DOCKETED	
Docket Number:	20-IEPR-02
Project Title:	Transportation
TN #:	235683
Document Title:	Policy Pathways to TNC Electrification in California [REVIEW DRAFT]
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Filer:	Raquel Kravitz
Organization:	California Energy Commission
Submitter Role:	Commission Staff
Submission Date:	11/18/2020 2:36:14 PM
Docketed Date:	11/18/2020

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Policy Pathways to TNC Electrification in California [REVIEW DRAFT]

ISSUE PAPER
May 2020

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Summary

Electrifying Transportation Network Company (TNC) vehicles is a high-impact strategy for reducing emissions. Given the market upset associated with the COVID-19 pandemic, there are many unknowns associated with future TNC use and impacts. But under pre-pandemic market circumstances, TNC vehicles drove more than three times the average distance of non-commercial vehicles[i] and emitted 50% more greenhouse gases (GHGs) per passenger mile.[ii] While TNC vehicles made up a small percentage of overall vehicle use, the number of people who used TNCs has increased substantially over the last several years, doubling from 23% in 2015 to 46% in 2018.[iii]

The California legislature took its first step towards addressing TNC emissions in 2018 by establishing the Clean Miles Standard Program. The program requires TNCs to reduce emissions beginning in 2021, relying on a flexible metric of GHGs per passenger mile to evaluate progress. This metric allows TNCs to reduce emissions by either increasing the number of zero- or low-emissions vehicles in their fleets, or by increasing pooling (the number of people in each vehicle). Given that both Uber and Lyft paused shared-ride service in TNCs in the U.S. and Canada during the peak of the pandemic,[iv] the former option will likely take on outsized importance.

This issue paper **synthesizes research related to electrification of TNC vehicles and considers policy pathways for addressing barriers to electric-vehicle (EV) use among TNC drivers.** Only 0.5% of the 2–3 million TNC drivers in the United States currently drive EVs. A primary barrier to wider EV adoption is the larger upfront cost of an EV relative to a conventional vehicle, a barrier that persists despite the potential for EV ownership to yield long-term savings. The short-term nature of this barrier speaks to a need for additional policies—such as purchase incentives for used EVs or support for TNC-EV rental programs—that can make EV access more equitable for TNC drivers.

Other barriers include charging availability and speed. Nearly a third of TNC-EV drivers do not charge at home, and TNC EVs account for 40% of all non-Tesla public fast-charger use.[v] Policymakers could accelerate TNC electrification by expanding public charging infrastructure. Public charging networks should include co-funded charging hubs as well as dedicated chargers or a priority-access system for TNC drivers. Strategically pricing public charging could benefit the environment and TNC drivers alike, partly because TNC drivers are more likely to charge during sunny, midday, off-peak times, when utilities may have greater access to lower-cost solar electricity.

This paper aims to inform stakeholders in the California legislature, the California Air Resources Board, other California agencies, and other states as they consider pathways to reduce TNC emissions. We note that this policy arena is evolving rapidly. Incorporating comprehensive data collection into TNC policy will enable research to keep up, so that policymakers can effectively iterate and respond to needs of a changing transportation sector.

[i] Jenn, Alan (2019). "Emissions Benefits of Electric Vehicles in Uber and Lyft Services." National Center for Sustainable Transportation. NCST Report. https://escholarship.org/uc/item/15s1h1kn.

[ii] California Air Resources Board (2019). "Clean Miles Standard 2018 Base-year Emissions Inventory Report." Sacramento, CA, 2019. https://ww2.arb.ca.gov/sites/default/files/2019-12/SB%201014%20-%20Base%20year%20Emissions%20Inventory_December_2019.pdf.

[iii] Circella, Giovanni, Grant Matson, Farzad Alemi, and Susan Handy (2019). "Panel Study of Emerging Transportation Technologies and Trends in California: Phase 2 Data Collection." UC Davis: National Center for Sustainable Transportation. https://escholarship.org/uc/item/35x894mg.

[iv] Bond, Shannon (2020). "Uber, Lyft Halt Shared Carpool Service In U.S. And Canada." NPR.org (blog). https://www.npr.org/2020/03/17/817240060/uber-lyft-halt-shared-carpool-service-in-u-s-and-canada.

[v] Sanguinetti, Angela, and Kenneth S. Kurani. (2020). "Characteristics and Experiences of Ride-Hailing Drivers with Plug-in Electric Vehicles." Institute of Transportation Studies at the University of California, Davis. https://escholarship.org/uc/item/1203t5fj.

1 Introduction

Although California is meeting its overall greenhouse gas emissions (GHG)-reduction targets, it is not yet on schedule to meet reduction targets for the transportation sector. California can efficiently make progress towards GHG-reduction goals for transportation by targeting high-mileage vehicles, like those serving Transportation Network Companies (TNCs). TNCs (e.g., Uber and Lyft) in California travel an average of 180 miles per day, significantly more than the average personally owned vehicle (23 miles per day in the Bay Area). Electrifying a single TNC vehicle therefore has a greater GHG impact than electrifying a single personally owned vehicle. Because TNCs also charge during the day—when solar-power supply is high—much more often than personally owned vehicles, TNC-EVs can more easily rely on renewable energy for charging. Given these two factors, electrifying a TNC vehicle using daytime charging would yield estimated emissions savings three times greater than electrifying a personally owned vehicle.[1] In order to capture the effects of both fuel and occupancy, California's recently implemented Clean Miles Standard Program evaluates TNC emissions impacts in terms of GHGs per passenger mile traveled (PMT). The California Air Resources Board (CARB) currently estimates that TNC vehicles operate at an average baseline of 301 gCO_2/PMT, which is approximately 50% higher than the average emissions impacts of passenger vehicles.[2] Managing TNC emissions is therefore a high-impact policy strategy and electrifying TNC vehicle fleets will be an important component of a broader emission reduction strategy.

It is important to note that TNCs do not typically own vehicle assets: TNCs are simply brokers that connect individual passengers with drivers.[3] As such, TNCs cannot directly invest in cleaner fleet vehicles. This differentiates TNCs from Transportation Charter Party-Carriers (TCPs) such as limousine or charter bus companies, which own, broker, and operate rides. While some TNCs or TNC components may transition to a TCP business model in the future, near-term TNC policies should assume that the majority of the TNC vehicles are owned by individual drivers. Policies designed to accelerate TNC electrification should therefore focus on incentives and disincentives that encourage individual TNC drivers to choose to drive electric.

This issue paper synthesizes research findings presented at a UC Davis workshop series that hosted the California legislature, the California Air Resources Board (CARB), the California Energy Commission (CEC), the California Public Utility Commission (CPUC), TNC representatives, as well as other industry and government stakeholders. The goals of this paper are to (1) highlight opportunities and barriers for TNC electrification and (2) present a list of potential policy pathways for accelerating TNC electrification equitably and efficiently.

2 Research Synopses

2.1 Trends in TNC Use

The COVID-19 pandemic will likely have an effect on TNC use, especially shared TNC use. Lyft and Uber, the two main U.S. TNCs, paused the shared-ride features on their apps in March 2020.[4] When the shared-ride feature will return is currently unknown, and future user adoption rates are difficult to predict. Fears of sharing rides with other passengers will likely linger, even as TNC usage increases. The unknowns associated with a post-pandemic travel market will likely point towards electrification playing a more prominent role in TNCs meeting Clean Miles Standard Program goals.

What is known is that prior to the pandemic, TNC ridership was up. Trends showed increasing TNC use among all income groups. Nearly 56% of respondents to a 2018 UC Davis survey reported having used a TNC, compared to

[1] Jenn, Alan (2019). "Emissions Benefits of Electric Vehicles in Uber and Lyft Services."
[2] California Air Resources Board. (2019). "Clean Miles Standard 2018 Base-year Emissions Inventory Report."
[3] TNC drivers are currently classified as independent contractors, but may be considered employees in the future due to California's Assembly Bill (AB) 5. This issue paper assumes that TNCs do not own the majority of vehicles in their fleet, regardless of driver employment status.
[4] Bond, Shannon (2020). "Uber, Lyft Halt Shared Carpool Service In U.S. And Canada."

only 26% in 2015.[5]

The 2018 survey also points to shared TNC ridership as highest among respondents with a car-free (or car-light) lifestyle. The survey reports that shared TNC services, which are cheaper and therefore capture a more cost-sensitive clientele, are more often replacing public transit and active modes of travel (e.g., walking and bicycling) than single-user TNC services.[6,7,8]

2.2 EV Purchase Barriers

Purchasing an EV and installing high-voltage home-charging infrastructure is more expensive than purchasing a comparable conventional, gas-powered vehicle. Electrifying TNC vehicles is an equity issue because TNC drivers tend to be lower-income and lack access to capital needed to finance the relatively high upfront costs of EV ownership. As such, these drivers cannot realize the long-term net savings that EV ownership can provide.[9,10,11]

Federal purchase incentives address this issue by offsetting the "sticker price" for an EV by $2,500–$7,500, thereby bringing the purchase cost for a typical EV closer to the purchase cost for a typical gas-powered vehicle. Many states have additional policies to augment federal purchase incentives, some of which include equity considerations. In California, an additional incentive of $1,500–$5,000 is available for households earning less than $150,000.[12] Another $2,000 is available for households earning below 300% of the federal poverty line. These incentives make EVs more affordable, but do not fully eliminate financial barriers to EV purchases for many lower-income TNC drivers. Another barrier to EV adoption among TNC drivers is lack of garage access or convertible outlets to make home fast charging a possibility.[13,14]

EV rental programs are a nascent strategy for addressing EV purchase barriers among TNC drivers. In such programs, drivers can access EVs for short-term use. The vehicles can be owned and operated by TNCs or rental-car companies. These companies can more easily amortize the costs of EV investments and can use bulk procurement to reduce per-vehicle purchase price. The state of Colorado is partnering with Lyft and Electrify America (Volkswagen) to add 200 EVs to its Flexdrive platform,[15] which allows TNC drivers to rent vehicles to earn on the Lyft platform. The program will subsidize Lyft up to $5,000 per vehicle in EV tax credits with the addition of each fleet vehicle in exchange for the reduced fleet emissions.[16]

Prior to this Colorado program, the only attempt at providing EV rental options for TNC drivers was from the private sector. Maven Gig, a former subsidiary of General Motors, began renting EVs in 2017 and ramped up operations over its first years of service, only to cease operations in April 2020. Maven Gig rented Chevrolet Bolts

[5] Circella, Giovanni, et al. (2019). "Panel Study of Emerging Transportation Technologies and Trends in California: Phase 2 Data Collection."
[6] Ibid.
[7] Circella, Giovanni, and Lewis Fulton (2017). "The Impact of Shared Mobility on the Use of Other Transportation Modes and Auto Ownership among Millennials and Middle-Age Adults in California." National Center for Sustainable Transportation. https://ncst.ucdavis.edu/project/impact-shared-mobility-use-other-transportation-modes-and-auto-ownership-among-millennials.
[8] Slowik, Peter, Nikita Pavlenko, and Nic Lutsey (2019). "Emerging Policy Approaches to Electrify Ride-hailing in the United States." The International Council on Clean Transportation. https://theicct.org/publications/policy-briefing-electrify-ridehailing.
[9] Savings will likely change dramatically due to the price of oil dropping significantly.
[10] Berliner, Rosaria, and Gil Tal (2018). "What Drives Your Drivers: An In-Depth Look at Lyft and Uber Drivers." Institute of Transportation Studies at UC Davis. https://itspubs.ucdavis.edu/wp-content/themes/ucdavis/pubs/download_pdf.php?id=2851.
[11] Transportation Research Board and National Research Council (2015). "Overcoming Barriers to Deployment of Plug-in Electric Vehicles." Washington, DC: The National Academies Press. https://doi.org/10.17226/21725.
[12] Discounts on plug-in electric vehicles are limited to those earning under $150,000 for single filers; $204,000 for head-of-household filers; and $300,000 for joint filers.
[13] California Air Resources Board (2019). "Assembly Bill 615 Report to the Legislature on the Impact of the Clean Vehicle Rebate Project on California's Zero-Emission Vehicle Market." https://ww2.arb.ca.gov/sites/default/files/classic//research/apr/reports/AB%20615-Clean%20Vehicle%20Rebate.pdf.
[14] Fuller, Sam, and Austin Brown (2020). "The Effects of Equitability Policies on the ZEV Market: Evidence from California's Clean Vehicle Rebate Project." Policy Brief. UC Davis Policy Institute for Energy, Environment, and the Economy. https://escholarship.org/uc/item/3kj611tv.
[15] Lyft Colorado (2019). "Express Drive." https://www.lyftcolorado.com/flexdrive.
[16] Bosselman, Andy (2019). "Lyft to Add 200 Electric Vehicles to Its Colorado Fleet." StreetsBlog. https://denver.streetsblog.org/2019/11/14/lyft-to-add-200-electric-vehicles-to-its-colorado-fleet/.

to TNC drivers. The rentals included all charging fees in a flat-rate weekly rental cost.[17,18] More research is needed to understand why this private-sector option was not successful, and to assess opportunities for public subsidies for short and long-term EV rental models. This may require partnerships with automakers since rental car availability is intrinsically linked to auto sales markets.

2.3 Charging Infrastructure

TNC electrification lags electrification of personally owned vehicles. In 2017, only about 1% of vehicles serving TNCs in California were electric, compared to 7% of all new vehicles sold in California.[19,20] Of the 2–3 million TNC drivers in the US, only 0.5% drive an EV. Research from UC Davis indicates that availability of charging infrastructure strongly affects the feasibility of TNC electrification. EVs serving TNCs charge more often at public charging stations than at private charging stations, and rely almost exclusively on DC fast chargers.[21] In fact, TNC EVs account for 40% of all non-Tesla public fast-charger use. Reliance on public charging is particularly heavy for TNC drivers who use battery electric vehicles (BEVs) rather than plug-in hybrid electric vehicles (PHEVs). Research indicates that TNC-BEV drivers in California complete 27% of their charging at home, while TNC-PHEV drivers complete 58%. 32% of EV TNC drivers in California do not charge at home at all.[22]

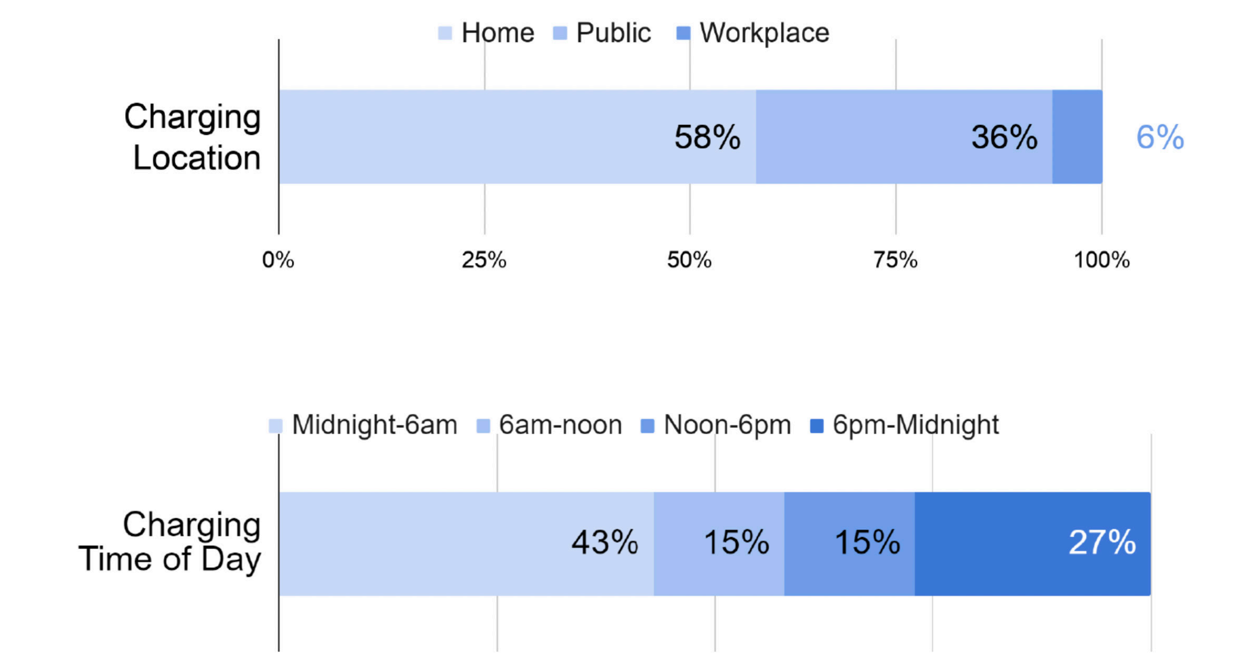

Figure 1. *Charging behavior of TNC-EV drivers, according to research from Sanguinetti and Kurani.[22]*

TNC-EV drivers may rely on public chargers because they lack (or are unaware of) charging options at home. This is especially true in urban areas, where TNCs are more popular and drivers are more likely to be renters in multi-unit buildings that provide limited or zero access to charging. Use of short-term rental EVs further disincentivizes home charging. EV renters are unlikely to pay for the additional rental time needed for home charging, which is often slow and located far away from commercial centers (whereas public chargers are fast and can be easily used during down time between rides). The problem is exacerbated by the fact that some TNC partnerships with rental

[17] MavenGig (2020). "About." https://mavengig.maven.com/us/en/.
[18] Ets-Hokin, Gabe (2019). "Here's What It Was Like to Rent an Electric Car From Maven Gig for Rideshare Driving." https://therideshareguy.com/maven-gig-review/.
[19] George, Simi R., and Marzia Zafar (2018). "Electrifying the Ride-Sourcing Sector in California." California Public Utilities Commission. https://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/About_Us/Organization/Divisions/Policy_and_Planning/PPD_Work/PPD_Work_Products_(2014_forward)/Electrifying%20the%20Ride%20Sourcing%20Sector.pdf.
[20] Slowik, Peter, et al. (2019). "Emerging Policy Approaches to Electrify Ride-hailing in the United States."
[21] Jenn, Alan (2019). "Emissions Benefits of Electric Vehicles in Uber and Lyft Services."
[22] Sanguinetti, Angela, and Kenneth S. Kurani. (2020). "Characteristics and Experiences of Ride-Hailing Drivers with Plug-in Electric Vehicles."

companies include unlimited charging in rental fees, meaning that the cost of public charging does not discourage public charger use.[23] This has led to overcrowding and increasing wait times at public chargers—for TNC EVs and personally owned EVs alike.

The aforementioned Jenn report also compared the charging behavior of TNC drivers in San Diego, Los Angeles, and San Francisco to the behavior of drivers of personally owned vehicles.[24] The results showed that (1) availability and speed of charging significantly impacts the work day of a TNC-EV driver, (2) range is a critical determinant of an EV's capacity to accommodate the travel demands of a TNC, (3) TNC-EVs charge more often at public stations than private ones, and (4) TNC-EVs are more likely to charge at "off peak" times and almost exclusively at fast chargers. The same report found that, on average, electrification of a single vehicle in a TNC fleet saves about 1,000 tons of CO_2 emissions, or about three times the CO_2 savings of electrifying a single personal vehicle.

UC Davis research studying the demographics and driver experiences of TNC drivers found that TNC drivers tend to be younger, less educated, and less wealthy than EV drivers as a whole.[25] Of the TNC drivers who do use EVs, most use PHEVs and a majority own rather than rent their vehicle. The stated motivations of TNC drivers for using an EV were (in order): saving money on fuel, environmental reasons, saving money on maintenance, and using the carpool lane. Drivers also noted that their experience using EVs for TNC service could be improved with longer-range EVs, more charging locations, improved financial incentives, and provision of more information before accepting a ride (in order to better plan charging).

Overall, research suggests that expanding access to public charging—and particularly public fast charging—will be essential to successful, large-scale TNC electrification. Other policy pathways include incentivizing home charging for TNC EV drivers who have access, and providing EV purchase incentives and financing options for TNC drivers to alleviate the high upfront costs associated with EV ownership. These pathways are discussed further below.

3 Policy Pathways

A recent paper from the International Council on Clean Transportation (ICCT) presents three major policy pathways towards TNC electrification: pricing signals and incentives, infrastructure support, and data collection. This section builds off of the ICCT framework to suggest specific policy actions to accelerate TNC electrification in California. The proposed policies are summarized in Table 1.

3.1 Pricing Signals and Incentives

High upfront purchase costs, opportunity costs of charging, and explicit costs of purchasing electricity from public fast chargers represent some of the greatest barriers to EV adoption in general. Each of these costs can also discourage EV adoption among TNC drivers. Various price signals and incentives can help address cost barriers and encourage TNC electrification.

Pricing strategies to bring more EVs into use for TNC services include:

- <u>Purchase incentives:</u> Sales rebates, tax exemptions, and financing plans that are not now readily available to TNC drivers could help reduce the high initial costs of purchasing an EV, especially for low-income owners. These incentives could be directed at and/or increased for TNC companies and drivers.
- <u>Support for EV rentals:</u> Public operation of or subsidies for EV rental programs could create affordable options for individuals interested in TNC driving but unable to purchase EVs.

Pricing strategies to improve charging:

[23] Lyft, Inc. (2019). "Making Cities More Livable with Electric Vehicles." https://www.lyft.com/blog/posts/making-cities-more-liveable-with-electric-vehicles.
[24] Jenn, Alan (2019). "Emissions Benefits of Electric Vehicles in Uber and Lyft Services."
[25] Sanguinetti, Angela, and Kenneth S. Kurani. (2020). "Characteristics and Experiences of Ride-Hailing Drivers with Plug-in Electric Vehicles."

- Right-of-way charging: TNCs could have dedicated chargers or a "fast lane" structure to minimize revenue lost while waiting for an open fast charger at public stations.
- Time-of-day or location-based pricing: Targeted pricing strategies could provide reduced rates for TNC drivers who charge at off-peak hours and/or at underutilized chargers.
- Charging rebates for TNC EV drivers from utility companies: Providing rebates to offset costs of charging by TNC drivers would make EVs more attractive for TNC drivers, but would require coordination among utility companies, TNCs, charging companies, and possibly public utility commissions.

Alternative utility pricing for charging hubs:

- Implement new energy rate structures: New rate structures could be put in place for commercial properties that wish to serve as charging hubs for TNCs. Under current policy, owners of such properties would pay peak-demand rates (monthly rates based on highest monthly usage). If alternative rates were available, this would allow charging hubs (which are likely to have high daytime peak usage) to incentivize certain charging behavior. For example, a charging hub could offer variable pricing to respond to queuing issues or capture savings from utilities for using off-peak electricity.

The relative effectiveness of pricing strategies depends on criteria that can vary in different TNC markets. For instance, direct financial purchase incentives will be more important in markets that do not provide drivers with EV rental options. Pricing signals will be more important if charging infrastructure in a particular market is limited (to encourage drivers to charge during off-peak hours), or if a TNC does not cover or subsidize charging costs for drivers. Finally, it is worth mentioning that any EV-TNC pricing structures will not exist in a vacuum. Policy makers will need to balance their objectives for reducing emissions from TNCs with other price incentives aimed at addressing equity or congestion.

3.2 Infrastructure support

There is a "chicken and egg" problem when it comes to EV charging infrastructure. Drivers are reluctant to adopt EVs if insufficient charging infrastructure is available, while charging companies are reluctant to install additional chargers if insufficient market demand is observed. Policymakers can encourage the expansion of charging networks through:

- Co-funded charging hubs: Co-funded charging hubs lower financial barriers to charger installation by distributing the cost burden among TNCs, cities, utilities, and property owners, all of whom benefit from electric TNCs. Co-funded hubs should be located where TNCs frequently drive and/or need charging. As mentioned above, utility cooperation will be needed to implement rate structures that make charging hubs feasible.
- Dedicated fast chargers: Public fast chargers dedicated for TNC use could be installed, especially around commercial hubs where TNC use is more prevalent or desired than use of personal vehicles. Dedicated chargers could be strategically located to complement public transit and encourage ride pooling.

3.3 Data Collection

TNC electrification is still in a nascent stage. Data reporting from TNCs could inform development of future TNC electrification programs. Such data could help plan infrastructure locations and optimize time-of-use or location-based price signals. Effective data-collection efforts will require coordination among stakeholders to ensure that data are collected in a way that is consistent, secure, and does not impose a substantial administrative burden.[26]

- Require data reporting: TNCs, charging providers, and utilities could be required to collect certain types

[26] D'Agostino, Mollie, Paige Pellaton, and Austin Brown (August 2019). "Mobility Data Sharing: Challenges and Policy Recommendations." UC Davis Policy Institute for Energy, Environment, and the Economy. https://escholarship.org/uc/item/4gw8g9ms.

of data (e.g., on vehicle miles traveled by TNC-EVs relative to other types of vehicles, on charger use at different locations and times of day, on the price of electricity used for EV charging, etc.) and report these data to policymakers and regulators.

- Provide strategic access to sensitive datasets: Removing personally identifiable information (PII) from data and aggregating data as much as possible (while maintaining the data's value) should be standard practices when it comes to transportation data. Yet even these steps may not be enough to fully obscure user identify for certain transportation data. To protect consumer privacy, access to those data should be provided strategically. This could involve storing data on a secure, third-party platform only open to certain government officials (for planning purposes) and by designated researchers except in special cases.

Table 1. Policy pathways for TNC EV adoption*

Pathway	Policy Mechanism	Implementing Party/Parties in California	Challenges/Barriers
Pricing signals and incentives	Support for EV rentals	CTC, CARB, CEC, rental companies, TNCs**	Cost
	Purchase incentives	CPUC***, CEC, utilities	Cost
	Time-of-day or location-based pricing for charging	CPUC, CEC, utilities, regional planners, cities, TNCs	Implementation
	Residential charging rebates	CPUC, CEC, utilities, TNCs	Cost
Infrastructure support	Co-funded charging	CPUC, CEC, utilities, cities, TNCs, charging companies, property owners	Cost, coordination
	Dedicated chargers	Utilities, cities, TNCs, property owners	Implementation, coordination
Data collection	Require data reporting	TNCs, states, cities, utilities, CPUC, TNC drivers, property owners, charging companies	Coordination, implementation, popularity

* CTC = California Transportation Commission; CARB = California Air Resources Board; CPUC = California Public Utilities Commission; CEC = California Energy Commission.
** "TNCs" in this table refers to both companies and drivers.
*** The California Public Utilities Commission (CPUC) is the regulatory agency in California responsible for the regulation of TNCs and utilities.

4 Conclusion

TNC electrification can deliver disproportionately large GHG emissions benefits relative to the size of TNC fleets. Maximizing TNC electrification in an efficient and equitable way will require a thoughtful, multipronged approach. TNC electrification policies must be tailored to accommodate the unique business structures, variable driving patterns, high mileages, and specific charging needs of TNCs and TNC drivers.

State and local policies targeted at EV purchases and EV charging infrastructure can help overcome cost barriers for EV adoption by TNCs and TNC drivers. Current policies are targeted at privately owned vehicle sales, but these can be slightly modified to incentivize EV usage by TNCs. The increased investment in incentives would be offset by the fast payback period for TNCs and emissions savings.

Development of such policies should innclude input from stakeholders including TNC drivers, rental companies (both independent and affiliated), peer-to-peer carsharing services, utilities and community choice aggregators, fast-charging providers, the hydrogen-fuel-cell community, and cities and municipalities. Further research should investigate the economics of shared fleets under different electrification pathways and include identification of the potential effectiveness and the risks of each policy pathway.