Electric Vehicle Research, Analysis & Cost Estimates

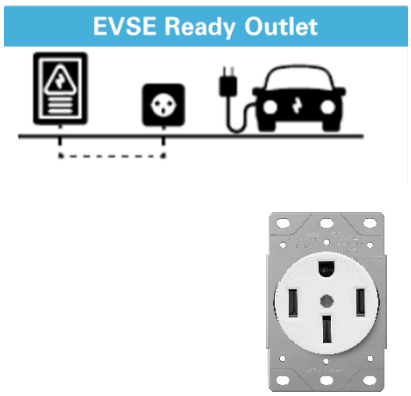
EV Infrastructure Definition and Purpose

Percent Total Readiness –EV infrastructure falls into the following Readiness Levels:

EV Readiness Levels, *listed from highest to lowest cost*

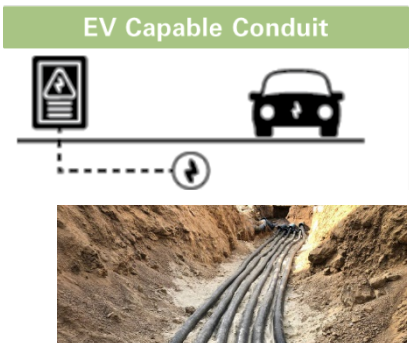
- **EV Installed Stations** – Installed charging station accessible to an EV parking space.

The purpose of EV Installed EV is to provide easy access for EV charging to a wide range of the general public. This is the most visible investment in EV infrastructure.



- **EV Ready Outlet** – Installed electrical panel capacity and raceway with conduit to terminate within reach of an EV parking space.

The purpose of EV Ready EV is to provide lower cost ready access to EV charging in locations with familiar or semi-regular users. Location-specific management strategies can be utilized to monitor or bill for charging access. Users may be required to provide their own charging cables to connect to an available outlet, or management may opt to provide this component



- **EV Capable Conduit** - Installed electrical panel capacity with a conduit from the panel to a future EV parking space.

The purpose of EV Capable conduit is to provide cost effective 'future proofing' for future EV charging at a site.

Peer City Case Studies

Municipalities across the United States are undergoing similar considerations to require EV charging infrastructure in their respective development codes. Generally, multifamily

development and commercial development are assigned different levels of readiness requirements, due to the differing use patterns and dwell times that occur at each type of location. To inform the details of proposed requirements in Tucson, a range of EV readiness in peer cities was reviewed.

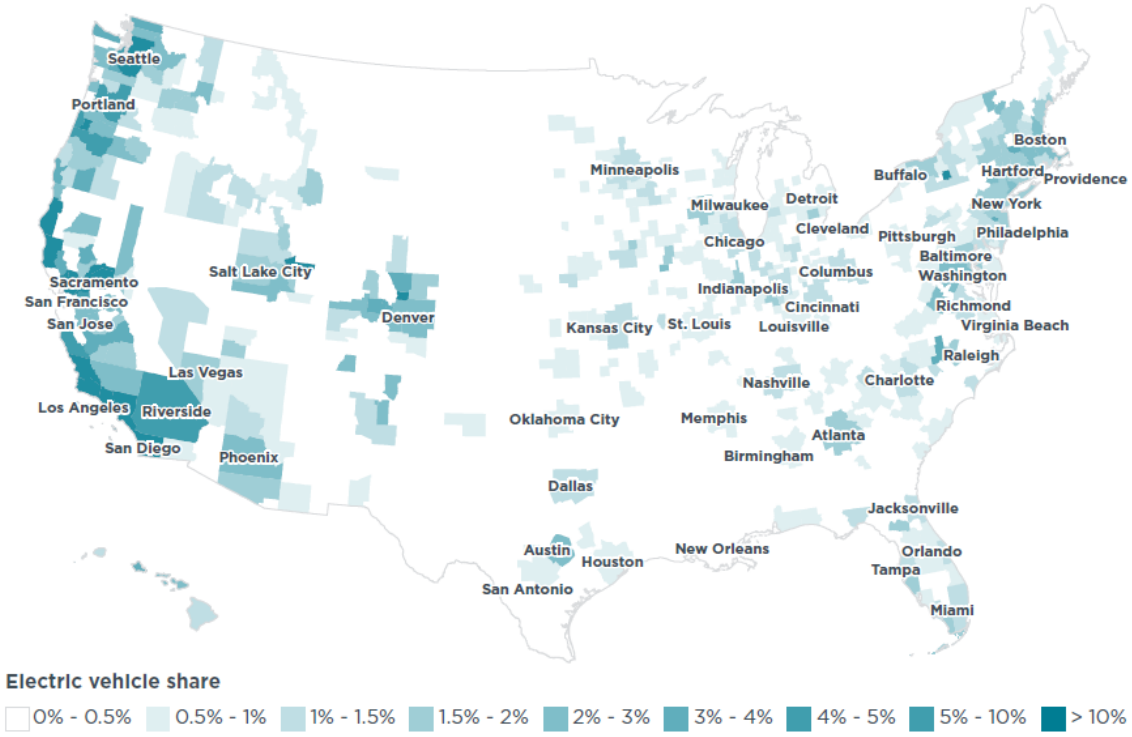


Figure 3. Electric vehicle share of new 2018 vehicle registrations by metropolitan area. (New vehicle registration data are from IHS Markit)

Arizona Peer Cities

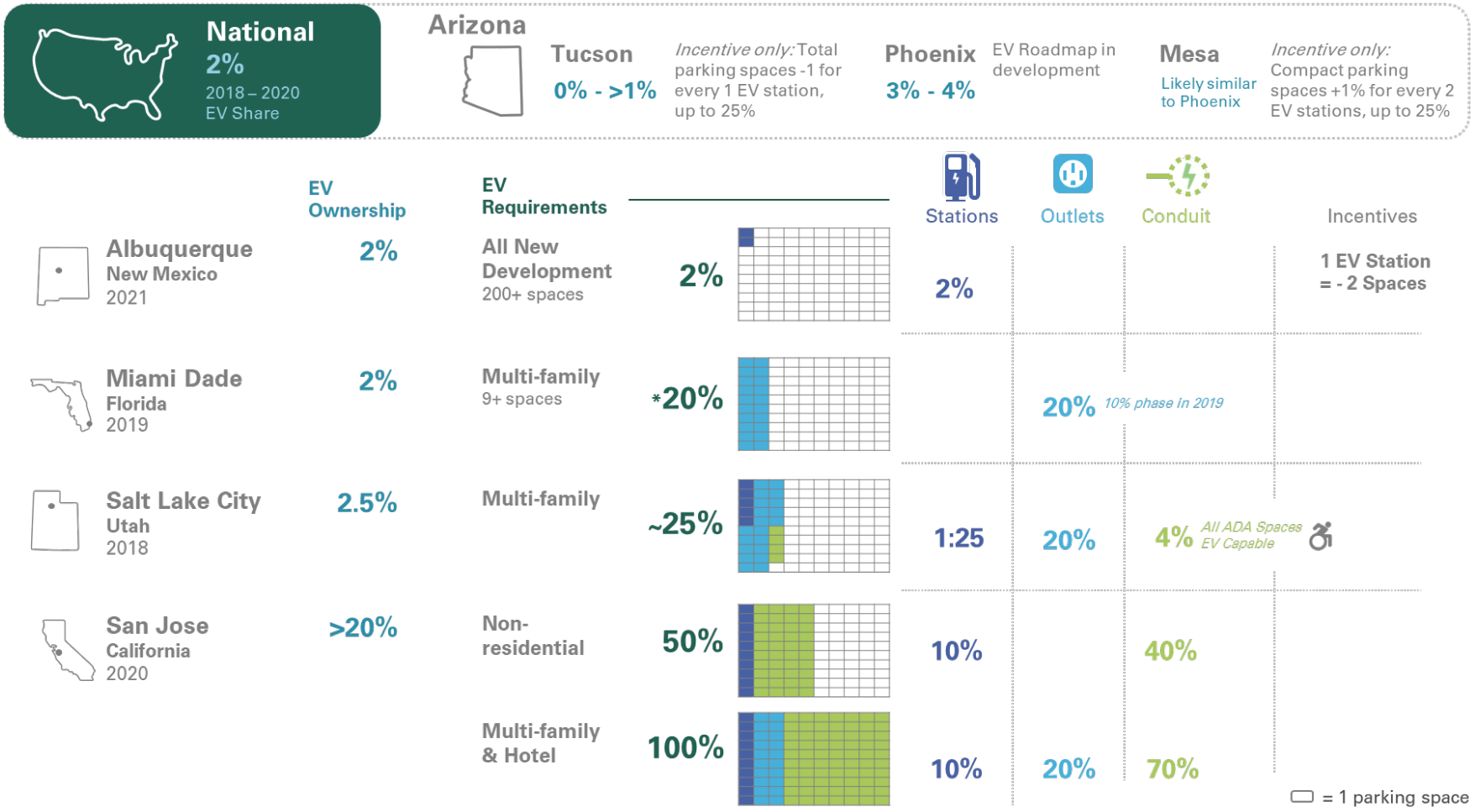
For additional regional context, descriptions of existing EV adoption rates and EV Readiness requirements for Arizona cities are as follows:

Phoenix currently boasts an EV adoption rate of three to four percent, and is in the process of developing a Citywide EV Roadmap.

Mesa likely has similar EV adoption rates to Phoenix and currently allows an incentive for providing EV Installed stations. For every two stations, the number of compact parking spaces can be increased on a site up to 25 percent.

Flagstaff has 0.5% - 1% EV adoption rates and requires a certain amount of EV Ready outlets in new multi-family, commercial, and industrial buildings with more than 20 parking spaces. The maximum requirement is 3 EV Ready spaces if the development has more than 100 parking spaces.

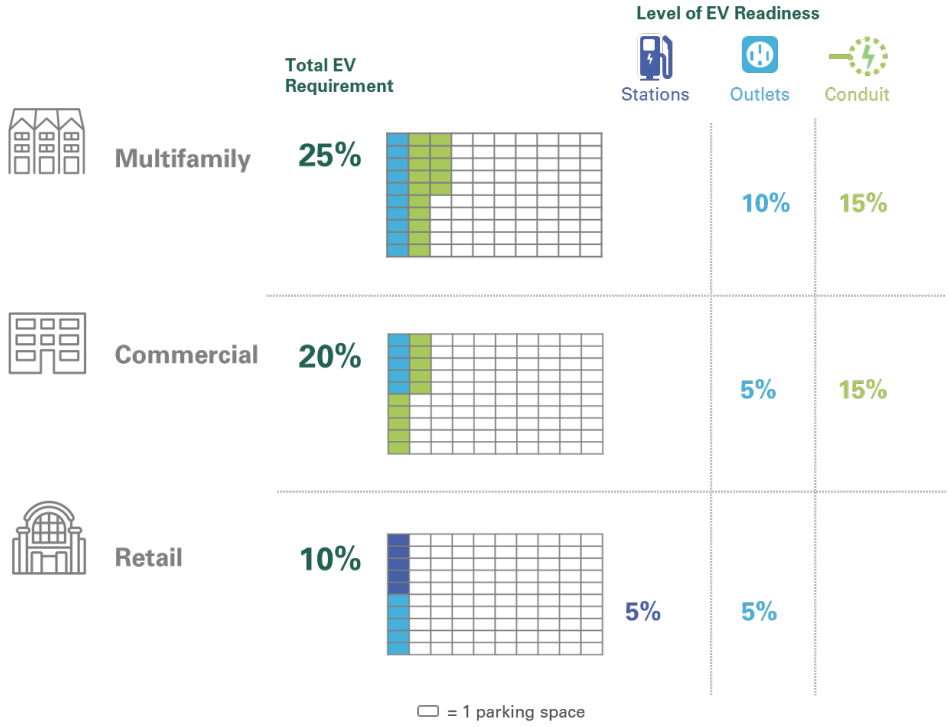
Peer City EV Ownership and EV Readiness Requirements



Tucson EV Readiness Requirements Proposal

The proposed requirements strike a balance of the goals of the EV Roadmap with the existing local rates of EV ownership. While requirements will set the minimum baseline commitment for EV investment in new development and significant cost savings by avoiding major retrofits, it is expected that market factors will also influence future levels of EV infrastructure.

Due to different use patterns at various commercial and multifamily locations and their expected charging habits, the proposals are separated into relevant use areas. The amounts below designate what is required in new development. Incentives that reduce the number of total required parking spaces encourages additional EV infrastructure installation beyond the minimum.



Incentives for additional EV infrastructure

In **Multifamily** and **Commercial** development, additional EV Installed station spaces or additional EV Ready spaces can be installed with an incentive to reduce total required spaces at 1 for 1 up to a 30 percent reduction.

In **Retail** development, EV Stations can be installed with an incentive to reduce total required spaces at 1 for 2 up to a 30 percent reduction.

ADA accessible spaces

Four percent (e.g., 1 in 25 spaces) but no less than one of electric vehicle (EV) charging spaces, in any given parking facility, must be accessible compliant. These spaces are accessible electric vehicle (EV) charging spaces, not ADA parking spaces.

Cost Estimates

The proposed requirements are to ensure an appropriate level of EV charging capability while recognizing the investment cost of a still changing technology.

Higher requirements for EV Ready outlets where visitation frequency and dwelling times makes them a feasible charging option provides some cost savings over requiring EV Installed stations. All required levels of EV Readiness provide safeguarding and future cost savings over forecasted retrofits.

Due to standard project costs, estimates for project sites with lots sizes of 10 or less result in significantly larger amounts when reported by cost per space compared to the bigger project sites.

Itemized costs are shown in the table below. Cost estimates based on development type and lot size are shown on the following page.

	note	Low	High	Unit
Direct Costs				
constant per project				
Custom signage and striping		$500	$1,500	$ / project
required, scales with number of spaces				
Trenching		$10.94	$18.49	$ / linear ft
Conduit		$10.75	$23.30	$ / linear ft
NEMA 14-50 outlet		$15	$50	$ / outlet
Transformer upgrade	$0 possible	$10,000	$25,000	$ / upgrade
Electrical panel upgrade	$0 possible	$1,800	$ 2,500	$ / upgrade
EVSE charger – *non networked*	$0 possible	$500	$1,700	$ / space
EVSE charger - *networked*	$0 possible	$1,887	$4,105	$ / space

Constant Measurements in feet

Width of parking space	8.5	8.5
Length of parking space	18	18
Width of parking aisle	24	24
Trenching/conduit multiplier	1.25	1.5

For all cost estimates

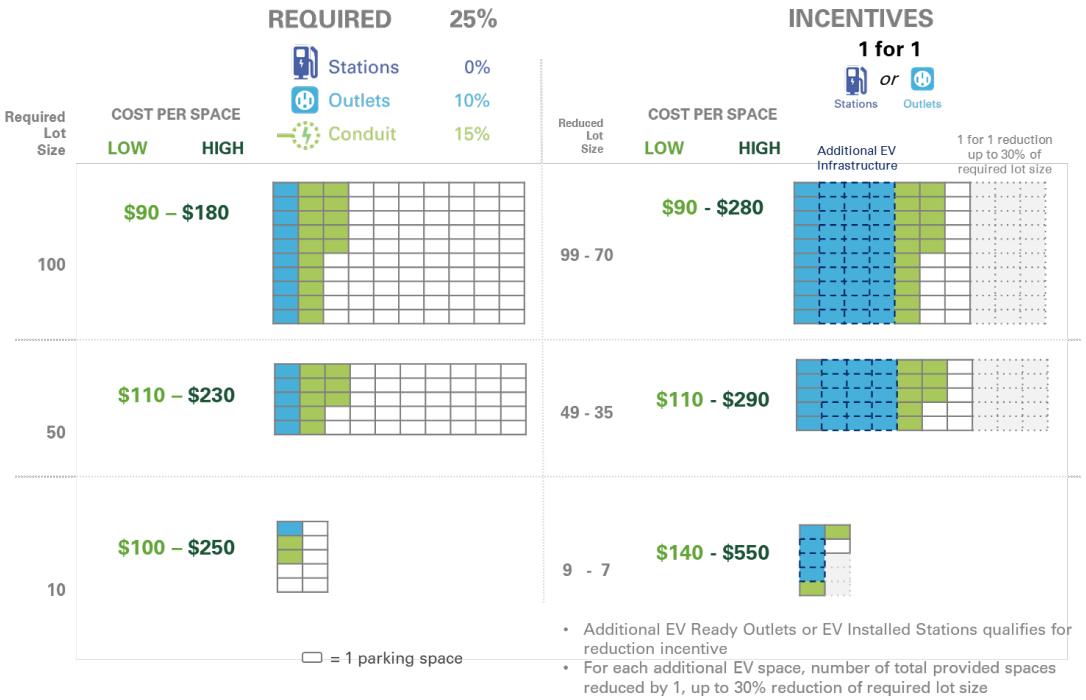
Cost Range is PER SPACE:

- In addition to base
- In addition to (potential) electrical upgrades
- Before reimbursements

Base Typical Parking Costs PER SPACE:

- Surface Lots: $5,000 - $10,000
- Structured Parking: $25,000 - $50,000

MULTIFAMILY Cost Estimates

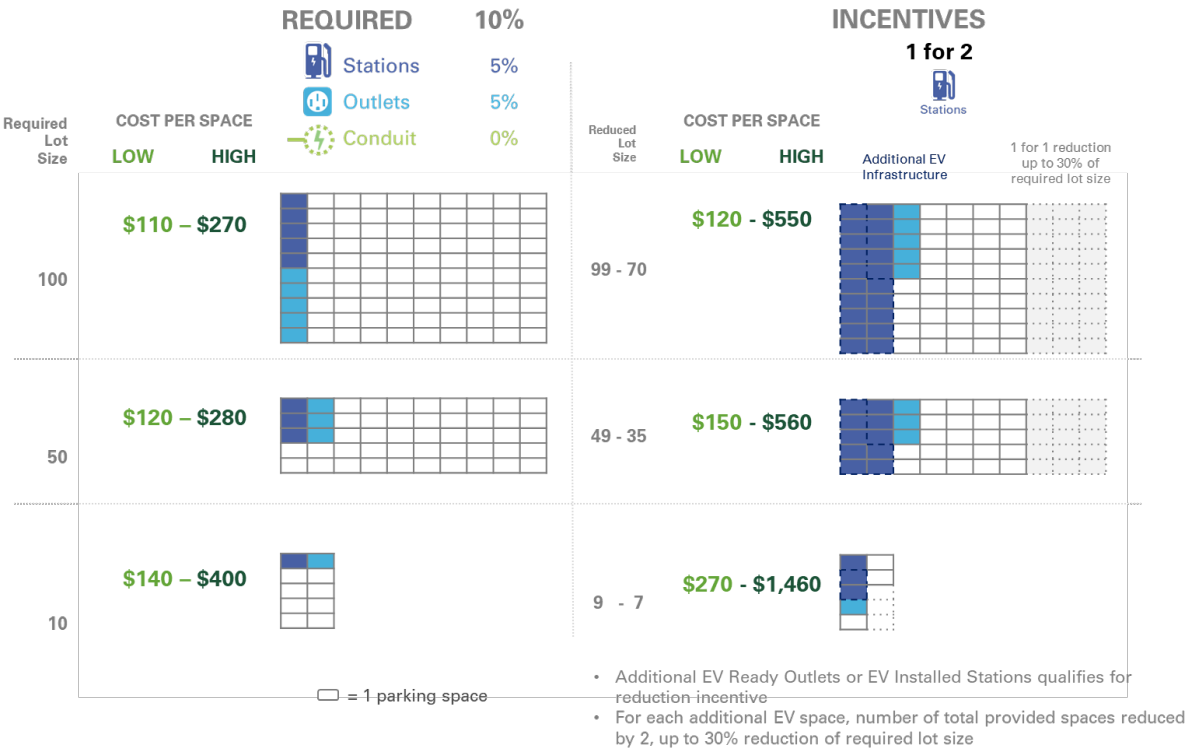


- Additional EV Ready Outlets or EV Installed Stations qualifies for reduction incentive
- For each additional EV space, number of total provided spaces reduced by 1, up to 30% reduction of required lot size

COMMERCIAL Cost Estimates

- Additional EV Ready Outlets or EV Installed Stations qualifies for reduction incentive
- For each additional EV space, number of total provided spaces reduced by 1, up to 30% reduction of required lot size

RETAIL Cost Estimates



- Additional EV Ready Outlets or EV Installed Stations qualifies for reduction incentive
- For each additional EV space, number of total provided spaces reduced by 2, up to 30% reduction of required lot size