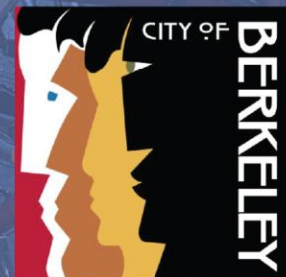# Berkeley Electric Mobility Roadmap

April 2020

CITY OF BERKELEY

Acknowledgements

The City of Berkeley would like to acknowledge the contributions of all who shared their input, guidance, and support for the development of this Roadmap. This list includes hundreds of people such as the individuals who took the online survey, participated in interviews and the stakeholder workshop, shared feedback during public events, and took the time to review the draft Roadmap and provide thoughtful written and verbal comments. Thank you.

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- Center for Independent Living
- World Institute on Disability
- Berkeley Black Ecumenical Ministerial Alliance (BBEMA)
- Church by the Side of the Road/Green the Church
- GRID Alternatives
- Satellite Affordable Housing Developers
- Berkeley Housing Authority
- Resources for Community Development
- BRIDGE Housing
- Building Opportunities for Self-Sufficiency (BOSS)
- Bay Area Organization of Black Owned Businesses (BAOBOB)
- TransForm
- Ecology Center
- Rising Sun Center for Opportunity
- Alameda County Transportation Commission
- Bay Area Air Quality Management District
- PG&E
- East Bay Community Energy (EBCE)
- University of California – Berkeley

- Lawrence Berkeley National Laboratory
- Berkeley Energy Commission
- Berkeley Community Environmental Advisory Commission
- Berkeley Transportation Commission
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- ChargePoint
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- GM Maven
- Envoy
- Walk Bike Berkeley
- 350 East Bay
- AC Transit
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- City of Berkeley Staff

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Executive Summary

The City of Berkeley has a strong history of sustainability leadership. In 2006, Berkeley voters overwhelmingly endorsed a ballot measure to reduce the community's greenhouse gas emissions by 80% below 2000 levels by 2050. In 2018, Berkeley City Council signaled the urgency and importance of climate action by declaring a Climate Emergency and the goal of becoming a Fossil Fuel Free City as soon as possible. Also in 2018, Governor Brown signed Executive Order B-55-18, committing California to carbon neutrality by 2045.

With transportation responsible for 60% of Berkeley's greenhouse gas emissions, carbon neutrality cannot be achieved without electric mobility. Cleaner electricity, now available through East Bay Community Energy, and State and local commitments to 100% renewable electricity by 2045, give electrification tremendous promise. The Berkeley Electric Mobility Roadmap is an essential building block of Berkeley's overall climate strategy.

This effort will not be easy. Transportation was the only sector in which Berkeley's emissions rose between 2000 and 2016. Furthermore, because high-quality transportation options are critical to residents' livelihood and well-being, this Roadmap must also equitably support access to opportunity. This Roadmap focuses on the movement of people, rather than freight. In doing so, it supports alternatives to driving, such as walking, biking, and quality public transit for all stakeholders.

This Roadmap centers equity by acknowledging and addressing the inequalities of our current transportation system. Early engagement of community-based organizations and nonprofits helped to identify important mobility gaps for low-income constituents, renters, communities of color, people with disabilities, and other priority stakeholders. Equity was used as a lens through which all proposed strategies were filtered.

The guiding vision established for the Electric Mobility Roadmap **is to create a fossil fuel-free transportation system that integrates with and supports the City's ongoing efforts to increase walking, biking, and public transportation use in Berkeley, and ensures equitable and affordable access to the benefits of clean transportation.** The following goals were identified to guide the creation and implementation of the Roadmap to achieve Berkeley's vision for inclusive electric mobility:

1. **Ensure Equity in Access to Electric Mobility:** *Maximize Electric Mobility Benefits in Underserved Communities*: The City is committed to equity in electric mobility, both in the process of developing the Roadmap as well as in implementing equitable solutions that are meaningful and measurable,

and that ensure the clean air and economic benefits of a transition to electric mobility are inclusive and accessible to underserved communities and businesses.

2. **Improve Alternatives to Driving:** *Shift trips to walking, cycling, and shared electric modes*: A key goal of this Roadmap is to complement Berkeley's efforts to shift trips to walking, biking, and shared modes to reduce congestion, improve quality of life, and support healthier outcomes from increased physical activity and reduced transportation pollution. The Roadmap focuses on increasing the accessibility of active and shared electric mobility options in Berkeley, particularly as the population continues to grow.

3. **Achieve Zero Net Carbon Emissions:** *Eliminate emissions from private vehicles:* Clean, safe, and attractive alternatives to driving are critical; in addition, the remaining vehicles must become carbon-free. This Roadmap goal is to scale adoption of light-duty electric vehicles (EVs) in Berkeley to a level that will enable the City to reach carbon neutrality by 2045, if not before. The City and its stakeholders envision increasing awareness and education about EVs, increasing access to EV charging options, and increasing the amount of clean energy to power EVs.

4. **Demonstrate City Leadership:** *Lead by example and guide the electric mobility transition:* The City aims to lead by example by accelerating electrification of the city fleet, and by taking tangible, meaningful, city-led actions to increase equitable electric mobility. Additionally, the City will guide implementation of the Roadmap, and will continue adjusting the plan as transportation trends and market conditions evolve.

While the vision and goals of this Roadmap are ambitious, the City has already shown leadership in electric mobility adoption. In 2017, Berkeley had the seventh highest EV sales share of cities in California (16%), and by mid-2019 had 105 publicly listed EV charging ports. In addition, a variety of other electric mobility options are becoming available to the Berkeley community, including eight new electric school buses, several hydrogen fuel cell and battery-electric buses for AC Transit, Bay Wheels' shared pedal assist e-bikes, and an anticipated electric scooter pilot. The Roadmap builds on a strong record of action at the City level as well as on available programs, policies, and regulations to support electric mobility at the state, region, and utility

scales. In the past several years, the City has installed over 70 public EV charging ports, streamlined permitting for home EV charging, increased requirements for EV readiness in new construction, implemented a residential curbside EV charging pilot, conducted electric mobility outreach through the City's website, and hosted annual Ride Electric events and EV 101 workshops.

Even with this progress, the urgency of the climate crisis necessitates a rapid increase in electric mobility adoption. To reach zero net carbon by 2045, scenario modeling conducted for the Roadmap indicates that EV sales shares would need to reach about 90% by 2025 and nearly 100% by 2030 (up from 16% in 2017). This translates to EVs being approximately 25% of the community-wide in-use fleet by 2025, 55% by 2030, and 100% by 2045.

Achieving the ambitious goals set forth in this Roadmap requires electric mobility options to become ubiquitous and well-utilized, with benefits that are broadly shared. The Roadmap explores solutions to the key barriers to adoption of electric mobility, including cost and financial access, education and awareness, access to EV charging, physical challenges and disabilities, and technology access. These barriers must also be viewed within the broader context of regional and systemic challenges that have led to unreliable transportation options and longer commutes, particularly for low-income communities and communities of color, due to displacement and the increasing cost of living. Stakeholders highlighted how these communities often face compounded challenges due to the intersection of poverty, race, and disability, which underscores the need for an integrated approach to provide access to clean, affordable, reliable transportation.

The Roadmap's goals, indicators and targets, and strategies are the culmination of a 15-month process of engaging residents and stakeholders, analyzing existing and future mobility options (including the EV market), assessing barriers, and collaboratively crafting appropriate solutions. The resulting strategies are summarized in the table below, and are described in greater detail in the Roadmap. For each strategy, the Roadmap includes actionable steps, lead departments and partners, timelines, and approximate costs. Over the next five to ten years, the City and its stakeholders will collaborate to implement these strategies, monitor progress, and adjust course as needed.

EXECUTIVE SUMMARY

Goals	Key Indicators and Targets	Strategies
Ensure Equity in Access to Electric Mobility: Maximize electric mobility benefits in underserved communities	✓ **Increase access to mobility** ✓ **Reduce air pollution** ✓ **Increase economic opportunity**	1: Community Driven Equity Pilot Projects 2: One Stop Shop for Electric Mobility 3: Digital and Financial Access to Transit and Shared Mobility 4: Accessible Electric Mobility 5: Equitable Workforce and Business Strategies 6: Electric Bus Rapid Transit Routes
Improve Alternatives to Driving: Shift trips to walking, biking, and shared electric modes	✓ **Increase non-auto mode share** ✓ **Increase access to electric mobility options**	1: Access and Use of Shared Mobility and Transit 2: Electrification of Shared Transportation Fleets 3: Shared Electric Mobility Hubs
Achieve Zero Net Carbon: Eliminate emissions from private vehicles	✓ **Increase electric vehicle adoption** ✓ **Expand public and workplace EV charging** ✓ **Increase electric mobility awareness and education**	1: EV Charging in New and Existing Buildings 2: EV Charging Permitting 3: Public EV Charging on City Property 4: Private EV Charging Site Hosts 5: Electric Mobility Education and Outreach 6: Smart, Resilient, Clean, and Affordable EV Charging 7: Electrification of Private Fleets 8: Disincentivize Fossil Fuel Vehicles without Creating New Inequities
Demonstrate City Leadership: Lead by example and guide the electric mobility transition	✓ **Increase electric vehicles in the City fleet** ✓ **Increase capacity for electric mobility**	1: City Fleet Electrification Plan 2: Electric Mobility Charging Management 3: Electric Mobility Planning Integration with Streetscape & Construction Projects 4: Local Innovation to Support Electric Mobility 5: Electric Mobility Roadmap Implementation Working Group 6: Funding for Roadmap Implementation

INTRODUCTION

Berkeley's Vision for Electric Mobility

In 2006, Berkeley residents voted to reduce the community's greenhouse gas (GHG) emissions 80% by 2050; the resulting Climate Action Plan was adopted by Berkeley City Council in 2009. In 2018, Berkeley City Council resolved to become a Fossil Fuel Free City as soon as possible, and Governor Brown committed California to carbon neutrality by 2045.

Berkeley City Council also declared a Climate Emergency to signal the urgency with which the City is taking on these ambitious goals, driven by the significant threats climate change poses to Berkeley's future as well as by the City's capacity to play a leadership role in advancing solutions. To address greenhouse gas emissions from transportation—the largest source at 60% of Berkeley's total emissions—the City envisions a future transportation system that increases walking, biking, and electric mobility to expand the benefits of clean transportation to all Berkeley residents, workers, students, and visitors.[1]

With Berkeley committed to reach 100% renewable energy and with the substantial progress already made toward low carbon electricity by joining East Bay Community Energy (EBCE), EVs are becoming an increasingly clean transportation option to reach the City's climate goals and to contribute to reduced regional air pollution levels.[2] Yet simply replacing every vehicle on Berkeley's streets today with vehicles powered by electricity would miss important benefits. Getting people out of cars improves health and quality of life The City and community partners continue to work to improve walking, biking, and public transportation options in Berkeley through implementation of its Bicycle Plan, updating its Pedestrian Master Plan, Vision Zero, and related efforts. The Electric Mobility Roadmap is designed to complement this core work.

Additionally, simply changing technologies would ignore the inequalities present in our current transportation system. Historically, transportation investments and decisions have unjustly burdened low-income communities and communities of color with air pollution and other negative impacts, while simultaneously failing to meet their transportation needs.[3] This has resulted in well-documented race and class disparities in the distribution of transportation burdens and benefits; for example, in Berkeley, the asthma hospitalization rate for children under five for African American children is 10 times higher—and for Latino children is 2.8 times higher—than the rate for white children.[4] Today, low-income communities, communities of color, and the disability community frequently experience the longest, most unreliable commutes, and spend the most as a proportion of their income on transportation costs.[5] Moreover, high upfront costs have thus far kept electric mobility options mostly out of reach for underserved communities.[6] To address these structural and institutional inequities, the Electric Mobility

INTRODUCTION

Roadmap has been developed, with a focus on advancing equitable solutions to the existing transportation gaps.

The guiding vision for the Electric Mobility Roadmap is to create a fossil fuel-free transportation system that integrates with and supports the City's ongoing efforts to increase walking, biking, and public transportation use in Berkeley, and that ensures equitable access to the benefits of clean transportation.

KEY TERMS

Types of electric vehicles (EVs)

- **EV:** A vehicle powered, at least in part, by electricity. In this report, EV refers to all plug-in vehicles.
- **BEV:** Battery-electric vehicle, e.g. a Nissan Leaf or Chevy Bolt. A vehicle powered entirely by electricity.
- **PHEV:** Plug-in hybrid electric vehicle, e.g. a Chevy Volt or Toyota Prius Prime. A vehicle with both a conventional engine and electric motor, powered either by gas or by electricity through a rechargeable battery.
- **ZEV:** Zero emission vehicle, which according to the California Air Resource Board includes full battery-electric, hydrogen fuel cell, and plug-in hybrid-electric vehicles.
- **E-bike**: as defined by California Assembly Bill 1096, a bicycle with fully operable pedals and a motor up to 750 watts. E-bikes can include pedal assist variants which only add power when the rider pedals, and throttle-assisted variants that do not require the rider to pedal, and variants that provide power only when the rider stops pedaling. Each variant has an associated maximum speed and additional regulations.

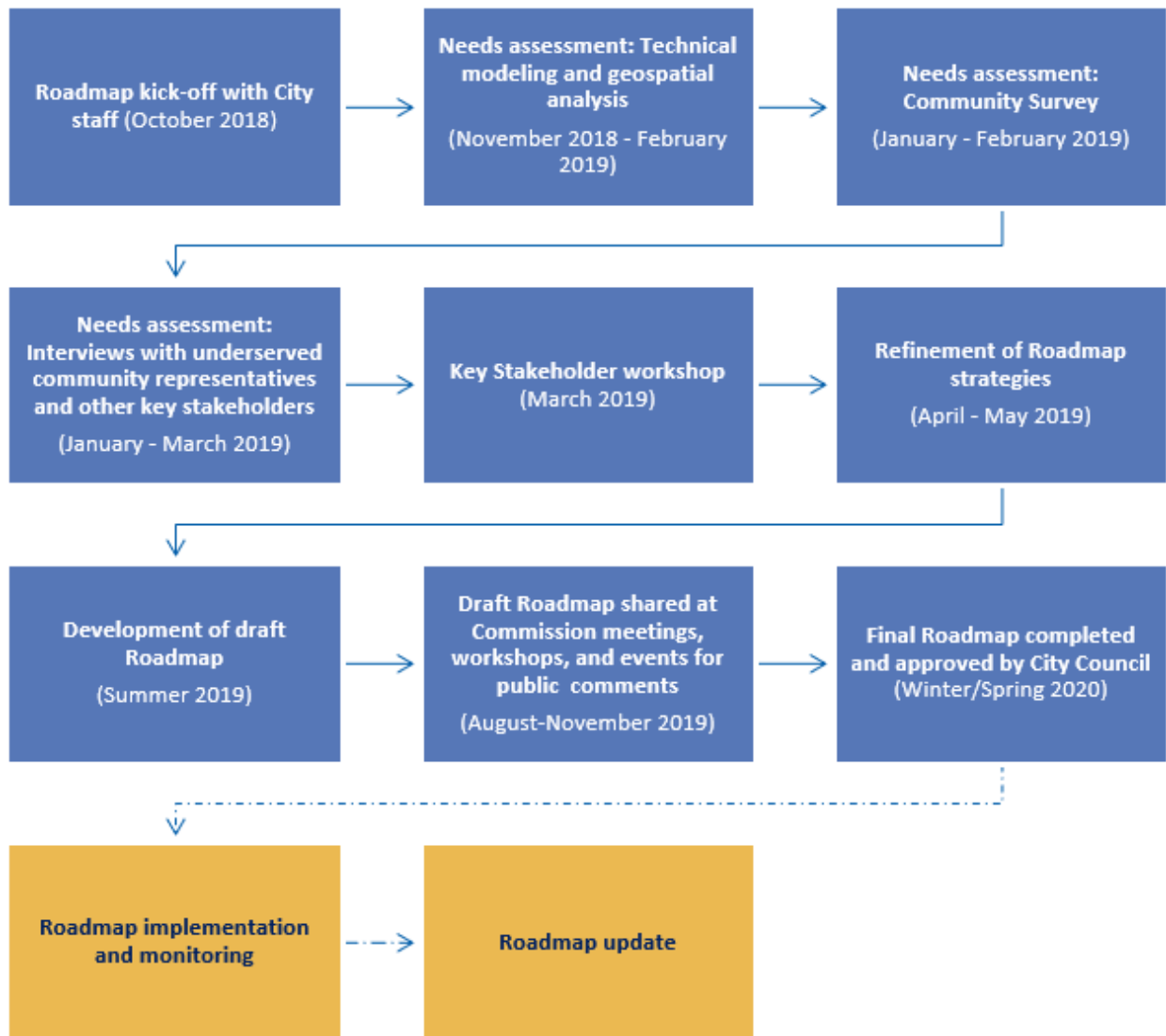## Electric vehicle charging terms (adapted from AFDC.gov)

- **Level 1:** AC Level 1 EV charging provides charging through a 120-volt (120V) AC plug (a typical wall outlet) at 12 -16 amps. For every hour of charging, Level 1 EV charging can provide about 3-5 miles of range.
- **Level 2:** AC Level 2 EV charging offers charging through 240V or 208V electrical service (like a dryer plug) at 12-80 amps (typically 32 amps). For every hour, Level 2 EV charging can provide about 10-20 miles of range.
- **DC fast charging (DCFC):** Direct-current (DC), fast-charging equipment, sometimes called Level 3, enables rapid charging at a rate of at least 40 kW, with newer chargers rated up to 350 kW. Depending on rated power and the vehicle's battery size, DCFC can often enable an 80% charge in 20-30 minutes. Currently, there are three types of DCFCs: SAE Combo (known also as Combined Charging System or CCS), CHAdeMO, and Tesla.
- **Electric Vehicle Supply Equipment (EVSE):** The hardware, including connectors, fixtures, devices, and other components required to charge an electric vehicle; commonly called a charging station.
- **Smart charging:** Smart (networked) charging provides control and monitoring features, and allows charging speeds to be modulated, enabling power sharing and demand response to help limit grid impacts.

Other mobility terms

- **Shared mobility:** Shared use of a motor vehicle, bicycle, scooter, or other travel mode.
- **Shared micromobility:** Shared use of a bicycle, scooter, or other low-speed travel mode.
- **Transportation Network Companies (TNCs):** Companies, such as Lyft or Uber, providing prearranged and on-demand transportation services. They connect drivers with passengers through mobile applications.
- **Carsharing:** Programs, like ZipCar, GIG Car Share, or Envoy, where individuals have short-term access to a vehicle without the costs and responsibilities of ownership.
- **Scooter sharing:** Allows individuals access to scooters by joining an organization that maintains a fleet of scooters at various locations. Scooter sharing models can include motorized and non-motorized scooters. The scooter service typically provides electric charge, maintenance, and may include parking as part of the service.
- **Bikesharing:** System where users access bicycles on an as needed basis for one-way (point-to-point) or roundtrip travel. Station-based bikesharing kiosks are typically unattended, concentrated in urban settings, and offer one-way station-based service (bicycles can be returned to any kiosk). Free-floating bikesharing offers users the ability to end their rental at locations not expressly prohibited within a predefined region. Users must not leave bikes where they block sidewalks, ramps for disabled access, driveways, or the street.

INTRODUCTION

Roadmap Process

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┌─────────────────────┐     ┌─────────────────────┐     ┌─────────────────────┐
│ Roadmap kick-off     │ →   │ Needs assessment:    │ →   │ Needs assessment:    │
│ with City staff      │     │ Technical modeling   │     │ Community Survey     │
│ (October 2018)       │     │ and geospatial       │     │ (January - February  │
│                      │     │ analysis             │     │ 2019)                │
│                      │     │ (November 2018 -     │     │                      │
│                      │     │ February 2019)       │     │                      │
└─────────────────────┘     └─────────────────────┘     └─────────────────────┘

┌─────────────────────┐     ┌─────────────────────┐     ┌─────────────────────┐
│ Needs assessment:    │ →   │ Key Stakeholder      │ →   │ Refinement of        │
│ Interviews with      │     │ workshop             │     │ Roadmap strategies   │
│ underserved          │     │ (March 2019)         │     │ (April - May 2019)   │
│ community            │     │                      │     │                      │
│ representatives and  │     │                      │     │                      │
│ other key            │     │                      │     │                      │
│ stakeholders         │     │                      │     │                      │
│ (January - March     │     │                      │     │                      │
│ 2019)                │     │                      │     │                      │
└─────────────────────┘     └─────────────────────┘     └─────────────────────┘

┌─────────────────────┐     ┌─────────────────────┐     ┌─────────────────────┐
│ Development of draft │ →   │ Draft Roadmap shared │ →   │ Final Roadmap        │
│ Roadmap              │     │ at Commission        │     │ completed and        │
│ (Summer 2019)        │     │ meetings, workshops, │     │ approved by City     │
│                      │     │ and events for       │     │ Council              │
│                      │     │ public comments      │     │ (Winter/Spring 2020) │
│                      │     │ (August-November     │     │                      │
│                      │     │ 2019)                │     │                      │
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┌─────────────────────┐     ┌─────────────────────┐
│ Roadmap              │ --→ │ Roadmap update       │
│ implementation and   │     │                      │
│ monitoring           │     │                      │
└─────────────────────┘     └─────────────────────┘
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Over the next five to ten years, the City and its community partners and other stakeholders will work together in a community-based decision-making process to implement the Roadmap strategies, monitor progress, and adjust course as needed. The City is committed to continuing to engage and collaborate

with underserved communities in Roadmap implementation. Given the dynamic nature of the EV market, technology, policy, and equity, the City will aim to revisit the Roadmap by 2025.

Roadmap Goals

Through the Roadmap's engagement with stakeholders, the following goals were identified to guide the creation and implementation of the Roadmap in order to achieve Berkeley's vision for inclusive electric mobility. The following sections describe key elements of each goal, based on input from stakeholders.

Ensure Equity in Access to Electric Mobility: Maximize electric mobility benefits in underserved communities

The City is committed to equity in electric mobility, both in the process of developing strategies as well as in implementing equitable solutions that are meaningful and measurable. The approach to equity in this Roadmap is informed by the Urban Sustainability Directors Network's (USDN) definition of equity, described in FIGURE 1, as well as the work of the Greenlining Institute, which served as an advisor to this project.

The Roadmap's equity approach includes ensuring solutions address specific mobility needs identified by underserved communities, which include low-income populations, communities of color, and the disability community. This must include increasing physical, financial, and digital access to high-quality (affordable, efficient, reliable, safe) electric mobility options, and ensuring the clean air and economic benefits of a transition to electric mobility are inclusive and accessible to underserved communities and businesses. It also views the electrification of mobility in the context of its impact on job opportunities and economic outcomes for underserved communities.

FIGURE 1: USDN'S FOUR DIMENSIONS OF EQUITY

The approach to equity in this Roadmap is informed by the Urban Sustainability Directors Network's (USDN) definition of equity, which includes four interlinked components:

1. **Procedural**, which stresses the importance of inclusive, accessible, authentic engagement in the process of developing policies and programs;
2. **Distributional**, which emphasizes the importance of programs and policies that result in fair distributions of benefits and burdens, prioritizing those with highest need;
3. **Structural,** which emphasizes that decision-makers institutionalize accountability and address historic systemic inequities, and
4. **Transgenerational,** which emphasizes that decisions consider generational impacts and do not result in unfair burdens on future generations.
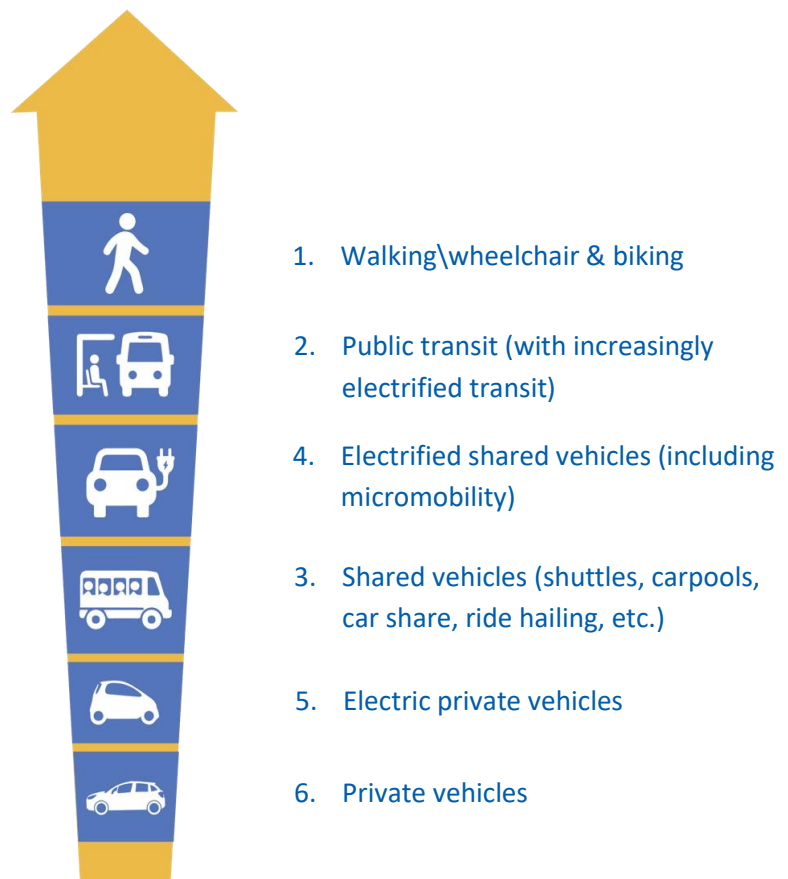
INTRODUCTION

Improve Alternatives to Driving: Shift trips to walking, cycling, and shared electric modes

A key goal of this Roadmap is to complement Berkeley's ongoing efforts to shift trips to walking, biking, and shared modes to reduce congestion, improve quality of life, and support healthier outcomes from increased physical activity and reduced transportation pollution. To do so, the Roadmap focuses on increasing the availability and accessibility of shared electric mobility options in Berkeley, and on ensuring that Roadmap strategies complement other efforts to get people out of cars. Berkeley already has a relatively low drive-alone rate compared to other cities of its size, with more than 50% of residents traveling to work by public transit, walking, bicycle, or other non-single occupant vehicle modes.[7] The City has the potential to reduce this rate even further. For more detail, see the later section, "Berkeley's Electric Mobility Landscape."

Based on stakeholder input and the guidance of the Roadmap's strategic advisors at the Greenlining Institute, FIGURE 2 outlines the prioritized modes of transit in Berkeley's electric mobility transition. This prioritization maximizes clean air, climate, sustainability, and economic benefits.

FIGURE 2: BERKELEY'S PRIORITIZATION OF MODES

1. Walking\wheelchair & biking

2. Public transit (with increasingly electrified transit)

4. Electrified shared vehicles (including micromobility)

3. Shared vehicles (shuttles, carpools, car share, ride hailing, etc.)

5. Electric private vehicles

6. Private vehicles

It emphasizes modes that are active transportation options, shared, and improve the use of public space. For example, while private vehicles represent the greatest proportion of transportation emissions and should be electrified, the City does not want to make owning an EV more attractive than taking public transportation, biking, and walking.
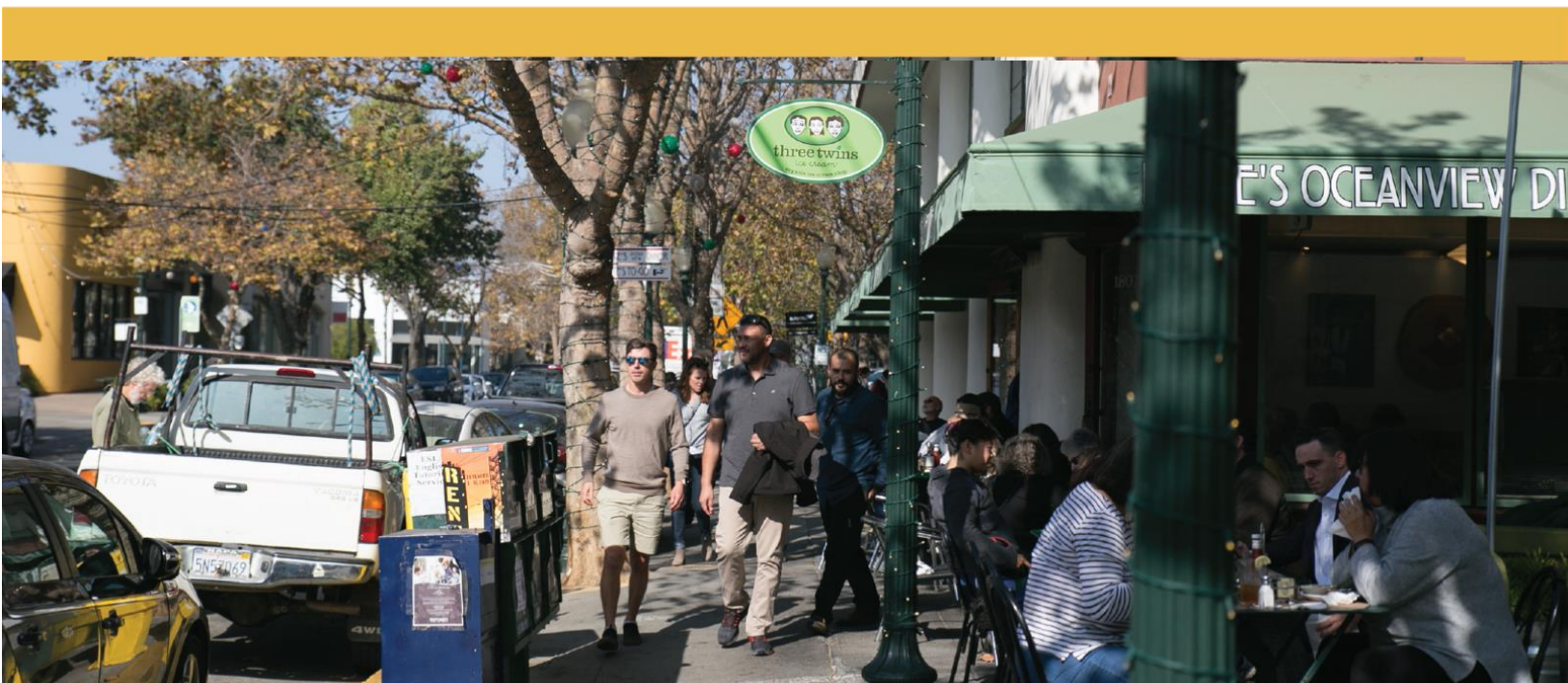
INTRODUCTION

Achieve Zero Net Carbon Emissions: Eliminate emissions from private vehicles

In addition to shifting away from driving, the adoption of EVs in Berkeley, including personal and fleet vehicles, must be scaled to a level that will enable the City to reach carbon neutrality by 2045. To do so, the City and its stakeholders envision increasing awareness and education about EVs, access to EV charging options, and the clean energy available to power EVs. Expanding awareness of and education about electric mobility options, incentive opportunities, and key programs amongst the general public, fleet operators, and other key stakeholders is critical. Creating an "ecosystem of EV charging" that provides a variety of charging options in different locations can serve different types of users and needs.

Demonstrate City Leadership: Lead by example and guide the electric mobility transition

The City aims to lead by example by accelerating electrification of the city fleet, and by taking tangible, meaningful, city-led actions to increase equitable electric mobility. The Roadmap aims to guide implementation by developing an actionable plan that integrates with existing city plans and regional efforts, managing an effective transition by addressing impacts to Berkeley's streetscape, parking, and other city operations; leveraging limited city funds and external funding opportunities to achieve the greatest impact possible; and conducting authentic and ongoing stakeholder engagement, while striving to use equity best practices in community engagement. Finally, the City aims to continue adjusting the Roadmap and planning for the future as conditions change, including planning for resilient electric mobility systems, mitigating potential grid impacts, and preparing for the introduction of new transportation technologies, such as autonomous vehicles (AVs).

INTRODUCTION

Barriers to Widespread Electric Mobility Adoption in Berkeley

Achieving the ambitious goals set forth in this Roadmap requires implementing strategies that can address key barriers and challenges to electric mobility options being ubiquitous and well-utilized, and for their benefits to be broadly shared. TABLE 1 summarizes findings from a survey of Berkeley residents, employees, and visitors as well as interviews with representatives of underserved communities that highlighted challenges to achieving an equitable, multi-modal, and electric mobility future in Berkeley. Stakeholders highlighted how low-income communities, and communities of color in particular, often face more than one of these challenges at a time, stressing the need for an integrated approach to address multiple barriers to accessing clean, affordable, reliable transportation.

Traveling in Berkeley

As part of this Roadmap, several people who live, work, or go to school in Berkeley shared stories of how they currently travel, what they like about it, and things they would like to see in the future.

Sarah
Berkeley Resident and UC-Berkeley Student
Pedestrian/ Bus Commuter

> " *I generally walk or take the bus, taking advantage of the AC Transit Clipper Card that is included in my tuition. Depending on when my day ends, and how safe I feel, I either take the 65 bus or sometimes take the nighttime North Side Safety Shuttle that I really appreciate because it runs so late.*

TABLE 1:

BARRIERS TO WIDESPREAD ELECTRIC MOBILITY ADOPTION IN BERKELEY

Cost and Financial Barriers: Cost and other financial barriers can inhibit access to electric shared mobility's benefits, whether it is the cost of owning an EV and accessing charging, or financial barriers, such as a lacking a credit card, bank account, or good credit to access shared mobility services or financing for an EV.

Education and Awareness Barriers: Many people are not aware of EVs and other electric mobility options, their benefits, or opportunities such as incentive programs. Some do not know anyone who uses electric mobility. Language barriers and cultural/trust considerations pose an additional challenge for spreading the word about electric mobility opportunities, particularly in underserved communities.

EV Charging Access Barriers: Many Berkeley residents face barriers to convenient, affordable EV charging. These barriers stem primarily from difficulties accessing charging at home due to lacking a parking space or renting one's home, but also extend to public and workplace charging access. Additionally, stakeholders highlight the importance of developing a resilient EV charging system that can still power vehicles in emergencies and power outages.

Physical and Safety Barriers: Many Berkeley residents face physical barriers to accessing certain transportation options, including age (both for seniors and parents transporting young children), disability, and safety (particularly for potential users of bikes, scooters, and other electrified micromobility for whom gaps in ubiquitous safe infrastructure discourages usage).

Technology Barriers: Community members face a range of technological barriers to accessing electric mobility options. For example, some seniors and affordable housing residents report lacking access to smart phones or internet at home, making it difficult to access shared mobility modes or EV information. Others report challenges with EV technology, like range barriers that may limit access to far-away employment opportunities, though EV ranges continue to improve.

Reliability Barriers: Some community members report lacking reliable transportation options. Some struggle with having to depend on older, unreliable personal vehicles, while others rely on public transit with limited schedules and routes, or paratransit service that can be inconvenient and is frequently delayed.

Regional and Systemic Challenges: Throughout the Bay Area, including in Berkeley, jobs-housing imbalances and an acute housing crisis have led to longer commutes and displacement of low-income communities and communities of color. While these challenges are broader than the Electric Mobility Roadmap, it's important to consider the wider context and challenges with creating equitable access to electric transportation options.

Electric Mobility Roadmap Strategies

Overview

Achieving Berkeley's ambitious electric mobility goals will require not one single approach, but a comprehensive set of strategies that can address a variety of barriers preventing acceleration of electric mobility adoption. This section describes the key strategies the City and its stakeholders will pursue together to achieve the goals of the Electric Mobility Roadmap.

The strategies are organized by the Electric Mobility Roadmap goals, and each strategy includes a description, specific actions to implement that strategy, roles and responsibilities of City of Berkeley Departments and key stakeholders, timeline for implementation, approximate cost, and potential resources to leverage in implementation, such as funding sources, programs, policies, and other opportunities.

ROADMAP STRATEGIES

TABLE 1: STRATEGY SUMMARY

Goal	Strategies
Ensure Equity in Access to Electric Mobility: Maximize electric mobility benefits in underserved communities	1: Community Driven Equity Pilot Projects
	2: One Stop Shop for Electric Mobility
	3: Digital and Financial Access to Transit and Shared Mobility
	4: Accessible Electric Mobility
	5: Equitable Workforce and Business Strategies
	6: Electric Bus Rapid Transit Routes
Improve Alternatives to Driving: Shift trips to walking, biking, and shared electric modes	1: Safety and Access
	2: Electrification of Shared Transportation Fleets
	3: Shared Electric Mobility Hubs
Achieve Zero Net Carbon: Eliminate emissions from private vehicles	1: EV Charging in Berkeley's New and Existing Buildings
	2: EV Charging Permitting
	3: Public EV Charging on City Property
	4: Private EV Charging Site Hosts
	5: Electric Mobility Education and Outreach
	6: Smart, Resilient, Clean, and Affordable EV Charging
	7: Electrification of Private Fleets
	8: Disincentivize Fossil Fuel Vehicles without Creating New Inequities
Demonstrate City Leadership: Lead by example and guide the electric mobility transition	1: City Fleet Electrification Plan
	2: Electric Mobility Charging Management
	3: Electric Mobility Planning Integration with Streetscape & Construction Projects
	4: Local Innovation to Support Electric Mobility
	5: Electric Mobility Roadmap Implementation Working Group
	6: Funding for Roadmap Implementation

ROADMAP STRATEGIES

Key Implementation Partners

The development of the Electric Mobility Roadmap has been led by the Office of Energy & Sustainable Development (OESD), who will continue to play a coordinating role with the Public Works Department as the Roadmap moves into implementation. Individual strategies will become the responsibility of other departments, or in some cases external stakeholders. The City is committed to continuing to seek out opportunities to work with other stakeholders to implement or enhance the strategies detailed in the Roadmap. Table 2 highlights key City departments, divisions, or offices, commissions, and external partners who have been involved in the development of the Roadmap, and/or who are likely to be involved with implementation.

TABLE 2: PRELIMINARY KEY IMPLEMENTATION PARTNERS

City of Berkeley Departments/Divisions
- Public Works
- Zero Waste
- Transportation
- Land Use Planning
- Office of Energy and Sustainable Development (OESD)
- Economic Development
- Health Housing & Community Services
- Police
- Fire
- Parks Recreation & Waterfront
- Neighborhood Services
- Finance
- City Attorney

Berkeley Commissions
- Energy Commission
- Transportation Commission
- Community Environmental Advisory Commission

External partners
- East Bay Community Energy (EBCE)
- Pacific Gas & Electric (PG&E)
- Bay Area Air Quality Management District (BAAQMD)
- Alameda County Transportation Commission (Alameda CTC)
- Alameda County Transit (AC Transit)
- Community-based organizations
- EV industry organizations
- TransForm
- Building Opportunities for Self-Sufficiency (BOSS)
- GRID Alternatives
- Greenlining Institute
- Shared Mobility Providers
- Affordable housing providers and other housing developers
- Metropolitan Transportation Commission (MTC)
- Center for Independent Living (CIL)
- World Institute on Disability (WID)
- Charging providers
- Rising Sun Center for Opportunity

STRATEGY: ENSURE EQUITY IN ACCESS

Ensure Equity in Access to Electric Mobility: Maximize electric mobility benefits in underserved communities

🎯 Key indicators and targets

- **Increase access to mobility:** Increase access to, and affordability of, electric mobility options for low-income communities of color, people with disabilities, and other underserved communities.

- **Reduce air pollution**: Reduce of air pollution throughout Berkeley, particularly in lower-income communities and those most impacted by air pollution.

- **Increase economic opportunity**: Expand access to employment, job training, and business opportunities and investment for low-income people of color, other people with barriers to employment (including people with disabilities, people with unreliable access to transportation, people with past criminal records, and others), and small, minority- and women-owned businesses.

Strategy Summary

TABLE 3: EQUITY IN ACCESS STRATEGY SUMMARY

Strategy	Action
1: Community Driven Equity Pilot Projects	1a. Develop partnerships with community-based organizations
	1b. Conduct a mobility needs assessment
	1c. Identify and implement pilot project(s)
2: One Stop Shop for Electric Mobility	2a. Connect underserved communities to electric mobility programs
	2b. Pursue options to increase access to used EVs
3: Digital and Financial Access to Transit and Shared Mobility	3a. Increase the use of AC Transit's EasyPass program
	3b. Pursue discounts and digital access strategies for electric shared mobility options
4: Accessible Electric Mobility	4a. Ensure ADA-accessible EV charging in Berkeley
	4b. Support advocacy for accessible shared mobility options
	4c. Provide geographic accessiblity
5: Equitable Workforce and Business Strategies	5a. Collaborate with EV workforce stakeholders to develop and promote training opportunities
	5b. Connect auto industry stakeholders in Berkeley with workforce opportunities
	5c. Center equity in City electric mobility projects and partnerships
6: Electric Bus Rapid Transit Routes	6a. Identify opportunities through Transit First implementation
	6b. Pursue the San Pablo Avenue Corridor Project

STRATEGY: ENSURE EQUITY IN ACCESS

Strategies

1: Community-Driven Equity Pilot Projects

The City will pursue development of partnerships to facilitate one or more community-driven, electric mobility equity pilot projects to benefit low-income communities, communities of color, and the disability community. Key actions to implement this strategy include:

1a. **Develop partnerships with community-based organizations:** Identify partners to develop pilot projects, such as affordable housing providers, the Berkeley Black Ecumenical Ministerial Alliance, GRID Alternatives, the Center for Independent Living (CIL), and Building Opportunities for Self-Sufficiency (BOSS), and other organizations working with underserved communities in Berkeley.

1b. **Conduct a mobility needs assessment:** With partners, conduct research to identify specific mobility needs, priorities, and opportunities in the community. Potential strategies for engaging community stakeholders in the needs assessment may include design charrettes, community-based participatory research, participatory budgeting, an advisory or shared decision-making group, and community benefits agreements.

Traveling in Berkeley

Senior Center Field Trip Shuttle

Athea
Berkeley Senior Center Member

"
I get around by BART and bus and I'm eligible for Paratransit. I also get around with my children and church family. Commuting is difficult because I'm disabled and sometimes the lifts on the bus don't work and the bus driver has to get off to help me. I recommend Paratransit for people like me.
"

1c. **Identify and implement pilot project(s):** Based on the mobility needs assessment, identify pilot project(s) for implementation, such as electric carsharing or carpooling/vanpooling pilots, bikesharing or e-bike incentive pilots, digital and payment access pilots, pilots to encourage multifamily properties to make Level 1 charging options available to residents, and pilots that address physical barriers to electric mobility for disabled and/or elderly residents. Seek funding for implementation. Projects will be informed by pilots being developed by TransForm and Metropolitan Transportation Commission (MTC) in the Bay Area, transportation equity projects funded by the California Air Resources Board's (CARB) Low Carbon Transportation Program, and those recommended by the Greenlining Institute.[8]

2: One-Stop Shop for Electric Mobility

The City will create outreach materials and services to connect low-income communities, communities of color, and the disability community with existing and upcoming programs that support equitable access to EVs, such as Clean Cars for All, Clean Vehicle Assistance Program, and other regional programs. Key actions to implement this strategy include:

2a. **Connect underserved communities to electric mobility programs:** Develop partnerships and outreach plans with the regional One Stop Shop operator, GRID Alternatives, and other community partners to help connect low-income communities and communities of color in Berkeley with electric mobility programs. Where appropriate, connect these efforts with other community and low-income service delivery, such as health clinics, immigration services, low-income energy efficiency programs, and/or workforce development programs. Partner with community organizations to develop materials and information in other languages to serve non-English speakers, and/or tailored to different audiences.[9] Outreach will focus on education about public transit, e-bikes, electric shared mobility options, used EVs, incentive programs, and consumer protections.

2b. **Pursue options to increase access to used EVs**: Study opportunities to increase awareness of and access to used EVs. Options may include leveraging incentive programs where used EVs are eligible (e.g. Clean Vehicle Assistance Program, Community Housing Development Corporation (CHDC) Transportation Program, and Clean Cars for All), establishing an EV donation program to be deployed at affordable housing sites, or establishing a used EV loaner (i.e., extended test drive) program to increase awareness amongst community leaders and organizations. Such a program could be designed to serve local community leaders, such as ministers in the Berkeley Black Ecumenical Ministerial Alliance, who could gain firsthand experience with EVs and could help educate others on their advantages.[10] Consider opportunities to support home charging for low-

income communities and communities of color, which may include finding funding sources for electrical panel upgrades for charging (an expense that is not currently covered by other existing programs).

3: Digital and Financial Access to Transit and Shared Mobility

The City will explore strategies to increase digital and financial access to transit and electric shared mobility. Based on a recent study in 10 U.S. cities, lower-income households are 19%–27% less likely to own smartphones than higher-income households, and African Americans and Hispanics are 4.5 more likely to lack bank accounts than whites.[11] Potential strategies include:

3a. **Increase the use of AC Transit's EasyPass program:** Work with affordable housing providers, major employers, and other community partners to raise awareness and use of the EasyPass program, a discounted pass purchasing system often used by employers, colleges, affordable housing, and other multifamily developments, to help underserved Berkeley residents and employees benefit from low-cost, increasingly electrified, bus transportation. Additionally, explore the potential for free, discounted, or means-tested transit passes, in coordination with MTC's efforts to establish means-based fare discount programs at Bay Area transit agencies.[12]

3b. **Pursue discounts and digital access strategies for electric shared mobility options:** Explore partnerships and strategies to enable access for people who lack bank accounts and digitally impoverished households, such as pay-as-you-go cards, cash payments, or other methods such as partnerships for storefront payments (similar to Lime's "PayNearMe" initiative) and opportunities for including as-required conditions of permits/contracts with electric shared mobility options.[13] Discounts may be available for carsharing, bikesharing, and scooter sharing memberships and fees.

STRATEGY: ENSURE EQUITY IN ACCESS

4: Accessible Electric Mobility

The City will support electric mobility options that are accessible to persons with disabilities, both for EV charging as well as electric shared mobility services, and that are geographically distributed to promote access. Key actions to implement this strategy include:

4a. **Ensure ADA-accessible EV charging in Berkeley:** Continue to implement ADA-accessible EV charging policies, both in City of Berkeley-owned projects and in permitting, following the guidance on accessible station design and requirements for the number of accessible of chargers per site, as set forth by the state.[14] Continue to gather input from CIL, World Institute on Disability (WID), and other stakeholders—as well as charging providers—to identify gaps in ADA-accessible EV charging and opportunities to provide additional charging for electric devices such as wheelchairs.

4b. **Require accessible shared mobility options:** Work with shared mobility providers, including micromobility providers, and regulators to ensure shared mobility services are ADA accessible. Specify accessibility requirements in permitting or contracting with providers. Partner with non-profits and the private sector to ensure that shared mobility options do not cause new challenges for people with disabilities.

4c. **Provide geographic accessibility:** Prioritize equity when locating, contracting, or permitting the location of electric mobility, including micromobility. Ensure that vendors include locations in areas that are more heavily impacted by pollution, poverty, and other socioeconomic vulnerabilities, including physical disabilities. Figure 3, based on a methodology described later in the chapter entitled "Berkeley's Electric Mobility Landscape," suggests areas where access to electric mobility could be prioritized in coordination with community engagement and input.

SPOTLIGHT: RIO MOBILITY

Based in Berkeley, Rio Mobility invents, develops, and markets products to overcome obstacles faced by wheelchair users. Their products span fully manual handcycle attachments for wheelchairs, power assist handcycle attachments, and fully electric devices that transform wheelchairs into powered three-wheeled scooters. Such products offered by Rio and its competitors can provide peace of mind for users that they can climb hills and navigate more challenging terrain. They also help overcome a major barrier for wheelchair users to use any micromobility service, the need to have one's wheelchair with them when completing a trip.

STRATEGY: ENSURE EQUITY IN ACCESS

FIGURE 3: ELECTRIC MOBILITY EQUITY INDEX MAP
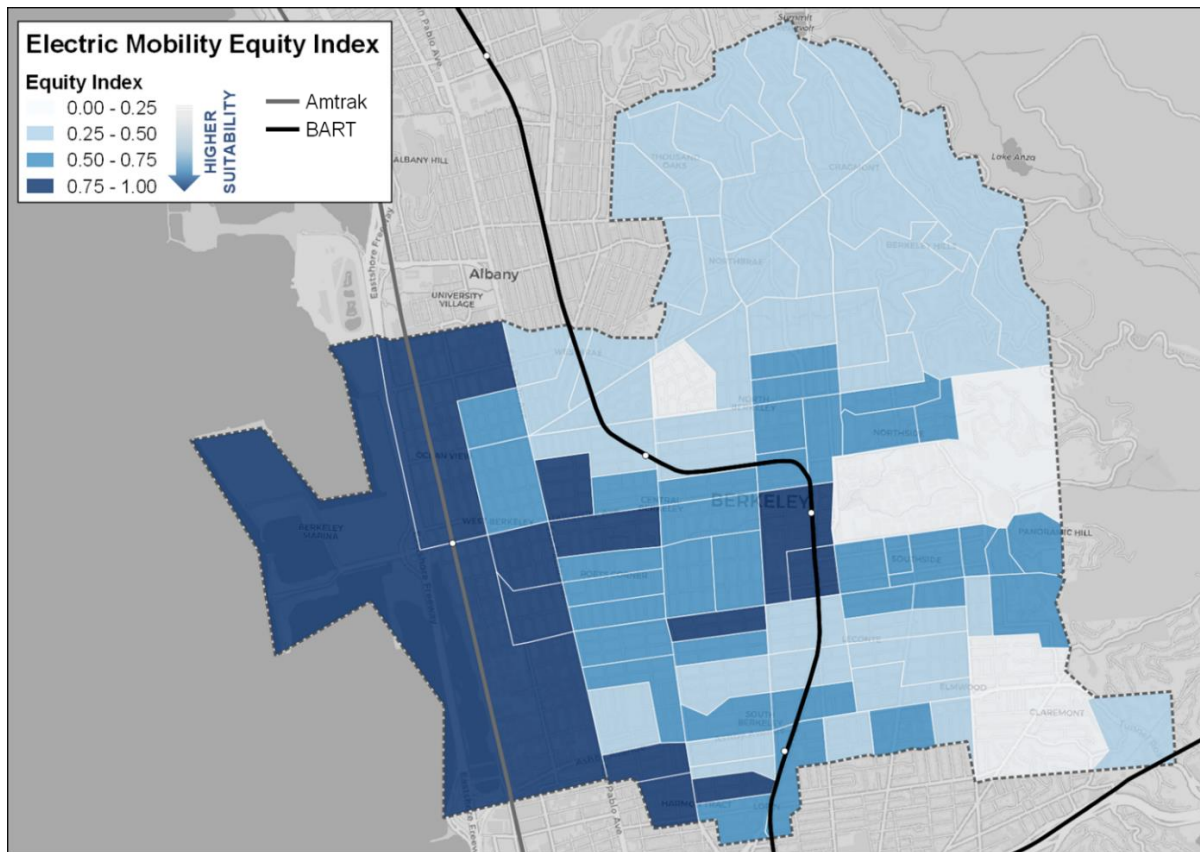
5: Equitable Workforce and Business Strategies

The City will pursue "high road" strategies to support entry of people with barriers to employment into the EV and EV charging industries. A "high road" strategy is "characterized by high-quality work, high-quality jobs and broad access to opportunity for a diversity of businesses and workers." Such high road work typically features good wages, benefits, and career pathways. Key actions to implement this strategy include:

5a. **Collaborate with EV workforce stakeholders to develop and promote training opportunities:**
Regionally, identify and raise awareness of EV and EVSE workforce development resources, courses, and other opportunities with EV and EVSE training programs, community colleges, industry leaders, unions, and workforce development programs in Alameda County, Contra Costa County, and neighboring jurisdictions. Within Berkeley, collaborate with organizations like BOSS, GRID Alternatives, and Rising Sun Center for Opportunity to connect underserved community members

and others with barriers to employment with workforce development opportunities, including addressing potential transportation or cost barriers to access courses and/or providing remote learning opportunities. New work opportunities could require specialized skills (such as becoming an electrician to tap into increased charging infrastructure installation opportunities), while others may be more broadly accessible (e.g., management of the network of assets for expanded shared bike and micromobility networks). Mechanics will need to be upskilled in more advanced diagnostics and vehicle electrical systems.[15]

5b. **Connect auto industry stakeholders in Berkeley with workforce opportunities:** Conduct outreach and interviews to understand the ecosystem and needs of the City's auto industry, including dealers, auto repair and maintenance shops, auto parts shops, and others, to identify their employment needs, particularly in relationship to electric mobility. Work to connect these stakeholders with training programs in the Bay Area, so they can provide input on training needs, refer their technicians for upskilling, find trained employees, and serve as an outreach arm to connect more potential workforce entrants to the trainings. Because widespread EV adoption is expected to reduce maintenance needs, efforts should also focus on providing a just transition for individuals whose jobs may be eliminated or reduced.

5c. **Center equity in City electric mobility projects and partnerships:** Where feasible, develop and use community workforce, community benefit, or project labor agreements for implementation of Roadmap strategies. In addition to standard City contracting requirements for living wage and equal benefits, utilize opportunities to require or incentivize partners and contractors to provide inclusive and equitable workforce and business opportunities. This could include assigning preference points to bidders, contractors, partners that demonstrate workforce equity and inclusion efforts, such as:

- Hiring of low-income workers and other people with barriers to employment;

- Maintaining a racially/ethnically diverse workforce;

- Partnerships with skills development programs targeted at low-income workers and people with barriers to employment, such as job training and pre-apprenticeship programs; especially those that provide support services to participants (e.g. child care, transportation assistance, financial stability).

Alternatively, the City could require that a significant percentage of spending on goods and services related to the implementation of the Roadmap go to these same types of organizations.

6: Electric Bus Rapid Transit Routes

The City will support opportunities to explore and advance electric buses on all transit routes, including rapid transit routes, which can provide mobility and health benefits—particularly for low-income communities of color. Key opportunities to implement this strategy include:

6a. **Identify Opportunities through Transit-First Implementation:** Adopted through the City's General Plan, Berkeley has a Transit-First Policy with commitments to give priority to alternative transportation and transit over single-occupant vehicles on transit routes. Ongoing implementation of the Transit-First Policy should include community-based organizations, such as Transform, BOSS, and Greenlining Institute, as well as AC Transit, residents, and businesses, to develop a strategy for corridor studies that recognizes mobility and health benefits of electric bus rapid transit for low-income communities of color and prioritizes opportunities for new transit priority treatments that provide these benefits. Transit priority treatments could include features as such dedicated bus lanes, queue jump lanes, and signals allowing buses to bypass congested segments to improve the reliability and speed of bus transit.

6b. **Pursue the San Pablo Avenue Corridor Project:** Work with Alameda County Transportation Commission (Alameda CTC), the lead agency on the current San Pablo Avenue Corridor Project, to identify areas in Berkeley along San Pablo Avenue for potential transit priority treatments. Work also with AC Transit, to advocate for the use of electric buses along this Corridor.

Traveling in Berkeley

Jessica
Berkeley Resident and UC-Berkeley Student Cyclist

" *I bike everywhere, rain or shine. I like being outside and moving my body, not being stuck in traffic, and having control of my timing. I wish we had more bike boulevards and well maintained roads.* "

STRATEGY: ENSURE EQUITY IN ACCESS

STRATEGY KEY

TIMELINE OR STATUS	**Short** = 1-2 years **Medium** = 2-5 years **Long** = 5+ years **Ongoing** = existing strategies to be continued and/or strengthened.
LEAD	The division or department within City of Berkeley government who will lead implementation of that action.
POTENTIAL PARTNERS	Other key partners for implementation (see Table 2). These are organizations and departments whose missions and priorities are aligned with or impacted by the Electric Mobility Roadmap strategies. They also bring expertise that the City can leverage to enhance the implementation of the Roadmap. The City has had productive conversations with these partners and will continue to engage them, gather their feedback, and collaborate with them to the extent possible.
ONE-TIME COSTS	This includes costs that occur one time, such as capital infrastructure costs, or the cost to conduct planning studies and analysis. **$** = Low (up to $25,000) **$$** = Medium ($25,000 - $50,000) **$$$** = High (Over $50,000) These ranges reflect thresholds at which an RFP is required ($25,000) and City Council approval is required ($50,000).
ONGOING COSTS	This includes costs that are incurred over time, either for staff time, or other costs such as EV charging networking fees. **$** = Low (up to $25,000) **$$** = Medium ($25,000 - $50,000) **$$$** = High (Over $50,000).
RESOURCES TO LEVERAGE	City funding, incentive programs, or other resources that may be leveraged in implementation. The City will not only develop its own policies and programs to advance electric mobility, but will also closely monitor efforts and proactively communicate with other levels of government to utilize opportunities and to inform others of Berkeley's electric mobility barriers and needs. Currently active federal, state, regional, and utility programs to incent electric mobility are catalogued in the Appendix.

Strategy	Action	Timeframe			Lead	Potential partners	One-time costs	Ongoing costs	Resources to leverage
1: Community Driven Equity Pilot Projects	1a: Develop partnerships with community-based organizations	Short			OESD	TransForm, BOSS, GRID Alternatives, Greenlining	-	$	
	1b: Conduct a mobility needs assessment	Short			OESD	TransForm, BOSS, GRID Alternatives, Greenlining	$$	-	
	1c: Identify and implement pilot project(s)		Medium		OESD	EBCE, PG&E, shared mobility providers, community partners	TBD	TBD	MTC, EBCE, California Air Resources Board
2: One Stop Shop for Electric Mobility	2a: Connect underserved communities to electric mobility programs	Short			OESD	GRID Alternatives	-	$	Clean Vehicle Rebate Project (CVRP), Clean Vehicle Assistance Program, Clean Cars for All
	2b: Pursue options to increase access to used EVs		Medium		OESD	GRID Alternatives	TBD	TBD	
3: Digital and Financial Access to Transit and Shared Mobility	3a: Increase the use of AC Transit's EasyPass program		Medium		Transportation	AC Transit, affordable housing providers, major employers, community partners.	$	$$	MTC Means-Based Fare Discount Program
	3b: Pursue discounts and digital access strategies for electric shared mobility options	Short			Transportation	Shared mobility providers, MTC	$$	$	

Strategy	Action	Timeframe			Lead	Potential partners	One-time costs	Ongoing costs	Resources to leverage
4: Accessible Electric Mobility	4a: Ensure ADA-accessible EV charging in Berkeley	Ongoing			Planning	OESD, CIL, WID, charging providers	$	$	
	4b: Support advocacy for accessible shared mobility options	Ongoing			OESD	CIL, WID, shared mobility providers	$	$	
	4c: Provide geographic accessibility	Ongoing			Transportation	OESD, Planning, HHCS, charging providers, shared mobility providers	$$$	TBD	
5: Equitable Workforce and Business Strategies	5a: Collaborate with EV workforce stakeholders to develop and promote training opportunities	Short			Economic Development	OESD, BOSS, GRID Alternatives, Rising Sun Center for Opportunity	$	$	Workforce development programs in Alameda County, Contra Costa County
	5b: Connect auto industry stakeholders in Berkeley with workforce opportunities		Medium		Economic Development	OESD	$	TBD	
	5c: Center equity in City electric mobility projects and partnerships		Medium		OESD	Finance, City Attorney	$	-	
6: Electric Bus Rapid Transit Routes	6a: Identify Opportunities through Transit-First Implementation		Medium		Transportation	AC Transit	$$	TBD	
	6b: Pursue the San Pablo Avenue Corridor Project	Short			Transportation	Alameda CTC, AC Transit	$	TBD	

STRATEGY: IMPROVE ALTERNATIVES TO DRIVING

Improve Alternatives to Driving: Shift trips to walking, biking, and shared electric modes

Key indicators and targets

- **Increase non-auto mode share:** Increase walking, cycling, and transit mode share through support of ongoing city efforts to implement Berkeley's Transit-First Policy, Bicycle Plan, Pedestrian Master Plan Update, Vision Zero Action Plan, and other key efforts.

- **Increase access to electric mobility options:** Expand electric mobility options available to City residents, including both the diversity and number of mobility options as well as their geographic availability across the City.

Strategy Summary

TABLE 5: IMPROVE ALTERNATIVES TO DRIVING STRATEGY SUMMARY

Strategy	Action
1: Safety and Access	1a. Support safe infrastructure for non-auto modes
	1b. Prioritize safety, equity, and electrification in shared mobility opportunities
	1c. Increase transportation demand management (TDM) program offerings and participation
2: Electrification of Shared Transportation Fleets	2a. Develop program for electrifying fleets for underserved communities
	2b. Support bus electrification
	2c. Pursue options to expand electrification of shared mobility
	2d. Plan for electrified autonomous vehicles (AVs)
3: Shared Electric Mobility Hubs	3a. Develop concept and plans for electric shared mobility hubs

Strategies

1: Safety and Access

The City recognizes that infrastructure which provides safety, connection, and convenience for pedestrians, bikers, and transit-riders encourages the use of alternatives to driving. In comparison to automobile ownership (gasoline or electric), walking, biking, and transit produces fewer GHG emissions and has less embodied carbon. In addition to supporting implementation of the Berkeley Bicycle Plan, Vision Zero Action Plan and other key efforts, the City will develop programs and plans to improve access and use of shared mobility options. These programs may include provisions for shared mobility rights of way, curb space management, and best practices for engaging and partnering with shared mobility providers. Key actions to implement this strategy include:

1a. **Support safe infrastructure for non-auto modes:** Support rapid implementation Berkeley's Transit-First Policy, Bicycle Plan, Pedestrian Master Plan Update, and Vision Zero Action Plan. Biking and walking trips make up 40% of trips in Berkley, but 80% of the severe injuries and fatalities due to collisions.[16] Implementation of Berkeley's existing efforts resulting in improved safety and connections encourages non-auto modes of travel, including e-bikes and other micromobility. It also directly impacts equity because people of color, people with low or no income, youth, seniors, and people with disabilities are disproportionately harmed by severe injury and fatal collisions. Ensure that work on safety and safety infrastructure is prioritized for low-income communities such as in the development of safe bicycle lanes and facilities.

1b. **Prioritize safety, equity, and electrification in shared mobility opportunities:** Utilize existing and future opportunities to regulate operations of shared mobility and charging providers. Working with stakeholders including residents, community-based organizations, and businesses, identify shared mobility offerings that solve transportation challenges for Berkeley residents, workers, and visitors, prioritizing safety and equity that will be executed through agreements with shared mobility providers. Identify opportunities, synergies, and gaps for encouraging expansion and electrification, as opposed to the use of gasoline or diesel, of shared mobility options. Study and implement ways to improve the safety of existing infrastructure for vulnerable road users, taking into account the speeds, visibility, predictability, and behavior of users of these modes of transportation, in alignment with the Vision Zero Action Plan, Bicycle Plan, and Pedestrian Master Plan Update.

1c. **Increase transportation demand management program (TDM) offerings and participation:** Identify opportunities to expand electric mobility offerings within TDM programs and regulations. Increase the utilization of employer-paid or provided transit, vanpool, and bicycle commuter benefits and resident transit benefits in new buildings with transportation demand management requirements,

particularly for electric transportation options, including e-bikes, through increased education and enforcement. For new buildings with TDM requirements, make sure that adequately-sized, secure parking that can incorporate the size and weight of cargo bikes and e-bikes is incorporated into the design and construction.

2: Electrification of Shared Transportation Fleets

The City will pursue strategies, in close partnership with EBCE and PG&E, to support electrification of vehicles used for shared transportation options in Berkeley, with an emphasis on prioritizing vehicles that provide service to underserved communities. Vehicle fleets include public transit, school buses, shuttles, non-profit service providers' vehicles, car sharing, Transportation Network Companies (TNCs), ferries, and others. Key actions to implement this strategy include:

Traveling in Berkeley

Brian
Berkeley Resident and Business Owner
Cyclist

"

People think that an auto free lifestyle for families isn't attainable, but my electric cargo bike takes me places faster than a car. E-bikes are expensive but in six months they pay for themselves and then you have money to get around for your other transportation expenses like car share. On my e-cargo bike, I interact with my kids who actually notice landmarks. My favorite part of my commute is engaging with my community.

"

STRATEGY: IMPROVE ALTERNATIVES TO DRIVING

2a. **Develop program for electrifying fleets for underserved communities**: Develop a program to offer technical assistance, connection to state programs, and possibly incentives to organizations to electrify fleets utilized for transportation services to underserved communities. Some organizations that provide services to underserved communities in Berkeley, such as non-profit affordable housing developers, senior services, and others, provide their own transportation services to their communities, and are interested in electrification.

2b. **Support bus electrification:** In collaboration with EBCE, work with AC Transit, BUSD, city-owned shuttles that serve senior centers, private shuttle operators (e.g. shuttles serving UC Berkeley, Berkeley Lab, and West Berkeley), and other bus fleets that serve the Berkeley community to connect fleets with incentives (e.g. Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP), Low Carbon Fuel Standard (LCFS) credits, PG&E programs, and EBCE funding) and provide other technical assistance as needed. The State's Innovative Clean Transit regulation requires all public transit agencies to transition to a zero emission bus fleet; as of 2029, all new transit bus purchases must be fully electric with a goal of full transition by 2040.

2c. **Pursue options to expand electrification of shared mobility:** Develop options to enable, incentivize, shape, and expand electrification of shared mobility options, like the City's One-Way Car Share Ordinance, with bikesharing program, and the anticipated scooter sharing pilot. In addition to providing models for people with disabilities, potential bikeshare expansions could include cargo bikes (designed for transporting loads, including children) and long term (monthly) e-bike rental programs.[17] Explore options for partnerships or assistance to identify site hosts for charging (not through financial incentives) to support electrification of taxis and TNCs, and car sharing, as these fleets benefit from having access to dedicated chargers. For TNC vehicles, this will include complementing implementation efforts for the California Clean Miles Standard (SB1014) and Incentive Program, which will require these companies to develop plans to reduce their greenhouse gas emissions on a per-passenger-mile basis beginning in 2022. While most TNC regulation occurs at the state level in California, cities have options to complement or enhance state policies (e.g., SB1014), such as through regulating its curb space or utilizing other traffic engineering strategies, or implementing registration or reporting requirements as San Francisco has done.[18] The City can also monitor for any unintended impacts of TNC electrification, such as barriers that may affect the ability of the community of people with disabilities to access services.

2d. **Plan for electrified autonomous vehicles (AVs):** Monitor market development of AVs, and develop options to guide AV implementation, and incentivize or require AVs to be electric, once introduced.

3: Shared Electric Mobility Hubs

The City will work with partners and potential electric shared mobility site hosts to develop infrastructure needed to support electric shared mobility options. Key actions to implement this strategy include:

3a. **Develop concept and plans for electric shared mobility hubs:** Develop concept and plans for hubs at key locations, such as the University of California—Berkeley, libraries, senior centers, BART and Amtrak stations, and other key destinations, with the intention of enabling last-mile connections to transit and shifting short trips to walking, biking, and electric shared mobility. Consider opportunities for providing multiple services at each hub, such as DCFC for TNC drivers, Level 2 charging for carsharing, charging for micromobility, Wi-Fi access and electric wheelchair charging. Engage with TransForm, MTC, and other cities working on similar concepts to learn from their experiences in implementing shared mobility hubs. Work with shared mobility providers to assess charging infrastructure needs and options, and with potential site hosts (such as BART) to identify opportunities, plans, and funding strategies for infrastructure development.

Traveling in Berkeley

Janet and Steve
Berkeley Residents
Recently gave up car for e-bikes

"

We have been using e-bikes and it's great because they open the urban landscape for exploration, and can carry up to 100 lbs. of cargo which is great for errands. Unfortunately, most of the destinations are on big avenues that have virtually have zero accommodation for biking. In an ideal world, I would bike on the big streets and safely park there.
"

TABLE 6: IMPROVE ALTERNATIVES TO DRIVING – STRATEGY AND ACTION SUMMARY

| Strategy	Action	Time-Frame	Lead	Potential partners	One-time costs	Ongoing costs	Resources to leverage
1: Safety and Access	1a: Support safe infrastructure for non-auto modes	Ongoing	Transportation	Public Works, community partners	$$$	TBD	MTC, BAAQMD
	1b: Prioritize safety, equity, and electrification in shared mobility opportunities	Short	Transportation	OESD, Shared mobility providers, community partners	$$	-	
	1c: Increase transportation demand management program offerings and participation	Ongoing	Transportation	OESD, major employers, TDM program managers, housing developers	$	$	Tax Relief Action to Cut Commuter Carbon (TRACC) program
2: Electrification of Shared Transportation Fleets	2a: Develop program for electrifying fleets for underserved communities	Medium	Public Works	OESD, PG&E, EBCE, community partners	$$	$	Low Carbon Fuel Standard (LCFS), Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP), CVRP, EBCE, PG&E
	2b: Support bus electrification	Ongoing	Public Works	OESD, PG&E, EBCE, shuttle operators, AC Transit, BUSD	$	$	LCFS, HVIP, EBCE, PG&E
	2c: Pursue options to expand electrification of shared mobility	Medium	Transportation	OESD, shared mobility providers, EV charging providers, PG&E, EBCE	$$	$	SB1014
	2d: Plan for electrified AVs	Long	Transportation	OESD, EV charging provider partners, EBCE, PG&E	$$	-	
3: Shared Electric Mobility Hubs	3a: Develop concept and plans for electric shared mobility hubs	Medium	Public Works	OESD, shared mobility providers, EV charging provider partners, BART, PG&E, EBCE	$$$	$$	EBCE, PG&E, Electrify America

STRATEGY: ACHIEVE ZERO NET CARBON

Achieve Zero Net Carbon: Eliminate emissions from private vehicles

🎯 **Key indicators and targets**

- **Electric vehicle adoption:** To reach carbon neutrality by 2045, it is estimated the city will need to increase adoption of light-duty EVs registered in Berkeley to 25% by 2025, 55% by 2030, and 100% by 2045.

- **Expand public and workplace EV charging availability:** To support the city's target number of EVs on the road by 2025, Berkeley will need at least 420 public Level 2 chargers, 100 public DCFC chargers, and 610 workplace chargers.

- **Increase electric mobility awareness and education.** The City will gauge the community's awareness and perspective of electric mobility options in Berkeley, through surveys and/or participation in educational events.
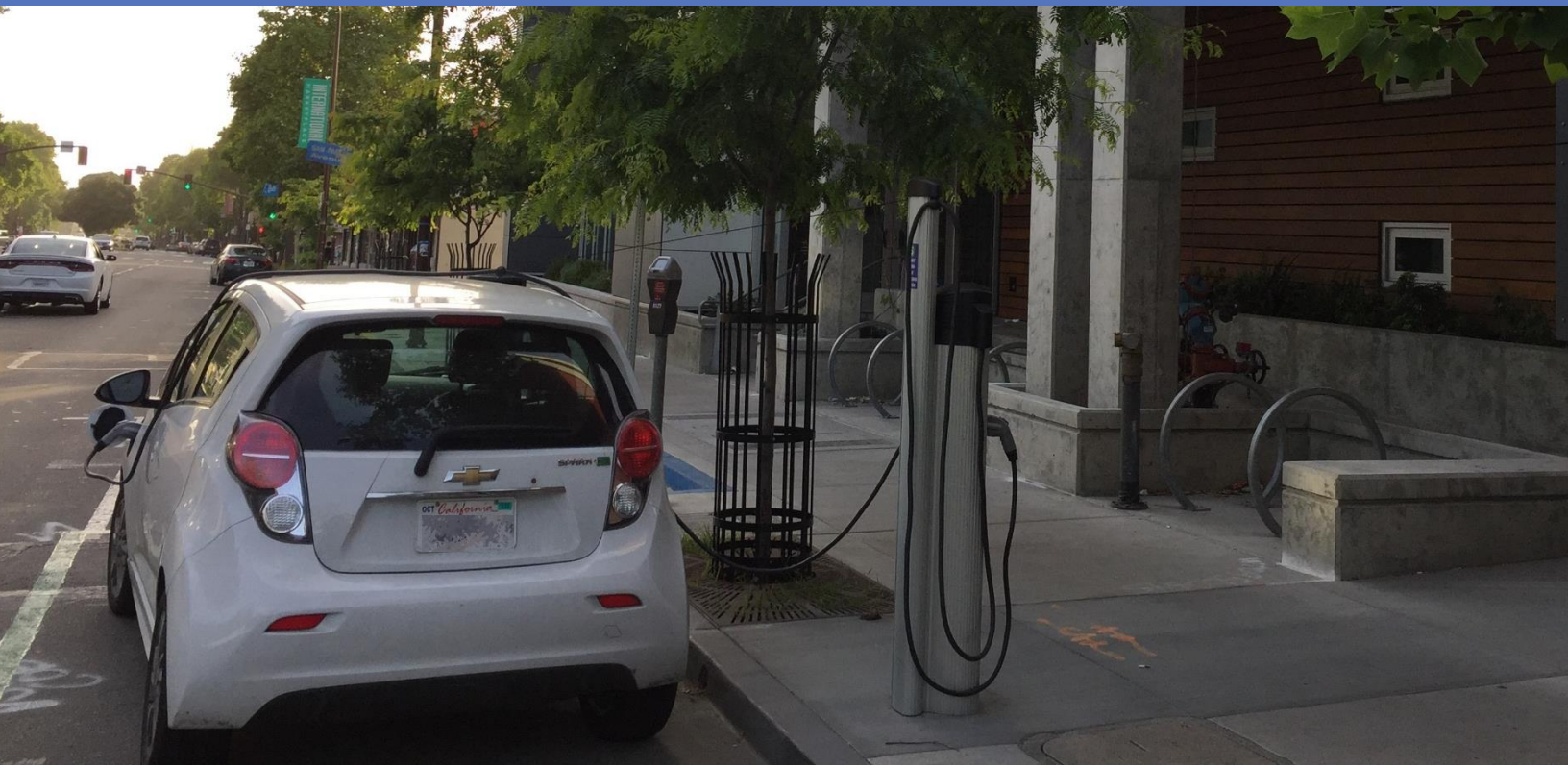
STRATEGY: ACHIEVE ZERO NET CARBON

Strategy Summary

TABLE 7: ACHIEVE ZERO NET CARBON STRATEGY SUMMARY

Strategy	Action
1: EV Charging in New and Existing Buildings	1a. Strengthen the building code
	1b. Utilize point-of-sale opportunities to incentivize electric panel upgrades and/or EV charger installations
	1c. Develop strategy to reach rental properties and other properties that haven't sold recently
2: EV Charging Permitting	2a. Improve process and communications for EV charging permitting
3: Public EV Charging on City Property	3a. Determine plan for public EV charging network expansion
	3b. Assess City parking spaces with potential for public EV charging
	3c. Develop approach and plan for curbside charging
	3d. Develop partnerships with EV charging providers to expand City EVSE network
4: Private EV Charging Site Hosts	4a. Develop incentive program for EV charging for underserved communities
	4b. Prioritize multifamily charging
	4c. Increase City capacity to conduct outreach and provide technical assistance to private site hosts
5: Electric Mobility Education and Outreach	5a. Maintain updated City electric mobility webpages and materials
	5b. Continue and expand participation in group electric mobility purchase campaigns
	5c. Raise awareness at partner events
	5d. Continue partnering with electric mobility and climate advocates
	5e. Develop culturally relevant awareness campaigns
	5f. Engage auto dealers to raise EV awareness
6: Smart, Resilient, Clean, and Affordable EV Charging	6a. Increase the share of EV charging powered by 100% renewable energy
	6b. Support smart charging
	6c. Support well-designed rates
	6d. Develop strategies to increase EV charging resilience
	6e. Continue to monitor emerging technologies and business models for EV charging
7: Electrification of Private Fleets	7a. Develop a plan to support and incentivize private fleet electrification
8 Disincentivize Fossil Fuel Vehicles without Creating New Inequities	8a. Conduct study on options to disincentivize fossil fuel vehicles

STRATEGY: ACHIEVE ZERO NET CARBON

Strategies

1: EV Charging in New and Existing Buildings

The City will pursue a variety of strategies to increase EV charging in new construction. Although more challenging, the City will also pursue options to encourage or require EV charging in existing buildings, leveraging opportunities to reach buildings undergoing major renovations, changing ownership, or going through rental property inspections. Key actions to implement this strategy include:

1a. **Strengthen the building code:** Update the building code with higher EV charging requirements in new construction to increase EV charging readiness requirements (the provision of electric capacity and conduit to support inexpensive future EV charging station installation) and potentially requiring EV charging station installations in some cases. These changes will require ongoing education and enforcement to assure compliance and can be analyzed to inform future updates. Explore opportunities to require EV readiness in the case of major remodels or renovations, beyond what is required by the building code.

Traveling in Berkeley

Jaron
Berkeley Resident
Pedestrian and Plug-In Hybrid Driver

"*In Berkeley I mostly get around on my feet. But when I go to work or shop I like to drive because my job is far away from where I live, as are many of the cheaper or bigger stores. When I was driving a gas car I filled up my tank every week; but, I only fill up my Prius Prime once every month.*"

1b. **Utilize point-of-sale opportunities to incentivize electric panel upgrades and/or EV charger installations:** Evaluate whether energy assessments completed at the time of property sales or for benchmarking required by Berkeley's Building Energy Saving Ordinance (BESO) could include measures such as electrical panel upgrades to support EV charging. Explore opportunities to expand the transfer tax rebate currently offered to purchasers of residential property for seismic retrofits to other property improvements that would support climate action, such as electrification of buildings and installation of charging infrastructure.

1c. **Develop strategy to reach rental properties and other properties that have not sold recently:** Study and implement options to increase EV readiness and charging access for rental properties as well as properties that have not sold recently. Sample actions may include working with the Berkeley Rent Stabilization Board or Berkeley's Rental Housing Safety Program to reach out to and educate landlords and property managers about EV charging and California's "right to charge" laws, funding electrical panel capacity assessments for multifamily buildings, or providing incentives to increase access to home EV charging for residents of these units.

2: EV Charging Permitting

The City will strive to continually streamline its EV charging permitting process and to exceed the requirements of AB1236, which requires local adoption of an ordinance to streamline and expedite EV charging permitting. The City has already been recognized by Governor's Office of Business and Economic Development[19] for its steps to streamline permitting, but stakeholders suggest even more could be done to lessen the time, cost, and complexity of permitting for EV charging. Key actions to implement this strategy include:

2a. **Improve process and communications for EV charging permitting:** Continue to engage partners such as EBCE, PG&E, EV charging providers, and electricians to solicit feedback and identify actions for permitting process improvement. Also consider best practices identified by peer cities and government agencies.[20] Develop and continually update guidance documents for contractors and site hosts for permitting EV charging installations in different contexts, including home charging, private shared charging such as workplace and multifamily charging, and public charging.

3: Public EV Charging on City Property

As Berkeley's Residential Curbside EV Charging Pilot comes to an end in 2020, the City will study options to alter or expand this program beyond individual charging stations at homes that lack off-street parking to additional opportunities. These could include publicly available infrastructure in curbside zones and city-owned off-street lots, possibly through partnerships with third-party EV charging providers to further leverage City and grant funds. Key actions to implement this strategy include:

3a. **Determine plan for public EV charging network expansion:** Assess peer cities' approaches to city-led public EV charging infrastructure development, EBCE, PG&E, and Electrify America's plans, and EV charging providers' plans for EVSE development in Berkeley. Consider the pros, cons, and track records of different partnership models with third-party charging providers, such as those piloted by Seattle, Sacramento, and Montreal, as well as options for charging management. Utilize index maps shown in Figures 15-17 to guide Berkeley's approach for meeting Level 2 and DCFC public charging needs.

3b. **Assess City parking spaces with potential for public EV charging:** Identify specific city parking spaces with the greatest feasibility and priority level for EV charging development, including opportunities for shared City fleet and public charging.

3c. **Develop approach and plan for curbside charging:** Develop a plan and potential zones for curbside charging, informed by peer-city research and City coordination of curb space use, with priority placed on encouraging alternatives to driving, such as transit and micromobility. This plan will incorporate lessons learned from the City's Residential Curbside EV Charging Pilot as well as plans to evolve or conclude the pilot. Between City parking spaces and curbside zones, plans will seek to enable convenient neighborhood access to charging, particularly in neighborhoods with high rates of multifamily and rental housing (see Figure 17 in the chapter "Berkeley's Electric Mobility Landscape").[21]
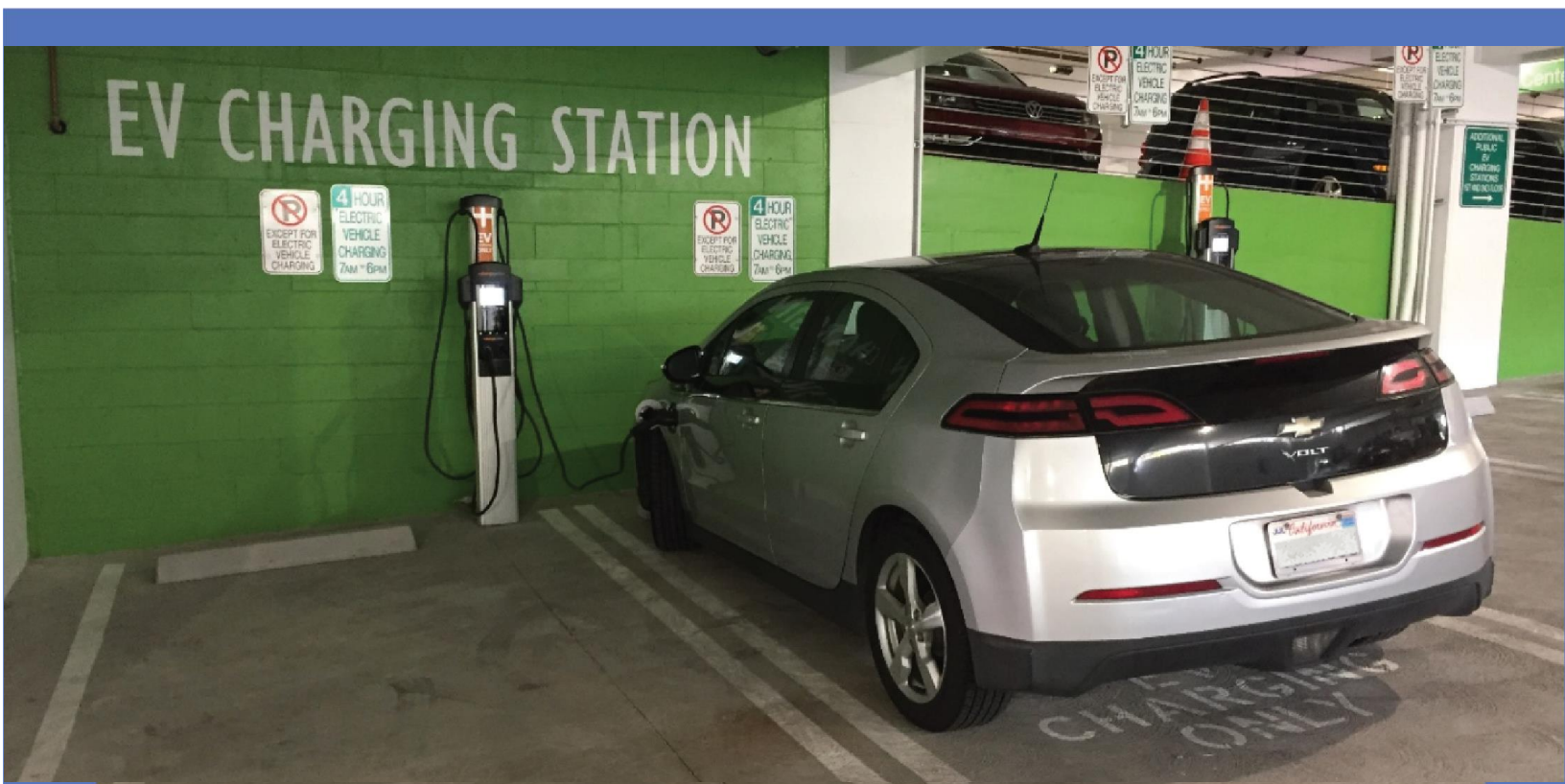
STRATEGY: ACHIEVE ZERO NET CARBON

3d. **Develop partnerships with EV charging providers to expand City EVSE network:** Consider releasing an RFI and/or RFP with the goal of developing partnerships with third-party charging providers to leverage their investment and to develop Level 2 and or DC fast-charging public stations in city-owned parking spaces and/or curbside zones, leveraging grant funding and investment from third-party charging providers where possible.[22]

4: Private EV Charging Site Hosts

The City will develop programs to conduct outreach, offer technical assistance, and possibly provide incentives to potential private EV charging site hosts with the intention of increasing EV charging accessibility at shopping and other destinations, community centers and other institutions, in multifamily housing, and at workplaces. Key actions to implement this strategy include:

4a. **Develop incentive program for EV charging for underserved communities:** Potentially in partnership with EBCE, develop an incentive program to support charging at community-based organizations, service providers, and affordable and/or rent-controlled housing in alignment with the Roadmap's equity goals. This program has the potential to be funded through LCFS credit funds and would aim to complement other EV charging incentive programs to increase EV charging access in underserved communities.[23]

4b. **Prioritize multifamily charging:** In addition to providing support for charging at affordable housing sites, the City will also identify needs and strategies to support charging at multifamily buildings and convenient alternatives for multifamily residents. The City will review best practices and key barriers, engage property owners and managers, assess opportunities within existing policies and programs, and review potential incentive programs and partnerships to leverage. The City will work with partners such as EBCE, PG&E, and Electrify America, to seek opportunities for DCFC installations, ideally as part of shared mobility hubs, near concentrations of multifamily buildings (see Figure 17 in the chapter "Berkeley's Electric Mobility Landscape") to improve access to charging and shared mobility services for the 45% of Berkeley residents who live in multifamily housing.

4c. **Increase City capacity to conduct outreach and to provide technical assistance to private site hosts:** Use the maps created for this Roadmap (Figures 15-17) to identify parking lots in high potential areas as well as to conduct focus groups with current EV charging site hosts, potential site hosts, and charging providers to identify their interests, challenges faced, and suggestions for approaches to recruit new EV charging site hosts. Increase staff capacity to conduct outreach and support workplaces, multifamily housing providers, community organizations, and other private site hosts in accessing incentive programs (including from PG&E, EBCE, and collaborating with Electrify America), going through permitting, and other steps to EV charging station development.[24] This effort may

include development of materials such as permitting guidance documents, sample lease agreements, and other suggestions to be identified through conversations with potential site hosts.

5: Electric Mobility Education and Outreach

The City will continue its existing electric mobility education and outreach activities, and seek to expand its reach and impact through partnerships with key stakeholders, with a goal of increasing awareness of electric mobility options and incentives. In addition to this outreach strategy, a more in-depth approach to reaching and partnering with underserved communities is described in the strategies under *Equity in Access*. The City has hosted annual Ride Electric events since 2017, which have featured private EVs, EV carsharing, and private and shared e-bikes. The City also maintains a website and educational materials about EVs and began offering EV 101 workshops in 2019. Key actions to implement this strategy include:

5a. **Maintain updated City electric mobility webpages and materials:** Include common messaging about electric mobility opportunities, rebates, and updates on Roadmap implementation progress. Identify opportunities to disseminate outreach materials through City communication channels, such as administration of the residential parking permit program, and partners' distribution channels such as 511, UC Berkeley Parking and Transportation outreach, and commuter benefits programs.

STRATEGY: ACHIEVE ZERO NET CARBON

5b. **Continue and expand participation in group electric mobility purchase campaigns:** Continue participating with organizations like Bay Area SunShares and Drive Clean Bay Area to run EV or EV charging group purchase campaigns. Explore opportunities to expand to e-bikes, including electric cargo bicycles, and other forms of electric micromobility, particularly since existing programs don't currently support these purchases.

5c. **Raise awareness at partner events:** Raise awareness about electric mobility opportunities through participation in community partner events and opportunities through other City outreach efforts, such as implementation of the Age-Friendly Berkeley Action Plan.

5d. **Continue partnering with mobility and climate advocates:** Continue and expand work with community organizations like the Ecology Center, Walk Bike Berkeley, 350 Bay Area, and EV driver advocates to help raise public awareness about micromobility, electric mobility, and EV opportunities. Additional EV outreach activities could focus on raising awareness about EV incentive opportunities, electricity rates for EV charging, and peer-to-peer charging apps where residents can find and share home chargers.

Traveling in Berkeley

Abeni
City of Berkeley Employee
Plug-in Hybrid Driver

"

I drive to work and it's a long commute but I am thankful for the HOV sticker I use to beat traffic even though I'm a solo commuter. I envision a future where we have stations for EV cars like we have gas stations.

"

5e. **Develop culturally relevant awareness campaigns:** Develop partnerships with organizations to create culturally appropriate awareness campaigns (in a language other than English, where appropriate), utilizing trusted mediums and messengers (such as Spanish language radio and community newspapers). Explore opportunities to provide grants to community organizations working with underserved communities to conduct electric mobility outreach.

5f. **Engage auto dealers to raise EV awareness:** Partner with organizations such as Plug in America and the Sierra Club, which have campaigns to engage auto dealerships and can play an important role in educating consumers about EVs. Options to engage and encourage dealers to promote and educate their customers about EVs may include dealer recognition programs, support for training salespeople on topics such as charging and available incentives, sharing materials developed for City, state, and EBCE programs, and partnering on ride and drive events.[25] Encourage local car dealerships to participate directly in the Clean Cars for All program to increase access for low-income communities and communities of color to EVs. This engagement effort could also be expanded to include engagement with car rental companies in Berkeley, as they can help expose drivers to EVs if they have EVs available and promote them to customers.

6: Smart, Resilient, Clean, and Affordable EV Charging

The City will work with PG&E, EBCE, and other key stakeholders to ensure EV charging that is smart, resilient, and powered by clean energy. Key action steps to implement this strategy include:

6a. **Increase the share of EV charging powered by 100% renewable energy:** Work with EBCE to promote its 100% renewable electricity options for EV charging, explore the possibility of opting up as a default for all accounts in the city, monitor opt-out rates, and develop contingency plans to ensure clean energy available in Berkeley remains available in the long term for EV charging. Continue to maintain a streamlined process for property owners (particularly workplaces and locations where EVs will use daytime charging) to install solar to contribute to the availability of local clean electricity matched with EV loads.

6b. **Support smart charging:** Smart charging refers to programs that manage EV charging to promote grid stability or efficient resource use, which will become increasingly important as the City seeks to electrify its buildings and transportation systems. These programs can include demand response, managed charging, vehicle-to-building, or vehicle-to-grid applications. Pursue partnerships with EBCE to incentivize smart chargers and to enable customers to opt into grid-controlled charging programs for their home chargers. Pursue smart charging options for medium and heavy duty fleets, including those operated by the City and by private sector operators. Work to connect property owners and fleets with resources to implement smart charging solutions.

STRATEGY: ACHIEVE ZERO NET CARBON

6c. **Support well-designed rates:** Engage with EBCE and PG&E on design of rates and pricing that encourage, or at a minimum do not penalize or discourage, electrification of transportation and buildings.

6d. **Develop strategies to increase EV charging resilience:** As more of the City's transportation systems run on electricity, it will be essential to develop strategies to enable back-up power in emergencies for critical transport services. Strategies may include generators, solar + storage integration, modular solar + storage charging pods, and creation of islandable (meaning can operate connected to the grid or independently) microgrids for charging.

6e. **Continue to monitor emerging technologies and business models for EV charging: Given** the dynamism of the electric mobility space, continue to monitor emerging technologies and business models for EVs and EV charging to be able to identify opportunities for the City. These include solutions such as mobile charging, sponsor-funded charging, valet solutions at workplaces, high-powered DC fast chargers, and other innovations.

7: Electrification of Private Fleets

Although the transport of goods is not the primary focus of this Roadmap, eliminating emissions from these vehicles will also be necessary to achieve zero net carbon. The City, in partnership with EBCE and PG&E, will explore ways to encourage electrification of private fleets used for goods movement and other commercial activities, such as delivery vehicles, heavy-duty fleets, and other institutional and commercial fleets, by providing technical assistance, raising awareness about incentive opportunities, and other regulatory levers. This strategy includes the following action:

7a. **Develop a plan to support and incentivize private-fleet electrification:** Identify and promote available incentives and programs for private-fleet operators, analyze delivery and freight routes and delivery zones in Berkeley, reach out to potential partners, such as the regional Clean Cities Coalition, and develop a list of private-fleet operators to reach out to. Explore options to support and incentivize private fleet operators to commit to an electrification goal, such as creating a designation for companies that make an electrification commitment, supporting programs through EBCE and/or PG&E, and establishing priority loading zones for electric delivery vehicles. Additionally, explore potential to include electric vehicle requirements or preference in City contract language for projects involving private fleets, such as road repair.

8: Disincentivize Fossil Fuel Vehicles without Creating New Inequities

The adoption of electric mobility options will need to accelerate rapidly to reach zero net carbon by 2045 (see "EV Adoption Rates in Berkeley" for more detail on EV adoption scenario modeling). The City

may need to consider disincentives, in addition to the many state, utility, and local incentives available and proposed in this Roadmap. However, if not designed appropriately, disincentives may unevenly burden certain groups and members of the community. This strategy includes the following action step:

8a. **Conduct study on options to disincentivize fossil fuel vehicles:** To ensure the City reaches its climate goals, conduct a study of options to increasingly disincentivize fossil fuel vehicles relative to EVs over time, through levers such as parking policy and pricing, congestion charges, and excluding fossil fuel vehicles from zones within the city. This could include disincentivizing driving generally, which would also help alleviate congestion and save electricity. Even if implemented at a time when EVs have reached cost parity for the majority of the population, these policies could have unintended adverse impacts on low-income constituents who cannot afford to replace their household vehicle(s), and people whose disabilities are not accommodated by available EV models (e.g., people with heavy wheelchairs that may not fit in EV models). Therefore, the City may consider these disincentives for the long term, when EVs become more and more affordable and more accessible to people with disabilities. Exceptions should be provided in any case when these disincentives would cause undue hardship. The City could consider a long-term action as strong as banning the use of Berkeley streets for internal combustion vehicles or banning sales of gasoline and diesel fuels and/or vehicles by 2045 to send a long-term signal, though the equity and economic impacts, effectiveness, legality, and implementation would need to be studied.

TABLE 8: ACHIEVE ZERO NET CARBON – STRATEGY AND ACTION SUMMARY

Strategy	Action	Time-Frame			Lead	Potential partners	One-time costs	Ongoing costs	Resources to leverage
1: EV Charging in New and Existing Buildings	1a: Strengthen the building code	Short	Medium		Building & Safety	OESD	$	$	
	1b: Utilize point-of-sale opportunities to incentivize electric panel upgrades and/or EV charger installations	Short			OESD	Finance Department	$$	$$	Building Energy Savings Ordinance (BESO), Seismic Retrofit Refund Program
	1c: Develop strategy to reach rental properties and other properties that haven't sold recently		Medium		OESD	Rent board, property owners, community partners	$$	$$	Rental Housing Safety Program
2: EV Charging Permitting	2a: Improve process and communications for EV charging permitting		Ongoing		Building & Safety	OESD	-	$	
3: Public EV Charging on City Property	3a: Determine plan for public EV charging network expansion		Medium		Public Works	OESD, EV charging provider partners, EBCE, PG&E	$$	TBD	
	3b: Assess City parking spaces with potential for public EV charging	Short			Public Works	OESD, Transportation	$	-	
	3c: Develop approach and plan for curbside charging		Medium		Public Works	OESD, Transportation	$$	-	
	3d: Develop partnerships with EV charging providers to expand City EVSE network		Ongoing		Public Works	OESD, EV charging provider partners	TBD	TBD	EBCE, PG&E
4: Private EV Charging Site Hosts	4a: Develop incentive program for EV charging for underserved communities	Short			OESD	Community partners, EBCE	$$	$$$	Low Carbon Fuel Standard (LCFS), EBCE, PG&E, Electrify America
	4b: Prioritize multifamily charging	Short			OESD	Multifamily and affordable housing providers, EBCE, PG&E	$$	$$	EBCE, PG&E, Electrify America

Category	Action	Short	Medium	Long	Lead	Partners	Cost 1	Cost 2	Partners 2
	4c: Increase City capacity to conduct outreach and provide technical assistance to private site hosts	Ongoing			OESD	Land Use Planning, EBCE, PG&E	$$	$$	EBCE, PG&E, Electrify America
5: Electric Mobility Education and Outreach	5a: Maintain updated City electric mobility webpages and materials	Ongoing			OESD		-	$	
	5b: Continue and expand participation in group electric mobility purchase campaigns				OESD	Bay Area SunShares, Drive Clean Bay Area	-	$	
	5c: Raise awareness at partner events	Ongoing			OESD	Community partners	-	$	
	5d: Continue partnering with electric mobility and climate advocates	Ongoing			OESD	Environmental advocates	-	$	
	5e: Develop culturally relevant awareness campaigns	Short			OESD	Community partners	$	$$	
	5f: Engage auto dealers to raise EV awareness		Medium		OESD	Environmental advocates	-	$	
6: Smart, Resilient, Clean, and Affordable EV Charging	6a: Increase the share of EV charging powered by 100% renewable energy	Ongoing			OESD	EBCE	-	$$	
	6b: Support smart charging	Ongoing			Public Works	OESD, EBCE	$$	$	
	6c: Support well-designed rates	Ongoing			OESD	PG&E, EBCE	-	$	
	6d: Develop strategies to increase EV charging resilience		Medium		Public Works	OESD, Fire, Police	$$	TBD	
	6e: Continue to monitor emerging technologies and business models for EV charging	Ongoing			OESD	Public Works	$	$	
7: Electrification of Private Fleets	7a: Develop a plan to support and incentivize private fleet electrification			Long	Public Works	OESD, Private fleet operators, EBCE, PG&E	$$	TBD	
8: Disincentivize Fossil Fuel Vehicles without Creating New Inequities	8a: Conduct study on options to disincentivize fossil fuel vehicles			Long	Transportation	OESD	$$	TBD	

Demonstrate City Leadership: Lead by example and guide the electric mobility transition

🎯 Key indicators and targets

- **All-electric City fleet by 2030:** The City will convert all City vehicles to electric where technically feasible by 2030.

Strategy Summary

TABLE 9: DEMONSTRATE CITY LEADERSHIP STRATEGY SUMMARY

Strategy	Action
1: City Fleet Electrification Plan	1a. Develop transition plan for the city fleet by 2020
	1b. Increase emerging mobility management capacity
2: Electric Mobility Charging Management	2a. Develop city-owned EV charging rules and regulations
	2b. Monitor and adjust EV charging rates over time
	2c. Develop city-owned EV charging operating plans
3: Electric Mobility Planning with Streetscape & Construction Projects	3a. Develop electric mobility integration process with relevant departments
4: Local Innovation to Support Electric Mobility	4a. Utilize business and innovation networks
	4b. Stimulate locally-developed technology pilots
5: Electric Mobility Roadmap Implementation Working Group	5a. Convene working group
	5b. Regularly report on progress
6: Funding for Roadmap Implementation	6a. Annually develop funding plan with working group

Strategies

1: Develop and Implement City Fleet Electrification Plan

The City will develop a plan to convert all City vehicles to electric, where technically feasible, and phase out their fossil fuel use by 2030. In 2019, the Berkeley City Council issued a directive for Public Works and the City Manager to collaborate on an action plan by June 2020 to "to aggressively accelerate the implementation of the electrification of the City's municipal fleet and phase out fossil fuel use in municipal vehicles by 2030 with consideration of an earlier transition for light-duty passenger vehicles." Key actions to implement this strategy include:

1a. **Develop transition plan for the city fleet by 2020:** Through EBCE, develop an electrification plan that requires all new city-owned vehicles to be electric (except when suitable EV models are not available), considering available technologies for different applications, vehicle ages, and duty cycles. Think broadly about electrification options for City fleet, such as substituting e-bikes or low-speed EVs (e.g., golf carts) instead of sedans, and potential downsizing or outsourcing vehicles. Include a charging infrastructure plan that fits the needs of the City fleet vehicles, and considers possibilities to make charging available either to other fleets or the public for charging during certain times. Include a funding and financing plan that may include alternative procurement and financing strategies and that best leverages the $600,000 in city funds allocated in FY 2020.

1b. **Increase emerging mobility management capacity:** Develop electric and emerging mobility expertise and capacity within the City through new training and/or staffing. Development and management of smart, resilient charging should be integrated into City operations.

STRATEGY: DEMONSTRATE CITY LEADERSHIP

2: Develop Electric Mobility Charging Management

The City will develop a comprehensive set of policies and standards, and assess any changes needed to parking ordinances and operations to effectively integrate management and enforcement of EV charging into the City's existing parking operations. Key actions to implement this strategy include:

2a. **Develop city-owned EV charging rules and regulations:** Develop or refine regulations for EV signage and wayfinding, parking, and enforcement, including parking rates, time limits, fees and penalties, and "parking while charging" restrictions that support turnover and charger availability. Identify EV charging rules that fit most easily within existing parking enforcement regulations and operations. Pursue use of queuing apps and other charging management strategies in partnership with charging providers.

2b. **Monitor and adjust EV charging rates over time:** Evaluate EV charging rates for city-owned chargers in relation to actual costs for the service, the comparable cost of gasoline, the price needed to ensure turnover and charger availability, and State requirements. Rates are approved by City Council and could be used to incentivize charging at specific times of day or locations.

2c. **Develop city-owned EV charging operating plans:** Identify staffing responsible for EV charging installations, operations, and maintenance on City property and other aspects, including managing LCFS credits, potentially in partnership with EBCE. Pursue opportunities to fully utilize charging infrastructure, such as allowing a combination of fleet and public use when appropriate.

3: Integrate Electric Mobility Planning with Streetscape and Construction Projects

The City will work with the Public Works and Planning departments to identify processes to incorporate EV charging and electric shared mobility planning into streetscape projects, re-paving, and other major public works projects to lessen costs and disruptions of EVSE development. Key actions to implement this strategy include:

3a. **Develop electric mobility integration process with relevant departments:** Meet with relevant departments to identify their timelines and processes for streetscape and public works projects, and to identify when and how to consider inclusion of EV charging in that process.

STRATEGY: DEMONSTRATE CITY LEADERSHIP

4: Local Innovation to Support Electric Mobility

The City will utilize the innovation of Berkeley's businesses and institutions, including the University of California – Berkeley and the Lawrence Berkeley National Laboratory, to support electric mobility within the community. The City will provide information, opportunities, and connections to enable this strategy through these key actions:

4a. **Utilize business and innovation networks:** Share information about opportunities for local companies to support citywide electric mobility through a variety of business and innovation networks, including the Berkeley Business District Network, Berkeley Startup Cluster, Berkeley Chamber of Commerce, Alameda County Green Business Network, and the East Bay Economic Development Alliance.

4b. **Stimulate locally-developed technology pilots:** As opportunities arise, introduce Berkeley-based electric mobility business leaders to city staff to explore opportunities for locally developed technology pilots, demonstration projects, or longer-term contracts that enable citywide electric mobility.

5: Electric Mobility Roadmap Implementation Working Group

The City will establish a working group to manage implementation of the Electric Mobility Roadmap that includes both internal and external stakeholders, and that will strive to include a diversity of perspectives and representation from underserved communities and strive to use equity best practices in community engagement. The working group's mandate will be to track and evaluate implementation progress, coordinate amongst department leads and external stakeholders, adjust the Roadmap strategies over time as conditions change or challenges arise, and will be guided by the equity goal in the Roadmap. Key actions to implement this strategy include:

5a. **Convene working group:** Within six months of the approval of the Roadmap, the City will convene a working group, seeking representation from internal and external stakeholders, with an emphasis on representatives from underserved communities.

5b. **Regularly report on progress:** The working group will share progress publicly on an annual basis to track progress towards Roadmap targets and indicators. As additional data become available (for example, on the use of anticipated shared electric mobility fleets or participation in future incentive programs), track and share that data as well.

6: Identify funding sources for Roadmap Implementation

The City has already committed significant resources to electric mobility, with $600,000 approved in the FY 2020 budget for City fleet and EV charging infrastructure. The City will continue to develop plans to fund Roadmap implementation on an ongoing basis, through leveraging external programs, City funds, and innovative approaches, such as financing options, leveraging LCFS credits generated from city-owned EV chargers, taxes on University of California-Berkeley parking, or other new and unencumbered revenue sources. Ultimately, achieving the ambitious goals in the plan will require investment by private and other public entities beyond the City's limited budget. In identifying funds for Roadmap implementation, the City will consider the beneficiaries of city funds and seek an equitable distribution of those funds.

6a. **Annually develop funding plan with working group:** OESD will work annually with the Roadmap Implementation Working Group to identify funding needs for top priority initiatives for that year as well as potential funding sources, such as a budget request to City Council, LCFS funds, grant funds, or in-kind sources from private sector partners.

Traveling in Berkeley

South Berkeley Senior Center

Daughter of Morie
Berkeley Senior Center Member

"My father Morie comes to the Senior Center for sing along with a pianist. I drive him around in our car as we have zero public transit in our neighborhood. As a daughter with an elderly father, I envision a future with small electric buses and taxis having a general route that branches out for elderly people that can't walk far."

TABLE 10: DEMONSTRATE CITY LEADERSHIP—STRATEGY AND ACTION SUMMARY

Strategy	Action	Time-Frame	Lead	Potential partners	One-time costs	Ongoing costs	Resources to leverage
1: City Fleet Electrification Plan	1a: Develop transition plan for the city fleet by 2020	Short	Public Works	OESD, EBCE, PG&E	$$	TBD	HVIP, EBCE, PG&E
	1b: Increase emerging mobility management capacity	Medium	Public Works	OESD	$	$$$	
2: Electric Mobility Charging Management	2a: Develop city-owned EV charging rules and regulations	Short	Transportation	OESD, Public Works, EV charging providers	$$	$	
	2b: Monitor and adjust EV charging rates over time	Ongoing	Transportation	OESD, Public Works, EV charging providers	-	$	
	2c: Develop city-owned EV charging operating plans	Short	Transportation	OESD, Public Works, EV charging providers	$$	$	
3: Electric Mobility Planning with Streetscape & Construction Projects	3a: Develop electric mobility integration process with relevant departments	Short	Public Works	OESD	$$	$	
4: Local Innovation to Support Electric Mobility	4a: Utilize business and innovation networks	Ongoing	Economic Development		-	$	
	4b: Stimulate locally-developed technology pilots	Ongoing	Economic Development	Public Works, OESD, Transportation	-	$	
5: Electric Mobility Roadmap Implementation Working Group	5a: Convene working group	Short	OESD	Transportation, Public Works	$	$	
	5b: Regularly report on progress	Ongoing	OESD		-	$	
6: Funding for Roadmap Implementation	6a: Annually develop funding plan with working group	Ongoing	OESD	Transportation, Public Works	$	TBD	

ELECTRIC MOBILITY LANDSCAPE

Berkeley's Electric Mobility Landscape

This section highlights key learnings from the Needs Assessment, conducted to understand Berkeley's current mobility context and to inform development of the Roadmap. The Needs Assessment included an online survey, stakeholder interviews and workshops, geospatial analysis, and EV adoption and EV charging projections. It provides quantitative and qualitative background for the Roadmap goals.

The online survey was distributed on Berkeley's OpenGov platform in January 2019, and over 670 individuals, who either live, work, study, or spend time in Berkeley, responded to the survey. It is important to note in interpreting the results that a higher percentage of survey respondents were EV owners, homeowners, higher-income, and/or white as compared to the Berkeley population as a whole, and therefore did not provide an accurate representation of the population.

FIGURE 4: STAKEHOLDER INTERVIEWS

- Center for Independent Living
- World Institute on Disability
- Berkeley Black Ecumenical Ministerial Alliance (BBEMA)
- GRID Alternatives
- Satellite Affordable Housing Developers
- Berkeley Housing Authority
- Resources for Community Development
- BRIDGE Housing
- Building Opportunities for Self-Sufficiency (BOSS)
- TransForm
- Bay Area Organization of Black Owned Businesses (BAOBOB)

Interviews were conducted in spring 2019 with representatives of underserved communities and other key stakeholders. The organizations interviewed are shown in Figure 4. Given the distribution of the survey responses, the findings of the stakeholder interviews provide a broader perspective of mobility trends and EV perspectives in the Berkeley community, particularly among underserved communities.

On March 15, 2019, a key stakeholder workshop—including representatives from the community organizations in Figure 4 as well as the Ecology Center, PG&E, EBCE, EVgo, Tesla, ChargePoint, GM Maven, Envoy, UC-Berkeley, Lawrence Berkeley National Lab, Alameda CTC, Berkeley Energy and Transportation Commissioners, and City staff—was held. This workshop shared highlights from the best practices research, interviews, surveys, geospatial analysis, and electric mobility adoption scenarios, and provided an opportunity to share ideas that shaped the goals, strategies, and actions of the Roadmap.

The Roadmap was further refined through feedback from Berkeley's Community Environmental Advisory Commission, Transportation Commission, and Energy Commission to Roadmap presentations in July 2019. In addition, the public was invited to learn about the Roadmap at a Berkeley Climate Action Coalition "Ride Electric All the Way Home" workshop on August 22, 2019, and the "Ride Electric at the Farmer's Market" event on September 14, 2019; feedback from these events further refined the content

and priorities of the Roadmap. For example, electric bus and shuttles were frequently cited as a priority in Berkeley, prompting the creation of the *Electric Bus Rapid Transit Routes* strategy as well as refinements to other strategies on transit and shared mobility.

A complete Draft Roadmap was shared on the City's webpage in October 2019. E-mail notifications were sent to all stakeholders and shared on general distribution lists. Public comments on the Draft Roadmap were accepted between October 15 and November 15, 2019. Nearly 30 individuals and organizations submitted comments, including the Berkeley Energy Commission, EBCE, RCD Housing, Transform, World Institute on Disabilities, Center for Sustainable Living, Rising Sun Center for Opportunity, Walk Bike Berkeley, 350 Bay Area, ChargePoint, Tesla, several City of Berkeley staff, and other individuals. These comments were used to refine the Roadmap, as presented to Berkeley City Council in April 2020.

General Mobility Context in Berkeley

This section provides background on how the Berkeley community travels today and what factors influence transportation decisions to help ground the focus of the Roadmap's strategies.

How the Berkeley Community Travels

Survey respondents report relying most heavily on driving and walking to get around day to day, though many also bicycle or use transit every day or a few times a week (Figure 5). Many respondents also use public transit and TNCs for occasional trips.

ELECTRIC MOBILITY LANDSCAPE

FIGURE 5: SURVEY: MOST FREQUENTLY USED TRANSPORTATION MODES

How frequently do you use the following transportation options to get to work, shopping, recreational activities, or other locations? (N=639)
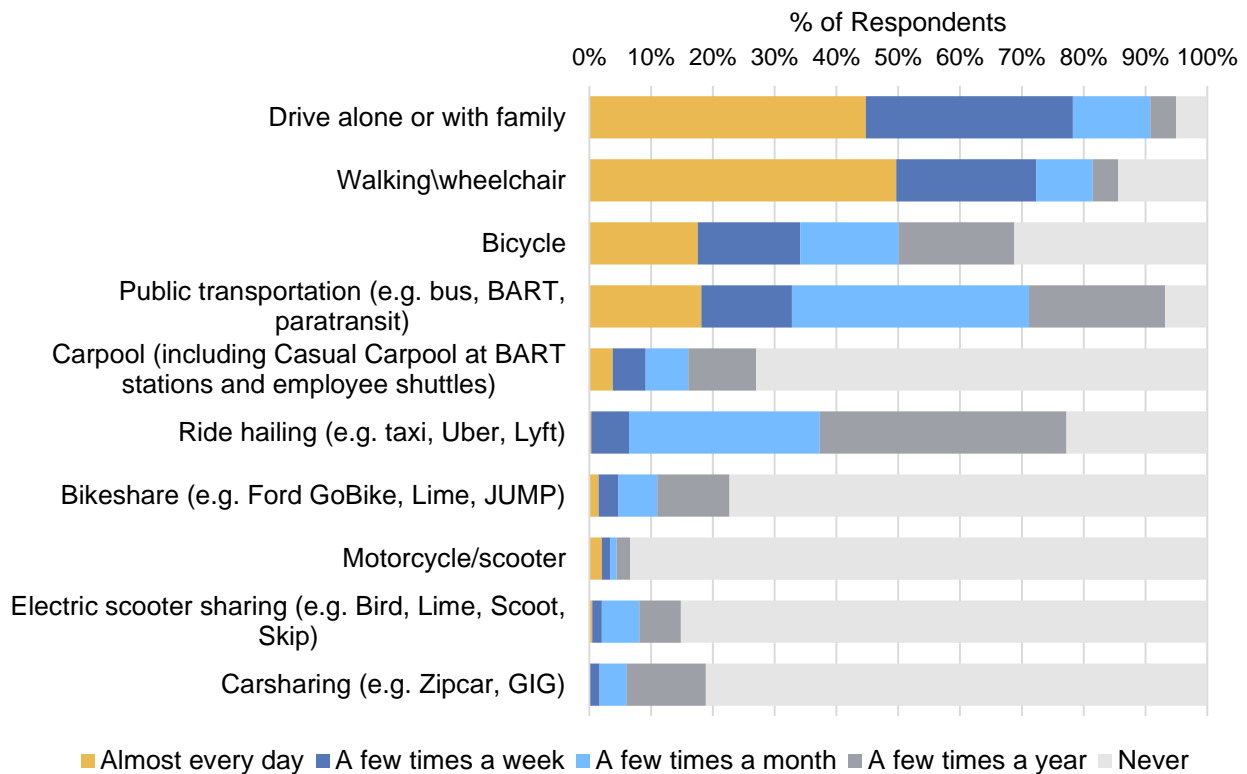
Survey respondents reported the top factors in choosing how to travel were convenience, travel time, safety, cost, and comfort. Some also mentioned environmental motivations, age or other physical limitations that affect their choices, health and exercise benefits, work requirements, and reliability and accessibility of transportation options (particularly for public transit and parking) as key factors.

Interviewees reported that underserved communities in Berkeley rely heavily on public transit, walking/wheelchair, and driving their own vehicles. Some utilize bicycling, carpooling, taxis, TNCs, paratransit, and shuttles (such as those serving Kaiser). Others use specialized services for seniors or persons with disabilities, such as Easy Does It Transportation Services.

ELECTRIC MOBILITY LANDSCAPE

Interviewees stressed that cost is a key factor driving underserved communities' transportation choices, and that many struggle to afford bus or BART fares. Others stressed physical limitations to drive or access certain modes due to age or disability. While many lower-income community members do rely on transit, interviewees stressed that job locations and requirements do necessitate many lower-income community members to drive (both those that are residents and those that commute into Berkeley for a job). In Berkeley, Census commuting data suggest lower-income households commute by car somewhat less than higher-income households, but that at least 30% commute by car or carpooling (see Figure 6).

FIGURE 6: MEANS OF TRANSPORTATION TO WORK BY HOUSEHOLD INCOME FOR BERKELEY RESIDENTS, American Community Survey 5-year 2017

> $50,000 HH Income
< $50,000 HH Income

0%   20%   40%   60%   80%   100%

- Car, truck, or van - drove alone
- Car, truck, or van - carpooled
- Public transportation (excluding taxicab)
- Walked
- Taxicab, motorcycle, bicycle, or other means
- Worked at home

Interviewees also highlighted that displacement pressure has distanced many community members from services and institutions, which, for example, requires some members of historically black churches to drive to church on Sundays from outside of Berkeley.

ELECTRIC MOBILITY LANDSCAPE

Vehicle Ownership and Use

Citywide, Census data indicate 79% of Berkeley households have at least one vehicle. For renter-occupied housing, that figure is 67%, while 96% of owner-occupied households have at least one car. While it is estimated that around 3.7% of registered vehicles in Berkeley were EVs as of late 2018, 42% of survey respondents reported owning an EV.[26] This both underscores that the survey sample is not representative of the Berkeley community as a whole, and highlights a strong base of community members who are enthusiastic about owning an EV.

Interviewees reported that vehicle ownership is generally lower in their communities than in the broader population, particularly those that primarily serve seniors or very low-income communities. Interviewees noted that those who must drive spend a disproportionate share of their income on fuel and maintenance, highlighting the potential savings benefits from driving an EV. Interviewees also highlighted the impacts of predatory car loans on their communities, as well as an increasing number of community members driving for TNCs where income and ability to repay those loans can be highly uncertain. Some interviewees' organizations also own vehicles to provide transportation service to their communities, and expressed interest in electrifying those vehicles. For example, one affordable housing organization has six buses to take seniors on trips to the supermarket, recreational activities, and medical appointments.

Awareness and Perspectives on EVs

More than half of survey respondents reported knowing someone who has an EV or has direct experience with EVs, while only 10% said they have no experience with EVs. In considering future vehicle purchases, respondents report that charging at home, purchase price, and range will be the biggest factors influencing their decisions to purchase an EV.

On the other hand, interviewees felt their communities are unfamiliar with EV technology and are not aware of incentive opportunities. Additionally, interviewees expressed concerns that without action, their communities seem unlikely to experience the benefits of EVs, and would likely face difficulties accessing charging at home.

Berkeley's Electric Mobility Context

Existing EV Initiatives in Berkeley

The Roadmap builds on a strong base of local, regional, state, and federal support for EV adoption. To date, the City of Berkeley has taken a number of steps forward to support EV charging and raise awareness about EVs, as is detailed in Figure 7.

ELECTRIC MOBILITY LANDSCAPE

FIGURE 7: KEY CITY OF BERKELEY EV INITIATIVES

- **City-owned public EV charging stations:** Berkeley has installed 73 public Level 2 EV charging ports, including over 50 in the newly-opened Center Street Garage

- **Streamlined permitting for home EV charging:** Berkeley has streamlined permitting for home EV charging, enabling online or in-person applications, and requires only an electrical permit (no plans, manufacturer's specification sheets, zoning review or plan review are required for permitting).

- **EV charging readiness:** Beginning in 2020, Berkeley requires Level 2 EV charging readiness at new single family homes, duplexes and townhomes (at least one space per dwelling unit) and at 20% of parking spaces at new multifamily buildings (and raceway at the remaining 80% of parking spaces). New hotels, motels, and nonresidential buildings must have Level 2 charging installed at 10% of parking spaces (and raceway at 40% of the spaces). These specifications are required through a local amendment to the California Green Building Code. Previously, from 2013-2019, the City had utilized conditions of land use permits to specify that 10% of spaces (or at least one space) in new residential construction must be pre-wired for Level 2 EV charging, and 3% of spaces in non-residential new construction that had at least 20 parking spaces.

- **Residential curbside EV charging pilot:** Berkeley is running a pilot that enables EV drivers without access to an off-street parking space a way to charge at home.

- **Berkeley EV website and materials:** The City maintains an in-depth website with information about driving an EV, including "Drive Electric on a Budget" brochure, info on charging, and more.

- **Annual ride electric events:** The City has partnered with local organizations to host an annual event that enables residents to learn about electric mobility including EVs, EV car sharing, and e-bikes.

- **EV 101 Workshops:** The City has partnered with 350 Bay Area and other communities to hold regular informational workshops on EVs, charging, incentives, financing, and other resources.

In addition to Berkeley's efforts, there are many programs, policies, and regulations to support EV adoption in place at the state, regional, and utility scales. Berkeley's distribution utility PG&E, community choice aggregator EBCE, the Bay Area Air Quality Management District, and various state-level agencies each have a variety of programs and incentives available for EVs for personal use and fleet use, as well as for EV charging. While these policies and programs can change frequently, it is essential for the City to continue to monitor and leverage these programs for its own fleet as well as to connect residents, businesses, and other stakeholders with them. Please see the Appendix for a table detailing current key state, regional, and utility EV programs and policies to leverage in the implementation of this Roadmap.
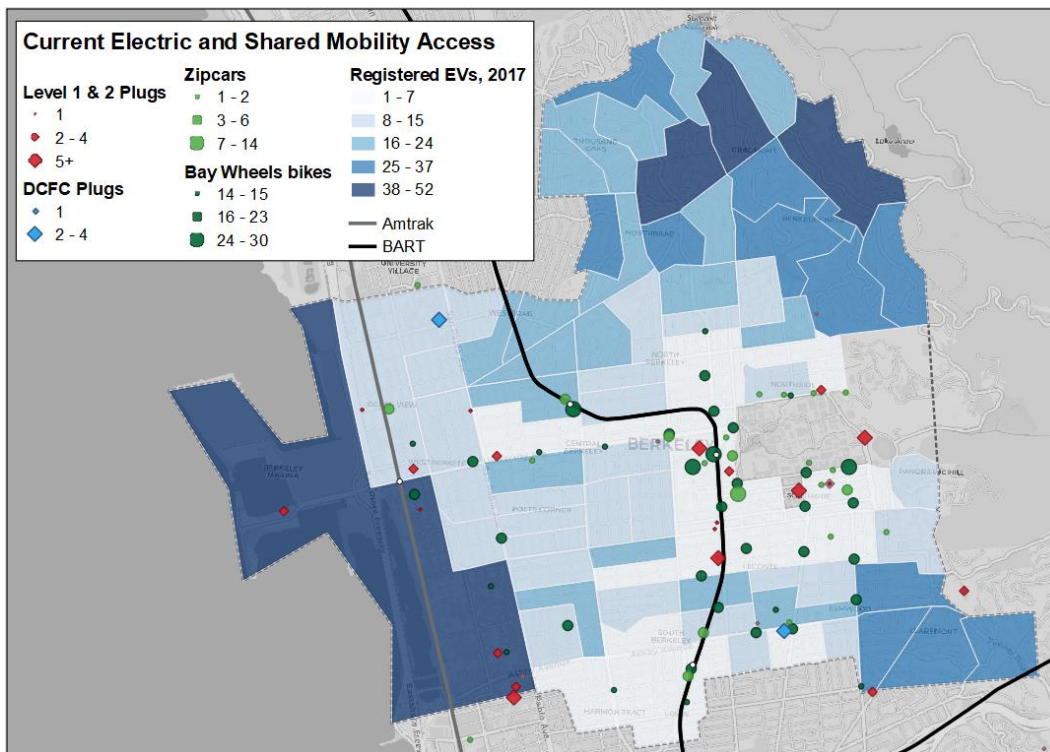
ELECTRIC MOBILITY LANDSCAPE

Current Electric and Shared Mobility Options in Berkeley

In addition to personal EV ownership and access to EV charging, a variety of shared mobility options (some of which are electric) are available in Berkeley. These include Zipcar carsharing (no EVs yet), GIG carshare (hybrid vehicles), Bay Wheels (formerly Ford GoBike, includes conventional bikesharing bikes as well as pedal assist e-bikes), and soon will include an anticipated shared electric scooter pilot. At UC Berkeley, the university received a grant that has enabled them to provide free bikesharing memberships to qualifying students (those with Pell and DREAM grants).[27] In addition, key institutions in Berkeley have also been taking action to advance electric mobility. Berkeley United School District (BUSD) has received funds to electrify eight of its school buses, and AC Transit has been operating 13 hydrogen fuel cell buses for several years and is adding five battery-electric buses to its fleet in 2019.

The map in Figure 8 highlights the distribution of current electric and shared mobility options in Berkeley, including (1) the Census block groups where personal EVs were registered in 2017 (shaded in blue); (2) publicly available Level 1 and 2 EV charging ports (in red and blue diamonds); and (3) shared mobility options in Berkeley (in light and dark green circles).

FIGURE 8: CURRENT ELECTRIC AND SHARED MOBILITY ACCESS IN BERKELEY

Note: The high share of EV registrations in West Berkeley is driven in part by registrations at a car dealership.

ELECTRIC MOBILITY LANDSCAPE

EV Adoption Rates in Berkeley

EV Adoption Trends

In 2017, Berkeley had the seventh highest electric vehicle sales share of cities in California.[28] The percent of new vehicles registered in Berkeley that are EVs (including BEVs and PHEVs) has risen from 1.9% in 2011 to 16% in 2017 (see Figure 9). Out of total registered vehicles on the road in Berkeley, EVs were still a fairly small number as of 2017 according to DMV data: 3.3% of Berkeley's 64,400 personal vehicles; 3.1% of the city's 6,400 commercial vehicles; and 1.5% of government vehicles. As of October 1, 2018, the percentage of EVs grew to 3.7% of registered personal vehicles in Berkeley.[29]

FIGURE 9: EV % OF NEW PERSONAL VEHICLE REGISTRATIONS BY YEAR (DMV)
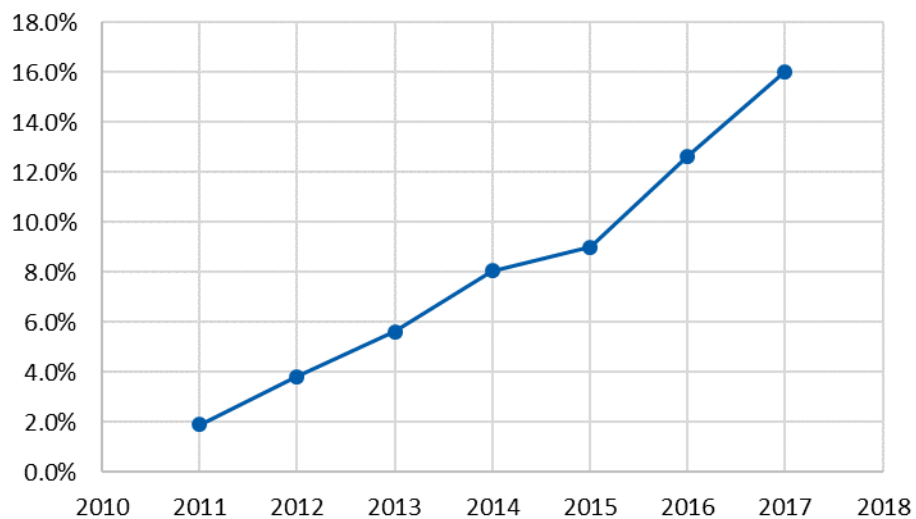
In 2016, California began offering increased EV rebates for low- and moderate-income applicants. Since that time, Berkeley residents have received 26 of these increased rebates (out of over 600 total rebates received).[30] In addition to ranking among the top 10 cities in California in new EV sales, Berkeley also stands apart from peer cities with similar median household incomes, having nearly double the new EV sales share as many of these cities (see Figure 10).

FIGURE 10: EV SHARE OF NEW VEHICLE SALES BY CITY MEDIAN HOUSEHOLD INCOME (ICCT 2018)[31]
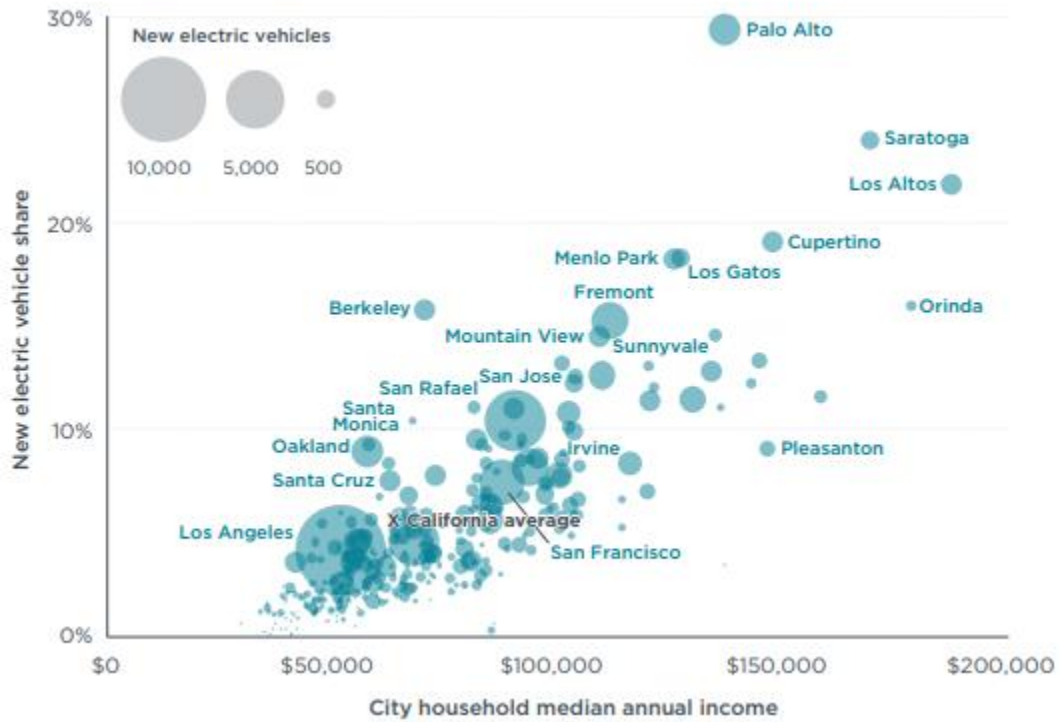
ELECTRIC MOBILITY LANDSCAPE

EV Adoption Scenarios

To understand what EV adoption rates would be necessary to achieve Berkeley's climate change goals, the Roadmap team developed three scenarios, described in Figure 11. The first scenario illustrates what may happen if EV adoption trends in recent years were to continue, while Scenarios 2 and 3 envision a rapid increase in adoption to reach Berkeley's climate goals.

FIGURE 11: BERKELEY EV ADOPTION SCENARIOS

Scenario 1: Historical Extrapolation	Scenario 2: 80x50	Scenario 3: Zero Net Carbon
Linearly extends historical EV sales trends	Demonstrates needed growth rates to reach 80% reduction in greenhouse gases by 2050	Demonstrates needed growth rates to reach carbon neutrality by 2045
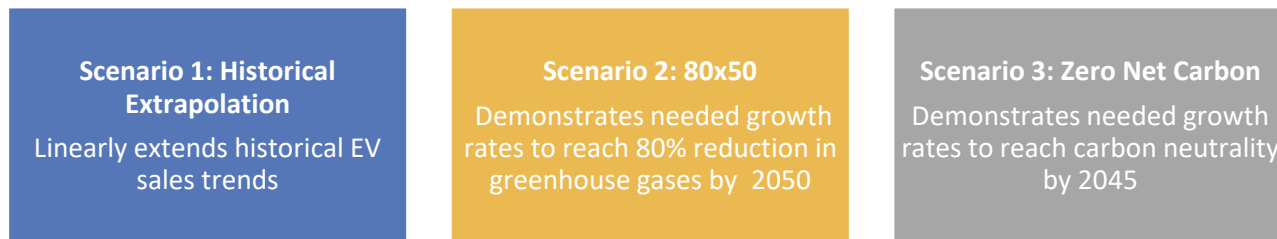
Figure 12 depicts the percent of EVs of total light duty vehicle sales in Berkeley by different scenario between 2019 and 2050. From 2011 through 2018, it includes historical EV sales data in Berkeley. Because vehicles are driven for many years, it is estimated that EV adoption would need to increase rapidly to reach midcentury climate targets. To reach zero net carbon by 2045, EV sales shares would need to reach about 90% by 2025 and nearly 100% by 2030 (up from 16% in 2017).

FIGURE 12: PERCENT EV OF TOTAL LIGHT DUTY SALES IN BERKELEY BY SCENARIO (PHEV & BEV)
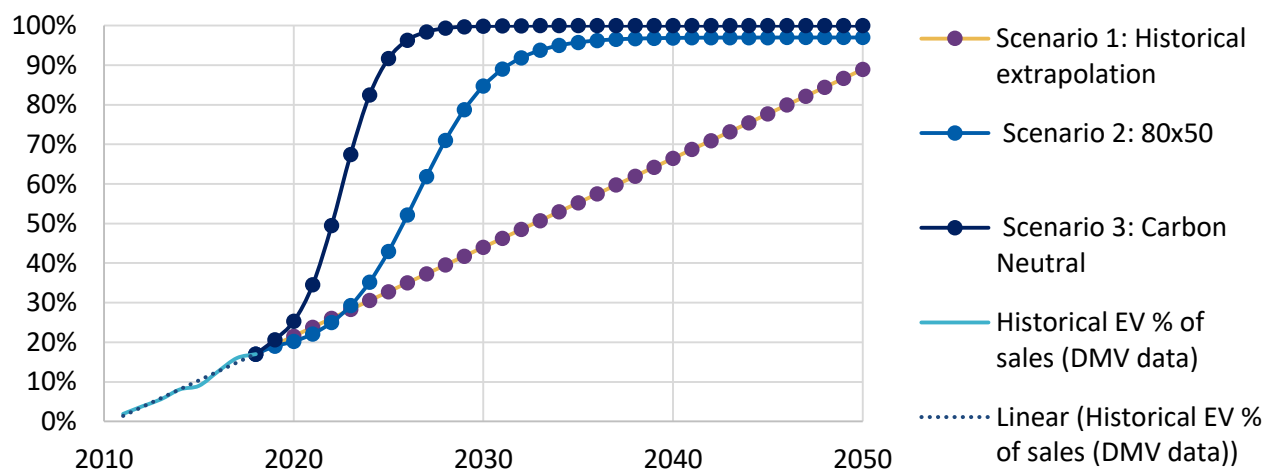
ELECTRIC MOBILITY LANDSCAPE

When considering typical vehicle scrappage rates, this translates to EVs being approximately 25% of the community-wide in-use fleet by 2025, 55% by 2030, and 100% by 2045 in order to reach the city's zero net climate target (Figure 13). By 2025, this would mean Berkeley having approximately 12,800 EVs on the road, if current vehicle ownership patterns hold constant.

FIGURE 13: PERCENT EV OF TOTAL IN-USE LIGHT DUTY VEHICLES IN BERKELEY, SCENARIO 3

Legend: ■ % Gasoline/Diesel Vehicles ■ % BEV ■ % PHEV
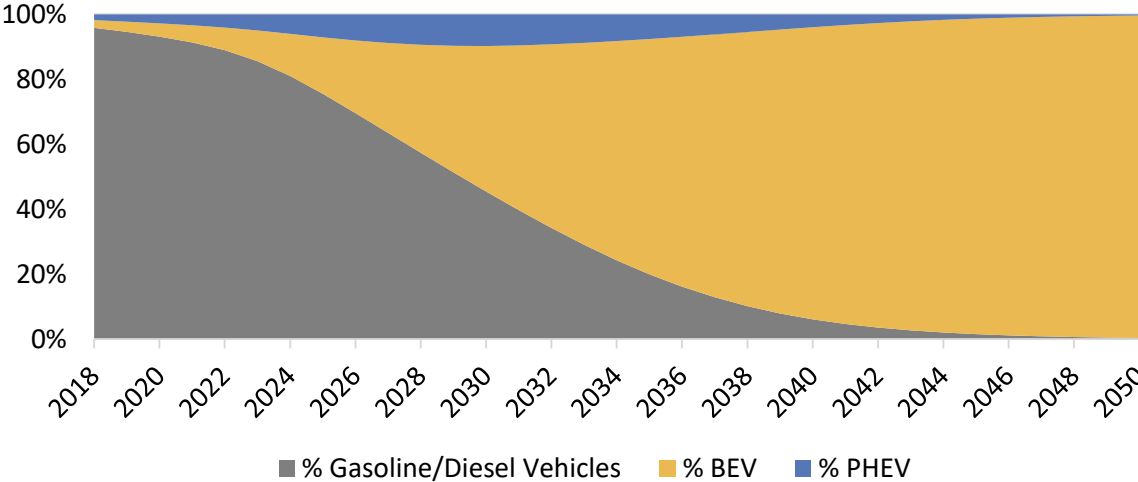
ELECTRIC MOBILITY LANDSCAPE

Electric Mobility Impacts on the Grid

While dramatically increasing adoption of electric mobility, Berkeley must also transition buildings away from fossil fuels for heating and water heating. In summer 2019, Berkeley became the first city in the nation to ban natural gas connections in newly constructed buildings, a major step in driving the city's initiatives on building electrification. Together, the efforts to dramatically scale adoption of building and transportation electrification will add substantial new electricity load to the grid, which could have major impacts on the region's electricity networks if not properly planned and managed. By 2030, light-duty EV electricity use could increase Berkeley's total electricity use by 24% by 2030 in the carbon-neutral scenario, and 35% by 2050 (see Figure 14), starting from a baseline of 470 million kWh (470,000 MWh) in 2016.

FIGURE 14: ELECTRICITY USE FROM LIGHT-DUTY VEHICLES IN BERKELEY BY SCENARIO
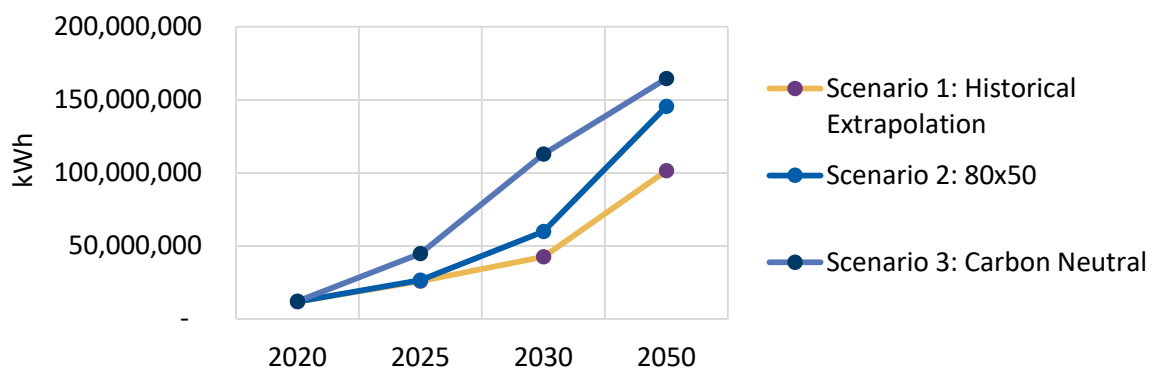
The grid impact of this increased electricity use for EVs will depend on when and where vehicles charge. While most early EV adopters have primarily charged at home, overnight, as more people adopt EVs who cannot charge at home, there may be more daytime charging at work or public charging sites. Significant benefits for all can be obtained from aligning EV charging timing with the availability of projected clean power sources and times of lowest utilization of the grid, including reduced emissions and lower electricity rates for all. Daytime charging could leverage surplus renewable energy during the daytime if managed well through strategies like time-of-use rates and smart charging. Early evaluations by Idaho National Labs' EV Project found EV drivers are very responsive to time-of-use rates and will shift much of their charging to off-peak hours.[32]

ELECTRIC MOBILITY LANDSCAPE

Berkeley's EV Charging Ecosystem

Existing Public EV Charging Network

As of February 2019, there were 105 total EV charging ports listed on PlugShare and the Department of Energy's Alternative Fuels Data Center in Berkeley. Of those ports, 76 were listed as public access, 21 are residential (meaning a resident has offered to share their home charger with neighbors), and eight are restricted. Table 11 lists the number of EV charging ports available in Berkeley by access and charging level in February 2019.

TABLE 11: EV CHARGING PORTS LISTED IN BERKELEY LISTED ON PLUGSHARE, FEB 2019

Access	Level 1	Level 2	DCFC	Total
Public	2	68	6	**76**
Residential	5	16	0	**21**
Restricted	2	6	0	**8**
Total	**9**	**90**	**6**	**105**

Table 12 summarizes the use of the City's EV charging stations in 2018, including total charging time, utilization rate (charging time divided by total hours in the year), and number of unique users. These figures do not yet include utilization for the EV chargers in Center Street Garage since they came online partway through 2018. Anecdotally, multiple survey respondents reported in open responses that some chargers now have longer waits as the number of EVs in Berkeley increases and the use of EVs by TNC drivers increases.

TABLE 12: CITY-OWNED CHARGER UTILIZATION, 2018

City Charging Station	Charging Time (Hours)	Utilization Rate	Unique Users
Telegraph Channing Garage (3 stations)	3,531	13%	2,313
Oxford Garage (2 stations)	4,678	27%	2,203
Marina Dock (1 station)	1,716	20%	835
West Library (1 station)	1,404	16%	902

Existing Access to Charging at Home and Work

Being able to charge at home or work are considered critical for supporting EV ownership, as these locations are where drivers park their vehicles the longest. The full number of EV charging ports at private homes, multifamily dwellings, and workplaces is not known. A lack of access to charging at home

for renters and multifamily building residents was reported by survey respondents as a primary barrier to increasing the use of EVs in Berkeley. Being able to charge at home can be particularly difficult for renters (57% of Berkeley residents) as well as multifamily residents due to lacking off-street parking, lacking access to a nearby wall outlet or place to install a charger by their parking space, and/or lacking permission to install a charger from their landlord. While the curbside charging pilot has addressed these challenges for some residents, the cost to participate suggests additional solutions will be needed. For workplace charging, just 23% of survey respondents report having access to charging at their school or workplace.

Estimated EV Charging Needs in 2025

The California Energy Commission (CEC) provides low and high estimates for how many EV chargers are needed by 2025 to support the state's zero emission vehicle (ZEV) deployment goals.[33] Berkeley's estimates are based on the CEC report using Alameda County's ratio of needed EV chargers to projected EVs. In 2025, it is estimated Berkeley would need 380–610 workplace chargers, 260–570 public Level 2 chargers, and 60–280 DC fast chargers, depending on the EV adoption scenario and CEC scenario (see Table 13).

In 2025, the adoption rates projected for Scenarios 1 and 2 have not yet diverged significantly enough for the EV charging estimates to be distinct. Estimates beyond 2025 are not included due to the evolving nature of EV charging models and behavior. The CEC methodology does not include low and high estimates for workplace charging, primarily due to more limited variance in charging time period than other types of charging. While the CEC report primarily models Level 2 workplace charging needs, many workplaces have found Level 1 charging to be an affordable and convenient alternative, which could lessen the number of Level 2 workplace ports needed.

TABLE 13: ESTIMATED EV CHARGING PORTS NEEDED IN 2025 BY SCENARIO AND TYPE

EV Charging Type	EV Adoption Scenario	Existing	CEC Scenario	
			Low	High
Workplace Level 2	Scenarios 1 & 2	Unknown	380	
	Scenario 3		610	
Public Level 2	Scenarios 1 & 2	99	260	360
	Scenario 3		420	570
DC Fast Charging	Scenarios 1 & 2	6	60	170
	Scenario 3		100	280

ELECTRIC MOBILITY LANDSCAPE

Changing Mobility Trends and Their Impacts on EV Charging

Significant shifts in the transportation sector are likely to impact the projected charging needs described above, requiring the City and its stakeholders to monitor these changes and adjust the Roadmap's course as needed. Some of the trends in the mobility sector with greatest uncertainty and their impacts to the Roadmap charging projections are described in Table 14.

TABLE 14: IMPACTS OF MOBILITY TRENDS ON EV CHARGING SCENARIOS

| Trend	Potential Impact to Charging Scenarios
Shared Mobility and Autonomy: While commercially-ready autonomous vehicles are in operation in very few places today, shared mobility options like TNCs, carsharing, and bikesharing have become widely available and are already reshaping how Berkeley community members travel.	If more of Berkeley's travel shifts to shared (and autonomous) mobility options, the City could need to install **more DC fast charging ports** to serve shared mobility fleets, while **lessening its plans for Level 2 chargers** that are most suitable for private vehicles.
Vehicle Miles Traveled (VMT), Vehicle Ownership, and Mode Share: Some studies predict autonomy and shared mobility could increase VMT by inducing more travel due to lowered costs and increased convenience, while others predict VMT could decrease if shared modes lessen vehicle ownership and use.[34] Experts are similarly divided as to whether recent trends in reduced single occupant vehicle ownership and driving mode share will continue, or reverse in the coming years.	An increase in VMT due to autonomy and shared mobility would likely necessitate a **greater investment in DC fast charging** to serve shared mobility fleets that are utilized heavily throughout the day. A decrease in VMT and/or private vehicle use could **reduce the number of chargers estimated.**
EV Technology Advancements: Changes in charging and vehicle technology, including increased charging speeds, increased range, and more could impact the number of chargers needed.	Higher powered DC fast chargers may mean **fewer DCFC ports** are required in the future to serve the same number of vehicles, and longer range EVs may also **lessen the need for ports of all types**.

ELECTRIC MOBILITY LANDSCAPE

Priority Areas for Electric Mobility and EV Charging

In addition to the number of EV chargers available, it is also important to consider their locations in the City, and to strive to provide access to a variety of charging options across the City when and where people need them. This includes electric mobility and public charging options near frequent destinations such as retail centers, workplace charging options at people's jobs, and residential charging options either at people's homes or very close by. This section includes maps created for this Roadmap to help guide future charging installations by the City and private site hosts.

Priority Areas for Equitable Electric Mobility Investment: The map in Figure 15 identifies areas to prioritize equity in electric mobility development, and highlights areas where residents (1) have less access to transportation options (vehicle ownership and public transit access); (2) live in affordable and/or multifamily housing; and (3) are more highly impacted by pollution, poverty, and other socioeconomic vulnerabilities.

FIGURE 15: ELECTRIC MOBILITY EQUITY INDEX MAP
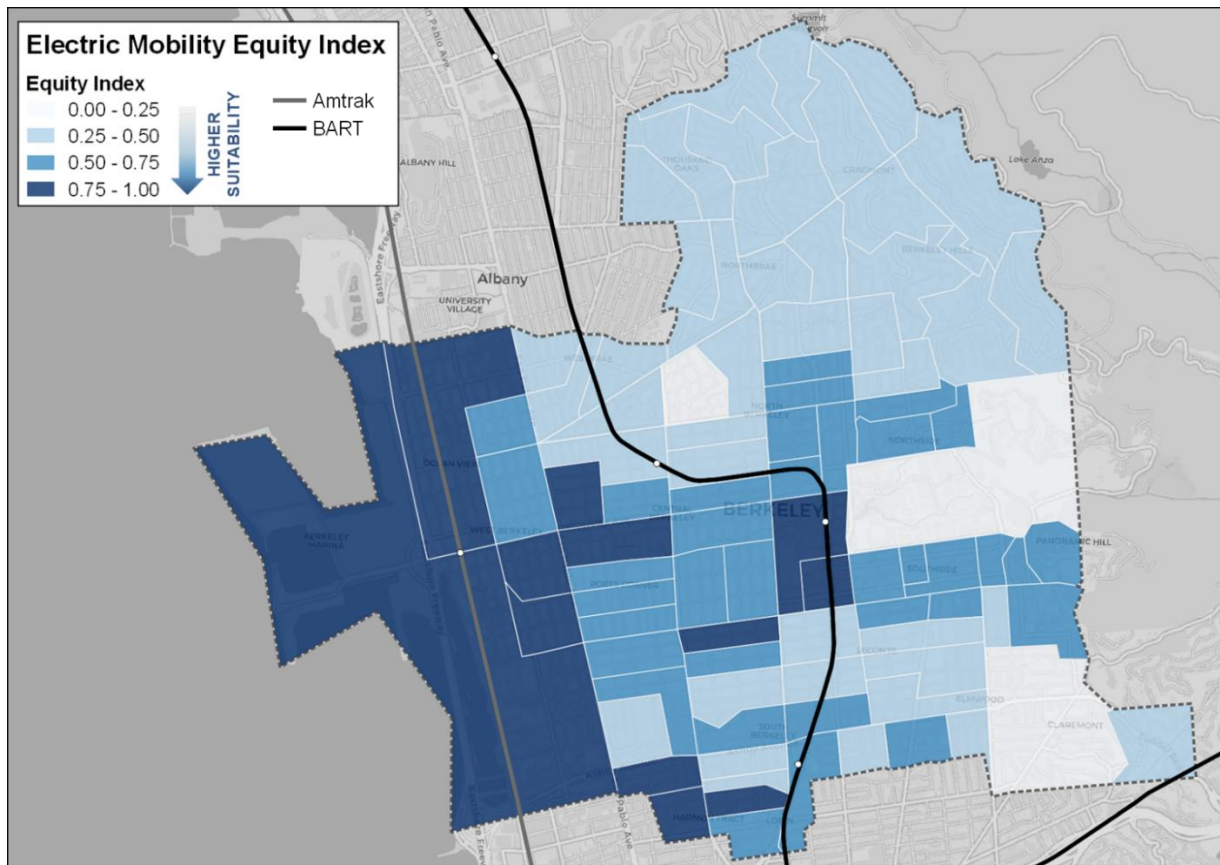
ELECTRIC MOBILITY LANDSCAPE

Priority Areas for Public and Workplace EV Charging: The map in Figure 16 identifies census block groups and specific public sites with high potential and need for public and workplace EVSE, by highlighting areas with: (1) less access to EV charging today; (2) higher density of jobs and workplace vehicle miles traveled; and (3) higher density of longer dwell time destinations (e.g., supermarkets, dining, institutions such as churches and schools, and entertainment and recreation destinations). Additionally, the map overlays potential suitable sites within those high potential areas, including city-owned buildings, parking meters, parking lots, and commercially zoned areas.

FIGURE 16: PUBLIC AND WORKPLACE EV CHARGING INDEX MAP
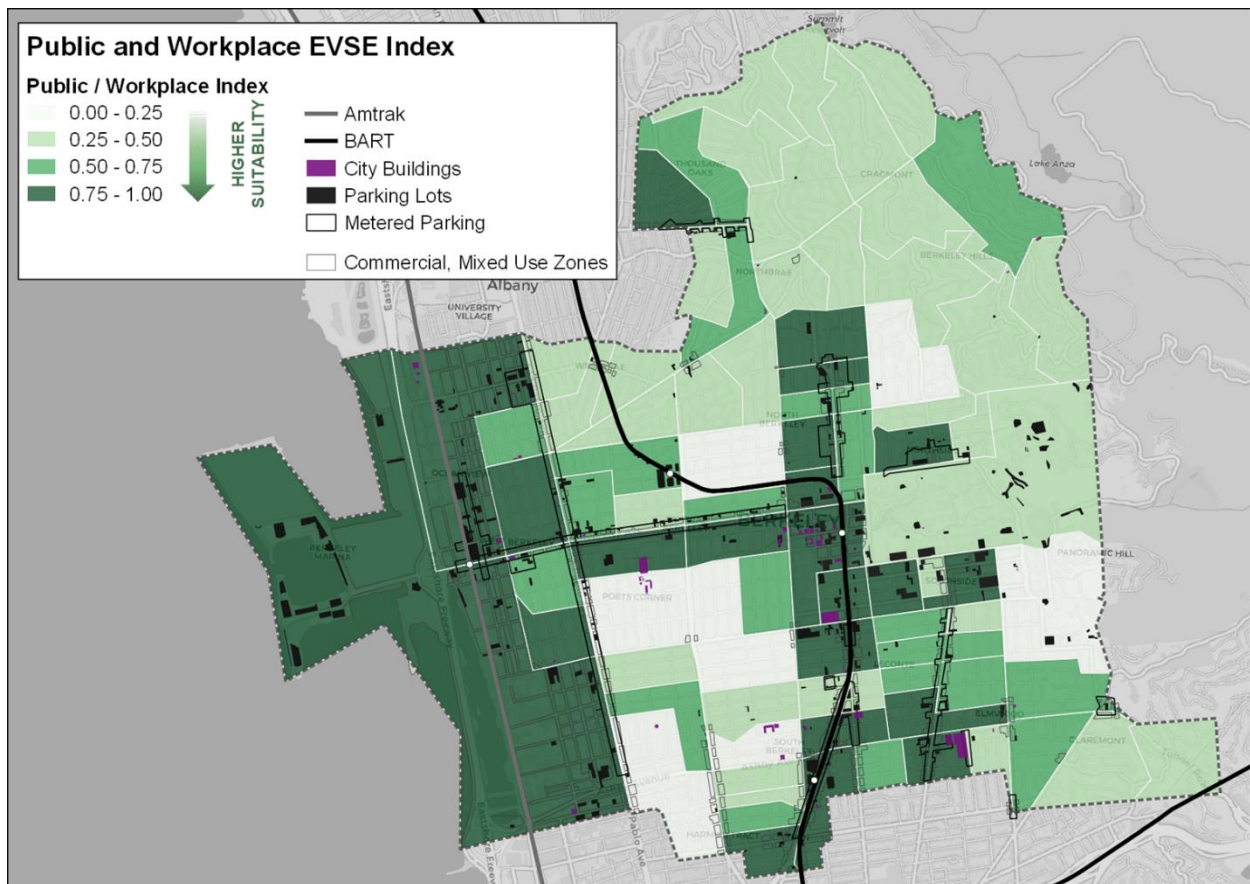
Priority Areas for Residential EV Charging: This map (Figure 17) identifies areas that may have a greater need for residential charging solutions to make EV ownership more accessible, particularly for multifamily residents and renters. Residential charging options for these residents could include installing charging at multifamily buildings, developing public curbside charging in residential neighborhoods with many multifamily and renter residents, or installing off-street public charging in these same areas. The map highlights areas with (1) less access to EV charging currently; (2) a higher share of multifamily buildings; (3) a higher share of renters; and (4) a higher share of residents who drive.

FIGURE 17: RESIDENTIAL EV CHARGING INDEX
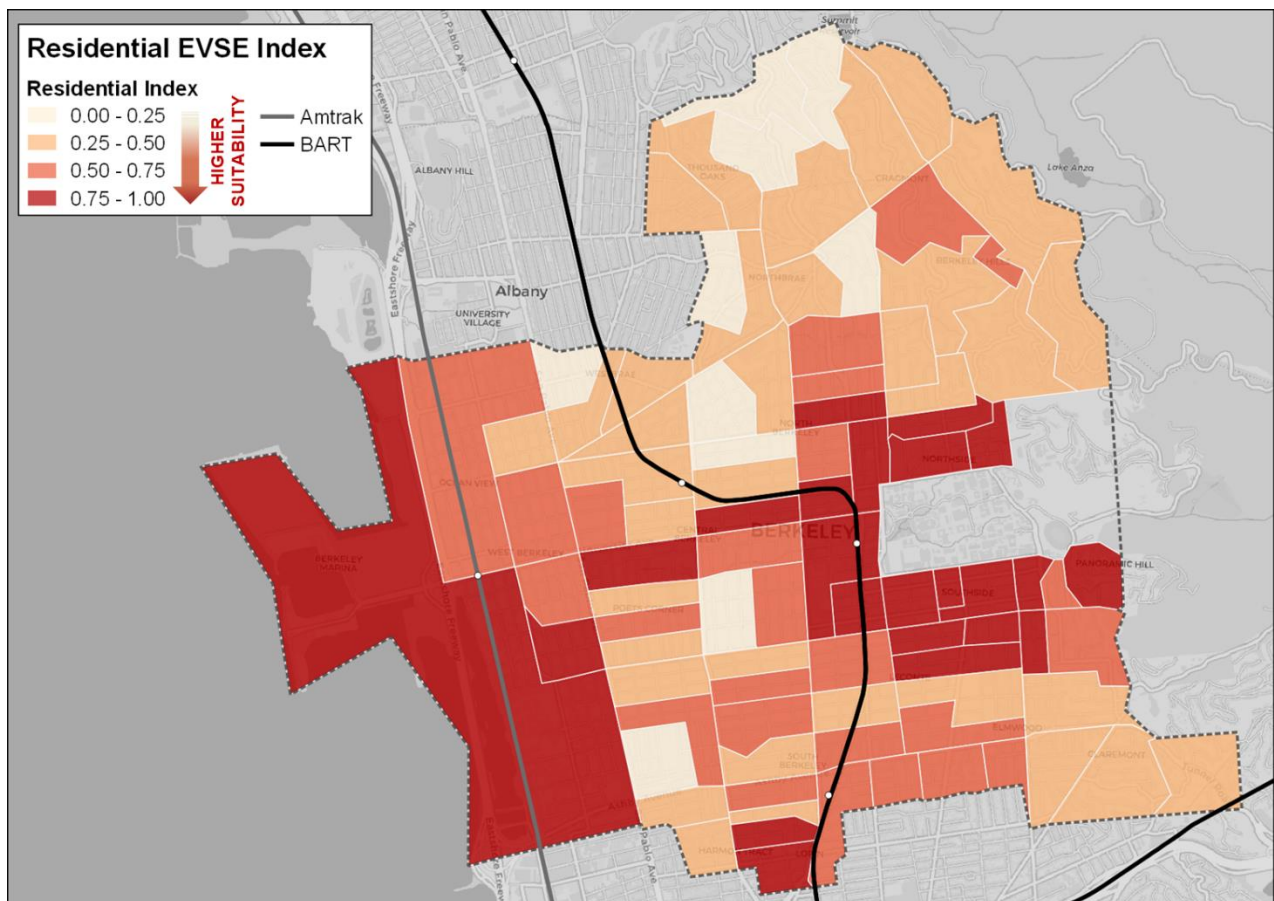
ELECTRIC MOBILITY LANDSCAPE

EV Charging Survey Location Recommendations Heat Map: The map in figure 18 highlights areas where survey respondents recommended the most new EV charging investments. Respondents highlighted many similar areas to those in the two EV charging indexes. Despite some areas already having EV charging coverage, the forecast need for new ports by 2025 and some survey responses indicating competition for available chargers suggest a need for more chargers even where some coverage exists.

FIGURE 18: EV CHARGING SURVEY LOCATION RECOMMENDATIONS HEAT MAP

Appendix: State, Regional, and Utility EV Policies and Programs

At the time of publication, programs and policies key to this Roadmap's implementation include:

TABLE 15: EXISTING EV PROGRAMS AND POLICIES TO LEVERAGE

*Note: Equity-oriented strategies are indicated with an ***

Initiative	Lead Organization
Consumer Incentives	
Clean Vehicle Rebate Project (CVRP) Rebates*	CARB
Federal Tax Credit	IRS
Plug-In Electric Vehicle (PEV) Rebates	PG&E
Clean Vehicle Assistance Program*	CARB
Community Housing Development Corporation (CHDC) Driving Clean Assistance Program*	CHDC
Clean Cars for All Program*	BAAQMD/CARB
Empower EV Charge Network* (proposed – for LMI customer home charging)	PG&E
High Occupancy Vehicle (HOV) and High Occupancy Toll (HOT) Lane Exemption	California DMV
Toll Discount for EVs on Bay Areas Bridges	FasTrak
Awareness, Outreach, and Engagement	
One-Stop-Shop Pilot* (upcoming outreach effort to connect income-qualifying residents with EV incentives)	CARB/GRID Alternatives
Bay Area EV Acceleration Plan: Off-the-shelf Outreach Toolkit	BAAQMD
Bay Area SunShares (solar and EV group purchasing program)	Business Council on Climate Change
Drive Clean Bay Area (EV group purchasing program)	Cool the Earth
Electric Vehicle Service Personnel Training Program (workforce training program)	City College of San Francisco
Home EV Charger Information Resource Pilot	PG&E
Plug-In Electric Vehicle (PEV) Resource Center (educational website)	CARB and Veloz
EV Charging	
Charge! Program (incentives for public charging infrastructure)	BAAQMD
Low Carbon Fuel Standard (credits from EV charging can be sold to fuel producers to earn revenue)	CARB
Make-ready rebates for DCFC* (approved to fund 52 sites with 234 stations)	PG&E

Berkeley, CA

Initiative	Lead Organization
Electric Vehicle Rate Plans (residential customers have two options for EV charging)	PG&E
PG&E Commercial EV Rate (proposed)	PG&E
Local Development Business Plan (includes support for EV charging, fleet electrification, etc.)	East Bay Community Energy
Cycle 1 and 2 investments (investments in Level 2 and DCFC public charging)	Electrify America
Fleet electrification	
SB1014: Clean Mileage Standard for Ride Hailing Fleets	State Legislature
Clean Fleets Program	BAAQMD
School Bus funding	BAAQMD
CARB Clean Transit Rule	CARB
CVRP Rebates for Fleets	CARB
FleetReady Program	PG&E
Clean Fleets Program	BAAQMD

Endnotes

[1] 2018 Climate Action Plan Update, City of Berkeley. https://www.cityofberkeley.info/climate/

[2] In the Bay Area, on-road mobile sources contribute 43% of ozone-forming NOx emissions, and 12% of PM2.5 emissions. Final 2017 Clean Air Plan. BAAQMD, 2017. http://www.baaqmd.gov/~/media/files/planning-and-research/plans/2017-clean-air-plan/attachment-a_-proposed-final-cap-vol-1-pdf.pdf?la=en

[3] While air pollution has been falling in the Bay Area, lower income, non-White communities continue to bear higher levels of localized air pollution from localized sources like freeways. Identifying Areas with Cumulative Impacts from Air Pollution in the San Francisco Bay Area. BAAQMD, 2014. http://www.baaqmd.gov/~/media/Files/Planning%20and%20Research/CARE%20Program/Documents/ImpactCommunities_2_Methodology.ashx?la=en

[4] City of Berkeley Health Status Summary Report, 2018. https://www.cityofberkeley.info/uploadedFiles/Health_Human_Services/Level_3_-_Public_Health/health-status-summary-report-2018.pdf

[5] In the Bay Area, a study by MTC found the region's low-income population spends more as a proportion of their income on transportation, and has been suburbanizing, or increasingly moving out of the Bay Area's central cities. Plan Bay Area Equity Analysis Report. MTC, 2015. https://mtc.ca.gov/sites/default/files/A-04_FINAL_PBA_Equity_Analysis_Report.pdf

[6] EV ownership has been highest to date in California's wealthiest cities, and nationally amongst the highest-income households. California has taken steps to design EV incentives to reach lower-income households to try to address this trend. California's continued electric vehicle market development. ICCT, 2018. https://theicct.org/sites/default/files/publications/CA-cityEV-Briefing-20180507.pdf

[7] American Community Survey 5-year 2017 data.

[8] See TransForm and MTC's Mobility Hubs at Affordable Housing Pilot, CARB's transportation equity pilot projects, and Greenlining Institute's Mobility Equity Framework.

[9] EV Hybrid Noire is the nation's "largest network of diverse EV drivers and enthusiasts", and their website and resources offers useful messaging and insights for community outreach. https://evhybridnoire.com/

[10] A similar model was piloted in Los Angeles, through CalETC's Prove It! Campaign, which supported week-long test drives for local faith leaders and other trusted community leaders, and shared their testimonials as a way to raise awareness about EVs. CalETC – About Prove it! http://www.caletc.com/prove-it/

[11] Equity and Smart Mobility, ISC and CNT. https://sustain.org/wp-content/uploads/2019/09/Equity-and-Smart-Mobility-Report.pdf

[12] Means-Based Fare Discount Program. https://mtc.ca.gov/our-work/plans-projects/other-plans/means-based-fare-discount-program

[13] Lime "PayNearMe" initiative allows individuals who are eligible for any local, state, or federally run assistance programs to pay for Lime shared bike rides with cash at a CVS, 7-Eleven, Family Dollar, or Casey's General Store at a discounted rate (50-95% discount). No bank accounts or smartphones are needed for this program. https://www.li.me/second-street/paynearme-lime-takes-industry-lead-on-transportation-equity

[14] Electric Vehicle Charging Station Permitting Guidebook. CA Governor's Office of Business and Economic Development, 2019. http://businessportal.ca.gov/wp-content/uploads/2019/07/GoBIZ-EVCharging-Guidebook.pdf

[15] For more detail on job training opportunities and needs, refer to Contra Costa County's EV workforce development research at https://ccta.net/2019/07/30/ev-readiness-blueprint/ (including a report for training needs for mechanics and another for electricians.

[16] California Household Travel Survey for the City of Berkeley, 2012, and the Statewide Integrated Traffic Records System five-year injury collision data, 2013-2017.

[17] Paris launched a low-cost, monthly electric bikeshare and incentive program in September 2019. https://www.citylab.com/transportation/2019/09/electric-bikes-paris-bicycle-rental-france-e-bike-subsidy/598192/.

[18] The TNC Regulatory Landscape: An Overview of Current TNC Regulation in California and Across the Country. San Francisco County Transportation Authority, 2017. https://www.sfcta.org/sites/default/files/2019-03/TNC_regulatory_020218.pdf

[19] California Governor's Office of Business and Economic Development: Electric Vehicle Charging Station Permit Streamlining Map. http://www.business.ca.gov/ZEVReadiness

[20] Electric Vehicle Charging Station Permitting Guidebook. CA Governor's Office of Business and Economic Development, 2019. http://businessportal.ca.gov/wp-content/uploads/2019/07/GoBIZ-EVCharging-Guidebook.pdf

[21] Due to increasing competition for curb space from micro-mobility, transit, TNCs, delivery zones, and other modes, care should be taken to avoid planning curb space for EV charging where it may be best used for encouraging alternatives to personal vehicle travel. Still, curbside charging is beginning to play an important role in enabling convenient neighborhood charging access in cities like Montreal and Amsterdam, which have deployed hundreds to thousands of curbside chargers, as well as American cities like Santa Monica and Sacramento which have begun pilots of curbside charging.

[22] The City of Portland is exploring ways to leverage public-private partnerships to support innovation in potential co-location of services in the right-of-way (or at other site hosts), such as "renewable power generation, wireless internet, lighting or public art." Electric Vehicles the Portland Way. https://www.portlandoregon.gov/shared/cfm/image.cfm?id=309915

[23] As an example, the City of Santa Monica funded a pilot multifamily EV charging incentive. The pilot received a lot of interest from both renter and owner multifamily residents and property owners, utilizing all available grants in the first round of funding. Multi-Unit Dwelling EV Charging Station Rebate Program. City of Santa Monica. https://www.smgov.net/uploadedFiles/Departments/OSE/Categories/Transportation/EV_Rebate_Packet_Phase_2.pdf

[24] In addition to commercial or institutional site hosts, which is the primary focus of this action, the City could consider EV owners themselves to be potential site hosts and, pending legal assessment, conduct outreach to encourage them to list their chargers for others to use, using websites such as Plugshare. Sharing private charging could reduce the need for public infrastructure.

[25] Multi-state Study of the Electric Vehicle Shopping Experience. Sierra Club, 2016.

[26] Fuel Type by City as of 10/1/2018. California DMV.

[27] Bringing Bike-share to Underserved Populations: A Case Study. International Parking & Mobility Institute. https://www.parking-mobility.org/2019/04/17/bringing-bike-share-to-underserved-populations-a-case-study/

[28] California's continued electric vehicle market development. ICCT, 2018.

[29] Fuel Type by City as of 10/1/2018. California DMV.

[30] Clean Vehicle Rebate Statistics. https://cleanvehiclerebate.org/eng/rebate-statistics

[31] California's continued electric vehicle market development. ICCT, 2018.

[32] How do PEV owners respond to time-of-use rates while charging EV Project vehicles? The EV Project, 2013.

[33] California Energy Commission 2018. California PEV Infrastructure Projections 2017-2025. https://www.nrel.gov/docs/fy18osti/70893.pdf

[34] Wadud, Z., MacKenzie, D., & Leiby, P. (2016). Help or hindrance? The travel, energy and carbon impacts of highly automated vehicles. Transportation Research Part A: Policy and Practice, 86, 1-18.