charging stations are already in operation, many of which are free or available at low cost through manufacturers' programs and other providers.³³ But only in the past half-decade or so has the focus turned to outfitting disadvantaged communities with them.

For used-car shoppers, there is one more cost consideration: battery replacement. The overall cost of EV maintenance is lower than for gasoline-fueled cars, but the largest cost for consumers is likely to be the need to

replace the battery after several years of use. A number of factors affect battery degradation, such as high ambient temperatures, overcharging, voltage levels, and the type and distance of driving.³⁴ On the bright side: a 2015 study from the Berkeley Lab shows that even when a battery operates at 50 percent of its capacity, 80 percent of drivers can meet their daily driving needs.³⁵

Battery prices have been consistently dropping with improvements in technology. General Motors batteries, for example, now cost \$145 per kilowatt-hour (down from the \$200 range) and are expected to cost \$100 per kilowatt-hour by 2022.³⁶ Typical EV batteries with a 24-kilowatt-hour capacity have an 80-mile range and would cost \$11,600 at current pricing. While this is expected to decrease to \$8,000 by 2022, it is still a costly component to replace. Many original equipment manufacturers provide warranties on their batteries; BMW, Chevrolet, Kia, Mercedes, Nissan, and Volkswagen warranty their batteries over time and mileage. Other car makers, including Ford, Fiat, Mitsubishi, and Tesla, exclude battery degradation from warranty coverage.³⁷ Tesla reports that the nonprofit educational organization Plug In America conducted tests on 50 Model S cars and found that the battery degradation amounts to a loss of 2.3 miles for every 10,000 miles.³⁸

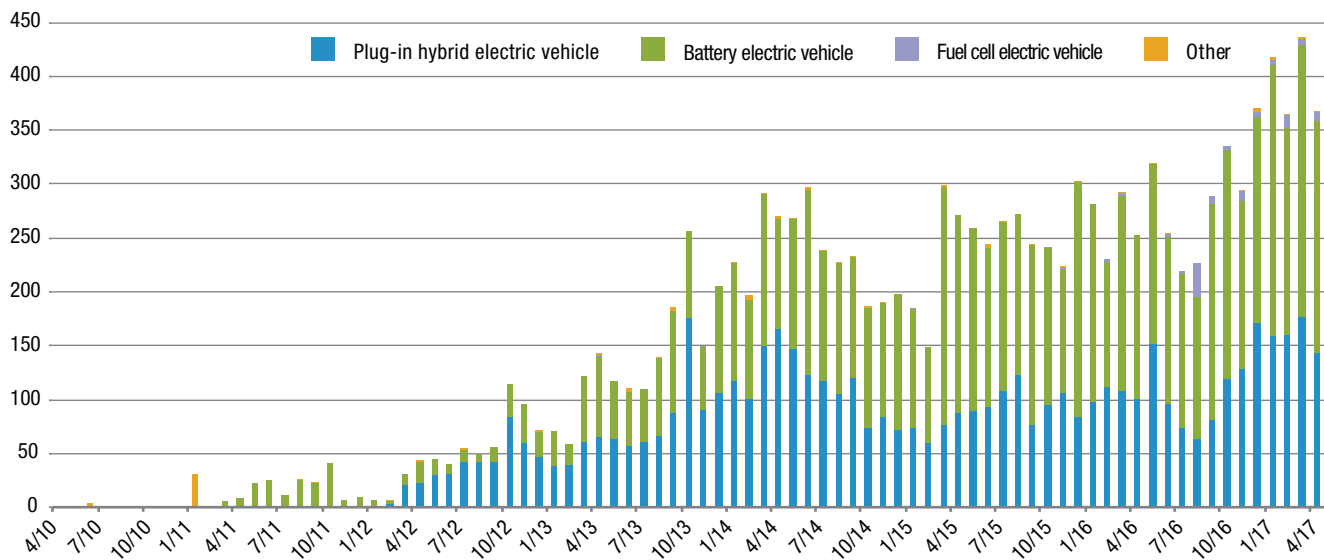
All these associated costs can make an EV purchase seem quite high, particularly for those living in disadvantaged communities. However, federal and state incentives exist to make the switch from gasoline to electricity more palatable.

In mid-2009, the federal Car Allowance Rebate System (CARS) went into effect, buying back eligible “clunkers” and getting them off the roads for good. Known colloquially as Cash for Clunkers, the program came to a halt after just two months, when it ran out of funding, having handed out all its budgeted rebates, from \$3,500 to \$4,500 apiece, or \$2.85 billion, to the owners of those 700,000 vehicles.³⁹ But the IRS has an ongoing program, Plug-In Electric Drive Vehicle Credit (IRC 30D), which offers tax credits up to \$7,500 to original owners of qualifying PEVs purchased after 2009. There’s a catch to this program, though: it has a built-in phase-out whenever a manufacturer of the vehicle sells 200,000 cars in the US (the tax credit slowly phases out three and six months after that 200,000th car is sold).⁴⁰ There is some speculation, reported by the car research firm Edmunds, that Tesla and GM will hit 200,000 mark in 2018 or 2019.⁴¹

California has also introduced state rebate programs to encourage drivers to purchase ZEVs at lower overall costs. One of these, the Clean Vehicle Rebate Project (CVRP), was created in fiscal year 2009–2010 with a \$4.1 million grant from the Air Resources Board (ARB) to help consumers with the purchase of new fuel-efficient cars, including electric vehicles, plug-in hybrids, and fuel cell vehicles.⁴² Funding comes from a number of sources, including the state’s Air Quality Improvement Program, vehicle registration fees, license plate fees, and allocations from the cap-and-trade auction revenues. From the program’s introduction in 2010 through FY 2013–2014, it had distributed some \$146 million.⁴³

In June 2015, the CVRP was funded with \$163 million to advance air-quality improvement efforts, largely through funds from the Greenhouse Gas Reduction Fund, created in 2012.⁴⁴ (The Greenhouse Gas Reduction Fund also receives proceeds from the cap-and-trade quarterly auctions, and 25 percent of the proceeds are designated for disadvantaged communities.)⁴⁵

The project offers rebates of up to \$7,000 for the purchase or lease of an eligible ZEV.⁴⁶ The rebates are available for income-eligible applicants⁴⁷ until funding for the program is maxed out in any given year. For fiscal year 2016–17, \$72.33 million is available for rebates, of which 55 percent was already spent by April 2017.⁴⁸ Participation in the rebate project has been strong since it received additional funding, as shown in figure 6.

FIGURE 6 Clean Vehicle Rebate Project rebates by month, March 2010 through April 2017

Source: CVRP.

The Enhanced Fleet Modernization Program (EFMP) and Plus-Up pilot project launched in 2016 by the California Air Resources Board specifically targets providing low-income families with the largest rebates to purchase a new or used energy-efficient vehicle. The program is currently operating in the South Coast Air Quality Management District and the San Joaquin Valley Air Pollution Control District and seeks to provide financial incentives to residents in disadvantaged communities with incomes under 225 percent of the federal poverty level.⁴⁹ Households that fall in the lowest income bracket are eligible for up to \$9,500 plus an additional \$2,000 for a charging unit. This program can also be combined with eligible CVRP rebates.⁵⁰

There are also a number of local rebates. The San Joaquin Valley Air Pollution Control District, for example, offers rebates of up to \$3,000, depending on the vehicle, that can be used along with the state rebates, depending on eligibility.⁵¹ Both the South Coast Air Quality Management District and Anaheim Public Utilities have pilot programs in place for Level 2 residential charger rebates.^{52, 53}

The longstanding California Capital Access Program (CalCAP) was introduced in 1994 to encourage banks to extend loans to “at-risk” small businesses. The California Pollution Control Financing Authority funds and operates the program; in 2017 it launched the Electric Vehicle Charging Station Financing Program with \$2 million to encourage lenders to extend loans to small businesses to install charging stations; it also provides loan-loss provisions of up to 100 percent for certain defaults. The borrowers may even be eligible for rebates on a percentage of the loan amount upon repayment.⁵⁴

This kind of program can introduce public chargers at small-business locations, possibly eliminating the need for residential chargers; and it provides incentives to business owners as well. But Lab participants noted that small businesses hesitate to install chargers because of the significant costs of installation and the loss of business due to construction, and even the loss of parking spaces replaced by the stations. Finally, they noted, many business owners don’t see the revenue benefit from installing chargers.

In February 2017, State Assembly member Phil Ting introduced a bill, AB 1184, to address electric vehicle charging infrastructure (as of publication, the bill is in committee, undergoing revisions). The bill would enable the California Public Utilities Commission to establish a California electric vehicle initiative that would create incentives for low-income households to purchase EVs and increase deployment of charging infrastructure by electrical corporations.⁵⁵

More public chargers could reduce the reliance on residential chargers and possibly eliminate the need for them altogether in some areas.

Consumers, of course, must pay out of pocket for the charging equipment and installation, and a portion of the vehicles that are not covered by rebates and tax credits. Credit unions and community development financial institutions can step in to provide consumer and small-business loans in disadvantaged communities. These organizations tend to work closely with their communities to provide capital access to those not considered creditworthy by large banks or dealer finance departments. For example, in Bakersfield, the Kern Federal Credit Union reaches disadvantaged communities in the Central Valley through its lending program.⁵⁶ Lab participants noted, however, that car loans in particular aren't so common, either because the residents don't qualify or aren't interested in using loans to buy an electric vehicle.

There are still other discounts, though. Some insurance companies, e.g., Allstate and Travelers, offer discounts on hybrids and EVs. Utility discounts, and parking and charging discounts, are fairly numerous.⁵⁷ Some car manufacturers like Nissan and BMW offer free charging incentives.⁵⁸ Non-financial incentives for EVs include free access to the high-occupancy vehicle (HOV) lanes.

Large legal awards are going a long way to helping the state's disadvantaged communities go green. In 2012 the California Public Utilities Commission settled a long-running lawsuit against the Texas energy marketer NRG Energy and other subsidiaries of Dynergy Inc. for their roles in market manipulation and price fixing during the California energy crisis ten years earlier. Under the terms of the \$120 million settlement, NRG Energy is to install 200 fast-charging stations in the San Diego, Los Angeles, and San Francisco areas, and in the San Joaquin Valley, with 20 percent going into low-income areas. The settlement also required NRG to pay for low-income carsharing programs and collaborate on new charging technologies.⁵⁹

In 2016 the federal EPA announced settlement of a far-reaching civil suit against Volkswagen (including subsidiaries) that accused the manufacturer of violating the US Clear Air Act by installing "cheating" software in its vehicles that recorded better emissions control compliance during testing than when in actual operation. The \$2 billion settlement included \$800 million for California, whose regulators had helped uncover the fraud, which US District Court for the Northern District of California would handle the hundreds of consolidated lawsuits, and where most of the fraud occurred. Over the next decade, distributions will go toward building the state's EV charging infrastructure and promoting the use of ZEVs.⁶⁰

The California Air Resources Board resolved to distribute \$200 million of settlement funds over each of four 30-month cycles, and, in March 2017, released its spending plan for the first cycle, including building up the charging infrastructure in high-access areas and along highways, creating a Green City initiative ("ZEV car sharing, ZEV delivery fleet, and ZEV taxi fleet"), and cultivating community education campaigns. Some 75 percent of the highway installations will be located in nearby disadvantaged communities that experience heavy traffic pollution.⁶¹

In late 2015, the City of Los Angeles received a \$1.6 million grant from the Air Resources Board to add to \$8 million from in-kind city and investor services to launch its BlueLA car-sharing program in some of the city's communities most affected by poverty and pollution. Car-sharing (short-term car rentals, usually for just a few hours) is a boon for people who drive only occasionally and for short periods. It is hoped that some 7,000 people will use the service, which features 100 EVs and 200 charging stations.⁶² This would allow for greater adoption of clean energy transportation without the commitment of purchasing a vehicle outright. The city has partnered with the French conglomerate Bolloré Group, which manufactures electric cars and batteries. Rollout is expected by mid-2017.⁶³

Yet despite rebates and discounts for EVs and their chargers, and the lower costs for used EVs, these incentives may not be enough for consumers in the communities most in need of the benefits of green transportation. This gap

is what the Lab set out to explore: Is public perception part of the problem? What work-arounds exist to bridge the remaining financial gaps? Are there innovative financial tools that can help?

BARRIERS TO ADOPTION

The no's to any query are always the easy part, and this is where Lab participants began, summarizing obstacles in front of many residents of disadvantaged communities who may want to be part of the region's clean-driving solutions.

Some participants noted that members of disadvantaged communities are slower to adopt EV technology because they aren't aware of the cost benefits. For too many, a car purchase isn't a planned purchase, but rather the result of an emergency; a car has been totaled or run down beyond reasonable repair. Purchases tend to be rushed, and consumers rarely have the time consider long-term cost benefits. Low credit scores can also mean unaffordable interest rates on car loans, another obstacle. And perhaps the biggest obstacle? Like car buyers elsewhere, many consumers in DACs prefer or need pickups, SUVs, and minivans.

Community Awareness and Access

There's no one-stop venue for learning about the pluses of electrical vehicles, or for checking out the models, pricing, or rebates and discounts from manufacturers, insurers, dealers, local and regional air quality boards, and state and federal agencies. It requires research and learning as one goes, and Lab participants agreed that the public in general, and residents of disadvantaged communities in particular, aren't aware of all the resources available to them.

Additionally, anxiety about matters like battery limits or where to find public charging stations give consumers pause, particularly when they drive long commutes or plan overnight or longer road trips. While some of this is warranted because range can be affected by outside temperature and terrain, most of the time, people can fulfill a day's commute on one charge.⁶⁴ This obstacle is caused chiefly by unfamiliarity with the benefits of EVs and their capacity to operate well within consumers' daily routines.

Financing Costs and Credit Scores

Because many residents in disadvantaged communities have low incomes, uneven job histories, or low or no credit scores, they may be unable to qualify for car loans or lease-to-purchase programs. They tend to pay in cash for used cars, and through online platforms like Craigslist or from a junkyard, rather than through a dealership. Those who do have credit scores may qualify for a loan, but at prohibitive interest rates. If they already hold substantial debt, they may turn to less expensive cars they can pay for with cash.

Residential Charger Costs and Accessibility

Rebates cover some of the upfront costs of a residential charger but apply only to the physical infrastructure, not the cost of installation. Since EV drivers do more than 80 percent of their charging at home,⁶⁵ it becomes essential to have some form of charging infrastructure. For drivers with a garage or parking spot near an accessible outlet, this may not present a problem; but those who need to perform any rewiring to install an outlet or upgrade to a faster charger could face significant costs. And for residents who have street parking only, or parking lots with no available outlets, the challenge may seem insurmountable.

Over a third of Californians either rent or live in multi-unit dwellings (MuDs), according to the Air Resources Board's DriveClean website.⁶⁶ These dwellings range from rental apartments and duplexes to condominiums and townhouses, and landlords may not permit plug-in charging because of the added electricity costs. Buildings that offer garage parking may lack the capacity to connect to meters designated for specific units only. A partial silver lining for this

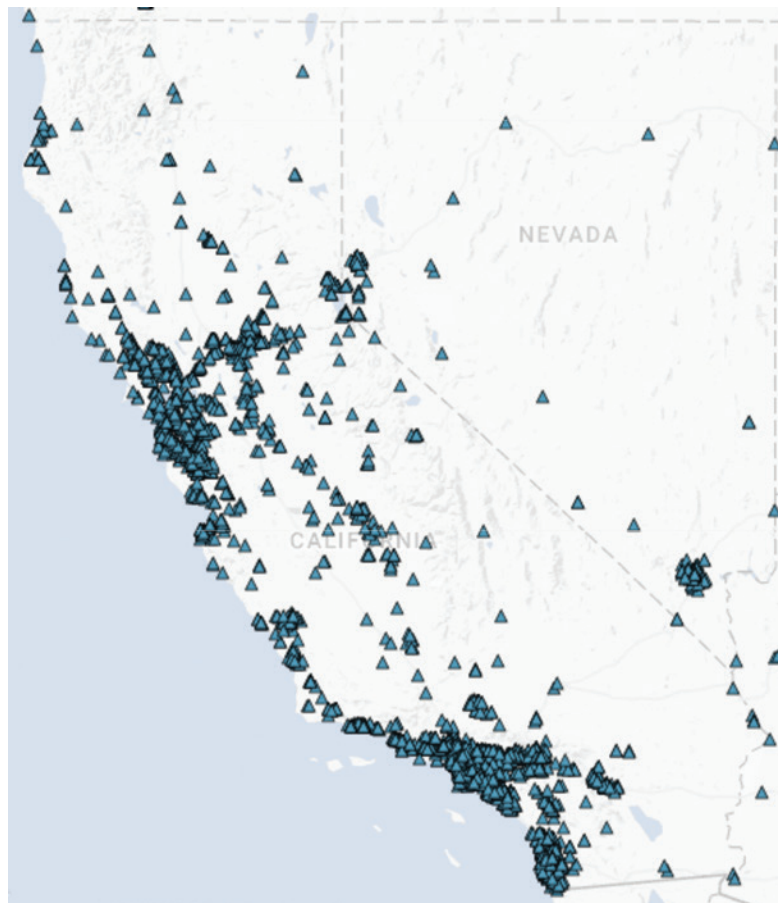
issue has been Senate Bill 880, which Gov. Brown signed into law in 2012. The bill authorizes resident homeowners (HOA members, for example) to install EV charging equipment in their designated parking spaces if they agree to cover the installation costs.⁶⁷

Assembly Bill 2565, signed into law on September 21, 2014, does protect renters, mandating that landlords approve written requests by renters to install EV chargers. The bill exempts buildings that have fewer than five parking spots and those that are rent stabilized; and the renter must pay for all costs associated with installation and maintenance of the equipment.⁶⁸

Public Charging Infrastructure

For people without access to garage parking, access to public chargers is critical. As noted earlier, initiatives are in place to bring more charging stations to disadvantaged communities and along their nearby highway corridors, especially in the wake of the NRG and Volkswagen settlements; but until these are operational, EV adoption will likely slow. Figure 7 is a map of charging stations in California, and shows their high concentration around San Francisco, Sacramento, Los Angeles, and San Diego. While this is in line with current EV ownership trends, inland cities in the Central Valley and low-income urban areas most affected by pollutants remain without adequate infrastructure.

FIGURE 7 | Map of EV charging stations in California



The electrical utility Southern California Edison is spending \$22 million on a pilot program to install some 1,500 charging stations in its service area. In March 2017, the utility announced construction in the two inaugural cities. The first, Lynwood, is a designated disadvantaged community and is on the books to receive 14 stations to accommodate the city's EV fleet and residents wanting to charge in the civic center public parking lot. The second, Ontario, located inland in San Bernardino County, is expected to receive 45 charging stations and be fully online in the summer. Fifty more sites are planned for the program, including more disadvantaged communities.⁶⁹ In a similar effort, in January 2016, San Diego Gas & Electric announced it was going to install 3,500 charging stations at 350 sites in San Diego and southern Orange county. Over 50 percent of the residents who live in the region served by the utility live in multifamily homes, so public chargers are an essential component of their decision-making process when purchasing an EV.⁷⁰

Cost of Battery Replacement

As mentioned earlier, the used EV market provides significant cost savings for consumers, though with some drawbacks. The used car will have lower drive range, along with battery wear and an earlier replacement time. The replacement cost can be a significant expense and isn't covered by rebate programs. Most EVs, however, do warranty the batteries, generally for eight years or 100,000 miles, and this may offer enough protection for the life of the car.

Robust and Accessible Used-Car Market

While the used-car market for EVs is growing, in part also because of the numbers of EVs at the end of their leases, there are still far fewer of them for sale than conventional fuel cars. And many must be shipped in from other locations, which can make them more expensive. Lab participants noted that cars turned in at the end of their lease tend to be sent out of state to make room for new vehicles. And because the more affluent consumers demand the latest technology, dealers have little incentive to keep older, lower-priced cars on their lots.

Accessibility to the used EV car market is an issue that community leaders noted. As mentioned earlier, members of disadvantaged communities tend to buy their used cars from classified website postings, which list far fewer EVs than do more conventional sales platforms. And for many residents in disadvantaged communities, car purchases are unplanned events, arising from sudden necessity. For this reason, consumers don't have the time to conduct the due diligence on an EV, or wait for approvals for rebate applications.

Vehicle Body Types

One of the major barriers, according to Lab participants, is the limited body type. Like families and the ranks of the employed elsewhere, residents of disadvantaged communities are more likely to buy pickup trucks, SUVs, and minivans. Manufacturers recently began to address this issue by introducing larger body types. However, very few of these are available on the used-EV market. In April 2017, Tesla unveiled plans to release an all-electric pickup truck but may not start production for several years.⁷¹ In January 2015, Ford announced an all-electric SUV with upwards of 300 miles in range, and a hybrid F-150 pickup truck.⁷² While these anticipated vehicles will fill that need, the pricing will likely be too high for most residents in low-income communities.

CREATING SOLUTIONS ALONG THE VALUE CHAIN

Solutions to address barriers include policy and financial innovations. Different parts of the value chain—vehicle purchase, charging equipment, and battery replacement—require some combination of solutions.

ADDRESSING THE FUNDING GAP FOR VEHICLES

Multibank with a Loan-Loss Reserve

Current funding for EVs comes in a mix of local, state, and federal rebates, as well as cash and financing options from traditional institutions, such as banks and the financing arms of auto manufacturers. Some local credit unions have started to extend loans for EVs and charging infrastructure, but a gap in private funding remains.

A multibank structure, operated by a consortium of banks to pool funding and provide lending in underserved areas, could address this obstacle.

Multibank community development corporations, or MBCDCs, spread the risk among several lenders and have been used to develop infrastructure and extend credit for small-business loans, real estate development, and affordable housing construction. A similar structure could be applied to fund loans for EVs in disadvantaged communities. The multibank could also serve as a platform for education on electrical vehicles and clean-driving initiatives while it provides credit to the population it serves. The Office of the Comptroller of the Currency, which serves as the administrator of national banks, advises that such partnerships are beneficial because the banks cultivate goodwill while attracting new clients, and share not only the risks but the operating costs among themselves.^{73, 74}



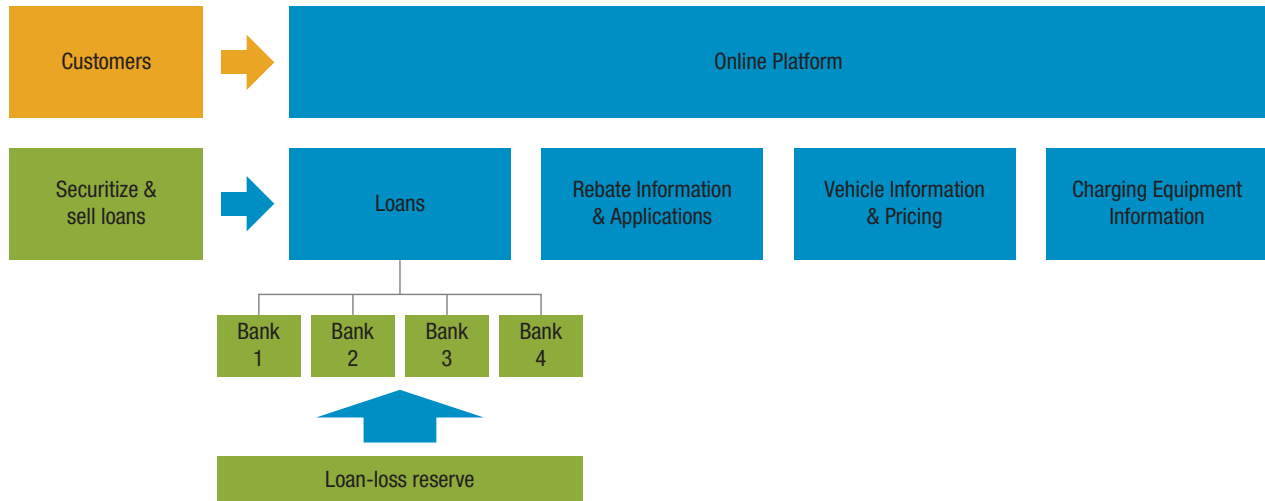
Lab participants design a prototype of the components necessary for a successful multibank.

Lab participants agreed that multibanks would be more likely to extend EV-related loans in disadvantaged communities if the state or federal government funds a loan-loss reserve that would cover some percentage of defaulted loans. This is in fact a recommendation from the federal Department of Energy's Office of Energy Efficiency and Renewable Energy for funding other types of clean-energy investments.⁷⁵ Knowing they have this loss-protection reserve should make lenders feel more confident extending loans to borrowers without much credit history or with low FICO scores. Lab participants noted that this type of facility would have to be accompanied by regulations to guide lenders to ensure borrowers have the capacity to service their debt.

Multibank member banks may also be able use this type of lending when they come up for review under the Community Reinvestment Act. This act mandates that bank regulators periodically review the practices of all banks that qualify for FDIC depository insurance, and see how well they meet regulatory expectations for serving all populations in their service area, including lower-income groups. The CRA doesn't require banks to take unsound risks, but the bank's lending practices and outreach are noted when it applies for approval of expanded business activities, such as additional branches, and mergers and acquisitions. (The purpose of the act is to discourage redlining^{76, 77})

Participants also agreed that the multibank structure would be most effective as an online information-access platform, where customers could look up rebates, discounts, chargers, vehicles, and loan terms. The online platform could help community organizations disseminate information on the benefits of EVs and the associated costs in the manner of a clear "one-stop shop." Figure 8 illustrates how the entire process would look.

FIGURE 8 || Multibank structure



Source: Milken Institute.

NEXT STEPS

Identify appropriate banks that can participate in a consortium and serve as lenders to the specific disadvantaged community; design an online platform that can aggregate the appropriate resources and information needed for consumers to identify the appropriate vehicle and financing options.

Interest Rate Buy-Downs

Interest rate buy-downs could make loans more affordable, and the DOE’s Office of Energy Efficiency and Renewable Energy includes them in its list of financial tools to enhance “green” investments.⁷⁸ Buy-downs are up-front costs incurred at closing in the housing market; a homebuyer can buy down his interest rate by paying a portion of the interest up front in exchange for a lower interest rate over the term of the mortgage. In the case of EV loans, a government body or donor could help bring down interest rates for consumers by making the upfront payment.

While mortgages are often longer term, 25–30 years, auto loans would likely be more attractive for buy-downs since they are of much shorter duration, usually four to five years, and for smaller dollar amounts. But both types of loans depend a great deal on one’s FICO score, and higher interest rates can make monthly car loan payments prohibitive for someone with a history of low income, inconsistent employment, or no prior work history.

Lab participants agreed that lower loan interest rates specifically designed for EV buyers could make the cars more affordable and thus more attractive.

NEXT STEPS

Convene possible funders: foundations, high net worth individuals, and corporate social responsibility programs to discuss the possibility of donor funding to buy down interest rates on EV purchases. Additionally, explore regulatory hurdles on applying this framework to the auto industry.

Incentives for Dealer Salespeople

The service, parts, and body shop departments are the most profitable divisions of a car dealership, accounting in 2016 for 47.3 percent of gross profits for the average car dealership profile, according to data from the National Automobile Dealers Association (NADA).⁷⁹ From this vantage point, the lower maintenance needs of an EV could create a disincentive for the dealership and salespeople. However, most car salespeople work on a commission basis and would no doubt react positively to an additional cash incentive for selling EVs.

Commissions earned on small- to midsize cars range from \$150 to \$200. For premium cars, such as luxury cars or large pickups, the incentive can be as high as \$1,000, according to Utility Dive, a website covering the utilities industry; offering an amount somewhere in the range, could help increase EV sales. Utility Dive recommends empowering salespeople to offer the incentives that go with EV ownership. For example, a customer who can pick up the HOV lane sticker, apply for all eligible rebates, and learn the costs and benefits of an EV in “one stop” will likely have an easier experience adopting the technology.⁸⁰

“This is not about justifying the added revenues those particular cars will bring to the utility,” notes Utility Dive. “It’s about encouraging the sale of relatively few cars in the short term, so that the market reaches a tipping point in which EVs become competitive, mainstream options that no longer require financial incentives.”

Utility companies might be well positioned to leverage their existing programs that offer training and incentives to retailers selling energy-saving products to provide commissions for sales of EVs.

INNOVATION: AN APP THAT PICKS A CAR FOR YOU, BASED ON HOW YOU DRIVE

Financial innovations, public outreach, and policy changes that ensure support during the lifetime of the vehicle are all moving forward. And user-friendly educational technologies seem to be on a parallel course. Take MyGreenCar, created by the Berkeley Lab to accelerate the deployment of green cars and currently in beta testing with other DOE national labs and the EPA.

MyGreenCar is a downloadable iPhone and Android app with intuitive visualization so that any user can see at a glance the value of any car she’s considering, based on her driving patterns. She drives her current car in her neighborhood and along her commute routes; the program takes all the data from these drives—how hard she drives, the type of traffic she’s in, the hills, the braking, the distance—and computes it into “the value of green”—the range, fuel costs, fuel economy, and battery usage, based on a database of 5,000 car models it runs on a supercomputer.

A platform that could complement this kind of data, offering at-a-glance information on costs, incentive structures, and public charging station locations, could serve as an “electric vehicle concierge,” assisting consumers through the purchase and life-cycle of an electric vehicle.

NEXT STEPS

Determine the feasibility of redirecting some public funding available for rebates, consumer education, and installation of charging equipment to dealer incentives. Bring together a group of policymakers and original equipment manufacturers to determine the right level of dealer incentive, where the funding could come from, and how to prevent misguided sales. Work with the Department of Motor Vehicles and state policymakers to determine the feasibility of bringing rebate applications and HOV sticker distribution to the manufacturers.

ADDRESSING THE FUNDING GAP FOR CHARGING INFRASTRUCTURE

Green Bonds

Green bonds are issued by companies or by municipalities to help facilitate investment into environmental initiatives, such as clean water or renewable energy.

In March 2014, Toyota Financial Services, the company's US financial/insurance arm, issued the automotive industry's first asset-backed green bond, \$1.75 billion in securities backed with US dealer income stream, to fund conventional loans and leases on sales of its nine hybrid and ZEV models in the United States.⁸¹ Since then, Toyota Financial Services has issued two more green bonds, the latest in May 2016, for \$1.6 billion, this time covering eight vehicles.⁸² In March 2016, Hyundai Capital Services issued Korea's first global green bond, for US\$500 million to finance the provision of loans and lease contracts for nine Hyundai and Kia hybrid and electric models.⁸³ A few months later, in May 2016, the Chinese car manufacturer Zhejiang Geely Holding Group (Geely) issued \$400 million in green bonds to build a factory north of London and finance the manufacture of zero-emission taxis by its subsidiary London Taxi Company.⁸⁴ Geely's bonds issued were oversubscribed six times, demonstrating the demand for these financial instruments. Issuers of the bonds benefit from a diversified investor base of impact investors, pension funds, and other investors that focus on sustainability.

State-, county-, or locally issued "green" municipal bonds, on the other hand, use public funds to target a variety of environmental investments, from solar panels to wastewater treatment, seawalls, and clean air. In return, they offer tax-free income. These bonds can be labeled "green," or go unlabeled, which means they're not subject to some of the hurdles but still target environmental projects. Green-label bonds come with greater investor assurance, in terms of the bond's undiluted focus.

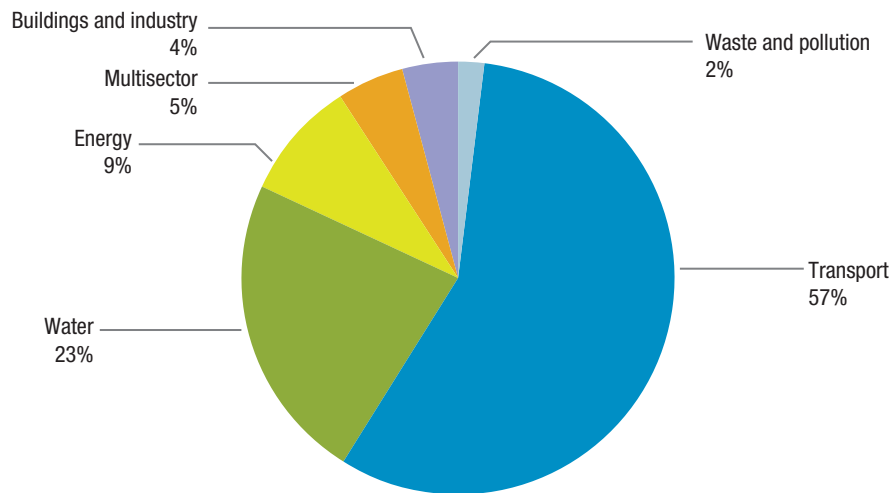
For the past five years, the London-based Climate Bonds Initiative, an "investor-focused nonprofit," has released annual state-of-the-market reports on labeled green bonds and unlabeled "climate-aligned" bonds (which may have longer terms but fewer regulatory hurdles) worldwide. In its 2016 report, it counts \$30.3 billion in environmentally related US municipal bonds, of which \$9.7 billion are green-labeled, and the great majority, \$20.6 billion, are in unlabeled bonds.⁸⁵

Energy projects still constitute a small percentage of overall issuances, but transportation makes up 57 percent of issuances, and these are primarily from transit authorities.⁸⁶ For example, in 2015, the Central Puget Sound Regional Transit Authority (Sound Transit), which oversees metropolitan Seattle and regional rail, light rail, and buses, raised nearly \$1 billion, the largest municipal bond issuance in the world, for operational, safety, and environmental upgrades and expansion. Figure 9 shows share of total green municipal bonds by project sector, with green energy projects accounting for just 9 percent of the total.



Lab participant Jason Bradley of the California Pollution Control Financing Authority discusses a new lending facility designed to engage small-business owners in installing charging infrastructure in their parking lots.

FIGURE 9 Projects funded by green municipal bonds



Source: Climate Bonds Initiative, 2016.

According to a January 2017 report on green bonds (part one of a three-part series) from the California Treasurer’s Office, California entered the market in 2014, and its state or local entities issued some \$800 million in green bonds by Q1 2016. This report, documenting a series of meetings with investors, bond issuers and underwriters, cites a number of reasons for slow growth in the US labeled green muni bond market, including market immaturity, a lack of public consensus on climate change, and perceptions of higher costs, regulatory hurdles, transparency and disclosure, yield, and liquidity.

The report lists some early recommendations from the meeting participants, such as multiple agencies bundling their projects into single issuances that are larger in size and more liquid; greater commitments to outreach and education; and adding investment subsidies to expand the municipal tax exemption to non-US investors.⁸⁷

Lab participants agreed that a green bond could be designed to provide the initial cash outlay to purchase and install EV chargers, and to upgrade the state’s aging grid infrastructure in disadvantaged communities.

Figure 10 explores different ways that green municipal bonds can be structured. For helping disadvantaged communities, Lab participants agreed that green general obligation bonds made the most sense because of their lower regulatory hurdles for issuance and the broader applicability of the funds in the event that additional projects, such as electric grid updates, are necessary.

FIGURE 10 Possible green municipal bond structures

MUNI BOND TYPE	PROCEEDS RAISED BY BOND SALE	DEBT RECOURSE	EXAMPLE
General Obligation (GO) Bond	Earmarked for green projects.	Full recourse to issuer – same credit rating applies as to the issuer’s other bonds.	In September 2014, California issued \$300 million in Aa3/A green bonds maturing in 2037. It was backed by the state’s GO fund and went to projects across several categories—including air pollution, clean water, and flood prevention.
Project Bond	Ring-fenced for specific underlying green project(s).	Recourse is only to the project’s assets and revenue.	No issuance in the market yet.
Securitized Bond	Either earmarked for green project OR goes directly into the underlying green projects.	Recourse is to a group of financial assets that serve as collateral.	In November 2014, Hawaii issued \$150 million AA-rated asset-backed securities. The bonds were backed by a green infrastructure fee applied to the bills of the state utility’s electricity customers. Proceeds went to loans to install distributed solar panels, connectors, and storage.

Source: Climate Bonds Initiative.

NEXT STEPS

Identify a municipality that would serve as a demonstration project, and convene an issuing authority and investors to determine the demand and pricing for green municipal bonds sufficient to meet the project’s need.

Small-Business Microloans

Microloans are small-business loans offered at attractive interest rates to help businesses access capital for items like machinery or fixtures. These types of loans can be leveraged to provide funding for electric vehicle charging equipment and associated installation costs.

One such microlender is LiftFund, a highly regarded certified community development financial institution, or CDFI. CDFIs provide loans, financial education, and other financial services in underserved communities. LiftFund is a microlender based in San Antonio, Texas, and was founded in 1994. The nonprofit now operates in 13 states—Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, Missouri, New Mexico, Oklahoma, South Carolina, Tennessee, and Texas.⁸⁸ Its supporters include regional and national banks, chambers of commerce, philanthropic foundations, local governments, and business and civic leaders.

Microlenders like LiftFund that provide loans for a range of uses, including equipment and vehicles, can play important roles in helping small businesses in underserved communities. They may also have close ties with specific communities and thus be better equipped, for example, to help small-business owners make decisions about EV purchases or EV charging installations for business parking that could improve parts of the enterprise that aren’t directly related to profitability. EV wiring costs range from several hundred dollars to several thousand, and microlenders can fill an important niche.

As noted earlier, California’s Electric Vehicle Charging Station program, launched earlier this year, provides financial incentives and loan-loss reserves, to small-business lenders who want to install EV charging systems. It also offers rebates to eligible businesses when their loans are repaid in full. State-chartered banks, savings associations, CDFIs, and credit unions are eligible to offer these loans.

NEXT STEPS

Include microlenders in a working group to explore their participation in the state's EVCS program, along with an outreach and educational curriculum to help small businesses understand the value in installing charging stations.

Pooled Procurement Fund

Sooner rather than later, communities will face the need for large-scale roll-outs of electric charging stations to compete with the ubiquity of gas stations. One way to save costs is to buy in bulk. Pooled procurement funds, common in the health services, use collective bargaining power to negotiate lower prices.

Foundations, donors, and corporations with corporate social responsibility programs could seed a pooled fund that would purchase EV chargers in bulk and underwrite their installation in disadvantaged communities. This fund can also play an important role in community engagement and education.

A tax credit could be a compelling incentive for corporate donors of a pooled fund who also install EV chargers in their own parking lots. They could use the credit themselves or reinvest it in the fund. Target Corporation, for example, has an admirable commitment to social responsibility, including reducing its carbon footprint in transportation and greenhouse gas emissions.⁸⁹ Every week it donates 5 percent of its profits, or millions of dollars, and Target employees donate hundreds of thousands of volunteer hours.⁹⁰ Thus a single Target store could contribute to the pooled fund and install 10 chargers in its own lot, benefiting not just from a tax credit but also from the reduced energy costs.

POLICY INNOVATIONS CAN ADDRESS CHARGING INFRASTRUCTURE

The CalCAP EVCS program has had limited success. The main issue for small businesses, according to Lab participants, is that they can't afford to lose parking spots to construction, even for a few days during the installation process. Additionally, Americans with Disabilities Act (ADA) compliance guidelines mandate at least one handicapped-accessible EV charging parking spot.⁹¹ Accessible spots are wider than regular parking spots, and in some cases, they result in fewer total spots. For small businesses, these costs may not translate to an overall increase in business from the added convenience of having charging stations for customers.

One innovation discussed by Lab participants is to offer a tax credit for the usage of electricity in these parking spots. This could help offset some of the increases in electricity costs to the businesses.

On the residential side, while rebates have helped to bring down the cost of the physical charging unit, little has been done to offset costs of installation. These costs range from intangible costs, such as sourcing an appropriate electrician and taking days off work for the installation, to the hard costs, which can run into the thousands of dollars for rewiring. Lab participants felt that a service that could help residents procure and install the charger would be beneficial. In some cases, utilities offer a "make-ready" program that subsidizes costs to make a property ready for installation of a charger. Current programs, however, are funded through ratepayer bill increases.⁹² One way policymakers can step in is to use some available funding for rebates to help residents pay for installation or to upgrade electric grids where there would be larger demand for chargers.

NEXT STEPS

Convene donors and charger manufacturers to discuss the best unit pricing for charging stations.

ADDRESSING THE FUNDING GAP FOR BATTERY REPLACEMENT COSTS

Extended Warranty

Many electric vehicles offer battery warranties, with an eight-year/100,000-mile warranty being the most common. However, the warranties don't "reset" when the EVs are resold. This has become a concern, particularly for owners of used EVs who have to pay for new batteries out of pocket.

One way to tackle this problem is to offer an extended or more comprehensive warranty program for consumers in disadvantaged communities. The state rebate program could fund, or partly fund, this warranty coverage, and it could be offered directly by the original equipment manufacturers or used-car dealerships.

NEXT STEPS

Convene policymakers to determine the best way to reroute some funding from the rebate program to offset the cost of extended warranties for disadvantaged communities.

Battery Repurposing Programs

While an EV battery may need replacement, the old battery could yet serve a valuable purpose. The manufacturers generally assign a value to an old battery that they pass through to a customer when they complete a battery replacement. However, some Lab participants suggested that consumers could get more value by selling the used battery directly to businesses that specialize in repurposing them.

Repurposed batteries can be used to store energy. Businesses and public buildings that offer charging stations may be able to use these batteries to store solar energy during off-peak hours to help offset the costs of the higher electricity needs of the chargers. Additionally, companies that offer mobile charging, like the San Francisco-area FreeWire Technologies,⁹³ should have higher demand for used batteries as the number of EV drivers grows.



Participants workshop innovative solutions to better align policy initiatives with potential financing models.

NEXT STEPS

Convene energy storage companies and businesses that can benefit from storing solar energy during off-peak hours to determine how to formalize a market for used batteries.

CONCLUSION

Electric vehicles can play a vital role in helping California meet its greenhouse 2025-and-beyond emissions reduction targets. For people who live in communities labeled as disadvantaged in great part because of the long-term negative effects on health and quality of life from environmental pollutants, the issue has added urgency. This Lab's focus is on one small but vital aspect of the solution: to reduce the reliance on fossil fuels in these communities via rebates, discounts, and other incentives, backed in part by local, state, and private funds. These incentives and outreach can help vulnerable communities become more energy efficient and able to take part in greater economic opportunity.

It is our aim to explore ways to reduce high upfront costs and discomfort with electric vehicle technologies. It will take innovative collaboration between policymakers and the private sector, novel financing and policy mechanisms, and outreach to both lenders and borrowers along the value chain of vehicle purchase, charging infrastructure, and battery replacement.

The funding exists, as does the commitment. Now it's up to policymakers, lenders, and community leaders to galvanize their efforts to offer more credit and loan access at reasonable costs, ensure that rebates and other state incentives are deployed effectively for the long run, and create the public infrastructure necessary to support the electric vehicles on the roads.

These efforts must also extend to clean-energy bus service, vanpools, and carsharing programs for residents in these areas for whom public transportation offers a greater convenience or for whom a car purchase isn't an option. Solutions will take many forms. Quality of life should be less negotiable.



APPENDIX

Financial Innovations Lab Participants

(Affiliations at time of Lab)

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