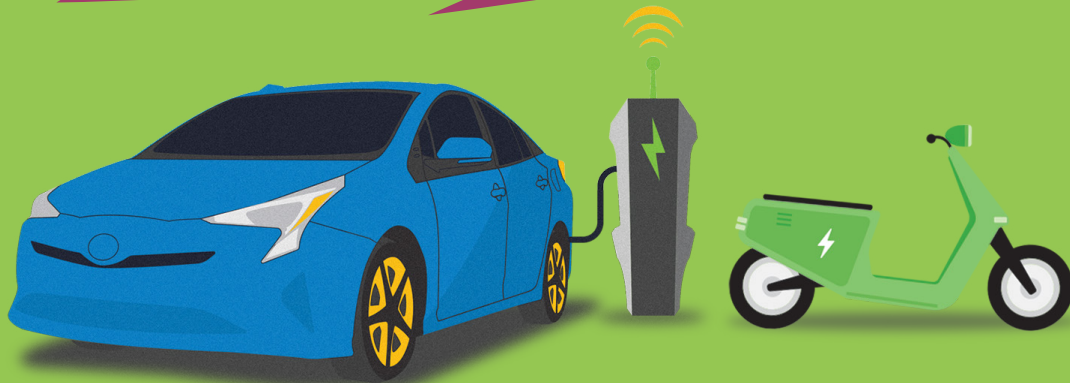




City of Phoenix

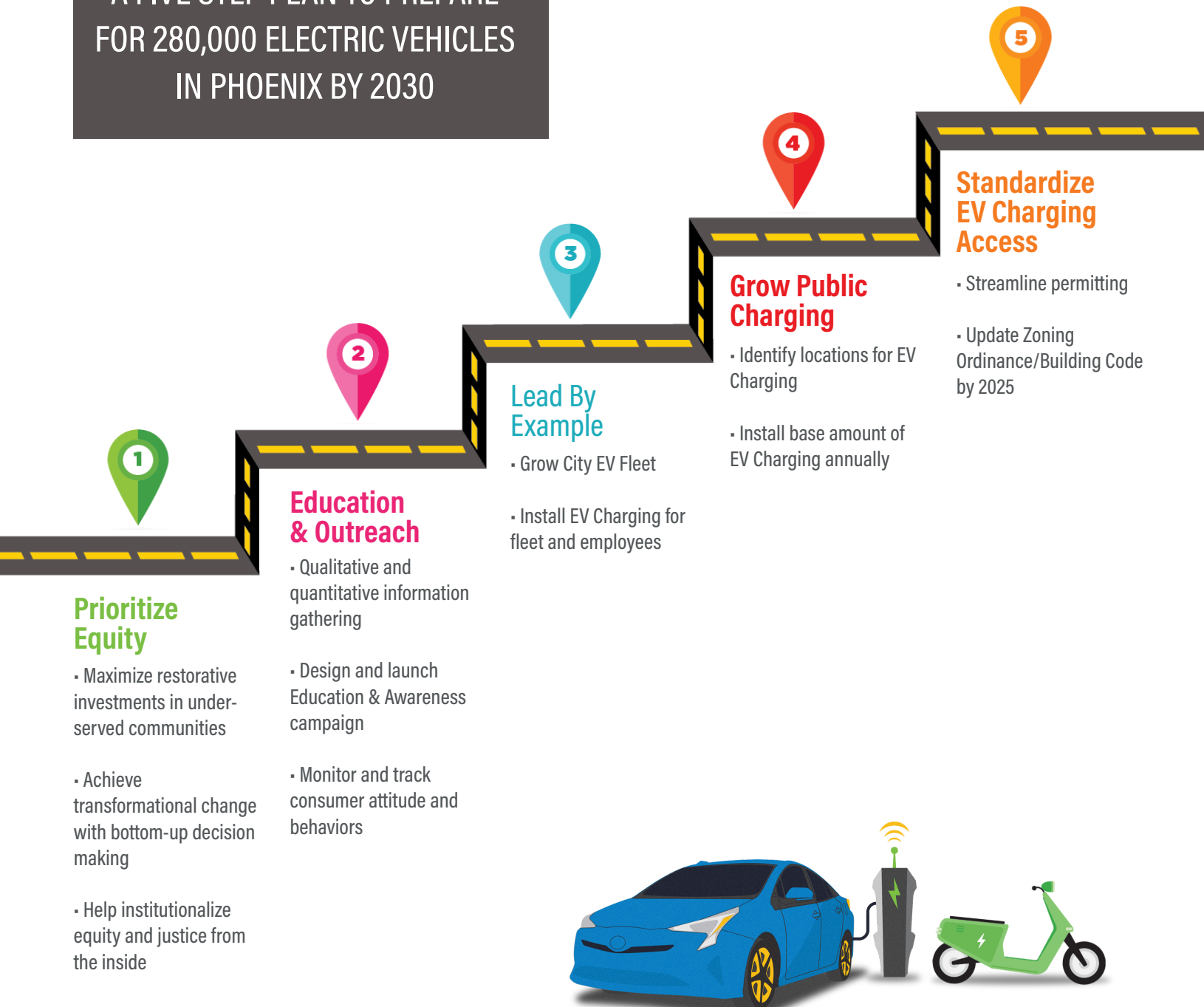
TRANSPORTATION ELECTRIFICATION  
**ACTION PLAN**





## ROADMAP 2030

A FIVE STEP PLAN TO PREPARE  
FOR 280,000 ELECTRIC VEHICLES  
IN PHOENIX BY 2030





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## ACKNOWLEDGMENTS

The City of Phoenix Ad Hoc Committee on Electric Vehicles was established by Mayor Gallego on June 25, 2021, and consists of one member of the City Council and 14 members of the public.

- **Councilwoman Yassamin Ansari**, Chair
- **Autumn Johnson**, Public Interest Policy Advocate, Tierra Strategy
- **Caryn Potter**, Utility Program Manager, Southwest Energy Efficiency Project (SWEEP)
- **Catherine O'Brien**, Electric Vehicle Lead, Salt River Project
- **Clark A. Miller**, Professor & Director of the Center for Energy & Society, Arizona State University
- **Columba Sainz**, Community Advocate
- **Court S. Rich**, Director, Renewable Energy and Regulatory Law Department, Rose Law Group
- **Delbert Hawk**, President of the International Brotherhood of Electrical Workers Local Union 640
- **Jason Smith**, Energy Innovation Program Consultant, Arizona Public Service (APS)
- **Katherine Stainken**, Senior Director of EV Policy, Electrification Coalition (EC)
- **Kathy Knoop**, Manager, Vehicle Grid Integration Solutions, General Motors
- **Lisa M. Perez**, Public Affairs Consultant
- **Omar Gonzales**, Manager of State and Local Government Affairs, Nikola Corporation
- **Tim Sprague**, Owner/Partner, Habitat Metro
- **Vianey Olivarria**, State Co-Director, CHISPA Arizona

To accomplish its work, the Ad Hoc Committee established three subcommittees (SC):

### SC1 - Education, Outreach & Equity

**Sub-Committee Members:**

- Councilwoman Ansari
- Omar Gonzales
- Clark Miller
- Vianey Olivarria
- Lisa Perez

### SC2 - Public, Workplace, and Home Charging Infrastructure

**Sub-Committee Members:**

- Omar Gonzales
- Autumn Johnson
- Catherine O'Brien
- Court Rich
- Tim Sprague
- Jason Smith
- Caryn Potter

### SC3 - City Fleet and City Charging Infrastructure

**Sub-Committee Members:**

- Councilwoman Ansari
- Kathy Knoop
- Caryn Potter
- Katherine Stainken
- Delbert Hawk

The Committee was hosted by Deputy City Manager Karen Peters and the City's Office of Sustainability staff Mark Hartman, Karen Apple, Michelle Litwin, and Darice Ellis. City Departments including Public Works, Planning and Development, Public Transit, Information Technology Services, Aviation, Phoenix Convention Center, Parks and Recreation, Law, Community and Economic Development, Street Transportation, the City Manager's Office, the City Attorney, and the Office of the Mayor supported the work of the committee and provided input into the Transportation Electrification Action Plan.



## **OUTREACH AND ENGAGEMENT OF THIS ACTION PLAN**

The EV Ad Hoc Committee wishes to thank stakeholders and the community for providing constructive and supportive feedback on the Draft EV Roadmap that led to this Transportation Electrification Action Plan (TEAP). The Ad Hoc Committee members conducted extensive outreach to the community—seeking input through social media, online surveys, and public presentations. The outreach and engagement activities as of May 30, 2022, included the following:

- 40 community meetings including village planning committees, boards and commissions, employee groups, community partners, and events
- 1,584 community survey responses in English and Spanish with 759 written comments
- 25,820 engagements with social media posts in English and Spanish such as likes, comments, and shares

The comments from the community and feedback received can be divided into five major categories:

### **(a) General comments**

The clear majority of respondents were positive and supportive of the market transition to electric vehicles with the most frequently articulated reason being that electric vehicles are good for air quality and the environment. The reason most often stated to purchase an electric vehicle was to save money on current gas prices, and there was significant interest in possible incentives that the city, utilities, and the federal government could provide to encourage EV adoption. Alongside these positive comments were concerns about declining gas tax revenues used to maintain roads. Although current forecasts are for a maximum of 15 percent of vehicles to be all-electric in Phoenix by 2030, it was suggested that given the growing electric vehicle market, solutions other than the gas tax are needed to support ongoing road maintenance.

### **(b) Concern for EV infrastructure and workforce development**

In the community meetings, there was support for additional public electric vehicle charging stations based on concerns about the lack of current infrastructure. Some wondered if there would be lineups at charging stations in the future, while others expressed concern about the transition of car repair shops to maintain electric vehicles and how their employees would be trained. There were also questions about the best way to incorporate EV charging in new and existing multi-family buildings. Slightly less than half of the respondents thought that users of EV charging in multi-family buildings should cover the full cost, while the remaining half thought that it should be included as an amenity like a gym or pool.



**(c) EV Equity**

There were ADA recommendations put forth by the community—to include larger parking stalls in a small percentage of EV parking spaces to accommodate ADA access. There were also questions related to understanding EV Equity along with requests for an equity map. In the process of outreach, a definition of EV equity was developed and defined as “Increasing access to and distribution of electrified transportation options and services in a way that meets the diverse mobility needs of our communities”. In response to community requests, equity considerations were added to each section of the action plan.

**(d) EV Education and Outreach**

There was widespread acknowledgment of the need for educational materials related to electric vehicles such as purchasing guides, total cost of ownership calculations, and charging basics, as well as strategies to lower charging costs. The survey results showed that forty-six percent of respondents said they did not know a lot about electric vehicles. And during public discussions, there seemed to be limited awareness of the benefits of daytime charging suggesting a need for it to be emphasized in future educational materials.

**(e) Grid Capacity for Electric Vehicles**

There were some general concerns about the impact of electric vehicles on the grid and if sufficient electrical capacity would be available. Out of that concern, there seemed strong support from the community to encourage “managed charging” and incentivize daytime and overnight charging. Very few members of the public seemed aware that a market transition to all-electric vehicles over the next fifteen years is expected to increase regional electricity use by less than ten percent—highlighting a need for public messaging about the resiliency of the local electricity grid.

In total, there were eleven notable recommendations, summarized above, that were added to the Action Plan as a result of the community engagement.



## **EXECUTIVE SUMMARY**

Mayor Kate Gallego announced the launch of the Ad Hoc Committee on Electric Vehicles in June 2021 with a mandate to identify recommendations that would help accelerate the transition to electric vehicles (EVs) as described in the City’s recently adopted Climate Action Plan. Led by its chair, Councilwoman Yassamin Ansari, the Ad Hoc Committee has prepared recommendations in the form of this Transportation Electrification Action Plan—for which the committee sought Council and community input prior to making its final recommendations.

As background, the current market desire for the electrification of transportation is both a national and global phenomenon. Businesses, governments, and the public are signaling strong future demand for EVs, and many EV manufacturers have declared plans for a transition to fully electric offerings within the coming decade. However, this market shift, fueled by a desire for better air quality, a reduction in carbon emissions, and a reduction in vehicle operating and maintenance costs, has significant implications for cities: how do cities prepare for forthcoming public demand for EVs and the associated EV charging infrastructure, both at home, on the road, and, more importantly, how do they prioritize investments in historically underserved communities to provide equitable low-carbon transportation options?

Cities and other market players can provide support for a just transition to EVs through implementing policies, programs, and initiatives that remove barriers to EV adoption and satisfy the public and business need for services in a low-carbon future. Based on state and national forecasts, that future may include up to 280,000 EVs on the road in Phoenix by the year 2030.

To facilitate the transition to EVs, the City’s Ad Hoc Committee on Electric Vehicles has six recommendations:

### **1. Adopt guiding principles for City action**

Guiding principles signal Council support for developing EV policies and programs and for investments that will accelerate the transition. The following principles are recommended by the Ad Hoc Committee:

- a. Prioritize early action.
- b. Prioritize investments in underserved communities.
- c. Actively pursue federal grants and other funding opportunities.
- d. Seek partnerships with businesses, utilities, and other stakeholders.
- e. Invest in the electrification of the City’s fleet and corresponding charging infrastructure, as well as installing workplace charging infrastructure for city employees.



**2. Support accelerated EV adoption in the community**

Although vehicle manufacturers, dealers, utilities, and other EV advocates will be promoting and encouraging EV adoption in general, there are barriers to EV adoption in the region including a lack of access to charging infrastructure and myths and misconceptions about EVs and their use. The Ad Hoc Committee recommends the following to address these and other barriers to adoption:

- a. Assign dedicated staff to focus on public education, outreach & business training.
- b. Launch qualitative and quantitative data gathering to inform future actions.
- c. Launch a robust EV education and awareness campaign that clarifies the benefits of EVs, dispels myths, provides resources (such as vehicle buying guides and information on charging infrastructure), and identifies the best applications for EVs.

**3. Expand access to public EV charging**

- a. Work with cities, regional planning agencies, and the state on a Regional EV Infrastructure Needs Assessment and Siting Recommendations for public EV charging stations.
- b. Leverage local, state, and federal funding to install 500 City-hosted public charging stations by 2030 including installing a minimum number of EV charging stations each year in parks, city parking facilities, and in rights-of-way.

**4. Support access to home, business, and workplace EV charging**

- a. Investigate opportunities to streamline the permitting process for installing workplace, business, home, and multi-family EV charging stations.
- b. Develop proposals for EV Ready building codes and zoning ordinances for stakeholder input and future adoption.
- c. Work with utilities on developing an education program specific to builders, developers, and businesses.

**5. Develop and pilot a local model of e-mobility investment in an underserved community**

- a. Assign dedicated staff to focus on equity and build relationships with community leaders and advocates.
- b. Develop an understanding of the unique mobility needs of underserved communities and design solutions to meet those needs.
- c. Launch a local model of e-mobility investment in an underserved (“front-line”) community as recommended by community leaders and advocates.





**6. Lead by Example**

- a. Evaluate infrastructure/power needs and financial resources to support the transition of light-duty vehicles to EVs.
- b. Adopt a “preferred purchasing policy for EVs” provided it meets the business needs and is in a similar price range to a non-electric vehicle model from a life-cycle cost perspective (i.e., accounting for savings in fuel costs and maintenance).
- c. Pilot electrification in medium and heavy-duty equipment such as transit buses, refuse trucks, and street sweepers to better understand electric equipment operating characteristics.
- d. Proactively install supporting charging infrastructure to prepare for future adoption of EVs in the City fleet.
- e. Identify City employee charging needs and provide access to charging infrastructure to City employees to meet demand.
- f. Implement training of employees for EV driving, EV charging, and EV maintenance prioritizing employee change management to achieve effective employee engagement.
- g. Develop and implement City standards and regulations that require all electricians installing EV charging infrastructure to be certified by the Electric Vehicle Infrastructure Training Program (EVITP).

The following sections contain additional details on the specifics and timeline of the six recommendations summarized above.





## **INTRODUCTION**

### **ELECTRIC VEHICLES (“EVs”)**



The term EV refers to two types of vehicles: battery electric vehicles (BEV) and plug-in hybrid electric vehicles (PHEV). BEVs have a battery instead of a gasoline tank, and an electric motor instead of an internal combustion engine (ICE). PHEVs are a combination of gasoline and electric vehicles, so they have a battery, an electric motor, a gasoline tank, and an internal combustion engine. Both vehicles can be plugged in to charge the battery with electricity. Many models of light-duty vehicles such as passenger cars are available on the market today, but new applications for medium- and heavy-duty (e.g., buses, delivery vans, refuse collection, street sweepers, and long-haul trucks) are being manufactured and starting to appear in the marketplace. Table 1 provides examples of BEVs and PHEVs.

The up-front purchase price of an EV is typically more than a comparative ICE vehicle due to the cost of the large battery, but the incremental cost can often be offset from a “total cost of ownership” perspective (i.e., by including the savings from reduced maintenance and the avoidance of the use of gasoline). However, as technology advances and battery manufacturing capacity increases, the upfront EV cost is likely to decrease. According to a March 25, 2021, Bloomberg New Energy Finance Hyperdrive Daily article, EVs should be cheaper to buy on average than ICE vehicles in about five years; that’s the point at which EVs will reach price parity with ICE vehicles. Price parity refers to the point at which automakers can build and sell an EV with the same margin as an ICE vehicle, assuming no subsidies are available.


Regarding an EV’s battery technology, EV batteries undergo cycles of discharge, that occur while driving, and charge, when the vehicle is plugged in. Repeating this process over time affects the amount of charge the battery can hold. This decreases the range and time needed between vehicle charges. Most manufacturers have a five to eight-year warranty on their battery. However, the current prediction is that EV batteries will last from 10-20 years before they require replacement.



**TABLE 1: EV TYPES**




Vehicle Type	Description	Example
Plug-In Hybrid Electric Vehicle (PHEV)	PHEVs are powered by an ICE (internal combustion engine) and an electric motor that uses energy stored in a battery. The vehicle can be plugged into an electric power source to charge the battery and can travel on either electricity or gasoline. The all-electric range can be from 10 to over 50 miles depending on the model.	Chevy Volt 
Battery Electric Vehicle (BEV)	BEVs use a battery to store the electric energy that fully powers the motor. A BEV does not have an ICE. BEV batteries are charged by plugging the vehicle into an electric power source. The range of a BEV on a full charge varies between 100-400 miles, however, there are some EV models on the current market that can achieve a longer range.	Nissan Leaf 

**TABLE 2: OTHER ELECTRIFIED VEHICLES**

Micro-Mobility Examples	Description	Example
Electric Bicycle (E-Bike)	A bicycle with an electric motor that is used to assist propulsion. Electric bicycles use rechargeable batteries and can travel up to 15 to 20 mph. Many bikes can assist the rider's pedal power and/or can add a throttle.	



**TABLE 2: OTHER ELECTRIFIED VEHICLES (CONT)**

Micro-Mobility Examples	Description	Example
Electric Scooter (E-Scooter)	Device weighing less than one hundred pounds, with handlebars and an electric motor that has a maximum speed of 20 mph.	
Medium and Heavy-Duty Examples	Description	Example
Electric Street Sweeper	Powered by an electric motor with the advantages of no tailpipe emissions. Street Sweepers are used to control dust and improve air quality, so the electric option aligns well with this purpose.	
Electric Transit Bus	Transit buses powered by an electric motor enable transit agencies to significantly reduce operating costs while delivering clean, quiet transportation to the community.	



## **BENEFITS OF EVS**

The City of Phoenix supports the use of different transportation options for City employees, residents, and visitors—including biking, walking, public transportation, carpooling, and vehicle sharing. However, given the large geographical area of the city, in many circumstances, a private vehicle can be the most convenient option for navigating around the community. EVs are recommended over gasoline- and diesel-powered vehicles with internal-combustion engines (ICE) as they better align with the City’s air quality, climate, transportation, and sustainability goals as outlined in the City’s Climate Action Plan.

### **The benefits of EVs include:**

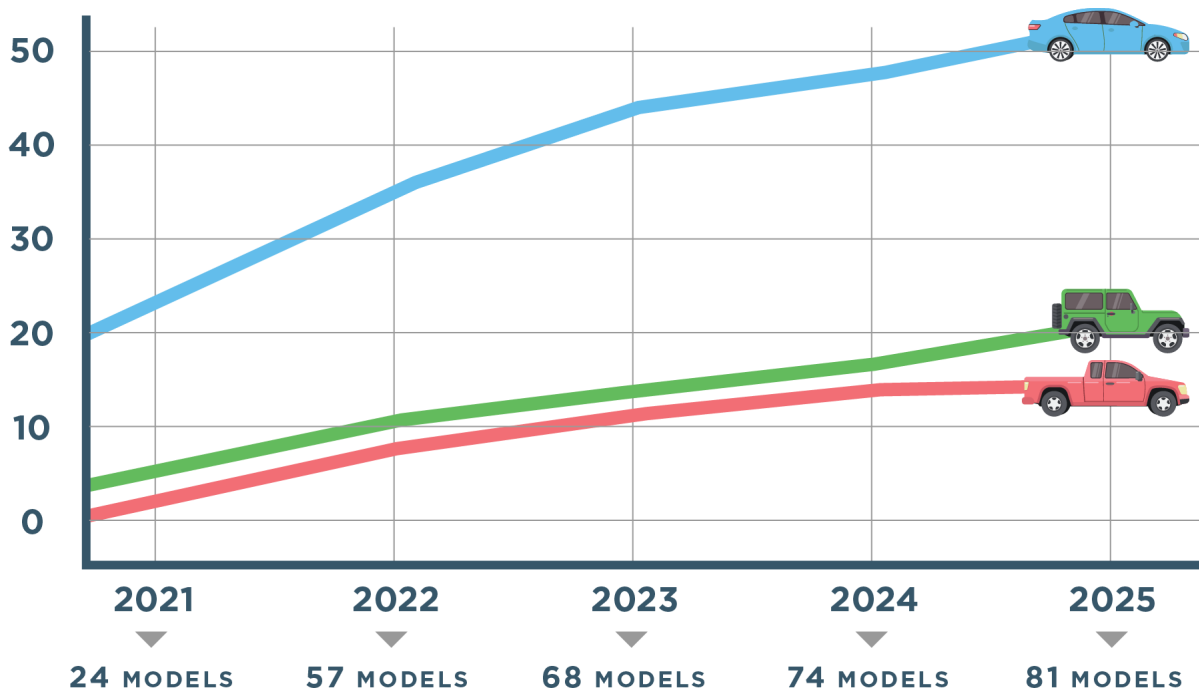
- EVs have little or no tailpipe emissions (depending on the type of vehicle), so they reduce local air pollution, global greenhouse gas emissions (GHGs) emissions, and improve public health outcomes.
- Regardless of the electricity generation mix, EVs have lower associated GHG emissions than ICE vehicles and will continually lower emissions as the electricity generation mix gets cleaner. APS and SRP continue to increase renewable energy sources such as solar in their portfolios thereby decreasing the GHGs at the point of electricity generation. This is referred to as “greening the grid”.
- The cost to charge an EV can be less than 10 percent of the price of the equivalent amount of gasoline and can even be lower if using utility time-of-use rates. The U.S. Department of Energy’s (DOE) eGallon tool provides a general cost comparison based on U.S. averages.
- EVs, particularly BEVs, which do not have an ICE, may require less maintenance. Depending on the miles driven and the price of fuel, EVs can have a lower lifetime cost of ownership than conventional ICE vehicles.
- EVs lessen dependence on foreign oil and avoids the volatility of crude oil and gasoline prices.



## SUPPLY OF ELECTRIC VEHICLES

While EVs currently represent less than two percent of all light-duty vehicles in the U.S., vehicle manufacturers are investing in EV technology and some manufacturers suggest an all-EV future. By the end of 2022, there will be approximately 225 light-duty EV makes and models available on the worldwide market and 57 exclusively battery electric vehicles (BEVs), as shown in Figure 1.

Figure 1: Battery Electric Vehicle models being added to the light-duty market.



By the end of 2020, there were 17 BEV models on the market. Cumulatively, by 2025, there will be at least 81 additional BEV models available to consumers.



**NATIONAL EV FUNDING EFFORTS**

There are several notable EV initiatives underway at the national level. The US Department of Transportation (DOT) Federal Highway Administration (FHWA) is establishing a national network of alternative fueling and electric vehicle charging stations along national highway system corridors. There are several designated corridors within Phoenix, including I-10 and I-17. While this designation does not guarantee funding for projects, it may give I-10 and I-17 priority for future funding. Table 3 provides an overview of federal incentives available as of June 2022, including a description and funding amounts.

**Table 3: Federal EV funding initiatives**

FUNDING SOURCE	FUNDING AMOUNT	DESCRIPTION
Qualified EV Tax Credit	Up to \$7,500 per vehicle	A tax credit is available for the purchase of a new qualified EV, with the amount based on each vehicle’s battery capacity and the gross vehicle weight rating. The credit will begin to be phased out for each manufacturer after 200,000 qualified EVs have been sold by that manufacturer for use in the US. To date, all Tesla and GM models have met the 200,000 EVs sold and do not qualify for the tax credit.
Federal Transit Administration Low or No Emission Vehicle Program	Varies up to a total of \$84.45 million available annually	State and local governments are eligible to receive program funds to purchase or lease zero-emission and low-emission transit buses and supporting fueling facilities.
Infrastructure Investment and Jobs Act (IIJA)	The formulary EV charging program funds up to \$5 billion over five years and various EV charging and refueling competitive grants available, up to \$2.5 billion over five years. There is also other funding across other sectors.	The formula program provides funding to States to deploy publicly accessible EV charging infrastructure. Competitive grant programs provide funding to local governments to strategically deploy publicly accessible EV charging infrastructure along designated alternative fuel corridors or publicly accessible areas.  Other funding includes Clean School Bus Program, Grants for Buses and Bus Facilities, Surface Transportation Block Grant Program, Congestion Mitigation and Air Quality Improvement Program, and the Carbon Reduction Program.

## ELECTRIC VEHICLE CHARGING

Charging equipment for EVs, also called electric vehicle supply equipment (EVSE), is categorized based on how quickly it can charge the vehicle’s battery. The time needed to fully charge an EV will vary based on the size of the battery, how depleted the battery is, and the electric current of the EV charging equipment.

### Light-Duty Vehicle Charging

EV drivers have the flexibility to charge at a variety of locations, including home (single-family and multi-family), work, and other destinations such as shopping centers, restaurants, and fleet parking facilities. Figure 2 highlights the three levels of charging and operating characteristics. Level 1 EV chargers are mostly used in single-family homes, Level 2 EV chargers are also used in single-family as well as commercial and multi-family buildings, and DC Fast Chargers (DCFC) are primarily used to quickly charge an EV and can be located at commercial properties and along interstate corridors. DCFC are also used for medium and heavy-duty vehicle fleets, such as transit buses, that require increased charging times due to vehicle function and operation.

Figure 2: Representative Operational Characteristics of EV Chargers for Light-Duty Vehicles

AC Level 1	AC Level 2	DC Fast Charge
<b>Voltage</b> 120V 1-Phase AC	<b>Voltage</b> 208V or 240V 1-Phase AC	<b>Voltage</b> 208V or 480V 3-Phase AC
<b>Amps</b> 12 – 16 Amps	<b>Amps</b> 12 – 80 Amps (Typ. 32 Amps)	<b>Amps</b> <125 Amps (Typ. 60 Amps)
<b>Charging Loads</b> 1.4 to 1.9 kW	<b>Charging Loads</b> 2.5 to 19.2 kW (Typ. 7kW)	<b>Charging Loads</b> <90 kW (Typ. 50kW)
<b>Charge time for vehicle</b> 3 – 5 miles of range per hour	<b>Charge time for vehicle</b> 10 – 20 miles of Range per hour	<b>Charge time for vehicle</b> 80% Charge in 20 – 30 minutes

Most EV charging occurs at home. However, there are some challenges with installing EV charging infrastructure in multi-family developments, including access to reliable parking, billing, sufficient power supply, and ownership concerns. Workplace charging is a significant opportunity for the City of Phoenix and Phoenix’s employers, as workplace charging helps increase the convenience of driving electric for employees and encourages charging during off-peak hours. Similarly, access to daytime public charging is a key factor in decreasing range anxiety and increasing the convenience of driving EVs in the region.





## **GUIDING PRINCIPLES PROPOSED FOR ADOPTION**

The Ad Hoc Committee recommends the following guiding principles necessary for developing EV policies and programs that will accelerate the transition:

- Prioritize early action—to ensure the city can provide a timely implementation of solutions.
- Prioritize investments in underserved communities—to ensure equity principles are incorporated into policies and programs, to make low-carbon mobility options affordable and accessible to underserved, disadvantaged communities, to better understand their mobility needs, and to identify solutions to meet those needs.
- Actively pursue federal grants and other funding opportunities—identifying potential funding opportunities provided by the federal government through grants, direct or formulary/competitive allocations, local utilities incentive programs, city budget allocations, and vendor offerings to assist in covering the cost of EV fleet transitions and EV charging infrastructure.
- Seek partnerships with businesses, utilities, and other stakeholders—leveraging and engaging community, business, and utility stakeholder partnerships, and establishing new relationships with local community agencies, community groups, nonprofits, businesses, and residents to identify needs and resources to create innovative solutions.
- Invest in the electrification of the City’s fleet and corresponding charging infrastructure, as well as installing workplace charging infrastructure for city employees.

### **Transportation Electrification Action Plan Assumptions**

In recognition of technology availability and current and forecast trends, this Transportation Electrification Action Plan focuses on actions in the near term for light-duty passenger vehicles and trucks (SUVs, crossovers, and pickup trucks), for personal use and fleet use cases. Heavy-duty equipment has different considerations from light-duty vehicles when it comes to electrification. As technology advances in the medium- and heavy-duty sector, the city will pilot opportunities and collaborate with manufacturers on solutions. For example, although viable solutions are still under development, hydrogen fuel-cell propulsion systems have the potential to service a portion of the medium and heavy-duty sector.

A second assumption is that although EV models have been announced, mass-market availability may not happen until after 2024. However, based on manufacturer declarations, the number of EV models available for purchase will likely overtake the number of ICE prior to 2030.





## **CURRENT STATE OF ELECTRIC VEHICLES IN PHOENIX**

The City’s 2021 Climate Action Plan includes goals for EV adoption, EV charging equipment deployment, and the incorporation of equity principles. The current state of EVs in Phoenix includes the following challenges and opportunities:

- Current citywide goals for EV adoption are in line with the federal government’s 2030 goals for nationwide EV adoption—projecting up to 50% of car sales to be EVs by 2030.
- The city currently does not have the number of EV chargers, nor the supporting infrastructure, to support Phoenix’s target numbers of EVs for the public, the city’s fleet, or workplace users.
- Federal funding and grants are being made available and will assist in the planning and deployment of EV charging infrastructure.
- Other cities are implementing EV policies, programs, and practices that can be leveraged to increase EV adoption, support, and awareness.

## **CURRENT LIGHT-DUTY EV ADOPTION RATES**

Phoenix residents and businesses are adopting EVs; however, adoption rates must accelerate to achieve the 2030 EV goals identified in the City’s 2021 Climate Action Plan.

The Maricopa Association of Governments (MAG) forecasts plug-in electric vehicles (PEV), which include both BEV and PHEV, will increase significantly at a compound growth rate of 36.4% from 2021 to 2029 <sup>1</sup>. Similarly, the Arizona Statewide Transportation Electrification Plan set a projection of 1.1 million EVs in the State by 2030 which, when downscaled to the City of Phoenix, translates to approximately 280,000 vehicles by 2030 <sup>2</sup>.

One of the primary obstacles to widespread adoption of EVs is range anxiety due to the limited network of EV charging stations, including along highway corridors throughout the National Highway System. According to national survey data, 78 percent of Americans believe that finding an EV charging station is at least moderately difficult. Of drivers who are not planning to buy or lease an EV when they purchase their next vehicle, 48 percent reported concerns about having enough public charging stations.

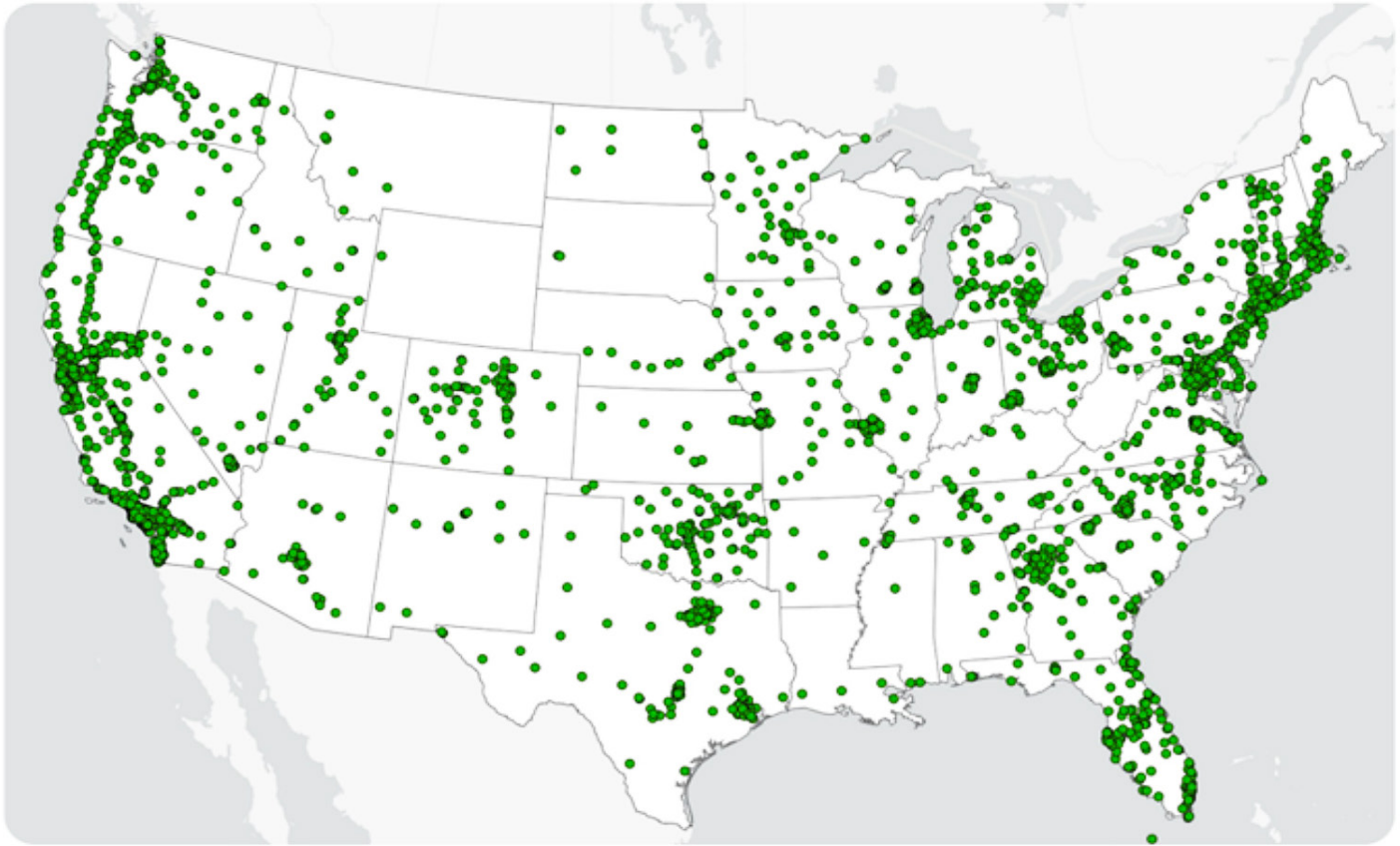
As of April 2021, there were approximately 38,000 publicly accessible EV charging stations nationally with approximately 79,000 charging ports (i.e., a charging station typically has two outlets—to charge two vehicles at the same time). Figure 3 identifies the location of DC Fast charging stations in the US.

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1 Maricopa Association of Governments Battery Electric Vehicle (EV) Modeling Support Task - 2021  
2 <https://illumeadvising.com/files/Arizona-Phase-1-TE-Report-Final.pdf>

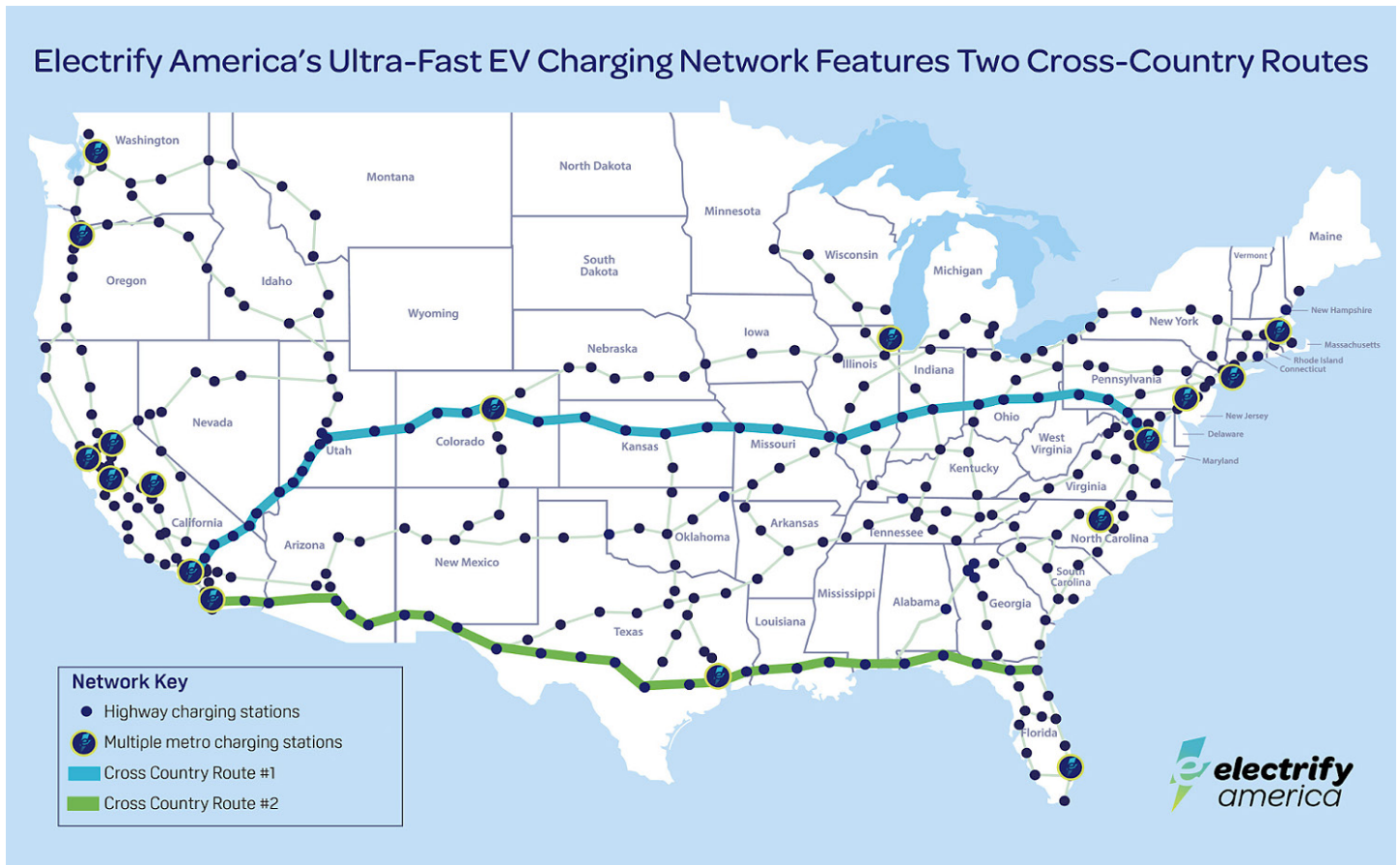


Figure 3: DC Fast Charging Stations in the Continental U.S



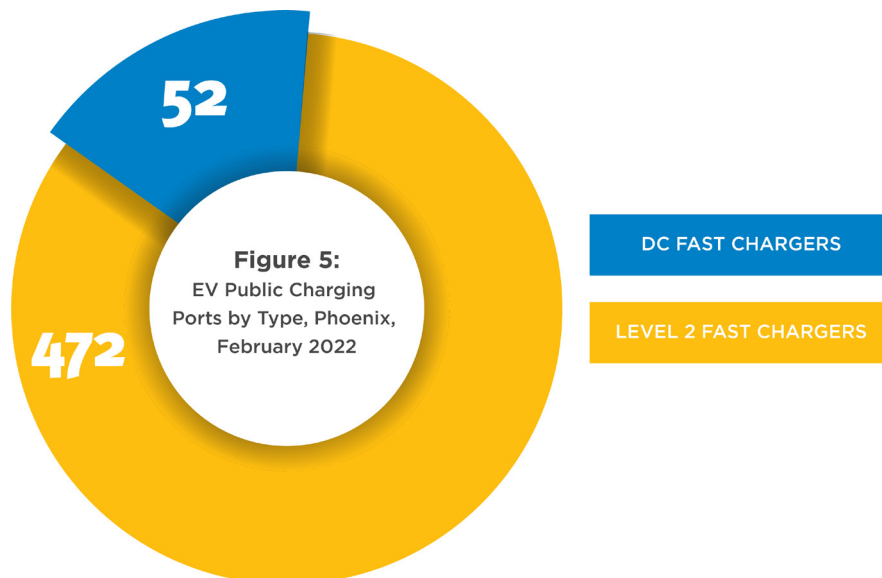
To expand this national network, the current Bipartisan Infrastructure Law (BIL) is providing \$7.5 billion in new funding to expand the charging network nationwide over the next five years to have a DCFC every 50 miles along U.S. highways. Because Phoenix is served by two major interstates, I-10 and I-17, the city is optimistic that additional EV chargers will be installed within the city limits because of the BIL. Additionally, the city will leverage Federal grant opportunities for installation of EV chargers and planning and design activities. More specifically, Electrify America has added 600 DCFC sites (with over 2600 charging ports) over the last three years and has targeted two cross-country routes and interstate highways for national connectivity including the I-10 and the I-17. Figure 4 identifies the DCFC stations installed by Electrify America.

Figure 4: DC Fast Charging Stations installed by Electrify America



## PUBLIC EV CHARGING PORTS IN PHOENIX

According to the Alternative Fuels Data Center (AFDC), 472 Level 2 public charging ports and 52 DCFCs are in Phoenix as of February 2022, as shown in Figure 5. The Level 2 EV chargers comprise 90% of the available public EV charging ports, while DCFCs comprise 10% of the available public accessible ports.



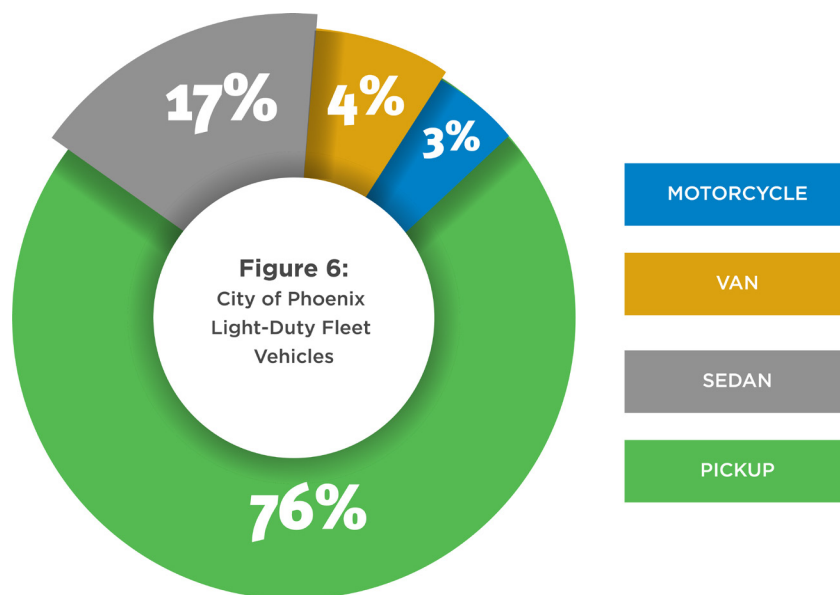


The EV Infrastructure Projection Tool (EVI-Pro) from the US Department of Energy calculates that 280,000 electric vehicles would require 3,000 Level 2 charging ports and 430 DC Fast Chargers (DCFC) in the city by 2030—approximately six times the current number of public Level 2 charging ports. The ratio of Level 2 EV charging ports versus DCFC has been initially forecast at a 6-to-1 ratio but this ratio may change over time based on market needs.

Based on the above ratios, it is estimated that 500 publicly accessible EV charging ports are needed on City properties by 2030 (although this number will be modified over time based on EV market activity).

### **CITY OF PHOENIX FLEET EVS, AND FLEET AND EMPLOYEE EV CHARGING PORTS**

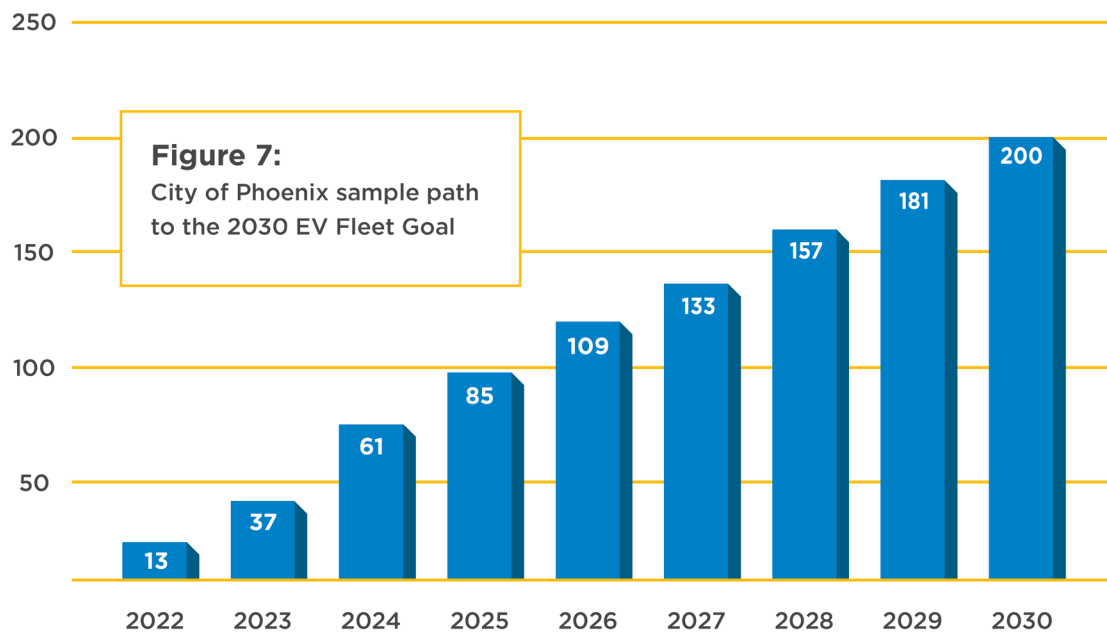
The City of Phoenix operates and maintains approximately 7,700 light, medium, and heavy-duty vehicles in its fleet. Of the approximate 7,700 total fleet vehicles, 3,837 are classified as light-duty vehicles. As shown in Figure 6, most of the light-duty fleet is pick-up trucks.



As of February 2022, the City of Phoenix currently has 13 EVs in the light-duty fleet—nine sedans and four motorcycles. In the next eight years, the city has a goal to transition 200 light-duty gas-powered vehicles to EVs. In order to reach this goal, on average, the city needs to transition approximately 24 EVs a year. Figure 7 identifies the current number of EVs and a smooth path to the 2030 EV fleet goals although the timing of the actual replacement will be based on business needs and be less uniform.



Figure 7: DC Fast Charging Stations in the Continental U.S



## STRENGTHS AND OPPORTUNITIES

The 2021 Climate Action Plan set ambitious targets for EVs for 2030:

- Accelerating EV action to support 280,000 electric vehicles citywide by 2030.
- Support for 3,500 public and workplace charging stations citywide.
- A target of 200 EVs in the City Fleet.

In support of these goals, several market players are helping the electrification of transportation:

- Electric utilities have ambitious EV goals, incentives, and dedicated staff to accelerate the transition to EVs with a target of over 1.1 million EVs in the state by 2030.
- The federal government is providing \$7.5B in funding for EV charging infrastructure in the recently signed Bipartisan Infrastructure Law.
- Electrify America (electrifyamerica.com) is investing \$1 billion in EV Infrastructure on national highways using the Volkswagen Environmental Mitigation Trust Settlement (“VW Settlement”).
- Vehicle manufacturers are shifting priorities toward continued research and development, and expansion of EV models and capabilities in the market.
- And, lastly, polling by the American Lung Association indicates that Arizona residents are supportive of the electrification of transportation <sup>3</sup>.

<sup>3</sup> <https://www.lung.org/media/press-releases/lung-association-az-supports-renewable-energy>



## **BARRIERS TO EV ADOPTION** <sup>4</sup>

- Actual and perceived costs of EV purchasing/ownership
- The limited number of EVs currently available in Arizona
- Lack of EV-ready building codes and limited access to EV charging in multi-family buildings
- Current limitations of EVs (range and performance) for meeting business and personal needs
- Range anxiety partially due to the current lack of charging infrastructure
- Cost of adding EV charging infrastructure to existing multi-family buildings
- Lack of public knowledge and experience with EVs and EV charging equipment

## **GOALS AND STRATEGIES**

### **1. PRIORITIZING EQUITY**

As the Ad Hoc Committee developed recommendations to accelerate the adoption of EVs across the city, they emphasized the importance of also ensuring those recommendations addressed the unique mobility needs of historically underserved communities. EV Equity does not translate to simply providing electric vehicle charging in these communities, but instead, identifies residents in underserved communities, conducts listening sessions to understand their unique mobility needs, and implements solutions to meet those needs.

In recent years, City outreach to underserved communities has seen significant benefits from partnering with community-based organizations (CBOs) to connect outreach directly with those community voices that can articulate the needs of the residents and businesses. As programs and infrastructure are rolled out in these underserved communities, the city should be deliberate in its outreach and hear back from community members that the process was inclusive, and that their input was incorporated into solutions.

The Ad Hoc Committee outlined a collaborative approach to center justice and embed equity through investment in underserved communities. The equity priorities are based on the federal Justice 40 goals and principles:

- Maximize restorative investments in underserved communities.
- Achieve transformational change with bottom-up decision-making (community input).
- Help institutionalize equity and justice from the inside (policies that prioritize equity).

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<sup>4</sup> As identified in [The Arizona Statewide Transportation Electrification Plan](#)





Summary of Equity Recommendations (in line with best practice)	Year
1. Assign dedicated staff to focus on equity and build relationships with community leaders and advocates	2022
2. Develop an understanding of the unique mobility needs of underserved communities and design solutions to meet those needs.	2023
3. Launch local model of e-mobility investment in an underserved (“front-line”) community as recommended by community leaders and advocates.	2023-2024

**Detailed Recommendations:**

**BY DECEMBER 2022**

**Hire or assign a dedicated staff member focused on equity as part of a citywide EV team to implement the following actions.**

- **Develop a short-term strategy to define EV equity** and a corresponding education and outreach program focused on underserved communities.
- **Identify underserved (“front-line”) communities**, existing disparities in Phoenix, and equity metrics.
- **Adopt a guiding principle** to invest at least 40% of mobility/electrification funding in underserved communities.
- Identify compensation desired and funding source(s) for community participants.
- **Explore EV equity programs** implemented by comparable cities and identify scope, schedule, and budgets to help identify potential projects and programs for use in underserved communities.

**BY DECEMBER 2023**

- **Develop long-term EV equity strategies** and approaches to identify ongoing equity programs and determine success metrics.
- **Identify key communities** and investment priorities leveraging data, for example, create an Environmental Justice (EJ) Screening tool with the following features:
  - Model of community collaboration and accountability.
  - Integrated progress metrics.
  - Multilingual, user-friendly, and accessible.
  - Open to feedback from the community, ready to modify the tool as needed.
- **Conduct listening sessions** in an underserved community in partnership with community-based organizations and trusted partners



- **Identify measurable metrics** and manner of reporting for clear reporting and evaluating processes to ensure accountability and transparency.
- **Coordinate with staff** from the Planning Department and American Disability Act (ADA) Liaison to identify an appropriate standard detail for EV parking stalls that should be sized to accommodate EV owners that require ADA accommodations.

**BY DECEMBER 2024**

- **Launch a local model** of micro-mobility investment in an underserved community.
- **Launch investment** targeting priority communities (for example, 25% of projects to be located within the boundaries of, and benefit individuals living in, disadvantaged communities).

**Example:** Community workshops reach deep into the community through trusted partners. Each community can articulate its particular and unique mobility needs—EV Car Shares, e-Uber, e-Bikes, e-Scooters, Cool Corridors, etc., and a program is designed and launched to meet those specific needs in a prioritized community.





## 2. ACCELERATE PUBLIC ADOPTION OF ELECTRIC VEHICLES

### 2a: Education and Outreach

**Goal:** Launch a robust public education & awareness campaign to help meet the climate action plan goal of 280,000 electric vehicles registered in the City of Phoenix by 2030.

Summary of Equity Recommendations	Year
1. Assign dedicated staff to focus on Public Education, Outreach & Training	2022
2. Launch a qualitative and quantitative public data gathering	2022
3. Launch Public EV Education & Awareness Campaign	2022

#### Detailed Recommendations:

#### BY DECEMBER 2022

- **Support/expand ideas for federal funding opportunities** (Bipartisan Infrastructure Law).
- **Assign staff** to coordinate ongoing Education & Outreach.
- **Identify a robust approach** to gathering information on public views and sector-specific mobility needs (e.g., small businesses, underserved communities, and workers) for Year 2 implementation.
- **Identify the goals and scope** of an Education & Outreach program for the entire Phoenix community with a strong focus on equity to build trust and inclusion in the underserved areas.
- **Identify funding** needed to support a broad education & awareness campaign.
- **Propose recommendations for future public input.**



## **BY DECEMBER 2023**

- Launch qualitative and quantitative information gathering phase leveraging tools such as surveys, workshops, focus groups, and street teams to shape the design of education and outreach strategy to identify barriers to adoption of EVs and public understanding of the benefits (Fall 2022).
  - Include community/business needs for the time-of-day charging.
  - Track and include incentives for participation from disadvantaged communities (e.g., gift cards) varying the time of outreach to accommodate schedules.
  - Integrate educational materials into the information-gathering process.
- Launch “Phase 1” education and awareness campaign in English and Spanish that may include flyers, bill inserts, webinars, phone banks, newspaper ads, billboards, TV, and ride-&-drive events, outreach to students, listening sessions, and an EV101 video.
  - Explore possible partnerships with local media (print/cable/tv) to assist with outreach efforts including publications/media in Spanish.
- Increase awareness of the real estate development community and property owners on the benefits of incorporating ESVE in their properties.
- Include information related to costs of maintenance and batteries, environmental impacts of mining, and greenhouse gas emissions.
- Launch program to monitor public attitudes related to EVs by sector (dual-language, disadvantaged communities, and workers).
- Develop business and employee guidance and education around EVs
  - Create a business-friendly information clearinghouse to educate developers and owners on how to easily install EV charging infrastructure.
  - Create guidance for those businesses wanting to install EV charging at their sites.
  - Launch an employee and business workplace EVSE awareness and education program.

## **BY DECEMBER 2025**

- **Continue to track changes** in public attitudes towards EVs to identify barriers to adoption—including distribution of EV sales and revenue generated from sales tax.
- Review metrics and data from “Phase 1” to identify strengths and weaknesses to be considered when updating the “Phase 2” plan.
- **Launch “Phase 2” education and awareness campaign for broader engagement.**



**2b: Public Charging Infrastructure**

**Goal:** Install at least 500 public EV charging stations on City properties or rights-of-way (ROW) by 2030, prioritizing equity.

Summary of Equity Recommendations	Year
1. Work with cities/MAG/State on a regional EV Infrastructure needs assessment and siting recommendations for public EV charging stations	2022 & 2023
2. Leverage local, state, and federal funding to install 500 City-hosted public charging stations by 2030	2022-2030

**Detailed Recommendations:**

**BY DECEMBER 2022**

- Conduct solicitation to engage consultant(s) or assign staff to collect data, identify potential charging locations inclusive of underserved and overburdened neighborhoods, and begin investigative work on future actions listed below.
- Incorporate e-bikes and other electrified mobility considerations as part of mobility planning options.
- Identify collaborative multi-city and regional EV charger bulk purchase opportunities on a local, state, and national level to lower upfront equipment costs (i.e., driveevfleets.org, other cities, MAG).
- Assign permanent staff role that will coordinate ongoing and long-term EV charging implementation, maintenance, and investments.
- Work with third-party charging service providers (CSP) to explore funding options:
  - Hosting third-party-owned charging infrastructure on City property or in ROW in place of City-owned infrastructure where such makes economic sense and limits risks.
  - Sponsorship/advertising/branding options for charging stations (to offset costs as well as provide a potential revenue stream).
  - Private/public partnership business models.



### **BY DECEMBER 2023**

- Work with cities/MAG on a regional EV Infrastructure needs assessment and siting recommendations.
- Identify potential locations for the proposed 500 public charging stations with a plan to complete by 2030 that considers equity and charging time. While Level 1 charging can cost-effectively address workplace charging needs in some cases, Level 2 or DCFC charging equipment will also be needed at specific locations. The city should explore partnerships with nearby businesses that could provide charging or needed parking spaces to better optimize pre-existing parking structures.
- Work with City departments to identify and recommend parking locations for the city fleet.
- Create recommendations for on-street charging in City right-of-way (ROW) to assist equity and support EV charging capability for nearby multi-family buildings. Design and safety standards will need to be considered for ROW permitting and approval.
- Explore new policies with third-party collaborators to support public charging:
  - Expand current policies to include EV charger advertising revenue (i.e., LED screens) and co-branding to fund future EV charging infrastructure and offset network fees and electricity costs.
  - Explore policy that determines charging rates for customers charging on City property or in ROW—to incentivize charging during “off-peak” daytime charging (also noting lower carbon impact). Work with utilities to identify “off-peak” times.
- Evaluate and implement pilot programs citywide for medium/heavy duty fleets to demonstrate new EV service equipment (EVSE) providers.
  - Coordinate with utilities to perform a utility analysis of grid capacity and load management to identify opportunities for ROW charging that leverage existing infrastructure (such as streetlight infrastructure for EV charging).
- By June 2023, install 20 new EV charging ports on City property/ROW.

### **BY DECEMBER 2025**

- Install new EV charging ports on City property/ROW to reach 300 charging stalls in the ROW by the end of 2025.



**2c: Workplace, Business, and Multi-Family Charging Infrastructure**

**Goal:**

- Support the installation of 500 additional workplaces and businesses EV chargers by 2030.
- A minimum of 20 percent of EV chargers are to be installed at or near small commercial buildings.

Summary of Recommendations for Workplace & Business Charging	Year
1. Recommend opportunities to streamline the permitting process for installing workplace, business, and multi-family electric vehicle supply equipment (EVSE)	2022
2. Develop standard stipulation language for rezoning cases to provide EV charging infrastructure	2022
3. Develop proposals for EV Ready building codes and zoning ordinances for stakeholder input	2022-2023
4. Support an education and outreach program specific to businesses	2023-2026

**Detailed Recommendations:**

**BY DECEMBER 2022**

- Explore opportunities for streamlined permitting for multi-family and commercial installation of EVSEs.

**Justification:** Making EVSE permitting quicker and more efficient will encourage faster deployment of EV charging facilities. In a world where jurisdictions are competing to attract private investment in EV infrastructure, jurisdictions that make it the quickest and easiest will be the focus of early adoption. Furthermore, a streamlined process will reduce the burden on City staff as the number of projects increases. Multi-family may include ground-floor retail that requires access to EV charging infrastructure.

- Develop standard stipulation language for rezoning cases to provide EV charging infrastructure by December 2022.



**BY DECEMBER 2023**

- Develop proposals for EV-Ready building code and zoning ordinance updates to support EV-Ready updates with the following attributes:
  - Work with the development community for input on the recommendations.
  - Develop and refine definitions and standards for EV charging or make-ready equipment as part of a future update to the Phoenix zoning ordinance.
  - Explore policies, procedures, and potential code updates that would facilitate the installation of EV charging equipment or make-ready equipment in existing buildings without requiring a site plan or zoning approvals.
  - Explore minimum requirements and/or incentives for EV ready parking spaces on new multi-family residential, commercial, office, and industrial development as part of a future update to the Phoenix zoning ordinance.
  - Research the development of an incentive or development standard bonus program to encourage the installation of EV charging infrastructure in new development and large expansions.

**Justification:** Requiring EV spaces in new construction while providing bonuses for additional spaces balances “carrot and stick” forces to ensure new buildings in Phoenix are future-ready. This will reduce the burden on City staff and will speed adoption while lowering adoption costs for businesses and other end users.

**BY DECEMBER 2025**

- Support education program to install new EV charging ports in small and large businesses and multi-family buildings with an emphasis on inclusion in underserved communities.







**2d:Single-Family Home Charging Infrastructure**

**Goal:** Implement an EV-Ready building code for all new single-family developments by December 2025.

Summary of Recommendations for Single-Family Home Charging Infrastructure	Year
1. Recommend streamlining the EV charger permitting process for new and retrofit of single-family homes	2022
2. Develop proposals for single-family home EV-Ready building codes and obtain stakeholder input	2023
3. Create a streamlined process to support the EV charger infrastructure installation in single-family homes	2023
4. Create a general guidance document to assist customers on the process, checklist, flow charts and applications for home charging.	2023
5. Produce an EVSE Plan Review and Permit guide identifying the process	2023-2024

**Detailed Recommendations:**

**BY DECEMBER 2022**

- Identify utility & City monetary & non-monetary incentives that could encourage increased EVSE adoption.
- Continue to coordinate with APS in consideration of its ongoing Transportation Electrification Implementation Plans (TEIPs), as well as SRP in consideration of its 2035 Sustainability Goals.
- Develop a list of stakeholders for future outreach relating to EV charging standards and proposals. Stakeholder lists may include but are not limited to design and development professionals (i.e., home builders, community members, EV charging and energy efficiency professionals, and NGOs.).
- Streamline the EV charger permitting process for retrofit and new single-family properties within identified parameters.
  - Include opportunities/incentives for developers and builders to provide for futureproofing and incentives to offset the cost of electrical conduits on new single-family developments with funding from sources outside of the planning and development permit process.
  - Include input from building and development stakeholders regarding best practices for EV charging implementations.



**BY DECEMBER 2023**

- Develop draft language for EV-ready building code for public and developer input for single family homes.
- Planning and Development staff to create a general overview document to assist and guide customers on the process, checklist, flow charts and applications and obtain approval for the guidelines through the Development Advisory Board which incorporates feedback from the development community.
- Create a streamlined process to support the EV charger infrastructure installation in single-family homes

**BY DECEMBER 2025**

- Finalize and present through public hearing process code language for EV-Ready building code / zoning ordinance for City Council consideration.





### 3. LEAD BY EXAMPLE

#### 3a: City Fleet – Purchase of Light-Duty Vehicles

**Goal:** Purchase 200 Light Duty Electric Vehicles in the City Fleet across all departments by 2030  
 (Goal is based on the City of Phoenix approved Climate Action Plan)

Summary of Recommendations for City Fleet - Light Duty	Year
1. Develop criteria for replacing existing internal combustion engine-equipped vehicles with EVs when due or nearly due for replacement	2022
2. Evaluate financial resources to support the transition of light-duty vehicles to EVs.	2022
3. Update procurement agreements necessary to purchase light-duty EV vehicles—leveraging cooperative contracts to purchase a wide variety of vehicles	2022

#### Detailed Recommendations:

#### BY DECEMBER 2022

- Develop criteria for replacing existing ICE vehicles with EVs when due or nearly due for replacement if EVs meet the business needs considering:
  - Savings from the lower maintenance and fuel costs of EVs
  - Required ranges to meet operational needs, miles traveled per day, anticipated advances in technology for medium and heavy-duty models, and total cost of ownership.
  - EV fleet transition purchasing policies can prioritize EV as a first-choice option, where applicable.
  - Vehicle availability/delivery coincides with available, installed charging infrastructure.
  - Funding opportunities to support capital expenses.
  - Replacement cycles that prioritize replacements based on vehicle age, mileage, maintenance costs, and other relevant replacement criteria.



- Establish an EV Steering Committee of City staff to oversee a transition of the City fleet to EVs.
- Identify a funding approach to purchase light-duty EV vehicles as replacements for ICE vehicles recognizing that the up-front purchase price for EV vehicles may be higher than ICE vehicles. Pursue funding from public and private sources including federal opportunities.
- Update fleet vehicle procurement agreements regularly to ensure a wide variety of EV procurement options.
- Train vehicle operators and fleet technicians on proper EV vehicle operation and maintenance.

**BY DECEMBER 2022**

- Utilize a professional consultant, as necessary, to perform an infrastructure needs assessment and assist in the development of a transition strategy.
- Update fleet vehicle procurement agreements regularly to ensure a wide variety of EV procurement options.
- Coordinate with local high schools and community colleges and/or other educational training facilities to develop an EV workforce development and training curriculum to train mechanics and fleet technicians on the proper EV operation and maintenance requirements.
- Pilot fleet programs, including medium and heavy-duty vehicles.
- Leverage citywide contracts and cooperative agreements for vehicle purchases or leases, in alignment with available vehicle charging infrastructure.

**BY DECEMBER 2025**

- Evaluate potential locations of charging infrastructure compared to vehicle purchase schedule.
- Work with utilities to develop alternative charging rates and cost-sharing opportunities.
- Pilot fleet programs, including medium and heavy-duty vehicles.





**EV Fleet Planning Tools**

The Electrification Coalition recently launched its Dashboard for Rapid Vehicle Electrification (DRVE) tool—an open-source tool that can be used by prospective fleet managers to better estimate costs associated with light-duty, medium-duty, and heavy-duty fleet electrification.

The National Association of State Energy Officials is working with state agency leads under the Volkswagen Environmental Mitigation Trust Settlement to develop a shared database of alternative fuel vehicle fleet data and associated charging infrastructure. The database, hosted by NREL’s Livewire program, will allow states to upload and aggregate common economic, energy and emissions data from fleet purchases or infrastructure investments funded through the VW settlement trust. This data can then be leveraged by states as they work to support the adoption of electric vehicles and other alternative fuel vehicles.

**3b: City Fleet – Medium & Heavy-Duty Vehicles**

**Goal:** Evaluate the performance of newly introduced electrified medium and heavy-duty vehicles for the city fleet.

Summary of Recommendations for City Fleet - Heavy Duty	Year
1. Utilize the strategy of pilot testing for new models of medium and heavy-duty EVs or other zero-emission solutions to evaluate their performance	2023
2. Develop criteria, if applicable, for replacing existing internal combustion engine equipped heavy-duty vehicles with EVs (or other zero-emission fuel)	2023-2024

**Detailed Recommendations:**

**BY DECEMBER 2023**

- **Develop criteria** for replacing existing internal combustion engine equipped vehicles with EVs when due or nearly due for replacement if EVs meet the business needs considering:
  - Required ranges to meet operational needs, miles traveled per day, anticipated advances in technology for medium and heavy-duty models, and total cost of ownership.



- Required ranges to meet operational needs, miles traveled per day, anticipated advances in technology for medium and heavy-duty models, and total cost of ownership.
- Local, state, and federal funding opportunities to support capital and operating expenses.
- Current replacement cycles prioritizing replacements based on vehicle age, mileage, and maintenance costs.
- A process for keeping an up-to-date list of eligible replacement options as new models come to the market—not only listing replacement options but also timelines and availability.
- Regularly schedule meetings with fleet vendors.



**Heavy-Duty Charging Connector**

Vehicle manufacturers, charging station developers, and the scientific research community are currently engaged in testing and developing a global Megawatt Charging System (MCS) standard for HD EV charging. There is a desire in the HD EV trucking sector to avoid the costs and confusion associated with the lack of a single, standard connector for LD EV charging. The Charging Interface Initiative (CharIN), a non-profit association focused on e-mobility solutions, is leading the development of this inlet hardware and connector technology in concert with the EV industry.

**3c: Charging Infrastructure for City Fleet**

**Goal:** Install light-duty EV Charging Infrastructure at city facilities to support the charging of 200 city fleet vehicles by 2030.

Summary of Recommendations for Charging Infrastructure for City Fleet	Year
1. Evaluate infrastructure/power needs and the required financial resources to support the transition of light-duty vehicles to EVs.	2023
2. As infrastructure is installed, develop necessary operations and maintenance procedures.	2023
3. Install 30 or more Fleet charging ports in City facilities	2024
4. Install 70 or more Fleet charging ports in City facilities	2025
5. Install 100 or more Fleet charging ports in City facilities	2025-2030



**Detailed Recommendations:**

**BY DECEMBER 2022**

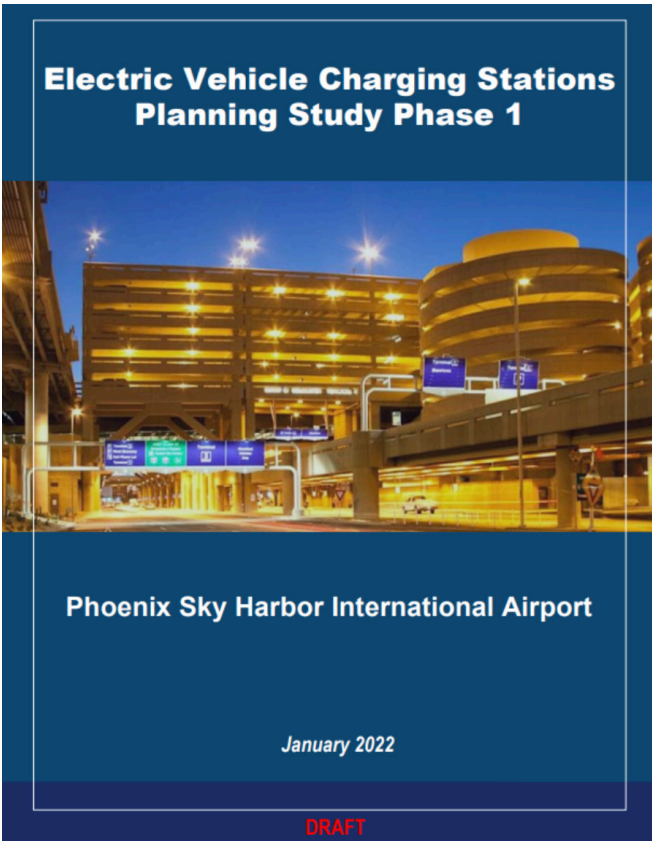
- Develop a City Operations EV Fleet Charging strategy that includes:
  - Guidance for selecting EV charger types (networked or non-networked) based on data desired (tracking of mileage, maintenance schedules, department charges).
  - Recommended rates of installation in advance of the purchase of EVs (just-in-time versus mass upgrades and future-proofing infrastructure through oversizing) that consider the lead time needed for permits.
  - An approach for “managed charging” and guidelines for fleet use that minimizes utility costs and demand charges/peak times and leverages energy storage and microgrids including the potential to use third-party-owned systems to lower costs and reduce risk.
  - Support for utility grid resiliency and charging station infrastructure—identifying who operates, maintains, and responds in emergency operations should there be malfunctions or outages. Explore how discretionary charging could be curtailed in power emergencies.
  - Best practice approaches such as the Department of Energy Alternatives Fuels Data Center EVSE tool to calculate the number of L1/L2/DCFC and/or combinations needed for fleet use.
- Request to hire or train technical experts to project manage all electrical installs and electrical upgrades and permits and utility coordination.

**BY DECEMBER 2023**

- Implement training of employees for EV driving, EV charging, and EV maintenance prioritizing employee change management to achieve effective employee engagement.

**BY DECEMBER 2025**

- Install a minimum of 100 new chargers and the associated electrical and infrastructure upgrades at City facilities with capacity for additional charging capability in the future. Include a maintenance contract when possible.



**Planning Process for EV Charging at Sky Harbor Airport**

Sky Harbor Airport has unique service demands including short- and long-term parking requirements for passengers and employees. Sky Harbor has an EV Charging Station Planning Study and a Capacity Demand Study underway that will inform infrastructure needs through 2030. The initial recommendations from these studies are not included alongside these recommendations except for forecasts for conversions of Aviation’s light-duty vehicle fleet.

**3d: Charging Infrastructure for Employees**

**Goal:**

Build out EV charging infrastructure for City employees to use at the workplace to meet employees’ current charging needs by 2025 based on ongoing employee EV surveys.

Summary of Recommendations for Charging Infrastructure for City Fleet	Year
1. Undertake EV Infrastructure needs assessment for employee charging	2022-2023
2. Install 30 or more employee charging ports in City facilities	2022-2023
3. Install 70 or more employee charging ports in City facilities	2023-2024
4. Install 70 or more employee charging ports in City facilities	2024-2025





**Detailed Recommendations:**

**BY DECEMBER 2022**

- Recommend Level 1 charging provided at no cost when available and Level 2 provided as initially free charging with an annual review to explore the viability of moving to cost recovery for employee EV charging and parking--exploring user fees versus City-paid as an incentive for sustainable commuting.
- Recommend locations and timing for a rollout of employee/workplace charging.
- Adopt an Employee EV Etiquette Policy to maximize the use of Level 2 and DCFC charging infrastructure (i.e., vacate parking stalls when the charging session is complete).
- Provide guidance on the level and type of charging infrastructure to be installed (Level 1 or 2 and DCFC, and networked vs non-networked).
- Explore incentives to encourage daytime charging and EV purchases.
- Create an employee EV survey that asks employees who currently drive an EV, who is planning to purchase in the next year, 3 years, and 5 years, and which times they are parked and in which lots (i.e., some employees may work evening hours or off-peak hours).
- Identify the number of current parking spaces per City building and the electrical service capacity at that location.
- Create a partnership with local utilities to identify EV charging rates that would apply.
- Identify guidance from the Internal Revenue Service (IRS) that allows for/ does not allow for EV employee charging as a tax-deductible benefit. If the IRS does not allow this as a tax-deductible benefit (like a subway card / metro card / bike commuting card), then propose to City Council for EV charging to be an employee benefit.

**BY DECEMBER 2023**

- Re-issue employee EV Survey.
- Identify any further collaborative multi-city EV charger bulk purchase opportunities across the US and/or the Valley to lower upfront equipment costs.
- Secure ongoing annual City funding to support 100% of city employees having access to workplace EV charging by 2030.
- Purchase EV charging stations, either through any identified group-buy opportunities or through a stand-alone RFP.



# APPENDIX 1

## GLOSSARY OF TERMS





## **TYPES OF VEHICLES AND OPERATIONAL TERMS**

**(ZEV) Zero-Emission Vehicles:** ZEVs are vehicles that produce no tailpipe emissions of any criteria pollutant (or precursor pollutant) or greenhouse gas emissions from the onboard source of power, such as some plug-in hybrid electric vehicles (PHEV), battery-electric vehicles (BEV), and hydrogen fuel cell vehicles.

**(EV) Electric Vehicles:** EVs are a broad category that includes vehicles powered, at least in part, by electricity—using a battery to store energy that powers the motor. Unless otherwise noted, EV refers to all plug-in vehicles in this report, including PHEVs and BEVs.

**(BEV) Battery-Electric Vehicles:** BEVs also known as pure electric vehicles or all-electric vehicles, contain batteries that can be charged externally, and store recovered braking energy. It uses an electric motor to power the vehicle. (Examples: Tesla Model 3, Chevrolet Bolt, Nissan Leaf)

**(PHEV) Plug-in Hybrid Electric Vehicles:** PHEVs are vehicles with both an internal combustion engine and an electric motor that can be powered either by gas or electricity through a rechargeable battery. PHEVs may be zero-emission vehicles if they're operated entirely as EVs but are not true ZEVs because the hybrid model includes use of an internal combustion engine. (Examples: Chevrolet Volt, Chrysler Pacifica, Mitsubishi Outlander)

**(FCEV) Fuel Cell Electric Vehicles:** Vehicles that produce electricity using hydrogen gas and produce no harmful tailpipe emissions, just water vapor.

**(ICEV) Internal Combustion Engine Vehicles:** ICE vehicles have an engine that is powered by fossil fuels (gas or diesel) in which the combustion of a fuel occurs with an oxidizer in a combustion chamber. This type of vehicle is associated with tailpipe emissions.

**Regenerative Braking:** A method of braking used by an EV in which the energy that would have been lost as heat energy during braking is captured using a traction motor and stored in the battery.

**Battery Management System:** An electronic system within an EV that manages battery parameters such as state of charge, health of the battery, and maximum and minimum limits of energy. It also protects the battery by controlling energy flow to and from the battery.

**Lithium-Ion Battery:** Commonly used battery material used to power an EV.



## ELECTRIC VEHICLE CHARGING TERMS

**(EVSE) Electric Vehicle Supply Equipment:** Refers to all of the equipment associated with transferring electric energy to a battery or other energy storage device in an electric vehicle. This includes hardware, including connectors, fixtures, devices, and other components. This is commonly called a charging station.

**Level 1:** AC Level 1 EV charging (often referred to simply as Level 1) provides charging through a 120-volt (120V) single-phase AC plug (a typical wall outlet) at 12-16 amps. Level 1 EV chargers provide about 3-5 miles of range per hour of charging. This type of charging is usually done at home.

**Level 2:** AC Level 2 EV charging offers charging through 240V (typical in residential applications) or 208V (typical in commercial applications) single-phase electrical service (like a dryer plug) at 12-80 amps (typically 32 amps). Level 2 EV chargers provide about 10-20 miles of range per hour of charging.

**(DCFC) Direct-current fast charging:** DCFC equipment (typically 208/480V AC three-phase input and less than 125 amps), enables rapid charging at a rate of at least 25 kW, with newer chargers rated up to 350 kW. Most commonly, DCFC can provide about 125 miles in 20-30 minutes.

**Fleet Charging:** EV charging infrastructure to accommodate a light-, medium- or heavy-duty fleet. Fleet charging infrastructure may consist of Level 2 and DC Fast Chargers based on the fleet operator's needs.

**Employee/Workplace Charging:** EV charging infrastructure provided by an employer for employee use while at work.

**Public Charging:** Public EV charging covers a wide range of situations where an EV driver could potentially charge when away from home or work. Examples: libraries, parks, shopping centers, and museums.

**Bidirectional Charging:** An EV charger that can flow charge to a battery and from battery to grid, to a vehicle, and to a home.

**State of Charge:** State of charge is the level of charge of an electric battery relative to its capacity. The units of State of charge are percentage points (0% = empty; 100% = full).

**Range:** The total distance an EV can travel on one full charge before the battery needs to be recharged.



**Range Anxiety:** Range anxiety is the fear that an EV has insufficient range to reach its destination and would thus strand the vehicle’s occupants. Studies show that driving range is one of the primary barriers to EV adoption.

## **EV EQUITY TERMS**

**EV Equity:** Increasing access to and distribution of electrified transportation options and services in a way that meets the diverse mobility needs of our communities.

## **MOBILITY TERMS**

**Bike Share:** Bike share is a service where bicycles are available for shared use to individuals on a short-term basis.

**Car Share:** Car Share is a service that gives members access to an automobile for short-term use — usually by the minute, hour, or day.

**E-Bike:** E-bikes are bicycles with electric motors that can be used for propulsion. There are a few different types of e-bikes:

**Class 1:** The electric drive on the e-bike is only activated by pedaling and ceases to provide assistance once the e-bike reaches 20 mph. Unless otherwise specified, the term e-bike refers to Class 1 pedal-assist e-bikes.

**Class 2:** The electric drive on the e-bike can be activated through a throttle element and may also be activated through pedaling with top speeds limited to 20 mph.

**Class 3:** The electric drive system on the e-bike is activated by pedaling and ceases to provide assistance once the e-bike reaches 28 mph.

**Class 4:** Motorcycle/Moped: The electric drive system is activated by pedaling or throttle. These e-bikes can reach top speeds above 28 mph.

**Micro mobility:** Use of a low-speed travel mode or use by a single person including the use of e-scooters and e-bikes to travel distances five miles or less, and often to or from another mode of transportation (bus, train, car).

**Multimodal:** Characterized by several different travel modes or options.



**On-Road:** On-Road vehicles refer to motor vehicles intended for use on the road, being complete or incomplete, having at least four wheels, and a maximum design speed exceeding 15 mph.

**Off-Road:** Off-Road vehicles are operated on roads not maintained by a federal, provincial, state, or local agency, or any vehicle which cannot be licensed to drive on a public road and is designed and manufactured primarily for off-road usage.

**Shared Mobility:** Shared use of a travel mode.

**(TNCs) Transportation Network Companies:** Programs, like ride-hailing apps, that provide prearranged and on-demand transportation services for compensation by connecting drivers of personal vehicles with passengers through mobile applications.

**Transit Vehicles:** Vehicles that carry passengers or public riders. It does not include school buses or charter buses.

## **FLEET-RELATED TERMS**

**LDV:** Light-Duty Vehicles: Any Class One or Two motor vehicle designed primarily for the transportation of persons and having a design capacity of twelve persons or less with a Gross Vehicle Weight Rating of 8,500 or less. This includes sedans, full-size pick-ups, and minivans.

**MDV:** Medium-Duty Vehicles: Any Class Two to Six motor vehicle having a Gross Vehicle Weight Rating between 8,500 and 26,000 pounds.

**HDV:** Heavy-Duty Vehicles: Any class Seven and above motor vehicle having a Gross Vehicle Weight Rating over 26,000 pounds.

**SUV:** Sport Utility Vehicle

## **ELECTRICITY AND ENERGY-RELATED TERMS**

**Ampere (Amp):** A unit used to measure electric current (how fast an electric current flows), usually used in the context of EV charging (i.e., a 50-amp EV charger).

**Kilowatt (kW):** The basic measurement of an EVs power that is generated by its batteries. Kilowatts = 1,000 watts)



**Kilowatt/hour (kWh):** The kilowatt-hour (kWh) is a unit of energy and is commonly used as a billing unit for energy delivered to consumers by electric utilities. A kWh is a measure of how much energy you're using. It doesn't mean the number of kilowatts you're using per hour. It is simply a unit of measurement that equals the amount of energy you would use if you kept a 1,000-watt appliance running for an hour. If you switched on a 100-watt light bulb, it would take 10 hours to rack up 1 kWh of energy. While a 50-watt item could stay on for 20 hours before it used 1 kWh.

**Volt:** A measure of the electromotive force that drives electrons through a circuit (pressure).

**Demand Charges:** There are two parts to a commercial electricity bill: Energy charges are based on the total amount of electricity you use, while demand charges are based on your highest "peak usage". These demand charges are determined by the highest 15-minute average usage recorded on your demand meter that month. Demand charges are applied to help pay down the costs of maintaining the utility's delivery system (the power lines) and preserve power availability for all customers across the grid. Additionally, demand charges are intended to incentivize customers to both reduce their peak energy usage and shift their energy usage to non-peak times of the day.

**Managed Charging:** Managed charging is an approach to control EV charging to increase or decrease electricity demand based on the needs of the grid. Managed charging falls into two approaches: passive and active. Passive relies on the customer to change their charging behavior, either through a TOU rate or price signals sent to charge during off-peak hours. Active charging is when the utility or a third-party vendor takes control and operation of the charging, like a demand response program, to optimize the energy consumption of EVs.

**Off-Peak Charging:** Charging your EV during off-peak hours, usually during mid-day or nighttime hours.

**Renewable Energy:** Energy sources that naturally replenish, such as solar or wind power.

## **EV BUILDING CODE-RELATED TERMS**

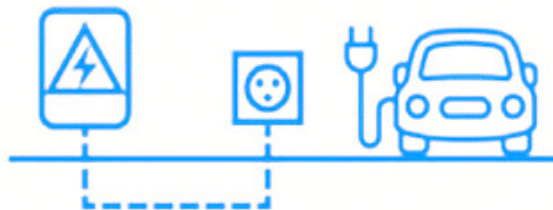
**EV Infrastructure Building Codes:** Require parking in new buildings to include the electrical equipment necessary to enable the installation of electric vehicle (EV) charging stations. EV building codes give more people the option to drive an EV by increasing the number of charging stations and by bringing down charger installation costs by 75% or more compared to installing EV chargers during a building retrofit.



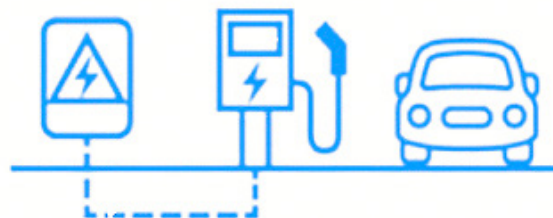
**EV-Capable:** Install electrical panel capacity with a dedicated branch circuit and a continuous raceway from the electrical panel to the future EV parking spot.



**EVSE-Ready Outlet:** Install electrical panel capacity and raceway with conduit to terminate in a junction box or 240-volt charging outlet.



**EVSE-Installed:** Install a minimum number of Level 2 EV charging stations.



## CLIMATE-RELATED ACRONYMS:

**CAP:** Climate Action Plan

**GHG:** Greenhouse Gas such as Carbon Dioxide that contributes to global warming through the absorption of infrared radiation.