June 1, 2020

The Infrastructure Needs and Costs for 5 Million Light-Duty Electric Vehicles in California by 2030

Electrifying transportation is critical for California's plans to address climate change and air quality. Electric vehicle (EV) sales, as a percentage of new vehicle sales, have increased year over year for the last decade. These increases culminated in over 650,000 EVs purchased in California in 2019, representing 7.5% of new passenger vehicle sales that year. An ever-expanding array of EV models are available to consumers. Reaching the state's goal of 5 million EVs on its roads by 2030 appears attainable, albeit challenging. Expanding access to charging infrastructure is a necessary complement to EV availability and sales. Access to charging will eliminate or reduce range anxiety and allow California's diverse population to electrify their mobility needs, including vehicles travelling the most miles every year (e.g. rideshare vehicles).

This paper summarizes the results of a modeling effort that was designed to provide order of magnitude estimates for the number of charging ports, sites, and associated costs of that infrastructure. These results should be viewed as directional and educational. Our hope is that policymakers, industry leaders, and regulatory agencies can use these results to help frame policies, regulations, and analysis that support California's goals for electric transportation. Please note that the cost estimates included in this paper are based on assumptions about EV charging site configurations and general cost estimates for associated work. They do not include detailed engineering design that would account for actual site conditions and that would be required to develop a robust site-level cost estimate. As such, the cost estimates in this paper should be considered as directional or order of magnitude estimates to support planning efforts.

This paper considers 243 scenarios for charging infrastructure to accommodate 5 million EVs in California in 2030 to determine:

- The number of residential and non-residential level 1, level 2, and DC fast charging ports (or "plugs") required;
- The potential utility-side and customer-side costs of developing that infrastructure; and
- The number of sites that may be required to be built to provide that charging.

The results show that between 3.8 million and 6 million charging ports will be needed to accommodate 5 million EVs in California, amounting to a cost of $5.5 billion to $25.4 billion for utility-side and customer-side infrastructure. Therefore, infrastructure for 5 million EVs will cost between $1,100 and $5,080 per vehicle. The large majority of these charging ports, representing 73% to 87% of all charging ports, are for level 1 or level 2 charging in detached residences. Notably, 81% of the scenarios have infrastructure costs below $17.4 billion and over 55% of the scenarios are below $13.4 billion. While the modeling did not account for existing infrastructure, based on estimates from the California Energy Commission for existing infrastructure and cost assumptions in this analysis, including existing infrastructure could reduce the cost estimates by 6%-16%.

Based upon site configurations that include between 5 and 100 chargers at level 1 and level 2 sites and between 2 and 120 chargers at DCFC sites, the non-residential EV charging infrastructure needed for 5 million light duty-vehicles will require developing between 30,000 and 97,000 sites by 2030. Assuming

250 working days per year, this equates to roughly 10 to 40 sites being built every day over the 2020-2030 timeframe, not including residential charging installations and sites built for non-light-duty vehicles.

Achieving an infrastructure roll out at this scale will be challenging. It will require cooperation from all the actors involved in developing EV charging infrastructure, including government (transportation planners, permit agencies, regulators, etc.), utilities, EV charging developers, construction companies, electrician organizations, and advocacy groups. A public and private task force would be a powerful asset to help identify adequate financing and funding to build out the necessary identified infrastructure to support 5 million EVs in California by 2030.

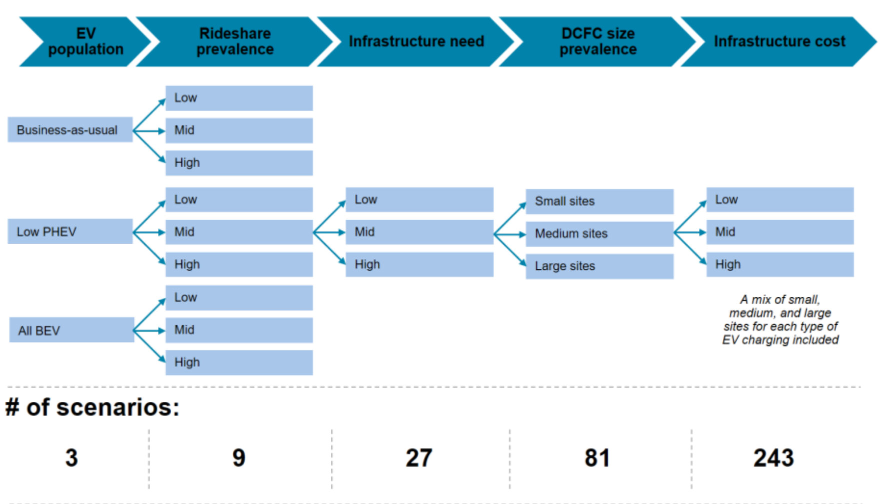
Description of scenarios of EV charging infrastructure needs and costs

Meeting EV drivers' needs in California will require a mix of residential and non-residential charging ports. However, given the lack of experience with widespread EV adoption, estimating California's actual EV charging needs for 5 million EVs in 2030 is a challenging task. The actual need will be highly influenced by the following factors:

- The type of EVs purchased (plug-in hybrid (PHEV) or battery electric (BEV)) and their range;
- Their vocation (i.e. if they are used for ridesharing);
- The amount of level 1, level 2, and direct current fast charging (DCFC) infrastructure needed to support EV charging at both residential and non-residential locations;
- The configuration of the charging sites (i.e. the load and number of chargers at each site); and
- The cost of installing EV charging infrastructure.

To estimate the need and cost for charging, three scenarios were considered for each of the five variables described above, for a total of 243 scenarios (as shown in Figure 1).

Figure 1 – General overview of EV infrastructure scenarios



EV population

For the EV population, this report considers six types of EVs:

1. PHEVs with < 30 miles of range
2. PHEVs with 30+ miles of range
3. BEVs with <100-mile range
4. BEVs with 100-200 miles of range
5. BEVs with 200+ miles of range
6. BEVs with 200+ miles of range being used in rideshare applications

Using these six EV types, three EV population scenarios for the mix of EVs in California's fleet of 5 million EVs in 2030 were developed:

- **Business-as-usual scenario:** the mix of EVs in 2030 is the same as it is today
- **Low PHEV scenario:** the PHEV share declines from roughly 35% today to 20% in 2030, and the mix of BEVs remains the same as today
- **All BEV scenario:** all 5 million EVs in 2030 are BEVs with 100+ miles of range

Rideshare prevalence

"Rideshare EVs" are then included within the long-range BEV population of each EV population scenario. Low, medium, and high rideshare scenarios, assume that 50k, 100k, and 150k EVs, respectively, are used for ridesharing. These "rideshare EVs", have a higher demand for DC fast charging than non-rideshare vehicles, thereby potentially having a substantial impact on infrastructure needs and costs.

Infrastructure needs

The infrastructure needs for each of the six types of EVs were then estimated in a low-, mid-, and high-need scenario. This includes the following six types of charging:

- Level 1, residential
- Level 2, residential
- Level 1, non-residential
- Level 2, non-residential
- Level 2, multi-unit dwellings
- DC fast charging

Each vehicle type is assumed to have a different need for each type of infrastructure within the infrastructure scenarios as show in

Table 1. For example, PHEVs are unlikely to ever use DC fast charging and are more likely to find level 1 charging to be adequate for their needs. As a result, in all scenarios, PHEVs have a need for 0 DC fast charging, but they require between 800 and 900 Level 1 residential charging ports per 1,000 vehicles. On the other hand, BEVs being used for ridesharing are likely to use DC fast charging at a substantially higher rate than other EVs, ranging from 10 to 30 DC fast charging ports per 1,000 "Rideshare EVs".

Table 1 – Infrastructure needs per 1,000 EVs by scenario, vehicle type, and charging type

		Infrastructure need per 1,000 EVs					
Scenario	**Vehicle type**	**Level 1, residential**	**Level 1, non-residential**	**Level 2, residential**	**Level 2, non-residential**	**Level 2, multi-unit dwelling**	**DC fast charging**
Low infrastructure need	PHEV (<30 mi)	800	50	0	0	0	0
	PHEV (30+ mi)	800	50	0	0	0	0
	BEV (<100 mi)	300	25	300	50	120	0
	BEV (100-200 mi)	200	25	400	50	80	3
	BEV (200+ mi), non-rideshare	100	25	600	50	40	3
	BEV (200+ mi), rideshare	0	0	0	0	0	10
Moderate infrastructure need	PHEV (<30 mi)	850	100	0	25	0	0
	PHEV (30+ mi)	850	100	25	25	25	0
	BEV (<100 mi)	400	50	350	75	160	0.5
	BEV (100-200 mi)	300	50	500	75	120	4
	BEV (200+ mi), non-rideshare	150	50	700	75	70	4
	BEV (200+ mi), rideshare	0	0	0	0	0	20
High infrastructure need	PHEV (<30 mi)	900	150	0	50	0	0
	PHEV (30+ mi)	900	150	50	50	50	0
	BEV (<100 mi)	450	100	400	100	200	1
	BEV (100-200 mi)	250	100	600	100	160	5
	BEV (200+ mi), non-rideshare	100	100	800	100	100	5
	BEV (200+ mi), rideshare	0	0	0	0	0	30

DCFC size prevalence

Due to the large load, and resulting utility- and customer-side costs, associated with DC fast charging sites, the size of DCFC sites is varied across scenarios as shown in Table 2. As discussed in the next section, for all other charging types, a small, medium, and large site size is considered but their size is not varied across scenarios because the impact of variation on the result is relatively minor.

Table 2 – DCFC size prevalence scenarios

	Plugs at site type, by share of all DCFC plugs		
DCFC scenarios	**DCFC, micro site**	**DCFC, station**	**DCFC, hub**
Small sites	35%	60%	5%
Medium sites	25%	60%	15%
Large sites	20%	60%	20%

Site configurations and infrastructure costs

Accurate cost estimates for EV charging infrastructure are not possible unless the specific location of the chargers is known, and detailed engineering studies are conducted to assess the adequacy of existing infrastructure and infrastructure upgrades required to construct the site. To represent this uncertainty, the cost of EV infrastructure is also varied across low-, mid- and high-cost scenarios.

Developing the EV charging network will require upgrades to and expansion of the electrical grid (the "utility-side"), and building "customer-side" electrical infrastructure and EV chargers. The mix of chargers will have a strong influence on cost because, in general, as power levels increase the cost of building the site increases. At the same time, higher power charging can serve more vehicles per day and can allow EVs to be used for the most mileage-intense use cases on the roads (e.g. long trips and taxi or rideshare operations). Because of these uncertainties related to cost, the modelling described in this report considers several different site configurations for each type of infrastructure as shown in Table 3.

Table 3 – EV charging sites size (number & power of chargers) and share of sites

			Number of ports (power level, kW)				
Site type	**Site size**	**Share of site type[1]**	**Low**	**Mid**	**High**	**Total**	**Site power**
Level 1, residential	Small	40%	-	1 (1.4 kW)	-	1	1.4 kW
	Medium	40%	-	1 (1.4 kW)	-	1	1.4 kW
	Large	20%	-	2 (1.4 kW)	-	2	2.8 kW
Level 1, non-residential	Small	50%	-	5 (1.4 kW)	-	5	7 kW
	Medium	30%	-	10 (1.4 kW)	-	10	14 kW
	Large	20%	-	50 (1.4 kW)	-	50	70 kW
Level 2, residential	Small	75%	1 (7.2 kW)	-	-	1	7.2 kW
	Medium	20%	2 (7.2 kW)	-	-	2	14.4 kW
	Large	5%	1 (7.2 kW)	-	1 (19 kW)	2	26.2 kW
Level 2, non-residential	Small	20%	-	5 (7.2 kW)	-	5	36 kW
	Medium	70%	-	20 (7.2 kW)	-	20	144 kW
	Large	10%	-	100 (7.2 kW)	-	100	720 kW
Level 2, multi-unit dwelling	Small	30%	-	5 (7.2 kW)	-	5	36 kW
	Medium	60%	-	20 (7.2 kW)	-	20	144 kW
	Large	10%	-	100 (7.2 kW)	-	100	720 kW
DCFC, micro site	Small	20%	2 (50 kW)	0	-	2	100 kW
	Medium	40%	1 (50 kW)	2 (150 kW)	-	3	350 kW
	Large	40%	0	3 (150 kW)	-	3	450 kW
DCFC, station	Small	30%	-	4 (150 kW)	-	4	600 kW
	Medium	40%	-	5 (150 kW)	1 (350 kW)	6	1,100 kW
	Large	30%	-	8 (150 kW)	2 (350 kW)	10	1,900 kW
DCFC, hub	Small	40%	-	20 (150 kW)	5 (350 kW)	25	4,750 kW
	Medium	40%	-	40 (150 kW)	10 (350 kW)	50	9,500 kW
	Large	20%	-	100 (150 kW)	20 (350 kW)	120	22,000 kW

Note: (1) For all DCFC sites, the prevalence of site sizes (micro, station, and hub) is varied across scenarios as described above. All other sites, sizes do not vary across scenarios.

This report considers five infrastructure segments as shown in

Figure 2. These include three segments on the utility-side of the meter (the substation, primary distribution, and secondary distribution) and two segments on the customer-side (the "make-ready"[1] and the charger). In addition, EV charging needs in California may require upgrades to the transmission system. Transmission upgrades, however, are difficult to attribute to development of individual EV charging stations and are therefore not considered in this cost modelling.[2]

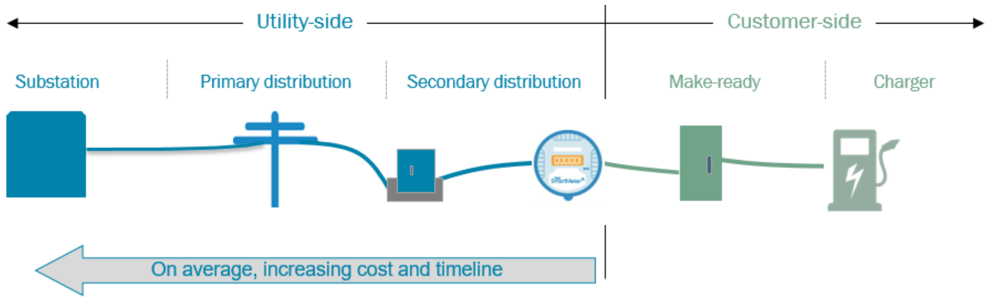
This report does not consider vehicle-grid integration (VGI) strategies to address load management for EV charging. VGI can be used to reduce the cost of operating an EV charging site and inform charging site configurations by accommodating, among other things, specific time of use rates, power sharing, active managed charging, and vehicle to grid (V2G) capabilities. The impact of VGI on EV charging site development costs are site specific and not generalizable in modeling of the type presented in this paper. In some cases, VGI strategies will be able to reduce development costs (e.g. if they can reduce

[1] The customer-side make-ready is all the infrastructure on the customer-side of the utility meter up to, but not including, the EV charger.

[2] Weiss, J., Hagerty, J.M., Castaner, M. (2019) *The Coming Electrification of the North American Economy*, prepared by The Brattle Group for WIRES, available at https://wiresgroup.com/wp-content/uploads/2019/03/Electrification_BrattleReport_WIRES_FINAL_03062019.pdf

coincident peak load) and in others could increase upfront site costs (e.g. due to requirements for additional load management technologies and/or energy storage).

Figure 2 – Electrical infrastructure segments considered



To assess an expected cost for each infrastructure segment, based upon the power level (in kW, see Table 3) for the site, a probability of an upgrade being required for each segment was assessed and multiplied by the cost of the upgrade in the low-, mid-, and high-cost scenarios. This means that for some sites, the cost of some infrastructure segments could be less than the segment's infrastructure cost identified below or could be zero. While actual site costs will always depend upon existing site conditions, this methodology addresses some level of variability in site conditions statewide.

On the utility-side, in general, as the electrical load for the EV chargers being installed increases, it will trigger (or be more likely to trigger) increases in upgrades of the utility-side infrastructure, with the cost, complexity, and timeline increasing in parallel.[3] In all cases and for all infrastructure, the actual conditions at the site will be a determining factor for actual costs. The probabilities of required upgrades were assessed by power level of the site as shown in Table 4; table items with ranges were varied according to cost scenario.

Table 4 – Probability of utility-side upgrades, by infrastructure segment and power level

Power level	Substation	Primary distribution	Secondary distribution
<7.2kW	0%	0%	0%
7.2kW – 15kW	0%	0%	2%-8%[1]
15kW – 50kW	0%	0%	70%
50kW – 100kW	0%	0%	96%
100kW – 5MW	0% - 50%	5% - 90%	100%
>5MW	100%	100%	100%

Note: (1) The IOU load research report assesses the probability for a 7.2kW upgrade at 0.19%. For this report, the probability was increased to consider homes that install two 7.2 kW chargers and the possibility that as EV adoption increases, multiple homes on a secondary distribution circuit may install EV chargers thereby increasing the probability of triggering an upgrade.
(2) Probabilities provided in this table are meant as a general assessment of diversity of conditions across California. They do not represent findings of a

[3] For example, it is possible, albeit with low probability, that a 7.2 kilowatt (kW) residential level 2 residential charger will trigger a secondary distribution upgrade, but that load will not require a substation upgrade. A 5 megawatt (MW) DCFC site, on the other hand, will always trigger a secondary distribution upgrade, and has a moderate probability of triggering a primary distribution and/or substation upgrade.

detailed load research assessment and therefore are not appropriate for use in system planning, budgeting, etc.

Depending on the power level of the site, and the cost scenario considered, the utility-side costs by infrastructure segment range from:

- $1M to $9M for a substation upgrade
- $150k to $6M for a primary distribution upgrade
- $5k to $100k for a secondary distribution upgrade

On the customer-side, the probability of a site requiring a “make-ready” and chargers is 100% in all cases, except for the following which were varied by cost scenario: Level 1 non-residential has a 50%-100% probability of requiring a make-ready, Level 1 residential is assessed as having a 0%-25% probability of requiring a make-ready (e.g. moving a plug to accommodate a charger) and a 50% probability of requiring a charger, and Level 2 residential has a 50%-100% probability of requiring a make-ready.

Assumptions related to customer-side costs are included in Table 5. Additionally, the costs included below are not adjusted for sites that implement power sharing, which could lower the cost per charger.

Table 5 – Customer-side infrastructure cost ranges, by site type and infrastructure segment

Site type	Make-ready, per site	Per charger
Level 1, residential	$50 - $250	$125 - $175
Level 1, non-residential	$100 - $45,000[1]	$125 - $175
Level 2, residential	$200 - $2,000	$500 - $2,500[2]
Level 2, non-residential	$50,000 - $250,000[3]	$800 - $1,000
Level 2, multi-unit dwelling	$50,000 - $250,000[3]	$800 - $1,000
DCFC	$50,000 - $320,000[4]	$20,000 - $100,000[5]

Notes: (1) The low end of this range corresponds to a site with 5 chargers that does not require trenching work and the high end corresponds to 50 chargers which does require trenching. (2) Range includes costs for both 7.2kW and 19kW chargers. (3) The range assumes make-ready infrastructure requires trenching; there will be sites that fall below this range based upon specific site conditions. (4) make-ready costs for sites with a large number of ports could exceed this range, but the prevalence of those sites across scenarios is small and therefore does not have a material impact on the overall results. (5) Range includes costs for 50kW, 150kW, and 350kW chargers.

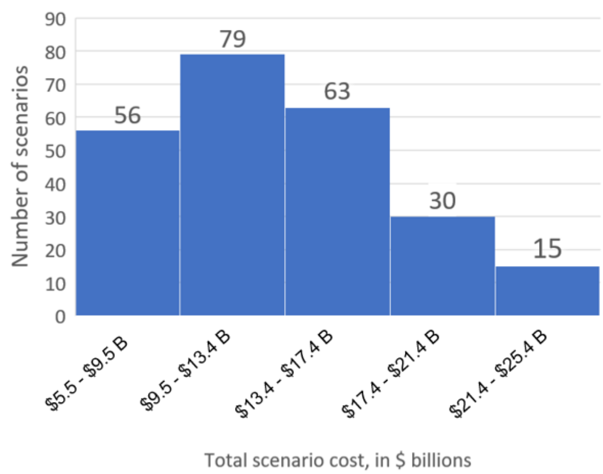
Scenario results

To accommodate 5 million EVs in California, the 243 scenarios conducted show a need for between 3.8 million and 6 million charging ports. The cost of developing this number of charging ports ranges from $5.5 billion to $25.4 billion[4]. As shown in

[4] The results do not account for existing infrastructure. Based on estimates from the California Energy Commission for existing infrastructure and cost assumptions included in this analysis, including existing infrastructure could reduce the cost estimates in this analysis by 6%-16%.

Figure 3, 198 of the 243 scenarios (over 81%) have infrastructure costs below $17.4 billion, and 135 scenarios (over 55%) have costs less than $13.4 billion.

Figure 3 – Total infrastructure cost, by number of scenarios



In all scenarios, a large share of charging is level 1 or level 2 charging in detached residential housing:

- 627,000 to 2.1 million level 1 charging ports will be needed in 564,000 to 1.9 million homes
- 1.6 million to 3.7 million level 2 charging ports will be needed in 1.4 million to 2.2 million homes

Non-residential charging plug needs (level 1, level 2, and DCFC) range from 513,000 to 1.6 million, accounting for 13% to 27% of all charging ports. In terms of cost, however, non-residential charging accounts for a majority of costs in all scenarios, ranging from 57% to 75% of total costs (see Table 6).

Table 6 – Share of total cost, charging type

	L1, res	L2, res	All res	L1, non-res	L2, comm	L2, MUD	DCFC	All non-res
Min	0.6%	22.3%	25.0%	1.6%	16.8%	21.0%	12.1%	56.9%
Max	5.7%	41.0%	43.1%	6.2%	24.4%	30.4%	18.2%	75.0%
Median	2.3%	30.9%	33.5%	3.5%	20.5%	26.6%	16.1%	66.5%

Note: (1) Residential and non-residential shares do not sum to 100% because the min, max and median do not necessarily come from the same scenarios.

As shown in Table 7, in all scenarios, customer-side infrastructure makes up most of the total costs, representing between 77% and 85% of overall costs. This is, in part, because of the high prevalence of residential charging. At the site level, utility-side costs tend to increase in parallel with power level, and residential charging is relatively low power and so requires relatively few utility-side upgrades.

Table 7 – Infrastructure segment share of total scenario cost

	Substation	Primary dist.	Secondary dist.	Utility-side total	Make-ready	Charger	Customer-side total
Minimum	0.1%	0.1%	15%	15%	36%	22%	77%
Maximum	3.0%	2.8%	18%	23%	58%	48%	85%
Median	0.8%	1.5%	17%	20%	47%	33%	81%

Note: Utility- and customer-side shares do not sum to 100% because the customer-side min, max and median do not necessarily come from the same scenario as those for the utility-side

As shown in Table 8, the utility share of overall costs is roughly twice as high for non-residential charging as for residential charging. If future EV charging development trends towards more centralized locations of higher power charging (e.g. due to ridesharing or autonomous EVs), it is possible that the utility-side share of costs will be higher than the scenarios considered. Likewise, the utility-side share of costs for medium- and heavy-duty EVs, which are charged at much higher power and often in centralized locations, is likely to be higher than for the light-duty scenarios considered in this report.

Table 8 – Utility- and customer-side share of costs by residential and non-residential charging costs

	Residential charging		Non-residential charging	
	Utility-side	Customer-side	Utility-side	Customer-side
Minimum	11.0%	85.2%	17.2%	70.9%
Maximum	14.8%	89.0%	29.1%	82.8%
Median	12.3%	87.7%	22.4%	77.6%

Note: 1) Residential charging includes level 1 and level 2 at detached homes. Level 2 charging at multi-unit dwellings are included in non-residential.

Based upon site configurations that include between 5 and 100 chargers at level 1 and level 2 sites and between 2 and 120 chargers at DCFC sites, the number of non-residential stations[5] needed is between 30,000 and 97,000, of which 1,714 to 6,690 sites are DC fast charging (see

[5] For the purposes of this summary, level 2 charging at multi-unit dwellings is considered non-residential charging because its characteristics (charger type and cost, construction costs, permitting, etc.) are more like a commercial level 2 installation than that of a residential charger in a detached home.

Table 9). In addition to the sites shown in

Table 9, between 13,000 and 63,000 non-residential level 1 sites will support charging, but these have substantially lower power levels and reduced site complexity.

Table 9 – Number of non-residential sites, by site type

	Level 2, commercial	Level 2, MUD	DC fast charger	Total non-res sites
Minimum	11,894	16,618	1,714	30,226
Maximum	37,620	52,813	6,690	97,123
Median	24,131	31,159	3,474	58,764

Number of sites to be developed

In addition to the financing and funding required to develop California's EV charging network, there are non-monetary issues that must be addressed to ensure that the infrastructure can be built within the required timeframe. As discussed above, non-residential EV charging infrastructure will require developing between 30,000 and 97,000 sites by 2030. Assuming 250 working days per year, this equates to roughly 10 to 40 sites being built every day over the 2020-2030 timeframe, not including single-family detached residential charging installations and sites built for non-light-duty vehicles. The number of sites that need to be designed, permitted, constructed, and electrified each day to meet the capacity needed to fuel 5 million EVs is significant and reinforces the urgency with which we must act to reach our goals.

Conclusions

Achieving California's 2030 EV adoption goal will be highly dependent on the ability of the state and private industry to develop the required EV charging network. Over 81% of the scenarios conducted for this report have infrastructure costs below $17.4 billion and over 55% of the scenarios are below $13.4 billion. This indicates that significant savings can be achieved by strategically focusing efforts on lower cost solutions to avoid the higher cost scenarios, which can reach up to $25.4 billion.

To do so, strategies must address:

- *Financing:* money required upfront to pay for infrastructure development
- *Funding:* money, available over time, to payback financing and/or pay for infrastructure operations and maintenance
- *Non-financial factors:* availability of non-monetary resources that can impact EV charging infrastructure development cost and timelines

Financing EV charging infrastructure

To date, financing for "utility-side" infrastructure for EV charging has been funded by investor-owned utilities' general rate cases and/or supplemental utility EV programs for secondary distribution upgrades. Publicly owned utilities (POUs) have a portion of LCFS funding for some charging infrastructure. It will be important for utility planning efforts to reflect expected EV adoption and the associated cost of EV charging infrastructure going forward.

On the "customer-side", California has relied on a range of sources to finance EV charging infrastructure. These include government grants like the California Energy Commission's Clean Transportation Program, utility program investments, legal settlement money, market-based mechanisms including the Low Carbon Fuel Standard (LCFS) and the Greenhouse Gas Reduction Fund, and private financing. However, even with these programs there is a significant funding gap that needs to be addressed to develop the "customer-side" EV charging infrastructure that California needs to achieve its goals. Filling that gap will require expanding existing and developing new sources of financing, including unlocking additional private financing of EV infrastructure development based upon robust and sustainable funding resulting from the use of the assets.

Funding EV charging infrastructure

To date, funding for "utility-side" infrastructure is collected in a reliable manner through utility distribution and transmission rates. However, some POUs have opted to collect infrastructure upgrades from the customers that are triggering those upgrades. On the "customer side," funding has come from local, state, and federal funds, usage and subscription fees from customers using EV charging, and market-based mechanisms (such as LCFS revenues). Robust funding for customer-side EV infrastructure is necessary for sustainable long-term development and to unlock access to private financing. At current adoption levels, this can be challenging given the relatively low utilization of some EV charging infrastructure.

Non-financial factors

The availability of and competition for human resources who are trained to build EV charging and utility infrastructure and those trained to permit and inspect at the local level could present a challenge as EV charging competes with other priorities (e.g. wildfire rebuilding and system hardening). Construction timelines for large utility upgrades can also be problematic, with large projects often taking multiple years to complete. Finally, heterogeneity of requirements and timelines for permitting at the local level are problematic as infrastructure is being developed around the state.

Achieving an infrastructure roll out at this scale is a tall order and will require cooperation from all the actors involved in developing EV charging infrastructure, including government (transportation planners, permit agencies, regulators, etc.), utilities, EV charging developers, construction companies, electrician organizations, and advocacy groups. A public and private task force would be a powerful asset to help identify adequate financing and funding to build out the necessary identified infrastructure to support 5 million EVs in California by 2030.