COUNCIL AGENDA: 3/28/23
FILE: 23-436
ITEM: 6.1

CITY OF SAN JOSE
CAPITAL OF SILICON VALLEY

Memorandum

TO: HONORABLE MAYOR AND CITY COUNCIL

FROM: Kerrie Romanow
Chris Burton

SUBJECT: **SEE BELOW**

DATE: March 6, 2023

Approved Jennifer A. Maguire

Date 3/16/23

SUBJECT: REACH CODE ORDINANCE UPDATE FOR ELECTRIC VEHICLE INFRASTRUCTURE IN NEW MULTIFAMILY DEVELOPMENTS

RECOMMENDATION

(a) Adopt findings related to local modifications of the state codes based upon local geographical, topographical, and climatic conditions.
(b) Approve an Ordinance of the City of San José Amending Parts 2 and 3 of Chapter 24.10 of Title 24 (Technical Codes) of the San José Municipal Code as a Reach Code to Increase Requirements Related to Electric Vehicle Charging Stations

SUMMARY AND OUTCOME

The City's current reach code for new multifamily development, in place since 2020, requires developments to be 70 percent electric vehicle (EV) capable (providing wiring infrastructure but no outlet), have 20 percent EV charging outlets, meet 10 percent charging station requirements, and have no direct billing standards for parking spaces. In 2022, City Council directed staff to analyze the marginal cost per-unit of increasing EV infrastructure in new multifamily developments to 95 percent EV ready (charging outlet) and five percent EV service equipment (charging station) and then to return with a proposed reach code update. The proposed reach code would ensure EV charging access for a maximum number of multifamily households, which do not have full access to EV charging outlets or charging equipment under the City's current reach code, and include direct billing requirements, achieved through direct wiring to unit electrical panels so that residents can monitor and manage their EV charging to reduce costs.

In December 2022, staff presented the marginal cost analysis and stakeholder engagement results to the Transportation and Environment Council Committee. The Committee requested staff bring the reach code ordinance update back to City Council by the end of March 2023. Staff received public support and input on the marginal-cost analysis and on the proposed reach code update presented through public webinars in November 2022 and February 2023, respectively. If the EV infrastructure recommendation is approved by City Council, the new EV infrastructure requirements under the City's reach code for new multifamily developments are expected to be effective in July 2023.

BACKGROUND

The effects of climate change are devastating and increasing. To set out an aggressive pathway to reduce San José's greenhouse gas emissions, City Council approved the Climate Smart San José Plan in 2018 followed by the Pathway to Carbon Neutrality by 2030 in 2022. Buildings, transportation, and our power source are the City's key focus areas for greenhouse gas emissions reductions.

Every three years, the state updates its Technical Codes, including California Building Energy Efficiency Standards (Part 6, Energy Standards) and the California Green Building Standards Code (Part 11, CALGreen). Local jurisdictions may adopt building "reach codes" to require development projects to exceed minimum state standards based upon geographical, topographical, or local climatic conditions. In 2019, City Council adopted a building reach code that included increased EV charging infrastructure requirements for all new building types and readopted that existing reach code in 2022, as is required every three-year building code cycle to ensure continued application. As defined in the City's existing reach code: an EV Capable space has all the electric wiring necessary to install charging access in the future; an EV Ready (charging outlet) space is equipped with a charging outlet; and EV service equipment (charging station) space is equipped with a charging station. The EV charging infrastructure can be designed to provide increasingly fast charging, going from level 1 (120V/20 amp) to level 2 (240V/20-40 amp), and finally Direct Current fast charging (480V-100 amp). The City's current reach code requires the following for new multifamily developments: 70 percent EV capable, 20 percent charging outlet, and 10 percent charging station, with no direct billing standards.

In 2020, Governor Gavin Newsom issued Executive Order N-79-20, which bans the sale of gas-powered passenger vehicles by 2030. To meet this goal, the California Air Resources Board adopted Resolution 22-12 which calls for immediate local action to provide the charging infrastructure necessary to meet the growing demand for EV ownership. In San José, EV ownership has been on a steady incline since 2015.[1] However, multifamily residents often lack access to onsite EV charging, which hinders EV uptake.

In April 2022, City Council directed staff to analyze the marginal cost per-unit of expanding EV infrastructure in new multifamily developments with parking to 95 percent charging outlets and five percent charging stations. This proposal differs from the City's current standards in that it eliminates EV capable spaces, which provide wiring but no charging outlet, and provides 100 percent charging access. The marginal costs analysis concluded that expanding EV charging infrastructure is cost-comparable to the City's current reach code. At the December 2022 Transportation and Environment Council Committee meeting, staff presented the cost analysis findings and was instructed to return to City Council in March 2023 with an updated reach code ordinance.

[1]Mobility: Electric Vehicles. City of San Jose (2022): https://www.sanjoseca.gov/your-government/departments-offices/environmental-services/climate-smart-san-jos/climate-smart-data-dashboard/mobility-electric-vehicles

ANALYSIS

Based on City Council direction, staff research, and public engagement (see Public Outreach section for details), staff evaluated an EV reach code update for new multifamily developments with the following goals in mind: 1) keep construction costs as close to the City's existing EV reach code as possible, 2) provide as much EV charging access to each multifamily household as possible, and 3) allow multifamily residents to manage their own EV charging costs (e.g., through choice of electric rate and access to usage and direct charges).

Peninsula Clean Energy, the community choice aggregation program serving San Mateo County, completed a study for multifamily developments which found that low-power charging can meet the vast majority of EV drivers' needs, especially if these drivers are charging their cars overnight.[2] Requiring more low-power charging outlets also helps to decrease the overall cost to developers.

Staff evaluated three different EV reach code update options, each with different power and direct billing requirements:

1. Option 1 - Mixed-Power and Direct Billing: This option enables direct billing by assigning an EV-specific meter to a dwelling unit, and a mix of low-power level 2 and standard level 2 charging outlets for 94 percent of parking spaces while exceeding the minimum CalGreen 2022 charging station requirement by requiring six percent charging station infrastructure with a lower cost charging equipment option (i.e., load-managed dual-port).
2. Option 2 – High-Power and Direct Billing: This option enables direct billing by assigning an EV-specific meter to a dwelling unit, and standard level 2 charging outlets for 95 percent of parking spaces while meeting the five percent minimum requirement for charging stations under the CalGreen 2022 standards.
3. Option 3 – HighPower and No Direct Billing: This option does not provide direct billing to a unit's electrical panel but provides standard level 2 charging outlets for 95 percent of parking spaces while meeting the five percent minimum requirement for charging stations under the CalGreen 2022 standards

Racial Equity Impact Analysis

The Mixed-Power and Direct Billing reach code option provides two essential benefits to multifamily residents: 1) equitable access to charging infrastructure, with each household having access to at least one parking space with EV charging capability, and 2) equitable access to the most affordable electricity, through direct wiring requirements that allow residents to manage their electricity rate and EV charging costs. Together, these also benefit the most energy-burdened communities in San José. In a 2020 study on energy burden, the American Council for an Energy-Efficient Economy found that low-income multifamily renters experience the highest

[2] Commute & Multifamily EV Charging Level Needs Analysis. Peninsula Clean Energy: https://www.peninsulacleanenergy.com/wp-content/uploads/2021/09/Determining-the-Appropriate-Level-of-Power-Sharing-for-EV-Charging-in-Multifamily-Properties-1.pdf

median energy burden in San José.[3] This means renters in these households are spending more than six percent of their monthly income on energy expenses. These households are impacted monthly, as they are forced to make decisions between paying their utility bill or going without electricity in order to meet other necessities. The direct billing requirement, achieved through direct wiring to a dwelling unit's panel, will empower all multifamily households to access the most affordable electricity to charge their EVs. Over the lifespan of their EVs, these same households can expect to save $6,000-$10,000 by choosing an electric vehicle over its gas-powered counterpart.[4]

For the Mixed-Power and Direct Billing reach code option, common space parking not tied directly to a residential unit would be required to have EV charging stations at each parking stall or equal to the number of residential units, whichever is less. This will ensure that multifamily residents have as much access to EV charging even if there are fewer parking spaces than number of units and provide access to charging information and costs for transparency to the user.

EV Reach Code Recommendation

Based on the cost analysis and internal department and public input, staff recommends City Council adopt Option 1 – Mixed-Power and Direct Billing, requiring the following parking space standards for new multifamily developments:

- Eighty-four percent EV level 2 low power (20 amp) charging outlets – providing direct EV charging access with maximized low power level 2 to reduce construction cost.
- Ten percent EV level 2 (40 amp) charging outlets – providing direct EV charging access but minimized EV ready level 2 as much as possible to reduce cost.
- Six percent dual port charging stations with network and load management capabilities – lowest cost CalGreen requires at least five percent to be charging equipment minimum required to be a reach code.
- Common area parking shall be provided with level 2 (40 amp) charging stations for 100 percent of units or 100 percent of parking spaces, whichever is less.

The City estimates that its current EV reach code for new multifamily developments costs approximately $252,731, which amounts to about 0.4 percent of the total construction costs for EV infrastructure alone. Compared to the City's current reach code, the Mixed-Power and Direct Billing option is estimated to cost developers approximately $332,016, which represents about 0.53 percent of construction costs for EV infrastructure alone, for a standard multifamily development. The Mixed-Power and Direct Billing option ensures that residents have full EV charging access and direct billing through direct wiring to unit electrical panels so that residents can monitor and manage their EV charging to reduce costs. See Attachment - EV Reach Code Cost Analysis, for the full detailed cost analysis.

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[3] How High Are Household Energy Burdens? An Assessment of National and Metropolitan Energy Burdens Across the U.S. ACEEE (2020): https://www.aceee.org/research-report/u2006

[4] EVs Offer Big Savings Over Traditional Gas-Powered Cars. Consumer Reports (2022): https://www.consumerreports.org/hybrids-evs/evs-offer-big-savings-over-traditional-gas-powered-cars/

This option balances the City's goals to keep construction costs down while providing residents with maximized EV charging access and ability to manage their own EV charging costs. As EV adoption grows locally and more gas-powered vehicles are retired, all neighborhoods - especially those that are the most pollution-burdened - will benefit from cleaner, healthier air.

Policy Alternatives

Alternative #1: *High-Power and Direct Billing*
Pros: This alternative would require that 95 percent of parking spaces provide EV level 2 (40 amp) charging outlets and the remaining five percent of parking spaces be equipped with charging stations, single-port (40 amp), providing 100 percent high-power charging access to multifamily residents and direct billing by assigning an EV-specific meter to a dwelling unit, which allows residents to access electric utility time-of-use rates to charge their vehicles during times when electricity is more affordable and/or electricity is from more carbon-free sources.
Cons: Under this alternative, a developer could expect to spend $378,999, about 0.6 percent more, when compared to the City's current reach code, for a 100-unit multifamily development with charging infrastructure for each parking space with direct billing – which is about 0.6 percent of construction costs for EV infrastructure alone.
Reason for not recommending: Requiring all high-power charging can lead to overnight demand spikes that will be carbon-intensive and expensive in the short term.

Alternative #2: *High-Power and No Direct Billing*
Pros: This alternative would require that 95 percent of parking spaces provide EV level 2 (40 amp) charging outlets and the remaining five percent of parking spaces be equipped with charging stations, single-port (40 amp), providing 100 percent charging access to multifamily residents.
Cons: Under this alternative, a developer could expect to spend $302,327, about 0.2 percent more, when compared to the City's current reach code, for a 100-unit multifamily development with charging infrastructure for each parking space – which is about 0.48 percent of construction costs for EV infrastructure alone. Additionally, this scenario does not include direct billing requirements, so residents would not be able to access electric utility time-of-use-rates nor have visibility into their charging costs.
Reason for not recommending: This option is a cost increase but does not include direct wiring and does not allow residents to access electric utility time-of-use rates to charge their vehicles during times when electricity is more affordable and/or electricity is from more carbon-free sources.

Alternative #3: *Do Not Update the 2022 EV Reach Code*
Pros: This alternative would continue to apply the City's existing reach code requiring 70 percent EV capable parking spaces, 20 percent EV level 2 (40 amp) parking spaces equipped with charging outlets, and the remaining 10 percent of parking spaces equipped with charging stations, dual port, with automatic load management capabilities. It is the least expensive option – estimated at $252,731 or about 0.4 percent of construction costs

for a new 100-unit multifamily housing development with EV charging infrastructure at each parking space.
Cons: Only provides 30 percent charging access, not all multifamily households will have the opportunity to charge EVs onsite.
Reason for not recommending: Does not help meet future demand for charging infrastructure due to the expected increase in EV ownership due to State legislation and City goals.

Climate Smart San José Analysis
Updating the City's EV infrastructure reach code requirements helps to advance two goals under Climate Smart San José, by facilitating:

- the reduction of energy or water use consumption, or increases the demand for renewable energy, and
- the choice of mobility choices other than single-occupancy, gas-powered vehicles.

EVALUATION AND FOLLOW-UP

Staff will continue to provide progress updates to the Transportation and Environment Committee and City Council on Climate Smart San José activities on a semi-annual basis.

COORDINATION

This memorandum has been coordinated with the City Attorney's Office, City Manager's Budget Office, Department of Transportation, and Community Energy Department.

PUBLIC OUTREACH

This memorandum will be posted on the City's Council Agenda website for the March 28, 2023 City Council meeting.

Outreach was undertaken for this item in addition to the agenda posting described above. These outreach efforts are described below.

Public Outreach Feedback
In November 2022, staff held three public webinars to share its marginal-cost analysis for potential EV reach code options that met the 95 percent EV charging outlets and five percent charging station requirements, as directed by the City Council. In February 2023, following the direction from the Transportation and Environment Council Committee in December 2022, staff held an additional three public webinars to present updated reach code policy options that meet City Council's requirements for 95 percent EV charging outlets and five percent charging stations, but differ in their approach (e.g., including direct wiring requirements, offering various

mixes of low-power and standard-power level 2 EV charging infrastructure) and cost, to allow participants to provide feedback.

Staff shared webinar invitations with over 1300 email contacts covering a variety of stakeholder groups, including business associations, affordable housing developers, local nonprofits, community-based organizations, environmental organizations, residents, and developers. Staff promoted the webinars on social media and the Climate Smart San José webpage. Staff also notified Councilmembers about the webinars via email and encouraged them to share with their constituents.

Based on input received during the public webinars, there is general public support to update the EV reach code for new multifamily developments to level 2 charging outlets with direct billing because it provides residents with equitable access to quicker EV charging infrastructure while allowing residents to access the most affordable electricity to charge their vehicles.

COMMISSION RECOMMENDATION AND INPUT

No commission recommendation or input is associated with this action.

CEQA

Categorically Exempt: (File No. PP19-067) CEQA Guidelines Section 15308, Actions by Regulatory Agencies for the Protection of the Environment because it is an action taken by a regulatory agency, as authorized by state or local ordinance, to assure the maintenance, restoration, enhancement, or protection of the environment where the regulatory process involves procedures for protection of the environment. Those procedures involve implementing electric vehicle infrastructure for multifamily developments with the overall intent of environmental protection to address climate change. There are no construction activities or relaxation of standards that would allow environmental degradation that are part of the adoption of this ordinance.

PUBLIC SUBSIDY REPORTING

This item does not include a public subsidy as defined in section 53083 or 53083.1 of the California Government Code or the City's Open Government Resolution.

/s/	/s/
CHRIS BURTON	KERRIE ROMANOW
Director, Planning, Building, and Code Enforcement	Director, Environmental Services

For questions, please contact Julie Benabente, Deputy Director, at *Julie.Benabente@sanjoseca.gov*.

ATTACHMENT – EV Charging Infrastructure Installation: Minimum Project Cost Analysis

EV Charging Infrastructure Installation: Minimum Project Cost Analysis

METHODOLOGY

Analysis Objective:

Support policy adoption by estimating costs for various EV charging installation space types:	ALMS:
A. Circuit sharing (2) Level 2 EV Capable (240V, 40A each when circuit eventually installed)	Capable of 20A each w ALMS
B. Conduit sharing (2) Level 1 EV Ready outlets (120V, 20A each).	None
C. Conduit sharing (2) Level 2 Low Power EV Ready outlets (240V, 20A each).	None
D. Conduit sharing (2) Level 2 EV Ready outlets (240V, 40A each). Excludes panel ALMS.	None
E. Circuit sharing (2) Level 2 EV Charging Stations (240V, 40A each)	20A when two vehicles charging
F. Conduit sharing (2) Networked Level 2 EV Charging Station (240V, 40A each)	Capable via networking
G. (1) Networked Level 2 EV Charging Station (240V, 80A each)	Capable via networking

Notes:

(1) This is a bottom-up theoretical model, not using actual construction cost data. Costs are based on RSMeans, vendor websites, PG&E information, and an interview with one local electrician with experience in multifamily buildings.

(2) The cost model does not include:
a. CALeVIP incentive amounts, due to varying project costs, locations, and applications. Incentive amounts are located here: https://calevip.org/faq/what-are-incentive-amounts-charger-9
b. Real estate costs, including electrical rooms, underground transformers, or impacts of the number of parking spaces, are excluded. These are real, potentially large, costs but can vary widely depending on the size and function of the building. Higher capacity systems will require more real estate.
c. Detailed cost models for Direct Billing costs
d. A sliding payment scale for developer payment of utility-side electrical costs

(3) Load Management strategies via networked or 'dumb' chargers are only assumed. Panel, receptacle, or other load management technologies have not been compared.

(4) The analysis assumes that the EVSE installations are located close to a panel (150'), and EVSEs are mounted to a wall. Stations installed for adjacent parking stalls will be mounted in the middle of the two stalls. Main and distribution panel costs are assumed to be negligible. Subpanel costs for Direct Billing-related strategies have been estimated.

(5) The analysis uses Clipper Creek HCS D40 Dual Charging Stations and Enel X JuiceBox as the proxies for L2 circuit sharing configuration. The cost listed in the 'Assumptions' table on Tab 'Cost Analysis' can be changed to reflect the preferred EVSE. The HCS D40 unit reflects the 'floor' cost for EVSE, but project costs can be $2500-$4000 more per port depending on EVSE vendor and ALMS strategy.

(6) The analysis uses outdoor-rated outlets intended to conform to NEC and local permitting requirements.

(7) 2022 CALGreen requirements are a percentage of parking spaces provided, not a percentage of dwelling units. Conversely, the reach code requirements are a percentage of dwelling units - with a goal to ensure EV charging access to 100% of dwellings. Because San Jose has no parking minimum requirements, this analysis assumes 100 dwellings are provided with 1 parking space each. If a developer provides greater than 1 parking space per dwelling, the costs associated with 2022 CALGreen will increase while the others will remain the same.

Definitions:

ALMS = Automatic Load Management System, which reduces charging rates when more vehicles are plugged in

"Dumb" ALMS = non-networked charger that reduces charging rates without any external communications, only depending on the number of chargers connected.

"Networked" ALMS = charger that exchanges data with other chargers, vehicles, or control system

Direct Billing = Resident is able to pay directly for the kWh used for at-home vehicle charging. See sheet "Costs - Upstream of Panel" rows 17-20 for more detail on various options.

EV Capable = panel capacity, conduit

EV Ready = panel capacity, conduit, wiring, breaker, receptacle

EV Charging Station = panel capacity, conduit, wiring, breaker, charger

RESULTS

Input Variables

Port Type	Max Volts / Amps per Port	minimum kVA	Cost per Port	2022 CALGreen		San Jose 2019 Reach		1: High Power - No Direct		2: High Power + Direct Billing		3: Mixed Power + Direct Billing	
				% of units (1 space/unit)	cost	% of units (1 space/unit)	cost	% of units (1 space/unit)	cost	% of units (1 space/unit)	cost	% of units (1 space/unit)	cost
L2 EV Capable	240V/40A	0	$2,362	10%	$23,623	70%	$165,358		$0		$0		$0
L1 EV Ready	120V/20A	2.4	$2,061		$0		$0		$0		$0		$0
L2 EV Ready - LPL2	240V/20A	4.8	$2,352		$0		$0		$0		$0	84%	$197,551
L2 EV Ready	240V/40A	9.6	$2,806	25%	$70,139	20%	$56,111	95%	$266,527	95%	$266,527	10%	$28,056
L2 EVCS - dumb ALMS, dual port	240V/40A	4.8	$3,114		$0	10%	$31,136		$0		$0		$0
L2 EVCS - networked ALMS, dual port	240V/40A	4.8	$4,935		$0		$0		$0		$0	6%	$29,611
L2 EVCS - networked ALMS, single port	240V/40A	9.6	$7,135	5%	$35,673		$0	5%	$35,673	5%	$35,673		$0
Totals - Breaker and Downstream				40%	$129,434	100%	$252,604	100%	$302,200	100%	$302,200	100%	$255,218
Direct Billing Approach				None		None		None		Dedicated EV Meter per DU		Dedicated EV Meter per DU	

kVA		288	240	960	960	528
Rule 29 Applicable?		Yes	Yes	Yes	Yes	Yes
Utility Cost - Transformer + Feeder (Rate-Based)		$61,350	$61,350	$114,360	$114,360	$91,940
Developer Cost - Transformer + Feeder		$0	$0	$0	$0	$0
Developer Cost - Direct Billing + Metering		$127	$127	$127	$76,799	$76,799
Developer	Cost	$129,561	$252,731	$302,327	$378,999	$332,016
	Percent of construction	**0.21%**	**0.40%**	**0.48%**	**0.60%**	**0.53%**
Developer and Utility	Cost	$190,911	$314,081	$416,687	$493,359	$423,956
	Percent of construction	0.30%	0.50%	0.66%	0.78%	0.67%

Total Parking Spaces	100
Cost of Construction $/ft2	$420
ft2 per dwelling, including common areas	1500
Building size ft2	150,000
Construction cost	$62,925,000

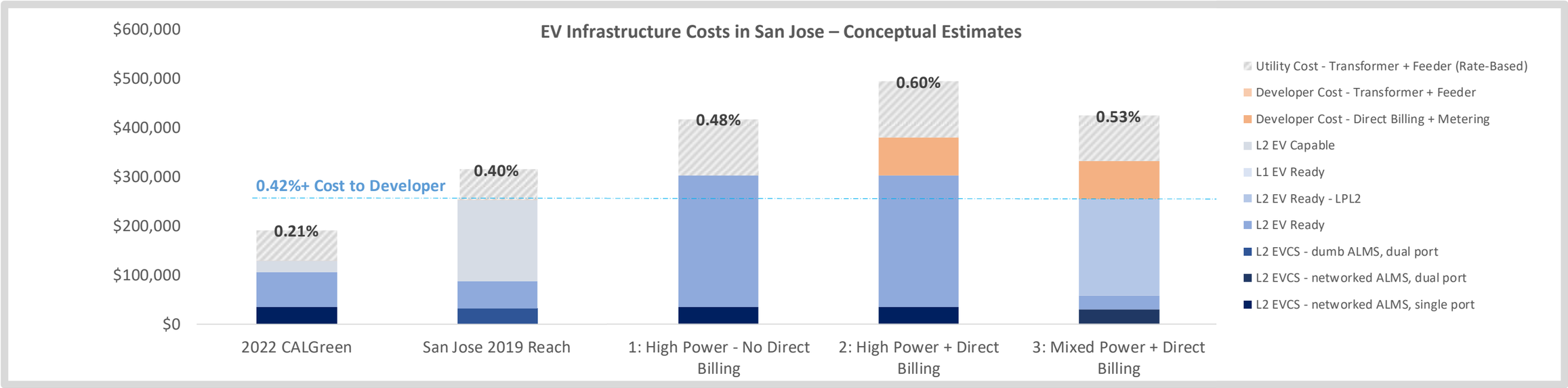
This assumes a 100-unit multifamily building with exactly 1 space per dwelling. Do not increase beyond 160 in this cost model.

source

North America

Region construction cost performance

International building costs per m² of internal area, in 2022	Chicago USD (ft²)	Chicago USD (m²)	Houston USD (ft²)	Houston USD (m²)	Los Angeles USD (ft²)	Los Angeles USD (m²)	Mexico City MXN	Mexico City USD	New York City USD (ft²)	New York City USD (m²)	San Francisco USD (ft²)	San Francisco USD (m²)	Toronto CAD	Toronto USD	Vancouver CAD	Vancouver USD
Commercial																
CBD Offices – high-rise prestige	551.9	5,938.0	372.5	4,008.0	613.6	6,602.0	37,000.0	1,857.6	850.0	9,146.0	736.1	7,920.0	4,704.0	3,768.4	6,500.0	5,207.2
CBD Offices – up to 20 floors medium (A-Grade)	431.4	4,642.0	274.1	2,949.0	520.6	5,601.7	28,000.0	1,405.8	650.0	6,994.0	607.8	6,540.0	3,360.0	2,691.7	4,500.0	3,605.0
Office fit-out (30,000sq ft) low specification	144.7	1,556.5	149.8	1,612.0	176.5	1,898.7	15,000.0	753.1	160.7	1,729.4	215.1	2,315.0	1,595.0	1,277.8	1,635.0	1,309.8
Office fit-out (30,000sq ft) medium specification	218.7	2,353.1	216.3	2,327.0	230.5	2,480.2	25,000.0	1,255.2	243.0	2,614.6	354.6	3,815.0	2,557.0	2,048.4	2,320.0	1,858.6
Office fit-out (30,000sq ft) high specification	326.8	3,516.6	306.0	3,293.0	323.5	3,480.5	40,000.0	2,008.2	363.1	3,907.3	426.6	4,590.0	4,042.0	3,238.1	3,788.9	3,035.3
Education																
Primary and secondary	278.2	2,993.7	287.5	3,094.0	468.7	5,043.6	17,500.0	878.6	585.0	6,294.6	527.8	5,679.0	2,400.0	1,922.7	5,110.0	4,093.7
General Hospital (e.g. city teaching hospital)	620.4	6,675.1	640.1	6,887.0	950.0	10,222.0	45,000.0	2,259.3	990.0	10,652.4	941.8	10,134.0	9,300.0	7,450.3	9,000.0	7,210.0
Hotels																
3-Star travellers	309.1	3,326.0	180.5	1,942.0	312.3	3,360.0	23,000.0	1,154.7	327.6	3,525.0	356.9	3,840.0	2,800.0	2,243.1	3,584.0	2,871.2
5-Star luxury	614.8	6,615.0	399.3	4,296.0	606.7	6,527.9	46,000.0	2,309.5	605.5	6,515.0	679.4	7,310.0	5,208.0	4,172.2	5,600.0	4,486.2
Resort style	387.3	4,167.0	244.7	2,633.0	387.6	4,170.6	53,000.0	2,660.9	415.0	4,465.0	425.7	4,580.0	3,920.0	3,140.3	5,600.0	4,486.2
Industrial																
Advanced manufacturing facility	641.3	6,900.0	584.9	6,294.0	734.2	7,900.0	27,000.0	1,355.6	603.3	6,491.0	750.3	8,073.0	7,500.0	6,008.3	7,500.0	6,008.3
Large warehouse distribution centre	177.4	1,909.1	99.5	1,071.0	169.5	1,823.4	16,000.0	803.3	171.4	1,844.1	172.3	1,854.0	1,400.0	1,121.6	2,100.0	1,682.3
Retail																
Large shopping centre including mall	255.3	2,747.2	292.8	3,151.0	307.2	3,305.9	26,000.0	1,305.4	372.2	4,005.0	405.7	4,365.0	3,483.2	2,790.4	3,400.0	2,723.8
Neighbourhood incl supermarket	142.2	1,530.0	130.5	1,404.0	183.8	1,978.2	19,000.0	953.9	223.6	2,406.0	229.1	2,465.0	2,072.0	1,659.9	2,300.0	1,842.5
Prestige car showroom	347.5	3,739.0	318.9	3,431.0	326.9	3,517.5	30,000.0	1,506.2	370.6	3,988.0	382.0	4,110.0	4,100.0	3,284.5	3,300.0	2,643.7
Residential																
Apartments high-rise	275.1	2,960.0	203.3	2,188.0	382.3	4,114.0	21,000.0	1,054.3	404.5	4,352.0	540.4	5,815.0	3,363.0	2,694.1	4,300.0	3,444.8
Townhouses medium standard	174.2	1,874.0	109.5	1,178.0	260.1	2,798.6	15,000.0	753.1	227.7	2,450.0	298.8	3,215.0	2,065.0	1,654.3	3,250.0	2,603.6



Analysis - San Jose 2019 Reach has a 0.40% of construction cost to developer. Ideally, costs to developer are maintained near this level. Policy that increases power (such as higher power receptacles) and/or infrastructure (such as infrastructure needed to enable direct billing) increases cost. This may change based on potential automatic load managmenet strategies, which, due to high complexity and wide ranging costs, are not captured in this study.

A. *Option 1* represents the model supported by Dept of Transportation; *Option 2*: Represents *Option 2* with direct billing; *Option 3* represents a mix of power with a slighly higher EVCS rate to enable ALMS and with the inclusion of Direct Billing at minimum cost.
B. *Option 1* is the lowest cost option at 0.48% of construction cost. *Option 2* and *Option 3* increase cost due primarily due to direct billing. *Option 2* introduces Direct Billing at a cost increase of 0.12% to the developer compared to *Option 1* due to the increase in infrastructure. *Option 3* Reduces cost from Option 2 because it provides lower charging speeds, albeit enough to provide at least 130 miles for an overnight charge.

COSTS – BREAKER & DOWNSTREAM

Assumptions

Component	Unit Measure		Cost
Electrical Materials & EVSE			
Level 1			
Breaker (15A)[1]	1	$	6.50
Wire (12 AWG)[2]	ft	$	1.50
3/4" Conduit[3]	ft	$	20.00
Outlet[4]	1	$	20.00
Cover[5]	1	$	35.00
Level 2			
Breaker (40A)[6]	1	$	16.00
Breaker (80A)[7]	1	$	43.00
Wire (8 AWG)[8]	ft	$	2.30
Wire (3 AWG)[9]	ft	$	5.20
1-1/4" Conduit[10]	ft	$	27.00
1-1/2" Conduit[11]	ft	$	30.00
Outlet[12]	1	$	42.00
Dual Port, Dumb EVSE[13]	1	$	1,500.00
Single Port, Networked, EVSE[14]	1	$	1,400.00
Dual Port, Networked, EVSE[15]	1	$	5,600.00
Junction Box[12]	1	$	35.00
Low Power Level 2			
Breaker (20A)[17]	1	$	16.00
Wire (10 AWG)[18]	ft	$	1.75
1" Conduit[19]	ft	$	23.00
Outlet[20]	1	$	12.00
Labor, Permitting, & Other Soft Costs			
Labor[21]	hours	$	175.00
Permit[22]	1	$	-
Networking[23]	month/unit	$	500.00
Contractor Fee[24]	%		10%
CALeVIP Incentive[25]	1	?	

ATTACHMENT

Building BOM from RSMeans, HomeDepot, Clipper Creek, Enel X, and estimates

2x Level 2 EV Capable - Conduit for 240V/40A, Load Managed

Electrical Materials & EVSE

Component	# of Units	Cost
		$ -
		$ -
Conduit	150	$ 4,050.00
Junction Box	2	$ 70.00
-		
Subtotal		$ 4,120.00

Labor, Permitting, & Other Soft Costs

Component	# of Units	Cost
Labor - J-Box	1	$ 175.00
		$ -
		$ -
Subtotal		$ 175.00
Materials & Labor Total		$ 4,295.00
Contractor Fee		$ 429.50
Total		$ 4,724.50
cost per port		**$ 2,362**

2x Level 1 EV Ready - Wire is 120V/20A, Conduit handles 2 circuits

Electrical Materials & EVSE

Component	# of Units	Cost
Breaker	2	$ 13.00
Wire	300	$ 450.00
Conduit	150	$ 3,000.00
Outlet	2	$ 40.00
Cover	2	$ 70.00
Subtotal		$ 3,573.00

Labor, Permitting, & Other Soft Costs

Component	# of Units	Cost
Labor - Breaker, outlets,	1	$ 175.00
		$ -
		$ -
Subtotal		$ 175.00
Materials & Labor Total		$ 3,748.00
Contractor Fee		$ 374.80
Total		$ 4,122.80
cost per port		**$ 2,061**

2x Level 2 Low Power EV Ready - Wire is 240V/20A, Conduit handles 2 circuits

Electrical Materials & EVSE

Component	# of Units	Cost
Breaker	2	$ 32.00
Wire	300	$ 525.00
Conduit	150	$ 3,450.00
Outlet	2	$ 24.00
Cover	2	$ 70.00
Subtotal		$ 4,101.00

Labor, Permitting, & Other Soft Costs

Component	# of Units	Cost
Labor - Breaker, outlets, covers	1	$ 175.00
		$ -
		$ -
Subtotal		$ 175.00
Materials & Labor Total		$ 4,276.00
Contractor Fee		$ 427.60
Total		$ 4,703.60
cost per port		**$ 2,352**

2x Level 2 EV Ready - Wire is 240V/40A, Conduit handles 2 circuits

Electrical Materials & EVSE

Component	# of Units	Cost
Breaker	2	$ 32.00
Wire	300	$ 690.00
Conduit	150	$ 4,050.00
Outlet	2	$ 84.00
Cover	2	$ 70.00
Subtotal		$ 4,926.00

Labor, Permitting, & Other Soft Costs

Component	# of Units	Cost
Labor - Breaker, outlets, covers	1	$ 175.00
		$ -
		$ -
Subtotal		$ 175.00
Materials & Labor Total		$ 5,101.00
Contractor Fee		$ 510.10
Total		$ 5,611.10
cost per port		**$ 2,806**

Dumb EVSE can meet EV Ready + ALMS rather than EV Ready + outlet or panel-level load mgmt

Electrical Materials & EVSE

Component	# of Units	Cost
Breaker	1	$ 16.00
Wire	150	$ 345.00
Conduit	150	$ 3,450.00
EVSE	1	$ 1,500.00
		$ -
Subtotal		$ 5,311.00

Labor, Permitting, & Other Soft Costs

Component	# of Units	Cost
Labor - Breaker, EVSE	2	$ 350.00
		$ -
		$ -
Subtotal		$ 350.00
Materials & Labor Total		$ 5,661.00
Contractor Fee		$ 566.10
Total		$ 6,227.10
cost per port		**$ 3,114**

2x Level 2 EVCS - Wire is 240V/80A, Conduit handles 1 circuit. Networked EVCS

Electrical Materials & EVSE

Component	# of Units	Cost
Breaker	1	$ 43.00
Wire	150	$ 780.00
Conduit	150	$ 4,500.00
EVSE	2	$ 2,800.00
		$ -
Subtotal		$ 8,123.00

Labor, Permitting, & Other Soft Costs

Component	# of Units	Cost
Labor - Breaker, EVSE	2	$ 350.00
Networking (2-yr)		$ 500.00
		$ -
Subtotal		$ 850.00
Materials & Labor Total		$ 8,973.00
Contractor Fee		$ 897.30
Total		$ 9,870.30
cost per port		**$ 4,935**

1x Level 2 EVCS - Wire is 240V/40A, Conduit handle 1 circuit. Networked EVCS

Electrical Materials & EVSE

Component	# of Units	Cost
Breaker	1	$ 16.00
Wire	150	$ 345.00
Conduit	150	$ 4,050.00
EVSE	1	$ 1,400.00
		$ -
Subtotal		$ 5,811.00

Labor, Permitting, & Other Soft Costs

Component	# of Units	Cost
Labor - Breaker, outlets, covers	1	$ 175.00
Networking (2-yr)		$ 500.00
		$ -
Subtotal		$ 675.00
Materials & Labor Total		$ 6,486.00
Contractor Fee		$ 648.60
Total		$ 7,134.60
cost per port		**$ 7,135**

Level 1 References

1 https://www.homedepot.com/p/Square-D-Homel
2 RSMeans Online, San Jose CA, THHN #12 Solid, St
3 RSMeans Online, San Jose CA, 3/4" EMT Aluminu
4 https://www.homedepot.com/p/Square-D-X-Serie
5 https://www.homedepot.com/p/TAYMAC-N3R-In

Level 2 References

6 https://www.homedepot.com/p/Square-D-Homelin
7 https://www.homedepot.com/p/Siemens-80-Amp-
8 RSMeans Online, San Jose CA, THHN #8 Stranded, S
9 RSMeans Online, San Jose CA, THHN #3 Stranded, S
10 RSMeans Online, San Jose CA, 1-1/4" EMT Aluminum, Standard Union, $27/linear foot, Q2 2022. Includes installation, ov
11 RSMeans Online, San Jose CA, 1-1/2" EMT Aluminum, Standard Union, $29.55/linear foot, Q2 2022. Includes installation, overhead, and profit
12 https://www.homedepot.com/p/Midwest-Electric-Products-50-Amp-Temporary-RV-Power-Outlet-U054P/100193650
13 https://store.clippercreek.com/dual-ev-charging-station?search=hcs-d
14 https://evcharging.enelx.com/store/commercial/juicebox-pro-32-commercial
15 https://www.bulbs.com/product/SC7P-FULL1-P
16 https://www.homedepot.com/p/8-in-x-8-in-x-4-in-Junction-Box-R5133712/202043419

Low Power Level 2 References

17 https://www.homedepot.com/p/GE-Q-Line-20-Ar
18 RSMeans Online, San Jose CA, THHN #10 Strande
19 RSMeans Online, San Jose CA, 1" EMT Aluminum,
20 https://www.homedepot.com/p/Leviton-20-Amp

Labor, Permitting Soft Cost References

21 Estimate, can be refined
22 Estimated permit cost; set at $0 because it assumes a permit needed at NC anyway
23 Networking fees to account for variances across site types, data and networking packages, etc. Not necessary for 'dumb' load managing charger selected.
24 Contractor estimated based on prior experience
25 https://calevip.org/faq/what-are-incentive-amounts-charger-9

COSTS – UPSTREAM OF PANEL

	2022 CALGreen	San Jose 2019 Reach	1: High Power - No Direct Billing	2: High Power + Direct Billing	3: Mixed Power + Direct Billing
kVA	288	240	960	960	528
Transformer and Feeder Cost	$61,350	$61,350	$114,360	$114,360	$91,940
Direct Billing Approach	None	None	None	Dedicated EV Meter per DU	Dedicated EV Meter per DU
Developer Direct Billing Cost, incld meter	$1	$1	$1	$768	$768

kVA	PG&E Unit Cost	RSMeans Online, San Jose CA, Liquid-Filled Transformer, Standard Union, Q2 2022. Includes installation, overhead, and profit	3-phase Amps	Feeder Cost	Transformer and Feeder Service
150	$ 44,070	$ 21,000	416	$ 4,120	$ 48,190
300	$ 53,110	$ 26,000	833	$ 8,240	$ 61,350
750	$ 65,540	$ 62,000	2,082	$ 26,400	$ 91,940
1000	$ 81,360	$ 77,000	2,776	$ 33,000	$ 114,360
1500	$ 110,740	$ 94,500	4,164	$ 52,800	$ 163,540
113%	Inflation Adjustment, from April 2021 to Q4 2022				

Option	Direct Billing Approach	Description	Notes	Cost/Dwelling	Rule 29 Applicable	Annual Min Meter Fees / Dwelling
A	None	- Entire feeder bank is on one (1) EV meter. - Developer may install networked chargers to comply with USDA rule		0	Yes	$1.27
B	Long Circuits from DU Panel to EV	- Running wiring from each unit's electrical panel to the unit's parking space. Not discussed in depth but Farhad's estimates that this is about $500-$1000/dwelling as well (example 100-units in a 5-story building) - Eligible for EV2A rate		750	No	$0.00
C	EV Subpanel at Garage	- Run wiring from meter to subpanel with one feed to the EV Ready 20a receptacle. Entails additional costs for individual subpanels & breakers. $500-$1000/dwelling for materials and labor (mostly labor) '- No clear best practice for metering. - May require additional room in the room/area housing the individual unit electrical meters for 12" x 8" subpanel, 20A + 100A breaker - Eligible for EV2A Rate		750	No	$0.00
D	Dedicated EV Meter per DU	- Install a second meter per unit dedicated for that unit's EV charging. Requires paying for second meter service. $500-$1000/dwelling for materials and labor (mostly materials). - Circuits from the EV meter go straight to the EV charger - Includes utility 2nd meter surcharges - Leverages Rule 29 - Eligible for EV-B Rate. Single PG&E account with 2 meters.		750	Yes	$17.99

Review the meter fee. This is going to be a big meter.

Amps	Gauge	Cost (RSMeans Online, San Jose CA, THH 4 wires, 100 ft from utility to elec rm			
420	600 kcmil	$	1,030	$	4,120
545	1000 kcmil	$	1,650	$	6,600

https://www.usawire-cable.com/pdfs/nec%20ampacities.pdf

SIZE AWG OR kcmil	Copper Conductors		
	Temperature Rating of Conductor		
	60°C	75°C	90°C
	TYPES	TYPES	TYPES
	TW UF	RHW THW THWN THHW XHHW USE	RHH RHW-2 XHHW XHHW-2 XHH THHW THWN-2 THW-2 THHN USE-2
14**	20	20	25
12**	25	25	30
10**	30	35	40
8	40	50	55
6	55	65	75
4	70	85*	95*
3	85	100*	110*
2	95	115*	130*
1	110	130*	150*
1/0	125	150*	170*
2/0	145	175*	195*
3/0	165	200*	225*
4/0	195	230*	260*
250	215	255*	290*
300	240	285	320
350	260	310*	350*
400	280	335*	380*
500	320	380	430
600	355	420	475
700	385	460	520
750	400	475	535
800	410	490	555
900	435	520	585
1000	455	545	615
1250	495	590	665
1500	520	625	705
1750	545	650	735
2000	560	665	750

https://www.pge.com/tariffs/assets/pdf/tariffbook/ELEC_SCHEDS_EV%20(Sch).pdf

ELECTRIC SCHEDULE EV Sheet 2

RESIDENTIAL TIME-OF-USE

SERVICE FOR PLUG-IN ELECTRIC VEHICLE CUSTOMERS

RATES:(Cont'd.)

TOTAL BUNDLED RATES

Rate A

Total Energy Rates ($ per kWh)	PEAK		PART-PEAK		OFF-PEAK	
Summer Usage	$0.61273	(I)	$0.36862	(I)	$0.25607	(I)
Winter Usage	$0.43013	(I)	$0.29812	(I)	$0.22639	(I)

Delivery Minimum Bill Amount ($ per meter per day)	$0.34810

$ 0.35

TOTAL BUNDLED RATES

Rate B

Total Energy Rates ($ per kWh)	PEAK		PART-PEAK		OFF-PEAK	
Summer Usage	$0.60969	(I)	$0.36558	(I)	$0.25303	(I)
Winter Usage	$0.42715	(I)	$0.29514	(I)	$0.22341	(I)

Total Meter Charge Per Day	$0.04928

Total bundled service charges shown on customer's bills are unbundled according to the component rates shown below.

UNBUNDLING OF TOTAL RATES

$ 0.05