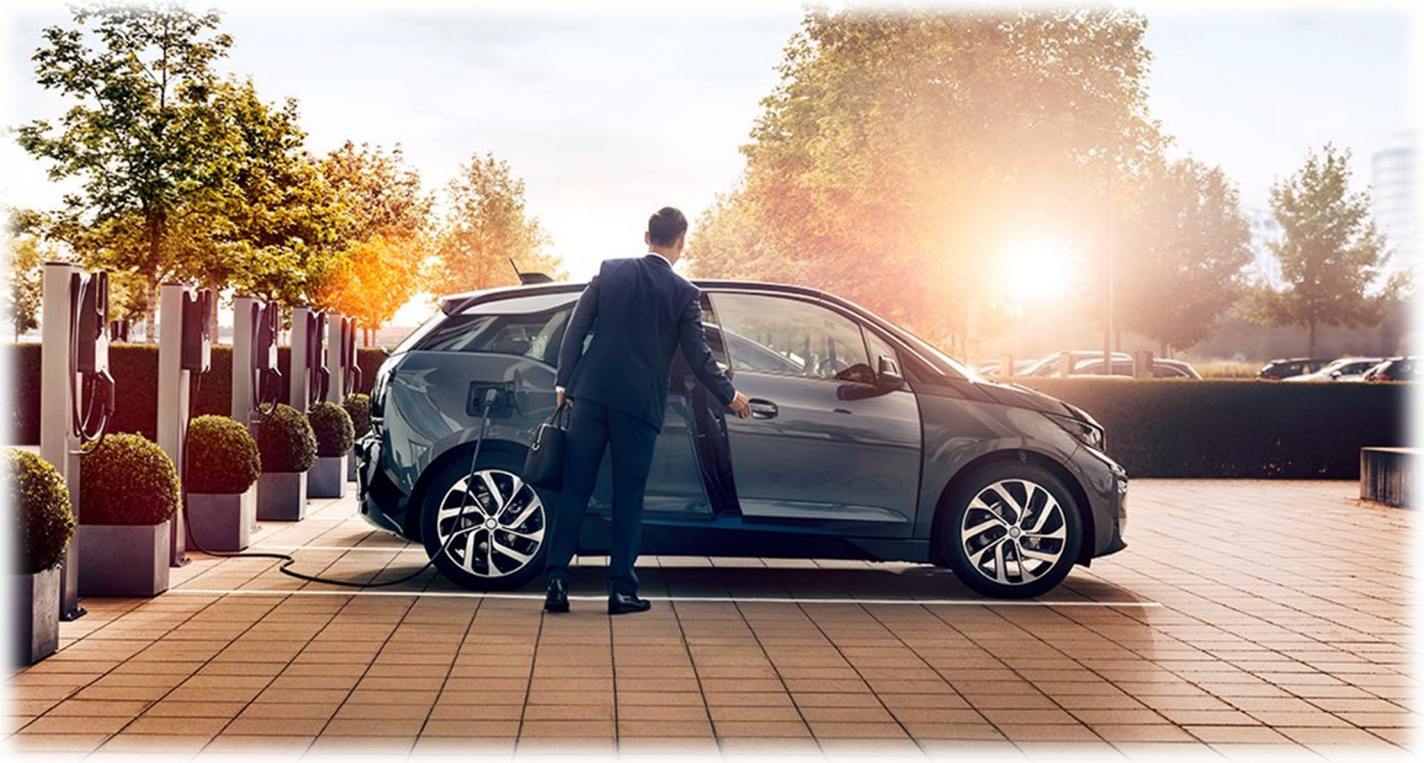

EV Charging Infrastructure: Nonresidential Building Standards

CALIFORNIA
AIR RESOURCES BOARD

2019/2020 Intervening Code Cycle: CARB Staff Technical and Cost Analysis

California Air Resources Board 11/15/19

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1) EV Solutions, The Benefits of Electric Vehicle Charging for Businesses
2) Irvine Company Office Properties, McCarthy Ranch Electric Vehicle Charging Stations
3) Houston Galveston Clean Cities, Establishing Workplace EV Charging Stations

California Air Resources Board (CARB)

Executive Officer
Richard W. Corey

Prepared by
Sustainable Transportation and Communities Division (STCD)

Primary Author
Dana Papke Waters

Contributors
Gerhard Achtelik
Marcus Barrango
Analisa Bevan
Joshua Cunningham
Nicole Dolney
Kathy Jaw
Elise Keddie
Glenn Gallagher
Neil Matouka
Stephanie Palmer
Chris Ruehl
Annalisa Schilla
Marissa Williams
Mark Williams
Melanie Zauscher

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Michael Nearman, California Building Standards Commission

Additional Reviewers and Contributors

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Technical and Fiscal Analysis Pursuant to AB 341

Health and Safety Code, § 18930.5 (b) as amended by Assembly Bill 341 in October 2013 allows the Building Standards Commission (BSC) and other State agencies that propose building standards to allow for input by State agencies with expertise in green building subject areas. California Air Resources Board (CARB) staff has expertise in air quality and climate change, which is related to multiple building standards in the Green Building Standards (CALGreen) Code. Since 2008, CARB staff has provided suggested changes to the CALGreen Code to ensure it is updated to support CARB programs and regulations including, but not limited to, California Global Warming Solutions Act of 2006 (AB 32, Nuñez, Chapter 488, Statutes of 2006 and SB 32, Pavley, Chapter 249, Statutes of 2016), Zero Emission Vehicle (ZEV) Regulation, and The Sustainable Communities and Climate Protection Act of 2008 (SB 375, Steinberg, Chapter 728, Statutes of 2006).

Beginning with the 2016 triennial Code Cycle, CARB staff provides technical and fiscal analyses along with suggested code changes as required by Health and Safety Code, § 18930.5 (b). Additionally, CARB staff identifies which proposed changes may be considered for adoption as mandatory within the next two code adoption cycles. This document provides the technical analysis to support the suggested code changes under AB 341. As part of the complete submittal package, CARB is providing Draft Express Terms with the suggested code language, draft Initial Statement of Reasons, and an economic and fiscal analysis with a Form 399 Economic and Fiscal Impact Statement.

Disclaimer

This document has been prepared by the staff of the California Air Resources Board. CARB's Executive Officer certifies, by this submittal, to the California Building Standards, Division of the State Architect, and Housing and Community Development that the information provided in the document is true and accurate based upon the information currently known to CARB staff and the staff's expertise. Formal submittal and publication do not indicate that the contents have been reviewed and/or approved by the Board members of the California Air Resources Board.

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Executive Summary

Transportation is the leading cause of smog-forming pollutants and greenhouse gas (GHG) emissions in California (California Air Resources Board, 2017). Expanding the number of zero emission vehicles (ZEVs) on California roads can help to reduce statewide emissions. In order to meet California's climate and air quality goals, 100 percent of light-duty car sales will need to be ZEVs by 2035 and the majority of the light- duty fleet will need to be ZEVs by 2050 (California Air Resources Board, 2019).

In the near term, California's ZEV infrastructure must support 1.5 million vehicles by 2025 and 5 million vehicles by 2030 (Governor Brown, 2018). By 2025, California has set specific goals to provide 250,000 battery electric vehicle chargers, including 10,000 direct current (DC) fast chargers (Brecht, 2019). Installing adequate infrastructure statewide is essential to assist with charging and refueling ZEVs. Nonresidential building standards that facilitate installation of electric vehicle (EV) charging infrastructure provides a unique low-cost opportunity to reduce the barriers to clean transportation access in workplace and public locations.

Current Building Standards

California's Green Building Standards (CALGreen) Code requires all new nonresidential buildings with 10 or more parking spaces to install EV Capable infrastructure in approximately 6 percent of parking spaces. EV Capable infrastructure includes raceway (the conduit or pipe that future wiring can be pulled through) and panel capacity to support future installation of a Level 2 charger on a dedicated 40-amp, 208/240-volt branch circuit.

Gap Analysis for Nonresidential Buildings

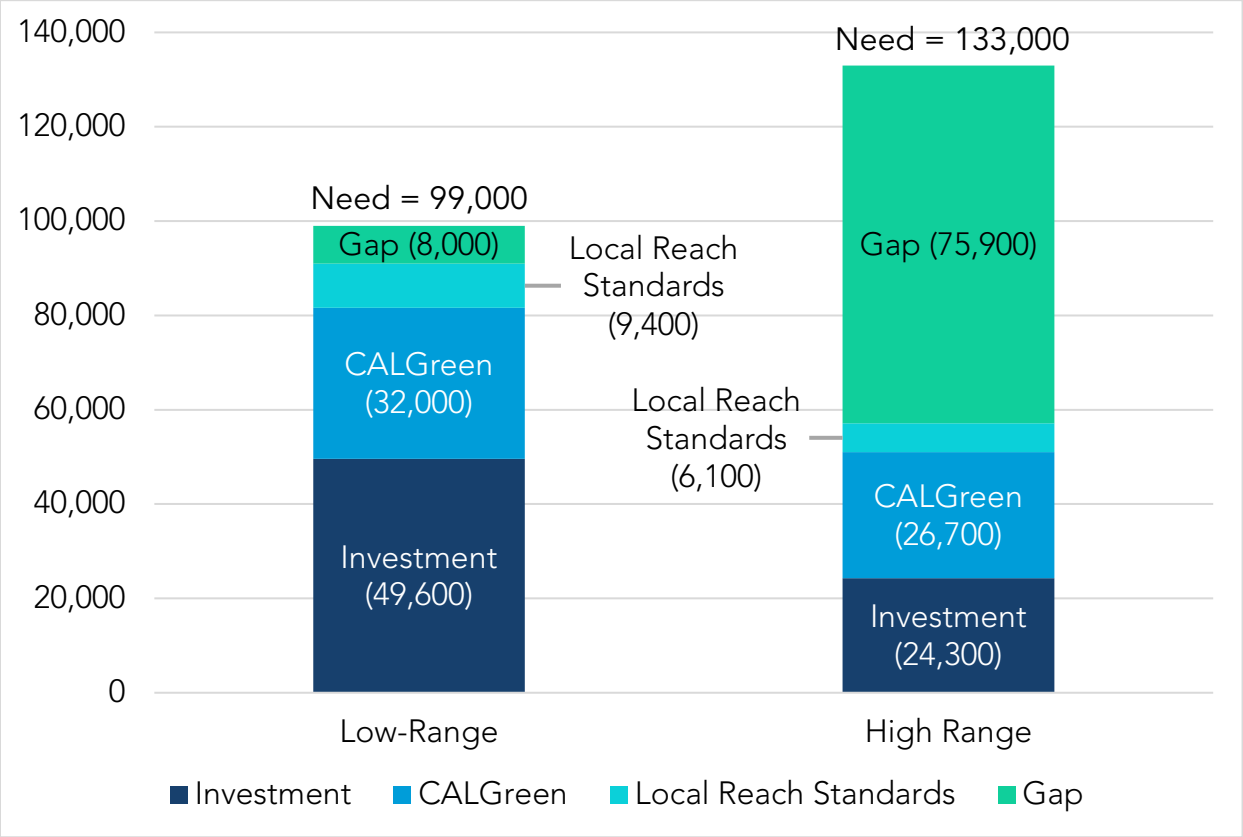
California's ZEV infrastructure is not keeping up with vehicle deployment. A recently completed CEC report estimates that California is likely to fall about 80,000 chargers short of the overall goal for 250,000 chargers by 2025 (Brecht, 2019). More specifically for workplace and public locations, CARB staff also estimates a significant gap in Level 2 chargers by 2025.

The Electric Vehicle Infrastructure Projections (EVI-Pro) model developed by the National Renewable Energy Laboratory (NREL) and the California Energy Commission (CEC) estimates on a county basis the number of Level 2 chargers and DC fast chargers needed to support a California State fleet of battery- and plug-in hybrid- electric vehicles, collectively referred to as plug-in electric vehicles (PEVs). Using the EVI-Pro model, results aggregated to the State level show a need for 99,000 to 133,000 Level 2 chargers in public and workplace locations by 2025. EVI-Pro also estimates a need for 9,000 to 25,000 DC fast chargers to support California's goal of 1.5 million zero emission vehicles by 2025 (Bedir, Crisostomo, Allen, Wood, & Rames, 2018).

CARB staff completed a gap analysis to estimate what may be done to meet this 2025 need, while noting that additional charging infrastructure will be needed to meet PEV

demand beyond 2025. As of August 2019, CARB staff reviewed multiple sources of investments to identify funded, proposed, and anticipated Level 2 chargers and DC fast chargers that may be installed by 2025. CARB staff also estimated the number of Level 2 EV chargers that may be installed due to the current CALGreen Code requirements and local government reach standards. Based on these estimates, a significant gap between 8,000 to 75,900 Level 2 chargers and 4,000 to 18,900 DC fast chargers exists between what is potentially being done and the number of chargers needed to support the State passenger PEV fleet by 2025. Additional charging infrastructure will be needed to support PEV market acceleration to meet longer-term 2030 targets.

Figure 1: Workplace and Public Locations: Estimated Gap in Level 2 Chargers by 2025



Suggested Code Changes to Fill the Gap

New buildings are long-term investments. EV charging infrastructure installed in new buildings should have the ability to support the demand for charging many years into the future. CARB staff recommends several code changes to advance the EV charging infrastructure provisions in the CALGreen Code during the Intervening 2019/2020 code cycle. First, CARB staff recommends all proposing State agencies (BSC, DSA, and HCD) adopt a mandatory ten percent requirement for EV Capable spaces in the nonresidential provisions of the CALGreen Code. Second, CARB staff recommends deleting the proposed exception for energy management systems from the mandatory

provisions; the exception completely undermines the code by eliminating the requirement for installing adequate panel capacity to support future installation of Level 2 chargers. Third, CARB staff recommends adopting voluntary Tier 1 and Tier 2 thresholds for 15 and 20 percent EV Capable standards, respectively.

Additional Code Changes to Advance CALGreen

CARB staff urges proposing State agencies (BSC, DSA, and HCD) to adopt two additional code changes to support long-term demand for workplace and public charging in California. While EV Capable building standards help to facilitate cost-effective installation of Level 2 chargers in the future, actual chargers are needed to meet the demand for PEV refueling. CARB staff recommends that proposing State agencies add a requirement for installation of at least one Level 2 EV charger in new nonresidential buildings. Additionally, only about 10 percent of nonresidential buildings will be EV Capable by 2030 if building standards are limited to new construction. It is critical for proposing State agencies to begin to address cost-effective building standards to installing EV charging infrastructure in existing buildings. If these additional code changes to advance CALGreen are not adopted during the 2019/2020 Intervening Code Cycle, CARB staff recommends that they be considered for adoption during the 2022 Triennial Code Cycle. The following justification, costs, and benefits do not account for these additional code changes to advance CALGreen.

Justification for Suggested Code Changes

First, CARB staff recommends adoption of a 10 percent requirement for raceway and panel capacity to ensure new buildings are EV Capable. Based on CEC projections for planned new construction of nonresidential buildings and CARB staff projections for new parking spaces and a recently completed report that indicates only 30 percent of EV Capable spaces are converted to EV chargers (Crowe, 2018), a 10 percent requirement is needed to fill mid-range gap in Level 2 chargers needed by 2025. A ten percent requirement also puts California on track to achieving 2030 ZEV infrastructure and climate goals. Second, CARB staff recommends deleting the exception for Energy Management Systems. The exception dilutes the CALGreen Code EV charging infrastructure provisions by eliminating panel capacity requirement, which is critical for ensuring cost-effective future installation of Level 2 chargers. Third, CARB staff recommends adopting 15 percent and 20 percent thresholds for voluntary tiers. These Tier 1 and Tier 2 thresholds provide a path for suggested code changes planned over the next two code cycles.

Table 1: Estimated Number of EV Charging Spaces by 2025 with Various Percent Requirement Options

Range	Mandatory per Section 5.106.5.3	Options for Revised Percentages			
	6%	8%	10%	15%	20%
Low	25,477	33,969	**42,462**	63,693	84,924
High	31,070	41,426	**51,783**	77,674	103,565

Cost Estimate

CARB staff estimate that the cost for EV Capable building standards in nonresidential new construction is between $870-960 to install raceway and 40-amp, 208/240-volt panel capacity per space. Statewide cost estimates for building standards are based on the incremental difference between the current 6 percent requirement and a suggested 10 percent requirement. Therefore, the statewide cost estimate is based on an incremental number of approximately 57,000 to 69,000 EV Capable spaces. As a result, the total statewide costs for a ten percent requirement is between $49 million and $66 million for the four-year time period between mid-2021 and the end of 2024. Average annual costs of the proposed regulation are between $12.3 million and $16.6 million.

Statewide Benefit

Significant retrofit costs between $7,000 and $8,000 per space can be avoided by installing EV charging infrastructure in new construction. Overall, there is a significant statewide cost benefit with CARB's suggested code changes. Over the four-year period between mid-2021 and the end of 2024, statewide retrofit costs between $396 million and $552 million could be avoided, which results in an overall estimated statewide benefit (avoided costs) between $347 million and $486 million over the four-year time period between mid-2021 and the end of 2024. Annually, average retrofit costs between $99 million and $138 million could be avoided, which results in an estimated average statewide benefit (avoided costs) between $86 million and $121 million.

Additional Benefits

In addition to significant avoided costs, there are additional benefits to advancing the EV charging infrastructure provisions in the CALGreen Code. First of all, by providing more access to Level 2 chargers, these code changes increase equity. By providing more charging infrastructure in workplace and public locations, it will allow multifamily households with PEVs to charge more easily if they do not have access to parking at home. Ultimately, these code changes will increase electric vehicle miles driven. Finally, there is a statewide benefit of reduced GHG emissions due to advancing the CALGreen Code EV charging provisions. An estimated 173,000 to 204,000 metric tons CO_2e may be reduced annually. Over the four-year timeframe between mid-2021 and the end of 2024, an estimated total 690,000 to 820,000 metric tons CO_2e may be

reduced due to the suggested code changes for a ten percent requirement for EV charging infrastructure.

1) Introduction

Transportation activities cause the majority of California's greenhouse gas (GHG) emissions and criteria pollutants. CARB leads the State's efforts to reduce transportation-related smog-forming pollutants and GHG emissions in California. Transportation electrification provides a key opportunity to reduce tailpipe emissions especially as California's electricity grid continues to become cleaner with increased amounts of renewable and carbon-free energy.

Annual on-road sales of ZEVs reached 8 percent of total new car sales in 2018 (California New Car Dealers Association, 2019). ZEVs sales are expected to ramp up to 15 percent by 2025. Approximately 1.5 million ZEVs projected to be on California's roadways by 2025. Five million ZEVs are projected for California roadways by 2030. In order to meet California's climate and air quality goals, 100 percent of new light-duty car sales will need to be ZEVs by 2035 and the majority of the light duty fleet will need to be ZEVs by 2050 (California Air Resources Board, 2019).

The CALGreen Code supports California's ZEV goals; it includes mandatory requirements for EV charging infrastructure in new residential buildings and nonresidential buildings. CARB staff evaluated the current building standards for EV charging infrastructure in nonresidential buildings to determine if the provisions would meet the needs for workplace and public locations by 2025 and beyond.

In new nonresidential buildings where 10 or more parking spaces are constructed, the CALGreen Code requires installation of EV charging infrastructure. The main requirements for infrastructure includes raceway and panel capacity, which must be installed in at least 6 percent of total parking spaces. These building standards require a minimum of 40 amps, 208/240 volt panel capacity for each parking space in order to support future installation of Level 2 EV chargers. Based on the findings in this technical and cost analysis, CARB staff determined that the current building standards for new construction are not adequate to support the need for charging stations to serve public and workplace locations in California by 2025 or 2030.

CARB staff developed this technical and cost analysis in consultation with several State agencies including the CEC, California Public Utilities Commission (CPUC), the Governor's Office of Business and Economic Development (GO-Biz), and the California Building Standards Commission (BSC). The main purpose of completing the technical and cost analysis was to determine if any changes are needed to the CALGreen Code to help meet the demand for EV charging in public places and workplace locations. This document provides the justification to support CARB's suggested code changes for nonresidential buildings during the Intervening 2019/2020 Code Cycle.

EV sales continue to grow rapidly. One of the main barriers to EV adoption is limited access to EV chargers. As more ZEVs are on California roadways, it is essential for EV chargers to be abundantly available to provide adequate fueling. A variety of chargers

including Level 1, Level 2 and DC fast chargers in homes, workplaces, public places, corridors, and destinations are needed to meet the demand. It is essential for new buildings to install raceway and panel capacity to support future installation of chargers. But, EV Capable spaces are not sufficient. California needs actual chargers installed in workplace and public locations. Furthermore, by installing at least one Level 2 charger in new nonresidential buildings, it provides the complete infrastructure needed for refueling PEVs. In both cases, installing EV charging infrastructure in new buildings prevents significant retrofit costs in the future.

2) Gap Analysis for Workplace and Public Locations

A. What infrastructure is needed for 2025 and beyond?

The EVI-Pro model developed by NREL and the CEC estimates on a county basis the number of Level 2 chargers and DC fast chargers needed to support 1.5 million ZEVs on California roads by 2025. Using the EVI-Pro model, results aggregated to the State level show a need for 99,000 to 133,000 Level 2 chargers in public and workplace locations by 2025 (Table 2). An additional 9,000 to 25,000 DC fast chargers are needed in public and workplace locations by 2025. Additionally, the EVI-Pro model determined that 120,000 PEVs will reside in multifamily housing by 2025 (Bedir, Crisostomo, Allen, Wood, & Rames, 2018).[1] California therefore needs 229,000 to 279,000 chargers in all of these locations to support that State's goal of 1.5 million ZEVs. Furthermore, in January 2018, Executive Order B-48-18 directed the State government to work with the private sector and other appropriate levels of government to support deployment of at least 5 million ZEVs and PHEVs in California by 2030, including 250,000 Level 2 chargers and 10,000 DC fast chargers by 2025.

While the EVI-Pro model results show the need for 99,000 to 133,000 Level 2 nonresidential chargers and 9,000 to 22,000 DC fast chargers, significantly more chargers will be need to support the Governor's 2030 goal.

Table 2: Statewide PEV Chargers Needed in Public and Workplace Locations

Level 2 Chargers			
Target	Total PEVs	Low Charger Estimate	High Charger Estimate
By 2020	645,135	53,173	70,368
By 2025	1,321,371	99,333	133,270
DC Fast Chargers			
By 2020	356,814	4,881	13,752
By 2025	729,150	9,064	24,967

[1] The definition of a charger per CEC's *California Plug-In Electric Vehicle Infrastructure Projections: 2017-2025* report is a connector that can serve a vehicle at the full rated power capacity without any operational limitations.

B. What is being done to meet the need?

Number of Level 2 Chargers in Nonresidential Buildings

Several efforts are underway to support the installation of Level 2 EV chargers statewide. CARB staff evaluated the existing, funded, proposed, and anticipated investments for EV charging infrastructure in California (Table 3). CARB staff estimates that approximately 24,300 to 49,600 Level 2 chargers may be installed in nonresidential buildings by 2025 based on current installed chargers and future infrastructure programs, such as from the California Energy Commission, Electrify America, and investor-owned utilities.

The low-range estimate is based on what's existing and what's funded. The high-range estimate includes existing, funded, proposed, and anticipated investments in Level 2 chargers statewide. A detailed summary of the estimates for "What's Being Done to Meet the Need" can be found in Appendix A.

Number of DC Fast Chargers in Nonresidential Buildings

In addition to Level 2 chargers, several efforts are underway to install DC fast chargers in California. CARB staff reviewed the electric utility investments in DC fast chargers serving passenger vehicles under transportation electrification programs, as well as the NRG and VW settlements to estimate DCFC infrastructure investments (Table 3). An estimated total of approximately 2,600 to 6,060 DC fast charging stations may be installed by 2025.

Table 3: Estimated Range of Chargers Installed in Nonresidential Buildings in California Due to Existing, Funded, Proposed, and Anticipated Investments

Range	Type	Charging Station Estimate	
		Level 2	DCFC
Low	Existing	14,200	2,600
	Funded	10,100	2,400
	Total	**24,300**	**5,000**
High	Existing	14,200	2,600
	Funded	10,100	2,400
	Proposed	19,900	300
	Anticipated	5,400	800
	Total	**49,600**	**6,100**

CALGreen Code Requirements

CARB staff estimated the number of EV Capable spaces installed due to the 6 percent requirement and projected the number of Level 2 chargers that may be installed to help meet the need in 2025. While the number of EV Capable spaces converted to Level 2 chargers will not necessarily be mutually exclusive of other investments, it is useful to incorporate a best estimate of the CALGreen Code impact on Level 2 chargers needed

to serve passenger vehicles. CARB staff assumed that 30 percent of EV Capable spaces would be converted to EV chargers (Crowe, 2018). Therefore, CARB staff estimates that an additional 26,700 to 32,000 Level 2 chargers may be installed statewide due the current CALGreen Code standards.

Table 4: Estimated Level 2 Chargers Converted from EV Capable Spaces Installed through Nonresidential CALGreen Code Requirements

Building Type	Low	High
Retail, Grocery, and Restaurants	6,299	7,558
Small Office	1,024	1,229
Large Office	4,686	5,623
Misc.	5,616	6,739
Warehouses	3,811	4,574
Colleges & Schools	2,410	2,892
Hospitals	1,503	1,804
Hotels	1,371	1,645
Total	**26,720**	**32,064**

Local Government Reach Standards

A total of 21 jurisdictions, representing about 26% of the statewide population, have adopted EV charging reach standards for nonresidential buildings in California. The majority of those local jurisdictions have adopted EV Capable[2] reach standards. A total of 12 jurisdictions have adopted EV Capable standards that go beyond State code; four have adopted EV Capable standards in combination with EVSE requirements. A total of seven jurisdictions have adopted EV Ready[3] standards; two have adopted EV Ready standards in combination with EVSE standards. Two additional jurisdictions, Contra Costa County and Santa Cruz, strictly require installation of EVSE. CARB staff review of local government reach standards that go beyond CALGreen Code building standards indicates that an additional 6,100 to 9,400 Level 2 chargers may be installed statewide by 2025. These estimates are based on the incremental difference between what's required in the code and what's adopted locally. Appendix G provides more details on EV charging infrastructure building standards adopted at the local level.

[2] EV Capable building standards require the installation of "raceway" (the enclosed conduit that forms the physical pathway for electrical wiring to protect it from damage) and panel capacity to support future installation of a dedicated 208/240 VAC, 40 amp branch circuit and charging station(s).
[3] EV Ready building standards require installation of dedicated 208/240 VAC, 40 amp branch circuit(s), circuit breakers, and other electrical components, including a receptacle or blank cover needed to support future installation of one or more charging stations.

Table 5: Summary of Local Jurisdiction Reach Standards Adopted for Nonresidential Buildings and Projected Level 2 EV Chargers by 2025

Reach Standard	Local Jurisdictions	Plus EVSE	Total	Low	High
EV Capable	8	4	12	2,600	3,200
EV Ready	5	2	7	1,500	4,200
EVSE			2	2,000	2,000
Total			**21**	**6,100**	**9,400**

C. What is the gap in EV charging infrastructure for commercial buildings?

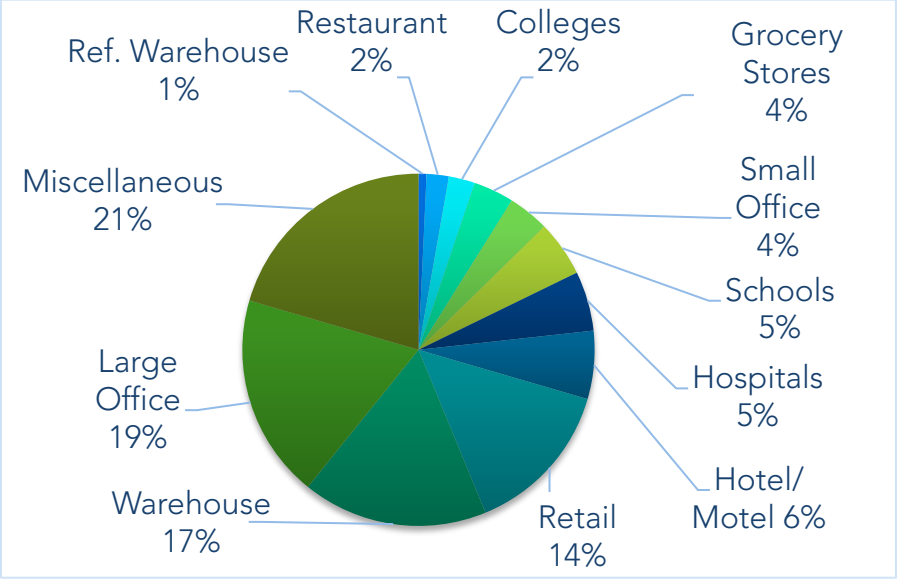
A significant gap between 8,000 and nearly 76,000 Level 2 chargers is projected for workplace and public locations by 2025. Figure 1 in the Executive Summary provides an illustration of this estimated gap in Level 2 chargers. The estimated gap is based on CEC's EVI-Pro model projection for the number of Level 2 chargers needed in 2025 and CARB staff review of what's existing and projected for installation based on funded and planned future investments, CALGreen Code building standards, and local government reach standards.

3) Filling the Gap with Nonresidential Building Standards

A. How much new construction is planned by 2025?

With about 100 million square feet newly constructed annually, an estimated 358 million square feet of new commercial construction is planned between mid-2021 and the end of 2024. About half of all new construction planned is anticipated to be retail, warehouse, and large offices. Another quarter of new construction includes grocery stores, small offices, colleges,

Figure 2: Percent Distribution of Nonresidential New Construction by Building Type



schools, hospitals and hotel/motels. These estimates were used to estimate how much new construction may be impacted by the EV charging infrastructure provisions in the CALGreen Code. Table 6 provides a summary of CEC's Commercial Floorspace Forecast including the break-down between existing buildings and annual new construction between 2021 and 2030 (California Energy Commission, 2018).

Table 6: California's Planned New Construction of Nonresidential Buildings (Million Square Feet)

Year	Total Commercial Floorspace	Existing Buildings	New Construction
2021	7,778	7,676	102
2022	7,878	7,778	100
2023	7,978	7,878	101
2024	8,085	7,978	107
2025	8,196	8,085	111
2026	8,303	8,196	107
2027	8,407	8,303	104
2028	8,512	8,407	104
2029	8,617	8,512	105
2030	8,723	8,617	106

B. How much parking is projected for new construction?

Based on review of over 200 local municipal codes, approximately one parking space is installed for every 275 square feet of commercial building floor space constructed. However, the total square feet per parking space varies by building type. Table 7 provides a summary of the average square feet per parking space as required by many local jurisdictions in California. These details were used to project the total parking spaces and estimate the number of EV Capable spaces with various percent requirement options for the CALGreen Code.

Table 7: Average Parking Requirements by Building Type

Building Type	Mean (sf/space)
Restaurant	68
Colleges	52
Grocery Stores	238
Small Office	271
Schools	230
Hospitals	106
Hotel/Motel	325
Retail	253
Warehouse	933
Large Office	273
Miscellaneous	275
Average	275

CARB staff developed statewide estimates for the total number of parking spaces installed in commercial buildings between mid-2021 and the end of 2024 based on the average parking requirements by building type. Current projections estimate that approximately 500,000 parking spaces may be constructed annually for a total of 1.7 million total new parking spaces may be constructed between 2021 and 2024. CARB staff estimates that this is the maximum number of parking spaces that may be constructed due to new nonresidential development by 2025.

That said, approximately 60 percent of the 200+ local municipal codes reviewed provide options to reduce minimum parking requirements. The average percent parking reduction allowed is 30 percent. CARB staff adjusted the projections for new parking spaces to account for this trend. An adjusted 1.4 million total new parking spaces may be a more realistic minimum number estimate of parking constructed between mid-2021 and 2024. Appendix C provides more details on these estimated parking projections.

C. 10 percent requirement needed in CALGreen to fill gap

CARB staff estimated a significant gap between 8,000 and nearly 76,000 Level 2 chargers is projected for workplace and public locations by 2025. Using the estimated nonresidential new construction projection of 3.58 million square feet and average parking requirements, CARB staff estimated between 1.4 million and 1.7 million new parking spaces may be installed statewide by 2025. While a ten percent requirement may result in the installation of a total of 142,000 to 173,000 EV Capable spaces by 2025, there is no guarantee that these spaces will be converted to actual Level 2 chargers. In fact, a recently completed independent accountant's report auditing compliance with the NRG Settlement indicates that approximately 30 percent of EV Capable spaces are converted to EV chargers (Crowe, 2018). While this may actually be a high-end assumption for conversion rates, CARB staff assumes that the statewide conversion rate for all EV Capable spaces is comparable. CARB staff accounted for this 30 percent

conversion rate when estimating the percent requirement options. CARB staff recommends a minimum 10 percent requirement for new construction to assist with filling the mid-range gap in Level 2 chargers needed by 2025.

Table 8: Low-End Range: CARB Staff Estimate of EV Charging Spaces Installed in All Nonresidential Buildings by 2025

Year	Minimum Number New Parking Spaces	Mandatory per Section 5.106.5.3	Options for Revised Percentages			
		6%	8%	10%	15%	20%
2021	201,112	3,620	4,827	6,033	9,050	12,067
2022	396,757	7,142	9,522	11,903	17,854	23,805
2023	398,236	7,168	9,558	11,947	17,921	23,894
2024	419,286	7,547	10,063	12,579	18,868	25,157
Total	1,415,392	25,477	33,969	42,462	63,693	84,924

Table 9: High-End Range: CARB Staff Estimate of EV Charging Spaces Installed in All Nonresidential Buildings By 2025

Year	Maximum Number New Parking Spaces	Mandatory per Section 5.106.5.3	Options for Revised Percentages			
		6%	8%	10%	15%	20%
2021	245,259	4,415	5,886	7,358	11,037	14,716
2022	483,850	8,709	11,612	14,516	21,773	29,031
2023	485,654	8,742	11,656	14,570	21,854	29,139
2024	511,325	9,204	12,272	15,340	23,010	30,679
Total	1,726,088	31,070	41,426	51,783	77,674	103,565

While Tables 8 and 9 provide the statewide number of EV charging spaces projected for installation by 2025, Table 10 provides a break-out of the estimates by State agency authority. BSC has jurisdiction over most nonresidential buildings. DSA has jurisdiction over K-12 schools and colleges. HCD has jurisdiction over hotels and motels. CARB staff recommends each of these state agencies adopt a 10 percent requirement in order to fill the mid-range gap in Level 2 chargers needed by 2025.

Table 10: Estimated EV Charging Spaces Installed by 2025 with Various Percent Requirement Options in Nonresidential Buildings Constructed by State Agency Authority

State Agency Authority	Range	Options for Revised Percentages			
		8%	10%	15%	20%
Building Standards Commission (BSC)	Low	27,799	34,749	52,124	69,498
	High	33,901	42,377	63,565	84,754
Division of the State Architect (DSA)	Low	4,817	6,021	9,031	12,041
	High	5,874	7,342	11,013	14,684
Housing and Community Development (HCD)	Low	1,354	1,692	2,538	3,384
	High	1,651	2,064	3,095	4,127
Total	Low	33,969	42,462	63,693	84,924
	High	41,426	51,783	77,674	103,565

4) Technical Review of Nonresidential Building Standards

A. What are the barriers to installing EV chargers in nonresidential buildings?

PEVs provide an option for reducing GHG emissions and criteria pollutants. They also provide individual mobility benefits comparable to conventional vehicles, which allows drivers to switch to PEVs with little behavior change. However, the fueling infrastructure for electric vehicle charging stations is still in the early stages of development. One of the key barriers to PEV adoption is access to charging infrastructure. It may take several hours for PEVs to recharge compared to conventional gasoline refueling that may only take minutes. By increasing the amount of charging stations available in workplace and other public locations, there is the potential to increase the amount of commute miles driven on battery power. (DiFilippo, Moriyama, Terai, Trumbull, & Zhang, 2017)

B. What are the current code requirements for nonresidential buildings?

Effective January 1, 2017, nonresidential buildings with parking lots with 10 or more parking spaces must install EV charging infrastructure in 6 percent of parking spaces. This infrastructure includes the raceway (the conduit or pipe that future wiring can be pulled through) and panel capacity to support future installation of a Level 2 charger on a dedicated 40-amp, 208/240-volt branch circuit. In addition, these buildings must be identified as "EV Capable" on the site plan. Providing this basic EV charging infrastructure in new buildings provides a cost-effective option to support future

installation of Level 2 chargers. These building standards also prevent significant retrofit costs in the future.

C. Is the current 10 parking space threshold adequate?

Based on the average local parking requirement of one parking space per 275 square feet, nonresidential buildings with ten parking spaces are approximately 2,750 square feet in size. According to the 2012 Commercial Buildings Energy Consumption Survey (CBECS), nearly half of nonresidential buildings are in the 1,001 to 5,000 square foot range. The other half of buildings are 5,001 square feet and larger. CARB staff estimates a 50:50 split between buildings in the 1,001 to 2,500 square foot range and buildings in the 2,501 to 5,000 square foot range. Therefore, the current 10 parking space threshold impacts approximately three-quarters of new buildings constructed annually. As a result, CARB staff concluded that the current ten parking space threshold in combination with an updated 10 percent requirement should be adequate to ensure EV charging infrastructure is installed in the majority of new buildings statewide.

D. What code changes are recommended for the Intervening Code Cycle?

1. Adopt a 10 Percent Requirement for New Construction

CARB staff recommends adopting a ten percent mandatory provision for EV Capable spaces in new construction. A ten percent requirement may help to fill the mid-range gap in Level 2 chargers needed by 2025. A ten percent requirement will also support 2030 PEV infrastructure needs as well as climate and air quality goals. It is essential that all proposing state agencies adopt this requirement for nonresidential buildings under their authority.

2. Delete the exception for Energy Management Systems

Both Building Standards Commission and the Division of the State Architect have proposed adoption of an exception for the panel capacity requirements if nonresidential buildings include the installation of an energy management system. CARB staff strongly recommends deleting this exception. The proposed exception, as written, would allow for nonresidential buildings to skip the requirement to install 208/240 V AC, 40 amps panel capacity for each EV Capable space to support future installation of Level 2 chargers. While energy management systems could potentially have the ability to manage energy load between multiple Level 2 chargers, it should not be used as an avenue to eliminate the panel capacity requirements in the CALGreen Code.

3. Adopt 15 Percent and 20 Percent Thresholds for the Tiers

In addition to the mandatory provisions required by the CALGreen Code, the green building standards also include voluntary reach standards. CARB staff proposes a Tier 1 threshold for 15 percent of parking spaces and a Tier 2 threshold for 20 percent of parking spaces. Adopting a 10 percent mandatory provision along with 15 percent and 20 percent thresholds for Tier 1 and Tier 2

voluntary levels would be consistent with multifamily provisions in CALGreen. Furthermore, these thresholds are also consistent with what many jurisdictions are adopting as mandatory at the local level. The tiers also serve as a model code language to help make it easier for additional local jurisdictions to adopt these reach standards.

CARB staff encourages cities and counties to adopt either of these Tiers as a measure to achieve additional GHG emission reductions. These GHG emission reductions could count towards achieving "beyond code" goals in Climate Action Plans. Table 11 summarizes the estimated number of additional EV Capable parking spaces installed statewide if all local governments adopted the Tiers. CARB staff strongly recommends advancing Tier 1 and Tier 2 provisions to mandatory building standards within the next two code cycles. Advancing these voluntary provisions to mandatory in the next two code cycles will help to support the exponential increase in vehicle adoption rates that are expected to more than triple between 2025 and 2030.

Table 11: Estimated Number of EV Capable Spaces Installed Annually if All Local Governments Adopt the Tiers

Estimate	15% - Tier 1	20% - Tier 2
Low	20,000	40,000
High	25,000	50,000

E. What additional code changes are recommended to advance CALGreen?

CARB staff encourages proposing state agencies to adopt two additional code changes during the 2019/2020 Intervening Code Cycle. If proposing state agencies do not adopt these code changes at this time, they are recommended for adoption during the 2022 Triennial Code Cycle. Statewide costs and benefits outlined in the main body of this report do not reflect costs and benefits for these additional code changes. Appendix G provides more details on costs and benefits of these additional suggested code changes.

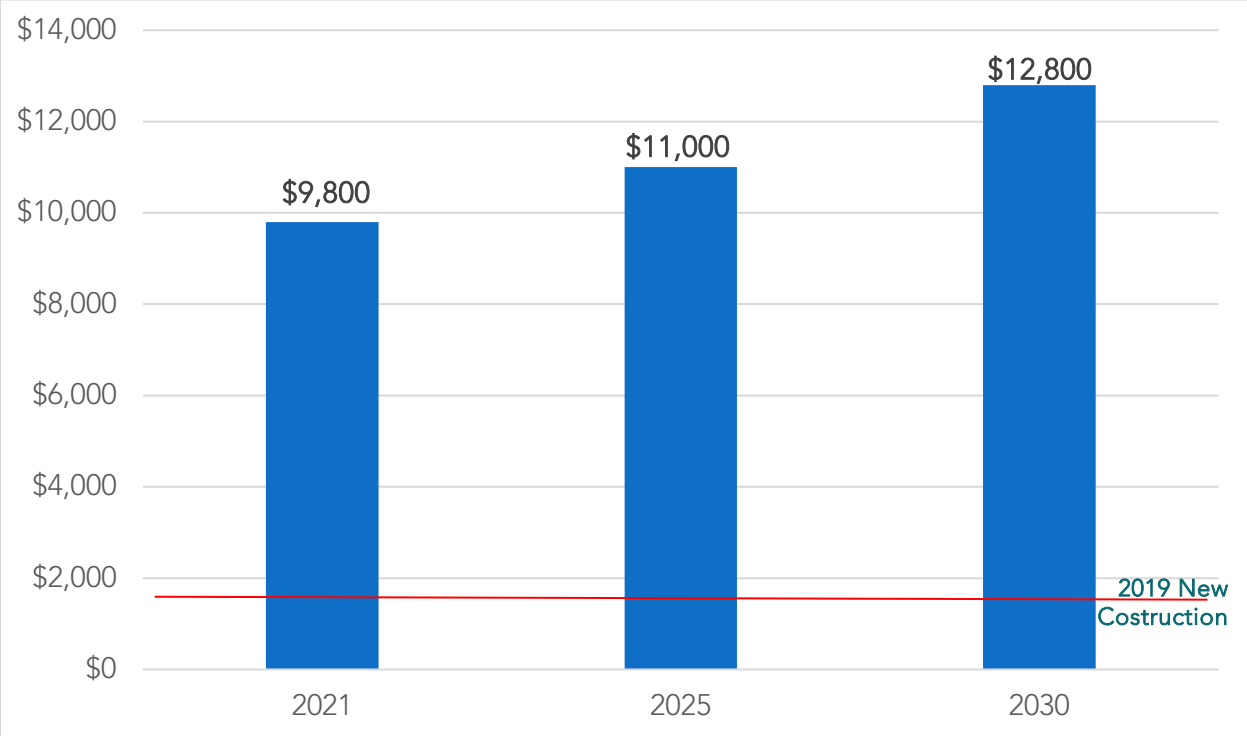
1. Install One Level 2 Charger per Building

Installing at least one Level 2 charger provides actual infrastructure needed. There are several financial incentives available for installing EV chargers. CARB staff are also exploring regulatory incentives for installing EV chargers. For example, one option that CARB staff is investigating is whether there may be an option to provide a compliance credit in the Energy Code for installing EV chargers. If builders install EV chargers, they may be able to get a compliance credit for the Energy Code by installing smart EV chargers that save energy. CARB staff plans to coordinate with CEC on this option during the 2022 Triennial Code Cycle.

The costs of retrofitting an existing nonresidential building with L2 chargers continues to grow over time and is significantly higher than the current cost of installing the same L2 chargers as part of new construction. These increased costs are due to the increased cost of a retrofit installation over the cost of including chargers in the original design, but also from the anticipated increased costs of labor and materials in the future.

The average incremental cost (above the cost of an "at-code" installation) of installing a L2 charger in a single commercial parking space is $1,800. However, even a single year later, the anticipated future cost of retrofitting that same space for a L2 charger is estimated as $9,800, based on increased labor and material costs. As a result, CARB staff strongly encourages proposing State agencies to adopt requirements for the installation of at least one Level 2 charger in each new building.

Figure 3: Average Incremental Future L2 Charger Retrofit Costs per Space



2. Expand Scope of Building Standards to Apply to Existing Buildings

California must advance the EV charging infrastructure provisions beyond new construction to include existing buildings. This suggested code change is listed as a priority to update the CALGreen Code during the 2019 Intervening Code Cycle (Governor's Office of Business and Economic Development, 2018). Annually, new construction represents about one percent of total nonresidential buildings. Only about 10 percent of nonresidential buildings are projected to be

EV Capable by 2030 if building standards are limited to new construction. There are several cost-effective trigger points to require EV infrastructure in existing buildings.

i. New Parking
ii. Repaving of Existing Parking
iii. Building alterations where electrical service is upgraded;
In this third option, CARB staff recommends adopting panel capacity requirements only. No raceway or charger should be required for installation in existing buildings when panel upgrades are the only trigger.

5) Cost Analysis

Significant retrofit costs can be avoided by installing raceway and panel capacity in new buildings to support future installation of Level 2 chargers. Based on data in the 2019 National Construction Estimator, initial construction costs to install raceway and panel capacity to support dedicated branch circuits for Level 2 chargers ranges from $870-960 for each EV Capable parking space. New parking spaces range in cost from approximately $20,000 per space for surface spaces, $50,000 per space for garages and structures, and up to $80,000 per space in underground parking spaces. These basic upfront costs for EV charging infrastructure represent between one and four percent of the initial construction cost per parking space. Alternatively, total construction costs for new nonresidential buildings is estimated to cost between $53.4 to $103.2 Billion between mid-2021 and the end of 2024. These added upfront costs for EV charging infrastructure in 10% of parking spaces represents between 0.06-0.09 percent of total construction costs for new nonresidential buildings. Additionally, it is extremely cost-effective to install EV charging infrastructure in new buildings relative to the significant retrofit costs to install infrastructure in existing buildings.

A. Annual Statewide Costs

Since the current EV charging provision requires 6 percent of parking spaces to install raceway and panel capacity to accommodate future EVSE infrastructure, the statewide cost estimate for this proposal is based on the difference between the existing standard and the proposed 10 percent requirement. Total new parking spaces installed in nonresidential buildings between mid-2021 and the end of 2024 may total between 1.4 million to 1.7 million. By 2025, the amount of EV charging infrastructure installed with the current 6 percent requirement may result in the installation of an estimated 85,000-104,000 EV Capable spaces. An updated threshold of 10 percent may result in the installation of an estimated 142,000 to 173,000 EV Capable spaces by 2025. However, the annual statewide cost estimate for adopting a ten percent requirement is based on the incremental difference in added infrastructure that may result in the installation of an estimated 57,000 to 69,000 additional EV Capable spaces by 2025. Using these figures, CARB staff estimated the statewide costs to adopt a 10 percent requirement for EV charging infrastructure in workplace and public locations may be between $49

million to $66 million in the four-year time frame between mid-2021 and the end of 2024. The average annual statewide cost is estimated as $12.3 million to $16.6 million.

B. Avoided Retrofit Costs

Significant retrofit costs can be avoided by installing EV charging infrastructure in new construction. CARB staff reviewed multiple sources to obtain average retrofit costs of installing infrastructure to support Level 2 charging stations in existing buildings. An estimated $7,000 per parking space can be avoided with multiple installations of Level 2 charging stations. An estimated $8,000 per parking space can be avoided when an individual Level 2 charging station is installed. These retrofit costs do not include the cost of the electrical vehicle supply equipment (EVSE). Retrofit costs are focused on parking lot trenching, adding electrical service and/or panel upgrades. The 10 percent requirement would result in the installation of an additional 57,000 to 69,000 parking spaces with EV charging infrastructure beyond the current 6 percent requirement in the four-year time frame between mid-2021 and the end of 2024. If the proposed 10 percent requirement were not adopted, CARB staff assumed that every one of these parking spaces would end up paying these average retrofit costs. CARB staff estimates that the total avoided retrofit costs by adopting a 10 percent requirement range from $396 million to $483 million by 2025. The average annual statewide avoided retrofit cost is estimated as $99 million to $138 million.

C. Statewide Benefit

There is a significant statewide cost benefit with CARB's suggested code changes. Based on new construction projections between mid-2021 and the end of 2024, the suggested code changes would result in an estimated statewide benefit (avoided costs) of $347 to $486 million between mid-2021 and the end of 2024 (Table 13). The average annual statewide benefit (avoided costs) in that same four-year timeframe ranges from $87 million to $122 million. Appendix F provides more details on these estimates.

Table 12: Estimated Statewide Benefit (Avoided Costs) for 10 Percent Requirement between Years Mid-2021 and End-2024

Timeframe	Range	Initial Construction Costs (Millions)	Avoided Retrofit Costs (Millions)	Statewide Benefit (Millions) (Avoided Costs)
Total	Low	$49	$396	$347
	High	$66	$483	$486
Annual	Low	$12.3	$99	$87
	High	$16.6	$138	$122

Table 13: Estimated Statewide Benefit (Avoided Costs) by State Agency Authority for 10 Percent Requirement for the 4-Year Period between Mid-2021 and End-2024

State Agency Authority	Initial Construction Costs (Millions)	Avoided Retrofit Costs (Millions)	Statewide Benefit (Millions) (Avoided Costs)
BSC	$40-54	$324-452	$284-398
DSA	$7-9	$56-78	$49-69
HCD	$2-3	$16-22	$14-19
Total	$49-66	$396-552	$347-486

6) Greenhouse Gas (GHG) Savings

CARB staff estimated GHG savings based on the incremental difference between the current 6 percent requirement and the suggested 10 percent requirement. A ten percent requirement may result in the installation of 42,000 to 52,000 Level 2 EV chargers by 2025. However, the current 6 percent requirement may result in the installation of 25,000 to 31,000 Level 2 EV chargers by 2025. Therefore, a 10 percent requirement may result in the installation of an additional 17,000 to 21,000 Level 2 EV chargers in California by 2025. Total estimated GHG savings are based on the difference between GHG emissions of typical gasoline vehicles and electric vehicles. If in fact 17,000 to 21,000 additional Level 2 chargers are installed statewide due to the suggested code changes, an estimated 107,000 to 126,000 metric tons CO_2e may be reduced annually. By 2025, an estimated total 428,000 to 504,000 metric tons CO_2e may be reduced due to the suggested code changes for a ten percent requirement for EV charging infrastructure. Overall, these CALGreen Code changes may cost approximately $115-132 per metric ton CO_2e. Appendix J provides more details on these estimates.

Table 14: Estimated GHG Savings by State Agency Authority

State Agency Authority	Range	Annual GHG Savings	GHG Savings (2021-2024)
BSC	Low	88,000	352,000
	High	102,000	408,000
DSA	Low	16,000	64,000
	High	18,000	72,000
HCD	Low	3,000	12,000
	High	6,000	24,000
Total	Low	107,000	428,000
	High	126,000	504,000

7) Summary and Conclusions

CARB staff strongly recommends proposing State agencies strengthen the current provisions for EV charging infrastructure in nonresidential buildings. First, CARB staff recommends adopting a requirement for 10 percent of total parking spaces to install EV charging infrastructure in all nonresidential buildings. It is the minimum amount of infrastructure necessary to put California on track to meet 2030 PEV infrastructure goals. Second, CARB staff recommends deleting the proposed exception for energy management systems. The exception undermines the CALGreen Code by eliminating the requirement to install adequate panel capacity to support future installation of Level 2 chargers. Third, CARB staff recommends that proposing State agencies adopt 15 percent and 20 percent EV Capable thresholds for the voluntary tiers. These voluntary standards are an indication of how the code will need to advance in the next two code cycles. By adopting these suggested code changes, proposing State agencies will help to fill the gap of Level 2 chargers needed to serve nonresidential buildings in 2025 and put California on track to meeting EV charging needs in 2030. BSC, DSA, and HCD adoption of these requirements for nonresidential buildings will help to improve air quality and support achievement of the statewide goals to reduce GHG emissions in California.

Appendix A: Details on "What's Being Done to Meet the Need?"

Existing Charging Stations in Nonresidential Buildings

CARB staff utilized the U.S. Department of Energy's Alternative Fuels Data Center (AFDC) to determine the total number of Level 2 chargers and direct current fast chargers (DCFC) currently installed in California.[1] Many electric vehicle service providers with publicly available chargers are required to report to this database, and data on an increasing number of private chargers is also being submitted to help track overall progress toward charging station deployment goals. However, a substantial number of shared private chargers often found in workplaces may be underrepresented in this count since they may not be required to report to the AFDC. California is working to develop better tools to track these shared private chargers.

To be consistent with the California Building Standards, a charger is defined as an electric vehicle charging space served by an electric vehicle charger. A multiport electric vehicle charger that can charge vehicles in multiple spaces simultaneously is counted based on the number of vehicles that can charge at one time at the fully rated power capacity. As of September 10, 2019, there are 21,020 Level 2 charging connectors at 5,644 station locations and 3,489 DC fast charging connectors at 784 station locations for both public and private use in California (U.S. Department of Energy, 2019). Since Level 2 and DC fast charging electric vehicle supply equipment (EVSE) may have more than one connector, but can only charge one vehicle at a time, CARB staff adjusted the AFDC charging connector data to more accurately align with the charger definition.

CARB staff converted the number of connectors to chargers using an estimate of the current distribution of EVSE technologies. Currently, about 51 percent of DCFCs are single port/dual connector (meaning only one vehicle can charge at a time). Therefore, the number of DC fast chargers is 74.5 percent of the number of DCFC connectors. For Level 2, roughly 35 percent of the EVSEs are single port/single connector (connector counts are converted to chargers on a 1:1 basis), 5 percent of the EVSEs have one port/two connectors (and can only charge one vehicle at a time), and the remaining approximately 60 percent are dual port/dual connector EVSEs. While most dual port Level 2 EVSE have two ports with two connectors and can serve two vehicles at a time, most share power when multiple vehicles are charging simultaneously. Since this gap comparison is to CEC's EVI-Pro report definition of a charger – a connector that can serve a vehicle at the full rated power capacity without any operational limitations – CARB staff further adjusted the dual port Level 2 chargers to align definitions. CARB staff assumed that all of the Level 2 dual port connectors share power, therefore Level 2

[1] Not all connectors serve all plug-in electric vehicles and not all connectors can be used simultaneously. For example, Tesla operates a network of chargers dedicated to Tesla vehicles, which are included in this count.

chargers are 67.5 percent of the number of Level 2 connectors in this gap analysis.[2] This conversion is shown in Table A1.

Table A1: Existing EV Charging Infrastructure[3]

Description	Workplace/Public Level 2	DCFC
Total Installed Charging Connectors	21,020	3,489
Conversion Factor	.675	.745
Total Installed Charging Stations	14,189	2,599

Funded, Proposed, and Anticipated Charging Stations in Nonresidential Buildings

CARB staff assessed information on future funded, proposed, and anticipated infrastructure projects from major investment sources, such as from the California Energy Commission, investor owned utilities, and Electrify America. A detailed summary of the charging stations counts from these sources is presented in Table A2.

The Clean Transportation Program, (formerly the Alternative and Renewable Fuel and Vehicle Technology Program), administered by the California Energy Commission, provides funding to support PEV infrastructure through various grant solicitations. In late 2017, the California Energy Commission introduced the California Electric Vehicle Infrastructure Project (CALeVIP) to provide streamlined incentives for electric vehicle charging infrastructure. Each CALeVIP project provides incentives for infrastructure in specific regions throughout the State. CALeVIP projects currently provide incentives to businesses and public agencies in Fresno, Los Angeles, Orange, Riverside, San Bernardino, Sacramento, Humboldt, Shasta, and Tehama counties, with anticipated program expansion to the broader San Joaquin Valley, Central Coast, southern Bay Area, San Diego, and the Sonoma Coast within the next year. Through June 2019, the CEC has allocated $51 million for charger rebates through CALeVIP, and the Energy Commission may make up to $200 million available through this funding mechanism (Brecht, 2019).

The California Public Utilities Commission (CPUC) authorizes investor-owned electric utilities to undertake transportation electrification activities. In 2016, the CPUC approved charging infrastructure pilot programs for three large investor-owned utilities – PG&E, SCE, and SDG&E – to install charging stations for a combined budget of up to $197 million. In 2018, the CPUC approved additional investor-owned utility projects to deploy charging infrastructure pursuant to SB 350 (De León, Chapter 547, Statutes of

[2] CARB staff assumes that all of the Level 2 dual port chargers share power as a conservative estimate of currently installed charging stations.
[3] These estimates do not include privately funded charging stations installed statewide unless they are publicly listed on the AFDC website.

2015). Separately, AB 1082 (Burke, Chapter 637, Statutes of 2017) and AB 1083 (Burke, Chapter 638, Statutes of 2017) authorize the investor-owned utilities to propose pilot programs to install electric vehicle charging infrastructure at school facilities and/or State parks and beaches. These pilot program proposals and additional transportation electrification proposals are currently being reviewed by the CPUC (California Public Utility Commission, 2019).

Volkswagen, through its subsidiary Electrify America, has agreed to invest $800 million over a 10-year period for ZEV infrastructure, education, and access in California as part of a settlement with CARB. Electrify America will invest $200 million in four installments over the next 10 years. In the first 30-month cycle of the settlement, Electrify America invested $45 million in community chargers in major metropolitan areas and $75 million in highway fast charging throughout California (Volkswagen Group of America, 2017). For the second cycle, Electrify America is expected to invest $95 million to $115 million in community chargers, $25 million to $30 million in highway fast chargers, and $16 million to $29 million for other pilot projects (Electrify America, 2018).

Table A2: Estimated Number of Level 2 and DC Fast Chargers for Nonresidential Buildings in California, Detailed Version

Type	Program	Workplace or Public Level 2 Chargers[4]	DC Fast Chargers
Funded	BVES SB 350 Destination Make-Ready Program	34	0
Funded	Liberty SB 350 DCFC Project & Charger Rebate	68	28
Funded	PacifiCorp SB 350 Demo and Development Project	18	0
Funded	PG&E EV Charge Network Pilot	2,475	0
Funded	PG&E SB 350 DCFC Make Ready	0	234
Funded	SCE Charge Ready Pilot & Bridge	684	0
Funded	SCE SB 350 Urban DCFC Clusters	0	12
Funded	SDG&E SB 350 Electrify Local Highways	54	8
Funded	BAAQMD Charge!	290	0
Funded	Peninsula Clean Energy Charge Up	716	0
Funded	EVgo NRG Settlement	47	110
Funded	Volkswagen Appendix D	290	25
Funded	Electrify America Cycle 1	759	492
Funded	Electrify America Cycle 2	143	427
Funded	CEC Clean Transportation Program	4,539	1,060
	Funded Subtotal	**10,117**	**2,396**
Proposed	Caltrans 30-30 Plan	0	37
Proposed	Liberty AB 1082 & 1083	45	2
Proposed	PG&E AB 1082 & 1083	108	10
Proposed	SCE AB 1082 & 1083	216	10
Proposed	SCE Phase 2 Charge Ready	19,302	205
Proposed	SDG&E AB 1082 & 1083	212	22
	Proposed Subtotal	**19,883**	**286**
Anticipated	LADWP Charge Up LA	5,130	0
Anticipated	Electrify America Cycle 3 & 4	270	0
Anticipated	Tesla Network	0	776
	Anticipated Subtotal	**5,400**	**776**
	Total	**35,400**	**3,458**

Combining the currently installed charging stations with the future funded, proposed, and anticipated infrastructure projects, results in a high-range estimation of what is

[4] CARB staff applied the same conversion factor of .675 to future Level 2 investments to count charging stations rather than connectors.

being done to meet the need by 2025 (Table A3). A low-range estimation assumes that only existing and funded charging stations will be installed by 2025.

Table A3: Estimated Number of Chargers in California by 2025

	Workplace or Public Level 2 Charging Stations	DC Fast Charging Stations
Installed	**14,189**	**2,599**
Future	**35,400**	**3,458**
Total Estimated Charging Stations by 2025	**49,589**	**6,057**

Appendix B: Commercial Floor Space Forecast

Table B1: New Construction Totals Between July 1, 2021 (Effective Date) and December 30, 2030 (Million Square Feet)

Year	Ref. Warehouse	Restaurant	Colleges	Grocery Stores	Small Office	Schools	Hospitals	Hotel/ Motel	Retail	Warehouse	Large Office	Misc.	Totals
2021	0.39	1.11	1.22	2.09	1.81	2.65	2.84	3.03	8.04	8.79	8.37	10.46	50.81
2022	0.80	2.15	2.46	3.91	3.56	5.49	5.66	6.08	15.06	17.49	16.42	20.91	99.99
2023	0.77	2.16	2.41	3.85	3.71	5.36	5.68	6.49	14.80	17.17	17.29	20.84	100.53
2024	0.75	2.20	2.47	3.93	4.11	5.25	5.81	6.78	15.10	17.89	21.16	21.50	106.95
SUBTOTAL													**358.28**
2025	0.78	2.20	2.64	3.99	4.28	5.39	5.76	6.66	15.36	18.76	22.54	22.19	110.56
2026	0.78	2.14	2.60	3.92	4.16	5.37	5.70	6.49	15.08	18.05	21.44	21.62	107.35
2027	0.76	2.08	2.54	3.83	3.97	5.36	5.74	6.52	14.75	17.48	19.93	21.31	104.28
2028	0.75	2.06	2.58	3.81	3.93	5.43	5.75	6.65	14.67	17.78	19.41	21.63	104.47
2029	0.76	2.07	2.59	3.81	3.97	5.39	5.76	6.76	14.67	18.00	19.76	21.75	105.27
2030	0.76	2.08	2.57	3.81	3.99	5.44	5.77	6.82	14.66	18.14	20.05	21.86	105.95
Total	7.31	20.24	24.09	36.94	37.49	51.14	54.47	62.29	142.19	169.55	186.37	204.07	996.16

Appendix C: Projections for New Parking Spaces in Nonresidential Buildings

Table C1: Average Parking Requirements by Building Type (Parking Space/Square Foot)

	Building Type	Restaurant	Colleges	Grocery Stores	Small Office	Schools	Hospitals	Hotel/ Motel	Retail	Warehouse	Large Office	Average
All Local Codes	**Mean (space/sf)**	0.015	0.019	0.004	0.004	0.004	0.009	0.003	0.004	0.001	0.004	0.007
	Mean (sf/space)	68	52	238	271	230	106	325	253	933	273	275
	n	212	136	205	210	187	183	202	211	185	210	194
n= number of jurisdictions/ municipal codes reviewed												

Table C2: All Buildings: Maximum Number of Projected Parking Spaces Installed Between July 1, 2021 (Effective Date) and December 30, 2030

Year	Ref. Warehouse	Restaurant	Colleges	Grocery Stores	Small Office	Schools	Hospitals	Hotel/ Motel	Retail	Warehouse	Large Office	Misc.	Totals
2021	422	16,294	23,285	8,776	6,671	11,492	26,751	9,325	31,791	9,425	30,692	70,334	245,259
2022	855	31,648	46,872	16,437	13,147	23,835	53,273	18,698	59,578	18,739	60,185	140,583	483,850
2023	826	31,835	46,045	16,184	13,698	23,272	53,495	19,938	58,531	18,403	63,376	140,050	485,654
2024	806	32,365	47,134	16,510	15,162	22,807	54,705	20,824	59,755	19,170	77,582	144,504	511,325
SUBTOTAL							1,726,088						
2025	833	32,438	50,277	16,774	15,793	23,394	54,261	20,482	60,758	20,107	82,626	149,175	526,920
2026	840	31,507	49,665	16,478	15,332	23,308	53,638	19,948	59,654	19,345	78,607	145,311	513,633
2027	815	30,583	48,468	16,124	14,657	23,272	53,994	20,048	58,366	18,738	73,043	143,248	501,356
2028	809	30,399	49,264	16,035	14,497	23,587	54,132	20,448	58,054	19,050	71,158	145,367	502,800
2029	814	30,567	49,320	16,030	14,634	23,380	54,187	20,762	58,031	19,288	72,437	146,202	505,652
2030	815	30,595	48,940	16,012	14,734	23,631	54,358	20,945	57,988	19,438	73,510	146,950	507,916
Total	7,836	298,232	459,270	155,361	138,325	221,978	512,793	191,418	562,507	181,703	683,217	1,371,724	4,784,365

Table C3: All Buildings: Adjusted Number of Projected Parking Spaces Installed Between July 1, 2021 (Effective Date) and December 30, 2030

Year	Ref. Warehouse	Restaurant	Colleges	Grocery Stores	Small Office	Schools	Hospitals	Hotel/ Motel	Retail	Warehouse	Large Office	Misc.	Totals
2021	346	13,361	19,094	7,196	5,470	9,423	21,936	7,647	26,069	7,728	25,168	57,674	201,112
2022	701	25,951	38,435	13,478	10,780	19,545	43,683	15,332	48,854	15,366	49,352	115,278	396,757
2023	678	26,104	37,757	13,271	11,233	19,083	43,866	16,349	47,996	15,090	51,969	114,841	398,236
2024	661	26,540	38,650	13,538	12,433	18,702	44,858	17,076	48,999	15,720	63,617	118,494	419,286
SUBTOTAL													1,415,392
2025	683	26,599	41,228	13,755	12,950	19,183	44,494	16,795	49,822	16,488	67,754	122,324	432,074
2026	689	25,836	40,726	13,512	12,572	19,112	43,983	16,357	48,916	15,863	64,457	119,155	421,179
2027	669	25,078	39,744	13,222	12,019	19,083	44,275	16,439	47,860	15,366	59,895	117,464	411,112
2028	663	24,928	40,396	13,149	11,887	19,342	44,388	16,767	47,604	15,621	58,350	119,201	412,296
2029	667	25,065	40,442	13,145	12,000	19,172	44,433	17,025	47,586	15,816	59,398	119,885	414,635
2030	668	25,088	40,131	13,130	12,082	19,378	44,573	17,175	47,551	15,939	60,278	120,499	416,491
Total	6,425	244,551	376,601	127,396	113,426	182,022	420,491	156,963	461,256	148,997	560,238	1,124,814	3,923,179

Table C4: Buildings Under BSC Authority Adjusted Number of Projected Parking Spaces Installed Between July 1, 2021 (Effective Date) and December 30, 2030

Year	Ref. Warehouse	Restaurant	Grocery Stores	Small Office	Hospitals	Retail	Warehouse	Large Office	Misc.	Totals
2021	346	13,361	7,196	5,470	21,936	26,069	7,728	25,168	57,674	164,949
2022	701	25,951	13,478	10,780	43,683	48,854	15,366	49,352	115,278	323,445
2023	678	26,104	13,271	11,233	43,866	47,996	15,090	51,969	114,841	325,047
2024	661	26,540	13,538	12,433	44,858	48,999	15,720	63,617	118,494	344,859
SUBTOTAL										1,158,300
2025	683	26,599	13,755	12,950	44,494	49,822	16,488	67,754	122,324	354,868
2026	689	25,836	13,512	12,572	43,983	48,916	15,863	64,457	119,155	344,984
2027	669	25,078	13,222	12,019	44,275	47,860	15,366	59,895	117,464	335,847
2028	663	24,928	13,149	11,887	44,388	47,604	15,621	58,350	119,201	335,791
2029	667	25,065	13,145	12,000	44,433	47,586	15,816	59,398	119,885	337,996
2030	668	25,088	13,130	12,082	44,573	47,551	15,939	60,278	120,499	339,807
Total	6,425	244,551	127,396	113,426	420,491	461,256	148,997	560,238	1,124,814	3,207,593

Table C5: Buildings Under BSC Authority Maximum Number of Projected Parking Spaces Installed Between July 1, 2021 (Effective Date) and December 30, 2030

Year	Ref. Warehouse	Restaurant	Grocery Stores	Small Office	Hospitals	Retail	Warehouse	Large Office	Misc.	Totals
2021	422	16,294	8,776	6,671	26,751	31,791	9,425	30,692	70,334	201,157
2022	855	31,648	16,437	13,147	53,273	59,578	18,739	60,185	140,583	394,446
2023	826	31,835	16,184	13,698	53,495	58,531	18,403	63,376	140,050	396,399
2024	806	32,365	16,510	15,162	54,705	59,755	19,170	77,582	144,504	420,560
SUBTOTAL										1,412,561
2025	833	32,438	16,774	15,793	54,261	60,758	20,107	82,626	149,175	432,766
2026	840	31,507	16,478	15,332	53,638	59,654	19,345	78,607	145,311	420,712
2027	815	30,583	16,124	14,657	53,994	58,366	18,738	73,043	143,248	409,569
2028	809	30,399	16,035	14,497	54,132	58,054	19,050	71,158	145,367	409,501
2029	814	30,567	16,030	14,634	54,187	58,031	19,288	72,437	146,202	412,190
2030	815	30,595	16,012	14,734	54,358	57,988	19,438	73,510	146,950	414,399
Total	7,836	298,232	155,361	138,325	512,793	562,507	181,703	683,217	1,371,724	3,911,699

Table C6: Buildings Under DSA Authority: Adjusted Number of Projected Parking Spaces Installed Between July 1, 2021 (Effective Date) and December 30, 2030

Year	Colleges	Schools	Totals
2021	19,094	9,423	28,517
2022	38,435	19,545	57,980
2023	37,757	19,083	56,840
2024	38,650	18,702	57,351
2025	41,228	19,183	60,411
2026	40,726	19,112	59,838
2027	39,744	19,083	58,826
2028	40,396	19,342	59,738
2029	40,442	19,172	59,614
2030	40,131	19,378	59,508
Total	376,601	182,022	558,623

Table C7: Buildings Under DSA Authority: Maximum Number of Projected Parking Spaces Installed Between July 1, 2021 (Effective Date) and December 30, 2030

Year	Colleges	Schools	Totals
2021	23,285	11,492	34,777
2022	46,872	23,835	70,707
2023	46,045	23,272	69,317
2024	47,134	22,807	69,941
2025	50,277	23,394	73,672
2026	49,665	23,308	72,973
2027	48,468	23,272	71,740
2028	49,264	23,587	72,851
2029	49,320	23,380	72,700
2030	48,940	23,631	72,571
Total	459,270	221,978	681,248

Table C8: Buildings Under HCD Authority: Adjusted Number of Projected Parking Spaces Installed Between July 1, 2021 (Effective Date) and December 30, 2030

Year	Hotel/ Motel	Totals
2021	7,647	7,647
2022	15,332	15,332
2023	16,349	16,349
2024	17,076	17,076
2025	16,795	16,795
2026	16,357	16,357
2027	16,439	16,439
2028	16,767	16,767
2029	17,025	17,025
2030	17,175	17,175
Total	156,963	156,963

Table C9: Buildings Under HCD Authority: Maximum Number of Projected Parking Spaces Installed Between July 1, 2021 (Effective Date) and December 30, 2030

Year	Hotel/ Motel	Totals
2021	9,325	9,325
2022	18,698	18,698
2023	19,938	19,938
2024	20,824	20,824
2025	20,482	20,482
2026	19,948	19,948
2027	20,048	20,048
2028	20,448	20,448
2029	20,762	20,762
2030	20,945	20,945
Total	191,418	191,418

Appendix D: Percent Requirement Options for New Nonresidential Buildings

Table D1: LOW-RANGE: All Buildings: CARB Staff Estimate of Level 2 EV Chargers Installed in Nonresidential Buildings by 2025 (Years Mid 2021 – 2024)

Year	Adjusted Total Parking Spaces	Mandatory per Section 5.106.5.3	Options for Revised Percentages							
		6%	8%	10%	12%	14%	15%	16%	18%	20%
2021	201,112	3,620	4,827	6,033	7,240	8,447	9,050	9,653	10,860	12,067
2022	396,757	7,142	9,522	11,903	14,283	16,664	17,854	19,044	21,425	23,805
2023	398,236	7,168	9,558	11,947	14,337	16,726	17,921	19,115	21,505	23,894
2024	419,286	7,547	10,063	12,579	15,094	17,610	18,868	20,126	22,641	25,157
Total	**1,415,392**	**25,477**	**33,969**	**42,462**	**50,954**	**59,446**	**63,693**	**67,939**	**76,431**	**84,924**

Table D2: HIGH-RANGE: All Buildings: CARB Staff Estimate of Level 2 EV Chargers Installed in Nonresidential Buildings by 2025 (Years Mid 2021 – 2024)

Year	Adjusted Total Parking Spaces	Mandatory per Section 5.106.5.3	Options for Revised Percentages							
		6%	8%	10%	12%	14%	15%	16%	18%	20%
2021	245,259	4,415	5,886	7,358	8,829	10,301	11,037	11,772	13,244	14,716
2022	483,850	8,709	11,612	14,516	17,419	20,322	21,773	23,225	26,128	29,031
2023	485,654	8,742	11,656	14,570	17,484	20,397	21,854	23,311	26,225	29,139
2024	511,325	9,204	12,272	15,340	18,408	21,476	23,010	24,544	27,612	30,679
Total	**1,726,088**	**31,070**	**41,426**	**51,783**	**62,139**	**72,496**	**77,674**	**82,852**	**93,209**	**103,565**

Table D3: LOW-RANGE: BSC Authority Buildings: CARB Staff Estimate of Level 2 Chargers Installed in Nonresidential Buildings by 2025 (Years Mid 2021 - 2024)

Year	Adjusted Total Parking Spaces	Mandatory per Section 5.106.5.3	Options for Revised Percentages							
		6%	8%	10%	12%	14%	15%	16%	18%	20%
2021	164,949	2,969	3,959	4,948	5,938	6,928	7,423	7,918	8,907	9,897
2022	323,445	5,822	7,763	9,703	11,644	13,585	14,555	15,525	17,466	19,407
2023	325,047	5,851	7,801	9,751	11,702	13,652	14,627	15,602	17,553	19,503
2024	344,859	6,207	8,277	10,346	12,415	14,484	15,519	16,553	18,622	20,692
Total	**1,158,300**	**20,849**	**27,799**	**34,749**	**41,699**	**48,649**	**52,124**	**55,598**	**62,548**	**69,498**

Table D4: HIGH-RANGE: BSC Authority Buildings: CARB Staff Estimate of Level 2 EV Chargers Installed in Nonresidential Buildings by 2025 (Years Mid 2021 - 2024)

Year	Adjusted Total Parking Spaces	Mandatory per Section 5.106.5.3	Options for Revised Percentages							
		6%	8%	10%	12%	14%	15%	16%	18%	20%
2021	201,157	3,621	4,828	6,035	7,242	8,449	9,052	9,656	10,862	12,069
2022	394,446	7,100	9,467	11,833	14,200	16,567	17,750	18,933	21,300	23,667
2023	396,399	7,135	9,514	11,892	14,270	16,649	17,838	19,027	21,406	23,784
2024	420,560	7,570	10,093	12,617	15,140	17,664	18,925	20,187	22,710	25,234
Total	**1,412,561**	**25,426**	**33,901**	**42,377**	**50,852**	**59,328**	**63,565**	**67,803**	**76,278**	**84,754**

Table D5: LOW-RANGE: DSA Authority Buildings: CARB Staff Estimate of Level 2 EV Chargers Installed in Nonresidential Buildings by 2025 (Years Mid 2021 - 2024)

Year	Adjusted Total Parking Spaces	Mandatory per Section 5.106.5.3	Options for Revised Percentages							
		6%	8%	10%	12%	14%	15%	16%	18%	20%
2021	28,517	513	684	856	1,027	1,198	1,283	1,369	1,540	1,711
2022	57,980	1,044	1,392	1,739	2,087	2,435	2,609	2,783	3,131	3,479
2023	56,840	1,023	1,364	1,705	2,046	2,387	2,558	2,728	3,069	3,410
2024	57,351	1,032	1,376	1,721	2,065	2,409	2,581	2,753	3,097	3,441
Total	**200,688**	**3,612**	**4,817**	**6,021**	**7,225**	**8,429**	**9,031**	**9,633**	**10,837**	**12,041**

Table D6: HIGH-RANGE: DSA Authority Buildings: CARB Staff Estimate of Level 2 EV Chargers Installed in Nonresidential Buildings by 2025 (Years Mid 2021 - 2024)

Year	Adjusted Total Parking Spaces	Mandatory per Section 5.106.5.3	Options for Revised Percentages							
		6%	8%	10%	12%	14%	15%	16%	18%	20%
2021	34,777	626	835	1,043	1,252	1,461	1,565	1,669	1,878	2,087
2022	70,707	1,273	1,697	2,121	2,545	2,970	3,182	3,394	3,818	4,242
2023	69,317	1,248	1,664	2,080	2,495	2,911	3,119	3,327	3,743	4,159
2024	69,941	1,259	1,679	2,098	2,518	2,938	3,147	3,357	3,777	4,196
Total	**244,741**	**4,405**	**5,874**	**7,342**	**8,811**	**10,279**	**11,013**	**11,748**	**13,216**	**14,684**

Table D7: LOW-RANGE: HCD Authority Buildings: CARB Staff Estimate of Level 2 EV Chargers Installed in Nonresidential Buildings by 2025 (Years Mid 2021 - 2024)

Year	Adjusted Total Parking Spaces	Mandatory per Section 5.106.5.3	Options for Revised Percentages							
		6%	8%	10%	12%	14%	15%	16%	18%	20%
2021	7,647	138	184	229	275	321	344	367	413	459
2022	15,332	276	368	460	552	644	690	736	828	920
2023	16,349	294	392	490	589	687	736	785	883	981
2024	17,076	307	410	512	615	717	768	820	922	1,025
Total	**56,404**	**1,015**	**1,354**	**1,692**	**2,031**	**2,369**	**2,538**	**2,707**	**3,046**	**3,384**

Table D8: HIGH-RANGE: HCD Authority Buildings: CARB Staff Estimate of Level 2 EV Chargers Installed in Nonresidential Buildings by 2025 (Years Mid 2021 - 2024)

Year	Adjusted Total Parking Spaces	Mandatory per Section 5.106.5.3	Options for Revised Percentages							
		6%	8%	10%	12%	14%	15%	16%	18%	20%
2021	9,325	168	224	280	336	392	420	448	504	560
2022	18,698	337	449	561	673	785	841	897	1,010	1,122
2023	19,938	359	479	598	718	837	897	957	1,077	1,196
2024	20,824	375	500	625	750	875	937	1,000	1,125	1,249
Total	**68,785**	**1,238**	**1,651**	**2,064**	**2,476**	**2,889**	**3,095**	**3,302**	**3,714**	**4,127**

Appendix E: Estimated Total Number of Buildings by Size in California

Summary of Total Nonresidential Building Estimates

CARB staff estimated a total of 731,924 buildings in California for the year 2019. As a starting point to develop this estimate, CARB staff located the U.S. Energy Information Administration data on the total number of buildings in the U.S. as reported in the Commercial Buildings Energy Consumption Survey (CBECS). CARB staff scaled the total number of buildings in the U.S. from CBECS to estimate the number of buildings in California based on a historical annual growth rate of 0.75 percent from CEC's Commercial Floorspace Forecast and California's share of the national population.

Table E1: CARB Staff Estimate of Total Buildings in California in the Year 2019

CBECS Table B1. Summary table: total and means of floorspace, number of workers, and hours of operation, 2012							CARB Staff Estimate of Buildings in California		
	Number of buildings (thousand)	Total floorspace (million square feet)	Total workers (thousand)	Mean square feet per building (thousand)	Mean square feet per worker	Mean operating hours per week	Annual growth 2012-2019	CA Share of National Population	Year - 2019 - Buildings scaled to CA population, w/ annual growth
All commercial buildings	5,557	87,093	88,182	15.7	936	62	0.75%	0.125	731,924

Source:

U.S. Energy Information Administration

Commercial Buildings Energy Consumption Survey (CBECS), Table B1, Summary Table: Total and Means of Floorspace

Website: https://www.eia.gov/consumption/commercial/data/2012/bc/cfm/b3.php

Table E2: CARB Staff Estimated Number of Nonresidential Buildings in California (Total Buildings)

Year	Total Buildings (Cumulative)	Existing Buildings (Cumulative)	New Construction (Annual)
2019	731,924	721,274	10,650
2020	737,413	727,279	10,134
2021	742,944	733,201	9,743
2022	748,516	739,015	9,501
2023	754,130	744,627	9,503
2024	759,786	749,735	10,051
2025	765,484	755,158	10,326
2026	771,225	761,254	9,971
2027	777,009	767,372	9,638
2028	782,837	773,229	9,608
2029	788,708	779,073	9,636
2030	794,623	784,972	9,651

Table E3: Summary of CEC Commercial Floorspace Forecast Mid-Demand Scenario (Million Square Feet)

Year	Existing Buildings (Cumulative)	New Construction (Annual)	Total
2019	7,460	110	7,571
2020	7,571	105	7,676
2021	7,676	102	7,778
2022	7,778	100	7,878
2023	7,878	101	7,978
2024	7,978	107	8,085
2025	8,085	111	8,196
2026	8,196	107	8,303
2027	8,303	104	8,407
2028	8,407	104	8,512
2029	8,512	105	8,617
2030	8,617	106	8,723

Table E4: Copy of CBECS Table B6

Building size, number of buildings, 2012 - West as California

	Number of buildings (thousand)								
		Building size							
Year	All buildings	1,001 to 5,000 square feet	5,001 to 10,000 square feet	10,001 to 25,000 square feet	25,001 to 50,000 square feet	50,001 to 100,000 square feet	100,001 to 200,000 square feet	200,001 to 500,000 square feet	Over 500,000 square feet
West	1,267	601	310	221	75	34	17	7	1
Percent	100%	47.4%	24.5%	17.4%	5.9%	2.7%	1.3%	0.6%	0.1%

Source:
U.S. Energy Information Administration
Commercial Buildings Energy Consumption Survey (CBECS)
Website:
https://www.eia.gov/consumption/commercial/data/2012/bc/cfm/b6.php
Note: Percent total does not equal 100% due to rounding error.

Table E5: Cumulative Total Number of Existing Nonresidential Buildings in California by Building Size Between 2021 and 2030

Year	All Buildings	1,001 to 5,000 square feet	5,001 to 10,000 square feet	10,001 to 25,000 square feet	25,001 to 50,000 square feet	50,001 to 100,000 square feet	100,001 to 200,000 square feet	200,001 to 500,000 square feet	Over 500,000 square feet
2021	742,944	352,414	181,778	129,590	43,979	19,937	9,968	4,105	586
2022	748,516	355,058	183,141	130,562	44,308	20,086	10,043	4,135	591
2023	754,130	357,721	184,515	131,541	44,641	20,237	10,119	4,166	595
2024	759,786	360,403	185,899	132,528	44,975	20,389	10,194	4,198	600
2025	765,484	363,106	187,293	133,522	45,313	20,542	10,271	4,229	604
2026	771,225	365,830	188,698	134,523	45,653	20,696	10,348	4,261	609
2027	777,009	368,573	190,113	135,532	45,995	20,851	10,426	4,293	613
2028	782,837	371,338	191,539	136,549	46,340	21,007	10,504	4,325	618
2029	788,708	374,123	192,975	137,573	46,688	21,165	10,583	4,358	623
2030	794,623	376,929	194,422	138,604	47,038	21,324	10,662	4,390	627

Table E6: Projected Number of New Nonresidential Buildings Constructed Annually in California by Building Size Between 2021 and 2030

Year	Annual New Construction	1,001 to 5,000 square feet	5,001 to 10,000 square feet	10,001 to 25,000 square feet	25,001 to 50,000 square feet	50,001 to 100,000 square feet	100,001 to 200,000 square feet	200,001 to 500,000 square feet	Over 500,000 square feet
2021	9,743	4,618	2,387	1,695	575	263	127	58	10
2022	9,501	4,503	2,328	1,653	561	257	124	57	10
2023	9,503	4,504	2,328	1,653	561	257	124	57	10
2024	10,051	4,764	2,462	1,749	593	271	131	60	10
2025	10,326	4,895	2,530	1,797	609	279	134	62	10
2026	9,971	4,726	2,443	1,735	588	269	130	60	10
2027	9,638	4,568	2,361	1,677	569	260	125	58	10
2028	9,608	4,554	2,354	1,672	567	259	125	58	10
2029	9,636	4,567	2,361	1,677	568	260	125	58	10
2030	9,651	4,575	2,365	1,679	569	261	125	58	10

Table E7: Estimated Number of New Nonresidential Buildings Constructed Annually and Impacted by the Suggested Code Changes to EV Charging Infrastructure Provisions in CALGreen by Building Size Between 2021 and 2030

Year	Annual New Construction	New Buildings Impacted by Code	1,001 to 2,500 square feet	2,501 to 5,000 square feet	5,001 to 10,000 square feet	10,001 to 25,000 square feet	25,001 to 50,000 square feet	50,001 to 100,000 square feet	100,001 to 200,000 square feet	200,001 to 500,000 square feet	Over 500,000 square feet
2021	9,743	7,424	2,309	2,309	2,387	1,695	575	263	127	58	10
2022	9,501	7,240	2,252	2,252	2,328	1,653	561	257	124	57	10
2023	9,503	7,241	2,252	2,252	2,328	1,653	561	257	124	57	10
2024	10,051	7,659	2,382	2,382	2,462	1,749	593	271	131	60	10
2025	10,326	7,868	2,447	2,447	2,530	1,797	609	279	134	62	10
2026	9,971	7,598	2,363	2,363	2,443	1,735	588	269	130	60	10
2027	9,638	7,344	2,284	2,284	2,361	1,677	569	260	125	58	10
2028	9,608	7,321	2,277	2,277	2,354	1,672	567	259	125	58	10
2029	9,636	7,342	2,284	2,284	2,361	1,677	568	260	125	58	10
2030	9,651	7,354	2,287	2,287	2,365	1,679	569	261	125	58	10

CARB Staff Assumptions:

275 square feet/parking space
10 parking space threshold to trigger code requirements
2750 square foot building - typical size to trigger EV charging code requirements
50% of buildings in the original 1,001 to 5,000 square feet size range have 10 parking spaces or more

Table E8: Copy of CBECS Table B7

Building size, floorspace, 2012

	Total floorspace (million square feet)								
		Building size							
Year	All buildings (million square feet)	1,001 to 5,000 square feet	5,001 to 10,000 square feet	10,001 to 25,000 square feet	25,001 to 50,000 square feet	50,001 to 100,000 square feet	100,001 to 200,000 square feet	200,001 to 500,000 square feet	Over 500,000 square feet
All buildings	87,093	8,041	8,900	14,105	11,917	13,918	12,415	10,724	7,074
Northeast	15,534	1,057	1,248	2,408	1,644	2,676	2,542	2,232	1,727
Midwest	18,919	1,858	1,872	2,889	3,029	2,729	2,400	2,726	1,418
South	34,279	3,383	3,535	5,209	4,528	6,139	5,152	3,681	2,652
West	**18,360**	**1,744**	**2,245**	**3,599**	**2,716**	**2,374**	**2,321**	**2,084**	**1,277**
Percent	**100%**	**9%**	**12%**	**20%**	**15%**	**13%**	**13%**	**11%**	**7%**

Table E9: Square Footage of Existing Nonresidential Buildings in California by Building Size Between 2021 and 2030 (Million Square Feet)

Year	Total	1,001 to 5,000 square feet	5,001 to 10,000 square feet	10,001 to 25,000 square feet	25,001 to 50,000 square feet	50,001 to 100,000 square feet	100,001 to 200,000 square feet	200,001 to 500,000 square feet	Over 500,000 square feet
2021	7,676	729	939	1,505	1,136	993	970	871	534
2022	7,778	739	951	1,525	1,151	1,006	983	883	541
2023	7,878	748	963	1,544	1,165	1,019	996	894	548
2024	7,978	758	976	1,564	1,180	1,032	1,009	906	555
2025	8,085	768	989	1,585	1,196	1,045	1,022	918	562
2026	8,196	779	1,002	1,607	1,212	1,060	1,036	930	570
2027	8,303	789	1,015	1,628	1,228	1,074	1,050	942	578
2028	8,407	799	1,028	1,648	1,244	1,087	1,063	954	585
2029	8,512	809	1,041	1,669	1,259	1,101	1,076	966	592
2030	8,617	819	1,054	1,689	1,275	1,114	1,089	978	599

Comment:

Table above has been generated by assuming the following:

(1) California building stock currently and in the future will resemble the rest of Western United States.
(2) Commercial Building Energy Consumption Survey (CBECS) accurately and precisely represents the size ranges of buildings currently and in the future.
(3) Total New California Commercial Construction in million square feet are accurate and based on CEC Commercial Floorspace Forecast

(4) Principal Building Activity categories in CBECS can be accumulated, regrouped, and reflected in categories of interest.
(5) This regrouping, and reflection is based on the fraction of number of buildings in each category.

Appendix F: Summary of Cost Estimates

Table F1: Low-Range: New Construction Cost Estimate to Install Raceway, Branch Circuits, and Panel Capacity

Component	Description	Material	Labor	Total	Estimated Cost per Parking Space
PVC Schedule 40 Conduit	Installed in or under building slab. No wire, fittings or supports included. (Per Linear Foot)	$ 0.40	$ 2.31	$ 2.71	$ 271.00
Electrical Outlet Box	Handy Boxes, 4" X 2-1/8" (Weatherproof Box and Cover)	$ 3.82	$ 2.97	$ 6.79	$ 6.79
Safety Switches	Wall mounted switches with enclosures as noted. No fuses or hubs included. Heavy Duty (NEMA-1) 600 Volt 2, 3, or 4 pole fusible safety switches (60 amp)	$ 216.00	$ 196.00	$ 412.00	$ 412.00
Circuit Breakers	No enclosure included, 10,000 amp interrupt capacity except as noted. 15 to 60 amps, two pole	$ 9.57	$ 22.40	$ 31.97	$ 31.97
Fuses	No enclosures included, 250 Volt 35 to 60 amp	$ 2.86	$ 4.60	$ 7.46	$ 7.46
Combination Service Entrance Device (Panel)	Meter socket, service disconnect and loadcenter. Surface mount NEMA Type 3R enclosure with ring type utility meter socket, service disconnect, and integral HOM loadcenter. Single phase 3-wire. 120/240 Volt AC, 22,000 amp short circuit current rating. Overhead or underground service feed. Add the cost of distribution breakers and conduit hubs. (100 amp, 16 spaces, 24 circuits)	$ 80.00	$ 60.30	$ 140.30	$ 140.30
Total					$ 870.00

Source: 2019 National Construction Estimator, 67th Edition, Edited by Richard Pray, Craftsman Book Company, November 2018.

Table F2: High-Range: New Construction Cost Estimate to Install Raceway, Branch Circuits, and Panel Capacity

Component	Description	Material	Labor	Total	Estimated Cost per Parking Space
Electric Metallic Tubing (EMT) (1" Conduit)	EMT Installed exposed in a building either vertically or horizontally up to 10' above floor level. No wire, fittings or supports included except as noted. (Per Linear Foot)	$ 0.89	$ 2.77	$ 3.66	$ 366.00
Electrical Outlet Box	Handy Boxes, 4" X 2-1/8" (Weatherproof Box and Cover)	$ 3.82	$ 2.97	$ 6.79	$ 6.79
Safety Switches	Wall mounted switches with enclosures as noted. No fuses or hubs included. Heavy Duty (NEMA-1) 600 Volt 2, 3, or 4 pole fusible safety switches (60 amp)	$ 216.00	$ 196.00	$ 412.00	$ 412.00
Circuit Breakers	No enclosure included, 10,000 amp interrupt capacity except as noted. 15 to 60 amps, two pole	$ 9.57	$ 22.40	$ 31.97	$ 31.97
Fuses	No enclosures included, 250 Volt 35 to 60 amp	$ 2.86	$ 4.60	$ 7.46	$ 7.46
Combination Service Entrance Device (Panel)	Meter socket, service disconnect and loadcenter. Surface mount NEMA Type 3R enclosure with ring type utility meter socket, service disconnect, and integral HOM loadcenter. Single phase 3-wire. 120/240 Volt AC, 22,000 amp short circuit current rating. Overhead or underground service feed. Add the cost of distribution breakers and conduit hubs. (100 amp, 16 spaces, 24 circuits)	$ 80.00	$ 60.30	$ 140.30	$ 140.30
Total					$ 960.00

Source: 2019 National Construction Estimator, 67th Edition, Edited by Richard Pray, Craftsman Book Company, November 2018.

2019/2020 Intervening Code Cycle: Statewide Costs and Benefits for All Nonresidential Buildings to Meet Suggested 10 Percent Requirement

Table F3: All Nonresidential Buildings: Incremental Difference in Number of EV Spaces between Current 6 Percent Requirement and Suggested 10 Percent Requirement

Year	New Construction Totals (Million Square Feet)	New Parking Spaces		EV Spaces w/6% Requirement		EV Spaces w/10% Requirement		Incremental Difference	
		Low	High	Low	High	Low	High	Low	High
2021	50.81	201,112	245,259	12,067	14,716	20,111	24,526	8,044	9,810
2022	99.99	396,757	483,850	23,805	29,031	39,676	48,385	15,870	19,354
2023	100.53	398,236	485,654	23,894	29,139	39,824	48,565	15,929	19,426
2024	106.95	419,286	511,325	25,157	30,679	41,929	51,132	16,771	20,453
Total	**358.28**	**1,415,392**	**1,726,088**	**84,924**	**103,565**	**141,539**	**172,609**	**56,616**	**69,044**

Table F4: Incremental Cost to Install Raceway and Panel Capacity in 10 Percent of Parking Spaces in New Nonresidential Buildings

Year	Incremental Difference in EV Capable Parking Spaces Installed		Initial Construction Costs	
			Low	High
			$870/Space	$960/Space
2021	Low	8,044	$6,998,698	$7,722,701
	High	9,810	$8,534,997	$9,417,928
2022	Low	15,870	$13,807,150	$15,235,476
	High	19,354	$16,837,988	$18,579,849
2023	Low	15,929	$13,858,620	$15,292,270
	High	19,426	$16,900,756	$18,649,110
2024	Low	16,771	$14,591,170	$16,100,601
	High	20,453	$17,794,109	$19,634,879
Total	Low	56,616	$49,255,637	$54,351,048
	High	69,044	$60,067,850	$66,281,765
Average Annual	**Low**	**14,154**	**$12,313,909**	**$13,587,762**
	High	**17,261**	**$15,016,962**	**$16,570,441**

Table F5: 2019/2020 Intervening Code Cycle: Avoided Retrofit Costs by Installing EV Charging Infrastructure in New Nonresidential Buildings

Year	Incremental Difference in EV Capable Parking Spaces Installed		Avoided Retrofit Costs	
			Multiple Level 2 Installations	Single Level 2 Installation
			$7,000/Space	$8,000/Space
2021	Low	8,044	$56,311,362	$64,355,842
	High	9,810	$68,672,393	$78,482,734
2022	Low	15,870	$111,092,011	$126,962,298
	High	19,354	$135,478,062	$154,832,071
2023	Low	15,929	$111,506,134	$127,435,582
	High	19,426	$135,983,090	$155,409,246
2024	Low	16,771	$117,400,216	$134,171,675
	High	20,453	$143,170,995	$163,623,994
Total	Low	56,616	$396,309,723	$452,925,397
	High	69,044	$483,304,540	$552,348,046
Average Annual	**Low**	**14,154**	**$99,077,431**	**$113,231,349**
	High	**17,261**	**$120,826,135**	**$138,087,011**

Table F6: 2019/2020 Intervening Code Cycle: Statewide Benefit with Limited Scope to Install Raceway and Panel Capacity in 10 Percent of Parking Spaces in New Nonresidential Buildings

Year	Range	Initial Construction Costs	Avoided Retrofit Costs	Benefit
2021	Low	$6,998,698	$56,311,362	-$49,312,664
	High	$9,417,928	$78,482,734	-$69,064,806
2022	Low	$13,807,150	$111,092,011	-$97,284,861
	High	$18,579,849	$154,832,071	-$136,252,223
2023	Low	$13,858,620	$111,506,134	-$97,647,515
	High	$18,649,110	$155,409,246	-$136,760,137
2024	Low	$14,591,170	$117,400,216	-$102,809,046
	High	$19,634,879	$163,623,994	-$143,989,115
Total	Low	$49,255,637	$396,309,723	-$347,054,086
	High	$66,281,765	$552,348,046	-$486,066,280
Average Annual	**Low**	**$12,313,909**	**$99,077,431**	**-$86,763,521**
	High	**$16,570,441**	**$138,087,011**	**-$121,516,570**

2019/2020 Intervening Code Cycle: Statewide Costs and Benefits for Nonresidential Buildings under BSC Authority to Meet Suggested 10 Percent Requirement

Table F7: BSC Authority - Nonresidential Buildings: Incremental Difference in Number of EV Spaces between Current 6 Percent Requirement and Suggested 10 Percent Requirement

Year	New Construction Totals (Million Square Feet)	New Parking Spaces		EV Spaces w/6% Requirement		EV Spaces w/10% Requirement		Incremental Difference	
		Low	High	Low	High	Low	High	Low	High
2021	43.90	164,949	201,157	9,897	12,069	16,495	20,116	6,598	8,046
2022	85.95	323,445	394,446	19,407	23,667	32,345	39,445	12,938	15,778
2023	86.27	325,047	396,399	19,503	23,784	32,505	39,640	13,002	15,856
2024	92.45	344,859	420,560	20,692	25,234	34,486	42,056	13,794	16,822
Total	**308.57**	**1,158,300**	**1,412,561**	**69,498**	**84,754**	**115,830**	**141,256**	**46,332**	**56,502**

Table F8: BSC Authority - Incremental Cost to Install Raceway and Panel Capacity in 10 Percent of Parking Spaces in New Nonresidential Buildings

Year	Incremental Difference in EV Capable Parking Spaces Installed		Initial Construction Costs	
			Low	High
			$870/Space	$960/Space
2021	Low	6,598	$5,740,210	$6,334,025
	High	8,046	$7,000,257	$7,724,421
2022	Low	12,938	$11,255,902	$12,420,306
	High	15,778	$13,726,710	$15,146,714
2023	Low	13,002	$11,311,630	$12,481,799
	High	15,856	$13,794,671	$15,221,706
2024	Low	13,794	$12,001,104	$13,242,598
	High	16,822	$14,635,493	$16,149,510
Total	Low	46,332	$40,308,847	$44,478,728
	High	56,502	$49,157,131	$54,242,351
Average Annual	**Low**	**11,583**	**$10,077,212**	**$11,119,682**
	High	**14,126**	**$12,289,283**	**$13,560,588**

Table F9: BSC Authority - Avoided Retrofit Costs by Installing EV Charging Infrastructure in New Nonresidential Buildings

Year	Incremental Difference in EV Capable Parking Spaces Installed		Avoided Retrofit Costs	
			Multiple Level 2 Installations	Single Level 2 Installation
			$7,000/Space	$8,000/Space
2021	Low	6,598	$46,185,601	$52,783,545
	High	9,810	$68,672,393	$78,482,734
2022	Low	15,870	$111,092,011	$126,962,298
	High	19,354	$135,478,062	$154,832,071
2023	Low	15,929	$111,506,134	$127,435,582
	High	19,426	$135,983,090	$155,409,246
2024	Low	16,771	$117,400,216	$134,171,675
	High	20,453	$143,170,995	$163,623,994
Total	Low	46,332	$324,324,057	$370,656,065
	High	56,502	$395,517,143	$452,019,592
Average Annual	**Low**	**11,583**	**$81,081,014**	**$92,664,016**
	High	**14,126**	**$98,879,286**	**$113,004,898**

Table F10: BSC Authority - Statewide Benefit to Install Raceway and Panel Capacity in 10 Percent of Parking Spaces in New Nonresidential Buildings

Year	Range	Initial Construction Costs	Avoided Retrofit Costs	Benefit
2021	Low	$5,740,210	$46,185,601	-$40,445,391
	High	$7,724,421	$78,482,734	-$70,758,313
2022	Low	$11,255,902	$111,092,011	-$99,836,109
	High	$15,146,714	$154,832,071	-$139,685,357
2023	Low	$11,311,630	$111,506,134	-$100,194,504
	High	$15,221,706	$155,409,246	-$140,187,540
2024	Low	$12,001,104	$117,400,216	-$105,399,111
	High	$16,149,510	$163,623,994	-$147,474,484
Total	Low	$40,308,847	$324,324,057	-$284,015,210
	High	$54,242,351	$452,019,592	-$397,777,241
Average Annual	**Low**	**$10,077,212**	**$81,081,014**	**-$71,003,802**
	High	**$13,560,588**	**$113,004,898**	**-$99,444,310**

2019/2020 Intervening Code Cycle: Statewide Costs and Benefits for Nonresidential Buildings under DSA Authority to Meet Suggested 10 Percent Requirement

Table F11: DSA Authority - Nonresidential Buildings: Incremental Difference in Number of EV Spaces between Current 6 Percent Requirement and Suggested 10 Percent Requirement

Year	New Construction Totals (Million Square Feet)	New Parking Spaces		EV Spaces w/6% Requirement		EV Spaces w/10% Requirement		Incremental Difference	
		Low	High	Low	High	Low	High	Low	High
2021	3.87	28,517	34,777	1,711	2,087	2,852	3,478	1,141	1,391
2022	7.95	57,980	70,707	3,479	4,242	5,798	7,071	2,319	2,828
2023	7.78	56,840	69,317	3,410	4,159	5,684	6,932	2,274	2,773
2024	7.73	57,351	69,941	3,441	4,196	5,735	6,994	2,294	2,798
Total	**27.32**	**200,688**	**244,741**	**12,041**	**14,684**	**20,069**	**24,474**	**8,028**	**9,790**

Table F12: DSA Authority - Incremental Cost to Install Raceway and Panel Capacity in 10 Percent of Parking Spaces in New Nonresidential Buildings

Year	Incremental Difference in EV Capable Parking Spaces Installed		Initial Construction Costs	
			Low	High
			$870/Space	$960/Space
2021	Low	1,141	$992,383	$1,095,044
	High	1,391	$1,210,224	$1,335,419
2022	Low	2,319	$2,017,688	$2,226,415
	High	2,828	$2,460,595	$2,715,140
2023	Low	2,274	$1,978,032	$2,182,656
	High	2,773	$2,412,234	$2,661,776
2024	Low	2,294	$1,995,824	$2,202,289
	High	2,798	$2,433,932	$2,685,718
Total	Low	8,028	$6,983,928	$7,706,403
	High	9,790	$8,516,985	$9,398,053
Average Annual	**Low**	**2,007**	**$1,745,982**	**$1,926,601**
	High	**2,447**	**$2,129,246**	**$2,349,513**

Table F13: DSA Authority - Avoided Retrofit Costs by Installing EV Charging Infrastructure in New Nonresidential Construction

Year	Incremental Difference in EV Capable Parking Spaces Installed		Avoided Retrofit Costs	
			Multiple Level 2 Installations	Single Level 2 Installation
			$7,000/Space	$8,000/Space
2021	Low	1,141	$7,984,695	$9,125,365
	High	1,391	$9,737,433	$11,128,494
2022	Low	2,319	$16,234,273	$18,553,454
	High	2,828	$19,797,893	$22,626,164
2023	Low	2,274	$15,915,202	$18,188,802
	High	2,773	$19,408,783	$22,181,466
2024	Low	2,294	$16,058,356	$18,352,406
	High	2,798	$19,583,360	$22,380,983
Total	Low	8,028	$56,192,525	$64,220,028
	High	9,790	$68,527,469	$78,317,107
Average Annual	**Low**	**2,007**	**$14,048,131**	**$16,055,007**
	High	**2,447**	**$17,131,867**	**$19,579,277**

Table F14: DSA Authority - Combined Statewide Benefit to Install Raceway and Panel Capacity in 10 Percent of Parking Spaces in New Nonresidential Buildings

Year	Range	Initial Construction Costs	Avoided Retrofit Costs	Benefit
2021	Low	$992,383	$7,984,695	-$6,992,311
	High	$1,335,419	$11,128,494	-$9,793,075
2022	Low	$2,017,688	$16,234,273	-$14,216,584
	High	$2,715,140	$22,626,164	-$19,911,024
2023	Low	$1,978,032	$15,915,202	-$13,937,169
	High	$2,661,776	$22,181,466	-$19,519,690
2024	Low	$1,995,824	$16,058,356	-$14,062,531
	High	$2,685,718	$22,380,983	-$19,695,265
Total	Low	$6,983,928	$56,192,525	-$49,208,597
	High	$9,398,053	$78,317,107	-$68,919,055
Average Annual	**Low**	**$1,745,982**	**$14,048,131**	**-$12,302,149**
	High	**$2,349,513**	**$19,579,277**	**-$17,229,764**

Alternative 1: Statewide Costs and Benefits for Nonresidential Buildings to Meet 15 Percent Requirement for Raceway and Panel Capacity

Table F15: Alternative 1: All Nonresidential Buildings: Incremental Difference in Number of EV Capable Spaces between Current 6% Requirement and 15% Alternative Mandatory Provision

Year	New Construction Totals (Million Square Feet)	New Parking Spaces		EV Spaces w/6% Requirement		EV Spaces w/15% Tier 1 Adoption		Incremental Difference	
		Low	High	Low	High	Low	High	Low	High
2021	50.81	201,112	245,259	12,067	14,716	30,167	36,789	18,100	22,073
2022	99.99	396,757	483,850	23,805	29,031	59,514	72,578	35,708	43,547
2023	100.53	398,236	485,654	23,894	29,139	59,735	72,848	35,841	43,709
2024	106.95	419,286	511,325	25,157	30,679	62,893	76,699	37,736	46,019
Total	**358.28**	**1,415,392**	**1,726,088**	**84,924**	**103,565**	**212,309**	**258,913**	**127,385**	**155,348**

Table F16: Alternative 1: BSC Authority - Nonresidential Buildings: Incremental Difference in Number of EV Capable Spaces between Current 6% Requirement and 15% Alternative Mandatory Provision

Year	New Construction Totals (Million Square Feet)	New Parking Spaces		EV Spaces w/6% Requirement		EV Spaces w/15% Tier 1 Adoption		Incremental Difference	
		Low	High	Low	High	Low	High	Low	High
2021	43.90	164,949	201,157	9,897	12,069	24,742	30,174	14,845	18,104
2022	85.95	323,445	394,446	19,407	23,667	48,517	59,167	29,110	35,500
2023	86.27	325,047	396,399	19,503	23,784	48,757	59,460	29,254	35,676
2024	92.45	344,859	420,560	20,692	25,234	51,729	63,084	31,037	37,850
Total	**308.57**	**1,158,300**	**1,412,561**	**69,498**	**84,754**	**173,745**	**211,884**	**104,247**	**127,131**

Table F17: Alternative 1: DSA Authority - Nonresidential Buildings: Incremental Difference in Number of EV Capable Spaces between Current 6% Requirement and 15% Alternative Mandatory Provision

Year	New Construction Totals (Million Square Feet)	New Parking Spaces		EV Spaces w/6% Requirement		EV Spaces w/15% Tier 1 Adoption		Incremental Difference	
		Low	High	Low	High	Low	High	Low	High
2021	3.87	28,517	34,777	1,711	2,087	4,278	5,216	2,567	3,130
2022	7.95	57,980	70,707	3,479	4,242	8,697	10,606	5,218	6,364
2023	7.78	56,840	69,317	3,410	4,159	8,526	10,398	5,116	6,239
2024	7.73	57,351	69,941	3,441	4,196	8,603	10,491	5,162	6,295
Total	**27.32**	**200,688**	**244,741**	**12,041**	**14,684**	**30,103**	**36,711**	**18,062**	**22,027**

Table F18: Alternative 1: All Nonresidential Buildings: Incremental Cost to Install Raceway and Panel Capacity in 15% of Parking Spaces in New Nonresidential Buildings

Year	**Incremental Difference in EV Capable Parking Spaces Installed**		**Initial Construction Costs**	
			Low	**High**
			$870/Space	**$960/Space**
2021	Low	18,100	$15,747,070	$17,376,077
	High	22,073	$19,203,744	$21,190,338
2022	Low	35,708	$31,066,087	$34,279,821
	High	43,547	$37,885,472	$41,804,659
2023	Low	35,841	$31,181,894	$34,407,607
	High	43,709	$38,026,700	$41,960,496
2024	Low	37,736	$32,830,132	$36,226,352
	High	46,019	$40,036,746	$44,178,478
Total	Low	127,385	$110,825,183	$122,289,857
	High	155,348	$135,152,662	$149,133,972
Average Annual	**Low**	**31,846**	**$27,706,296**	**$30,572,464**
	High	**38,837**	**$33,788,166**	**$37,283,493**

Table F19: Alternative 1: All Nonresidential Buildings: Avoided Retrofit Costs by Installing EV Charging Infrastructure in 15% of Parking Spaces in New Nonresidential Construction

Year	Incremental Difference in EV Capable Parking Spaces Installed		Avoided Retrofit Costs	
			Multiple Level 2 Installations	Single Level 2 Installation
			$7,000/Space	$8,000/Space
2021	Low	18,100	$126,700,564	$144,800,645
	High	22,073	$154,512,883	$176,586,152
2022	Low	35,708	$249,957,025	$285,665,171
	High	43,547	$304,825,640	$348,372,160
2023	Low	35,841	$250,888,802	$286,730,059
	High	43,709	$305,961,953	$349,670,804
2024	Low	37,736	$264,150,485	$301,886,269
	High	46,019	$322,134,738	$368,153,986
Total	Low	127,385	$891,696,876	$1,019,082,144
	High	155,348	$1,087,435,215	$1,242,783,102
Average Annual	**Low**	**31,846**	**$222,924,219**	**$254,770,536**
	High	**38,837**	**$271,858,804**	**$310,695,776**

Table F20: Alternative 1: All Nonresidential Buildings: Statewide Benefit to Install Raceway and Panel Capacity in 15% of Parking Spaces in New Nonresidential Buildings

Year	Range	Initial Construction Costs	Avoided Retrofit Costs	Benefit
2021	Low	$15,747,070	$126,700,564	-$110,953,494
	High	$21,190,338	$176,586,152	-$155,395,814
2022	Low	$31,066,087	$249,957,025	-$218,890,937
	High	$41,804,659	$348,372,160	-$306,567,501
2023	Low	$31,181,894	$250,888,802	-$219,706,908
	High	$41,960,496	$349,670,804	-$307,710,307
2024	Low	$32,830,132	$264,150,485	-$231,320,353
	High	$44,178,478	$368,153,986	-$323,975,508
Total	Low	$110,825,183	$891,696,876	-$780,871,693
	High	$149,133,972	$1,242,783,102	-$1,093,649,130
Average Annual	**Low**	**$27,706,296**	**$222,924,219**	**-$195,217,923**
	High	**$37,283,493**	**$310,695,775**	**-$273,412,283**

Table F21: Alternative 1: BSC Authority - Incremental Cost to Install Raceway and Panel Capacity in 15% of Parking Spaces in New Nonresidential Buildings

Year	Incremental Difference in EV Capable Parking Spaces Installed		Initial Construction Costs	
			Low	High
			$870/Space	$960/Space
2021	Low	14,845	$12,915,474	$14,251,557
	High	18,104	$15,750,578	$17,379,948
2022	Low	29,110	$25,325,780	$27,945,688
	High	35,500	$30,885,097	$34,080,107
2023	Low	29,254	$25,451,168	$28,084,047
	High	35,676	$31,038,009	$34,248,838
2024	Low	31,037	$27,002,485	$29,795,845
	High	37,850	$32,929,860	$36,336,397
Total	Low	104,247	$90,694,906	$100,077,138
	High	127,131	$110,603,544	$122,045,290
Average Annual	**Low**	**26,062**	**$22,673,726**	**$25,019,284**
	High	**31,783**	**$27,650,886**	**$30,511,322**

Table F22: Alternative 1: BSC Authority - Avoided Retrofit Costs by Installing EV Charging Infrastructure in 15% of Parking Spaces in New Nonresidential Buildings

Year	Incremental Difference in EV Capable Parking Spaces Installed		Avoided Retrofit Costs	
			Multiple Level 2 Installations	Single Level 2 Installation
			$7,000/Space	$8,000/Space
2021	Low	8,247	$57,732,002	$65,979,431
	High	10,058	$70,404,880	$80,462,720
2022	Low	16,172	$113,205,912	$129,378,186
	High	19,722	$138,055,991	$157,778,275
2023	Low	16,252	$113,766,394	$130,018,736
	High	19,820	$138,739,505	$158,559,434
2024	Low	17,243	$120,700,763	$137,943,729
	High	21,028	$147,196,052	$168,224,059
Total	Low	57,915	$405,405,071	$463,320,081
	High	70,628	$494,396,428	$565,024,489
Average Annual	**Low**	**14,479**	**$101,351,268**	**$115,830,020**
	High	**17,657**	**$123,599,107**	**$141,256,122**

Table F23: Alternative 1: BSC Authority - Statewide Benefit to Install Raceway and Panel Capacity in 15% of Parking Spaces in New Nonresidential Buildings

Year	Range	Initial Construction Costs	Avoided Retrofit Costs	Benefit
2021	Low	$12,915,474	$57,732,002	-$44,816,528
	High	$17,379,948	$80,462,720	-$63,082,773
2022	Low	$25,325,780	$113,205,912	-$87,880,133
	High	$34,080,107	$157,778,275	-$123,698,168
2023	Low	$25,451,168	$113,766,394	-$88,315,227
	High	$34,248,838	$158,559,434	-$124,310,597
2024	Low	$27,002,485	$120,700,763	-$93,698,278
	High	$36,336,397	$168,224,059	-$131,887,663
Total	Low	$90,694,906	$405,405,071	-$314,710,165
	High	$122,045,290	$565,024,489	-$442,979,200
Average Annual	**Low**	**$22,673,726**	**$101,351,268**	**-$78,677,541**
	High	**$30,511,322**	**$141,256,122**	**-$110,744,800**

Table F24: Alternative 1: DSA Authority - Incremental Cost to Install Raceway and Panel Capacity in 15% of Parking Spaces in New Nonresidential Buildings

Year	Incremental Difference in EV Capable Parking Spaces Installed		Initial Construction Costs	
			Low	High
			$870/Space	$960/Space
2021	Low	2,567	$2,232,863	$2,463,849
	High	3,130	$2,723,003	$3,004,694
2022	Low	5,218	$4,539,798	$5,009,433
	High	6,364	$5,536,339	$6,109,064
2023	Low	5,116	$4,450,572	$4,910,977
	High	6,239	$5,427,527	$5,988,996
2024	Low	5,162	$4,490,604	$4,955,150
	High	6,295	$5,476,347	$6,042,866
Total	Low	18,062	$15,713,838	$17,339,408
	High	22,027	$19,163,217	$21,145,619
Average Annual	**Low**	**4,515**	**$3,928,460**	**$4,334,852**
	High	**5,507**	**$4,790,804**	**$5,286,405**

Table F25: Alternative 1: DSA Authority - Avoided Retrofit Costs by Installing EV Charging Infrastructure in 15% of Parking Spaces in New Nonresidential Construction

Year	Incremental Difference in EV Capable Parking Spaces Installed		Avoided Retrofit Costs	
			Multiple Level 2 Installations	Single Level 2 Installation
			$7,000/Space	$8,000/Space
2021	Low	1,426	$9,980,868	$11,406,707
	High	1,739	$12,171,791	$13,910,618
2022	Low	2,899	$20,292,841	$23,191,818
	High	3,535	$24,747,367	$28,282,705
2023	Low	2,842	$19,894,002	$22,736,002
	High	3,466	$24,260,978	$27,726,832
2024	Low	2,868	$20,072,944	$22,940,508
	High	3,497	$24,479,201	$27,976,229
Total	Low	10,034	$70,240,656	$80,275,035
	High	12,237	$85,659,336	$97,896,384
Average Annual	**Low**	**2,509**	**$17,560,164**	**$20,068,759**
	High	**3,059**	**$21,414,834**	**$24,474,096**

Table F26: Alternative 1: DSA Authority - Combined Statewide Benefit to Install Raceway and Panel Capacity in 15% of Parking Spaces in New Nonresidential Buildings

Year	Range	Initial Construction Costs	Avoided Retrofit Costs	Benefit
2021	Low	$2,232,863	$9,980,868	-$7,748,006
	High	$3,004,694	$13,910,618	-$10,905,925
2022	Low	$4,539,798	$20,292,841	-$15,753,042
	High	$6,109,064	$28,282,705	-$22,173,641
2023	Low	$4,450,572	$19,894,002	-$15,443,430
	High	$5,988,996	$27,726,832	-$21,737,836
2024	Low	$4,490,604	$20,072,944	-$15,582,340
	High	$6,042,866	$27,976,229	-$21,933,364
Total	Low	$15,713,838	$70,240,656	-$54,526,818
	High	$21,145,619	$97,896,384	-$76,750,765
Average Annual	**Low**	**$3,928,460**	**$17,560,164**	**-$13,631,704**
	High	**$5,286,405**	**$24,474,096**	**-$19,187,691**

Alternative 2: Statewide Costs and Benefits for Nonresidential Buildings to Meet 20 Percent Requirement for Raceway and Panel Capacity

Table F27: Alternative 2: All Nonresidential Buildings: Incremental Difference in Number of EV Capable Spaces between Current 6% Requirement and 20% Alternative Mandatory Provision

Year	New Construction Totals (Million Square Feet)	New Parking Spaces		EV Spaces w/6% Requirement		EV Spaces w/20% Tier 2 Adoption		Incremental Difference	
		Low	High	Low	High	Low	High	Low	High
2021	50.81	201,112	245,259	12,067	14,716	40,222	49,052	28,156	34,336
2022	99.99	396,757	483,850	23,805	29,031	79,351	96,770	55,546	67,739
2023	100.53	398,236	485,654	23,894	29,139	79,647	97,131	55,753	67,992
2024	106.95	419,286	511,325	25,157	30,679	83,857	102,265	58,700	71,585
Total	**358.28**	**1,415,392**	**1,726,088**	**84,924**	**103,565**	**283,078**	**345,218**	**198,155**	**241,652**

Table F28: Alternative 2: BSC Authority - Nonresidential Buildings: Incremental Difference in Number of EV Capable Spaces between Current 6% Requirement and 20% Alternative Mandatory Provision

Year	New Construction Totals (Million Square Feet)	New Parking Spaces		EV Spaces w/6% Requirement		EV Spaces w/20% Tier 2 Adoption		Incremental Difference	
		Low	High	Low	High	Low	High	Low	High
2021	43.90	164,949	201,157	9,897	12,069	32,990	40,231	23,093	28,162
2022	85.95	323,445	394,446	19,407	23,667	64,689	78,889	45,282	55,222
2023	86.27	325,047	396,399	19,503	23,784	65,009	79,280	45,507	55,496
2024	92.45	344,859	420,560	20,692	25,234	68,972	84,112	48,280	58,878
Total	**308.57**	**1,158,300**	**1,412,561**	**69,498**	**84,754**	**231,660**	**282,512**	**162,162**	**197,759**

Table F29: Alternative 2: DSA Authority - Nonresidential Buildings: Incremental Difference in Number of EV Capable Spaces between Current 6% Requirement and 20% Alternative Mandatory Provision

Year	New Construction Totals (Million Square Feet)	New Parking Spaces		EV Spaces w/6% Requirement		EV Spaces w/20% Tier 1 Adoption		Incremental Difference	
		Low	High	Low	High	Low	High	Low	High
2021	3.87	28,517	34,777	1,711	2,087	5,703	6,955	3,992	4,869
2022	7.95	57,980	70,707	3,479	4,242	11,596	14,141	8,117	9,899
2023	7.78	56,840	69,317	3,410	4,159	11,368	13,863	7,958	9,704
2024	7.73	57,351	69,941	3,441	4,196	11,470	13,988	8,029	9,792
Total	**27.32**	**200,688**	**244,741**	**12,041**	**14,684**	**40,138**	**48,948**	**28,096**	**34,264**

Table F30: Alternative 2: All Nonresidential Buildings: Incremental Cost to Install Raceway and Panel Capacity in 20% of Parking Spaces in New Nonresidential Buildings

Year	Incremental Difference in EV Capable Parking Spaces Installed		Initial Construction Costs	
			Low	High
			$870/Space	$960/Space
2021	Low	28,156	$24,495,442	$27,029,454
	High	34,336	$29,872,491	$32,962,748
2022	Low	55,546	$48,325,025	$53,324,165
	High	67,739	$58,932,957	$65,029,470
2023	Low	55,753	$48,505,168	$53,522,944
	High	67,992	$59,152,644	$65,271,883
2024	Low	58,700	$51,069,094	$56,352,104
	High	71,585	$62,279,383	$68,722,077
Total	Low	198,155	$172,394,729	$190,228,667
	High	241,652	$210,237,475	$231,986,179
Average Annual	**Low**	**49,539**	**$43,098,682**	**$47,557,167**
	High	**60,413**	**$52,559,369**	**$57,996,545**

Table F31: Alternative 2: All Nonresidential Buildings: Avoided Retrofit Costs by Installing EV Charging Infrastructure in 20% of Parking Spaces in New Nonresidential Construction

Year	Incremental Difference in EV Capable Parking Spaces Installed		Avoided Retrofit Costs	
			Multiple Level 2 Installations	Single Level 2 Installation
			$7,000/Space	$8,000/Space
2021	Low	28,156	$197,089,767	$225,245,448
	High	34,336	$240,353,374	$274,689,570
2022	Low	55,546	$388,822,039	$444,368,044
	High	67,739	$474,173,218	$541,912,249
2023	Low	55,753	$390,271,469	$446,024,536
	High	67,992	$475,940,816	$543,932,361
2024	Low	58,700	$410,900,755	$469,600,863
	High	71,585	$501,098,481	$572,683,979
Total	Low	198,155	$1,387,084,029	$1,585,238,891
	High	241,652	$1,691,565,889	$1,933,218,159
Average Annual	**Low**	**49,539**	**$346,771,007**	**$396,309,723**
	High	**60,413**	**$422,891,472**	**$483,304,540**

Table F32: Alternative 2: All Nonresidential Buildings: Statewide Benefit to Install Raceway and Panel Capacity in 20% of Parking Spaces in New Nonresidential Buildings

Year	Range	Initial Construction Costs	Avoided Retrofit Costs	Benefit
2021	Low	$24,495,442	$197,089,767	-$172,594,324
	High	$32,962,748	$274,689,570	-$241,726,822
2022	Low	$48,325,025	$388,822,039	-$340,497,014
	High	$65,029,470	$541,912,249	-$476,882,779
2023	Low	$48,505,168	$390,271,469	-$341,766,301
	High	$65,271,883	$543,932,361	-$478,660,478
2024	Low	$51,069,094	$410,900,755	-$359,831,661
	High	$68,722,077	$572,683,979	-$503,961,901
Total	Low	$172,394,729	$1,387,084,029	-$1,214,689,300
	High	$231,986,179	$1,933,218,159	-$1,701,231,980
Average Annual	**Low**	**$43,098,682**	**$346,771,007**	**-$303,672,325**
	High	**$57,996,545**	**$483,304,540**	**-$425,307,995**

Table F33: Alternative 2: BSC Authority - Incremental Cost to Install Raceway and Panel Capacity in 20% of Parking Spaces in New Nonresidential Buildings

Year	Incremental Difference in EV Capable Parking Spaces Installed		Initial Construction Costs	
			Low	High
			$870/Space	$960/Space
2021	Low	23,093	$20,090,737	$22,169,089
	High	28,162	$24,500,898	$27,035,474
2022	Low	45,282	$39,395,658	$43,471,070
	High	55,222	$48,043,485	$53,013,500
2023	Low	45,507	$39,590,705	$43,686,295
	High	55,496	$48,281,348	$53,275,970
2024	Low	48,280	$42,003,865	$46,349,093
	High	58,878	$51,224,226	$56,523,284
Total	Low	162,162	$141,080,965	$155,675,547
	High	197,759	$172,049,957	$189,848,228
Average Annual	**Low**	**40,541**	**$35,270,241**	**$38,918,887**
	High	**49,440**	**$43,012,489**	**$47,462,057**

Table F34: Alternative 2: BSC Authority - Avoided Retrofit Costs by Installing EV Charging Infrastructure in 20% of Parking Spaces in New Nonresidential Construction

Year	Incremental Difference in EV Capable Parking Spaces Installed		Avoided Retrofit Costs	
			Multiple Level 2 Installations	Single Level 2 Installation
			$7,000/Space	$8,000/Space
2021	Low	16,495	$115,464,004	$131,958,861
	High	20,116	$140,809,761	$160,925,441
2022	Low	32,345	$226,411,825	$258,756,371
	High	39,445	$276,111,981	$315,556,550
2023	Low	32,505	$227,532,788	$260,037,473
	High	39,640	$277,479,010	$317,118,869
2024	Low	34,486	$241,401,525	$275,887,457
	High	42,056	$294,392,104	$336,448,119
Total	Low	115,830	$810,810,142	$926,640,163
	High	141,256	$988,792,856	$1,130,048,979
Average Annual	**Low**	**28,958**	**$202,702,536**	**$231,660,041**
	High	**35,314**	**$247,198,214**	**$282,512,245**

Table F35: Alternative 2: BSC Authority - Statewide Benefit to Install Raceway and Panel Capacity in 20% of Parking Spaces in New Nonresidential Buildings

Year	Range	Initial Construction Costs	Avoided Retrofit Costs	Benefit
2021	Low	$20,090,737	$115,464,004	-$95,373,267
	High	$27,035,474	$160,925,441	-$133,889,967
2022	Low	$39,395,658	$226,411,825	-$187,016,167
	High	$53,013,500	$315,556,550	-$262,543,050
2023	Low	$39,590,705	$227,532,788	-$187,942,083
	High	$53,275,970	$317,118,869	-$263,842,899
2024	Low	$42,003,865	$241,401,525	-$199,397,660
	High	$56,523,284	$336,448,119	-$279,924,835
Total	Low	$141,080,965	$810,810,142	-$669,729,178
	High	$189,848,228	$1,130,048,979	-$940,200,750
Average Annual	**Low**	**$35,270,241**	**$202,702,536**	**-$167,432,294**
	High	**$47,462,057**	**$282,512,245**	**-$235,050,188**

Table F36: Alternative 2: DSA Authority - Incremental Cost to Install Raceway and Panel Capacity in 20% of Parking Spaces in New Nonresidential Buildings

Year	Incremental Difference in EV Capable Parking Spaces Installed		Initial Construction Costs	
			Low	High
			$870/Space	$960/Space
2021	Low	3,992	$3,473,342	$3,832,653
	High	4,869	$4,235,783	$4,673,968
2022	Low	8,117	$7,061,909	$7,792,451
	High	9,899	$8,612,084	$9,502,989
2023	Low	7,958	$6,923,113	$7,639,297
	High	9,704	$8,442,820	$9,316,216
2024	Low	8,029	$6,985,385	$7,708,011
	High	9,792	$8,518,762	$9,400,013
Total	Low	28,096	$24,443,748	$26,972,412
	High	34,264	$29,809,449	$32,893,185
Average Annual	**Low**	**7,024**	**$6,110,937**	**$6,743,103**
	High	**8,566**	**$7,452,362**	**$8,223,296**

Table F37: Alternative 2: DSA Authority - Avoided Retrofit Costs by Installing EV Charging Infrastructure in 20% of Parking Spaces in New Nonresidential Construction

Year	Incremental Difference in EV Capable Parking Spaces Installed		Avoided Retrofit Costs	
			Multiple Level 2 Installations	Single Level 2 Installation
			$7,000/Space	$8,000/Space
2021	Low	2,852	$19,961,737	$22,813,414
	High	3,478	$24,343,582	$27,821,236
2022	Low	5,798	$40,585,682	$46,383,636
	High	7,071	$49,494,734	$56,565,410
2023	Low	5,684	$39,788,004	$45,472,005
	High	6,932	$48,521,956	$55,453,664
2024	Low	5,735	$40,145,889	$45,881,016
	High	6,994	$48,958,401	$55,952,458
Total	Low	20,069	$140,481,312	$160,550,070
	High	24,474	$171,318,673	$195,792,769
Average Annual	**Low**	**5,017**	**$35,120,328**	**$40,137,518**
	High	**6,119**	**$42,829,668**	**$48,948,192**

Table F38: Alternative 2: DSA Authority - Combined Statewide Benefit to Install Raceway and Panel Capacity in 20% of Parking Spaces in New Nonresidential Buildings

Year	Range	Initial Construction Costs	Avoided Retrofit Costs	Benefit
2021	Low	$3,473,342	$19,961,737	-$16,488,395
	High	$4,673,968	$27,821,236	-$23,147,268
2022	Low	$7,061,909	$40,585,682	-$33,523,773
	High	$9,502,989	$56,565,410	-$47,062,421
2023	Low	$6,923,113	$39,788,004	-$32,864,891
	High	$9,316,216	$55,453,664	-$46,137,449
2024	Low	$6,985,385	$40,145,889	-$33,160,504
	High	$9,400,013	$55,952,458	-$46,552,445
Total	Low	$24,443,748	$140,481,312	-$116,037,563
	High	$32,893,185	$195,792,769	-$162,899,584
Average Annual	**Low**	**$6,110,937**	**$35,120,328**	**-$29,009,391**
	High	**$8,223,296**	**$48,948,192**	**-$40,724,896**

Table F39: Cost per Square Foot Estimates for California (RS Means, 2019)

Range	Retail, Grocery, Restaurant	Office	Misc. (Mixed Use)	Warehouses	Hospitals	Schools	Colleges	Hotels (Parking Garage/Mixed Use)
Low	$139	$154	$184	$69	$245	$162	$202	$164
High	$284	$285	$335	$238	$395	$286	$368	$177

Table F40: Total Construction Cost Estimates for California ($Billions)

Range	Retail, Grocery, and Restaurant	Office (Small and Large)	Misc.	Warehouses	Hospitals	College & Schools	Hotels	Total	Total - BSC Authority Only	Total - DSA Authority	Total - HCD Authority
Low	$10.301	$11.770	$13.563	$4.419	$4.898	$4.771	$3.670	$53.395	$44.953	$4.771	$3.670
High	$21.123	$21.783	$24.693	$15.244	$7.897	$8.518	$3.961	$103.223	$90.743	$8.518	$3.961

Table F41: Suggested Code Change: 10% Raceway and Panel Capacity

Total Statewide Costs (Mid 2021-2024) for EV Charging Infrastructure			**Percent of Total New Construction Costs**	
State Agency Authority	Low	High	Low	High
All	$49,255,637	$66,281,765	0.092%	0.064%
BSC	$40,308,847	$54,242,351	0.090%	0.060%
DSA	$6,983,928	$9,398,053	0.146%	0.110%
HCD	$1,962,862	$2,641,362	0.053%	0.067%

Table F42: Alternative 1: 15% Raceway and Panel Capacity

Total Statewide Costs (Mid 2021-2024) for EV Charging Infrastructure			Percent of Total New Construction Costs	
State Agency Authority	Low	High	Low	High
All	$110,825,183	$149,133,972	0.208%	0.144%
BSC	$90,694,906	$122,045,290	0.202%	0.134%
DSA	$15,713,838	$21,145,619	0.329%	0.248%
HCD	$4,416,439	$5,943,064	0.120%	0.150%

Table F43: Alternative 2: 20% Raceway and Panel Capacity

Total Statewide Costs (Mid 2021-2024) for EV Charging Infrastructure			Percent of Total New Construction Costs	
State Agency Authority	Low	High	Low	High
All	$172,394,729	$231,986,179	0.323%	0.225%
BSC	$141,080,965	$189,848,228	0.314%	0.209%
DSA	$24,443,748	$32,893,185	0.512%	0.386%
HCD	$6,870,016	$9,244,766	0.187%	0.233%

Appendix G. Statewide Costs and Benefits for Additional Code Changes for All Nonresidential Buildings

Adopt Suggested 10 Percent Requirement and Installation of One Level 2 Charger in Each New Building

In addition to adopting a ten percent requirement to install raceway and panel capacity, CARB staff recommends that at least one Level 2 charger be installed in each new nonresidential building. CARB staff estimate that the cost for EV Capable building standards in nonresidential new construction is between $870-960 to install raceway and 40-amp, 208/240-volt panel capacity per space. CARB staff estimates that a total of 25,851 new nonresidential buildings with 10 parking spaces or more would be constructed by 2025. CARB staff estimates a CALGreen Code requirement to install one Level 2 charger would add approximately $1,630 to $2,040 in incremental costs to each building.

Statewide cost estimates for building standards are based on the incremental difference between the current 6 Percent requirement and a 10 Percent requirement. Therefore, the statewide cost estimate is based on an incremental number of approximately 57,000 to 69,000 EV Capable spaces. As a result, the total statewide costs for a ten percent requirement in combination with a requirement to install one Level 2 charger per building is between $91 million and $119 million for the four-year time period between mid-2021 and the end of 2024. Average annual costs of this alternative option are between $23 million and $30 million.

Statewide Benefit

Significant retrofit costs between $7,000 and $8,000 per space can be avoided by installing EV charging infrastructure in new construction. Overall, there is a significant statewide cost benefit with this alternative option considered for the 2019/2020 Intervening Code Cycle. Over the four-year period between mid-2021 and the end of 2024, statewide retrofit costs between $396 million and $552 million could be avoided, which results in an overall estimated statewide benefit (avoided costs) of $305 to $443 million between mid-2021 and the end of 2024. Annually, average retrofit costs between $99 million and $138 million could be avoided, which results in an estimated average statewide benefit (avoided costs) of $76 million to $108 million. The following tables include documentation to support these cost estimates.

Table G1: Cost Estimates for Commercial Grade Level 2 Chargers

Manufacturer	Product Name	Basic EVSE	Smart EVSE	Ports	Port Unit Cost[5]	Port Cost w. Pedestal	Charging Power (kW)
Elmec	EV Duty 40 Smart Pro		x	1	$1,219		7.2
Delta	EV AC 30 Networked 25'		x	1	$1,050		7.2
Delta	EV AC 40 Networked 25'		x	1	$1,160		9.6
EVo Charge	30A EVoReel EVSE Networked		x	1	$2,399	$3,399	7.2
EVo Charge	30A EVoCharge iEVSE		x	1	$1,599	$2,599	7.2
EVo Charge	30A EVoCharge iEVSE Dual Port		x	2		$2,100	7.2
PowerCharge	Energy Platinum Commercial EV Charger		x	1	$1,099		7.4
PowerCharge	P20DWN Networked Commercial EV Charger		x	2	$1,998		7.2
PowerCharge	P20DPN Networked Commercial EV Charger		x	2		$2,248	7.2
Juice Box	Pro 75C		x	1	$899		18
Juice Box	Pro 40C		x	1	$579		10
EVBox	Double Businessline Hub Charging Station		x	2		$2,478	7.4
ChargePoint	CT4021-GW1 Dual Bollard Charging Station		x	2		$3,605	7.2
Webasto	EVSE RS	x		1	$599		7.4
Bosch	EV200 Series	x		1	$749		7.2
Bosch	Bollard EV850	x		1		$1,697	7.2
Bosch	Bollard EV860	x		2		$1,443	7.2
Clipper Creek	HCS-50	x		1	$635	$1,555	9.6
Clipper Creek	HCS-60	x		1	$899	$1,620	11.5

[5] Costs listed are those published on publicly available manufacturer websites as of September 2019; costs may vary and additional products may be available by contacting charger manufacturers directly.

Manufacturer	Product Name	Basic EVSE	Smart EVSE	Ports	Port Unit Cost[5]	Port Cost w. Pedestal	Charging Power (kW)
Clipper Creek	HCS-40	x		1	$565	$1,285	7.2
Clipper Creek	CS-60	x		1	$1,995	$2,695	11.5
Clipper Creek	CS-40	x		1	$1,750	$2,450	7.4
Elmec	EV Duty 40	x		1	$819		7.2
Leviton	Evr-Green e30	x		1	$779	$1,537	7.2
Leviton	Evr-Green e40	x		1	$953	$1,711	9.6
Delta	EV AC 30	x		1	$590		7.2
EVBox	Double Businessline Hub Charging Station	x		2		$2,090	7.4
EVo Charge	EVoInnovate EVSE 25'	x		1	$649		7.4
EVo Charge	30A EVoReel EVSE	x		1	$1,599	$2,599	7.2
EVo Charge	30A EVoCharge EVSE	x		1	$799	$1,799	7.2
EVo Charge	30A EVoCharge EVSE Dual Port	x		2		$1,300	7.2
PowerCharge	P20SW Commercial EV Charger	x		1	$1,795		7.2
PowerCharge	P20SP Commercial EV Charger	x		1		$2,095	7.2
PowerCharge	P20DW Commercial EV Charger	x		2	$1,248		7.2
PowerCharge	P20DP Commercial EV Charger	x		2		$1,348	7.2
WattZilla	Wall Wattz 40 Amp EVSE	x			$799		7.2
Basic EVSE Average Cost per Port					**$1,389**		
Networked EVSE Average Cost per Port					**$1,895**		

Table G2: Low-Range: New Construction Cost Estimate to Install Wiring and Level 2 EV Charger

Component	Description	Material	Labor	Total	Estimated Cost per Parking Space
EMT Conduit Circuits[1]	Cost per circuit based on 30' run from the panel. Includes THHN copper wire pulled in conduit, 2 compression connectors, 2 couplings, conduit binding, straps, bolts, and washer. 50 amp circuit - 5 #8 wire, 1" conduit (4X for 120' Run)	$ 73.40	$ 202.00	$ 275.40	$ 1,102
Level 2 EV Charger	Average cost of a Level 2 EV Charger based on data from multiple manufacturers			$ 1,389.00	$ 1,389.00
Total					$ 2,500.00

[1]Source: 2019 National Construction Estimator, 67th Edition, Edited by Richard Pray, Craftsman Book Company, November 2018.

Table G3: High-Range: New Construction Cost Estimate to Install Wiring and Level 2 EV Charger

Component	Description	Material	Labor	Total	Estimated Cost per Parking Space
EMT Conduit Circuits[1]	Cost per circuit based on 30' run from the panel. Includes THHN copper wire pulled in conduit, 2 compression connectors, 2 couplings, conduit binding, straps, bolts, and washer. 50 amp circuit - 5 #8 wire, 1" conduit (4X for 120' Run)	$ 73.40	$ 202.00	$ 275.40	$ 1,102
Level 2 EV Charger	Average cost of a Level 2 EV Charger based on data from multiple manufacturers			$ 1,895.00	$ 1,895.00
Total					$ 3,000.00

[1]Source: 2019 National Construction Estimator, 67th Edition, Edited by Richard Pray, Craftsman Book Company, November 2018.

Table G4: Incremental Cost to Install Raceway and Panel Capacity in 10% of Parking Spaces in All New Nonresidential Buildings

Year	Incremental Difference in EV Capable Parking Spaces Installed		Initial Construction Costs	
			Low	High
			$870/Space	$960/Space
2021	Low	8,044	$6,998,698	$7,722,701
	High	9,810	$8,534,997	$9,417,928
2022	Low	15,870	$13,807,150	$15,235,476
	High	19,354	$16,837,988	$18,579,849
2023	Low	15,929	$13,858,620	$15,292,270
	High	19,426	$16,900,756	$18,649,110
2024	Low	16,771	$14,591,170	$16,100,601
	High	20,453	$17,794,109	$19,634,879
Total	Low	56,616	$49,255,637	$54,351,048
	High	69,044	$60,067,850	$66,281,765
Average Annual	**Low**	**14,154**	**$12,313,909**	**$13,587,762**
	High	**17,261**	**$15,016,962**	**$16,570,441**

Table G5: Estimated Statewide Cost to Install One Level 2 Charger in Each New Nonresidential Building

Year	New Buildings Constructed w/10 Parking Spaces or More	Initial Construction Costs		Raceway and Panel Capacity Costs		Incremental Cost	
		Low	High	Low	High	Low	High
		$2,500.00	$3,000.00	$870.00	$960.00	$1,630.00	$2,040.00
2021	3,712	$9,280,008	$11,136,010	$3,229,443	$3,563,523	$6,050,565	$7,572,487
2022	7,240	$18,098,766	$21,718,519	$6,298,371	$6,949,926	$11,800,396	$14,768,593
2023	7,241	$18,102,270	$21,722,724	$6,299,590	$6,951,272	$11,802,680	$14,771,452
2024	7,659	$19,146,305	$22,975,566	$6,662,914	$7,352,181	$12,483,391	$15,623,385
Total	25,851	$64,627,349	$77,552,819	$22,490,318	$24,816,902	$42,137,032	$52,735,917
Average Annual		**$16,156,837**	**$19,388,205**	**$5,622,579**	**$6,204,226**	**$10,534,258**	**$13,183,979**

Table G6: Avoided Retrofit Costs by Installing EV Charging Infrastructure in New Nonresidential Construction

Year	Incremental Difference in EV Capable Parking Spaces Installed		Avoided Retrofit Costs	
			Multiple Level 2 Installations	Single Level 2 Installation
			$7,000/Space	$8,000/Space
2021	Low	8,044	$56,311,362	$64,355,842
	High	9,810	$68,672,393	$78,482,734
2022	Low	15,870	$111,092,011	$126,962,298
	High	19,354	$135,478,062	$154,832,071
2023	Low	15,929	$111,506,134	$127,435,582
	High	19,426	$135,983,090	$155,409,246
2024	Low	16,771	$117,400,216	$134,171,675
	High	20,453	$143,170,995	$163,623,994
Total	Low	56,616	$396,309,723	$452,925,397
	High	69,044	$483,304,540	$552,348,046
Average Annual	**Low**	**14,154**	**$99,077,431**	**$113,231,349**
	High	**17,261**	**$120,826,135**	**$138,087,011**

Table G7: Combined Statewide Benefit to Install Raceway and Panel Capacity in 10% of Parking Spaces and One Level 2 Charger in New Nonresidential Buildings

Year	Range	Initial Construction Costs	Avoided Retrofit Costs	Benefit
2021	Low	$13,049,263	$56,311,362	-$43,262,099
	High	$16,990,415	$78,482,734	-$61,492,320
2022	Low	$25,607,545	$111,092,011	-$85,484,466
	High	$33,348,442	$154,832,071	-$121,483,629
2023	Low	$25,661,299	$111,506,134	-$85,844,835
	High	$33,420,562	$155,409,246	-$121,988,684
2024	Low	$27,074,561	$117,400,216	-$90,325,655
	High	$35,258,264	$163,623,994	-$128,365,729
Total	Low	$91,392,669	$396,309,723	-$304,917,054
	High	$119,017,683	$552,348,046	-$433,330,363
Average Annual	**Low**	**$22,848,167**	**$99,077,431**	**-$76,229,263**
	High	**$29,754,421**	**$138,087,011**	**-$108,332,591**

Table G8: BSC Authority - Incremental Cost to Install Raceway and Panel Capacity in 10% of Parking Spaces in New Nonresidential Buildings Under BSC Authority

Year	Incremental Difference in EV Capable Parking Spaces Installed		Initial Construction Costs	
			Low	High
			$870/Space	$960/Space
2021	Low	6,598	$5,740,210	$6,334,025
	High	9,810	$8,534,997	$9,417,928
2022	Low	15,870	$13,807,150	$15,235,476
	High	19,354	$16,837,988	$18,579,849
2023	Low	15,929	$13,858,620	$15,292,270
	High	19,426	$16,900,756	$18,649,110
2024	Low	16,771	$14,591,170	$16,100,601
	High	20,453	$17,794,109	$19,634,879
Total	Low	46,332	$40,308,847	$44,478,728
	High	56,502	$49,157,131	$54,242,351
Average Annual	**Low**	**11,583**	**$10,077,212**	**$11,119,682**
	High	**14,126**	**$12,289,283**	**$13,560,588**

Table G9: BSC Authority - Estimated Statewide Cost to Install One Level 2 Charger in Each New Nonresidential Building

Year	New Buildings Constructed	Initial Construction Costs		Raceway and Panel Capacity Costs		Incremental Cost	
		Low	High	Low	High	Low	High
		$2,500.00	$3,000.00	$870.00	$960.00	$1,630.00	$2,040.00
2021	3,197	$7,992,563	$9,591,075	$2,781,412	$3,069,144	$5,211,151	$6,521,931
2022	6,235	$15,587,866	$18,705,439	$5,424,577	$5,985,741	$10,163,289	$12,719,699
2023	6,236	$15,590,883	$18,709,060	$5,425,627	$5,986,899	$10,165,256	$12,722,161
2024	6,596	$16,490,077	$19,788,092	$5,738,547	$6,332,189	$10,751,530	$13,455,903
Total	22,265	$55,661,389	$66,793,666	$19,370,163	$21,373,973	$36,291,225	$45,419,693
Average Annual		**$13,915,347**	**$16,698,417**	**$4,842,541**	**$5,343,493**	**$9,072,806**	**$11,354,923**

Table G10: BSC Authority - Avoided Retrofit Costs by Installing EV Charging Infrastructure in New Nonresidential Construction

Year	Incremental Difference in EV Capable Parking Spaces Installed		Avoided Retrofit Costs	
			Multiple Level 2 Installations	Single Level 2 Installation
			$7,000/Space	$8,000/Space
2021	Low	6,598	$46,185,601	$52,783,545
	High	9,810	$68,672,393	$78,482,734
2022	Low	15,870	$111,092,011	$126,962,298
	High	19,354	$135,478,062	$154,832,071
2023	Low	15,929	$111,506,134	$127,435,582
	High	19,426	$135,983,090	$155,409,246
2024	Low	16,771	$117,400,216	$134,171,675
	High	20,453	$143,170,995	$163,623,994
Total	Low	46,332	$324,324,057	$370,656,065
	High	56,502	$395,517,143	$452,019,592
Average Annual	**Low**	**11,583**	**$81,081,014**	**$92,664,016**
	High	**14,126**	**$98,879,286**	**$113,004,898**

Table G11: BSC Authority - Combined Statewide Benefit to Install Raceway and Panel Capacity in 10% of Parking Spaces and One Level 2 Charger in New Nonresidential Buildings Under BSC Authority

Year	Range	Initial Construction Costs	Avoided Retrofit Costs	Benefit
2021	Low	$10,951,361	$46,185,601	-$35,234,240
	High	$15,939,859	$78,482,734	-$62,542,875
2022	Low	$23,970,439	$111,092,011	-$87,121,573
	High	$31,299,547	$154,832,071	-$123,532,524
2023	Low	$24,023,876	$111,506,134	-$87,482,259
	High	$31,371,270	$155,409,246	-$124,037,976
2024	Low	$25,342,700	$117,400,216	-$92,057,516
	High	$33,090,782	$163,623,994	-$130,533,212
Total	Low	$76,600,072	$324,324,057	-$247,723,984
	High	$99,662,044	$452,019,592	-$352,357,547
Average Annual	**Low**	**$19,150,018**	**$81,081,014**	**-$61,930,996**
	High	**$24,915,511**	**$113,004,898**	**-$88,089,387**

Table G12: DSA Authority - Incremental Cost to Install Raceway and Panel Capacity in 10% of Parking Spaces in New Nonresidential Buildings Under DSA Authority

Year	Incremental Difference in EV Capable Parking Spaces Installed		Initial Construction Costs	
			Low	High
			$870/Space	$960/Space
2021	Low	1,141	$992,383	$1,095,044
	High	1,391	$1,210,224	$1,335,419
2022	Low	2,319	$2,017,688	$2,226,415
	High	2,828	$2,460,595	$2,715,140
2023	Low	2,274	$1,978,032	$2,182,656
	High	2,773	$2,412,234	$2,661,776
2024	Low	2,294	$1,995,824	$2,202,289
	High	2,798	$2,433,932	$2,685,718
Total	Low	8,028	$6,983,928	$7,706,403
	High	9,790	$8,516,985	$9,398,053
Average Annual	**Low**	**2,007**	**$1,745,982**	**$1,926,601**
	High	**2,447**	**$2,129,246**	**$2,349,513**

Table G13: DSA Authority - Estimated Statewide Cost to Install One Level 2 Charger in Each New Nonresidential Building

Year	New Buildings Constructed	Initial Construction Costs		Raceway and Panel Capacity Costs		Incremental Cost	
		Low	High	Low	High	Low	High
		$2,500.00	$3,000.00	$870.00	$960.00	$1,630.00	$2,040.00
2021	283	$707,694	$849,233	$246,278	$271,755	$461,417	$577,479
2022	552	$1,380,214	$1,656,256	$480,314	$530,002	$899,899	$1,126,254
2023	552	$1,380,481	$1,656,577	$480,407	$530,105	$900,074	$1,126,472
2024	584	$1,460,099	$1,752,119	$508,115	$560,678	$951,985	$1,191,441
Total	1,971	$4,928,488	$5,914,186	$1,715,114	$1,892,539	$3,213,374	$4,021,646
Average Annual		**$1,232,122**	**$1,478,546**	**$428,778**	**$473,135**	**$803,344**	**$1,005,412**

Table G14: DSA Authority - Avoided Retrofit Costs by Installing EV Charging Infrastructure in New Nonresidential Construction

Year	Incremental Difference in EV Capable Parking Spaces Installed		Avoided Retrofit Costs	
			Multiple Level 2 Installations	Single Level 2 Installation
			$7,000/Space	$8,000/Space
2021	Low	6,598	$46,185,601	$52,783,545
	High	9,810	$68,672,393	$78,482,734
2022	Low	15,870	$111,092,011	$126,962,298
	High	19,354	$135,478,062	$154,832,071
2023	Low	15,929	$111,506,134	$127,435,582
	High	19,426	$135,983,090	$155,409,246
2024	Low	16,771	$117,400,216	$134,171,675
	High	20,453	$143,170,995	$163,623,994
Total	Low	46,332	$324,324,057	$370,656,065
	High	56,502	$395,517,143	$452,019,592
Average Annual	**Low**	**11,583**	**$81,081,014**	**$92,664,016**
	High	**14,126**	**$98,879,286**	**$113,004,898**

Table G15: DSA Authority - Combined Statewide Benefit to Install Raceway and Panel Capacity in 10% of Parking Spaces and One Level 2 Charger in New Nonresidential Buildings Under BSC Authority

Year	Range	Initial Construction Costs	Avoided Retrofit Costs	Benefit
2021	Low	$1,453,800	$46,185,601	-$44,731,801
	High	$1,912,898	$78,482,734	-$76,569,836
2022	Low	$2,917,588	$111,092,011	-$108,174,424
	High	$3,841,394	$154,832,071	-$150,990,677
2023	Low	$2,878,106	$111,506,134	-$108,628,028
	High	$3,788,248	$155,409,246	-$151,620,998
2024	Low	$2,947,809	$117,400,216	-$114,452,407
	High	$3,877,159	$163,623,994	-$159,746,835
Total	Low	$10,197,302	$324,324,057	-$314,126,755
	High	$13,419,699	$452,019,592	-$438,599,892
Average Annual	**Low**	**$2,549,326**	**$81,081,014**	**-$78,531,689**
	High	**$3,354,925**	**$113,004,898**	**-$109,649,973**

Appendix H: Summary of Local Government Reach Standards

Table H1: Summary of Nonresidential EV Charging Infrastructure Local Government Reach Standards

Region	Jurisdiction	EV Charging Percent Requirement
East Bay	Berkeley	3% Pre-wired in developments with 20+ parking spaces
	Fremont	10% EV Ready with Full Circuit
	Oakland	10% Full Circuit plus 10% Inaccessible Raceway and 20% total Electrical Panel Capacity.
	Contra Costa County	6% - EVSE Installed
San Francisco County	City and County of San Francisco	New construction and major alterations where electrical service is upgraded: 10% EV Spaces with full branch circuit, 20% Panel Capacity & 100% - Conduit Only ; Installation of 1 DCFC can replace up to 10 EV Spaces
North Bay	Healdsburg	8% Tier 1 applies to buildings over 10,000 s.f.
	San Rafael	8% EV Capable (Tier 1)
	Santa Rosa	8% EV Capable (Tier 1)
	Marin County	New construction: 100% EV Capable and 10% EV Ready; Additions and Alterations: Main Electrical Panel Modified, Add Capacity for 20% of Parking Spaces, If more than 25% of parking lot surface is modified, add circuit to all parking spaces.
Silicon Valley	Palo Alto	25% EV Ready with at least 5% EVSE Installed; Hotels Only: 30% EV Ready with 10% EVSE Installed
	Portola Valley	6% EV Capable with 50 amp panel capacity AND raceway or wiring to accommodate 100 amp circuit per EV Space
	Santa Clara County	5% - EV Capable & 1% Additional Shall Install EVSE
	San Mateo	10% - EV Capable (Tier 2)
	Cupertino	10% - EV Capable (Tier 2)
	Menlo Park	New construction: 15% Pre-Wire and 10% EVSE Installed in Buildings greater than 9,999 s.f. and Additions and/or Alterations: 10% Pre-Wire and 1% EVSE
Central LA	Los Angeles	6% EV Capable; Plus at least 1 EVSE or more for parking lots with 51 spaces or more; 5 EVSE for every 500 parking spaces.
South LA	Long Beach	25% EV Capable & 5% EV Chargers
West LA	Santa Monica	Minimum Load for EV charging shall be no less than 10kW for 5% of parking spaces
East LA	Pasadena	8% EV Capable (Tier 1) for buildings > 25,000 s.f.; 10% EV Capable (Tier 2) for buildings > 50,000 s.f.
Central Coast	Santa Cruz	6% - EVSE Installed
San Diego County	Carlsbad	10% EV Capable with 50% EVSE Installed

Table H2: Estimated Number of Additional "Beyond Code" EV Capable Spaces, EV Ready Spaces and EV Charging Stations from New Nonresidential Buildings (2021-2025)

Jurisdiction	Population[1]	Projected new nonresidential construction from 2021-2025 (square feet)	Maximum Estimated New Parking from 2021-2025	Adjusted New Parking from 2021-2025	Percent Above Code	EV Capable Spaces	EV Ready Spaces	EV Chargers	Low-Range Total	High-Range Total
California	**39,557,045**	**358,277,212**	**275**	**60% of Jurisdictions Allow for 30% Reduction in Parking**						
Berkeley[2]	121,643	1,101,748	4,006	3,285	3%	0	99	0	10	30
Fremont[2]	237,807	2,153,872	7,832	6,422	4%	0	642	0	64	193
Oakland	429,082	3,886,294	14,132	11,588	14%	0	1622	0	162	487
Contra Costa County[2]	1,150,215	10,417,761	37,883	31,064	0%	0	0	1864	1864	1864
San Francisco	883,305	8,000,296	29,092	23,855	14%	0	3,340	0	334	1002
Healdsburg	12,104	109,629	399	327	2%	7	0	0	1	2
San Rafael	58,704	531,696	1,933	1,585	2%	32	0	0	3	10
Santa Rosa	177,586	1,608,437	5,849	4,796	2%	96	0	0	10	29
Marin County	259,666	2,351,854	8,552	7,013	94%	6592	701	0	729	2188

Jurisdiction	Population[1]	Projected new nonresidential construction from 2021-2025 (square feet)	Maximum Estimated New Parking from 2021-2025	Adjusted New Parking from 2021-2025	Percent Above Code	EV Capable Spaces	EV Ready Spaces	EV Chargers	Low-Range Total	High-Range Total
California	**39,557,045**	**358,277,212**	**275**	**60% of Jurisdictions Allow for 30% Reduction in Parking**						
Palo Alto[2]	66,666	603,809	2,196	1,800	19%	342	0	90	124	193
Portola Valley	4,611	41,763	152	125	0%	0	0	0	0	0
Santa Clara County	1,937,570	17,549,015	63,815	52,328	1%	0	0	523	523	523
San Mateo	105,025	951,235	3,459	2,836	4%	113	0	0	11	34
Cupertino	60,170	544,973	1,982	1,625	4%	65	0	0	7	20
Menlo Park	34,549	312,918	1,138	933	9%	0	84	93	102	118
Los Angeles	3,990,456	36,142,473	131,427	107,770	0%	0	0	1,078	1078	1078
Long Beach	467,354	4,232,932	15,392	12,622	19%	2398	0	631	871	1351
Santa Monica	91,411	827,930	3,011	2,469	0%	0	0	0	0	0
Pasadena	141,371	1,280,430	4,656	3,818	3%	115	0	2	13	36
Santa Cruz[3]	64,725	586,229	2,132	1,748	6%	0	0	105	105	105

Jurisdiction	Population[1]	Projected new nonresidential construction from 2021-2025 (square feet)	Maximum Estimated New Parking from 2021-2025	Adjusted New Parking from 2021-2025	Percent Above Code	EV Capable Spaces	EV Ready Spaces	EV Chargers	Low-Range Total	High-Range Total
California	**39,557,045**	**358,277,212**	**275**	**60% of Jurisdictions Allow for 30% Reduction in Parking**						
Carlsbad	115,877	1,049,525	3,816	3,129	4%	125	0	63	75	100
Totals	10,409,897	94,284,820	342,854	281,140	Varies	9,885	6,488	4,449	6,086	9,361

Appendix I: Copy of Locally Adopted EV Charging Reach Standards for Nonresidential

City of Los Angeles

SEC. 99.05.106. SITE DEVELOPMENT.
(Amended by Ord. No. 184,692, Eff. 12/30/16.)

99.05.106.5.3. Electric Vehicle (EV) Charging [N]. Construction shall comply with LAMC Paragraphs 99.05.106.5.3 through 99.05.106.5.3.3 and CALGreen Sections 5.106.5.3.4 and 5.106.5.3.5 to facilitate the installation of electric vehicle supply equipment (EVSE). When EVSEs is/are installed, it shall be in accordance with the Los Angeles Building Code, the Los Angeles Electrical Code and as follows: **(Amended by Ord. No. 185,198, Eff. 11/22/17.)**

99.05.106.5.3.1. Single EV Charging Space Requirements [N]. When only a single charging space is required per LAMC Table 99.05.106.5.3.3, a raceway is required to be installed at the time of construction and shall be installed in accordance with the Los Angeles Electrical Code. Construction plans and specifications shall include, but are not limited to, the following:

1. The type and location of the EVSE.

2. A listed raceway capable of accommodating a 208/240 volt dedicated branch circuit.

3. The raceway shall not be less than trade size 1".

4. The raceway shall originate at a service panel or a subpanel serving the area, and shall terminate in close proximity to the proposed location of the charging equipment and into a listed suitable cabinet, box, enclosure or equivalent.

5. The service panel or subpanel shall have sufficient capacity to accommodate a minimum 40 ampere dedicated branch circuit for the future installation of the EVSE.

99.05.106.5.3.2. Multiple EV Charging Space Requirements [N]. When multiple charging spaces are required per LAMC Table 99.05.106.5.3.3, raceway(s) is/are required to be installed at the time of construction and shall be installed in accordance with the Los Angeles Electrical Code. Construction plans and specifications shall include, but are not limited to the following:

1. The type and location of the EVSE.

2. The raceway shall originate at a service panel or a subpanel(s) serving the area, and shall terminate in close proximity to the proposed location of the charging equipment and into a listed suitable cabinet(s), box(es), enclosure(s) or equivalent.

3. Plan design shall be based upon 40 ampere minimum branch circuits.

4. Electrical calculations shall substantiate the design of the electrical system, to include the rating of equipment and any on-site distribution transformers and have sufficient capacity to simultaneously charge all required EVs at its full rated amperage, unless otherwise permitted by the Los Angeles Electrical Code.

5. The service panel or subpanel(s) shall have sufficient capacity to accommodate the required number of dedicated branch circuit(s) for the future installation of the EVSE.

99.05.106.5.3.2.1. Charging Station Requirements [N]. When charging stations are required per LAMC Table 99.05.106.5.3.3 , they shall be installed within the EV charging space(s) and in accordance with the Los Angeles Electrical Code.

99.05.106.5.3.3. EV Charging Spaces and EV Charging Station Calculations [N]. LAMC Table 99.05.106.5.3.3 shall be used to determine if single EV or multiple EV charging space(s) requirements apply for the installation of EVSE and if EV charging stations are required to be installed.

EXCEPTIONS: On a case-by-case basis where the local enforcing agency has determined EV charging and infrastructure is not feasible based upon one or more of the following conditions:

1. Where there is insufficient electrical supply.

2. Where there is evidence suitable to the local enforcing agency substantiating that additional local utility infrastructure design requirements, directly related to the implementation of LAMC Subdivision 99.05.106.5.3 may adversely impact the construction cost of the project.

TABLE 99.05.106.5.3.3

Total number of actual parking spaces	Number of required EV charging spaces	Number of required EV charging stations
0 - 9	0	0
10 - 25	1	0
26 - 50	2	0
51 - 75	4	1
76 - 100	5	2
101 - 150	7	3
151 - 200	10	4
201 and over	6% Percent of total [1]	4 + (1 for every additional 500 spaces after the first 200)

City of Oakland

15.04.3.11130 - CGBSC Sections 5.106.5.3—5.106.5.3.4 amended.

In Section 5.106.5.3 of the California Green Building Standards Code, delete subparagraphs 5.106.5.3, 5.106.5.3.1, 5.106.5.3.2, 5.106.5.3.3 and 5.106.5.3.4 in their entirety and replace with the following:

SECTION 5.106.5.3
SITE DEVELOPMENT

5.106.5.3 Electric vehicle (EV) charging. Construction shall include EV charging electric infrastructure as specified in this Section to facilitate future installation of EVSE. All EV charging electric infrastructure and EVSE (when installed) shall be in accordance with the California Electrical Code.

	Full Circuit	Inaccessible Raceway Installed	Electric Panel Capacity
Greater than 20 parking spaces	10 percent of parking spaces (rounded up)	10 percent of parking spaces (rounded up)	Sufficient to supply 20 percent of parking spaces

	Full Circuit	Inaccessible Raceway Installed	Electric Panel Capacity
16—20 or more parking spaces	2 parking spaces	2 parking spaces	Sufficient to supply 4 parking spaces
11—15 parking spaces	2 parking spaces	1 parking spaces	Sufficient to supply 3 parking spaces
2—10 parking spaces	2 parking spaces	-	Sufficient to supply 2 parking spaces
1 parking space	1 parking space	-	Sufficient to supply 1 parking space

Exceptions: On a case-by-case basis where the local enforcing agency has determined EV charging and infrastructure is not feasible based upon one or more of the following conditions:

1. Where there is insufficient electrical supply.
2. Where there is evidence substantiating that meeting the requirements will alter the local utility infrastructure design requirements on the utility side of the meter so as to increase the utility side cost to the developer by more than $400.00 per parking space. In such cases, buildings subject to Section 5.106.5.3 shall maximize the quantity of EV infrastructure, without exceeding the limit above. Cost shall be determined by dividing total cost by total number of EV and non-EV parking spaces.

5.106.5.3.1 Full circuit.

Required full circuits shall be installed with 40-Amp 208/240-Volt capacity including raceway, electrical panel capacity, overprotection devices, wire and termination point such as a receptacle at the time of construction. The termination point shall be in close proximity to the proposed EV charger location. Where a single EV parking space is required, the raceway shall not be less than trade size 1 (nominal 1-inch inside diameter).

5.106.5.3.2 Inaccessible raceway.

Construction documents shall indicate wiring schematics, raceway methods, the raceway termination point and proposed location of future EV spaces and EV chargers. Raceways and related components that are planned to be installed

underground, enclosed, inaccessible or in concealed areas and spaces shall be installed at the time of original construction.

5.106.5.3.3 Electrical Panel Capacity.

Electrical panels shall be installed with capacity to support one 40-Amp 208/240-Volt circuit for each parking space specified in 5.106.5.3 under "Electrical Panel Capacity". Construction documents shall verify that the electrical panel service capacity and electrical system, including any on-site distribution transformer(s), have sufficient capacity to simultaneously charge all EVs at all required EV spaces at 40-Amps.

Note: Panel capacity to install full circuits at the time of original construction as well as capacity to support future addition of additional circuits shall count towards satisfying this requirement. This requirement does not preclude building owners from allocating the required capacity to increase the number of EVCS and provide less than 40-Amp per vehicle.

5.106.5.3.4 Identification.

The service panel or subpanel circuit directory shall identify the overcurrent protective device space(s) reserved for future EV charging as "EV READY" for full circuits and otherwise "EV CAPABLE". The raceway termination location shall be permanently and visibly marked as "EV READY" for full circuits and otherwise "EV CAPABLE".

(Ord. No. 13419, § 4, 2-21-2017)

15.04.3.11135 - CGBSC Section 5.106.5.3.6 added.

In Section 5.106.5.3 of the California Green Building Standards Code, add new subsection 5.106.5.3.6:

5.106.5.3.6 Chapter 11B Accessible EVCS requirements.

Construction documents shall indicate how many accessible EVCS would be required under Title 24 Chapter 11B Table 11B-228.3.2.1, if applicable, in order to convert all EV capable and EV ready spaces required under 5.106.5.3 to EVCS. Construction documents shall also demonstrate that the facility is designed so that compliance with accessibility standards including 11B-812.5 accessible routes will be feasible for the required accessible EVCS at the time of EVCS installation. Surface slope for any area designated for accessible EVCS shall meet slope requirements in section 11B-812.3 at the time of original building construction and vertical clearance requirements in Section 11B-812.4.

Note: Section 11B-812 of the 2016 California Building Code requires that a facility providing EVCS for public and common use also provide one or more accessible EVCS as specified in Table 11B-228.3.2.1. Chapter 11B applies to

certain facilities including but not limited to public accommodations and publicly funded housing (see section 1.9 of Part 2 of the California Building Code). Section 11B-812.4 requires that "Parking spaces, access aisles and vehicular routes serving them shall provide a vertical clearance of 98 inches (2489 mm) minimum." Section 11B-812.3 requires that parking spaces and access aisles meet maximum slope requirements of 1 unit vertical in 48 units horizontal (2.083 percent slope) in any direction at the time of new building construction or renovation. Section 11B-812.5 contains accessible route requirements. Section 5.106.5.3.5 requires that developers meet certain aspects of accessibility requirements at the time of new construction.

(Ord. No. 13419, § 4, 2-21-2017)

City of Carlsbad

18.21.150 California Green Building Standards Code Chapter 5 amended—Nonresidential electric vehicle charging.

B. Section 5.106.5.3 of the California Green Building Standards Code is amended to read as follows:

5.106.5.3 Electric vehicle (EV) charging. [N] Construction shall comply with Section 5.106.5.3.1 or Section 5.106.5.3.2 to facilitate installation and future installation of electric vehicle supply equipment (EVSE). When EVSE(s) is/are installed, it shall be in accordance with the California Building Code, the California Electrical Code and as follows:

5.106.5.3.1 Single charging space requirements. [N] When only a single charging space is required per Table 5.106.5.3.3, one EVSE Installed space shall be installed in accordance with the California Electrical Code.

5.106.5.3.2 Multiple charging space requirements. [N] When multiple EV spaces are required per Table 5.106.5.3.3, the corresponding number of EVSE Installed spaces are required to be installed at the time of construction and shall be installed in accordance with the California Electrical Code. The remainder of the EV spaces required per Table 5.106.5.3.3 may be EVSE Installed, EVSE Ready, or EVSE Capable spaces.

5.106.5.3.2.1 Construction documents. Construction plans and specifications shall include, but are not limited to, the following:

1. The type and location of the EVSE.
2. The raceway(s) shall originate at a service panel or a subpanel(s) serving the area, and shall terminate in close proximity to the proposed location of the charging equipment and into listed suitable cabinet(s), box(es), enclosure(s) or equivalent.
3. Plan design shall be based upon 40-ampere minimum branch circuits.

4. Electrical calculations shall substantiate the design of the electrical system, to include the rating of equipment and any on-site distribution transformers and have sufficient capacity to simultaneously charge all required EVs at its full rated amperage.
5. The service panel or subpanel(s) shall have sufficient capacity to accommodate the required number of dedicated branch circuit(s) for the future installation of the EVSE.

5.106.5.3.3 EV charging space calculation. [N] Table 5.106.5.3.3 shall be used to determine if single or multiple charging space requirements apply for the installation and future installation of EVSE.

Exceptions: On a case-by-case basis where the local enforcing agency has determined EV charging and infrastructure is not feasible based upon one or more of the following conditions:

1. Where there is insufficient electrical supply.
2. Where there is evidence suitable to the local enforcing agency substantiating that additional local utility infrastructure design requirements, directly related to the implementation of Section 5.106.5.3, may adversely impact the construction cost of the project.

TABLE 5.106.5.3.3

TOTAL NUMBER OF ACTUAL PARKING SPACES	NUMBER OF REQUIRED EV SPACES	NUMBER OF REQUIRED EVSE INSTALLED SPACES
0-9	1	1
10-25	2	1
26-50	4	2
51-75	6	3
76-100	9	5
101-150	12	6
151-200	17	9
201 and over	10 percent of total[1]	50 percent of required EVSE Installed spaces[1]

1. Calculation for EV spaces and EVSE Installed spaces shall be rounded up to the nearest whole number.

5.106.5.3.4 [N] Identification. The service panel or subpanel(s) circuit directory shall identify the reserved overcurrent protective device space(s) for future EV charging as "EV CAPABLE". The raceway termination location shall be permanently and visibly marked as "EV CAPABLE."

5.106.5.3.5 [N] Future charging spaces qualify as designated parking as described in Section 5.106.5.2 Designated parking for clean air vehicles.

Notes:

1. The California Department of Transportation adopts and publishes the California Manual on Uniform Traffic Control Devices (California MUTCD) to provide uniform standards and specifications for all official traffic control devices in California. Zero Emission Vehicle Signs and Pavement Markings can be found in the New Policies & Directives number 13-01.www.dot.ca.gov/hq/traffops/policy/13-01.pdf.
2. See Vehicle Code Section 22511 for EV charging spaces signage in off-street parking facilities and for use of EV charging spaces.
3. The Governor's Office of Planning and Research published a Zero-Emission Vehicle Community Readiness Guidebook which provides helpful information for local governments, residents and businesses. www.opr.ca.gov/docs/ZEV_Guidebook.pdf

(Ord. CS-349 § 6, 2019)

Santa Monica

Non-Residential Buildings. For new electrical services in non-residential buildings, the following shall apply:

(1) The total load calculations shall include a load for future electric vehicle charging. This load shall be a calculated at 10 kilowatts per five percent of the parking spaces provided.

The minimum load for future electrical vehicle charging shall not be less than 10 kilowatts; however, if the continuous rating of Level 2 and/or Level 3 electric vehicle service equipment is known at the time of installation then these ratings shall be applied to the load calculations, but in no cases less than 10 kilowatts per five percent of the parking spaces provided.

The minimum rating of the main service panel and the ampacity of the service entrance conductors shall be based on the total calculated load and the requirements of Chapter 2 of the California Electrical Code.

(2) The electrical distribution system shall include spaces for two-pole, 208/240 volt circuit breakers for future electric vehicle charging. The minimum number of circuit breaker spaces shall be equal to five percent of the provided parking spaces. These circuit spaces shall be dedicated and identified as "Future Electric Vehicle Charging."

(3) For new non-residential buildings, five percent of the parking spaces provided shall be dedicated to electric vehicles. Each parking space shall have a

raceway installed from the service or distribution panel and stubbed-up at the midline of each parking space. The minimum size of the raceway shall be one-inch nominal.

Where the parking accommodations include more than one floor or level, the parking spaces dedicated to electric vehicles, to the extent practicable, shall be provided at the first floor or level of parking access.

(4) Where the calculated number of five percent of the parking spaces provided results in a fraction of 0.5 or greater, the calculated number shall be rounded to the next higher whole number.

(d) **Exceptions.** The requirements of this Section shall not apply under the following conditions:

(1) New electrical service is installed in a building where there is no attached or dedicated parking facility;

(2) New electrical service is not associated with a building or structure;

(3) Compliance is technically infeasible due to the distance between a dedicated parking facility and the structure containing residential occupancies, or similar conditions. (Added by Ord. No. 2445CCS § 55, adopted 11/12/13; amended by Ord. No. 2527CCS § 11, adopted 11/22/16)

City and County of San Francisco

SEC. 5.103.3.3. ELECTRIC VEHICLE CHARGING.

Section 5.106. 5. 3 of this chapter shall apply to all newly constructed buildings and associated newly-constructed parking facilities for passenger vehicles and trucks, and to major alterations to existing Group A. B, I, and M occupancy buildings where electrical service to the building will be upgraded. In major alterations where existing electrical service will not be upgraded, all requirements under Section 5.106. 5 shall apply to the maximum extent that:

(1) does not require upgrade to existing service; and

(2) the Director does not determine that compliance with Section 5.106.5.3.3 and Title 24 Chapter 11 B. if applicable, is technically infeasible, as defined in California Building Code Chapter 2. Section 202.

Section 17. The Green Building Code is hereby amended by revising Section 5.106.5.3, to read as follows:

SEC. 5.106.5.3. ELECTRIC VEHICLE (EV) CHARGING.

In new construction and major alterations, 100% of off-street parking spaces in buildings and facilities provided for passenger vehicles and trucks shall be EV Spaces capable of supporting future EVSE. Electrical engineering design and construction documents shall indicate the location of all proposed EV spaces. When EVSE is installed, it shall be in accordance with the San Francisco Building Code and the San Francisco Electrical Code.

Section 18. The Green Building Code is hereby amended by revising Section 5.106.5.3.1, to read as follows:

SEC. 5.106.5.3.1. SINGLE CHARGING SPACE REQUIREMENTS.

When a single EV Space is required per Section 5.106. 5. 3. 3, install a full branch circuit with a minimum of 40-Amp 208 or 240 Volt capacity, including listed raceway, electrical panel capacity, overcurrent protection devices, wire, and suitable listed termination point such as a receptacle. The termination point shall be in close proximity to the proposed EV charger location. The raceway shall not be less than trade size I (nominal I-inch inside diameter). The circuit shall be installed in accordance with the San Francisco Electrical Code and the San Francisco Building Code.

Section 19. The Green Building Code is hereby amended by revising Section 5.106.5.3.2, to read as follows:

SEC. 5.106.5.3.2. MULTIPLE CHARGING SPACE REQUIREMENTS.

a) For a minimum of 10% of EV Spaces, and in no case less than two EV spaces when the total number of EV Spaces is two or more, install a full circuit with minimum of 40-Amp 208 or 240 Volt capacity per EV Space, including listed raceway, sufficient electrical panel service capacity, overcurrent protection devices, wire, and suitable listed termination point such as a receptacle. The termination point shall be in close proximity to the proposed EV charger location. Calculations for the number of EV Spaces shall be rounded up to the nearest whole number.
b) Branch circuit panelboard(s) shall be installed at each parking level with service capacity to deliver a minimum 40 amperes at 208 or 240 volts multiplied by 20% of the total number of EV Spaces. The panelboard(s) shall have sufficient space to install a minimum of one 40-ampere dedicated branch circuit and overcurrent protective device per EV Space up to a minimum of 20% of the total number of EV Spaces. The circuits and overcurrent protective devices shall remain reserved for exclusive use by electric vehicle charging.
c) For all EV Spaces not required to install full circuits or raceways per Section 5.106.5.3.2(a):
    1) Either:
    A) Provide space for future installation of additional electrical panelboards to support a 40 ampere 208 or 240 Volt capacity branch circuit and overcurrent

protection device per EV Space, or equivalent consistent with Section 5.106.5.3.2.1; or
(B) Provide space in installed electrical panelboard(s) to support installation of a 40 ampere 208 or 240 volt capacity branch circuit and overcurrent protection device per EV Space, or equivalent consistent with Section 5.106.5.3.2.1.

(2) Install raceway or sleeves where penetrations to walls, floors, or other partitions will be necessary to install panels, raceways, or related electrical components necessary for future installation of branch circuits. All such penetrations must comply with applicable codes, including but not limited to the San Francisco Electrical Code and the San Francisco Fire Code.
(d) Construction documents, including electrical engineering and design related documents, shall demonstrate the electrical service capacity of the electrical system, including any on-site distribution transformer(s) can charge EVSE at a minimum of 20% of the total number of EV Spaces simultaneously, at the full rated amperage of the EVSE or a minimum of 40 amperes per branch circuit, whichever is greater. As appropriate, construction documents shall provide information on raceway method(s), wiring schematics, anticipated EV load management system design(s), and electrical load calculations.
Exceptions
1. Where there is no commercial power supply.
2. Where there is evidence substantiating that meeting the requirements will alter the local utility infrastructure design requirements directly related to the implementation of this Section may increase the utility side cost to the developer by more than $400 per parking space. In such cases, buildings subject to Section 5.106.5.3.2 shall maximize the number of EV Spaces, up to a maximum utility side cost of $400 per space. Cost shall be determined by dividing the increase in local utility infrastructure cost attributable to compliance with this section by the sum of parking spaces and Electric Vehicle Charging Spaces.

3. In major alterations, where there is evidence substantiating that meeting the requirements of this section present an unreasonable hardship or is technically infeasible, the Director may upon request from the project sponsor consider an appeal to reduce the number of EV Spaces required.

Note: This section does not require installation of EVSE. The intent of sizing electrical service to provide 40 amperes at 208 or 240 Volts to at least 20% of spaces simultaneously is to provide the option to utilize listed EV Load Management Systems to provide Level 2 EV charging at 100% of parking spaces. A listed EV Load Management system manages the available capacity in a safe manner, such as allocating 36 amperes at 208 or 240 volts to vehicles in 20% of the total number of EV Charging Stations simultaneously, or

allocating 8 amperes to vehicles in 100% of parking spaces, or similar. Given the capacity required by this Section, individual EV chargers may be installed in up to 20% of parking spaces before an EV load management system is necessary.

Section 20. The Green Building Code is hereby amended by adding Section 5.106.5.3.2.1, to read as follows:

SEC. 5.106.5.3.2.1. ELECTRIC VEHICLE (EV) FAST CHARGING SPACES.
(a) Installation of one EV Fast Charger may reduce the number of EV Spaces required under Section 5.106.5.3.2(a) by up to 10 EV Spaces, provided the project includes at least one EV Space equipped with a full circuit able to deliver 40 Amps at 208 or 240 volts to the EV Space, including listed raceway, sufficient electrical panel capacity, overcurrent protection devices, wire, and suitable listed termination point such as a receptacle.

The electrical panel board(s) provided at each parking level served by EV Fast Chargers shall have sufficient capacity to supply each Electric Vehicle fast charger with a minimum of 30 kW AC in addition to the capacity to serve any remaining EV spaces with a minimum of 8-amperes at 208 or 240 volts per EV Space simultaneously, with a minimum of 40 amperes per circuit.

(b) After the requirements of 5.106.5.3.2(a) and (b) are met, each planned EV Fast Charger may reduce the number of planned EV Spaces required under 5.106.5.3.2(c) by up to 10 spaces. Electrical engineering design and construction documents shall indicate the raceway termination point and proposed location of future EV Fast Charger Spaces and EV Fast Chargers. Electrical engineering design and construction documents shall also provide information on amperage of EV Fast Chargers, raceway method(s), and wiring schematics. Electrical engineering design and construction documents shall also provide electrical load calculations to verify that the electrical panel service capacity and electrical system has sufficient capacity to simultaneously operate all installed EV Fast Chargers with the full rated amperage of the EV fast charger(s), and simultaneously serve a minimum of 40 amps per branch circuit to any remaining EV spaces required by Section 5.106.5.3.2(a). Raceways and related components that are planned to be installed in underground, enclosed, inaccessible, or otherwise concealed areas or spaces, shall be installed at the time of original construction.

Section 21. The Green Building Code is hereby amended by revising Section 5.106.5.3.3, to read as follows:

SEC. 5.106.5.3.3. EV SPACE SLOPE, DIMENSIONS, AND LOCATION.
Design and construction documents shall indicate how many accessible EVCS would be required under Title 24 Chapter 11B Table 11B-228.3.2.1, if

applicable, in order to convert all EV Spaces required under 5.106.5.3.2 to EVCS excluding the exceptions in 5.106.5.3.2. Design and construction documents shall also demonstrate that the facility is designed so that compliance with accessibility standards will be feasible for accessible EV Spaces at the time of EVCS installation. Surface slope for any area designated for accessible EV Spaces shall meet slope requirements in section 11B-812.3 at the time of original building construction and vertical clearance requirements in Section 11B-812-4, if applicable.

Exception: Accessibility requirements of Section 5.106.5.3.3 shall not apply to buildings that are not covered under Title 24 Part 2 Chapter 11B. In addition, all applicable exceptions to Chapter 11B shall apply to this Section 5.106.5.3.3

Note: Section 5.106.5.3.3, above, requires that the project be prepared to comply with accessibility requirements applicable at the time of EVSE installation. Section 11 B-812 of the 2016 California Building Code requires that a facility providing EVCS for public and common use also provide one or more accessibility EVCS as specified in Table 11B-228.3.2.1. Chapter 11 B regulates accessibility in certain buildings and facilities, including but not limited to accessibility in public buildings, public accommodations, commercial buildings, and publicly funded housing (see section 1.9 of Part 2 of the California Building Code). Section 11B-812.4 requires that "Parking spaces, access aisles and vehicular routes serving them shall provide a vertical clearance of98 inches (2489 mm) minimum. " Section 11B-812. 3 requires that parking spaces and access aisles meet maximum slope requirements of] unit vertical in 48 units horizontal (2. 083% slope) in any direction at the time of new building construction or renovation. Section 11B-812. 5 contains accessible route requirements.

Section 22. The Green Building Code is hereby amended by revising Section 5.106.5.3.4, to read as follows:

SEC. 5.106.5.3.4. IDENTIFICATION.
The service panel or subpanel(s) circuit directory shall identify the reserved overcurrent protective device space(s) for future EV charging as "EVSE READY'' for full circuits and otherwise "EVSE CAPABLE." The raceway termination location or receptacle shall be permanently and visibly marked as "EVSE READY" for full circuits and otherwise "EVSE CAPABLE" until such time as EVSE are installed.

Section 23. The Green Building Code is hereby amended by revising Section 5.106.5.3.5, to read as follows:

SEC. 5.106.5.3.5.

Future charging spaces qualify as designated parking as described in Section 5.106.5.2, Designated parking for clean air vehicles.

City of Palo Alto

16.14.430 Section A5.106.5.3 Electric vehicle (EV) charging for non-residential structures.

Section A5.106.5.3 of the California Green Building Standards Code is added as mandatory and amended to read:

A5.106.5.3 Electric Vehicle (EV) Charging for Non-Residential Structures. New non-residential structures shall comply with the following requirements for electric vehicle supply equipment (EVSE). All parking space calculations under this section shall be rounded up to the next full space. The requirements stated in this section are in addition to those contained in Section 5.106.5.3 of the California Green Building Standards Code. In the event of a conflict between this section and Section 5.106.5.3, the more robust EV Charging requirements shall prevail.

A5.106.5.3.1 Definitions. For the purposes of this section, the following definitions shall apply:

(a) Level 2 EVSE. "Level 2 EVSE" shall mean an EVSE capable of charging at 30 amperes or higher at 208 or 240 VAC. An EVSE capable of simultaneously charging at 30 amperes for each of two vehicles shall be counted as two Level 2 EVSE.

(b) Conduit Only. "Conduit Only" shall mean, at minimum: (1) a panel capable to accommodate a dedicated branch circuit and service capacity to install at least a 208/240V, 50 amperes grounded AC outlet; and (2) raceway or wiring with capacity to accommodate a 100 ampere circuit; terminating in (3) a listed cabinet, box, enclosure, or NEMA receptacle. The raceway shall be installed so that minimal removal of materials is necessary to complete the final installation.

(c) EVSE-Ready Outlet. "EVSE-Ready Outlet" shall mean, at minimum: (1) a panel capable to accommodate a dedicated branch circuit and service capacity to install at least a 208/240V, 50 amperes grounded AC outlet; (2) a two-pole circuit breaker; (3) raceway with capacity to accommodate a 100-ampere circuit; (4) 50 ampere wiring; terminating in (5) a 50 ampere NEMA receptacle in a covered outlet box.

(d) EVSE Installed. "EVSE Installed" shall mean an installed Level 2 EVSE.

A5.106.5.3.2 Non-Residential Structures Other than Hotels. The following standards apply to newly constructed non-residential structures other than hotels.

(a) In general. The property owner shall provide Conduit Only, EVSE-Ready Outlet, or EVSE Installed for at least 25% of parking spaces, among which at least 5% (and no fewer than one) shall be EVSE Installed.

(b) Accessible spaces. Projects shall comply with the 2016 California Building Code requirements for accessible electric vehicle parking.

(c) Minimum total circuit capacity. The property owner shall ensure sufficient circuit capacity, as determined by the Chief Building Official, to support a Level 2 EVSE in every location where Circuit Only, EVSE-Ready Outlet or EVSE Installed is required.

(d) Location. The EVSE, receptacles, and/or raceway required by this section shall be placed in locations allowing convenient installation of and access to EVSE. Location of EVSE or receptacles shall be consistent with all City guidelines, rules, and regulations.

A5.106.5.3.3 Hotels. The following standards apply newly constructed hotels.

(a) In general. The property owner shall provide Conduit Only, EVSE-Ready Outlet, or EVSE Installed for at least 30% of parking spaces, among which at least 10% (and no fewer than one) shall be EVSE Installed.

(b) Accessible spaces. Projects shall comply with the 2016 California Building Code requirements for accessible electric vehicle parking.

(c) Minimum total circuit capacity. The property owner shall ensure sufficient circuit capacity, as determined by the Chief Building Official, to support a Level 2 EVSE in every location where Circuit Only, EVSE-Ready Outlet or EVSE Installed is required.

(d) Location. The EVSE, receptacles, and/or raceway required by this section shall be placed in locations allowing convenient installation of and access to EVSE. Location of EVSE or receptacles shall be consistent with all City guidelines, rules, and regulations.

(Ord. 5393 § 1 (part), 2016)

Marin County

19.04.115 - California Green Building Standards Code—Local amendments.

- As outlined in Section 19.04.010(9), the county has adopted the 2016 edition of the California Green Building Standards Code known as California Code of Regulations, Part 11 of Title 24, with exceptions, additions, and deletions as provided in this subchapter. Requirements are outlined by project type in Tables 1 and 2 of this ordinance.

The provisions of this subchapter shall constitute local amendments to the cross-referenced provisions of the California Green Building Standards Code, 2016 Edition, and shall be deemed to replace the cross-referenced sections of said Code with the respective provisions set forth in this chapter.

Section 301.1 of Chapter 3 of the 2016 California Green Building Standards Code (Title 24, Part 11), California Code of Regulations is hereby amended by replacing the first sentence with the following:

301.1 Scope. Buildings shall be designed to comply with applicable requirements of Marin County Green Building Requirements beginning at Chapter 19.04.110, Marin County Code, and shall also include the green building measures specified as mandatory in the application checklists contained in this code.

Section 301.1.1 of Chapter 3 of the 2016 California Green Building Standards Code (Title 24, Part 11), California Code of Regulations is hereby amended by replacing the first sentence with the following:

301.1.1 Additions and alterations. The mandatory provisions of Chapter 4 shall be applied to additions and alterations of existing residential buildings in accordance with applicable requirements of Marin County Green Building Requirements beginning at Chapter 19.04.110, Marin County Code. Section A4.106.8.2 of Appendix A4 of the 2016 California Green Building Standards Code (Title 24, Part 11), California Code of Regulations is hereby amended by replacing the percentage of parking provided for EV spaces with the number that is outlined for the project type in Table 2 of this chapter.

Section A5.106.5.3 of Appendix A5 of the 2016 California Green Building Standards Code (Title 24, Part 11), California Code of Regulations is hereby amended by referring to Table 2 of this chapter rather than Sections A5.106.5.3 and A5.106.5.3.1 to determine the number of EV spaces required.

(Ord. No. 3685 , § II, 2018)

Editor's note— Ord. No. 3685 , § II, adopted March 13, 2018, amended § 19.04.115 in its entirety to read as herein set out. Former § 19.04.115 pertained to similar subject matter and derived from Ord. No. 3658, § II(Exh. A), adopted in 2016.

- **19.04.120 - Applicability.**

The provisions of this chapter shall apply to all construction or development projects defined below as a "covered project."

(Ord. No. 3658 , § II(exh. A), 2016; Ord. No. 3685 , § II, 2018)

- **19.04.130 - Definitions.**

For the purposes of interpreting this chapter and the associated standards for compliance, the following terms are defined as follows. When the definitions below differ from those contained elsewhere in this title, the provisions of this chapter shall apply. These definitions are additional to those outlined in Chapter 2 of the 2016 edition of the California Green Building Standards Code known as California Code of Regulations, Part 11 of Title 24,

(1)

"2016 State Energy Code" refers to the requirements outlined in the 2016 edition of the California Energy Code known as California Code of Regulations, Part 6 of Title 24.

(2)

"All-electric" refers to a building where electricity is the only permanent source of energy for water -heating, space-heating, space cooling, cooking and clothes-drying and there is no gas meter connection.

(3)

"CALGreen" refers to the California Green Building Standards Code, as included in Title 24, Part 11 of the California Code of Regulations

(4)

"CALGreen Mandatory" means those measures that are required for all covered projects. Residential mandatory measures are contained in CALGreen Chapter 4. Nonresidential mandatory measures are contained in CALGreen Chapter 5.

(5)

"CALGreen Tier 1" refers to required perquisite and elective measures in addition to the CALGreen mandatory measures, as outlined in CALGreen Appendix A4.601.4 for residential projects and CALGreen Appendix A5.601.2 for nonresidential projects. Where Tier 1 is required for covered projects that are not new construction, energy efficiency requirements beyond those outlined in CALGreen Mandatory are not required.

(6)

"Covered project" means a development project for which one or more building permits are required for new construction, additions, and/or remodels as set forth by the standards for compliance outlined in Section 19.04.140 and in Table 1.

(7)

"EVSE" means Electric Vehicle Supply Equipment, which defines the conductors, including the ungrounded, grounded, and equipment grounding conductors and the electric vehicle connectors, attachment plugs, and all other fittings, devices, power outlets, or apparatus installed specifically for the purpose of transferring energy between the premises wiring and the electric vehicle.

(8)

"EV Capable" refers to a parking space with conduit installed and allocated 208/240V 40-amp panel capacity for future EV charging stations.

(9)

"EV Ready" refers to an EV-ready parking space that has allocated 208/240V 40-amp panel capacity, conduit, wiring, receptacle, and overprotection devices, with an endpoint near to the parking space.

(10)

"EV Space" refers to a parking space intended for future installation of EVSE. The EV space does not need to be reserved for electric vehicle charging prior to the installation of EVSE.

(11)

"Green building checklist" means a checklist or rating sheet used for calculating a green building rating. Depending on the compliance pathway chosen by the applicant, this can include a checklist for CALGreen, Green Point Rated, LEED, and Passive House.

(12)

"Green building rating system" means a standardized rating system providing specific criteria to determine the level of compliance of building projects as set forth by the standards for compliance outlined in Section 19.04.140. This ordinance is centered around the state's CALGreen rating system and associated checklists, but allows for the use of equivalent alternatives, including GreenPoint rated, LEED, and Passive House.

(13)

"GreenPoint rated" means a residential building certified as complying with the green building rating systems developed by the Build It Green organization.

(14)

"LEED" means the "Leadership in Energy and Environmental Design" green building rating system developed by the U.S. Green Building Council.

(15)

"Mixed-fuel home" is a home where both natural gas and/or propane and electricity are used.

(16)

"Modified parking lot" shall be those for which paving material and curbing is removed,

(17)

"Passive house" means a home built to Passive House Institute US (PHIUS) certification standards.

(18)

"Qualified green building rater" means an individual who has been trained and certified as a CALGreen Inspector, LEED AP, GreenPoint rater, PHIUS Consultant, or has similar qualifications and certifications if acceptable to the chief building official.

(Ord. No. 3658 , § II(exh. A), 2016; Ord. No. 3685 , § II, 2018)

Table 2: Electric Vehicle Requirements by Project Type	
Project Type	Project Requirements
Single Family New Construction	Comply with CALGreen Measure A4.106.8.1

Table 2: Electric Vehicle Requirements by Project Type	
Project Type	Project Requirements
Single Family Additions and Alterations	If the project is modifying the main electrical service panel, comply with CALGreen Measure A4.106.8.1
Multifamily New Construction	For projects with 2-10 onsite parking spaces, build 2 parking spaces to be EV Ready and build the remaining spaces to be EV Capable. [1] OR For projects with greater than 10 onsite parking spaces, build 10% of spaces to be EV Ready and build the remaining spaces to be EV Capable. [1]
Multifamily Additions and Alterations	If the service panel is modified, add capacity for 20% of parking spaces. If more than 25% of the parking lot surface is modified, add conduit to all parking spaces. Where existing electrical service will not be upgraded in the existing project scope, designate capacity to the maximum extent that does not require an upgrade to existing electrical service.
Commercial New Construction	For 2-10 onsite parking spaces, build 2 parking spaces to be EV Ready and build the remaining spaces to be EV Capable. [1] OR For greater than 10 onsite parking spaces, build 10% of spaces to be EV Ready and build the remaining spaces to be EV Capable. [1]
Commercial Additions and Alterations	If the main electrical service panel is modified, add capacity for 20% of parking spaces. If more than 25% of the parking lot surface is modified, add

Table 2: Electric Vehicle Requirements by Project Type	
Project Type	Project Requirements
	circuit to all parking spaces. Where existing electrical service will not be upgraded in the existing project scope, designate capacity to the maximum extent that does not require an upgrade to existing electrical service.
[1] Electrical service capacity shall be able to deliver a minimum 40 amperes at 208 or 240 volts multiplied by 20% of the total number of EV Spaces. The panelboard(s) shall have sufficient space to install a minimum of one 40-ampere dedicated branch circuit and overcurrent protective device per EV Space up to a minimum of 20% of the total number of EV Spaces. The circuits and overcurrent protective devices shall remain reserved exclusively for EV charging. An EV Load management system may be necessary in order to provide EV charging at more than 20% of EV Spaces.	

City of Berkeley

At new non-residential developments with over 20 parking spaces, at least 3% of the spaces shall be pre-wired to allow for future Level 2 PEV charging system installation. At least one of the pre-wired parking spaces must be an accessible parking space, as defined by the California Building Code, or a standard parking space that can provide a 5' wide, 18' long access aisle and a path of travel to the building.

Any Level 2 PEV charging systems installed at parking spaces will be counted toward the applicable pre-wiring requirement. All parking spaces with PEV charging systems may be counted toward the number of parking spaces required by the Zoning Ordinance.

Contra Costa County

Section 5.106.5.3 (Electric vehicle (EV) charging) of CGBSC Chapter 5 (Nonresidential Mandatory Measures) is amended to read:

Section 5.106.5.3 Electric vehicle (EV) charging. [N] New nonresidential construction shall comply either with Section 5.106.5.3.1 or Section 5.106.5.3.2, whichever is applicable, and

provide the required number of fully operational EV charging spaces (EV spaces). Each EV space shall be installed in accordance with the California Building Code and California Electrical Code, and the requirements of Section 5.106.5.3.1 or Section 5.106.5.3.2, whichever is applicable.

(k)

Section 5.106.5.3.1 (Single charging space requirements) of CGBSC Chapter 5 (Nonresidential Mandatory Measures) is amended to read:

Section 5.106.5.3.1 Single charging space requirements. [N] If Table 5.106.5.3.3 requires only one EV space for new nonresidential construction, one fully operational EV space must be installed in accordance with the California Electrical Code. The construction plans and specifications for the new nonresidential construction must satisfy the following requirements:

1. The type and location of the EVSE must be identified on the plans and specifications.

2. The plans and specifications must establish that each raceway is not less than trade size one inch.

3. Each, and at least one, listed raceway capable of accommodating a 208/240-volt dedicated branch circuit must be identified on the plans and specifications.

4. Each raceway must originate at a service panel or subpanel serving the area where the EVSE will be located, and must terminate at the location of the required charging equipment and into a listed, suitable cabinet, box, enclosure, or equivalent structure.

5. Each service panel or subpanel must have sufficient capacity to accommodate a minimum 40-ampere dedicated branch circuit for the EVSE.

(l)

Section 5.106.5.3.2 (Multiple charging space requirements) of CGBSC Chapter 5 (Nonresidential Mandatory Measures) is amended to read:

Section 5.106.5.3.2 Multiple charging space requirements. [N] If Table 5.106.5.3.3 requires more than one EV space for new nonresidential construction, the number of fully operational EV spaces specified in Table 5.106.5.3.3 must be installed in accordance with the California Electrical Code. The construction plans and specifications for the new nonresidential construction must satisfy the following requirements:

1.

The type and location of the EVSE must be identified on the plans and specifications.

2. Each raceway must originate at a service panel or subpanel serving the area where the EVSE will be located, and must terminate at the location of the required charging equipment and into a listed, suitable cabinet, box, enclosure, or equivalent structure.

3. Each service panel or subpanel must have sufficient capacity to accommodate a minimum 40-ampere dedicated branch circuit for the EVSE.

4. The plans and specifications must include electrical calculations to substantiate that the design of the electrical system, including the rating of equipment and any onsite distribution transformers, has sufficient capacity to simultaneously charge EVs at all required EV spaces at their full-rated amperage.

5. Each service panel or subpanel must have sufficient capacity to accommodate the required number of dedicated branch circuits for the EVSE that will be installed.

(m) Section 5.106.5.3.3 (EV charging space calculation) of CGBSC Chapter 5 (Nonresidential Mandatory Measures) is amended to read:

Section 5.106.5.3.3 EV charging space calculations. [N] The required number of charging spaces with EVSE for new nonresidential construction must be calculated in accordance with Table 5.106.5.3.3.

Exception: On a case-by-case basis, the building official may require new construction to include fewer EV charging spaces than would otherwise be required by Table 5.106.5.3.3, or require no spaces, if the building official determines either of the following:

1. There is insufficient electrical supply to the new construction to adequately serve the required number of EV charging spaces.

2. The cost of the new construction will be substantially adversely impacted by any local utility infrastructure design requirements that are directly related to the installation of the required number of EV charging spaces.

TABLE 5.106.5.3.3 NONRESIDENTIAL CHARGING SPACE CALCULATION	
TOTAL NUMBER OF PARKING SPACES	NUMBER OF REQUIRED EV CHARGING SPACES
1—9	0
10—25	2
26—50	3
51—75	5
76—100	6
101—200	12
201 and over	6% *

Expand

* Calculation for spaces shall be rounded up to the nearest whole number

(n)

Section 5.106.5.3.4 (Identification) of CGBSC Chapter 5 (Nonresidential Mandatory Measures) is amended to read:

Section 5.106.5.3.4 [N] Identification. Each service panel or subpanel circuit directory must identify the reserved overcurrent protective device space or spaces for EV charging as "EV CAPABLE." Each raceway termination location must be permanently and visibly marked "EV CAPABLE."

(o)

Section 5.106.5.3.5 of Chapter 5 of CGBSC Chapter 5 (Nonresidential Mandatory Measures) is amended to read:

Section 5.106.5.3.5 [N] Each EV charging space required by Section 5.106.5.3.3 shall be counted as one designated parking space required by Section 5.106.5.2.

Cupertino

16.58.420 Section A5.106.5.3–Amended.

Add and amend Section A5.106.5.3 to read as follows:

A.5.106.5.3 New non-residential buildings. At least 10 percent of the total parking spaces, but not less than one, shall be capable of supporting installation of future electric vehicle supply equipment (EVSE).

A5.106.5.3.1 Single charging space requirements. When only a single charging space is required, install a dedicated branch circuit sufficient to provide adequate electrical capacity to serve a Level 2 EVSE. Also, install a listed raceway or pre-wiring from the dedicated branch circuit to the designated electric vehicle parking stall. The raceway shall not be less than trade size 1 (nominal 1-inch inside diameter). The raceway shall be securely fastened at the main service or subpanel and shall terminate in close proximity to the proposed location of the charging system into a listed cabinet, box or enclosure. Pre-wiring shall include the installation of appropriately sized conductors and adequate electrical capacity to serve a Level 2 EVSE.

Exception: Other pre-installation methods approved by the local enforcing agency that provide sufficient conductor sizing and service capacity to install Level 2 Electric Vehicle Supply Equipment (EVSE).

A5.106.5.3.2 Multiple charging spaces required. When multiple charging spaces are required, plans shall include the location(s) and type of the EVSE, raceway method(s), wiring schematics and electrical calculations to verify that the electrical system has sufficient capacity to simultaneously charge all the electrical vehicles (EV) at all designated EV charging spaces at their full rated amperage. Plan design shall be based upon Level 2 EVSE at its maximum operating ampacity. Provide raceways from the electrical service panel to the designated parking areas which are required to be installed at the time of construction. Pre-wiring shall include the installation of appropriately sized conductors and adequate electrical capacity to serve a Level 2 EVSE.

Note: Utilities and local enforcing agencies may have additional requirements for metering and EVSE installation, and should be consulted during the project design and installation.

A5.106.5.3.3 Tier 1. Not adopted.

A5.106.5.3.4 Tier 2. Not adopted.

A5.106.5.3.5 Labeling requirement. A label stating "EV CAPABLE" shall be posted in a conspicuous place at the service panel or subpanel and next to the dedicated EV charging spaces.

A.5.106.5.4 Alternative Means for Electric Vehicle (EV) Charging for Non-residential buildings. The provisions of Section A.5.106.5.3 are not intended to prevent the use of any alternative means of achieving the standards for electric vehicle charging, provided that any such alternative is approved by the Building Official based on findings that the proposed alternative is satisfactory and complies with the intent of the provisions and is at least as equivalent as the prescribed requirements.

(Ord. 14-2117, § 2, 2014)

City of Fremont

15.48.030 Amendment to 2016 CGBSC Section 202 (Definitions).

Section 202 of the 2016 California Green Building Standards Code is amended by modifying the following definition. The remaining definitions are not modified:

> EV READY PARKING SPACE: A parking space served by a complete 208/240 V 40 ampere electrical circuit.

(Ord. 21-2016 § 12, 11-1-16.)

15.48.060 Amendment to 2016 CGBSC Section 5.106 (Site Development).

Section 5.106 of the 2016 California Green Building Standards Code is amended as follows:

> 5.106.1 – 5.106.5.2.1 {CGBSC text not modified}
>
> 5.106.5.3 Electric vehicle (EV) charging for new construction and additions.
>
> The following number of EV Ready Parking Spaces are required at the time of original construction:

Total Number of Actual Parking Spaces	Number of Required EV Ready Parking Spaces
0-9	1

Total Number of Actual Parking Spaces	Number of Required EV Ready Parking Spaces
10-25	2
26-50	4
51-75	6
76-100	9
101-150	12
151-200	17
201 and over	10 percent of total[1]

[1] Calculation of number of spaces shall be rounded up to the nearest whole number.

5.106.5.3.1 EV ready parking space requirements. Construction documents shall verify that the electrical panel service capacity and electrical system, including any on-site distribution transformer(s), have sufficient capacity to simultaneously charge all EVs at all required EV Ready Parking Spaces at the full rated amperage of the EV Ready Parking Space.

A raceway, electrical panel capacity, wire and termination point supporting a 208/240 volt 40 ampere circuit is required to be installed at the time of construction for each EV Ready Parking Space required under 5.106.5.3. Where a single EV Ready Parking Space is required, the raceway shall not be less than trade size 1 (nominal 1-inch inside diameter). All electrical circuit components and EVSE, related to this section shall be installed in accordance with the California Electrical Code.

Note: Termination point should be a receptacle suitable for EVSE and located near the proposed EVSE location.

Exceptions: On a case-by-case basis where the local enforcing agency has determined EV charging and infrastructure is not feasible based upon one or more of the following conditions:

1. Where there is insufficient electrical supply.

2. Where there is evidence suitable to the local enforcing agency substantiating that additional local utility infrastructure design requirements, directly related to the implementation of Section 5.106.5.3, may adversely impact the construction cost of the project.

5.106.5.3.2 Identification. The service panel or subpanel(s) circuit directory shall identify the reserved overcurrent protective device space(s) for future EV charging as "EV READY". The raceway termination location shall be permanently and visibly marked as "EV READY."

5.106.5.3.3 Future charging spaces qualify as designated parking as described in Section 5.106.5.2 Designated parking for clean air vehicles.

5.106.5.3.4. deleted.

5.106.5.3.5 – 5.106.10 {CGBSC TEXT NOT MODIFIED}

(Ord. 21-2016 § 12, 11-1-16.)

Menlo Park

12.18.080 Section 5.106.5.3 of Chapter 5 amended.

Section 5.106.5.3 of Chapter 5 is amended to read as follows:

5.106.5.3 Electric Vehicle (EV) charging. Section 5.106.5.3 shall apply to newly constructed buildings or additions and/or alterations to existing buildings as established in Table 5.106.5.3.3. Construction shall comply with Section 5.106.5.3.1

or Section 5.106.5.3.2 to facilitate future installation of electric vehicle supply equipment (EVSE). When EVSE is/are installed, it shall be in accordance with the California Building Code, the California Electrical Code and as follows:

(Ord. 1049 § 2 (part), 2018: Ord. 1033 § 2 (part), 2017. Formerly 12.18.040).

12.18.090 Section 5.106.5.3.1 of Chapter 5 amended.

Section 5.106.5.3.1 of Chapter 5 is amended to read as follows:

5.106.5.3.1 Single charging space requirements. When only a single charging space is required per Table 5.106.3.3, the following are required to be installed at the time of construction:

- A raceway; and
- Wiring.

The raceway and wiring shall be installed in accordance with the California Electric Code. Construction plans and specifications shall include, but are not limited to the following:

Newly constructed buildings

1. The type and location of the EVSE.

2. Listed raceway and wiring capable of accommodating a 208/240-volt dedicated branch circuit.

3. The raceway shall not be less than trade size 1"

4. The raceway and wiring shall originate at a service panel or a subpanel serving the area and shall terminate in close proximity to the proposed location of the charging equipment and into a listed suitable cabinet, box, enclosure or equivalent.

5. The service panel or subpanel and wiring shall have sufficient capacity to accommodate a minimum 40-ampere dedicated branch circuit for the future installation of the EVSE.

Electrical calculations shall substantiate the design of the electrical system to include the rating of equipment and any on-site distribution transformers and have sufficient capacity to charge required EV at its full rated amperage.

Additions and/or alterations

1. The type and location of the EVSE.

2. A listed raceway capable of accommodating a 208/240-volt dedicated branch circuit.

3. The raceway shall not be less than trade size 1"

4. The raceway shall originate at a service panel or a subpanel serving the area and shall terminate in close proximity to the proposed location of the charging equipment and into a listed suitable cabinet, box, enclosure or equivalent.

5. The service panel or subpanel shall have sufficient capacity to accommodate a minimum 40-ampere dedicated branch circuit for the future installation of the EVSE.

6. Electrical calculations shall substantiate the design of the electrical system to include the rating of equipment and any on-site distribution transformers and have sufficient capacity to charge required EV at its full rated amperage.

(Ord. 1049 § 2 (part), 2018).

12.18.100 Section 5.106.5.3.2 of Chapter 5 amended.

Section 5.106.5.3.2 of Chapter 5 is amended to read as follows:

5.106.5.3.2 Multiple charging space requirements. When multiple charging spaces are required to be installed per Table 5.106.5.3.3, raceways(s) and wiring, is/are required to be installed at the time of construction and shall be installed in accordance with the California Electric Code. Construction plans and specifications shall include, but are not limited to, the following:

Newly constructed buildings

1. The type and location of the EVSE.

2. Listed raceway and wiring capable of accommodating a 208/240-volt dedicated branch circuit.

3. The raceway(s) and wiring shall originate at a service panel or a subpanel(s) serving the area and shall terminate in close proximity to the proposed location of the charging equipment and into a listed suitable cabinet(s), box(es), enclosure(s) or equivalent.

4. Plan design shall be based upon 40-ampere minimum branch circuits.

5. Electrical calculations shall substantiate the design of the electrical system to include the rating of equipment and any on-site distribution transformers and have sufficient capacity to simultaneously charge all required EV's at its full rated amperage.

6. The service panel or subpanel(s) shall have sufficient capacity to accommodate the required number of dedicated branch circuit(s) for future installation of the EVSE.

Additions and/or alterations

1. The type and location of the EVSE.

2. Listed raceway capable of accommodating a 208/240-volt dedicated branch circuit.

3. The raceway(s) shall originate at a service panel or a subpanel(s) serving the area and shall terminate in close proximity to the proposed location of the charging equipment and into a listed suitable cabinet(s), box(es), enclosure(s) or equivalent.

4. Plan design shall be based upon 40-ampere minimum branch circuits.

5. Electrical calculations shall substantiate the design of the electrical system to include the rating of equipment and any on-site distribution transformers and have sufficient capacity to simultaneously charge all required EV's at its full rated amperage.

6. The service panel or subpanel(s) shall have sufficient capacity to accommodate the required number of dedicated branch circuit(s) for future installation of the EVSE.

(Ord. 1049 § 2 (part), 2018).

12.18.110 Table 5.106.5.3.3 of Chapter 5 amended.

Table 5.106.5.3.3 of Chapter 5 is amended to read as follows:

Table 5.106.5.3.3

[1]

New Construction			Addition and/or Alteration	
Square Footage of Building	**Total Number of Parking Stalls**	**Number of Required EV Charging Spaces[2]**	**Square Footage of Affected Area**	**Number of Required EV Charging Spaces[2]**
1 sq. ft.—9,999 sq. ft.	0—9	0	1 sq. ft.—9,999 sq. ft.	0
	10—25	1		
	26—50	2		
	51—75	4	10,000 sq. ft.—25,000 sq. ft.[3]	Minimum of 5% of total required number of parking stalls and install EVSE in a minimum of 1 charging space.
Greater than 9,999 sq. ft.	N/A	Minimum of 15% of total required number of parking stalls[2] and install EVSE in 10% of the total required number of parking stalls, with a minimum of 1, in charging space(s).	Greater than 25,000 sq. ft.[4]	Minimum of 10% of total required number of parking stalls and install EVSE in 1 plus 1% of the total required number of parking stalls in charging space(s).

1. The EV space requirement is based on the required parking associated with the building where the work is being performed, inclusive of landscape reserve parking.

2. Calculations for spaces shall be rounded up to the nearest whole number.

3. For additions/alterations10,000 sq. ft.—25,000 sq. ft. in the first year after the effective date of the ordinance, the requirement would be one percent. In the second

year after the effective date of the ordinance, the requirement would be three percent. In the third year after the effective date of the ordinance and thereafter, the requirement would be five percent.

4. For larger additions/alterations (25,001 sq. ft. and greater), in the first year after the effective date of the ordinance, the requirement would be two percent. The second year after the effective date of the ordinance, the requirement would be five percent. In the third year after the effective date of the ordinance and thereafter, the requirement would be 10 percent.

(Ord. 1049 § 2 (part), 2018).

City of San Mateo

23.70.040 LOCAL AMENDMENT FOR ELECTRIC VEHICLE CHARGING FOR NEW NONRESIDENTIAL CONSTRUCTION.

The California Green Building Standards Code, 2016 Edition, Section 5.106.5.3.3 EV charging space calculation is amended to include the nonresidential/commercial voluntary Tier 2 Measure for EV charging space calculation per Section A5.106.5.3.3 as follows:

(a) **New Nonresidential Construction.** Table A5.106.5.3.2 shall be used to determine if single or multiple charging space requirements apply for future installation of electric vehicle supply equipment (EVSE). When a single charging space is required, refer to Section 5.106.5.3.1 for design requirements. When multiple charging spaces are required, refer to Section 5.106.5.3.2 for design requirements.

TABLE A5.106.5.3.2

TOTAL NUMBER OF ACTUAL PARKING SPACES	TIER 2 NUMBER OF REQUIRED EV CHARGING SPACES
0-9	1
10-25	2
26-50	4
51-75	6
76-100	6
101-150	12
151-200	17
201 and over	10 percent of total[1]

1. Calculation for spaces shall be rounded up to the nearest whole number.

Note: Projects shall reference the California Green Building Code, 2016 Edition, Section 5.106.5.3 and California Electrical Code for definitions and requirements related to electric vehicle charging spaces. (Ord. 2016-11 § 1)

San Rafael

- **12.23.010 - Adoption of California Green Building Standards Code, 2016 Edition, with amendments.**

The city council hereby adopts, for the purpose of improving public health, safety and general welfare by enhancing the design and construction of buildings through the use of building practices that reduce negative environmental impact and encourage sustainable construction practices, that certain code known as the 2016 California Green Building Standards Code, as is hereafter amended and modified by Section 12.23.020 of this chapter. Not less than one copy of said code shall be maintained by the office of the city clerk.

(Ord. No. 1943 , div. 8, 11-21-2016)

- **12.23.020 - Amendments to the California Green Building Standards Code.**

The 2016 California Green Building Standards Code is amended or modified as follows:

In addition to complying with the base provisions of the 2016 California Green Building Standards Code, new buildings for which an application for a building permit is submitted on or after January 2, 2017, shall additionally comply with Appendix A4 of such code, with respect to the Tier 1 measures, but excluding Division A4.2; or with Appendix A5 of such code, with respect to the Tier 1 measures, but excluding Division A5.2, depending on occupancy type.

(Ord. No. 1943 , div. 8, 11-21-2016)

Santa Clara County

- Section 5.106.5.3 (Electric vehicle (EV) charging.) is amended to read as follows:

> *5.106.5.3 Electric vehicle (EV) charging.* At least 5 percent of the total parking spaces, but not less than one, and not less than required by Table 5.106.5.3.3, shall be capable of supporting

future electric vehicle supply equipment (EVSE). The percentage calculated shall be rounded up to the next whole number. When EVSE(s) is/are installed, it shall be in accordance with the California Building Code, the California Electrical Code and as follows:

(d)

Section 5.106.5.3.1 (Single charging space requirements) is amended to read as follows:

5.106.5.3.1 Single charging space requirements. When only a single charging space is required, a raceway is required to be installed at the time of construction and shall be installed in accordance with the California Electrical Code. Construction plans and specifications shall include, but are not limited to, the following:

1.

The type and location of the EVSE.

2.

A listed raceway capable of accommodating a 208/240-volt dedicated branch circuit.

3.

The raceway shall not be less than trade size 1".

4.

The raceway shall originate at a service panel or a subpanel serving the area, and shall terminate in close proximity to the proposed location of the charging equipment and into a listed suitable cabinet, box, enclosure or equivalent.

5.

The service panel or subpanel shall have sufficient capacity to accommodate a minimum 40-ampere dedicated branch circuit for the future installation of the EVSE.

(e)

Section 5.106.5.3.2 (Multiple charging space requirements) is amended to read as follows:

5.106.5.3.2 Multiple charging space requirements. When multiple charging spaces are required, raceway(s) are required to be installed at the time of construction and shall be installed in accordance with the California Electrical Code. Construction plans and specifications shall include, but are not limited to, the following:

1.

The type and location of the EVSE.

2.

The raceway(s) shall originate at a service panel or a subpanel(s) serving the area, and shall terminate in close proximity to the proposed location of the charging equipment and into listed suitable cabinet(s), box(es), enclosure(s) or equivalent.

3.

Plan design shall be based upon 40-ampere minimum branch circuits.

4.

Electrical calculations shall substantiate the design of the electrical system, to include the rating of equipment and any on-site distribution transformers and have sufficient capacity to simultaneously charge all required EVs at its full rated amperage.

(f)

Section 5.106.5.3.3 (EV Charging space calculation.) is amended to read as follows:

5.106.5.3.3 Buildings with more than 100 new parking spaces. Install Level 2 EVSE to service one (1) percent of the total number of parking spaces. The percentage calculated shall be rounded up to the next whole number. The EVSE shall be located within the parking area.

Exceptions: On a case-by-case basis where the local enforcing agency has determined EV charging and infrastructure is not feasible based upon one or more of the following conditions:

1.

Where there is insufficient electrical supply.

2.

Where there is evidence suitable to the local enforcing agency substantiating that additional local utility infrastructure design requirements, directly related to the implementation of Section 5.106.5.3, may adversely impact the construction cost of the project.

(g)

Table 5.106.5.3.3 is deleted.

(h)

Section 5.106.5.3.6 (Shared Parking) is added to read as follows:

5.106.5.3.6 Shared Parking. When parking is provided to new buildings from shared parking lots, including existing and new parking lots, the requirements of this section may be met through the installation of pre-wiring and/or EVSE among both

the existing and new parking lots. Pre-wiring or EVSE previously installed in shared parking lots servicing new buildings may also meet the requirements of this section. If a new building does not require the installation of new parking spaces, as approved by the County, the requirements to install pre-wiring or EVSE in parking areas does not apply.

Santa Cruz

24.12.241 ELECTRIC VEHICLE CHARGING STATION REQUIREMENTS.

1. Definitions.

a. "Electric vehicle" means a vehicle that operates, either partially or exclusively, on electrical energy from the electrical grid, or an off-grid source, that is stored on board for motive purposes.

b. Electric Vehicle Supply Equipment (EVSE) Installed. "EVSE installed" shall mean an installed Level 2 EVSE, as defined by the California Green Building Standards Code (CAL Green) of California Building Standards regulations, et seq.

2. Required Spaces Are Rounded. When determination of the number of required electric vehicle parking stalls by this title results in a requirement of a fractional space, any fraction of less than one-half may be disregarded, while a fraction of one-half or more shall be counted as one parking space.

3. Electric Vehicle Charging Stations.

a. Electric Vehicle (EV) Charging for Multifamily Residential Structures. New multifamily dwellings on a single site with five or more units shall provide twelve percent of total parking, but no fewer than one, as electric vehicle parking space with EVSE installed. Multifamily projects requiring an EV van accessible parking space shall receive a credit of one parking space.

b. Electric Vehicle (EV) Charging for Nonresidential Structures. New nonresidential structures shall provide parking spaces with EVSE installed in accordance with the following table:

Total Number of Actual Parking Spaces	Total Number of Actual or Required EVSE Spaces, Whichever Is Greater
0 – 9	0
10 – 25	1
26 – 50	2
51 – 75	4
76 – 100	5
101 – 150	7
151 – 200	10
201 and over	6 percent of total

(Ord. 2017-02 § 2, 2017).

Santa Rosa

18-42.010 Citation of California Green Building Standards Code.

For purposes of citation, all sections of the California Green Building Standards Code, Part 11 of Title 24, 2016 Edition, published by the California Building Standards Commission, including its Appendix Chapter A4, Sections A4.1; A4.3, A4.4; A4.5 and A4.6, Residential Voluntary Measures at Tier I level for new structures; and Appendix Chapter A5, Sections A5.1; A5.3; A5.4; A5.5 and A5.6, Nonresidential Voluntary Measures at Tier I level for new structures only, as adopted by reference in this Title 18, are renumbered by adding "18-42." before each section number. (Ord. 4080 § 12, 2016)

Long Beach

18.47.050 - Amend CALGreen Section 5.106.5.3.3—EV charging space calculation.

Section 5.106.5.3.3 of the 2016 Edition of the California Green Building Standards Code is amended to read as follows:

5.106.5.3.3 EV charging space calculation. [N] Where nonresidential buildings or structures are constructed on a building site, twenty-five percent (25%) of the total number of parking spaces, but in no case less than one, shall be EV spaces capable of supporting future EVSE and five percent (5%) of the total number of parking spaces, but in no case less than one (1), shall have EV chargers installed. Calculations for the required number of EV spaces shall be rounded up to the nearest whole number.

(ORD-16-0026 § 1(Exh. A), 2016)

Pasadena

14.04.504 - Section 307 is added to the 2016 California Green Building Standards Code is to read as follows.

307.1 Buildings required to comply with Tier 1 include the following:

1. municipal buildings of 5,000 square feet or more of new construction.
2. non-residential buildings with 25,000 square feet or more of new construction.
3. tenant improvements of 25,000 square feet or more.
4. mixed use and multi-family residential buildings four stories in height or more.

307.2 Buildings required to comply with Tier 2 include the following:

1. new municipal buildings.
2. municipal renovations of 15,000 square feet or more.
3. commercial type buildings of over 50,000 square feet or more.

Note. Where there are practical difficulties involved in complying with the threshold levels of a tier, the enforcing agency may grant modifications for individual cases. The enforcing agency shall first find that a special individual reason makes the strict letter of the tier impractical and that modification is in conformance with the intent and purpose of the measure. The details of any action granting modification shall be recorded and entered in the files of the enforcing agency.

(Ord. No. 7289, § 3(J), 12-12-2016)

Portola Valley

Electric Vehicle "Ready" Infrastructure. "Section 4.106.4 Electric vehicle (EV) charging for new construction" of the California Green Building Standards Code is added as mandatory and amended with the additional requirements as outlined below.

(1) Service panel and/or subpanel shall provide, at minimum, capacity to install a 208/240v, 50 amperes grounded AC outlet and dedicated branch circuit.

(2) Raceway or wiring with capacity to accommodate a one hundred ampere circuit; terminating in a listed cabinet box, enclosure, or NEMA receptacle.

(3) The raceway shall be installed so that minimal removal of materials is necessary to complete the final installation.

Appendix J: Greenhouse Gas (GHG) Emission Reduction Estimates

Table J1: All Nonresidential Buildings: 10 Percent Mandatory Provision: Greenhouse Gas (GHG) Reduction Potential for Installation of Level 2 EV Chargers at EV Capable Spaces in All Nonresidential Buildings by 2025

Variable	Units		Low-Range Estimate of EV Capable Spaces (17,000) & Grid Average Electricity Emission Factor[a]		High-Range Estimate of EV Capable Spaces (21,000) & Marginal Electricity Emission Factor[b]	
			PHEV	**BEV**	**PHEV**	**BEV**
Electricity Emission Factor[1]	(MT CO_2e/MWh)		0.252	0.252	0.293	0.293
Fuel Economy of Electric Vehicle[2]	(kWh/mile)	0.25	0.25	0.25	0.25	0.25
Gasoline CO_2 Emission while Running[3]	(CO_2 grm/mile)	302	295	295	295	295
Annual VMT Reduction per Parking Spot[4]	(miles/charging station/year)		22,500	45,000	22,500	45,000
Number of Parking Spots Provided Chargers			8,500	8,500	10,500	10,500
Annual VMT Reduction of All Stations[5]	(miles/year)		153,000,000	306,000,000	189,000,000	378,000,000
GHG Emissions of Gasoline Vehicle[6]	(MT CO_2e)		45,089	90,178	55,698	111,397
GHG Emissions of Electric Vehicle[7]	(MT CO_2e)		9,639	19,278	13,844	27,689
GHG Emissions Reduction[8]	(MT CO_2e)		35,450	70,900	41,854	83,708
GHG Reductions per Charging Station Per Year	(MT CO_2e)		4	8	4	8
TOTAL	Annual VMT Reduction of All Stations (miles/year)		459,000,000		567,000,000	
	GHG Emissions of Gasoline Vehicle[5] (MT CO_2e)		136,000		168,000	
	GHG Emissions of Electric Vehicle[6] (MT CO_2e)		29,000		42,000	
	Annual GHG Emissions Reduction[7] (MT CO_2e)		107,000		126,000	

Notes:

[1] Carbon Dioxide Equivalent (CO2e) Emission Factors
[a] 2020 Grid Average Electricity Emissions Factor with 33% RPS, Larry Hunsaker, CARB
[b] 2020 Marginal Electricity Emissions Factor, Dave Mehl, CARB

[2] US Department of Energy, 2016, Benefits and Considerations of Electricity as a Vehicle Fuel. Available at: http://www.afdc.energy.gov/fuels/electricity_benefits.html. Accessed: February, 2017

[3] Using EMFAC 2014 Web Database, running exhaust emission rate for CO2 for all light duty gasoline models and speeds, averaged over all seasons for 2020. Available at: http://www.arb.ca.gov/emfac/2014. Accessed: February, 2017

[4] Annual VMT reduction estimated based on an estimate for annual hours/year of charge time per charging station that charges at a rate of 20 mi/hour for BEV at Level 2, and 10 mi/hour for PHEV at Level 2

[5] Annual VMT Reduction assumes an 80% space occupancy

[6] GHG emissions calculated using annual VMT reductions at all stations and CO_2 emission rate. Methane and nitrous oxide are conservatively not included.

[7] GHG emissions calculated using annual VMT reductions at all stations, fuel economy of electric vehicle, along with electricity CO_2e emission factors. Nitrous oxide is conservatively not included.

[8] GHG emissions reduction is a difference of GHG emissions of gasoline vehicles and GHG emissions of electric vehicles. Nitrous oxide is conservatively not included.

Abbreviations:

CO2e - equivalents of carbon dioxide

EV - electric vehicle, including both plug-in hybrid electric vehicles (PHEVs) and battery electric vehicle (BEV)

GHG - greenhouse gas

grm - grams

KWh - kilowatt hour

MT - metric ton

MWh - megawatt hour

VMT - vehicle miles traveled

Table J2: All Nonresidential Buildings: Estimated Annual Energy Demand for EV Chargers Installed at EV Capable Spaces in Nonresidential Buildings

Scenario	EVSE		Power (kW)[c]	Annual Hours	Annual (kWh)	Total Annual (MWh)
	Charger Type	Number of Spaces				
Low	L2 (PHEV)	8,500	3.3	2250	63,112,500	189,400
	L2 (BEV)	8,500	6.6	2250	126,225,000	
High	L2 (PHEV)	10,500	3.3	2250	77,962,500	233,900
	L2 (BEV)	10,500	6.6	2250	155,925,000	

[c] https://www.fleetcarma.com/electric-vehicle-charging-guide/ 3.3 kW for PHEVs and 6.6 kW for BEVs

Table J3: All Nonresidential Buildings: Estimated Annual VMT Reduction for EV Chargers Installed at EV Capable Spaces in Nonresidential Buildings

Scenario	EVSE		Annual Hours	Vehicle Onboard Charger Speed (Miles/Hour)	Annual VMT Reduction Per Parking Spot	Annual VMT Reduction for All Stations (miles/year)	Annual VMT Reduction per scenario (miles/year)
	Charger Type	Number of Spaces					
Low	L2 (PHEV)	8,500	2250	10	22,500	153,000,000	459,000,000
	L2 (BEV)	8,500	2250	20	45,000	306,000,000	
High	L2 (PHEV)	10,500	2250	10	22,500	189,000,000	567,000,000
	L2 (BEV)	10,500	2250	20	45,000	378,000,000	

Assumptions:

1) Annual hours are based on 250 days per year, 9 hours per day.
2) Space occupancy is 80%.

Table J4: Buildings Under BSC Authority- 10% Mandatory Provision: Annual Greenhouse Gas (GHG) Reduction Potential for Installation of Level 2 EV Chargers at EV Capable Spaces in Nonresidential Buildings

Variable	Units		Low Range Estimate of EV Capable Spaces (14,000) & Grid Average Electricity Emission Factor[a]		High Range Estimate of EV Capable Spaces (17,000) & Marginal Electricity Emission Factor[b]	
			PHEV	**BEV**	**PHEV**	**BEV**
Electricity Emission Factor[1]	(MT CO_2e/MWh)		0.252	0.252	0.293	0.293
Fuel Economy of Electric Vehicle[2]	(kWh/mile)	0.25	0.25	0.25	0.25	0.25
Gasoline CO_2 Emission while Running[3]	(CO_2 gms/mile)	302	295	295	295	295
Annual VMT Reduction per Parking Spot[4]	(miles/charging station/year)		22,500	45,000	22,500	45,000
Number of Parking Spots Provided Chargers			7,000	7,000	8,500	8,500
Annual VMT Reduction of All Stations[5]	(miles/year)		126,000,000	252,000,000	153,000,000	306,000,000
GHG Emissions of Gasoline Vehicle[6]	(MT CO_2e)		37,132	74,264	45,089	90,178
GHG Emissions of Electric Vehicle[7]	(MT CO_2e)		7,938	15,876	11,207	22,415
GHG Emissions Reduction[8]	(MT CO_2e)		29,194	58,388	33,882	67,764
GHG Reductions per Charging Station Per Year	(MT CO_2e)		4	8	4	8
TOTAL	Annual VMT Reduction of All Stations	(miles/year)	378,000,000		459,000,000	
	GHG Emissions of Gasoline Vehicle[5]	(MT CO_2e)	112,000		136,000	
	GHG Emissions of Electric Vehicle[6]	(MT CO_2e)	24,000		34,000	
	Annual GHG Emissions Reduction[7]	(MT CO_2e)	88,000		102,000	

Notes:

[1] Carbon Dioxide Equivalent (CO2e) Emission Factors

[a] 2020 Grid Average Electricity Emissions Factor with 33% RPS, Larry Hunsaker, CARB

[b] 2020 Marginal Electricity Emissions Factor, Dave Mehl, CARB

[2] US Department of Energy, 2016, Benefits and Considerations of Electricity as a Vehicle Fuel. Available at: http://www.afdc.energy.gov/fuels/electricity_benefits.html. Accessed: February, 2017

[3] Using EMFAC 2014 Web Database, running exhaust emission rate for CO2 for all light duty gasoline models and speeds, averaged over all seasons for 2020. Available at: http://www.arb.ca.gov/emfac/2014. Accessed: February, 2017

[4] Annual VMT reduction estimated based on an estimate for annual hours/year of charge time per charging station that charges at a rate of 20 mi/hour for BEV at Level 2, and 10 mi/hour for PHEV at Level 2

[5] Annual VMT Reduction assumes an 80% space occupancy

[6] GHG emissions calculated using annual VMT reductions at all stations and CO_2 emission rate. Methane and nitrous oxide are conservatively not included.

[7] GHG emissions calculated using annual VMT reductions at all stations, fuel economy of electric vehicle, along with electricity CO_2e emission factors. Nitrous oxide is conservatively not included.

[8] GHG emissions reduction is a difference of GHG emissions of gasoline vehicles and GHG emissions of electric vehicles. Nitrous oxide is conservatively not included.

Abbreviations:

CO2e - equivalents of carbon dioxide

EV - electric vehicle, including both plug-in hybrid electric vehicles (PHEVs) and battery electric vehicle (BEV)

GHG - greenhouse gas

grm - grams

KWh - kilowatt hour

MT - metric ton

MWh - megawatt hour

VMT - vehicle miles traveled

Table J5: Buildings Under BSC Authority: Estimated Annual Energy Demand for EV Chargers Installed at EV Capable Spaces in Nonresidential Buildings

Scenario	EVSE		Power (kW)[c]	Annual Hours	Annual (kWh)	Total Annual (MWh)
	Charger Type	Number of Spaces				
Low	L2 (PHEV)	7,000	3.3	2250	51,975,000	156,000
	L2 (BEV)	7,000	6.6	2250	103,950,000	
High	L2 (PHEV)	8,500	3.3	2250	63,112,500	189,400
	L2 (BEV)	8,500	6.6	2250	126,225,000	
[c] https://www.fleetcarma.com/electric-vehicle-charging-guide/ 3.3 kW for PHEVs and 6.6 kW for BEVs						

Table J6: Buildings Under BSC Authority: Estimated Annual VMT Reduction for EV Chargers Installed at EV Capable Spaces in Nonresidential Buildings

Scenario	EVSE		Annual Hours	Vehicle Onboard Charger Speed (Miles/Hour)	Annual VMT Reduction Per Parking Spot	Annual VMT Reduction for All Stations (miles/year)	Annual VMT Reduction per scenario (miles/year)
	Charger Type	Number of Spaces					
Low	L2 (PHEV)	7,000	2250	10	22,500	126,000,000	378,000,000
	L2 (BEV)	7,000	2250	20	45,000	252,000,000	
High	L2 (PHEV)	8,500	2250	10	22,500	153,000,000	459,000,000
	L2 (BEV)	8,500	2250	20	45,000	306,000,000	
Assumptions: 1) Annual hours are based on 250 days per year, 9 hours per day. 2) Space occupancy is 80%.							

Table J7: Buildings Under DSA Authority- 10% Mandatory Provision: Annual Greenhouse Gas (GHG) Reduction Potential for Installation of Level 2 EV Chargers at EV Capable Spaces in Nonresidential Buildings

Variable	Units		Low Range Estimate of EV Capable Spaces (2,400) & Grid Average Electricity Emission Factor[a]		High Range Estimate of EV Capable Spaces (2,900) & Marginal Electricity Emission Factor[b]	
			PHEV	**BEV**	**PHEV**	**BEV**
Electricity Emission Factor[1]	(MT CO_2e/MWh)		0.252	0.252	0.293	0.293
Fuel Economy of Electric Vehicle[2]	(kWh/mile)	0.25	0.25	0.25	0.25	0.25
Gasoline CO_2 Emission while Running[3]	(CO_2 gms/mile)	302	295	295	295	295
Annual VMT Reduction per Parking Spot[4]	(miles/charging station/year)		22,500	45,000	22,500	45,000
Number of Parking Spots Provided Chargers			1,200	1,200	1,450	1,450
Annual VMT Reduction of All Stations[5]	(miles/year)		21,600,000	43,200,000	26,100,000	52,200,000
GHG Emissions of Gasoline Vehicle[6]	(MT CO_2e)		6,366	12,731	7,692	15,383
GHG Emissions of Electric Vehicle[7]	(MT CO_2e)		1,361	2,722	1,912	3,824
GHG Emissions Reduction[8]	(MT CO_2e)		5,005	10,009	5,780	11,560
GHG Reductions per Charging Station Per Year	(MT CO_2e)		4	8	4	8
TOTAL	Annual VMT Reduction of All Stations	(miles/year)	64,800,000		78,300,000	
	GHG Emissions of Gasoline Vehicle[5]	(MT CO_2e)	20,000		24,000	
	GHG Emissions of Electric Vehicle[6]	(MT CO_2e)	5,000		6,000	
	Annual GHG Emissions Reduction[7]	(MT CO_2e)	16,000		18,000	

Notes:

[1] Carbon Dioxide Equivalent (CO2e) Emission Factors

[a] 2020 Grid Average Electricity Emissions Factor with 33% RPS, Larry Hunsaker, CARB

[b] 2020 Marginal Electricity Emissions Factor, Dave Mehl, CARB

[2] US Department of Energy, 2016, Benefits and Considerations of Electricity as a Vehicle Fuel. Available at: http://www.afdc.energy.gov/fuels/electricity_benefits.html. Accessed: February, 2017

[3] Using EMFAC 2014 Web Database, running exhaust emission rate for CO2 for all light duty gasoline models and speeds, averaged over all seasons for 2020. Available at: http://www.arb.ca.gov/emfac/2014. Accessed: February, 2017

[4] Annual VMT reduction estimated based on an estimate for annual hours/year of charge time per charging station that charges at a rate of 20 mi/hour for BEV at Level 2, and 10 mi/hour for PHEV at Level 2

[5] Annual VMT Reduction assumes an 80% space occupancy

[6] GHG emissions calculated using annual VMT reductions at all stations and CO_2 emisson rate. Methane and nitrous oxide are conservatively not included.

[7] GHG emissions calculated using annual VMT reductions at all stations, fuel economy of electric vehicle, along with electricity CO_2e emission factors. Nitrous oxide is conservatively not included.

[8] GHG emissions reduction is a difference of GHG emissions of gasoline vehicles and GHG emissions of electric vehicles. Nitrous oxide is conservatively not included.

Abbreviations:

CO2e - equivalents of carbon dioxide

EV - electric vehicle, including both plug-in hybrid electric vehicles (PHEVs) and battery electric vehicle (BEV)

GHG - greenhouse gas

grm - grams

KWh - kilowatt hour

MT - metric ton

MWh - megawatt hour

VMT - vehicle miles traveled

Table J8: Buildings Under DSA Authority: Estimated Annual Energy Demand for EV Chargers Installed at EV Capable Spaces in Nonresidential Buildings

Scenario	EVSE		Power (kW)[c]	Annual Hours	Annual (kWh)	Total Annual (MWh)
	Charger Type	Number of Spaces				
Low	L2 (PHEV)	1,200	3.3	2250	8,910,000	26,800
	L2 (BEV)	1,200	6.6	2250	17,820,000	
High	L2 (PHEV)	1,450	3.3	2250	10,766,200	32,300
	L2 (BEV)	1,450	6.6	2250	21,532,500	
[c] https://www.fleetcarma.com/electric-vehicle-charging-guide/ 3.3 kW for PHEVs and 6.6 kW for BEVs						

Table J9: Buildings Under DSA Authority: Estimated Annual VMT Reduction for EV Chargers Installed at EV Capable Spaces in Nonresidential Buildings

Scenario	EVSE		Annual Hours	Vehicle Onboard Charger Speed (Miles/Hour)	Annual VMT Reduction Per Parking Spot	Annual VMT Reduction for All Stations (miles/year)	Annual VMT Reduction per scenario (miles/year)
	Charger Type	Number of Spaces					
Low	L2 (PHEV)	1,200	2250	10	22,500	21,600,000	64,800,000
	L2 (BEV)	1,200	2250	20	45,000	43,200,000	
High	L2 (PHEV)	1,450	2250	10	22,500	26,100,000	78,300,000
	L2 (BEV)	1,450	2250	20	45,000	52,200,000	

Assumptions:

1) Annual hours are based on 250 days per year, 9 hours per day.
2) Space occupancy is 80%.

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