Economic and Fiscal Impact Statement Attachment

California Building Standards Commission – BSC 06-15
Amend the July 1, 2015 Supplement to the
California Green Building Standards Code, CCR, Title 24, Part 11
Additional information is provided below for specific items on the STD. 399

ECONOMIC IMPACT STATEMENT
Items:

A. ESTIMATED PRIVATE SECTOR COST IMPACTS

3. Describe the types of businesses (Include nonprofits):
   - The types of businesses impacted by the EV charging infrastructure provisions are any businesses funding the development of retail, grocery, restaurants, warehouses, or office buildings. New nonresidential construction projects with parking facilities greater than 9 stalls would be affected except hotels, schools, and hospitals.

   Total Number of Businesses Impacted
   - An estimated 800 to 1,000 new buildings may be constructed between 2017 and 2020. This economic analysis assumes that the total number of businesses impacted is equal to the total number of new commercial buildings constructed.

B. ESTIMATED COSTS

1. Estimated Statewide Dollar Costs for Businesses and Individuals
   - A statewide cost of $30 million to $36 million was estimated due to implementation of this regulation from 2017 to 2020. The current building standard requires installation of EV charging infrastructure in approximately 3 percent of total parking spaces for new nonresidential construction. The proposed building standard would require installation of EV charging infrastructure in approximately 6 percent of total parking spaces. The estimated statewide dollar costs are based on the estimated cost of $830 per charging space and the incremental difference in EV charging infrastructure that may result in the installation of an additional 36,000 to 43,000 EV charging spaces by 2020.

   b) The current EV charging infrastructure provisions in the CALGreen Code only go into effect in new commercial buildings with parking lots that have 51 parking spaces or more. The suggested code changes would require new commercial buildings with parking lots that have 10 parking spaces or more to install EV charging infrastructure. More than 70 percent of new buildings are estimated to be 10,000 square feet or smaller. The typical size parking lot for these buildings is under 50 parking spaces. As a result, the initial cost for a typical business is estimated to be between $830 and $1,660, which would be the cost to install EV charging infrastructure for only one or two charging spaces.

5. Explain the need for State regulation given the existence or absence of Federal regulations:
   - Currently there are no federal regulations for mandatory electric vehicle infrastructure installations. Assembly Bill 1092 (Ch. 410, Stats of 2013) directs CBSC to develop mandatory EV standards for non-residential development. In addition, this regulation supports Governor Brown's Executive Order B-16-2012 to provide charging infrastructure to support 1 million zero emission vehicles (ZEV) by 2020 and to have 1.5 million ZEVs on California roads by 2025.

C. ESTIMATED BENEFITS

1. Explain the estimated benefits to be derived from this proposal:
    - Statutory requirements include Assembly Bill 1092 (Ch. 410, Stats 2013), which directs CBSC to develop mandatory EV standards and SB 1473 (Chapter 719, Statutes 2008), which grants CBSC authority to develop green building standards for occupancies where no other agency has authority or expertise. The benefits of this regulation include sustaining California's natural resources by reduction in energy, reduction in greenhouse gas emissions, and less dependency on fossil fuel.

3. What are the total statewide benefits (avoided costs) from this regulation over its lifetime?
    - An estimated total statewide benefit (avoided cost) of $104 million to $263 million may be achieved due to adoption of the mandatory EV charging infrastructure provisions in the CALGreen Code. ARB assumed that each new charging space with EV charging infrastructure would avoid retrofit costs of $3,750 to $6,975 per charging space. The incremental difference between the 3 percent requirement and the 6 percent requirement would result in the installation of an additional 36,000 to 43,000 EV charging spaces. This suggested code change would result in statewide avoided retrofit costs of $134 million to $299 million. A statewide avoided cost (benefit) of $104 million to $263 million was estimated by subtracting the statewide initial cost of $30 million to $36 million from the estimated statewide avoided retrofit costs.

D. ALTERNATIVES TO THE REGULATION

D.1. and D.2. Alternatives

- The first alternative considered would include a requirement for 4 percent of parking spaces to install raceway and panel capacity to support dedicated branch circuits. An estimated total statewide benefit (avoided costs) of $32 million to $42 million may be achieved due to adoption of the first alternative for mandatory EV charging infrastructure provisions in the CALGreen Code. The incremental difference between the 3 percent requirement and the 4 percent requirement would result in the installation of an additional 12,000 to 14,000 EV charging spaces. Statewide initial construction costs of $10 million to $12 million were calculated based on the estimated upfront cost of $830 per each additional EV charging space installed. ARB assumed that each additional charging space with EV charging infrastructure would avoid retrofit costs of $3,750 to $6,975 per charging space. This first alternative would result in statewide avoided retrofit costs of $42 million to $54 million. A statewide avoided cost (benefit) of $32 million to $42 million was estimated by subtracting the statewide initial cost of $10 million to $12 million from the estimated statewide avoided retrofit costs.

- The second alternative considered would include a requirement for 6 percent of parking spaces to install raceway, wiring, and panel capacity to support dedicated branch circuits. An estimated total statewide benefit (avoided costs) of $75 million to $228 million may be achieved due to adoption of the second alternative for mandatory EV charging infrastructure provisions in the CALGreen Code. The incremental difference between the 3 percent requirement and the 6 percent requirement would result in the installation of an additional 36,000 to 43,000 EV charging spaces. Statewide initial construction costs of $59 million to $71 million were calculated based on the estimated upfront cost of $830 per each additional EV charging space installed. ARB assumed that each additional charging space with EV charging infrastructure would avoid retrofit costs of $3,750 to $6,975 per charging space. This second alternative would result in statewide avoided retrofit costs of $134 million to $299 million. A statewide avoided cost (benefit) of $75 million to $228

million was estimated by subtracting the statewide initial cost of $59 million to $71 million from the estimated statewide avoided retrofit costs.

E. MAJOR REGULATIONS

1. The benefits of the regulations, including, but not limited to, benefits to the health, safety, and welfare of California residents, worker safety, and the state's environment and quality of life, among any other benefits identified by the agency:
   - The benefits of these regulations include facilitating large scale deployment of zero emission vehicles, which will sustain California's natural resources by the reduction of energy use, reduction in greenhouse gas emissions, and less dependency on fossil fuels. The benefit also includes $104 million to $263 million in avoided costs statewide.

3. The cost-effectiveness ratio here represents compliance cost per dollar of benefit (avoided cost).

FISCAL IMPACT STATEMENT
Items:

B. ESTIMATED COSTS

4. Fiscal Effect on State Government
   No cost is expected for the California Building Standards Commission or any other local or State agencies and there is no impact on federal funding of state programs.

2015

Electric Vehicle Charging Infrastructure

Green Building Standards (CALGreen) Code
Suggested Code Changes for Nonresidential Buildings
Technical and Cost Analysis

California Environmental Protection Agency
Air Resources Board

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California Air Resources Board

Executive Officer
Richard W. Corey

Prepared by
Research Division
Emissions Compliance, Automotive Regulations and Science (ECARS) Division

Primary Author
Dana Papke Waters

Contributors
Simeon Haynes
Mark Siroky
Elise Keddie
Annalisa Schilla
Reza Mahdavi
Fereidun Feizollahi
Ash Lashgari
Eileen McCauley
Jorn D. Herner
Joshua Cunningham
Analisa Bevan
Bart Croes
Annette Hebert
Kurt Karperos
Alberto Ayala

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Disclaimer
This document has been prepared by the staff of the California Air Resources Board. Publication does not signify that the contents reflect the views and policies of the Air Resources Board.

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 (ARB) 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, ARB staff has provided suggested changes to the CALGreen Code to ensure it is updated to support ARB programs and regulations including, but not limited to, California Global Warming Solutions Act of 2006 (AB 32, Nunez, Statutes of 2006, Chapter 488), Zero Emission Vehicles (ZEV), and The Sustainable Communities and Climate Protection Act of 2008 (SB 375, Steinberg, Statutes of 2006, Chapter 728). Beginning with the 2016 triennial code cycle, ARB staff will provide technical and fiscal analyses along with suggested code changes as required by Health and Safety Code, § 18930.5 (b). Additionally, ARB staff will identify 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, ARB 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.

Table of Contents

Executive Summary

Electric vehicle (EV) charging infrastructure in the California Green Building Standards (CALGreen) Code supports California's Zero Emission Vehicle (ZEV) program, which aims to improve air quality and reduce greenhouse gas (GHG) emissions. The latest CALGreen Code, effective July 1, 2015, requires 3% of parking spaces to install EV charging infrastructure (raceway and panel capacity to support dedicated branch circuits) in new commercial buildings. These building standards are a good first step that provides EV charging infrastructure in new construction. However, in order to adequately meet future demand for EV charging, the CALGreen Code must be strengthened to require more EV charging infrastructure during the 2016 code cycle.

In early 2012, Governor Brown issued Executive Order B-16-12 directing state government to help accelerate the market for ZEVs in California. This executive order established several milestones on a path toward 1.5 million ZEVs in California by the year 2025. As an interim target, the executive order also requires California's ZEV infrastructure to support up to 1 million vehicles by 2020.

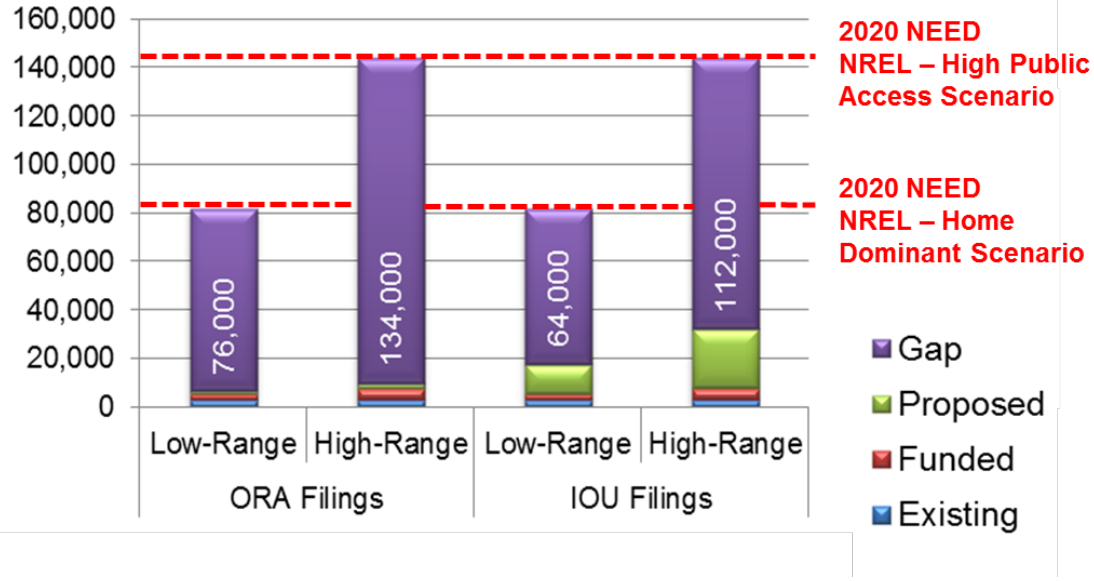
In response to the Executive Order, the Governor's Office released a ZEV Action Plan in February 2013. The ZEV Action Plan identified the California Energy Commission (CEC) as the lead agency to develop a statewide plan for plug-in electric vehicle (PEV) infrastructure. CEC contracted with the National Renewable Energy Laboratory (NREL) to develop a "California Statewide Plug-In Electric Vehicle Infrastructure Assessment." In order to meet the charging demand in 2020, NREL determined that between 82,000 and 144,000 Level 2 electric vehicle supply equipment (EVSE) charge points, often referred to as charging stations, are needed in workplace locations by 2020.

Recognizing the important role that building standards could play in advancing the market for ZEVs, the ZEV Action Plan also recommended amending the California Building Standards Code to ensure that new buildings are "ZEV-ready." The Building Standards Commission (BSC) adopted voluntary EV charging standards in the CALGreen Code during the 2012/13 Intervening Code Cycle. Under a mandate from Assembly Bill 1092 (Chapter 410 Statutes of 2013), BSC adopted mandatory EV charging standards for nonresidential buildings in Section 5.106.5 of the CALGreen Code that go into effect July 1, 2015. The EV charging standards in the CALGreen Code are "EV-capable" and provide EV charging infrastructure to support future installation of EVSE charging stations.

At the beginning of the 2016 Code Cycle, ARB staff recommended that the BSC revise both the mandatory and voluntary measures for EV charging infrastructure. ARB staff suggested increasing the requirement for percent of parking spaces to include EV charging infrastructure. ARB staff also suggested revising the minimum parking lot threshold that requires installing infrastructure to support at least one EV-capable charging space. These code changes will accommodate a greater percent of future EV charging. ARB staff received a public comment recommending a more detailed technical analysis to support the suggested code changes.

ARB staff gathered data from multiple sources to identify how many EV-capable charging spaces will be needed in workplace locations by 2020. ARB staff gathered information on existing, funded, and proposed EV charging infrastructure to determine the gap in needed Level 2 EVSE charge points remaining for 2020. ARB staff assumed that for every charge point needed in 2020, it would require a dedicated EV-capable charging space. An estimated gap of at least 64,000 and as many as 134,000 EV charging spaces are needed in workplace locations by 2020 (Figure 1).

Figure 1. Workplace Locations: Estimated Gap in EV Charging Spaces by 2020



2016 Code Cycle – Suggested Code Changes

For the 2016 Code Cycle, ARB staff recommends increasing the current 3 percent requirement to 6 percent for all new nonresidential buildings. Additionally, ARB staff recommends lowering the parking lot size threshold from 51 spaces to 10 spaces. Together, these changes would result in an estimated additional 72,000 to 86,000 EV-capable parking spaces statewide. This will help ensure that enough infrastructure will be installed between 2017 and 2020 to fill the gap between what exists, what is funded, what is proposed, and how many EVSE charge points are needed to meet projected 2020 demand in workplace locations. This document provides the technical and cost analysis to support these suggested code changes.

<u>Proposed Code Changes</u>

- Increase Percent of Required EV Charging Spaces
  - At least 6% of all new parking spaces should be EV-capable
  - Install raceway and panel capacity to support a dedicated 40 amp, 240 VAC circuit to every EV-capable charging space for future installation of Level 2 charging stations
- Lower the Parking Lot Size Threshold
  - 10 parking spaces or more should install EV charging infrastructure

A recent report indicates that the initial cost to install raceway at the time of new construction is between $400 and $1,800 per charging space. (MITRE, 2011) ARB staff estimates that the initial cost to install EV charging infrastructure with raceway and panel capacity at the time of new construction is approximately $830 per EV-capable charging space. Based on new construction projections between 2017 and 2020 for nonresidential buildings under BSC authority, ARB staff estimates total statewide costs of $30 million to $36 million for these suggested code changes. These initial construction costs represent a cost increase of about 0.1% above projected total new commercial building construction costs between 2017 and 2020. ARB staff also determined that retrofit costs between $3,750 and $6,975 per charging space could be avoided if EV charging infrastructure is installed at the time of new construction. Statewide retrofit costs of $134 million to $299 million could be avoided, which results in an estimated statewide benefit (avoided costs) of $104 million to $263 million.

Nearly three-quarters of new construction will occur in six regions with the greatest demand for EV charging infrastructure. However, the EV charging infrastructure provisions would apply to all new nonresidential buildings statewide. These code changes will help to put the State on track with providing the necessary infrastructure to support both the near term and long term goals for zero emission vehicles on California roadways.

Additionally, ARB staff recommends updating the CALGreen Code guidance document for design of new buildings to include the Division of the State Architect (DSA) accessibility provisions for EV charging stations. This will help to ensure that the associated EV charging infrastructure and EV-capable charging spaces in new parking lots are correctly sized to meet the accessibility provisions when EV charging stations are installed at a future date.

By supporting these suggested code changes, BSC will help to fill the gap of EVSE charge points needed in 2020. This is the last major triennial code cycle where these requirements could be implemented with adequate lead time to install a sufficient number of EV charging spaces by 2020. BSC adoption of these requirements is essential and will also help to improve air quality and reduce GHG emissions in California.

1. Introduction

Transportation accounts for the largest source (40%) of GHG emissions in California. In an effort to improve air quality and reduce transportation related GHG emissions, California's ZEV program requires manufacturers to produce increasing numbers of ZEVs. Annual on-road sales of ZEVs are expected to reach 8% of total new car sales by 2020 and ramp up to 15% in 2025. California is the world's single largest market for ZEVs, with PEV ownership in the State surpassing 120,000 vehicles. As of January 2015, Californians drive 40% of all PEVs on the road in the United States. This increase in PEVs on-road puts us on the path to achieve California's GHG emission reduction goals, but it will require widespread infrastructure to support charging needs.

In early 2012, Governor Brown issued Executive Order B-16-12 directing state government to help accelerate the market for ZEVs in California. The Executive Order established several milestones on a path toward 1.5 million ZEVs in California by the year 2025. As an interim target, the executive order also requires California's ZEV infrastructure to support up to 1 million vehicles by 2020.

In response to the Executive Order, the Governor's Office released a ZEV Action Plan in February 2013. Recognizing the important role that building standards could play in advancing the market for ZEVs, the ZEV Action Plan recommended amending the California Building Standards Code to ensure that new buildings are "ZEV-ready." The BSC adopted voluntary EV charging standards in the CALGreen Code during the 2012/13 Intervening Code Cycle. Under a mandate from Assembly Bill 1092 (Chapter 410 Statutes of 2013), BSC adopted mandatory EV charging standards for nonresidential new construction. The EV charging standards in the CALGreen Code are "EV-capable" and support future installation of electric vehicle supply equipment (EVSE).

The latest CALGreen Code, effective July 1, 2015, requires 3% of parking spaces to install EV charging infrastructure (raceway and panel capacity to support dedicated branch circuits) for new commercial buildings. These EV-capable building standards are a good first step that provides EV charging infrastructure in new construction. However, in order to meet future demand for EV charging, the CALGreen Code must be strengthened to require more EV charging infrastructure during the 2016 code cycle.

2. Background

Charging infrastructure is one of the most (if not the most) important predictors of EV adoption (e.g., Hidrue, et al. 2011, Sierzchula, et al. 2014). In California, nearly half of Clean Vehicle Rebate Program (CVRP) survey respondents indicated that access to workplace charging was at least moderately important to them when they decided to purchase their EV or plug-in hybrid (PHEV) (CSSE 2014). It is essential to update the CALGreen Code to provide the necessary EV charging infrastructure in new commercial buildings to support future installation of EVSE charging stations. A statewide effort may also be needed to provide incentives to install the actual EVSE charging stations in workplace locations to assist with EV adoption.

Earlier this year, Governor Brown adopted several 2030 climate commitments. California must reduce GHG emissions to 40 percent below 1990 levels by 2030. State agencies with jurisdiction over sources of GHG emissions shall implement measures, pursuant to their statutory authority, to achieve GHG reductions to meet the 2030 GHG reduction target. Additionally, the Governor set another goal for California to cut in half the amount of petroleum we use in our cars and trucks over the next 15 years. To accomplish these goals, California may need even more EV charging infrastructure in buildings than is suggested here.

a) Importance of Infrastructure for Supporting ZEV goals

There are many benefits to increasing the availability of EV charging infrastructure in workplace locations. Workplace charging provides a place where vehicle owners can typically park their car for about eight hours a day. In that amount of time, charging stations can add a useful amount of vehicle range. As a result, workplace charging can increase electric miles driven for plug-in electric vehicles and build range confidence for pure battery-electric vehicles by increasing the daily driving range. There is also the potential to attract new PEV drivers and accelerate the market for PEVs because workplace charging acts as a "natural showroom" for PEVs. Increasing PEV adoption helps to support ZEV goals and ensures that there is a market for the clean air vehicles that manufacturers are building.

b) Infrastructure Needs for 2020 and Beyond

In the ZEV Action Plan, the CEC is identified as the lead agency for a number of initiatives including the development of a statewide plan for PEV infrastructure. CEC contracted with NREL to complete an assessment of PEV infrastructure needed to meet the executive order goal to support up to 1 million vehicles by 2020. ARB staff used the statewide projections for EVSE charge points from the NREL study as the source for EV charging infrastructure needs in 2020. ARB staff assumed that for every EVSE charge point needed in 2020, it would require a dedicated EV-capable charging space.

NREL developed two different scenarios to identify where and how many EVSE charge points should be installed by 2020. In both scenarios the majority of charging occurs at home, but in the home dominant scenario, NREL assumed that a higher percentage of PEV charging will continue to occur at home. In this scenario, workplace and public charging support a modest fraction of total electric miles driven. In the high public access scenario, NREL assumed that many future PEV drivers will place a high premium on public charging and that stakeholders installing workplace and public EVSE stations receive significant benefits from installing EVSE stations, including revenue from kilowatt hour (kWh) sales and other benefits. In the high public access scenario, workplace and public charging account for one-third of total electricity supplied.

In order to provide adequate infrastructure to support 1 million ZEVs by 2020, NREL estimates that between 100,000 and 170,000 total charge points are needed in workplace locations. Approximately 80% of charge points are assumed to be Level 2. Table 1 summarizes the statewide projections for EVSE charge points needed in 2020 from the NREL report.

Table 1. Statewide Projections for EVSE Charge Points in 2020

Scenario	Home			Work			Public				TOTAL (Million)
	Level 1	Level 2	Total	Level 1	Level 2	Total	Level 1	Level 2	Fast Charger	Total	
Home Dominant	511,000	365,000	876,000	20,000	82,000	102,000	1,620	20,100	551	22,271	1.00
High Public Access	517,000	289,000	806,000	23,000	144,000	167,000	2,100	46,500	1,550	50,150	1.02

Source: National Renewable Energy Laboratory, *California Statewide Plug-In Electric Vehicle Infrastructure Assessment*, May 2014, Prepared for the California Energy Commission, Publication #CEC-600-2014-003, Pg. 16, Table 4.

c) What Is Being Done to Meet the Need

ARB staff gathered information on existing, funded, and proposed EV charging infrastructure to determine the gap in needed EV charging spaces. To identify existing EVSE charge points already in place statewide, ARB staff relied on the figures reported in the Department of Energy (DOE) Alternative Fuels Data Center. For existing EVSE charging stations installed in workplace locations, ARB staff used estimates from the California PEV Collaborative. For funded EVSE charging stations, ARB staff relied on data from the CEC Alternative and Renewable Fuel and Vehicle Technology Program (ARFVTP) and the NRG settlement[1]. For estimates on what is currently proposed, ARB staff used proposals submitted for funding to the California Public Utilities Commission (CPUC). Please see Appendix B for more details.

i. Existing

According to the Alternative Fuels Data Center, approximately 6,500 charge points (2,000 Level 2 charging stations) currently exist in California (DOE 2015). In September 2013, a CALSTART survey of California companies confirmed that about 800 charging stations have been installed in workplace locations (CALSTART 2013). In October 2013, the California PEV Collaborative released a workplace charging report with survey results indicating that about 950 Level 2 charging stations exist in workplace locations in California (PEV Collaborative, 2013). The PEV Collaborative is a public/private organization working to advance the PEV market in California. Steering Committee members include California policymakers, automakers, public utilities and EV supply providers and environmental NGOs. ARB staff used the data from the PEV Collaborative survey as the most current estimate of workplace charging stations. ARB staff assumed that workplace charging stations are a subset of the total number of charging stations

[1] The NRG Settlement is a reference to the joint offer of settlement, long-term contract settlement, and release of claims agreement to resolve all claims for the consolidated proceeding "EL02-60/62 Proceeding" between the California Public Utility Commission, California Electricity Oversight Board, and the Sellers of Long Term Contracts to the California Department of Water Resources.

reported in the Alternative Fuels Data Center. In order to translate the number of charging stations into a total number of charge points for workplace locations, ARB staff assumed that the ratio of workplace charging stations to workplace charge points is equivalent to the ratio of total charging stations to total charge points. ARB staff estimated that approximately 3,100 charge points currently exist in workplace locations in California.

ii. Funded

Every year, the CEC prepares and adopts an ARFVTP Investment Plan Update to decide on priorities for program funding. As of July 2014, the ARFVTP awarded more than $38.3 million to install 7,754 EVSE charging stations in commercial, workplace, residential, and corridor locations (CEC 2015). CEC states that 718 Level 2 charging stations will be installed in workplace locations by 2016. Please see Table 2 below and Table B2 in Appendix B for more details.

Table 2. CEC–Funded EVSE Charging Stations

Target Location	Level 2 Charging Stations
Commercial (Public)	2,742
Single-Family Residential	4,175
Workplace	718
DC-Fast Charging/Corridor	119
Total	**7,754**

According to the NRG settlement, infrastructure to support an additional 10,000 privately-owned Level 2 charging stations must be installed by 2020 at a total of 1,000 multi-family, workplace, and public interest sites. For the first 60 percent (6,000) of installations, NRG is required to allocate 35 percent of the infrastructure to multi-family, 15 percent to workplace, and 10 percent to public interest locations. The remaining 40 percent may be allocated at NRG discretion. Since NRG is mandated by law to install at least 1,500 charging stations in workplace locations, ARB staff used that amount as the total number of funded charging stations that will be installed by NRG.

EVSE charging stations can be categorized as Level 1 chargers, Level 2 chargers, and fast chargers. Level 2 and fast charging stations may have more than one charge point, allowing the station to connect to more than one vehicle at a time. ARB staff contacted several of the top manufacturers to identify the most common models sold to workplace locations in California. Most EVSE charging stations typically have either one or two connectors. ARB staff developed a low-range and high-range estimate to translate the number of funded charging stations into charge points. In the low-range estimate, ARB staff assumed that every charging station will be installed with only one charge point. In the high-range estimate, ARB staff assumed that every charging station will be installed with two charge points. Based on these assumptions, ARB staff estimates that currently funded activities may

result in the installation of between 2,218 and 4,436 charge points in workplace locations by 2020. See Tables B3 and B4 in Appendix B for more details on how these estimates were calculated.

iii. Proposed

Based on Investor Owned Utilities (IOU) filings to the CPUC, three utilities plan to install an additional 60,500 EV charging stations. About 70 percent (41,750) of those EV charging stations may be installed by 2020. The IOUs propose installing EV charging stations in workplace, multi-family unit dwellings (MuD), fleet locations, destination centers, and other public facilities.

The Office of Ratepayer Advocate's (ORA) has also submitted a proposal to the CPUC requesting that the IOU filings be suspended. The ORA submitted a proposal for one combined statewide program that would be implemented in all three IOU service territories. If the Office of Ratepayer Advocate's proposal to the CPUC for a CA Electric Vehicle Infrastructure Pilot goes through, a total of 3,700 EV charging stations would be installed in all three IOU service territories. Please see Table 3 for a summary of the differences between these two proposals.

Table 3. Filings to the CPUC - Proposed Number of EV Charging Stations

Description	SDG&E	SCE	PG&E	Total
Investor Owned Utility Proposals	5,500	30,000	25,000	60,500
Office of Ratepayer Advocate Proposal	500	1,500	1,700	3,700

While each proposal identifies the target locations (such as workplace, public, and residential) for program rollout, they do not identify the percent of total charging stations that will be installed in each target location. In order to estimate the number of EV charging stations that may be installed in each target location, ARB staff estimated the total number of charging stations that may be installed in workplace locations by assuming an equal distribution amongst the target locations for each utility service territory. An estimated 12,300 charging stations may be installed in workplace locations due to the IOU filings to the CPUC. An estimated 1,200 charging stations may be installed in workplace locations due to the ORA filing to the CPUC.

Since there is such a large variation between the amount of charging stations that would be installed due to the IOU proposals and the ORA proposal, ARB staff completed a gap analysis based on both options. In order to develop a low-range estimate, ARB staff assumed that each charging station may include one charge point. In the high-range estimate, ARB staff assumed that each charging station may include two charge points. For the IOU proposals, ARB staff estimated that between 12,300 and 24,600 charge points may be installed by 2020. For the ORA proposal, ARB staff estimated that between 1,200 and 2,400 charge points may be installed by 2020. The actual number

of EV charge points installed by 2020 may vary depending on the type of charging stations and the number of connectors installed. Tables B5, B6, B7, and B8 in Appendix B contain more details on these estimates.

d) What is the Gap?

In the home dominant scenario, NREL estimates that about 82,000 Level 2 EVSE charge points are needed in workplace locations by 2020. In the high public access scenario, NREL estimates that 144,000 Level 2 EVSE charge points are needed in workplace locations by 2020. Both of these scenarios are estimated to provide the necessary infrastructure to support the projected 1 million ZEVs on California roadways by 2020.

In order to estimate the gap in EVSE charge points by 2020, ARB staff first identified the total number of charge points that are currently installed in existing workplace locations. ARB staff also estimated the total number of charge points that may be installed in workplace locations based on recently funded activities and proposals to the CPUC. If the IOU proposals are approved by the CPUC, an estimated gap of 64,000 to 112,000 EV charging spaces may exist in 2020. If the ORA proposal is approved by the CPUC, an estimated gap of 75,000 to 134,000 EV charging spaces may exist in 2020. Table 4 below and Figure 1 in the Executive Summary contain more details on these estimates.

Table 4. Estimated Gap in EV Charging Spaces in Workplace Locations by 2020

Category	ORA Filings		IOU Filings	
	Low-Range	High-Range	Low-Range	High-Range
Existing	3,077	3,077	3,077	3,077
Funded	2,218	4,436	2,218	4,436
Proposed	1,191	2,382	12,331	24,663
Gap	**75,514**	**134,105**	**64,374**	**111,825**

3. Role for Building Code

a) Importance of providing infrastructure at workplace locations

After home charging, workplace charging is the second highest priority for installing statewide EVSE infrastructure. Public charging is the third highest priority. The BSC has authority to develop building codes for most nonresidential building types that would be considered workplace locations. However, BSC does not have authority to develop building codes for public locations. These suggested code changes do not address EV charging infrastructure for public charging.

b) Existing code requirements and where they would get us in 2020

Effective July 1, 2015, the nonresidential mandatory measure in the CALGreen code requires the installation of raceway and panel capacity to

support future installation of EVSE. The raceway must originate at a service panel and terminate in close proximity to the location of charging equipment. The service panel shall have sufficient capacity to accommodate a minimum of 40-amp, 240 VAC dedicated branch circuit. The CALGreen Code requires approximately 3 percent of total parking spaces install this EV charging infrastructure for nonresidential new construction depending on the total number of parking spaces. However, in smaller parking lots, infrastructure to support a nominal amount of EV charging spaces (between one and three) must be installed. Table 5 below is a copy of the current code requirements.

If we rely on the existing CALGreen Code requirements, an estimated 36,000 to 43,000 EV Charging Spaces may be installed in workplace locations under BSC authority by 2020. The existing code requirements help to fill part of the projected gap in 2020. However, infrastructure to support additional EV charging spaces is needed to completely fill the projected gap of 64,000 to 134,000 EV charging spaces remaining in 2020. As a result, ARB staff recommends increasing the CALGreen Code requirement from 3 percent to 6 percent.

Table 5. Current CALGreen Code Requirements Effective July 1, 2015

TABLE 5.106.5.3.3

TOTAL NUMBER OF PARKING SPACES	NUMBER OF REQUIRED EV CHARGING SPACES
0-50	0
51-75	1
76-100	2
101-200	3
201 and over	3%[1]

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

c) Local requirements for workplace parking spaces

ARB staff reviewed municipal codes for a least one city in each of the 58 counties in California to determine the average parking lot size for new commercial construction. The most common off-street parking requirement for office buildings requires that 1 space be installed for every 300 square feet of new construction. The second most common requirement for office buildings requires that 1 space be installed for every 250 square feet of new construction. These requirements were also the top two most common local parking requirements for retail buildings. These local requirements are applicable for evaluating EV charging space installations in workplace locations. However, some local jurisdictions are considering reducing parking lot sizes as they invest in more public transit infrastructure. In the long run, the average size of parking lots may be smaller than what is shown below. As a result, the estimates for the number of EV charging spaces installed statewide may also end up being smaller than projected in this report. Table

6 contains a comparison of the average size of parking lots for small and large commercial buildings.

Table 6. Comparison of Average Size Parking Lots for Commercial Buildings

Average Number of Spaces for a Typical Parking Lot			
Size of Building (square feet)		Local Parking Requirement	
		1 space/300 square feet	1 space/250 square feet
Small Building	5,000	17	20
	15,000	50	60
	30,000	100	120
Large Building	50,000	167	200
	100,000	333	400
	200,000	667	800

i. What is needed to fill the gap in infrastructure needs?

According to the California Commercial End-Use Survey, existing commercial floor space is estimated to be just over 4.9 billion square feet. Based on the CEC's California Commercial Floor Space Data, commercial buildings are expected to increase by about 445 million square feet between 2017 and 2020 (Table 7 and Figure 4). (CEC 2014)

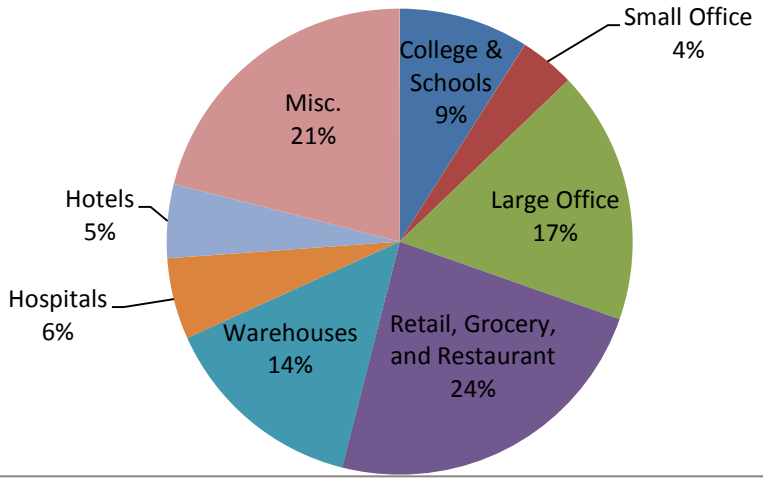
Table 7. Summary of Estimated Commercial Building New Construction

New Construction (Million Square Feet)									
Year	Retail, Grocery, and Restaurant	Small Office	Large Office	Misc.	Warehouses	College & Schools	Hospitals	Hotels	Total
2017	26.99	4.48	19.37	22.32	18.62	9.73	6.87	6.86	115.24
2018	27.43	4.51	20.74	25.12	16.01	10.42	6.30	6.42	116.95
2019	26.39	4.27	19.64	24.24	15.21	10.23	6.06	5.29	111.32
2020	24.17	3.82	18.34	21.93	13.68	9.79	5.82	4.27	101.82
Total	104.98	17.07	78.09	93.60	63.52	40.17	25.05	22.85	445.33

For the purpose of these suggested code changes, ARB staff assumed that all commercial buildings are representative of the workplace sector. While the BSC does not have authority to develop building codes for colleges, schools, hospitals, and hotels, the estimated new construction for those building types are included in these totals. It will likely take a concerted effort amongst BSC, the Division of the State Architect (DSA), the California Office of Statewide Health Planning and Development (OSHPD), and the California Department of Housing and Community Development (HCD) to adopt building codes for EV charging infrastructure to help fill the gap in needed EV charging spaces by 2020. ARB staff plans to submit similar suggested code changes to DSA, OSHPD, and HCD during the next intervening code cycle to recommend that they adopt

similar EV charging infrastructure provisions. ARB staff also plans to recommend to BSC in the next triennial code cycle that these suggested code changes be expanded to also apply to major renovations.

Figure 4. Forecasted Commercial Floor Space:
New Construction Estimates
Years 2017-2020



ARB staff used data from the CEC commercial floor space forecast to identify projections for new construction between 2017 and 2020. In order to determine how many total parking spaces would be installed statewide in all these new commercial buildings, ARB staff used the most common parking requirements adopted by local governments in California. Using this information, ARB staff calculated several options for filling the gap of EVSE charge points by increasing the current CALGreen Code requirement from 3 percent to various higher percentages. Tables B9 and B10 in Appendix B contains a summary of the estimated number of EV-capable charging spaces that may be installed in workplace locations if BSC, HCD, DSA, and OSHPD all adopted similar requirements. Tables B11 and B12 in Appendix B include estimates for the number of EV-capable charging spaces that may be installed statewide due to BSC adoption of the requirements.

ii. What is the right percent of EV-capable charging spaces?

ARB staff used the CEC forecast for commercial building new construction to estimate the number of required EV charging spaces if the code requirement 1) stayed the same (3 percent), 2) increased to 4 percent, and 3) was adopted at higher percentages. A low range estimate was developed using local parking requirements that mandate 1 space be installed for every 300 square feet of new commercial building space constructed. A high range estimate was developed using local parking requirements that mandate 1 space be installed for every 250 square feet of new commercial building space constructed.

Even with existing, funded, and proposed EV charging infrastructure, a gap between 64,000 to 134,000 EVSE charge points remains to meet the demand for workplace charging in 2020. Infrastructure to support an estimated 36,000 to 43,000 EV-capable charging spaces would be installed in workplace locations if the mandatory threshold of 3% remains the same and the requirement is only adopted by BSC. If the threshold increased to 4%, it may cover the low-end gap by providing infrastructure to support an estimated 48,000 to 57,000 EV-capable charging spaces. If the threshold increased to 6%, infrastructure to support an estimated 72,000 to 86,000 EV-capable charging spaces may be installed. An 8% requirement would nearly cover the high-end gap by providing an estimated 95,000 to 114,000 EV-capable charging spaces by 2020[2]. These estimates are based on the CEC forecast for new commercial construction. It also assumes that every single new parking space that is installed statewide between 2017 and 2020 would count towards the percent of required EV-capable charging spaces. However, the number of EV-capable charging spaces installed may vary depending on the actual size and number of new commercial buildings constructed between 2017 and 2020. Table 8 below and Tables B11 and B12 in Appendix B provide more details on these estimates.

Table 8. Estimated Number of EV Charging Spaces for All New Commercial Buildings Under BSC Authority (2017–2020)

Percent of Total Parking Spaces	Low Range	High Range
3%	36,000	43,000
4%	48,000	57,000
6%	72,000	86,000
8%	95,000	114,000

ARB staff recommends the CALGreen Code be revised to include a requirement for 6 percent of parking spaces in all commercial buildings to install EV charging infrastructure. Even though BSC does not have authority over schools, hospitals, or hotels, these suggested code changes assumes that all commercial building occupancies are looked at holistically. An updated code requirement closer to 10% of total parking spaces may be needed if the EV charging infrastructure provisions were only applied to occupancies under BSC authority.

[2] Since these estimates assume that all new construction is subject to these same requirements, the actual estimated number of EV-capable parking spaces that would result from BSC adoption of this proposal is lower. See section 3.c.iii below.

ARB staff recommends adopting a 6 percent requirement that is evenly distributed among lead agencies.

iii. What is the right parking space threshold?

In the latest version of the CALGreen Code, parking lots with 50 parking spaces or fewer do not need to install any infrastructure to accommodate future installation of EVSE. Parking lots with 51 to 200 parking spaces must install infrastructure (raceway and panel capacity to support dedicated branch circuits) for a nominal number of EV charging spaces. In parking lots with 201 or more parking spaces, at least 3% of parking spaces must include EV charging infrastructure (Table 5). Based on the most common local parking requirements, ARB staff determined that nonresidential buildings less than 15,150 square feet may not need to install infrastructure for EV charging (Table 9).

Table 9. Average Size of Parking Lots by Building Size

Total Number of Parking Spaces	Local Parking Requirement 1 space/300 s.f.	Local Parking Requirement 1 space/250 s.f.
	Size Range of Office Buildings	Size Range of Office Buildings
0-9	0 - 2,849	0 - 2,374
10-25	2,850 - 7,349	2,375 - 6,374
26-50	7,350 - 15,149	6,375 - 12,624
51-75	15,150 - 22,649	12,625 - 18,874
76-100	22,650 - 30,149	18,875 - 25,124
101-150	30,150 - 45,149	25,125 - 37,624
151-200	45,150 - 60,149	37,625 - 50,124
201 and over	60,150+	50,125+

According to the 2012 Commercial Buildings Energy Consumption Survey (CBECS) preliminary results, "the vast majority of commercial buildings are relatively small...nearly three-fourths are 10,000 square feet or smaller…the average size is 15,700 square feet." (EIA 2015) ARB staff estimated size ranges of new commercial buildings in California using the CBECS survey results. Based on this data, the majority of new buildings may be less than 25,000 square feet (Table 10).

Table 10. Estimated Size Ranges of New Commercial Buildings (2017–2020)

New Construction (Million Square Feet)									
Year	**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**	Total
2017	54.7	28.2	20.1	6.8	3.1	1.5	0.6	0.2	115.24
2018	55.5	28.6	20.4	6.9	3.1	1.6	0.6	0.2	116.95
2019	52.8	27.2	19.4	6.6	3.0	1.5	0.6	0.2	111.32
2020	48.3	24.9	17.8	6.0	2.7	1.4	0.6	0.2	101.82
Total	211.2	109.0	77.7	26.4	12.0	6.0	2.5	0.7	445.33

If the CALGreen Code nonresidential mandatory measures for EV charging are not updated during the 2016 Code Cycle, there is some risk that very little new EV charging infrastructure will actually be installed in new commercial buildings. ARB staff recommends lowering the threshold from 51 parking spaces to 10 parking spaces as the new trigger point for new buildings to install EV charging infrastructure.

By lowering the threshold for total number of parking spaces, buildings larger than 2,375 square feet would be required to install infrastructure for at least one EV charging space. An increased number of EV charging spaces would be installed for larger parking lots depending on final tables adopted by BSC. Appendix C contains the ARB staff proposal for the number of required EV-capable charging spaces. BSC adoption of this proposal to increase the percent of parking spaces to 6 percent, and the lowering of the parking lot threshold to 10 or more spaces to trigger the requirements, would result in the installation of an estimated additional 72,000 to 86,000 EV-capable charging spaces in new construction by 2020 (Table 8 and Tables B11 and B12 in Appendix B). This estimated number of charging spaces is based on the occupancy under BSC authority.

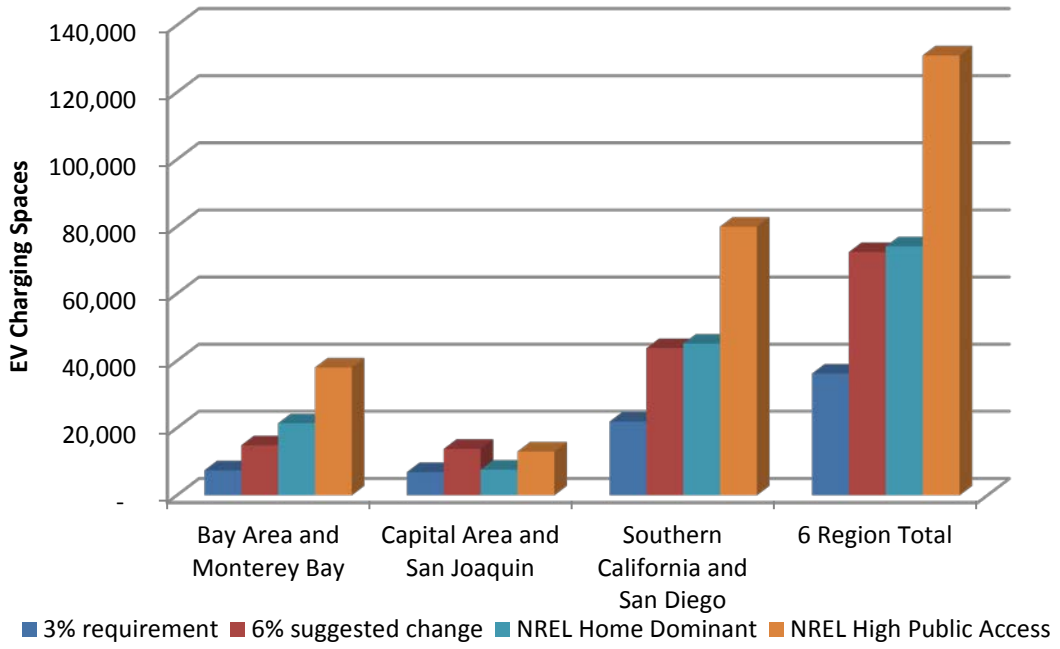
iv. Geographic Distribution of New Construction

ARB staff completed some additional analysis to determine whether or not a statewide approach to target all new construction would be appropriate and meet the demand for EV charging. ARB staff used the California commercial floor space estimates at the climate zone level (CEC 2014) and matched them with the geographic regions in the NREL infrastructure assessment report. ARB staff assumed one parking space would be installed for every 275 square feet of commercial floor space. This estimate is based on 250 square feet and 300 square feet being the two most common requirements in

existing municipal building codes. The analysis on geographic distribution focused on new construction and whether or not it would match the demand and did not include the location of the workplace charging stations that are already installed (3,000), funded (2,000-4,000), and proposed for installation by the IOUs (12,000) or proposed by the ORA (1,000).

Results of this geographic analysis indicate that nearly 75 percent of new construction will occur in the 6 regions with the greatest demand for EV charging infrastructure (Figure 5). The broad geographic distribution of new construction roughly matches the regional EV charging infrastructure needs for the NREL Home Dominant Scenario. This analysis supports meeting the Governor's goal of providing infrastructure to support 1 million ZEVs by 2020. Even though the adoption of ARB's recommended changes by BSC may result in a slight overbuilding of capacity in the Capital Area and San Joaquin Valley, infrastructure needs will only increase post-2020 in order to meet the Governor's goal of 1.5 million ZEVs by 2025 and California's overall GHG goals for 2030 and 2050. Additionally, statewide policy in the future may support daytime charging to use renewables at peak hours of supply. EV charging infrastructure in workplace locations may be even more important from a grid-management perspective rather than home charging.

Figure 5. Projected 2020 Supply and Demand for EV Charging Spaces by Region



v. Local Requirements for EV Charging in Nonresidential Buildings

The City of Los Angeles building code requires the installation of wiring and 208/240 V 40 amp, grounded AC outlets for at least 5 percent of total parking spaces in all new nonresidential buildings. Sunnyvale requires the installation of pre-wiring for a minimum of Level 2 electric car chargers for at least 3 percent of the total parking spaces in parking lots with 100 spaces or more in new industrial and office buildings. In Palo Alto, all new nonresidential structures other than hotels require the installation of EVSE charging stations for at least 5 percent of parking spaces and an additional 20 percent of the spaces shall include conduit, EVSE-ready outlet, or EVSE charging stations. For hotels, the requirements are the same, except that the percentage is increased; at least 10 percent of parking spaces shall install EVSE charging stations and an additional 20 percent have the flexibility to install conduit only, EVSE-ready outlet, or EVSE charging stations. In all nonresidential new buildings in Palo Alto, the percentage calculations shall also be applied separately to accessible parking spaces. Parking in accessible spaces where EVSE charging stations are installed is not limited to electric vehicles.

ARB staff contacted each of these local jurisdictions to determine when the building standards went into effect. ARB staff was also interested to find out if any EVSE charging stations are being installed where infrastructure is now in place. Sunnyvale does not track that type of information. Palo Alto stated that their provisions went into effect in July of 2014. All of the new commercial buildings affected by the building code are still under construction. Palo Alto does not have data yet on how many charging stations will be installed in these new projects. A building official with the City of Los Angeles stated that the building code had been in effect since 2011. Hundreds of projects have installed the EV wiring. They stated that about half of the parking spaces with EV charging infrastructure also now have the EVSE charging stations installed.

Appendix D includes a copy of the building code language and more details on the local requirements.

vi. What is the right infrastructure to require?

ARB staff is supportive of the requirement for adequate panel capacity to support dedicated branch circuits for future installation of Level 2 charging for each EV-capable charging space. ARB staff considered recommending an additional requirement to install wiring. If a building owner or third party decides to install EVSE charging stations in the EV-capable charging spaces, they will still need to hire an electrician to pull the wiring through the raceway, which has added costs in addition

to installing the charging station. If the wiring is already in place, the main barrier to the building owner or third party is the need to purchase EVSE charging stations. Retrofit costs are lower if the wiring is already in place compared to no infrastructure or just raceway. However, if wiring is installed at the time of new construction, it could potentially become a stranded asset if no charging station is installed. Additionally, there is the potential for theft of copper wiring. As a result, ARB is recommends that BSC maintain the current infrastructure requirement.

ARB staff does not recommend installing the EVSE charging stations. The equipment is getting less expensive, advancing technologically and it may add unnecessary costs if EVSE charging stations are installed at the time of new construction. The price of EVSE charging stations may continue to drop as EVSE production volumes increase. Additionally, it allows for third parties or building owners to install the EVSE charging stations of their choice. In some cases, building owners may want to install basic Level 2 charging stations and provide the electricity free of charge to their employees as a benefit. In other cases, third parties may wish to install smart chargers. By installing the wiring, panel capacity, and branch circuits at the time of new construction, it leaves flexibility for the building owner or third parties in selecting the type of EVSE charging stations. Regional planning agencies responsible for meeting SB 375 GHG emission reduction targets through a Sustainable Communities Strategy may be eligible for credit towards meeting their targets when they adopt measures that would exceed the code requirements and fund installations of EVSE charging stations in non-residential buildings. (The region's proposed method for quantifying such credits should be discussed with the Air Resources Board before attempting to receive credit.)

vii. Accessibility

Since October 2014, DSA has been working with stakeholders to develop accessibility provisions when EVSE charging stations are installed in new and existing buildings. The 45-day Express Terms for the proposed building standards are dated August 3, 2015. The proposed standards provide requirements for accessible routes to buildings from EV charging stations and from vehicle parking spaces to the EV charging stations. If one to four EV charging stalls (EVCS) are installed at a facility, the first one must be a van accessible space. If five to twenty-five EVCS are installed at a facility, the first two spaces must be van accessible and standard accessible. Additional requirements apply if twenty-six or more EVCS are installed at a facility. When four or fewer EVCS are installed, identification with an International Symbol of Accessibility (ISA) shall not be required. When five to twenty-five total EVCS are installed at a facility, the van

accessible EVCS shall be identified by an ISA. EVCS vehicle spaces shall be marked for "EV Charging Only."

The DSA accessibility provisions only go into effect when an EVSE charging station is installed. While the current and suggested EV charging infrastructure provisions in the CALGreen Code do not require installation of EVSE charging stations, ARB staff recommends the guidance document for the CALGreen Code be updated to encourage building designers to consider the new DSA accessibility provisions for EV charging stations when designing the EV-capable charging spaces in new parking lots. This would help to ensure that the associated EV charging infrastructure and EV-capable charging spaces in new parking lots are correctly sized to meet the accessibility provisions when EV charging stations are installed at a future date.

ARB staff estimates that more than 70 percent of new buildings may be under 10,000 square feet or smaller. The typical size parking lot for these buildings is under 50 parking spaces. As a result, most new commercial buildings may be installing infrastructure to support future installation of either one or two EV charging stations. In order for those one or two EV-capable charging spaces to be sized in alignment with the DSA requirements, the first EV-capable charging space would be a 12 foot wide van accessible space with a 5 foot wide access aisle. The second EV-capable charging space would be a 9 foot wide standard accessible space and it could share the 5 foot wide access aisle.

Building industry stakeholders expressed concerns that the proposed DSA accessibility provisions for EV charging stations may result in the loss of parking spaces. Most typical parking spaces are between 7 to 8 feet wide. If a new parking lot installs EV charging infrastructure for two EV-capable charging spaces that are in alignment with the DSA accessibility provisions, they would use 26 feet of space rather than the typical 14 to 16 feet of space. This means that a parking area that may have accommodated four standard parking spaces may now accommodate two EV-capable charging spaces. Similarly, if a new parking lot installs EV charging infrastructure for one EV-capable charging space, it would use 17 feet of space rather than 7 to 8 feet of space. For every one EV-capable space installed in alignment with the DSA accessibility provisions, it may displace one or two standard parking spaces.

viii. Assessment of Parking Lot Revenue

In the case of workplace locations, many employers offer free or subsidized parking to employees. A literature search revealed only one study regarding the number of employers that charge for parking. "Nine out of every ten American commuters who drive to work park free at work." (Wilson, et al. 1990) In the absence of newer data, ARB

staff assumed that approximately 10 percent of employers charge for parking.

Building owners or employers in urbanized areas may decide to charge employees for parking where space is limited and land is expensive. In urbanized areas, loss of parking spaces may result in the loss of revenue for building owners. This concern may be more of an issue in existing building parking lots where parking spaces are already generating revenue. New construction of parking lots can be designed with the EV-capable and EVCS accessibility provisions in mind.

In order to determine the amount of revenue that could be generated by a parking space in California, ARB staff used 2012 parking survey results to estimate statewide average annual parking revenue of $2,250 per parking space. If all new buildings were designed to accommodate the DSA accessibility provisions, ARB staff estimated a potential statewide loss of revenue. These estimates are based on 10 percent of new construction and the associated number of total new parking spaces installed. Based on this information, ARB staff estimated that a loss of revenue from parking rates due to these code changes may be on the order of $3.2 million to $3.8 million total between 2017 and 2020 or less than $1 million annually for all new buildings statewide. Appendix E provides more details on these estimates.

While there may be a potential loss of revenue for one or two parking spaces in new parking lots, there is also the potential to generate revenue if building owners decide to install EVSE charging stations. There are several models for installing EVSE charging stations. Some models provide revenue generation. For example, Liberty Plugins Inc. provides control systems for billing users of EVSE charging stations; site owners install EVSE charging stations of choice and link them with a Liberty Plugin billing system. Chargepoint sells EVSE charging stations for network operation, which allows clients to set pricing for use. Other companies such as OpConnect sell EVSE charging stations with a credit card reader and billing software. Greenlots sells EVSE charging stations that incorporate payment software with variable rates.

There are other strategies that building owners could implement to avoid the loss of revenue for parking spaces. One option is to increase the parking rate for all parking spaces in a parking lot. By increasing parking prices or charging for parking in facilities where parking is currently offered for free, there is also the potential to reduce vehicle travel and associated GHG emissions. (Spears, et al. 2014)

ix. Local Government Reach Standards

In addition to the mandatory provisions required by the CALGreen Code, the green building standards also include voluntary reach standards that can be adopted by local governments. ARB staff proposes a Tier 1 threshold of 8 percent and a Tier 2 threshold of 10 percent be adopted during the 2016 Code Cycle. ARB staff encourages local governments to adopt either of these tiers as mandatory at the local level as a measure to achieve additional GHG emission reductions. These GHG emission reductions could count towards achieving "beyond code" goals in Climate Action Plans. Please see Table 11 for a summary of the estimated number of additional EV-capable charging spaces installed statewide if all local governments adopted the Tiers. ARB staff does not anticipate advancing these reach standards to become mandatory in the next two code cycles.

Table 11. Estimated Number of Additional EV-capable Charging Spaces Installed Statewide if All Local Governments Adopted the Tiers

8% - Tier 1	Additional EV-capable Charging Spaces	10% - Tier 2	Additional EV-capable Charging Spaces
118,756	29,689	148,445	59,378
142,507	35,627	178,133	71,253

4. Cost Analysis

By installing raceway and panel capacity in new office buildings, it helps to provide the necessary infrastructure to support future installation of EVSE. It also helps to avoid retrofit costs. According to a report completed by the MITRE Corporation, initial construction costs to install raceway in new parking lots ranges from a low of $400 in garages to a high of $1,800 in surface lots. ARB staff reviewed cost data in the 2015 National Construction Estimator to determine whether these initial construction costs to install raceway are reasonable. Based on this review, costs to install raceway only ranged from $260 to $370 per 100 linear feet in length depending on the raceway type. Please see Table E12 for more information on these cost estimates. Since the typical distance between charging stations and electric panels is 50 to 100 feet, ARB staff figures that the lower end estimates in the $400 range per EV charging station may be reasonable as a low-range estimate to install raceway in new commercial building construction. However, the current building code also requires installation of adequate panel capacity to support a dedicated 40 amp, 240 VAC circuit to every EV-capable charging space for future installation of Level 2 charging stations. ARB staff reviewed the 2015 National Construction Estimator to identify a more accurate average cost for EV charging infrastructure with all of

these components. ARB staff estimated an average cost of $830 to install raceway and panel capacity to support dedicated branch circuits to each EV-capable charging space (Table E13). According to the 2015 National Construction Cost Estimator, typical costs to install electrical work in a surface parking lot is about $2 per square foot and $9 per square foot for a parking garage. Smaller buildings may have parking lots that range from about 2,000 square feet in size to 13,000 square feet in size. Larger commercial buildings may have parking lots that range from about 20,000 square feet to 90,000 square feet. The estimated cost of $830 to install EV charging infrastructure to one parking space may represent about 40 percent of the total cost of electrical work in a small building parking lot. Similarly, the cost to install wiring for EV charging may represent about 10 percent of total electrical work costs in larger parking lots.

a) Annual Statewide Costs

Since the current EV charging provision requires 3 percent of parking spaces to install raceway to accommodate future EVSE infrastructure, the statewide cost estimate for this proposal is based on the difference between the existing standard and the new suggested standards. The current requirement for 3 percent of parking spaces to install EV charging infrastructure may result in the installation of an estimated 36,000 to 43,000 EV spaces statewide by 2020. An updated threshold of 6 percent may result in the installation of an estimated 72,000 to 86,000 EV charging spaces. The annual statewide cost estimate for adopting this higher percentage is based on the difference in added infrastructure that may result in the installation of an estimated 36,000 to 43,000 additional EV charging spaces by 2020. Using these figures, ARB staff estimated the statewide costs to install EV charging infrastructure in workplace locations may be between $30 million to $36 million if the BSC adopts a revised percentage of 6 percent (Table 11).

Table 11. Estimated Costs to Install Wiring in All New Commercial Buildings (2017–2020)

Range	Statewide Construction Costs	Annual Construction Costs
Low	$30 M	$7.5 M
High	$36 M	$9 M

According to RS Means Construction Cost Data, construction costs per square foot of new commercial building can vary significantly depending on location and building type. ARB staff used the CEC estimates for total square footage of new commercial buildings and the RS Means estimates for cost per square foot by building type in California locations to estimate the total statewide construction costs for nonresidential new construction projected to occur between 2017 and 2020. An estimated $68 to $78 billion may be spent for new construction of commercial buildings over the

four year period between 2017 and 2020 (Table E20 and E21). The statewide costs to install EV charging infrastructure represents a cost increase of about 0.1% above projected total new commercial building construction costs between 2017 and 2020.

ARB staff also estimated the cost if the voluntary Tier 1 and Tier 2 provisions were adopted by every local government statewide, to provide a low-range and high-range estimate of the cost impact of these voluntary provisions. If all local governments adopted Tier 1 as mandatory, the estimated statewide construction costs would range from approximately $49 million to $59 million, representing a cost increase of about 0.07% to total construction costs for new commercial buildings during the 2017 to 2020 time period. If all local governments adopted Tier 2 as mandatory, the estimated statewide construction cost would range from approximately $98 million to $117 million, representing a cost increase of about 0.1% to total construction costs for new commercial buildings during the 2017 to 2020 time period.

b) Avoided Retrofit Costs

Retrofit costs can vary significantly depending on the existing commercial building site. Costs may be higher if there is not sufficient panel capacity. Costs can vary depending on the number of circuits and EVSE charging stations installed. Costs can increase if there is a long distance from the electrical panel to the charging location or if the electrical panel needs to be upgraded or a subpanel needs to be added. Costs can also be affected by the need to install transformers or other electrical infrastructure equipment. However, costs associated with transformers are often applicable for DC fast charging stations where higher voltage (480 VAC) is needed. Commercial buildings usually have 240 VAC power readily available and may not need to install additional transformers. Retrofit costs tend to be lower in parking garages because conduit and wiring can run along the walls and the charging stations can be mounted on the wall. Retrofit costs tend to be higher in parking lots because of the need for trenching through concrete or asphalt. Most of these retrofit costs can be avoided if EV charging infrastructure is installed during new construction.

MITRE Corporation estimated retrofit costs range from $1,200 in garages to $2,900 in surface lots. However, ARB staff reviewed multiple studies that indicate retrofit costs may actually be much higher and range from $3,500 to $12,500. ARB staff estimates that the median cost for retrofitting existing parking lots with EV charging infrastructure is $6,975 in surface lots and $3,750 in parking garages. ARB staff estimates that the avoided retrofit costs range from $134 million to $299 million total during the four year period between 2017 and 2020. As a result, a statewide avoided cost (benefit) of $104 million to $263 million may be achieved if wiring replaces the raceway standard in the CALGreen Code (Table 12).

Table 12. Estimated Statewide Benefit (Avoided Costs) for 6% Requirement (2017–2020)			
Range	Statewide Construction Costs[3]	Avoided Retrofit Costs	Benefit (Avoided Costs)
Low	$30 M	$134 M	$104 M
High	$36 M	$299 M	$263 M

5. Summary and Conclusions

ARB staff strongly recommends BSC strengthen the current provisions and adopt a requirement for 6 percent of total parking spaces to install EV charging infrastructure in all new commercial buildings, and reduce the threshold size for parking lots that must install EV charging infrastructure down to 10 or more parking spaces. By supporting these recommendations and adopting these code changes, BSC will help to fill the gap of EVSE charge points needed in 2020. This is the last major triennial code cycle where these requirements would be useful to help with installing an adequate number of EV charging spaces by 2020. Waiting until the Intervening Code Cycle in 2018 would mean missing out on half of the anticipated new construction and could mean that an even higher percent of parking spaces may need to be EV-capable to fill the gap in infrastructure. BSC adoption of these requirements for new commercial buildings during the 2016 Code Cycle will also help to improve air quality and demonstrate they are doing their part to support the statewide goals to reduce GHG emissions in California.

[3] Costs are likely over estimated because they do not account for economies of scale.

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7. Definition of terms

Battery electric vehicle (BEV): a type of electric vehicle that uses chemical energy stored in rechargeable battery packs. Sometimes the terms "pure" BEV or "battery-only electric vehicle" are used in conjunction with or instead of the term "BEV," often to emphasize that the vehicle's propulsion is derived from batteries only, and that the vehicle does not have an internal combustion engine, fuel cell, or fuel tank.

Charge point: also referred to as charging outlets. Level 2 and fast charging stations may have more than one charge point, allowing the station to connect to more than one vehicle at a time.

Charging station: often referred to as electric vehicle supply equipment (EVSE).

Electric vehicle supply equipment (EVSE): equipment associated with delivering electrical energy to the electric vehicle, including connectors, plugs and fittings, and other associated equipment, including conductors and housing.

Fast charger (FC): a general term used to denote a charger that has a direct current power supply and can typically charge an electric vehicle much faster than a Level 1 or Level 2 charger.

Level 1 charger (L1): Level 1 charging is 120V charging that would occur if an electric vehicle were plugged into an ordinary outlet at a typical home, meaning that a Level 1 charger could be considered the outlet or the home itself, for example.

Level 2 charger (L2): a charger that typically supplies 208V or 240V and is able to fully charge a battery in 4 – 6 hours. This charge time is optimal for overnight or long-length charging. This is the preferred EV charging method for both public and private facilities. They will be typically found in public areas, parking garages and commercial businesses.

Plug-in electric vehicle (PEV): in general, a vehicle that has the capability to be charged from an external source of electricity with the electricity being stored in onboard rechargeable batteries. The term "PEV" is most often used to denote both PHEVs and BEVs.

Plug-in hybrid electric vehicle (PHEV): a vehicle with an electric motor, an internal combustion engine, and a battery that can be charged using an external connector. PHEVs are bi-fuel vehicles that can be fueled with both gasoline and electricity.

Zero-emission vehicle (ZEV): in general, a vehicle that emits no harmful tailpipe emissions. ZEVs include BEVs and hydrogen fuel cell electric vehicles. For the purposes of the Governor's Office ZEV Action Plan, PHEVs are considered to be ZEVs.

8. Appendices

APPENDIX A

ARB Staff Proposal: Presented on February 5, 2015

During a February 5, 2015 Green Building Focus Group Meeting, ARB staff suggested that the BSC revise both the mandatory and voluntary measures for EV charging infrastructure. Since the requirement for designated parking of clean air vehicles is based on 8 percent of total parking spaces, ARB staff suggested that at least half (4 percent) of the parking spaces include EV charging infrastructure. ARB staff also suggested that smaller parking lots with 25 or more spaces should be the new threshold for installing at least one EV charging space. Lowering the threshold for total number of parking spaces and increasing the requirement from 3 percent to 4 percent would accommodate a greater percent of future EV charging (Table A1).

For the voluntary measures, ARB staff suggested that the Tier 1 threshold increase to 5 percent and the Tier 2 threshold increase to 7 percent of parking spaces. A Tier 1 threshold of 5 percent was suggested because it is half of the 10 percent Tier 1 threshold for designated parking for clean air vehicles. It was also the Tier 2 measure in the 2013 CALGreen Code. Since the tiers include a 2 percent difference, ARB staff suggested that the Tier 1 and Tier 2 thresholds should be 5 percent and 7 percent respectively (Tables A2 and A3).

Public Comments on ARB Staff Proposal

Some meeting attendees agreed that more spaces would provide infrastructure for more EV charging, but, questioned whether 4 percent was the right requirement for the number of parking spaces. They also questioned whether all commercial building types should be required to install this infrastructure or if it should be limited to certain building types. Commenters suggested that ARB staff look into these issues further.

Table A1. ARB Staff Proposal for Mandatory Measures Dated February 5, 2015

TABLE 5.106.5.3.3

TOTAL NUMBER OF PARKING SPACES	NUMBER OF REQUIRED EV CHARGING SPACES
0-24	0
25-50	1
51-75	3
76-100	4
101-200	6
201 and over	4%[1]

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

Table A2. ARB Staff Proposal for Tier 1 Dated February 5, 2015

TABLE A5.106.5.3.1

TOTAL NUMBER OF PARKING SPACES	TIER 1 NUMBER OF REQUIRED EV CHARGING SPACES
0-50	2
51-75	4
76-100	5
101-200	7
201 and over	5%[1]

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

Table A3. ARB Staff Proposal for Tier 2 Dated February 5, 2015

TABLE A5.106.5.3.2

TOTAL NUMBER OF PARKING SPACES	TIER 2 NUMBER OF REQUIRED EV CHARGING SPACES
0-50	3
51-75	5
76-100	6
101-200	10
201 and over	7%[1]

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

APPENDIX B

Details on Assumptions and Calculations

Existing EV Charging Infrastructure

ARB staff used the number of charging stations and charge points reported in the U.S. Department of Energy (DOE) Alternative Fuels Data Center as the total number for existing EV charging infrastructure. ARB staff used the survey results reported by the CA PEV Collaborative as the estimate for workplace charging stations. ARB staff assumed that workplace charging stations are a subset of total charging stations reported in the Alternative Fuels Data Center. ARB staff estimated the total number of workplace charge points by dividing the number of workplace charging stations by total statewide charging stations and multiplying that number by the total statewide charge points. An estimated 3,100 charge points exist in workplace locations in California.

Table B1. Existing EV Charging Infrastructure

Location	Estimates	
	Charging Stations	Charge Points
Total Statewide	2002	6484
Workplace	950	3077

Funded EVSE Charging Stations

ARB staff used data from the CEC Alternative and Renewable Fuel and Vehicle Technology Program and the NRG Settlement to estimate the total number of EVSE charging stations expected to be installed by 2020 due to recently funded activities. According to CEC staff, a total of 718 Level 2 EVSE charging stations will be installed in workplace locations by 2016. The NRG settlement requires NRG to install infrastructure to support 10,000 privately-owned chargers. Of the first 6,000 charging stations, NRG must install 1,500 charging stations at workplace locations. NRG may allocate the remaining 4,000 charging stations at their discretion. Since NRG is mandated by law to install 1,500 charging stations in workplace locations, that is the total number ARB staff assumed would be installed in workplace locations by 2020. Tables B2 and B3 provide more details on the amount of EVSE charging stations that will be installed due to currently funded activities.

Table B2. CEC–Funded EVSE Charging Stations

CEC Funded	Level 2 EVSE Charging Stations	Percent of Total Allocation
Commercial (Public)	2,742	35%
Single-Family Residential	4,175	54%
Workplace	718	9%
DC-Fast Charging/Corridor	119	2%
Total	7,754	100%

Source: California Energy Commission, Alternative and Renewable Fuel and Vehicle Technology Program, Funded Installation of Level 2 EVSE Charging Stations, Personal Communication with L. Baroody, May 11, 2015.

Table B3. NRG Settlement: Required Number of Charging Stations Installed

Target Location	First 60 Percent (6,000) Installations	
	Mandatory Percent Allocation	Number of Charging Stations
Multi-family	35	3,500
Workplace	15	1,500
Public Interest	10	1,000
Totals	60	6,000

*NRG Settlement - Requires installation of infrastructure to support 10,000 privately-owned chargers at a total of 1,000 multi-family, workplace, and public interest sites. The remaining 40 percent (4,000 installations) may be allocated at NRG discretion.

Translating Funded Charging Stations into Charge Points

Since Level 2 charging stations may have more than one charge point to allow the station to connect to more than one vehicle at a time, ARB staff developed a low-range estimate and a high-range estimate for the number of charge points that will be installed by 2020 due to funded activities. In the low-range estimate, ARB staff assumed that every charging station would have one charge point. In the high-range estimate, ARB staff assumed that every charging station would have two charge points. An estimated 2,218 to 4,436 charge points may be installed in workplace locations due to currently funded activities (Table B4).

Table B4. Summary of Funded EV Charging Infrastructure

Target Location	Low-Range		High-Range	
	Charging Stations	Charge Points	Charging Stations	Charge Points
Workplace	2,218	2,218	2,218	4,436

Proposed Installation of EVSE Charging Stations

Three IOUs have submitted proposals for EV charging infrastructure plans to install an additional 60,500 EV charging stations. About 70 percent (41,750) of those EV charging stations may be installed by 2020. ORA have also submitted a proposal to the CPUC requesting that the IOU filings be suspended. The ORA submitted a proposal for one combined statewide program that would be implemented in all three IOU service territories. If the ORA proposal to the CPUC is approved, a total of 3,700 EV charging stations may be installed in workplace locations by 2020. Table B5 provides a summary of the differences between these two proposals.

SDG&E's proposal to the CPUC suggests installing a blend of charging stations in workplace and multi-family unit dwellings. SCE's proposal targets workplace, multi-family unit dwellings, fleets, and destination centers. PG&E's proposal targets public facilities, workplaces, and multi-family unit dwellings. Both SCE and PG&E's proposals include deployment of EV service connection, EV supply infrastructure, and EV charging stations. SDG&E's proposal includes deployment of the EV service connection and EV supply infrastructure.

While each of the proposals includes a total estimated number of EV charging stations that may be installed by 2020, they do not identify the percent allocated to each target location. In order to estimate the number of charging stations that may be installed in workplace locations, ARB staff assumed an equal percent distribution among the targeted locations for each utility. For example, ARB staff assumed that 50 percent of the SDG&E charging stations would be installed in workplace locations and 50 percent would be installed in multi-family locations. ARB staff estimated that approximately 12,300 charging stations may be installed in workplace locations due to the IOU filings to the CPUC. ARB staff estimated that approximately 1,200 charging stations may be installed due to the ORA filing to the CPUC. Tables B6 and B7 provide more details on these assumptions and calculations.

In order to translate the number of charging stations into charge points, ARB staff developed a low-range and high-range estimate for both the IOU filings and the ORA filing. Similar to the estimate for funded charge points, ARB staff assumed that one charge point would be installed with each charging station in the low-range estimate. ARB staff assumed that two charge points may be installed in each charging station for the high-range estimate. Based on these assumptions, ARB staff estimate that between 12,300 and 24,600 charge points may be installed by 2020 due to the IOU filings to the CPUC. ARB staff also estimated that between 1,200 and 2,400 charge points may be installed in workplace locations by 2020 due to the ORA filing. Table B8 provides more details on these estimates.

Table B5. Filings to the CPUC - Proposed Number of EV Charging Stations

Description	SDG&E	SCE	PG&E	Total
Investor Owned Utility Proposals	5,500	30,000	25,000 (6,250 by 2020)	60,500 (41,750 by 2020)
Office of Ratepayer Advocate Proposal	500	1,500	1,700	3,700

Table B6. Overall Percent Allocations Among All Target Locations

Target Location	SDG&E	SCE	PG&E
Workplace	50	25	33
Multi-family Unit Dwellings	50	25	33
Fleets	0	25	0
Destination Centers	0	25	0
Public Facilities	0	0	33
Public Interest Sites	0	0	0
Percent Total	100	100	100

Table B7. Estimated Number of Proposed Installations of EVSE Charging Stations

	Proposed - IOU Filings				Proposed - ORA Filing			
Description	SDG&E	SCE	PG&E	Combined IOU Proposals	SDG&E	SCE	PG&E	Combined ORA Proposal
Level 2 EV Charging Stations	5,500	30,000	25,000	60,500	500	1,500	1,700	3,700
Percent Deployed by 2020	100%	100%	25%	69%	100%	100%	100%	100%
Total EV Charging Stations Installed by 2020	5,500	30,000	6,250	41,750	500	1,500	1,700	3,700
Workplace: Percent of Total Allocation	50%	25%	33%	30%	50%	25%	33%	32%
Workplace: Number of EV Charging Stations	2,750	7,500	2,081	12,331	250	375	566	1,191

Table B8. Proposed EV Charging Infrastructure: Converting Charging Stations into Charge Points

	IOU Proposals				ORA Proposal			
	Low-Range		High-Range		Low-Range		High-Range	
Target Location	Charging Stations	Charge Points	Charging Stations	Charge Points	Charging Stations	Charge Points	Charging Stations	Charge Points
Workplace	12,331	12,331	12,331	24,663	1,191	1,191	1,191	2,382

Workplace Charging: Low-Range Estimates

Table B9. Low-Range Estimate for Number of EV Charging Spaces in Workplace Locations (2017–2020)

Planned New Construction Between 2017 and 2020* - (Total Square Feet)		Total New Parking Spaces Statewide	Number of Required EV Charging Spaces					
		Local Parking Requirement	Mandatory per Table 5.106.5.3.3	Proposed	Revised Options			
		1 space/300 square feet	3%	4%	5%	6%	7%	8%
Retail, Grocery, and Restaurants	104,975,500	349,918	10,498	13,997	17,496	20,995	24,494	27,993
Small Office	17,073,300	56,911	1,707	2,276	2,846	3,415	3,984	4,553
Large Office	78,091,900	260,306	7,809	10,412	13,015	15,618	18,221	20,825
Misc.	93,602,000	312,007	9,360	12,480	15,600	18,720	21,840	24,961
Wharehouses	63,524,800	211,749	6,352	8,470	10,587	12,705	14,822	16,940
Colleges & Schools	40,167,900	133,893	4,017	5,356	6,695	8,034	9,373	10,711
Hospitals	25,052,000	83,507	2,505	3,340	4,175	5,010	5,845	6,681
Hotels	22,846,300	76,154	2,285	3,046	3,808	4,569	5,331	6,092
Totals	**445,333,700**	**1,484,446**	**44,533**	**59,378**	**74,222**	**89,067**	**103,911**	**118,756**

Workplace Charging: High-Range Estimates

Table B10. High-Range Estimate for Number of EV Charging Spaces in Workplace Locations (2017–2020)

Planned New Construction Between 2017 and 2020* - (Total Square Feet)		Total New Parking Spaces Statewide	Number of Required EV Charging Spaces					
		Local Parking Requirement	Mandatory per Table 5.106.5.3.3	Proposed	Revised Options			
		1 space/250 square feet	3%	4%	5%	6%	7%	8%
Retail, Grocery, and Restaurants	104,975,500	419,902	12,597	16,796	20,995	25,194	29,393	33,592
Small Office	17,073,300	68,293	2,049	2,732	3,415	4,098	4,781	5,463
Large Office	78,091,900	312,368	9,371	12,495	15,618	18,742	21,866	24,989
Misc.	93,602,000	374,408	11,232	14,976	18,720	22,464	26,209	29,953
Wharehouses	63,524,800	254,099	7,623	10,164	12,705	15,246	17,787	20,328
Colleges & Schools	40,167,900	160,672	4,820	6,427	8,034	9,640	11,247	12,854
Hospitals	25,052,000	100,208	3,006	4,008	5,010	6,012	7,015	8,017
Hotels	22,846,300	91,385	2,742	3,655	4,569	5,483	6,397	7,311
Totals	**445,333,700**	**1,781,335**	**53,440**	**71,253**	**89,067**	**106,880**	**124,693**	**142,507**

Table B11. Low-Range Estimate for Number of EV Charging Spaces in Workplace Locations Under BSC Authority (2017–2020)

Planned New Construction Between 2017 and 2020* - (Total Square Feet)		Total New Parking Spaces Statewide	Number of Required EV Charging Spaces						
		Local Parking Requirement	Mandatory per Table 5.106.5.3.3	Proposed	Revised Options				
		1 space/300 square feet	3%	4%	5%	6%	7%	8%	10%
Retail, Grocery, and Restaurants	104,975,500	349,918	10,498	13,997	17,496	20,995	24,494	27,993	34,992
Small Office	17,073,300	56,911	1,707	2,276	2,846	3,415	3,984	4,553	5,691
Large Office	78,091,900	260,306	7,809	10,412	13,015	15,618	18,221	20,825	26,031
Misc.	93,602,000	312,007	9,360	12,480	15,600	18,720	21,840	24,961	31,201
Wharehouses	63,524,800	211,749	6,352	8,470	10,587	12,705	14,822	16,940	21,175
Totals	**357,267,500**	**1,190,892**	**35,727**	**47,636**	**59,545**	**71,453**	**83,362**	**95,271**	**119,089**

Table B12. High-Range Estimate for Number of EV Charging Spaces in Workplace Locations Under BSC Authority (2017–2020)									
Planned New Construction Between 2017 and 2020* - (Total Square Feet)		Total New Parking Spaces Statewide	Number of Required EV Charging Spaces						
		Local Parking Requirement	Mandatory per Table 5.106.5.3.3	Proposed	Revised Options				
		1 space/250s.f.	3%	4%	5%	6%	7%	8%	10%
Retail, Grocery, and Restaurants	104,975,500	419,902	12,597	16,796	20,995	25,194	29,393	33,592	41,990
Small Office	17,073,300	68,293	2,049	2,732	3,415	4,098	4,781	5,463	6,829
Large Office	78,091,900	312,368	9,371	12,495	15,618	18,742	21,866	24,989	31,237
Misc.	93,602,000	374,408	11,232	14,976	18,720	22,464	26,209	29,953	37,441
Wharehouses	63,524,800	254,099	7,623	10,164	12,705	15,246	17,787	20,328	25,410
Totals	**357,267,500**	**1,429,070**	**42,872**	**57,163**	**71,453**	**85,744**	**100,035**	**114,326**	**142,907**

APPENDIX C

Table C1. ARB Staff Proposal for Mandatory Measures Dated June 24, 2015

TOTAL NUMBER OF PARKING SPACES	NUMBER OF REQUIRED EV CHARGING SPACES
0-9	0
10-25	1
26-50	2
51-75	4
76-100	5
101-150	7
151-200	10
201 and over	At least 6 percent of total[1]
1. Calculation for spaces shall be rounded up to the nearest whole number	

Table C2. ARB Staff Proposal for Tier 1 Dated June 24, 2015

TABLE A5.106.5.3.1

TOTAL NUMBER OF PARKING SPACES	TIER 1 NUMBER OF REQUIRED EV CHARGING SPACES
0-9	0
10-25	2
26-50	3
51-75	5
76-100	7
101-150	10
151-200	14
201 and over	At least 8 percent of total[1]
1. Calculation for spaces shall be rounded up to the nearest whole number	

Table C3. ARB Staff Proposal for Tier 2 Dated June 24, 2015

TABLE A5.106.5.3.2

TOTAL NUMBER OF PARKING SPACES	TIER 2 NUMBER OF REQUIRED EV CHARGING SPACES
0-9	1
10-25	2
26-50	4
51-75	6
76-100	9
101-150	12
151-200	17
201 and over	At least 10 percent of total[1]
1. Calculation for spaces shall be rounded up to the nearest whole number	

APPENDIX D
Locally Adopted Building Codes
Electric Vehicle Charging Requirements

City of Los Angeles – Municipal Code

Residential
99.04.106.6. Electric Vehicle Supply Wiring.
1. For one- or two- family dwellings and townhouses, provide a minimum of:

a. One 208/240 V 40 amp, grounded AC outlet, for each dwelling unit; or

b. Panel capacity and conduit for the future installation of a 208/240 V 40 amp, grounded AC outlet, for each dwelling unit.

The electrical outlet or conduit termination shall be located adjacent to the parking area.

2. For other residential occupancies where there is a common parking area, provide one of the following:

a. A minimum number of 208/240 V 40 amp, grounded AC outlets equal to 5 percent of the total number of parking spaces. The outlets shall be located within the parking area; or

b. Panel capacity and conduit for future installation of electrical outlets. The panel capacity and conduit size shall be designed to accommodate the future installation, and allow the simultaneous charging, of a minimum number of 208/240 V 40 amp, grounded AC outlets, that is equal to 5 percent of the total number of parking spaces. The conduit shall terminate within the parking area; or

c. Additional service capacity, space for future meters, and conduit for future installation of electrical outlets. The service capacity and conduit size shall be designed to accommodate the future installation, and allow the simultaneous charging, of a minimum number of 208/240 V 40 amp, grounded AC outlets, that is equal to 5 percent of the total number of parking spaces. The conduit shall terminate within the parking area.

When the application of the 5 percent results in a fractional space, round up to the next whole number.

Nonresidential
99.05.106.5.3.1. Electric Vehicle Supply Wiring. Provide a minimum number of 208/240 V 40 amp, grounded AC outlet(s), that is equal to 5 percent of the total number of parking spaces, rounded up to the next whole number. The outlet(s) shall be located in the parking area.

City of Sunnyvale – Municipal Code

Residential

16.43.040. Pre-wiring for electric car chargers.

2013 California Green Building Code Section 4.106.4 is hereby added:

(a) Section 4.106.4 Pre-Wiring for Electric Car Chargers. Effective July 1, 2012, parking spaces shall be pre-wired to accommodate Level 2 electric car chargers in accordance with Chapter 16.32, as follows:

(1) All garages or carports accessory to single-family dwelling;

(2) All garages or carports in residential developments with attached individual garages or carports;

(3) Twelve and one-half percent of the total required parking spaces in residential developments that provide common shared parking.

(Ord. 3015-13 § 2).

Nonresidential

19.46.100. General requirements for nonresidential and mixed-use parking.

(6) Electric Car Chargers. New construction of industrial uses, research and development office or other office uses with one hundred spaces or more is required to provide pre-wiring for a minimum of Level 2 electric car chargers for a minimum of three percent of the total parking spaces provided.

City of Palo Alto

Residential

16.14.370 Section A4.106.8 Electric vehicle (EV) charging.

Section A4.106.8 of the California Green Building Standards Code is added and amended to read:

A4.106.8 Electric Vehicle (EV) Charging for Residential Structures. Newly constructed single family and multifamily residential structures, including residential structures constructed as part of a mixed use development, 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.

A4.106.8.1 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 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 a 208/240V, 50 amperes grounded AC outlet; (2) a two-pole circuit breaker; (3) raceway with capacity to accommodate 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.

A4.106.8.2 Single Family Residences. The following standards apply to newly constructed detached and attached single family residences.

(a) In general. The property owner shall provide for each residence: Conduit Only, EVSE-Ready Outlet, or EVSE Installed.

(b) Location. The proposed location of a charging station may be internal or external to the dwelling, and shall be in close proximity to an on-site parking space consistent with City guidelines, rules, and regulations.

A4.106.8.3 Multi-Family Residential Structures with Individual, Attached Parking. The standards applicable to single family residences shall also apply to newly constructed residences in a multi-family residential structure, which: (1) are attached to a parking space; and (2) share an electrical panel with that parking space (e.g., tuck-under garages).

A4.106.8.4 Multi-Family Residential Structures Without Attached Parking. The following standards apply to newly constructed residences in a multi-family residential structure, and which are not governed by section A4.106.8.3.

(a) In general. The property owner shall provide for each residential unit in the structure: an EVSE-Ready Outlet or EVSE Installed.

(b) Multi-family Residential Structures Without Condo Map. In addition to the requirements of subsection (a), for multi-family residential structures in which individual residential units are not designated in a condominium map, the property owners shall provide EVSE Installed for at least 5% of the parking spaces reserved for residents.

(c) Accessible spaces. The percentage calculations and substantive requirements imposed by this section shall be applied separately to accessible parking spaces. Parking at accessible spaces where an EVSE is installed shall not be limited to electric vehicles.

(d) Location. If parking is deed-restricted to individual residential units, the EVSE or receptacles shall be located such that each unit has access to its own EVSE or receptacle. If parking is not deed-restricted to individual residential units, the EVSE or receptacles 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.

A4.106.8.5 Shared Parking in Mixed Use Facilities and Guest Parking for Multi-Family Residential Structures. The following standards apply to parking spaces shared by residential and non-residential uses in newly constructed mixed use structures, and parking spaces designated or counted as guest parking for newly constructed multi-family residential structures:

(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. The percentage calculations and substantive requirements imposed by this section shall be applied separately to accessible parking spaces. Parking at accessible spaces where an EVSE is installed shall not be limited to electric vehicles.

(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. 5263 § 2, 2014; Ord. 5228 § 2, 2014)

Nonresidential

16.14.380 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 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.

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 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. The percentage calculations and substantive requirements imposed by this section shall be applied separately to accessible parking spaces. Parking at accessible spaces where an EVSE is installed shall not be limited to electric vehicles.

(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. The percentage calculations and substantive requirements imposed by this section shall be applied separately to accessible parking spaces. Parking at accessible spaces where an EVSE is installed shall not be limited to electric vehicles.

(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. 5263 § 3, 2014)

City of Santa Monica

8.106.100 Residential electric vehicle charging.

(a) Multi-Family Dwellings. For new electrical services in multi-family dwellings, the following shall apply:

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

(2) 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.

(3) A separate multi-meter distribution section shall be provided for electrical vehicle charging only. The minimum number of meters in this multi-meter section shall be based on five percent of the parking spaces provided. The minimum rating of this multi-meter distribution section shall be calculated at ten kilowatts per five percent of the parking spaces provided.

Each meter shall have a space for a two-pole 208/240 volt circuit breaker where the space is identified as “Electric Vehicle Charging” or “Future Electric Vehicle Charging,” as applicable. This distribution panel section shall be permanently and conspicuously marked “Electric Vehicle Charging Only.”

(4) 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 in subsection (a), but in no case shall less than ten kilowatts per five percent of the parking spaces be provided.

(5) Where the calculated number of parking spaces results in a fraction of one-half or greater, the calculated number shall be rounded to the next higher whole number.

(b) Buildings of Mixed-Use Occupancies. For new electrical services in buildings of mixed-use occupancies, the following shall apply:

(1) The requirements in subsection (a) shall be applicable to the residential portion of the building. The residential distribution system shall supply the charging source for electric vehicles.

(c) 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) New electrical service serving only commercial occupancies; or

(4) Compliance is technically infeasible due to distance between dedicated parking facility and the structure containing residential occupancies, or similar conditions.

(Added by Ord. No. 2445CCS § 55, adopted 11/12/13)

Appendix E

Summary of Cost Estimates

New Construction

Table E12. Cost Estimates to Install Raceway in New Office Buildings

Raceway Type	Description	Size	Unit	Material	Labor	Total	Cost Per 100 L.F. Length
PVC Schedule 40 Conduit	Installed in or under building slab. No wire, fittings or supports included.	1"	L.F.	$0.34	$2.26	$2.60	$260
Flexible Aluminum Conduit	Installed in a building to 10' above floor level. No wire, fitting or supports included.	1"	L.F.	$1.24	$1.62	$2.86	$286
Flexible Steel Conduit	Installed in a building to 10' above floor level. No wire, fitting or supports included.	1"	L.F.	$1.84	$1.62	$3.46	$346
Wiremold Raceway	Installed on a finished wall in a building. Raceway including one coupling each 10 feet.	N/A	L.F.	$0.81	$2.89	$3.70	$370

Source: 2015 National Construction Estimator, Edited by Richard Pray, Craftsman Book Company, November 2014.

Table E13. Cost Estimates to Install Raceway and Panel Capacity to Support Dedicated Branch Circuits

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 1" Linear Foot)	$0.34	$2.26	$2.60	$260
Electrical Outlet Box	Handy Boxes, 4" X 2-1/8" (Weatherproof Box and Cover)	$5.27	$2.90	$8.17	$8
Safety Switches	Wall mounted switches with enclosures as noted. No fuses or hubs included. Heavy Dudy (NEMA-1) 600 Volt 2, 3, or 4 pole fusible safety switches (60 amp)	$214.00	$190.80	$404.80	$405
Circuit Breakers	No enclosure included, 10,000 amp interrupt capacity except as noted. 15 to 60 amps, two pole	$8.12	$21.80	$29.92	$30
Fuses	No enclosures included, 250 Volt 35 to 60 amp	$2.73	$4.49	$7.22	$7
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)	$60.40	$58.90	$119.30	$119
Total					$830

Source: 2015 National Construction Estimator, Edited by Richard Pray, Craftsman Book Company, November 2014.

Table E14. New Construction Cost Estimate to Install Wiring

Component	Description	Material	Labor	Total	Estimated Cost per Parking Space
EMT Conduit Circuits	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)	$72.90	$197.20	$270.10	$1,080
Electrical Outlet Box	Handy Boxes, 4" X 2-1/8" (Weatherproof Box and Cover)	$5.27	$2.90	$8.17	$8
Safety Switches	Wall mounted switches with enclosures as noted. No fuses or hubs included. Heavy Dudy (NEMA-1) 600 Volt 2, 3, or 4 pole fusible safety switches (60 amp)	$214.00	$190.80	$404.80	$405
Circuit Breakers	No enclosure included, 10,000 amp interrupt capacity except as noted. 15 to 60 amps, two pole	$8.12	$21.80	$29.92	$30
Fuses	No enclosures included, 250 Volt 35 to 60 amp	$2.73	$4.49	$7.22	$7
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)	$60.40	$58.90	$119.30	$119
Total[4]					$1,650

Source: 2015 National Construction Estimator, Edited by Richard Pray, Craftsman Book Company, November 2014.

[4] These cost estimates do not include the cost of distribution infrastructure upgrades that a utility may need to make to ensure that the site has enough electricity capacity to serve its load. In some jurisdictions, these utility costs are billed to the site owner. Distribution upgrade costs can vary substantially based on conditions unique to each site.

Retrofit Costs in Existing Buildings

ARB staff in the Emissions Compliance, Automotive Regulations and Science (ECARS) Division, reviewed multiple sources to obtain data on installation costs of EV charging infrastructure in existing buildings. Table E-13 summarizes the range of installation costs and the estimated average costs. ARB staff in the ECARS Division determined that the median cost of a Level 2 installation at a parking garage is $3,750 and $6,975 at a surface lot. For the purpose of estimating avoided retrofit costs due to the CALGreen Code EV charging infrastructure that must be installed in new commercial buildings, ARB staff in the Research Division eliminated the two outliers of $400 and $500 and used the low range average cost of $3,500 and the high range average cost of $12,500 as the estimated costs for retrofitting existing buildings. These installation costs are in line with two other recently completed studies that ARB staff reviewed. Please see the following section on other recent studies.

Table E14 EVSE Installation Costs for Level 2 Charging Stations

Type of Charger	Location Type	Installation Cost ($)	Average Cost ($)	Source
Public L2	Curbside or garage	60-80% of capital cost	-	RMI
Single L2 stations (single station)	Parking garages	4,000	4,000	RMI
Five L2 stations (cost is per station)	Parking garages	3,500	3,500	RMI
Single L2 station	Curbside	6,975	6,975	RMI
L2 Dual connector station	Curbside	3,750	3,750	RMI
Commercial L2	General	3,000-5,000	4,000	ABAG
Commercial L2	General	2,977-3,914	3,457	NREL
Basic L2 installation at location w/ preexisting electric infrastructure	Parking garage	300-500	400	DGS
Basic L2 w/ moderately complex installation	Parking garage	5,000-10,000	7,500	DGS
Smart L2 installation at location w/ preexisting electric infrastructure	Parking garage	400-600	500	DGS
Smart L2 w/ moderately complex installation	Parking garage	6,000-10,000	8,000	DGS
L2 basic and smart	Surface parking lot	10,000-15,000	12,500	DGS

Other Recent Studies

A U.S. Department of Energy (DOE) report entitled, "Plug-In Electric Vehicle Handbook for Public Charging Station Hosts," includes estimates for the total cost of installing a typical public charging station, including equipment and installation costs. In this report, various organizations report total costs to range from $12,000 to $18,000 for a level 2 charging station. Depending on the level of sophistication, USDOE estimates that the price of the Level 2 EVSE charging station ranges from $1,000 to $7,000 before incentives. Based on these estimates, ARB staff concludes that a high range estimate of retrofit costs may be on the order of $11,000.

The Electric Power Research Institute (EPRI) completed a technical report in 2013 entitled, Electric Vehicle Supply Equipment Installed Cost Analysis." Overall, average retrofit costs to install EV charging infrastructure was about $4,000. EPRI analyzed the retrofit costs of installing Level 2 EV charging infrastructure and did not factor in the cost of equipment (charging stations). Labor costs represented 55-60% of total costs, materials represented 30-35% of total costs, taxes and permits each represented about 5% of total costs.

The study evaluated a total of 637 site installations with 1,294 charging stations both inside and outside of California. Since California is a leader in EV charging infrastructure deployment, the majority of the data comes from California. Approximately 10 percent of the California sample had installation costs of $10,000 or more per EVSE. More than half of the sites were commercial buildings. Of those existing commercial building sites, more than half were public/retail locations, one quarter were workplace locations, and the remaining were fleet charging locations.

The EPRI study found that the least cost is afforded by installing EV charging infrastructure to support Dual Voltage EVSE (with one Level 2 port and one Level 1 port in a single unit) or Dual Port Level 2 EVSE (with 2 Level 2 ports per unit.)

Average Annual Parking Rate

ARB staff relied on Colliers International 2012 Parking Rate Survey as the source for data on the price of parking (Table E15). ARB staff used the midpoint between the lowest and highest values of the dataset (median) to calculate the average (mean) cost of parking rates in California. ARB staff estimated the annual parking rate by multiplying the monthly average by twelve months in a year. ARB staff completed these estimates to determine the statewide average as well as annual parking rates for the top five regions that are projected to have the greatest demand for EV charging infrastructure (Tables E16-E19). An estimated $2,000 to $2,500 is the average annual parking rate for parking spaces in California. For the purpose of assessing potential loss of revenue from the DSA accessibility provisions, ARB staff used an average annual parking rate of $2,250 per parking space. Assuming that 10 percent of employers charge for parking, ARB staff estimated a statewide loss of revenue based on 10 percent of new construction and the associated number of total new parking spaces installed. An estimated 1.2 million to 1.4 million total new parking spaces may be installed statewide between 2017 and 2020. Approximately 12,000 to 14,000 parking spaces may generate revenue. The CALGreen Code provisions would require that approximately

6 percent of those spaces (720 – 840) install EV charging infrastructure that is sized in accordance with the DSA accessibility provisions. Assuming that for every one EV charging space that is installed would result in the loss of two regular parking spaces, then the estimated number of parking spaces that may lose revenue would be doubled. An estimated 1,440 to 1,680 parking spaces multiplied by $2,250 per space may result in a statewide loss of revenue on the order of $3.2 million to $3.8 million between the years 2017 and 2020, which is approximately less than $1 million annually.

Table E15. 2012 Parking Rate Survey Results for California Cities						
Market	Parking Rate					
	Monthly Unreserved			Monthly Reserved		
	Low	Median	High	Low	Median	High
Bakersfield, CA	$45.00	$55.00	$65.00	$60.00	$60.00	$70.00
Fresno, CA	$65.00	$80.00	$95.00	$70.00	$80.00	$100.00
Los Angeles, CA	$100.00	$220.93	$363.00	$200.00	$275.50	$600.00
Oakland, CA	$155.00	$195.00	$225.00	$250.00	$255.00	$265.00
Sacramento, CA	$100.00	$145.00	$185.00	$150.00	$185.00	$225.00
San Diego, CA	$150.00	$175.00	$200.00	$190.00	$240.00	$320.00
San Francisco, CA	$120.00	$375.00	$535.00	$250.00	$450.00	$750.00
San Jose/Silicon Valley, CA	$70.00	$115.00	$165.00	$150.00	$200.00	$250.00
Walnut Creek/Pleasanton, CA	$35.00	$95.00	$135.00	$4.00	$150.00	$200.00
Source: Colliers International 2012 Parking Rate Survey						

Table E16. Bay Area Region Average Parking Rates				
Market	Monthly Parking Rate		Annual Parking Rate Estimate	
	Median			
	Unreserved	Reserved	Unreserved	Reserved
Oakland, CA	$195.00	$255.00	$2,340.00	$3,060.00
San Francisco, CA	$375.00	$450.00	$4,500.00	$5,400.00
San Jose/Silicon Valley, CA	$115.00	$200.00	$1,380.00	$2,400.00
Walnut Creek/Pleasanton, CA	$95.00	$150.00	$1,140.00	$1,800.00
Bay Area Average (Mean)	$195.00	$263.75	$2,340.00	$3,165.00

Table E17. Capital Area and San Joaquin Regions Average Parking Rates				
Market	Monthly Parking Rate		Annual Parking Rate Estimate	
	Median			
	Unreserved	Reserved	Unreserved	Reserved
Bakersfield, CA	$55.00	$60.00	$660.00	$720.00
Fresno, CA	$80.00	$80.00	$960.00	$960.00
Sacramento, CA	$145.00	$185.00	$1,740.00	$2,220.00
Capital Area and San Joaquin Average (Mean)	$93.33	$108.33	$1,120.00	$1,300.00

Table E18. Southern California and San Diego Regions Average Parking Rates				
Market	Monthly Parking Rate		Annual Parking Rate Estimate	
	Median			
	Unreserved	Reserved	Unreserved	Reserved

Los Angeles, CA	$220.93	$275.50	$2,651.16	$3,306.00
San Diego, CA	$175.00	$240.00	$2,100.00	$2,880.00
Southern California and San Diego: Average (Mean)	$197.97	$257.75	$2,375.58	$3,093.00

Table E19. California Statewide Average Parking Rates				
Market	Monthly Parking Rate Median		Annual Parking Rate Estimate	
	Unreserved	Reserved	Unreserved	Reserved
Bakersfield, CA	$55.00	$60.00	$660.00	$720.00
Fresno, CA	$80.00	$80.00	$960.00	$960.00
Los Angeles, CA	$220.93	$275.50	$2,651.16	$3,306.00
Oakland, CA	$195.00	$255.00	$2,340.00	$3,060.00
Sacramento, CA	$145.00	$185.00	$1,740.00	$2,220.00
San Diego, CA	$175.00	$240.00	$2,100.00	$2,880.00
San Francisco, CA	$375.00	$450.00	$4,500.00	$5,400.00
San Jose/Silicon Valley, CA	$115.00	$200.00	$1,380.00	$2,400.00
Walnut Creek/Pleasanton, CA	$95.00	$150.00	$1,140.00	$1,800.00
Statewide: Average (Mean)	$161.77	$210.61	$1,941.24	$2,527.33

Table E20. Cost per Square Foot Estimates for California								
Range	Retail, Grocery, and Restaurant	Small Office	Large Office	Misc.	Warehouses	College & Schools	Hospitals	Hotels
Low	$113	$190	$178	$160	$96	$195	$240	$186
High	$122	$228	$213	$174	$105	$233	$290	$223

Table E21. Total Construction Cost Estimates for California (Billions)									
Range	Retail, Grocery, and Restaurant	Small Office	Large Office	Misc.	Warehouses	College & Schools	Hospitals	Hotels	Total
Low	$11.9	$3.2	$13.9	$15	$6.1	$7.8	$6.0	$4.3	$68.2
High	$12.8	$3.9	$16.6	$16.3	$6.7	$9.4	$7.3	$5.1	$78.1

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California Environmental Protection Agency
Air Resources Board

1001 I Street

P.O. Box 2815

Sacramento, CA 95812

(916) 323-2514

www.arb.ca.gov