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Emerging policy approaches to electrify ride-hailing in the United States

This briefing identifies emerging policy approaches to support the deployment of electric vehicles within ride-hailing fleets, with a focus on the United States. It discusses the adoption barriers unique to ride-hailing fleets and summarizes several policy approaches for states, cities, and utilities to accelerate the transition to electric shared mobility fleets.

INTRODUCTION

The electric vehicle market continues to grow, with the United States now the third-largest market after China and Europe. Early electric vehicle market growth tends to be concentrated where governments are breaking down the barriers to adoption with supportive regulations, consumer incentives, charging infrastructure, and local actions that promote greater awareness. Similarly, the United States is among the top markets for shared mobility, with ride-hailing companies like Uber and Lyft expanding in U.S. cities.

However, the convergence of these two transitions—the electrification of growing ride-hailing fleets—has been relatively limited. In California, a hotbed for both trends, approximately 1% of ride-hailing vehicles were plug-in electric in 2017.[1] This level of

1 Simi Rose George and Marzia Zafar, "Electrifying the ride-sourcing sector in California," California Public Utilities Commission, Policy & Planning Division (April 2018), http://www.cpuc.ca.gov/General.aspx?id=6442457050

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electric vehicle adoption lags the market average in California, where 7% of new vehicles statewide, and 13% in the San Francisco Bay Area, were plug-ins in 2018.[2]

Efforts by cities and states to support the electrification of ride-hailing fleets are intensifying, as early evidence of ride-hailing fleets' impacts on cities become known. Table 1 summarizes key findings from several studies, with details regarding the riders, trips, and impacts of ride-hailing fleets. The analyses focused on major metropolitan including Boston, Chicago, Los Angeles, New York, San Francisco, Seattle, and Washington, D.C. What is clear from these studies is that in cities with especially high ride-hailing fleet use, there now are tens of thousands of drivers, more than 20% of urban residents are using ride-hailing apps, and the use of these fleets is now rivaling local bus use. These studies also generally conclude that ride-hailing fleets result in a net increase in vehicle miles traveled, typically in the most dense and congested areas of the cities.

Table 1. Summary of selected studies on ride-hailing fleet usage in U.S. cities

Study	Areas studied	Rider use and drivers	Trips	Vehicle miles traveled and emissions impacts
Clewlow & Mishra (2017)	Boston, Chicago, Los Angeles, New York, San Francisco, Seattle, Washington, D.C.	• Used by 30% of adults • Daily or weekly use by 24% of adults	• Half of trips would have been done by foot, bike, transit, or otherwise avoided	• Likely to increase vehicle miles traveled • Congestion and emissions likely to grow without policy
SFCTA (2017, 2018)	San Francisco	• Used in 9% of all person-trips • 45,000 drivers	• 170,000 daily weekday trips • 12 times amount of taxi trips • 15% of intra-city vehicle trips	• 570,000 daily weekday miles • 20% of intra-city vehicle travel • Increased activity linked with higher emissions • Half of city's 2010–2016 increase in congestion, travel, delays
Schaller Consulting (2017)	New York City	• 15 million monthly riders in fall 2016 • 43,000 licensed vehicles	• Increase of 31 million trips since 2013 • Increase of 52 million passengers since 2013	• Added 600 million miles in 3 years • Use increases overall vehicle miles travel • Use not linked with decrease in congestion or CO_2 emissions
Schaller Consulting (2018)	Nationwide and at the metropolitan area level for select cities	• Ride-hailing and taxi trips exceed national local bus use in 2018	• 1.7 billion trips in 2017 • 2.6 billion riders in 2017, a 37% year-over-year increase	• Added 5.7 billion annual miles of driving in nine major metro areas

Sources: Regina Clewlow and Gouri Mishra, *Disruptive Transportation: The Adoption, Utilization, and Impacts of Ride-Hailing in the United States* (University of California, Davis, 2017), UCD-ITS-RR-17-07; San Francisco County Transportation Authority, "TNCs today: A profile of San Francisco Transportation Network Company Activity," (June 2017). https://www.sfcta.org/sites/default/files/content/Planning/TNCs/TNCs_Today_112917.pdf; San Francisco County Transportation Authority, "TNCs & Congestion," (2018). https://www.sfcta.org/emerging-mobility/tncs-and-congestion; Schaller Consulting, "Unsustainable? The growth of app-based ride services and traffic, travel and the future of New York City," (2017). http://www.schallerconsult.com/rideservices/unsustainable.pdf; Schaller Consulting, "The new automobility: Lyft, Uber and the future of American cities," (2018). http://www.schallerconsult.com/rideservices/automobility.pdf

2 California New Car Dealers Association, "Auto Outlook: 2018 Quarter 3," (November 2018), https://www.cncda.org/news/2018-q3/ and California New Car Dealers Association, "California Green Vehicle Report," (August 2018), https://www.cncda.org/wp-content/uploads/Cal-Alt-Powertrain-Report-3Q-18-Release.pdf

As cities grapple with the various externalities from these ride-hailing operations, vehicle electrification offers an opportunity to eliminate these vehicles' local emissions. Because of declining battery costs and the increasing availability of long-range electric vehicle models, ride-hailing fleets are increasingly ripe for electrification. These ride-hailing vehicles' high annual driving means that the fuel savings are far greater and the payback is accelerated compared to private vehicles. It might be tempting to think that, with new electric vehicles with 250-plus miles in electric range and fast-charging capabilities, the electrification of ride-hailing fleets will occur naturally. However, without robust policy measures, the transition to electric ride-hailing vehicles is unlikely to occur because of lack of charging infrastructure and other barriers,[3] which we address below.

This briefing highlights major electric ride-hailing projects through 2018, and summarizes barriers to greater electrification. We also provide an overview of emerging policy approaches at the state, city, and utility levels to steer ride-hailing fleets toward electric vehicles, and offer several policy suggestions.

EARLY ELECTRIC VEHICLE DEPLOYMENT

A handful of ride-hailing fleets have started to go electric. The following highlights several of the transportation network companies (TNCs) that have deployed the most electric vehicles. These examples, including U.S. and international projects, are selected to highlight the policy context, as well as the unique opportunities and challenges that electric vehicles present for ride-hailing fleets.

United States—Maven. Maven, a subsidiary of General Motors, operates Maven City, a traditional carsharing platform for short, intra-urban trips; Maven Home, intended to serve residents of a single apartment building; and Maven Gig, which provides weekly vehicle rentals for delivery and ride-hailing drivers. Each of these services is available through an app that allows users to reserve a car from a fixed location for a period of time. Maven offers primarily gasoline vehicles, as well as plug-in Chevrolet Volts and Bolts in select markets.

Maven debuted Chevrolet Bolts in California cities in early 2017 through its Maven Gig platform. The deployment expanded to Austin, Texas, in early 2018 through a partnership with Austin Energy Plug-In Everywhere and the EVgo network, offering free charging to Maven Gig customers who rented electric vehicles. The incremental $30 per week cost of renting the Bolt can be paid off through approximately 300 miles of driving—an accessible benchmark to meet for a full-time ride-hailing driver. The flexibility of the platform allows users to experiment with driving an electric vehicle, increasing access to electric vehicles and providing many riders with their first rides in an electric vehicle.

Data from Maven Gig's electric vehicles provide several early insights on the feasibility of electric ride-hailing. In the first year, Maven Gig drivers of Bolts drove more than 6.5 million all-electric miles, and range anxiety does not appear to be a concern.[4]

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3 Nikita Pavlenko, Peter Slowik, and Nic Lutsey, *When does electrifying shared mobility make economic sense?* (ICCT: Washington, DC, January 2019), https://www.theicct.org/publications/shared-mobility-economic-sense

4 General Motors, "Maven Joins City of Austin, Texas in Deploying All-Electric Shared Use Fleet of Chevrolet Bolt EVs" (March 2, 2018). https://media.gm.com/media/us/en/gm/news.detail.html/content/Pages/news/us/en/2018/mar/0302-maven-austin.html

Bolt drivers have driven about 30% more miles on average than comparable gasoline vehicle drivers on the platform, with about 10% of Bolt drivers exceeding the car's 238-mile daily range.[5] To provide a charging network for its fleet, Maven partners with EVgo on dedicated charging networks in the cities where Maven operates. This allows for the strategic alignment of electric vehicles and charging stations for optimal location and high utilization.

Montréal, Canada—Téo Taxi. The all-electric taxi fleet Téo Taxi launched in 2016 and uses a mix of Kia Soul, Nissan Leaf, and Tesla vehicles to serve primarily the urban core of Montréal. The fleet has grown from 50 to 120 electric vehicles since 2016 and is expanding to 350 cars in its second phase of growth.[6] To facilitate consistent travel to and from Montréal-Trudeau Airport, Téo Taxi partnered with Tesla to deploy a 12-stall fast-charging station for its fleet at the airport.

Téo Taxi's vehicles typically are in operation for several shifts per day with different drivers, increasing their utilization and daily driving relative to a ride-hailing platform where each vehicle typically is registered to one driver. This system has enabled Téo Taxi to maximize the fuel-saving benefits compared to conventional vehicles for an improved payback period. Continuous operation also means that the fleet requires frequent fast charging, necessitating the company's investment in charging infrastructure. Furthermore, to mitigate range limitations, the Téo Taxi app tracks the remaining range for its fleet, matching vehicles to passengers and routing trips to ensure that the cars are within range of a charger if necessary.

London—Uber electric. As the city of London has worked to develop policies to steer all fleets toward electric, Uber conducted an electric vehicle trial there to study the challenges and opportunities of electrification.[7] Over the six-month pilot, 50 drivers drove 200,000 miles in Nissan Leaf, BYD e6, and Tesla Model S vehicles. Drivers received attractive electric vehicle rental rates from manufacturers as well as electricity pricing deals from select charging providers. The trial greatly increased rider awareness, as 35,000 riders experienced the technology firsthand and most had positive reactions. Some drivers felt as if they had effectively "sold" the electric vehicles.

However, the trial revealed that significant hurdles remain to the widespread adoption of electric ride-hailing. The trial demonstrated that improvements in residential and public direct current (DC) fast-charging infrastructure are needed. Many drivers reported the number and distribution of infrastructure as insufficient, restricting the number of hours they could drive and resulting in downtime and lost revenues. Few drivers reported charging at home because of the lack of infrastructure or off-street parking, indicating the importance of improving home, multi-unit dwelling, and curbside charging.

Uber continues to build from the London project with additional pilots elsewhere, including in its "EV Champions Initiative" in seven North American cities. These efforts include partnering with utilities on incentives, increasing driver access to electric

5 Peter B. Kosak, Statement to U.S. House Energy and Commerce Committee, Subcommittee on Digital Commerce and Consumer Protection, for Update on IoT Opportunities and Challenges hearing, June 13, 2017, https://docs.house.gov/meetings/IF/IF17/20170613/106103/HHRG-115-IF17-Wstate-KosakP-20170613.pdf

6 "Taxelco Announces Phase 2 of Its Financing," Caisse de dépôt et placement du Québec, February 7, 2017, https://www.cdpq.com/en/news/pressreleases/taxelco-announces-phase-2-of-its-financing

7 Gary Hartley, "Electric private hire vehicles in London: On the road, here and now," Energy Saving Trust, May 19, 2017, http://www.energysavingtrust.org.uk/blog/uber-electric-vehicle-trial-appy-drivers

vehicle resources, facilitating driving electric with app features, and raising public exposure with 5 million electric rides in 2019.[8]

China—Didi Chuxing. With more than 260,000 electric vehicles through late 2017, China's and the world's largest ride-hailing platform, Didi, stands out as an early electrification leader. The company aims for 1 million electric vehicles by 2020 and 10 million by 2028, and it is planning the construction of a nationwide charging infrastructure network. Various industry and government initiatives support electric vehicle integration on the Didi platform. Didi's strategic partnerships and alliances with car manufacturing and leasing companies have enabled bulk procurement of electric vehicles and their supporting infrastructure. In 2018, Didi announced its alliance with 31 auto industry partners to develop purpose-built electric vehicles for use in ride-hailing, carsharing, and other applications.

Policy implementation at the national and local levels has greatly supported electric vehicles in China. Reinforcing the strong central government policies, several cities aggressively promote electric vehicles in ride-hailing, taxi, and carsharing fleets. Shenzhen, for example, announced that it no longer would allocate ride-hailing licenses to non-electric cars starting in 2018. Many cities promote electric ride-hailing via financial rebates, usage fee exemptions, and incentives for group acquisition. Other factors encourage or facilitate electric ride-hailing in China, such as vehicle registration privileges, road access privileges, strong public fast-charging infrastructure network, and dedicated parking spaces.

BARRIERS AND OPPORTUNITIES

To put ride-hailing fleets' unique barriers to electrification in broader context, Table 2 compares barriers for private cars and ride-hailing fleets. As shown, one benefit is that ride-hailing companies can facilitate the acquisition of vehicles at lower bulk and wholesale prices. As the size of these companies increases, their purchasing power eventually can lead to purpose-built vehicles (e.g., Didi Chuxing as identified above). Also, because electric vehicles have lower operating costs, fleets or drivers with high annual driving miles realize shorter payback periods from going electric than private car owners. Overcoming awareness barriers for drivers also tends to be easier for ride-hailing cars, as companies and their associated financing firms can provide direct guidance on vehicle acquisitions. Because ride-hailing cars serve many passengers, there also is an opportunity for electric ride-hailing to help raise public exposure to the vehicles.

8 "Electrifying our network," Uber, June 20, 2018, https://www.uber.com/newsroom/electrifying-our-network/

Table 2. Electric vehicle barriers for private cars and ride-hailing fleets

Barrier	Electric vehicle barrier for private car owners	Is electric vehicle adoption less difficult (+) or more difficult (-) for ride-hailing fleets?
Cost	• Higher initial cost • Lower operating cost • Long payback period	+ Bulk procurement, slightly lower cost + Low operating cost (fueling, maintenance) + Much higher annual driving, shorter payback – Public rapid charging often relatively expensive – Significant opportunity cost from charging downtime
Charging convenience	• Frequent lack of available charging options • Most are charged at home, followed by some workplace and public charging	– Charging time can mean downtime and lost revenue – Much more dependent on public charging – More rapid charging in denser urban settings – Fewer home charging options for drivers in multi-unit dwellings without private garages
Consumer awareness	• Limited awareness • Low understanding of models, charging, benefits	+ Companies can give car purchasing/leasing guidance + Allows vehicle electrification incrementally *by the mile* (i.e., without an electric car purchase) + Awareness campaign for passengers

Charging convenience barriers typically are a greater challenge for ride-hailing compared to private cars. Ride-hailing is a commercial business, and time spent charging and driving to or queuing at charging stations means downtime and lost revenue. Given the high annual mileage and the need to minimize opportunity costs from charging downtime, ride-hailing is much more dependent on public rapid charging. Public fast charging often is relatively expensive compared to other charging options, reducing the fuel-saving benefits of electric vehicles. Access to Level 2 overnight charging (i.e., 200-240 volts, typical for home charging) greatly lowers operating costs by minimizing reliance on more expensive public fast charging and the associated opportunity costs from downtime during working hours.

Because of the high annual mileage of ride-hailing cars, investing in electric vehicles can lead to major financial benefits for the companies. As a result, many Uber and Lyft cars in the United States already are hybrids. Figure 1 shows the 5-year total cost of operation (TCO) for a typical full-time ride-hailing car in 2018, assuming 40,000 miles per year.[9] The TCO is shown for conventional gasoline and hybrid vehicles, and for electric vehicles capable of varying range excluding federal and state purchasing incentives, which are typically $7,500–$9,000 per vehicle. As shown, shorter-range electric vehicles have significant downtime and high electric charging costs due to their frequent use of public fast charging. In contrast, longer-range electric vehicles require less public fast charging and thus have lower relative downtime and charging costs. The TCO of 150- and 200-mile electric vehicles is less attractive than conventional and hybrid vehicles. However, 250-mile range electric vehicles have a TCO similar to the conventional gasoline model but are still more expensive to operate than the hybrid.

9 Figure 1 and Figure 2 are from Nikita Pavlenko, Peter Slowik, and Nic Lutsey. *When does electrifying shared mobility make economic sense?* (ICCT: Washington, DC, January 2019). https://www.theicct.org/publications/shared-mobility-economic-sense. See also further scenarios in that report.

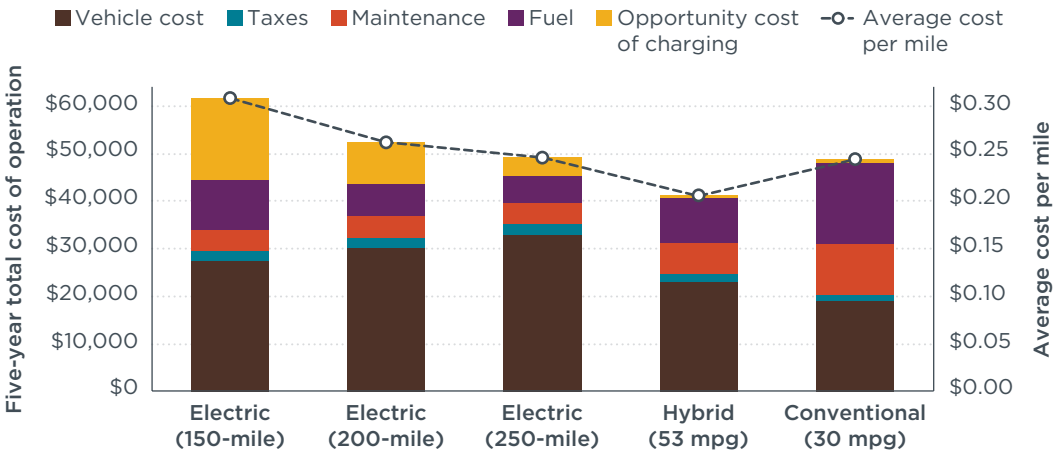

Figure 1. Ride-hailing car total cost of operation for gasoline, hybrid, and electric vehicles in the United States in 2018.

By 2025, as electric vehicle costs decline with battery improvements, the value proposition for electric vehicles greatly improves, but charging infrastructure remains a critical issue. Figure 2 illustrates how critical charging infrastructure expansion is to the economic viability of ride-hailing over time. The chart illustrates the 5-year costs of operating a 250-mile range electric ride-hailing vehicle versus conventional gasoline and hybrid vehicles. Electric vehicles with regular access to low-cost overnight residential electric vehicle charging—typically less than $0.15 per kilowatt-hour—already are competitive with conventional non-hybrids in 2018 and will reach operating costs that are lower than hybrids by 2023. However, if ride-hailing fleets are dependent upon higher-cost public fast charging—typically at least $0.30 per kilowatt-hour—this pushes out the electric-versus-hybrid breakeven point several years. This underscores the importance of policy and business decisions that maximize the use of residential charging rates and supply overnight charging opportunities.

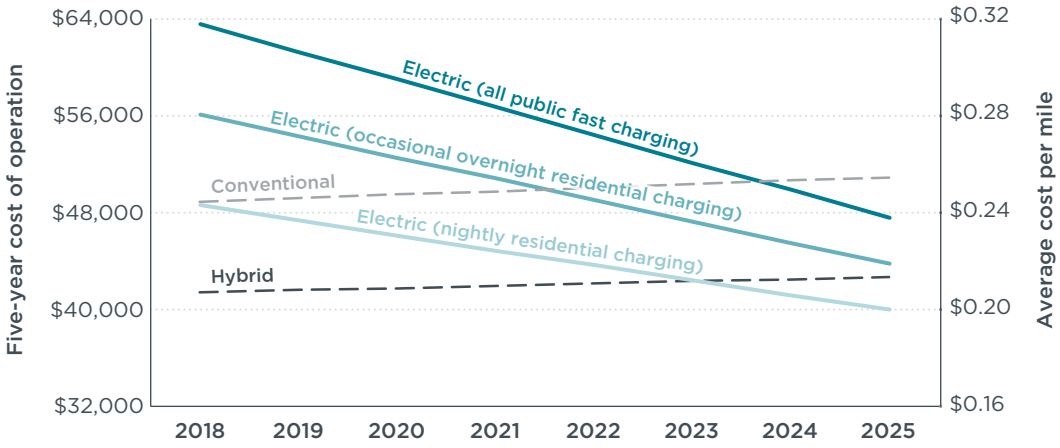

Figure 2. Average ride-hailing 5-year cost of operation and cost per mile for conventional, hybrid, and 250-mile electric vehicles for new vehicles from 2018–2025, depending on charging conditions.

Figure 1 and Figure 2 illustrate how promising electric ride-hailing is, but also how it is unlikely that ride-hailing fleets will quickly transition to electric based on market dynamics alone. Based on the technology developments, the economics suggest

all ride-hailing vehicles could feasibly be hybrids by the early 2020s, and all electric vehicles through the mid-2020s. Although Figure 2 demonstrates the promising economics for transitioning to electric by 2023–2025, this is contingent upon resolving the other underlying barriers, such as charging infrastructure and driver awareness. Government policy and industry actions can help overcome these barriers.

STATE-LEVEL POLICY APPROACHES

State governments have played a critical role supporting early electric vehicle market growth by developing policies, implementing incentives, and supporting the deployment of charging infrastructure. State policy actions bolstering the private-car market could be adapted to also encourage electric ride-hailing. The applicable regulatory authorities for ride-hailing fleets in California, the Public Utilities Commission and the Air Resources Board, are considering regulatory options to accelerate electric vehicle uptake in transportation network companies (TNCs), which includes ride-hailing companies. Recent California legislation, specifically Senate Bill 1014 of 2018, directs state agencies to develop regulations that reduce the per-passenger mile emissions of TNC operations, including company-specific targets for electric vehicle adoption.

Electric vehicle promotion policies typically have focused on private cars, and these could be modified to more effectively incentivize ride-hailing fleets. Considering that electric ride-hailing vehicles typically drive 3–5 times more miles per year than private vehicles and still will not be cost-competitive with hybrids for several years, directing more incentives toward electric ride-hailing vehicles would be justified. For example, California has per-company caps that limit how many commercially-owned electric vehicles may receive the electric vehicle incentives. The state could lift such a restriction and make the incentives contingent on verified high annual electric vehicle miles traveled. In addition, it is important that incentives are also directed at drivers, such as providing affordable leasing rates or low-interest financing.

Table 3 summarizes several state-level policy approaches to promote the electrification of ride-hailing fleets. In addition to providing purchasing incentives and promoting data collection, states can play a key role in supporting charging infrastructure deployment. For example, states can replicate early public charging incentives and could cover up to half the infrastructure hardware costs for dedicated ride-hailing fast-charging stations. State authorities can also exempt electric ride-hailing vehicles from registration fees or taxes, and they can authorize city governments to implement local pricing policies (e.g., fees per trip, per mile, or per airport pickup). Finally, requiring and publicly sharing data on electric ride-hailing fleet activity can help validate progress and also help cities and other stakeholders learn from the emerging patterns.

Table 3. Summary of state-level support actions for electric ride-hailing

Action	Description
Fleet regulations	• Implement fleet-based zero-emission vehicle (ZEV) regulations for commercial fleets (e.g., TNCs, taxis) to have increasing ZEV share to complement the automaker-focused ZEV regulation. • Implement fleet-based CO_2 regulations to reduce emissions per passenger mile, incentivize electrification, and increase the percentage of shared rides.
Financial incentives	• Incentivize with point-of-sale rebates, tax exemptions, or financing to reduce the upfront cost differential between electric and gasoline models for purchases and leases. • Ensure commercial fleets are eligible for incentives, contingent upon submission of public data that verify high annual electric vehicle miles traveled.
Public charger promotion	• Exempt taxes to partially reduce charging infrastructure installation costs. • Direct funding for key fast-charging destinations including airports and urban transportation hubs.
EV-friendly pricing schemes	• Exempt electric ride-hailing cars from existing state fees and registration taxes. • Grant authority to city governments to implement pricing schemes on TNCs (as demonstrated by California and San Francisco) with electric vehicle incentives.
Data reporting requirements	• Require data collection; monitor, validate, and publicly share data on portions of ride-hailing vehicle miles provided by electric vehicles for each fleet.

CITY-LEVEL POLICY APPROACHES

In terms of where electric vehicle uptake is highest and where policies have been the most robust, cities have been at the forefront of vehicle electrification. Cities are exploring many diverse measures to accelerate the electrification of ride-hailing cars. Approaches cities can take to spur electric ride-hailing include taking action to ensure there is sufficient charging infrastructure, granting preferential access, and incentivizing vehicle buyers through pricing schemes.

Cities typically have authority over land use, local infrastructure, curb space, zoning, building codes, and parking codes. Cities can promote competition in charging by streamlining the permitting processes for charger installations, adopting electric vehicle-ready building codes, allowing infrastructure installations in the public right-of-way, and partnering with private sector stakeholders on charging station costs and site identification. These actions can target public DC fast charging in ideal daytime charging locations where there is high ride-hailing concentration to minimize extra driving to charging stations and downtime.

Cities also can provide attractive perks such as preferential access to curbs, lanes, and parking for companies that demonstrate greater shares of electric vehicles or electric driving activity. For example, cities could grant electric ride-hailing vehicles preferential access at designated pickup and drop-off curbsides in popular locations

such as airports, train stations, or other travel hubs.[10] Cities can allow access to bus-only lanes, similar to what is sometimes given to taxis, for verified electric ride-hailing vehicles. Cities can impose volume caps on ride-hailing vehicle licenses while exempting electric ride-hailing vehicles, and over time license only electric vehicles. A bolder approach would be for cities to consider low-emission vehicle zones or limiting vehicle traffic in select areas to electric vehicles, as is done in some European cities.[11] There is evidence that such zones spur complementary actions from the private sector, including ride-hailing companies.[12] Each of these actions pushes for greater electrification by providing a competitive edge to the companies that electrify. These actions also can be implemented as part of cities' congestion mitigation plans, reducing access to private cars but allowing a shared-vehicle alternative to complement transit options.

Finally, some cities, including Chicago, have introduced pricing schemes on all TNC trips, similar to fees commonly imposed at airports. The city of Chicago imposes a per-trip fee for all Uber, Lyft, and similar trips.[13] The existing fee structure applies evenly across all vehicle types, but such a fee structure could be modified to partially or fully exempt electric ride-hailing vehicles. Doing so would create a direct economic incentive for companies and their drivers to electrify and could easily be justified based on the lower environmental externality of electric ride-hailing vehicles. A summary of these types of city-level policy approaches to spur electric ride-hailing is provided in Table 4.

10 For example, as done in Amsterdam. See City of Amsterdam, "Plan Amsterdam: The electric city, " (2016), https://issuu.com/gemeenteamsterdam/docs/plan_amsterdam_the_electric_city

11 Dale Hall, Marissa Moultak, and Nic Lutsey, *Electric vehicle capitals of the world: Demonstrating the path to electric drive,* (ICCT: Washington, DC, 2017). https://www.theicct.org/publications/EV-capitals-of-the-world

12 "Uber launches Clean Air Plan to help London go electric," Uber, October 23, 2018, https://www.uber.com/en-GB/newsroom/uber-helps-london-go-electric/

13 "TNP License fact sheet," City of Chicago Business Affairs and Consumer Protection, (January, 2018), https://www.cityofchicago.org/content/dam/city/depts/bacp/publicvehicleinfo/publicvehicle/TNPLicenseFactSheetJan012018.pdf

Table 4. Summary of city-level support actions for electric ride-hailing

Action	Description
Electric vehicle action plans	• Incorporate TNC-specific strategies in city electric vehicle action plans to identify and shape local actions to overcome adoption barriers.
Streamline DC fast charger permitting	• Streamline permitting to expedite installation of charging infrastructure, especially DC fast chargers in urban areas with high ride-hailing vehicle usage.
EV-ready building codes	• Adopt electric vehicle-ready building codes to ensure charging infrastructure everywhere, including multi-unit dwellings, curbside, and public DC fast charging.
Right-of-way parking and charging	• Permit public right-of-way space for constructing electric vehicle charging infrastructure, including strategically dedicating electric ride-hailing vehicle parking.
Partner with shared fleets	• Form partnerships with shared mobility companies to overcome barriers, identify optimal charging locations, and cost-share charging infrastructure installations.
Preferential access to curb space	• Convert parking in designated areas for electric ride-hailing pickup and drop-off.
Preferential lane access	• Allow verified shared electric ride-hailing vehicles in transit-only and HOV lanes.
Priority queue at key locations	• Grant priority access for electric ride-hailing vehicles in queues at airports, train stations, transit hubs, taxi ranks, and other locations.
Implement vehicle licensing caps	• Implement ride-hailing vehicle license cap to limit ride-hailing vehicles, and incrementally increase the share of permits that go to electric vehicles each year.
Low-emission areas	• Restrict vehicle traffic in select areas within the city, exempting only vehicles that emit zero emissions and are shared among multiple passengers.
Pricing schemes	• Implement or adapt pricing structures (e.g., price per trip or per mile) to be proportional to vehicle emission levels. • Exempt electric ride-hailing vehicles from fees.
Partnerships	• Partner with ride-haling companies to identify ways to complement transit systems and provide first- and last-mile connections. • Require ride-hailing companies to meet minimum electric share to join partnership.

UTILITY-LEVEL POLICY APPROACHES

Utility support for electric vehicles is increasingly common in many areas. Utility involvement includes installing charging infrastructure, offering preferred electric vehicle or time-of-use (TOU) rates, and sharing educational materials. Many of the utility electric vehicle promotion actions could be adapted to better support ride-hailing fleets. For example, utilities increasingly are directly investing in public charging infrastructure. Steering some of these investments toward strategic fast charging infrastructure installations can support greater volumes of electric ride-hailing vehicles and help guarantee high utilization.

Utility charging installations and the pricing of electricity could be critical in enabling electric ride-hailing. Figure 3 illustrates how the price of electricity at home and public locations is key to the economic value proposition of electric ride-hailing.[14] The figure shows the cost of driving on electricity compared to the equivalent per-mile driving cost of driving conventional and hybrid cars in 10 U.S. cities. Charging on residential electricity, typically less than $0.15 per kilowatt-watt, is generally very attractive for electric vehicles. This compares with public fast charging on a representative member network rate, which is generally $0.23 to $0.32 per kilowatt-hour and more expensive than hybrid gasoline vehicles. Fast charging at non-member rates often can be more expensive than operating conventional non-hybrids.

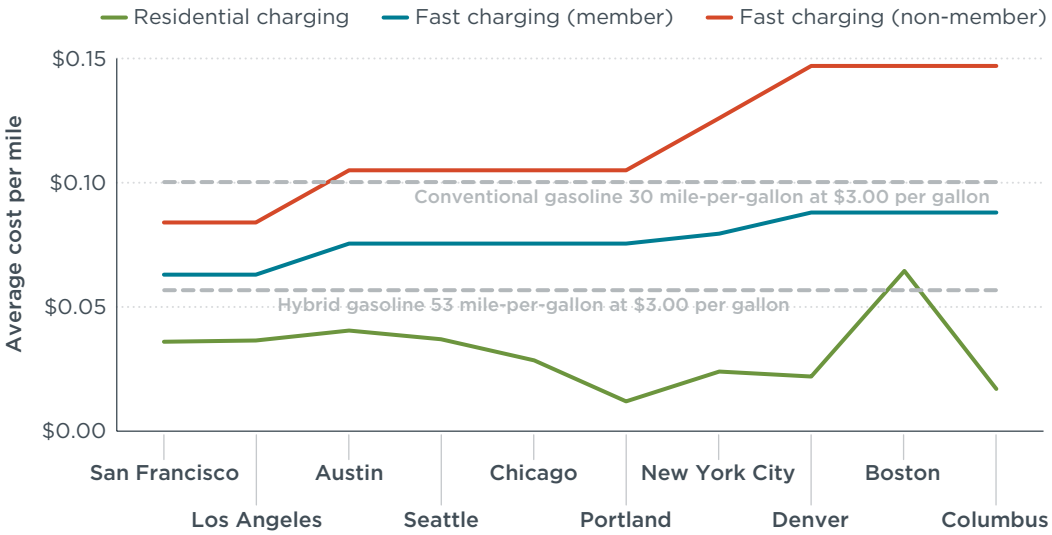

Figure 3. Residential and fast-charging (member and non-member) costs per mile compared with conventional and hybrid cars in 10 cities

Figure 3 shows the importance of establishing low-priced fast charging after ensuring ride-hailing drivers have access to lower-priced residential charging. There potentially are many ways to accomplish this. For example, this can be accomplished by creating a network of dedicated ride-hailing charging with predictable, high utilization. The Maven example appears to be headed in this direction. There is evidence that electric ride-hailing drivers represent a customer class distinct from others and hence may have a basis for TOU or other special rates. Modifying tariff structures to minimize or eliminate demand charges also would help electric vehicles compete with gasoline on a per-mile basis.

Table 5 summarizes utility-level policy approaches to accelerate electric ride-hailing in addition to investing in infrastructure and establishing special charging rates. As indicated, utilities also play a role in providing informational materials about electric vehicles to their customers. Customizing materials tailored to ride-hailing drivers can complement other supporting measures and inform drivers about electric models, charging options, and the comparative costs of driving electric and gasoline vehicles.

14 Based on Nikita Pavlenko, Peter Slowik, and Nic Lutsey, *When does electrifying shared mobility make economic sense?* (ICCT: Washington, DC, January 2019), https://www.theicct.org/publications/shared-mobility-economic-sense, and "Go farther for less money with our new pricing," EVgo, (accessed November 28, 2018), https://www.evgo.com/charging-plans/

Table 5. Summary of utility-level support actions for electric ride-hailing

Action	Description
Dedicated DC fast chargers	• Invest in dedicated DC fast charging for ride-hailing fleets, optimally placed for high utilization and to reduce deadheading, increase sharing, and complement transit.
Time-of-use rates	• Offer rate plans that include lower rates for electric vehicle charging for ride-hailing vehicles, linked with required data sharing.
Preferential electric vehicle rates	• Provide a special rate plan for electric vehicle charging. • Modify tariff structures to initially minimize or eliminate demand charges.
Electric vehicle or DC fast charger incentives	• Offer incentives for electric ride-hailing vehicles. • Offer incentives for dedicated electric ride-hailing fast-charging infrastructure.
Informational materials, cost comparison tools	• Provide information tailored to ride-hailing drivers to raise awareness and understanding of electric models, incentives, and charging options. • Offer a total cost of ownership tool specific to ride-hailing drivers and fleets to increase understanding of the economic benefits of electric vehicles.

PRIVATE SECTOR APPROACHES

Ride-hailing companies can facilitate the adoption of electric vehicles on their platforms through measures including public commitments, partnerships, driver education, and electric vehicle-friendly in-app features. Ride-hailing companies that publicly commit to increasing their volume or percentage of electric vehicles send signals to governments and automakers, and pressure competitors to do the same. Broader company commitments eventually could spark increased electric vehicle manufacturing volumes, and such commitments send a signal to help catalyze local investments in charging infrastructure to support the growing electric ride-hailing fleet.

Partnering with automakers to provide compelling electric vehicle pricing or leasing rates could greatly accelerate adoption. Lyft's Express Drive program, which offers short-term car rentals for Lyft drivers, demonstrates significant demand for electric vehicles versus gasoline models when the economics are favorable.[15] Other partnerships with cities, utilities, and charging providers could lead to opportunities for cost sharing and optimal siting for fast-charging infrastructure. Updates to in-app features can better serve electric drivers by providing more information on the length of upcoming rides and linking drop-off locations to nearby fast charging.

Ride-hailing companies also can play a more aggressive role in transitioning to electric vehicles by developing their own self-funded incentive programs. Regulatory changes in London, for example, have sparked action from the private sector to comply, and Uber initiated its own Clean Air Plan to help licensed drivers switch to electric. Uber created a 200-million-pound ($252 million) Clean Air Fund funded by a small per-mile

15 Simi Rose George and Marzia Zafar, "Electrifying the ride-sourcing sector in California," California Public Utilities Commission, Policy & Planning Division (April 2018), http://www.cpuc.ca.gov/General.aspx?id=6442457050

fee to provide its drivers with 3,000- to 4,500-pound incentives for electric vehicles. Uber also is installing rapid chargers in central London for electric vehicle drivers.

Charging providers also play a key role in accelerating electric ride-hailing, and naturally stand to benefit from greater electric vehicle adoption, including from ride-hailing vehicles with high public charging needs. Utilization rate is a key factor in the business case for fast charging, and electric TNCs offer an opportunity to significantly increase station utilization. Also, with some coordination between charging providers and TNCs, there is a relatively high ability to align plans for increased future deployment. Charging providers also could construct dedicated fast-charging hubs exclusive to ride-hail drivers to help ensure access to fast-charging infrastructure, as with the Maven Gig project with EVgo charging previously mentioned. These and other private sector actions to support electric ride-hailing are summarized in Table 6.

Table 6. Summary of private sector support actions for electric ride-hailing

Action	Description
Public commitments	• Send signals to governments, automakers, and competitors by committing to increasing the share of electric vehicles and electric driving.
Partner with automakers on deals	• Form partnerships with automakers for compelling leases for drivers to increase early volume and exposure.
Raise driver awareness through education	• Raise driver awareness and understanding with educational materials on available electric models, costs, benefits, charging, and incentives.
Partner on charging locations	• Form multi-stakeholder partnerships to collaborate on funding, installing, and identifying optimal locations for charging infrastructure, including DC fast.
Company fees to fund incentives	• Add surcharges on non-shared trips to generate revenue for supporting electric vehicle acquisition.
Support drivers with in-app features	• Update app features to facilitate electric ride-hailing by providing information on trip direction, length, and availability of fast chargers near destination.
Attractive charging rates for frequent users	• Charging providers could offer lower rates for high-use vehicles, with conditions and monthly membership programs.
Dedicated charging hubs	• Dedicate DC fast-charging hubs by utilities or charge providers for ride-hailing services to ensure access and high utilization.

EQUITY CONSIDERATIONS

Many governments are committed to pursuing equitable mobility solutions. As ride-hailing fleets make up an increasing share of urban travel, policymakers and business leaders strive to ensure the mobility benefits are broadly accessible within a mobility ecosystem. This means ensuring cities, states, utilities, and companies develop a comprehensive toolkit of emerging mobility services for efficient, low-emission, and affordable transportation that includes the most vulnerable populations. To do so, it is key that equity becomes a crosscutting element that touches the policy approaches previously discussed for ride-hailing fleets and other new mobility business models.

Cities are increasingly studying equity and including equity-focused goals within their policy approaches to new mobility business models. The San Francisco County Transportation Authority (SFCTA) assessed how emerging mobility companies like ride-hailing fleets contribute to city priorities such as equitable and disabled access.[16] The findings were mixed: TNCs increase mobility by providing service over weekends and at late-night hours, as well as in underserved areas where transit is insufficient; however, TNCs typically do not provide low-income fare options, multi-language support, or access for those without smartphones. In addition, there have been questions about racial, gender, and age discrimination. Seattle's new mobility playbook confronts these issues with principles and actions as associated policies are being developed.[17]

Access to data is critical to better understand how TNCs enhance or diminish transportation equity, and all associated policy activities could at a minimum include data reporting activities. Data that TNCs and other mobility services generate can reveal inequities and inform smarter policy. Pilots, partnerships, and permits are a good first step to help fill data and knowledge gaps by implementing data reporting requirements and verification. Policymakers could define equity metrics and evaluation criteria to track and measure impacts such as user statistics, spatial distribution of service locations, access times, and fares. Guided by data and metrics, a series of incentives, subsidies, and regulations can help steer the benefits of emerging mobility toward the groups who need them most.

Many of the previously discussed incentive-based "carrot" policy approaches motivate companies to electrify their fleet financially, with priority access, or through other perks. Policymakers could set criteria for eligibility, such that only companies that are committed to and demonstrating equitable access qualify. Furthermore, situations where cities or states have implemented TNC pricing schemes, such as Chicago create an important opportunity: Governments could direct some of the revenues to subsidize mobility options for disadvantaged and underserved communities that especially need but are underserved by TNCs.

Other equity-minded approaches for TNCs are being explored. Uber and Forth Mobility's FUTURO collaboration enhances mobility for underserved communities in the Portland, Ore., area, by coordinating subsidized rides without requiring information such as licensing, social security, credit card, or smartphone.[18] The Pinellas Suncoast Transit Authority in Florida partners with TNCs to expand affordable options and bridge transit gaps with first- and last-mile connections. The agency removed low-ridership bus routes and shifted the funds to subsidize TNC rides connecting riders with transit for $1. The partnership also provides some low-income residents with free on-demand rides when bus service is unavailable, as well as a phone dispatch service for groups without smartphones.[19] Such programs could be adapted to promote electrification and linked with the city and data promotion policies investigated above.

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16 San Francisco County Transportation Authority, "Emerging mobility evaluation report," (July 2018), https://www.sfcta.org/sites/default/files/Emerging%20Mobility%20Studies_exec_summary.pdf

17 Seattle Department of Transportation, "New mobility playbook," (September 2017), https://newmobilityseattle.info

18 Alexa Diaz and Catherine Teebay, "The future of car sharing: Electric, affordable, and community-centered," (Forth Mobility, 2018), https://forthmobility.org/CEVreport

19 Shared-Use Mobility Center, "How did Pinellas County, Florida become Uber's suburban laboratory?" (October 5, 2016), http://sharedusemobilitycenter.org/news/pinellas-county-florida-become-ubers-suburban-laboratory/

Government incentives and preferential access to lanes, parking, and charging for electric ride-hailing fleets could be made eligible to companies that are enacting similar programs and committed to equitable mobility.

State-level approaches already have emerged. In California, several equity-focused electric vehicle policies have been adopted, including restricting incentives for high-income buyers, increasing rebates for low-income buyers, linking higher rebates to vehicle scrappage, deploying electric vehicles in carsharing and ride-hailing fleets to broaden access, and directing charging infrastructure toward disadvantaged communities. These policies are in their early stages, and seem key to broadening the market, especially with the entrance of lower-cost models into the fleet. Continued efforts to accelerate the market and integrate electric vehicles within ride-hailing fleets can further expand access to electric mobility.

CONCLUSIONS

Ride-hailing fleets, and transportation network companies more generally, have experienced explosive growth over the past six years. Their transformative impact on urban mobility, congestion, and pollution make the ride-hailing sector a clear target for attention from transportation and environmental policymakers. For cities, states, and other stakeholders seeking measures to minimize the environmental and social externalities from these fleets, electrification offers a major opportunity.

Early electric ride-hailing projects show great promise. Based on innovative initiatives underway globally, ride-hailing fleets' unique characteristics offer advantages relative to electrifying private cars. Ride-hailing fleets can educate their drivers about the large fuel savings of electric vehicles and can, with their financing companies, guide and facilitate vehicle acquisitions at more affordable low-interest financing or leasing rates. As the size of these companies increases, their purchasing power eventually can lead to purpose-built vehicles for ride-hailing service. Electric ride-hailing vehicles especially accelerate the transition to electrification by accruing far more electric miles per vehicle than private vehicles, providing zero-emission travel options to many who do not otherwise have access. Our examination reveals two high-level policy findings for electrifying ride-hailing fleets.

Policy tools can break down the prevailing barriers and accelerate electric ride-hailing. States have the authority to regulate the emissions performance of ride-hailing vehicles. Based on the prevailing barriers and technology developments, emissions requirements that essentially require hybrids by the early 2020s, then shift toward all electric vehicles through the mid-2020s, would be appropriate. State agencies also could ensure electric ride-hailing vehicles are eligible for purchasing incentives. Local governments can use their authority over curbside loading, curbside parking, transit-only lanes, and parking facilities in key locations to offer a competitive edge to electric shared vehicles. Cities with low-emission zones, zero-emission areas, and congestion pricing can prioritize access to electric shared vehicles. To ensure ride-hailing fleets are integrated into a broader mobility ecosystem that works for all, these policies would include a transit equity element. Many ride-hailing drivers live in multi-unit dwellings, making electric vehicle-ready building codes and charging deployments at or near apartments important to enable overnight charging.

A comprehensive charging infrastructure network will be critical for ride-hailing fleets to transition to all electric. New electric vehicles with 250-plus miles in electric range and fast-charging capabilities will be critical, but not a panacea. A robust charging ecosystem remains important to meet different ride-hailing drivers' needs. To function best, optimally located charging infrastructure is needed, meaning near ride-hailing drivers' homes, near dense urban areas where much of the driving occurs, near places where drivers naturally take breaks, and near major destinations such as airports. Much of the associated public charging will likely need to be direct current fast charging, to minimize driver downtime charging, driving to stations, and queuing. Ride-hailing companies have direct knowledge of vehicles and driving patterns and therefore can partner with utilities and charging providers to deploy high-utilization charging networks. Utilities also can establish preferential electric ride-hailing rates—for example, for fleet operations that help utilities manage local loads—to ensure affordable electric charging. Public utility commissions could direct or give guidance for charging infrastructure investments to be aligned with state goals to electrify ride-hailing fleets.

Beyond the policy actions summarized in this briefing, many more ideas, policies, incentives, business practices, and partnerships are emerging that could help accelerate the electrification of ride-hailing fleets. Although we examine government policies, several ride-hailing companies have demonstrated similar approaches either in city-specific pilots or in companywide targets. This briefing is focused on the policy context of the United States, but more progressive actions regarding urban zero-emission zones, like those in Europe, and much stronger vehicle and fleet regulations, like those in China, would go much further than the policy ideas discussed here. It is, to be sure, very early in the shift toward electric vehicles and shared vehicle fleets, so there are still many more policy and industry innovations to come. The sooner governments and ride-hailing companies act together to overcome prevailing barriers, the faster the learning and ultimate transition to electric will occur.