

Accelerating EV Adoption in Low- and Moderate-Income Multi-family Properties

Innovation Onramp Grant Final Report



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Prepared by Ecology Action



Principal Investigators:

Sherry Lee Bryan, Program Manager,
sherry.bryan@ecoact.org

Mahlon Aldridge, Vice President, Strategy,
mahlon.aldridge@ecoact.org

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Executive Summary

Vehicle electrification provides one of the most promising greenhouse gas reduction strategies available today. However, without being able to charge overnight at home, people living in multi-family residences remain very unlikely to convert to electric vehicles (EVs).¹ In fact, providing reliable charging at home is the most influential way to encourage consumers to purchase EVs.² In the San Francisco Bay Area, more than half of residents live in multi-family properties, but less than 10% of zero-emission vehicles are owned by multi-family residents.³ The current market for deploying EV charging infrastructure in the United States, though successful in some sectors, is largely failing in multi-family properties, especially in low- and moderate-income communities.⁴

The work presented here was undertaken by Ecology Action with funding from a Silicon Valley Clean Energy (SVCE) Innovation Onramp grant to demonstrate a low-cost “direct-installation” (DI) delivery model for deploying multi-family EV charging that is aimed at addressing the unacceptable trend of disparity in EV ownership between single-family and multi-family residents. The project was undertaken as part of SVCE’s commitment to promoting equity among its customers and stimulating rapid growth in EV ownership among multi-family tenants. The specific program objectives were as follows:

- Demonstrate the viability of a direct-installation solution that utilizes existing panel capacity to deploy an average of five chargers per site, using L1 and automatically load-managed (ALM) L2 equipment. Although the goal was to install ten charging ports between two multi-family sites, the project team ultimately installed 17 ports across three multi-family properties renting to low- and moderate-income households, providing access to EV charging to 478 rental units.
- In collaboration with GRID Alternatives, test the impact of pairing EV charging installations with educational outreach to increase tenants’ EV adoption, build awareness of the benefits of EVs and facilitate access to California’s clean vehicle incentive equity programs.
- Identify current policy and regulatory barriers that limit multi-family property operators’ ability to leverage millions of dollars in charging incentives from government agencies and utilities, and identify paths to removing those barriers.

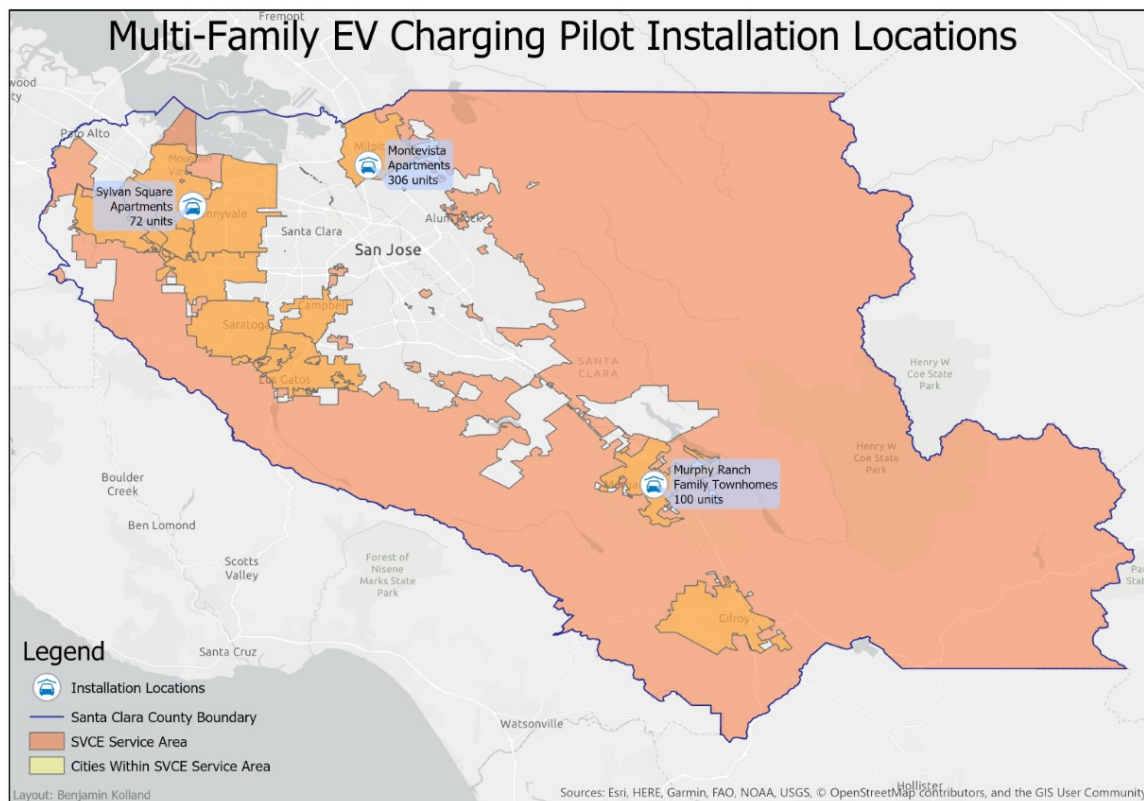
The work completed under this Innovation Onramp contract confirmed and further informed important cost and operational details that will be critical to scaling a direct installation–style offering for multi-family EV charging. Through the installation of the 17 EV charging ports at three multi-family properties, we were able to test real-world deployment of all aspects of direct-installation programming, including property recruitment, property operator requirements for participation, technical prequalification, permitting details, behavior and business motivations of vendors and supply chain actors, rules that govern the inclusion of charging incentives, and regulatory hurdles. Although each of these presented challenges and some degree of unexpected difficulty, this project has confirmed the key premise that for a solution to scale in the multi-family market, it must be nearly cost free and hassle free and have a price point that is affordable to the funder.

¹ Hardman, S. et al. 2018. “A Review of Consumer Preferences of and Interactions with Electric Vehicle Charging Infrastructure.” Transportation Research Part D: Transport and Environment 62: 508–23, p. 517.

² Ibid, p. 518.

³ Silicon Valley Clean Energy. “Electric Vehicle Infrastructure Joint Action Plan.” 2019, p. 7.

⁴ Muller, M. “California Approves Novel Low-Income EV Charger Program | NRDC,” September 12, 2019.



Pilot Site	# of EV Charging Stations Installed	EV Charging Solution	# of Households Engaged with Information about EVs
Montevista Apartments, Milpitas	8	Level 1, 1.92 kW Plugzio	306
Murphy Ranch Apartments, Morgan Hill	4	Level 2, 7.2 kW Evercharge	100
Sylvan Square Apartments, Mountain View	5	Level 1, 1.92 kW Plugzio	72
3 Pilot Sites	17 EV Charging Stations Installed		478 Rental Units Served

The team at Ecology Action was able to deliver the direct-installation solution within the projected budget, resulting in an all-in price point approximately 50% less per port than the dominant utility programs for delivering L2 charging to multi-family properties in California.⁵ We recognize that this is not an apples-to-apples comparison, however the report and the case studies herein highlight the opportunity to deploy EV charging more cost-effectively in properties with constrained electrical capacity. Likewise, the experiences reported here indicate that the direct-installation approach can serve as a cost-effective, targeted component of SVCE's overall effort to equitably scale EV charging at multi-family properties renting to low- and moderate-income residents in its service area.

⁵ Pacific Gas and Electric Company, EV Charge Network Quarterly Report, Report Period: January 1, 2020 – March 31, 2020 and Southern California Edison Company's Charge Ready Pilot Quarterly Report 1st Quarter, 2020, June 1, 2020. P. 18, Table 2.3.

Direct Installation Program Elements and Equipment Selection

Low-Cost Pilot Objectives

Given the limited opportunity for return on investment, most multi-family property owners have no compelling business justification for investing in EVSE at their existing facilities. Accordingly, the primary objective of this pilot was to demonstrate a low-cost, direct-installation turnkey service that assures EVSE projects are delivered at no cost and with minimal business disruption to the property operator. To deliver direct installation at no cost to the property owner, and at a cost acceptable to a utility funder, we aimed to demonstrate site-specific solutions that would not exceed an average of \$2,500 per EV charging port for equipment and installation labor. All property owners agreed to own and maintain the equipment as a condition of participation. The make-ready and equipment configurations used in the pilot were designed to lower costs but remain flexible for the unique, site-specific conditions found in the built environment. The key elements of the direct-installation pilot were as follows:

Participation is Easy and Free

- Direct-installation service is provided that includes technical assessment of electrical system capacity; EV charging system design, permitting, and installation by a program-vetted contractor; commissioning of EV charging equipment; and EVSP software training for the multi-family property operator.

Utilize Existing Electrical Capacity and Maximize Charging Speed

- Install 1 to 10 EVSEs per site. Draw power from more than one house panel or sub-panel ⁶ if necessary.
- Use existing house electrical capacity to avoid expensive electrical panel or utility service upgrades that would involve alterations to above- or below-ground conductors and transformers on the utility side of the meter.
- Allow for limited sub-panel upgrades when a building's electrical service is adequate and the costs needed for panel upgrades are modest.
- If a house electrical panel has limited capacity, install low-power, networked level 1 (L1) charging units. If the panel has sufficient capacity (>60 amps), install load-sharing, networked level 2 (L2) charging equipment. ⁷

Minimize Installation Costs and Plan for the Future

- Design for short conduit runs from the house panel to EV charging area, and mount EVSE to existing walls or structures when possible. Allow for more extensive trenching through hardscape (concrete or asphalt) at select properties, ideally for distances of less than 10'.
- Install EV charging solutions in assigned parking spaces rather than shared spaces, where ADA compliance requirements would increase cost. Design the assigned EV charging stations so that if they are eventually converted to shared charging, the property operator can cost-effectively comply with ADA regulations.
- Upsize conduits and conductors to allow for higher-power L2 charging in the future ("future-proofing"), in anticipation of eventual panel and/or electrical system capacity upgrades.

⁶ The term "house panel" refers to an electrical panel that is metered separately to serve the property's common-area electrical loads rather than the electrical loads in each residential unit.

⁷ Low-power, or Level 1 charging, uses a 120-v circuit or standard electrical outlet. L1 charging power output varies, typically between 12 and 16 amps of continuous power, and delivers between 3.5 and 6.5 miles of range per hour of charging. These rates are adequate for people who drive less than 40 miles daily and can charge overnight. L2 chargers use a 240-v circuit and typically produce between 16 and 40 amps of power output, which can deliver between 14 and 35 miles of electric range per hour of charging (CALeVIP, 2021).

Equipment Selection Considerations

Ecology Action is vendor neutral and has no financial interest in any specific electric vehicle service provider (EVSP). The team specified either L1 or automatically load managed (ALM) L2 EVSE based on the existing house panel capacity for increasing electrical loads. Regardless of power level, the team selected networked solutions that combined features that would allow the property operator and resident to understand energy consumption and the costs of providing EV charging. Likewise, solutions were selected only if they offered integrated payment collection capability, allowing the property operator to pass on cellular fees and operations and maintenance fees directly to residents.

Low-Power Pilot Solution

At the time of the pilot, the 16 amp, 1.92 kW Plugzio Integrated Unit was the only low-power “smart outlet” on the market with UL listing and networked software support for third-party payment collection. One other smart outlet with equivalent performance features was in the UL certification process but was not market-ready. Plugzio offered the following features, which met the objectives of the pilot:

- Ecology Action’s experience from multi-family market research ⁸ is that many multi-family property operators do not want members of the public coming onto their private property and using the EVSE that are installed for residents and staff. The Plugzio software platform allows the property operator to easily assign one or multiple residents to a unique Plugzio outlet using a serial number and email address. Alternatively, a public option is available that allows any apartment resident with a Plugzio user account to access the smart outlet and begin a charge.
- Property operators want to avoid the hassle of responsibility for fixing broken equipment. Charging-cord damage associated with L2 EVSE is the most typical O&M cost. Because EV drivers must use their own J1772 charging cords when using the Plugzio outlets, this concern is resolved.
- Plugzio allows property operators to collect payments from EV drivers by the hour or kWh, or to collect no charge (energy monitoring only). Cellular fees can be passed through to the user by building them into the hourly or kWh rate.
- When charging by kWh, Plugzio allows the rate billed to the driver to be set according to the time of use in the utility’s rate schedule. Setting a higher price per kWh during peak demand hours provides an economic incentive to residents to charge during times of lower demand.

Load-Sharing Networked L2 Solution

Evercharge was selected as the L2 vendor for the pilot on the basis of the EVSE’s technical capability for load sharing, the company’s experience serving the multi-family charging market, and Evercharge’s willingness to not begin charging networking fees until a driver is assigned to a charger. In Evercharge’s service model, the property operator does not have to take part in granting charging access apart from informing a resident of their assigned parking space number and providing them a document (supplied by Ecology Action) on how to register for an account with Evercharge. Evercharge then sends a key fob to the resident EV driver that enables access to a specific Evercharge EVSE. At any time, a property operator can contact Evercharge to convert assigned EVSE to shared EVSE among all residents with key fobs.

⁸ Ecology Action, November 2020. [Innovation In Electric Vehicle Charging For Multi-Unit Dwellings](#): Report Prepared for East Bay Community Energy.

Multi-Family Residential Pilot Site Acquisition

To recruit sites for the pilot program, Ecology Action contacted 41 multi-family community managers and property asset managers (property operators) representing 72 multi-family apartment communities in Silicon Valley Clean Energy's service area. As a result of these contacts, six properties participated in technical site assessments. In consultation with SVCE, three sites were selected and signed project agreements to participate in the Innovation Onramp pilot. This is a sales close rate of 7%.

Acquisition challenges and opportunities in affordable housing

Pilot site recruitment occurred from June to September 2020, during the covid-19 pandemic and general lockdown and shelter-in-place orders in the Bay Area. During this time, Ecology Action focused exclusively on recruiting affordable-housing properties,⁹ with the intention that the pilot serve low-income residents. Ecology Action's primary method of site recruitment was to call, email, and set up video meetings with decision makers to explain the benefits of participating in the free pilot program. After multiple phone calls and email attempts at engagement, representatives from six affordable-housing operators with multiple properties in Santa Clara County provided statements that they were not able to move forward with installing EV charging infrastructure at the time. The reasons cited ranged from economic uncertainty, sensitivity about starting an EV charging program when many residents weren't able to pay rent due to pandemic-related unemployment, the perception that residents were not interested in owning electric vehicles or couldn't afford them, and the need to prioritize available staff bandwidth on other capital improvement projects and maintenance.

In September 2020, after investing significant time and energy in the recruitment of affordable housing properties without affirmative signals that any would participate, the team pivoted to contacting market-rate properties that were either "naturally occurring" affordable housing for moderate-income renters (i.e., rent was no more than 30% of median income), and apartment complexes that offered below-market rate units. During this pivot, we continued to communicate with the affordable-housing contacts, some of whom eventually expressed interest but still needed time to obtain approval to proceed from property supervisors and executives.

In addition to targeted outreach to affordable-housing property owners and community managers, Ecology Action's marketing team launched a two-week paid Facebook ad campaign in disadvantaged-community zip codes (i.e., annual income was less than 80% of median). The ad invited multi-family residents to ecoact.org/evcharging to learn more about getting free EV charging installations at their apartment communities. The ad resulted in one contact from a resident of an apartment complex in Sunnyvale, but this resident did not respond to our follow-up emails. Although this short-duration ad campaign was not successful, Ecology Action believes that there is potential to build multi-family resident awareness and demand for EV charging installation programs through targeted social media campaigns.



In partnership with



Does your Apartment Complex need Electric Vehicle Charging?

If you are an apartment renter or apartment manager, your community may be eligible to receive a free Electric Vehicle charging station installation. Take this survey to see if your property qualifies for grant funding!

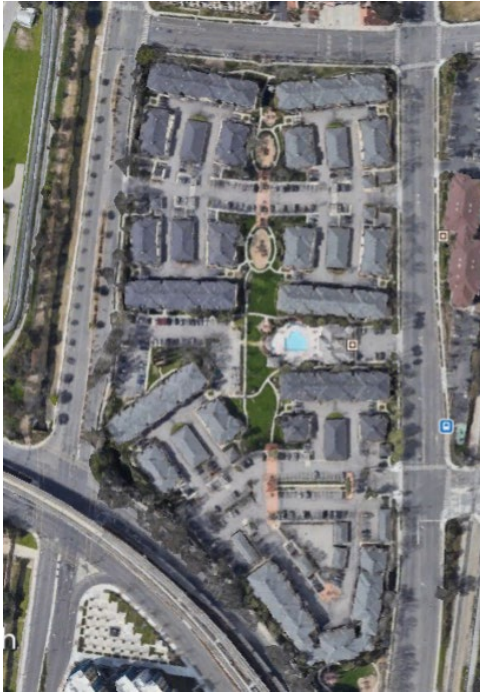
⁹ In this context, affordable housing is defined as deed-restricted, or made affordable to an income level below 50% of AMI. Deed-restricted housing is regulated by a use restriction limiting the price and occupancy to lower-income households for a period of time (generally 30 to 55 years).

The response rate to the offering was generally lower than anticipated. We speculate that the economic shutdown and the uncertainty caused by the covid-19 pandemic were the primary factors in the low demand for no-cost EV installation. Key takeaways from our recruitment efforts are that market-rate, multi-family property operators serving moderate-income households are more willing to consider adding EV charging as a resident amenity, can make quicker decisions about participating in programs due to business structures, and are more open to a limited cost-share if they can pass the costs on to their residents. Affordable housing operators take much longer to recruit and commit; in this case, six to twelve months passed between initial recruitment contacts and signed project agreements. Even when a champion exists within the affordable-housing organization, that champion must engage with and convince multiple decision makers in the organization that EV charging will be beneficial for residents. Regardless of property type, most multi-family property operators needed significant education to differentiate between L1 and L2 EV charging options, costs, and benefits.

Case Studies

Case Study 1: Montevista Apartments, Milpitas

Montevista Apartments is a 306-unit gated, garden-style property in Milpitas, CA. Constructed in 1998, Montevista Apartments is owned and operated by Bridge Housing. 203 of the 306 units (66%) are affordable housing dedicated to low-income households. Each unit has access to one garage, an assigned parking space for a second vehicle, and free, shared parking spaces for residents and guests.



Management's Operational Preferences for Charging

At the time of the initial site assessment, Montevista management reported that residents with EVs were charging with 120-v outlets in garages. Charging in garages presented two problems for the management:

1. The 120-v outlets in resident garages were on the same 20-amp circuit branch as garage door openers and garage lights for four garages. EV charging at 16 amps together with a lighting and garage door opening load of more than 4 amps will overload the circuit and trip the breaker. If two residents tried to charge their EVs by plugging into 120-v outlets on the same circuit branch, the circuit would also overload and trip the circuit breaker, creating a safety and electrical code violation issue. The installation of dedicated 20-amp circuits for L1 EV charging to individual garages was cost prohibitive.
2. Power supplied to the garages was provided by the house meter and the facility's common electrical power, not associated with the residents' electrical meters. Facilities staff were sealing off 120-v electrical outlets in garages to prevent increases in Montevista's energy costs incurred from residents' EV charging.

Bridge Housing decided to participate in the pilot project due to the demand for EV charging by one tenant and EV owner, and to prepare the property for future adoption of electric vehicles by tenants. Bridge Housing was interested in an EV charging solution that would fulfill the following objectives:

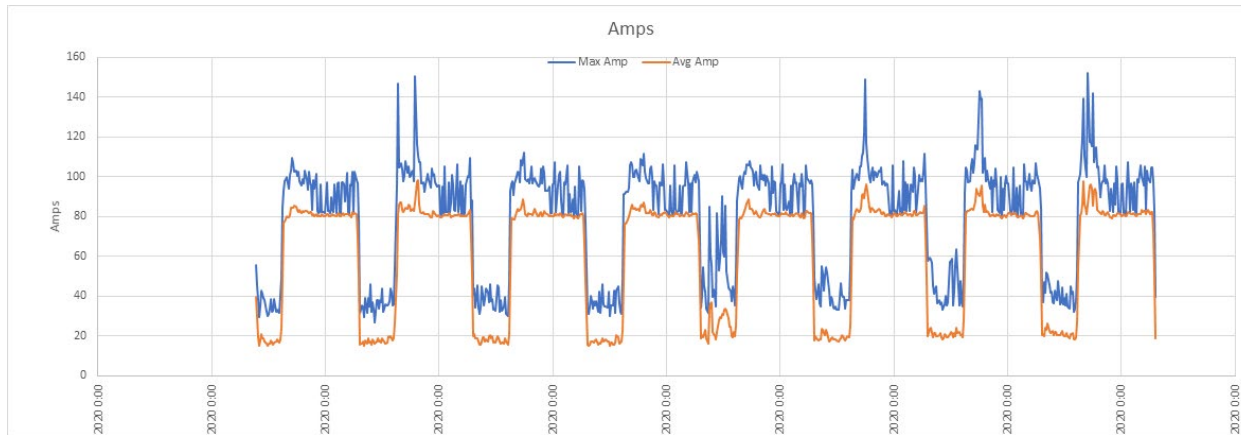
- Require no capital investment or cost share.
- Allow the property to be reimbursed by residents for the cost of electricity and other fees associated with EV charging.
- Avoid placing on management and facilities staff the burden of managing shared EV charging or resolving problems of non-functional charging stations.
- Minimize the O&M costs associated with broken charging cords and vandalism.

House Panel Electrical Load Capacity

The Montevista property's electrical service included several single-phase 100-amp house panels, each feeding three sub-panels through 50 or 60 circuit breakers for site lights, fire alarms, and garages. In order to permit and install one 16-amp L1 EV charging unit per building area, we needed to confirm that at least 20 amps (2,400 kW) was available at a house panel adjacent to a parking space.

In October 2021, a seven-day power meter study of a representative 100-amp house sub-panel showed that energy use was highest (average peak demand of 92 amps, or 22.241 kW) between 4 p.m. and 7 a.m., and consistently dropped to just 20 amps between 7 a.m. and 4 p.m. (see graph below).

Figure 1: Seven-Day Load Study at Montevista Apartment House Panel



We suspected that site lights on timers were a major energy user, and the facility manager confirmed that the site lights turned on from 4 p.m. to 7 a.m. The October power study showed that 125% of the existing load plus the new load from the EV charging unit would exceed the ampacity of the main house panel (100 amps).¹⁰ Fortunately, Bridge Housing had planned an LED site-lighting retrofit within the pilot's timeframe.

After the Montevista LED site-lighting retrofit was complete, Ecology Action and GRID Alternatives installed another DENT power meter on the same house panel to determine whether the LED site lighting retrofit had lowered power demand sufficiently to allow the installation of L1 EVSE on the house sub-panels. The results of the second power study showed a peak demand reduction of 69%. If it weren't for this scheduled energy efficiency upgrade, we would not have been able to justify the new L1 loads on each house sub-panel in a permit application to the city of Milpitas.

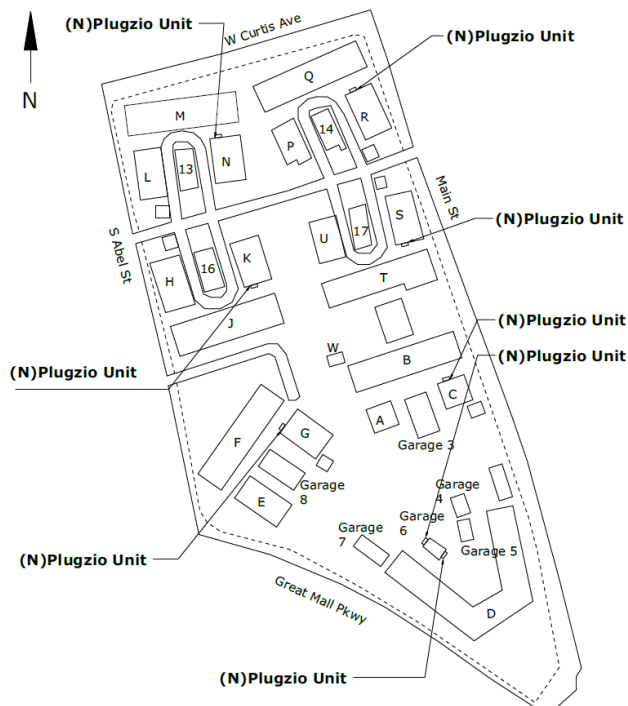
Load Study Date	Average Peak Demand
October 2020, before LED site-lighting retrofit	22.241 kW
March 2021, after LED site-lighting retrofit	6.950 kW
Total average peak demand¹¹ load reduction	15.291 kW, or 69%

¹⁰ NEC 220.87 (2) states that the maximum demand at 125% plus the new load does not exceed the ampacity of the feeder or the rating of the service.

¹¹ Peak demand is defined as the maximum load recorded in a 15-minute interval.

Montevista Low-Power EV Charging Solution

Figure 2: Locations of Plugzio units at Montevista Apartments



The L1 EV charging solution selected for the Montevista Apartments was a function of the limited panel capacity at house sub-panels observed during the initial October 2020 power study and the pilot's limited budget. Assuming that the LED site-lighting upgrade would free up available power at each house sub-panel, Ecology Action designed a decentralized EV charging solution in which one 16-amp (1.92-kW) Plugzio integrated charging unit was installed near a parking space on the exterior wall of a utility room or garage at each building cluster. A total of eight networked Plugzio EV charging units were installed throughout the property by our installation partner, GRID Alternatives. This decentralized approach to assigned charging ensured that resident EV drivers would not have to park and walk far from their homes to charge. At each sub-panel, the simple installation required installing a new 20-amp circuit breaker and running conduit and conductors through the exterior wall of the utility room. Plugzio units were mounted to an exterior wall of each utility room, avoiding the need for costly trenching through concrete sidewalks. If additional funding becomes available, then given existing loads, Montevista will be able to install six additional 16-amp L1

smart outlets or easily convert existing smart outlets into shared L2 EVSE (32- or 40-amp) by increasing circuit breaker size and utilizing the number-8 AWG wire installed. The charging configuration was designed so that when the number of EV drivers exceeds the number of assigned EV charging spaces and a shared charging solution is needed, Montevista may opt to convert the two parking spaces adjacent to Garage 6 into ADA-compliant charging stations, as required by the CA building code for shared charging.



Management reassigned resident's second parking space in order to accommodate the new assigned EV charging parking space.



The Plugzio unit is activated by cellular connection on resident's smart phone



Plugzio unit mounted to exterior wall of a utility room. Labeling recognizes SVCE as the funder.

Montevista Apartments EV Charging Installation Costs	
Electrical Permit Fees, City of Milpitas	\$2,254.20
Labor and Make-Ready Materials	\$4,412.99
8 Networked Plugzio Charging Units (<i>\$550 each</i>)	\$4,400
Cellular and Software Fees	Included for 1 year in the cost of each Plugzio unit. Afterwards, \$9/month per Plugzio unit.
Parking Signage	None required, as Plugzio units are assigned to residents by unit and parking space number.
TOTAL PROJECT COST	\$11,067.19
Cost per EV Charging Port	\$1,383.40
Property Owner Cost-Share	0%
Cost of EV Charging for Residents*	\$0.12/kWh

**Based on summer/winter blended SVCE/PG&E rate schedule for Montevista common area meters.*

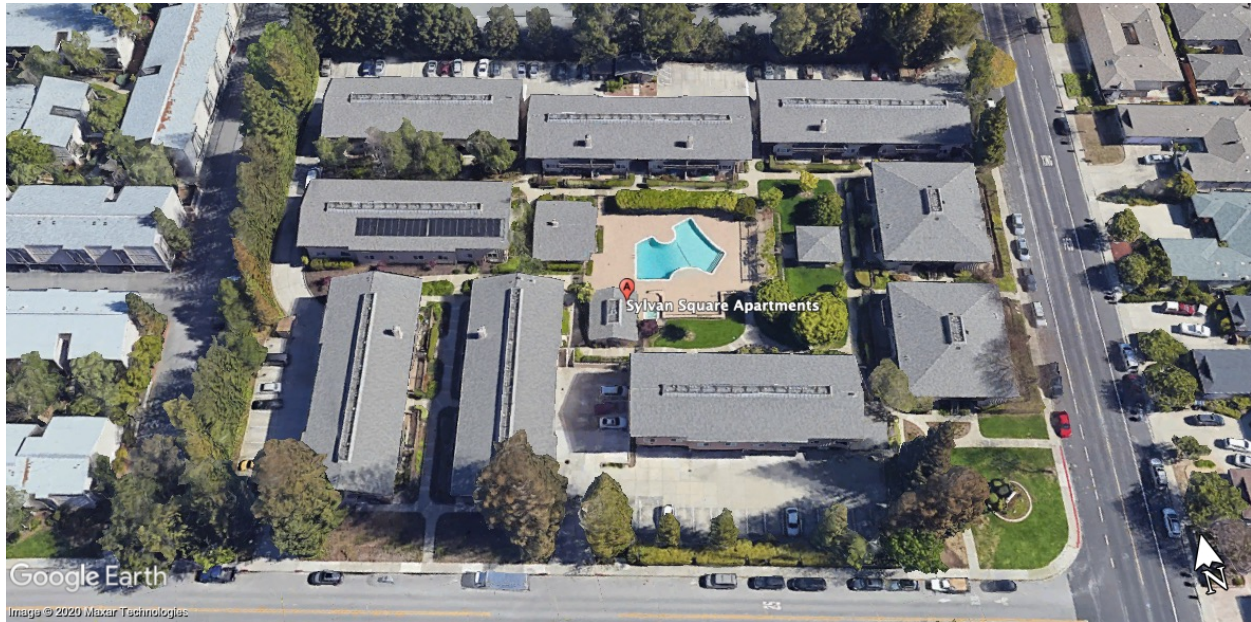
Key Lessons of the Montevista Pilot Site ¹²

- Decentralized, low-power EV charging solutions in larger apartment complexes can cost less than \$1,500/port when trenching and concrete cuts can be avoided by mounting the charging units to existing structures.
- Energy-efficiency projects associated with reducing loads to the common or house panel can make EV charging installation possible if initial electrical load assessments find insufficient power to permit additional loads from EV charging.
- The duration of the Montevista project was more than one year from initial site assessment to construction permit signoff, with no cost-share required. Aside from waiting for energy-efficiency retrofits to be completed before EV charging can be installed, property operators with larger project teams and more decision makers require more time to review and approve projects.
- A direct-installation program should budget and buffer for higher permitting costs in some jurisdictions. In the case of Montevista, the permit was 20% of the total project cost, whereas we had initially budgeted 10%.

¹² See the “Key Lessons” section for a more detailed discussion.

Case Study 2: Sylvan Square Apartments, Mountain View

Sylvan Square Apartments is a 72-unit, garden-style property in Mountain View, CA operated by Prodesse Property Group. Units are below market rate for the area and may be considered naturally occurring affordable housing.¹³ Each unit has access to one assigned covered parking space and free shared parking for second vehicles and guests.



Management's Operational Preferences for EV Charging

At the time of site recruitment for the pilot, the community manager at Sylvan Square reported that three residents drove EVs or plug-in hybrids, and that current and potential residents had inquired about EV charging. Resident EV owners were using 120-v outlets on the ceilings of their assigned parking stalls for charging, and the management had sent letters to these residents prohibiting the practice. Tenant EV charging in common area outlets presented two problems for the management:

- Power from the 120-v outlets was supplied through the property's common electrical meter, not the residents' individual utility meters. The property operator did not want to supply free electricity for EV charging.
- These 120-v outlets were on the same circuit branch as the covered parking lights; if more than one renter used the 120 v outlets on the same circuit to charge and site lights are on, the circuit could be tripped and the lights might turn off, creating a safety problem and electrical code violation.¹⁴

The owner of Sylvan Square participated in the pilot in order to serve current and future renters by providing convenient on-site EV charging options while recouping the cost of electricity. The management's preferences for an EV charging solution were as follows:

- Locate the new assigned chargers in parking spaces that were previously shared and available on a first-come,

¹³ "Naturally occurring affordable housing," as defined here, refers to a rental units with a monthly cost of no more than 30% of the area median income (AMI).

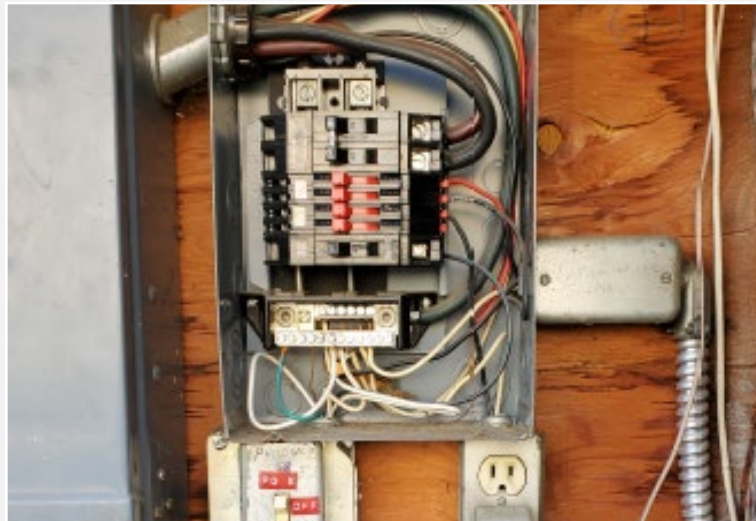
¹⁴ EVSEs are designated by the National Electric Code as providing a "dedicated continuous load." Overcurrent protection in NEC 220.87 (2) requires that 125% of the load be available on the circuit breaker. If site lights and receptacles (120-v outlets) are on the same 15-amp circuit breaker, EV charging at 12 amps together with a lighting load of more than 3 amps will overload the circuit and trip the breaker. If two residents tried to charge their EVs by plugging into 120-v outlets on the same circuit branch, the circuit would also overload and trip the breaker.

first-served basis.

- Rent the new electrified spaces as secondary assigned spaces, billing the resident a monthly amount that reflects the value of the amenity of access to the second assigned parking space while also reimbursing the owner for the projected cost of electricity and network fees.
- Avoid becoming involved in parking management issues related to shared EV charging stations.
- Comply with the city of Mountain View's rent control board requirements associated with charging residents additional rent for an EV parking space. The city of Mountain View requires a joint petition filed by either the tenant or the multi-family property manager in order to make any adjustments to the rental rate being charged for parking not currently listed in the existing housing rental agreement.¹⁵
- Minimize recurring costs and maintenance, including annual CDFA fees¹⁶ that may be charged to property owners when metering and selling electricity through EVSE.

Evaluation of House Electrical Panel Capacity

A seven-day load study of the existing single-phase 100-amp house sub-panel was conducted with a Dent power meter. The study found that there was sufficient power at the sub-panel to supply up to six L1 EVSE. However, because the existing electrical sub-panel was installed in 1968 and did not have the physical space to support additional circuit breakers, a panel upgrade was required. The limiting factor in the size of the sub-panel upgrade was the size of the #2 AWG conductor wire supplying power to the sub-panel. Upsizing the #2 AWG wire and the conduit running under the parking lot would have been prohibitively expensive.



The existing 125-amp, single-phase electrical sub-panel at Sylvan Square Apartments, had no space for additional circuit breakers for EV charging.

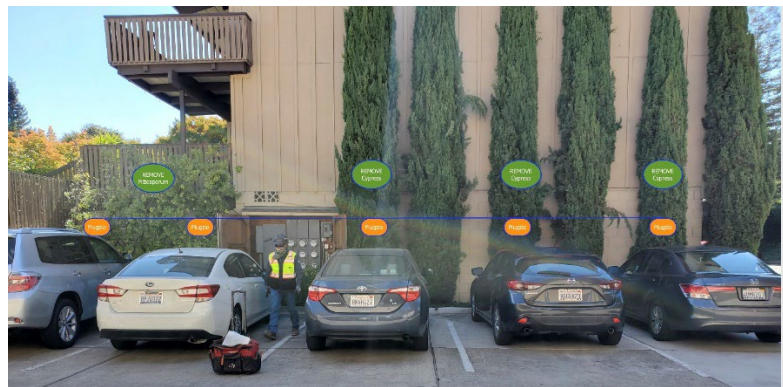
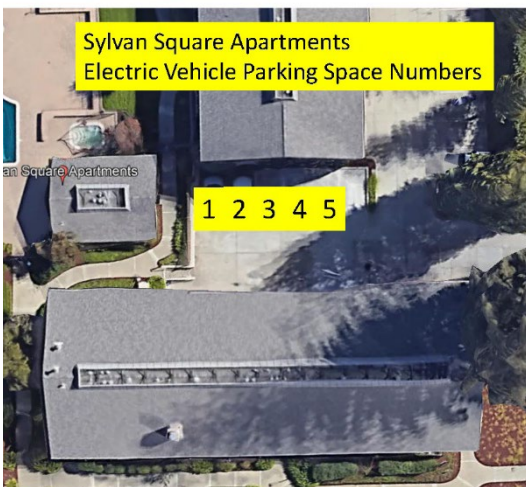
¹⁵ March 2021 City of Mountain View Rental Housing Committee Resolution. Chapter 6: Upward Adjustment Regulations, Item G, Joint Petition for New and Additional Services:

1. Joint Petition Process. The procedures set forth in this Section G create an expedited review of Joint Petitions for New and Additional Housing Services, by which approval for an increase in Rent or a one-time payment between Tenant(s) and Landlord(s) may occur. The Joint Petition for New and Additional Housing Services may be used to request an increase in Rent or a one-time payment to recover costs associated with the following: a. New or additional Housing Services that are not included in the written Rental Housing Agreement; including new or additional pets, additional parking, or storage spaces.

¹⁶ See the "Policy and Program Barriers" section for details of California Department of Food and Agriculture Weights and Measures regulations.

Sylvan Square Low-Power EV Charging Solution

Five 16-amp (1.92-kW) Plugzio charging units were installed at Sylvan Square Apartments by Low Power EV Charging, Inc. The location of the house electrical sub-panel, adjacent to a wall with six parking spaces, was the ideal demonstration of a low-cost installation where conduit and smart outlets could be attached to a wall, avoiding \$4,320 in additional labor costs that would have been required for burying conduit and installing pedestals. Although there were a total of six parking spaces adjacent to the house sub-panel, there was no wall adjacent to the sixth space. To avoid the extra labor cost of trenching through the concrete sidewalk and installing a post to mount a Plugzio unit, the sixth parking space was left open to allow for future conversion to an ADA van accessible space. Should the property owner decide to convert EV charging units from assigned to shared (common use) resident EV charging, the California Building Code requires that one of the EV charging stations be ADA van accessible, which will entail striping the sixth adjacent parking space.¹⁷ The property owner chose to be reimbursed for electricity and cellular-networking fees by collecting an additional \$95 monthly fee along with the residents' rent, via a parking lease agreement. The management reasoned that a second dedicated parking space, even if not electrified, was a desired amenity on the densely populated property, and that rental of additional parking spaces was already normalized in the multi-family rental market.



Conceptual proposal for L1 EV charging. Established cypress and vegetation were removed to facilitate access.

¹⁷ See the "Policy and Program Barriers" section for more information on ADA requirements for shared EV charging.

Plugzio outlets at Sylvan Square Apartments installed by Low Power EV Charging.



Sylvan Square EV Charging Installation Costs

Electrical Permit Fee, City of Mountain View	\$86.00
Installation of New 100-amp Sub-Panel	\$1,485.00
Labor and Materials, Make-Ready and Overhead	\$10,601.93
Plugzio Networked Charging Units <i>(\$800 each)</i>	\$4,000
Cellular and Software Fees	Included for 2 years in the cost of each Plugzio unit. Afterwards, \$9/month per Plugzio unit.
Parking Signage	No signage required as Plugzio units are assigned to residents by unit and parking space number.
TOTAL PROJECT COST	\$16,172.93
Cost per EV Charging Port	\$3,234.59
Property Owner Cost-Share <i>(paid for required panel upgrade)</i>	7%
Cost of EV Charging for Residents <i>(paid to management with monthly rent)</i>	\$95/month

Key Lessons of the Sylvan Square Pilot Site ¹⁸

- The grant offered the property owner a total cap of \$15,000, or \$3,000 per port, paid directly to Ecology Action's direct-installation contractor, Low Power EV Charging. The owners of this market-rate property were willing to pay a small cost-share of less than 10% directly to our program contractor to make up the difference in cost.
- Electrical panel upgrades will most likely be required to make EV charging possible at older multi-family properties. The electrical-panel upgrade increased the cost of this installation by approximately \$1,500 and was covered primarily by the cost-share. Without this upgrade, the cost per EV charging port at Sylvan Square would have been \$2,938/unit, instead of the actual \$3,235/unit.
- Encouraging tenants to opt into paying for EV charging can be a problem when tenants are accustomed to free electricity for charging. Three Sylvan Square residents were EV owners at the time of the Plugzio installation. Four months after installation, one resident EV owner had moved and one EV owner continued to charge for free by plugging into a common area 120-v outlet/light fixture near their assigned parking spot, even though this was prohibited by the management (see reasons on page 13, above). After door-to-door community canvassing and emailing these residents sign-up instructions for Plugzio, the two resident EV owners at Sylvan Square did not request assignment to EV charging parking spaces, possibly because they did not want to pay the \$95/month fee set by the property operator when they could charge for free. The management plans to evaluate and analyze real data from EV usage and restructure their pricing model if the data are compelling to do so.

Plugzio outlets at Sylvan Square Apartments installed by Low Power EV Charging.



¹⁸ See the "Key Lessons" section for a more detailed discussion.

Case Study 3: Murphy Ranch Apartments, Morgan Hill

Murphy Ranch Family Townhomes is a 100-unit garden-style property in Morgan Hill, CA owned and operated by First Community Housing (FCH) and FPI Property Management. 100% of the units are affordable housing, and each unit has access to one assigned covered parking space and to open, shared parking for second vehicles. Constructed in 2003–04, these apartments exceed California’s stringent Title 24 Energy Code by 25% and have installed a grid-tied 10-kW solar system to supply common area power.

Management’s Operational Preferences for Charging

First Community Housing has a dedicated transit hub manager who focuses on increasing residents’ access to sustainable transportation. FCH had no budget or cost-share for installation of EV charging stations and was searching for grants to cover the costs of charging station design and construction. First Community Housing was interested in an EV charging solution that would do the following:

- Require no upfront capital investment or cost-share.
- Charge \$0 in recurring networking fees to the property after installation.
- Provide a third-party payment system that would minimize management’s involvement in payment reimbursement for electricity and cellular fees associated with EV charging.
- Provide excellent support to residents requesting access to and activating EV chargers, with minimal involvement from management.
- Provide opportunities for shared EV charging or EV rideshare programs for Murphy Ranch residents in the future.

House Panel Electrical Load Capacity

Two single-phase 225-amp house sub-panels had several empty spaces for circuit breakers. The limiting factors in load capacity for EV charging at Murphy Ranch were the main service breakers and conductors rated for 100 amps that were supplying electricity to the 225-amp house sub-panels. Electrical loads from the house panels were calculated based on original stamped construction plans. Murphy Ranch Townhomes was designed to the Title 24 Energy Code, and efficient LED site-lighting loads left between 80 and 85 amps available for L2 EV charging at each house sub-panel.

A 100-amp main breaker feeds a house sub-panel rated for 250 amps.



Networked L2 Design Solution

Because of the existing panel capacity and the property owner's objectives, an L2 charging solution was possible at this site. Four Evercharge 30-amp (7.2-kW) L2 charging stations were installed at Murphy Ranch by GRID Alternatives. The two house electrical sub-panels were located approximately 20' from three shared parking spaces. Six feet of concrete sidewalk separated the conduit run from the parking stalls. Although each house electrical sub-panel had sufficient power to supply three load-managed L2 charging stations, the most cost-effective design strategy was to make one concrete cut per parking area and install one pedestal for two EVSEs.

Although EVSE will be assigned to residents, the Ecology Action design team planned for future shared EV charging. In each parking area, EV charging stations were placed so that the third adjacent parking space, on the passenger side of a vehicle, could be converted into a van-accessible ADA space if First Community Housing should decide to budget ADA parking lot improvements to enable shared EV charging in the future, when the number of residents with EVs exceeds the number of EVSE available. The strategy of assigning EV drivers to charging stations assures new EV drivers and early adopters in the community that they won't have to compete with neighbors for charging access. Finally, the ADA-compliance costs associated with shared charging are deferred until there is a community need for shared charging, or until a resident with a wheelchair-accessible van requests access to an EV charging station.

Figure 3: Murphy Ranch dual-mount Evercharge 30-amp EVSE locations.





Evercharge dual-mount 30-amp L2



Completed installation by GRID Alternatives

Murphy Ranch EV Charging Installation Costs	
Electrical Permit Fee, City of Mountain View	\$332.60
Labor and Materials, Make-Ready and Concrete Cutting	\$14,224.00
Two Evercharge Dual-Mount Kits (total of 4 EVSE)	\$7,900
Cellular and Software Fees	Resident pays Evercharge a \$15/month membership fee.
Parking Signage	None required, as EVSE are assigned to residents by unit and license plate number.
TOTAL PROJECT COST	\$22,500.00
Cost per EV Charging Port	\$5,625.00
Property Owner Cost-Share	0%
Cost to Resident for Charging	\$15/month membership fee + \$0.3125/kWh*

**Based on summer/winter SVCE/PG&E rate schedule for Murphy Ranch house meters.*

Key Lessons of the Murphy Ranch Pilot Site ¹⁹

- In this case, the cost of the Evercharge EVSE with mounting kit, at \$1,975/unit, was twice that of the networked, low-power Plugzio units installed at the other pilot sites. However, the additional cost of installing L2 chargers rather than L1 ports is justifiable when the investment “future-proofs” the system for the possibility of later conversion to be shared and ADA compliant.
- A direct-installation program should be prepared to cover a higher level of make ready costs at a certain percentage of project sites. In the case of Murphy Ranch the labor costs involved in concrete cutting and repair far exceeded the program’s target average of \$2,500/charging port. As is typically the case, the affordable housing property operator had no available budget for cost share, and so 100% of the installation cost was covered by the program implementor, allowing the property to be served.
- Relying on BAQMDD’s Charge! Program as a source of grant funding to cover the increased cost of the Murphy Ranch pilot site was not possible because of SVCE and BAQMDD grant’s temporal misalignment, requirements for shared EV charging, and requirements for documenting utilization within the first two years.

¹⁹ See the “Key Lessons” section for a more detailed discussion.

Increasing EV Ownership in Multi-Family Communities

The objective of this element of the pilot demonstration was to test the impact of pairing demand-generation activities with the new EV charging installations as a way to accelerate both the adoption of electric vehicles and utilization of the new EVSE. Ecology Action partnered with GRID Alternatives, the coordinator of both [Access Clean CA](#) and the Bay Area Air Quality Management District's [Clean Cars for All](#) programs and leveraged both of those incentive programs for this work.

Increasing EV Ownership and Awareness: Community Engagement Strategies during the Covid-19 Pandemic

Ecology Action and GRID conducted outreach at pilot apartment communities before and after EV charging installations to provide information about grants and incentives to help lower the purchase costs of electric vehicles and plug-in hybrids and to inform residents about how to sign up for and use the new EV charging ports at their multi-family community.

Community managers of both affordable housing communities did not use email to communicate with residents, so canvassing each unit was the only reliable way to reach all the residents of a community. Before the covid-19 pandemic, our outreach plan was to complete pre-construction door-to-door canvassing at all apartment units, initiate in-person conversations with residents about the environmental, economic, and health benefits of EV transportation, and survey those who wanted to learn more about local, state, and federal incentives available for the purchase of EVs.

Because the pandemic and the county's shelter-in-place orders eliminated the possibility of in-person conversations while canvassing, instead of knocking on doors, we left flyers with a survey link on doorsteps and posted flyers in common areas, such as laundry rooms and mailbox areas. Community members who wanted to learn more about purchasing an EV and using the EVSE installed at their community provided contact information to our team through the survey link or had the option of requesting a paper survey from the community office. Income-qualified residents who provided contact information on surveys were then offered one-on-one EV purchase guidance assistance for accessing grants and incentives. If a resident responded on their survey that they already owned an electric vehicle or a plug-in hybrid, our outreach team contacted them directly to see if they wanted to be assigned to an EV charging station.

Community managers and staff were given the opportunity to provide input on all canvassing flyers and resident communications, which ensured there was a strategy in place for the community management office to provide and collect paper surveys from community members who were unable to follow the survey link or use the QR code. At each apartment community, Ecology Action developed a document with site-specific instructions for residents to sign up for an EV charging station. Community managers and property operators provided input on this document and will continue to use it to inform residents of the sign-up process after the support provided by the SVCE Innovation Onramp grant has ended.

After EV charging ports were installed, Ecology Action and GRID Alternatives completed another round of canvassing at affordable housing communities (Murphy Ranch and Montevista) and coordinated with community managers to present a 1.5-hour "Affordable Electric Vehicle" webinar on Zoom. The webinar included an overview of EVs, the rebates and incentives available through state and regional programs, where to find public EV charging, and break-out rooms for pilot program residents to inform them about how to sign up for EV charging stations installed at their apartment communities.

Electric Vehicle Charging is Coming Soon to Montevista!

Do you pay too much for gas and vehicle repairs?

Now is the time to consider buying or leasing an electric vehicle or plug-in hybrid! Up to \$10,000 in grants and rebates are available to help you purchase a new or used clean vehicle.

Funding and Installation provided by:

SILICON VALLEY CLEAN ENERGY

Ecology ACTION

GRID ALTERNATIVES

Learn how you can afford an electric vehicle and get access to an EV charging station!

Complete a survey at ecoact.org/evsurvey, scan the QR code, or request a paper survey by completing the information on the reverse page and dropping your request in the office drop box.

All residents who participate in the survey will be entered into a drawing to win an electric bike!

Results of Resident Engagement

- 478 units at three properties were canvassed 1-2 times.
- 43 residents responded to canvassing by completing pre-construction surveys.
- Fifteen residents from two affordable-housing communities were provided with information about Access Clean CA services via either email or voicemail.
- Seven income-qualified residents were provided with one-on-one consultations and individualized assistance through Access Clean CA.
- No income-qualified residents took the next step of applying for low-carbon transportation equity program incentives or grants through the Access Clean CA platform. Funding gaps and long waiting lists for existing state and regional incentive programs that lower the purchase cost of EVs for income-qualified residents, such as the [Clean Vehicle Assistance](#) program, the [Driving Clean Assistance](#) program, and BAAQMD's [Clean Cars for All](#) program, played a significant role in preventing residents of pilot sites from applying and accessing grants they were eligible for during the pilot.
- 19 residents from two affordable-housing communities signed up to attend the Affordable EV webinar, which was recorded and provided to residents and community managers afterward.

Although the pilot program completed the intended resident outreach and technical assistance, the potential for success of this program component was not well established due to the covid-19 shelter-in-place orders, which hindered our ability to conduct in-person outreach at project sites. Additional discussion of this program element is presented in the Key Lessons & Recommendations section below.

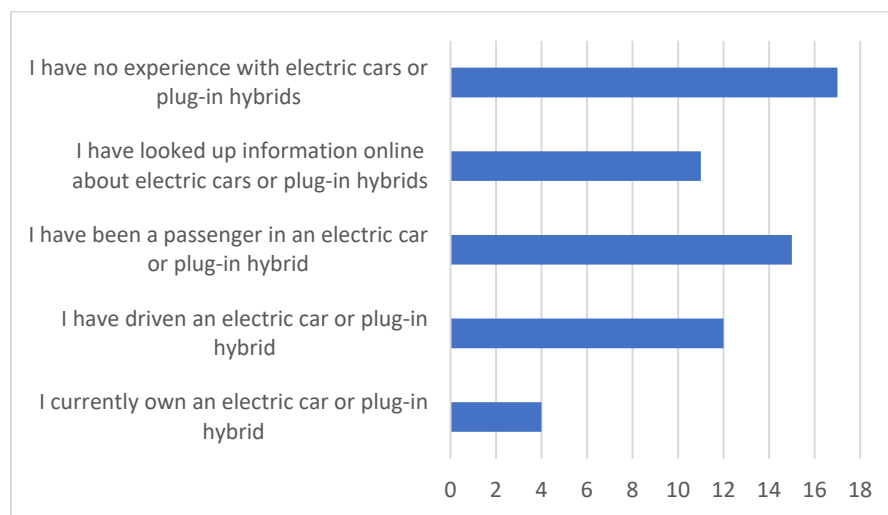
Results of Pre-Construction Resident Surveys

Pre-construction canvassing of 478 units at the three pilot demonstration sites resulted in completed surveys from residents of 43 units, a lower participation rate (9%) than we had hoped.

Key survey questions and responses are as follows (n = 43):

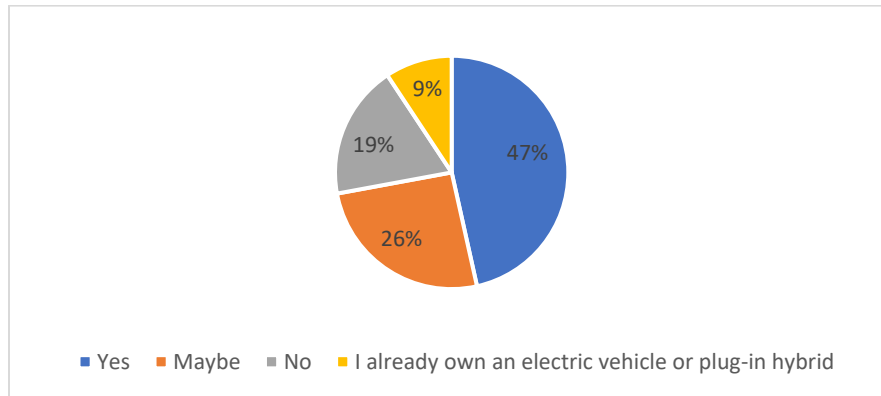
Q. What is your experience with electric cars and plug-in hybrids (vehicles that use both electricity and gas)?

17 survey respondents (40%) had no experience with EVs. Four (11%) reported owning an electric vehicle (three at Sylvan Square and one at Montevista). These four each reported an income of more than 80% of the area median.



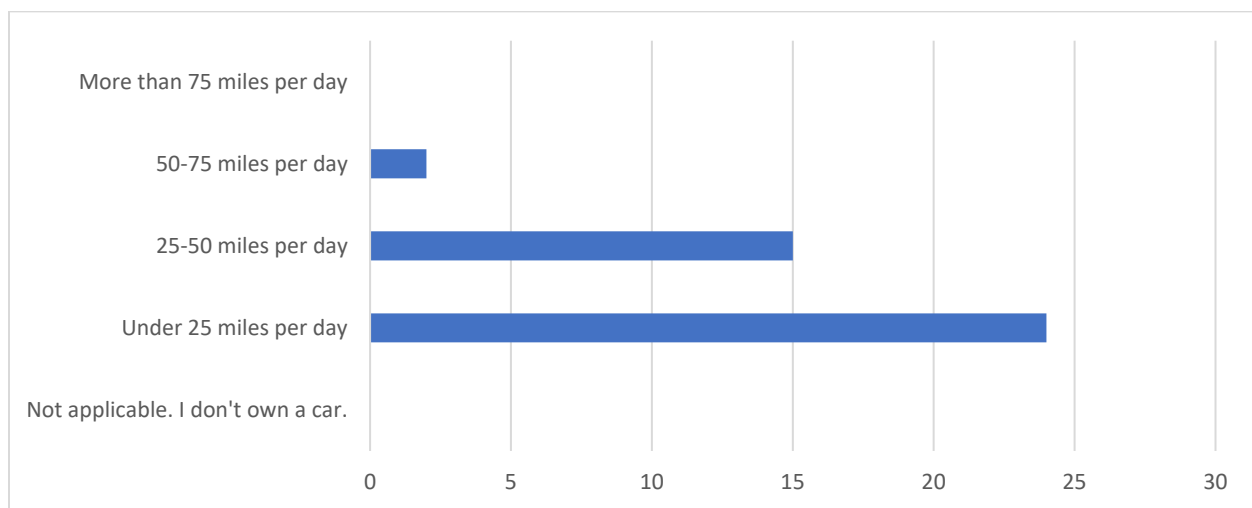
Q. When electric vehicle charging stations are available to residents in the parking lot, would you be willing to consider buying an electric vehicle or plug-in hybrid?

47% of respondents said they would be willing to consider buying an EV when charging stations are available to residents.



Q. On average, how many miles per day do you drive or commute?

55% of respondents reported driving or commuting less than 25 miles per day. These answers were given during covid-19 shelter-in-place orders, however, and may not reflect pre-pandemic driving habits.



Utilization of EV Charging Stations at Demonstration Sites

At the time of project closing (October 2021), two residents were assigned to EV charging stations installed through the pilot:

- One resident at Montevista, who was already a Tesla owner.
- One resident at Murphy Ranch, who purchased a Ford Fusion plug-in hybrid after EV charging was installed.

At our Affordable EV workshop (offered in October 2021), residents asked if they could reserve an EV parking space in advance of purchasing an electric vehicle, primarily because they wanted the confidence of knowing they would have access to a charging station before they purchased an EV.

Policy and Program Barriers for Multi-Family Properties

Incentive Program Barriers

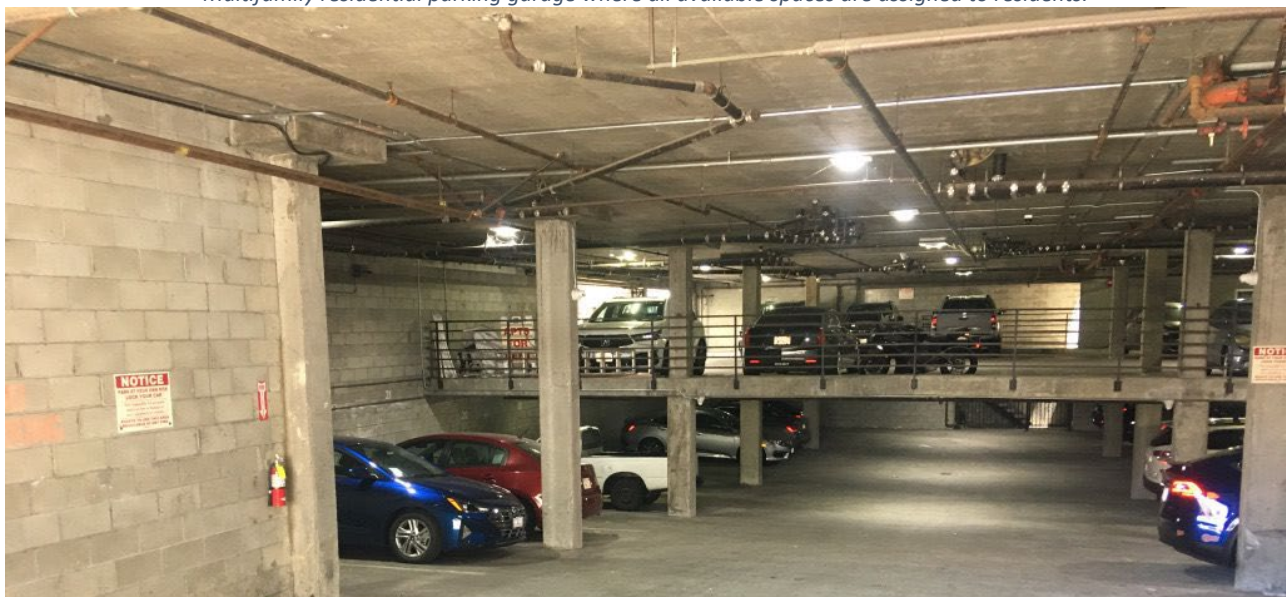
Multiple regional and local entities offer financial incentives or technical assistance in SVCE's service area for the installation of EVSE, each with varying programmatic requirements. These include BAAQMD's Charge! program, PG&E's Electric Vehicle Charge Network program, and CEC's CALeVIP program. While these programs have been proven to work well for destination, workplace, and corridor charging deployment, relatively few multi-family properties have been served. Program requirements often run counter to the needs of multi-family property operators and EV drivers and are at the core of the current multi-family EVSE market failure. Below, we describe the barriers identified and the dynamics of the multi-family residential market that create barriers to scaling.

Ecology Action's work to remove programmatic barriers has included the submission of filings in relevant proceedings and dockets at CEC and the CPUC, meetings with staff or governing bodies of all EVSE funding agencies, and engagement in informal settings, where we have cited SVCE Innovation Onramp pilot case studies as examples. In many cases, clearing policy or program barriers is procedurally simple but can meet with significant institutional resistance, making resolution quite challenging. In other cases, the solution is more complex—for example, requiring statutory changes. Specific solutions we recommend are included after the description of each barrier below.

Sharing Requirements

Several applicable programs require EV charging to be shared among residents. A significant number of properties, particularly in the dense Bay Area, have very few shared or common parking spaces (typically reserved for employees and visitors). Based on Ecology Action's experience, property operators are often reluctant to dedicate these spaces to EV charging, particularly if the parking spaces might remain unused, given the current low penetration of EVs. Available shared parking spaces may be located far from a common electric panel with adequate power, requiring cost-prohibitive conduit runs. Unlike private assigned EV charging, shared EV charging triggers ADA requirements for van-accessible and accessible parking spaces. The cost of additional signage and parking lot re-striping increases the total cost of the installation. Multi-family community managers are leery of overstay in shared parking causing tenant conflicts which could require their involvement. Both Sylvan Square and Montevista property operators expressed the desire to avoid shared resident EV charging for one or more of these reasons.

Multifamily residential parking garage where all available spaces are assigned to residents.



Requiring sharing effectively eliminates low-power L1 charging as a practical solution, since achieving an adequate charge for a typical daily commute on L1 requires 6–8 hours, which is not conducive to sharing. Shared charging provides less certainty and reliability for the tenant than assigned charging. Lack of reliable access to charging at home is the number-one barrier to converting to electric transportation cited by drivers. Although shared charging is certainly better than no charging for stimulating EV adoption and should be pursued when it is preferred by the property operator, it should not be a program requirement to the exclusion of the option of assigning charging stations to resident EV drivers.

Solution: We recommend removal of any exclusions for assigned EV charging. Requiring chargers to be shared among all residents eliminates the possibility of an L1 charger being assigned to a tenant. There are no statutory requirements for this program rule, and as such, changes could be made by the decision of staff and the governing body.

Utilization and Reporting Requirements

Multi-family renters effectively have no certainty of being able to charge at home and are thus less likely to buy EVs before charging is installed. As a result, after charging is installed at a multi-family property, there is often a lag of an undetermined time between installation and EV adoption by tenants. Multi-family property operators do not want to assume the financial risk of having to pay back incentive money if EV chargers are not utilized soon enough within the terms of the incentive agreement, or if they neglect required reporting of utilization data. Multi-family property operators that participated in the SVCE pilot cited utilization data reporting requirements as a major reason they did not apply to the CALeVIP Program.

Some funders tie incentive payouts to certain energy utilization requirements in newly installed chargers. For example, BAAQMD's Charge! program is funded through a combination of the Air District's [Transportation Fund for Clean Air Regional Fund](#) (TFCA) and [Mobile Source Incentive Fund](#) (MSIF). The statute for the TFCA funds stipulates that projects must meet cost-effectiveness thresholds developed by BAAQMD which are adopted by its Board. Cost effectiveness formulas for those funds are currently based on the three-year electricity throughput. MSIF funds do not carry the same statutory requirement, and as such sites in AB617 communities may now qualify for reduced usage requirements. The affordable housing properties in this pilot were outside of AB617 geographies and not eligible for reduced usage requirements.

Utilization requirements favor EV charging installations at luxury/upper-income apartment communities with more EV owners, or locations where charging is open to the public so that utilization targets are met. None of the three demonstration sites were amenable to opening their property to the public for charging access to increase usage.

Multi-family property operators do not want to assume the financial risk of having to pay back incentive money if EV chargers are not utilized soon enough within the terms of the incentive agreement.

Solution: We recommend waiving kW usage requirements in multi-family residential charging programs, regardless of geography. An alternative solution would be changing the formula the agency uses to include all the energy used by the EV, even if only a portion of its charging is done at home, on the rationale that the new EV would not have been acquired if not for the installation of the at-home charger.

Eligible Equipment

Incentive programs such as CALeVIP do not allow incentive funds to be spent on L1 or low-power L2, stipulating a minimum energy delivery of 6.2 kW per charger. L2 charging offers several performance advantages over L1 (e.g., faster charging and automatic load management). However L2 installations cannot always be supported by existing electrical service and panel capacity and so can necessitate costly upgrades. In many cases, the capacity required to run an L2 charger could supply power to up to three L1 charging units. If there is less than 30–40 amps of available capacity at the house panel, a panel or service upgrade is required to install an L2 EVSE. For example, in one property in PCE territory,

nine L1 chargers were installed for \$40K. The same number of L2 chargers would have cost \$179K to install.²⁰ The vast majority of this cost delta is driven by make-ready costs rather than by difference in the cost of the chargers themselves. This is an expense that neither the EVSP nor the property operator can readily recoup in their business models. The pilot program's ability to fund 90-100% of the cost of charging equipment by avoiding expensive electrical-system upgrades was critical to all three property operators' decisions to install EV charging through the pilot.

Solution: We recommend that equipment be eligible if it can deliver a minimum of 1.92 kW using a 120-v, 20-amp circuit, and that it explicitly not be required to have a J1772 connector in order to allow for "smart" outlets that require drivers to bring their own charging cables (standard equipment on all EVs). Not requiring the J1772 connector and charging cord eliminates future O&M costs for the multi-family property owner, as EVSE charging cords and cables experience the most wear and tear, and if broken, render equipment useless. There are no statutory requirements for this program rule in any of the entities that fund EVSE incentives in SVCE territory, and as such changes could be made by the decision of the staff and governing body.

Allowable Expenses Do Not Include Technical Assistance

Money alone is not enough to move most multi-family property operators to install charging. In other words, even if 100% of the cost is covered by incentives, there are still many barriers that preclude operators from going forward. These include lack of knowledge, vendor trust, parking concerns, technical assessment, site design and EVSE selection, electricity cost reimbursement, maintenance concerns, competing priorities, and the "hassle factor." To scale across the market, all of these barriers must be addressed adequately in a single offering. Unfortunately, many programs do not allow incentives to pay for the labor of the required turnkey services. Scaling requires a solution that provides hassle-free design, permitting, installation, and commissioning by vendor-neutral entities that hold the property owner's and residents' best interests as their primary concern. For example; incentives from BAAQMD's Charge! program can be paid only to the customer or EVSP, not to a third-party "developer" who has the ability to provide technical assistance and project support. Currently, this is considered "administration" and is not an eligible incentive expense. The pilot program's ability to provide the end-to-end technical support services was critical to all three property operators' decisions to install EV charging.

Solution: We recommend modifying incentive program guidelines so that funds can be used for technical assistance and project support regardless of who provides those services. This may require that funds paid to "developers" no longer be considered "administrative," but instead be viewed as essential installation services. There are no statutory requirements for this program rule, and as such changes could be made by the decision of the staff and governing body.

Match Requirements

SVCE's investment in this demonstration covered 100% of costs for customers to test its effectiveness in moving the market. The only program that provides 100% cost coverage is PG&E's EVCN program, through which multi-family properties in disadvantaged community (DAC) areas can receive charging, wrap-around design, and construction services without a match requirement. Other programs cap incentive dollars at a percentage of the installed cost; still others do not offer enough to cover the full cost of installation equipment and labor. Because there is no compelling return on investment on EV charging for multi-family property owners, cost-shares often end a project before it starts. Understanding that there was no ROI, the pilot offered direct installation to property operators at a zero or very low cost-share so that they would be more likely to participate.

If an owner or EVSP were to pursue other funders to cover the gap (stacking), those funds would come with complexities that are rarely surmounted. For example, award timing and application logistics are often deterrents. Applicants must contend with multiple sets of applicable rules, and mismatches in rules between programs means that applicants must default to the strictest rules for eligible equipment, sharing, utilization requirements, and cost-share. Likewise, multi-

²⁰ <https://www.penninsulaenergy.com/wp-content/uploads/2021/05/Low-Power-Case-Study-1.pdf>

family operators can find it difficult to secure adjunct rebates from separate sources because of the hyper-competitive nature of rebate reservations. These dynamics makes stacking incentives for program match an especially unscalable proposition. Stacking was attempted for the Murphy Ranch property to help cover the additional cost of the L2 installation but was unsuccessful for the reasons described in the case study above and in the “Key Lessons” section.

Solution: We recommend removing match requirements for all affordable housing properties and other multi-family properties serving low- and moderate-income renters, regardless of geography. For real estate investment properties serving higher income residents, we recommend giving preference to market-rate projects that can bring match funds. We suggest that higher match amounts be garnered from premium and luxury properties. There are no statutory requirements for these program rules, and as such changes could be made by the decision of the staff and governing body.

Minimum Charger-Count Requirements

PG&E’s EVCN program has a minimum of ten ports per property, leaving any multi-family property with fewer than ten electrifiable spaces ineligible. Assuming one parking space per dwelling unit, the minimum impact of this rule is the exclusion of any property with nine or fewer dwelling units. Approximately 37% of rental units available in the San Francisco Bay Area are in multi-family properties with fewer than nine dwelling units, and 54% of rental units in the Bay Area are in multi-family properties with fewer than twenty dwelling units.²¹ Ecology Action has advocated with PG&E and the CPUC for separate funding pools that complement and coordinate with existing IOU programs to serve properties that cannot accommodate ten or more ports. Because of electrical capacity constraints, none of the three participating sites for this pilot would have been able to accommodate ten L2 EVSE.

Solution: We recommend establishing separate funding pools for properties that cannot accommodate multiple ports. There are no statutory requirements for this program rule, and as such changes could be made by the decision of the staff and governing body.

Competitive Solicitations with Short Application Periods and Deadlines

Funding sources are often announced and then closed once funds are reserved through the very competitive reservation processes. Multi-family property operators must be ready to apply within the first few days of the grants becoming available, or else they may miss the window for applying. EVSPs typically have teams dedicated to competing for rebate reservations, which often exhaust funds before applications can be submitted. While EVSPs can and do apply on behalf of multi-family properties, they prioritize newer, larger, upper-income, luxury properties because such properties offer higher port counts and so are more profitable, are more financially capable of cost-share, and have clienteles with a higher penetration of EV drivers. Smaller multi-family property operators and affordable-housing properties that don’t have funds for cost-share in their operating budgets, and can’t afford the upfront costs of design, permitting, and construction are effectively structurally omitted from these deadline-driven incentive programs.

Solution: We recommend creating a specific budget set-aside for hard-to-reach properties in order to reduce the competitive pressure on the money for this market segment. Doing so effectively extends the window of time that hard-to-reach customers have to reserve funds. There are no statutory requirements for these program rules, and as such the changes could be made by the decision of the staff and governing body.

²¹ U.S. Census Bureau, 2017. American Community Survey, Housing Units in Structure. The SF Bay Area data include the six counties of Alameda, Contra Costa, Marin, San Mateo, San Francisco, and Santa Clara.

The table below describes these barriers by funding source for dominant programs in the San Francisco Bay Area.

Program Requirement Barrier for Multi-Family Markets	Funding Source		
	PG&E Charge Network	CEC – CALeVIP	BAQMDD Charge!
Sharing		x	x
Utilization		x	x
Eligible Equipment	x	x	
Allowable Expenses			x
Cost-Share	x	x	x
Minimum Charger Count	x		
Short Application Periods & Deadlines		x	x

State and Local Policy Barriers

Several regulations and requirements present additional barriers and should be examined or clarified by agencies to inform a multi-family EV charging direct-installation model. These include the following:

Local Construction Permitting

The three pilot sites experienced wide variation in permitting costs. For example, a permit to install L1 Plugzio smart outlets cost \$86 in the city of Mountain View and \$2,254.20 in the city of Milpitas. The permit for the L2 Evercharge installation in the city of Morgan Hill cost \$332.60. Regional consistency in permitting costs, or the limitation of these costs to no more than 5% of the total project cost, would make it easier for program contractors to give accurate cost estimates for EV charging.

Although much work is being done to streamline permitting and accelerate EVSE deployment, variation in requirements and costs remains a significant hurdle. The California Governor’s Office of Business and Economic Development (GO-Biz) is engaging in a Permitting Olympics, a new concept to overcome permitting challenges and achieving the streamlining called for in [AB 1236](#) (Chiu, 2015).

California Food and Agriculture Department (CDFA) Rules

California Code of Regulations Title 4, §§ 4001 and 4002.11, requires electric vehicle charging stations deployed for commercial use and installed on or after Jan. 1, 2021 to comply with new CDFA rules regarding the metering of electricity. Where this regulation applies, chargers must display the cost per unit of energy and the quantity of energy consumed, much like at a gasoline station. The EVSE must be certified and then inspected annually, with corresponding fees levied by the local county agricultural commissioner.

EVSE that are not available to the public, such as those used for residential or workplace charging, are exempt from the CDFA regulation. However, the CDFA deems the term “residential” to apply to single-family residences only, and it considers multi-family properties to be cases of commercial use.²² The significance of this is that when an EVSE is deployed at a multi-family property to measure electrical energy for the purpose of payment settlement, this constitutes a commercial use and is subject to the regulation.

There are several scenarios in which the CDFA regulation is not triggered at multi-family properties:

²² 7/31/20 Communication with California Department of Food and Agriculture staff Kevin Schnepf, Environmental Program Manager 1, Laboratories Branch, ZEV Special Projects.

1. Electrical energy is provided at no cost to the user, provided this fact is clearly indicated on the device.
2. The owner opts to settle payment on the basis of elapsed parking time.
3. A flat fee is paid by the user, similar to a monthly rent adder for parking rental or a pet surcharge.

But these alternative billing approaches are not an option for certain properties. Affordable-housing properties that are federally subsidized, including Murphy Ranch and Montevista in this pilot, are subject to the Fair Housing Act and are therefore restricted from levying additional fees to renters unless those can be tied to measured quantities such as a utility meter. Likewise, local rent control ordinances may prohibit property operators from charging additional rent for access to an additional, assigned EV parking space,²³ or may require reviews or petitions for rent adders through the local rent control board, as in the case of Sylvan Square in the city of Mountain View. All such cases in which multi-family property operators must use third-party payment settlement and meter kWh would be subject to CDFA certification and inspection.

Inspection and certification fees are determined at the county level by agricultural commissioners. As with any operating expense, multi-family property operators are likely to pass on the cost of inspections and certification for EVSE to their tenants through the charging rate. This increases the cost of charging for tenants above that of single-family residents. More details about CDFA fees and the inspection process will be necessary for disclosing these costs to multi-family property owners as they weigh EV charging options. Clarity is also needed from CDFA on whether L1 “smart” outlets assigned to multi-family residents, which are already UL listed for measuring kWh, will be subject to the same annual CDFA certification requirements for commercial L2 EVSE.

Americans with Disabilities Act Requirements

The 2019 California Building Code, Section 11B 228.3.2, states that where one to four EVSE are provided for common use, one van-accessible space is required. When five to 25 EVSE are provided for common use, one van-accessible and one standard accessible space are required. There is an exception written into this section of the code:

EVSE not available to the general public and intended for use by a designated vehicle or driver shall not be required to comply with Section 11B-228.3.2

If the building permit does not specifically state that the charging units to be installed are to be assigned to residents, the building official or plan checker will assume that EVSE are for “common use” and therefore subject to ADA space minimums. At the Montevista pilot site, proof of assignment to qualify for the exception was accomplished by providing a tracking sheet used by management that showed the specific parking space numbers that would be assigned to residents with specific EV license plates. An alternative way to prove assigned parking is to provide the local permitting agency with a copy of a template tenant EV charging parking agreement.

ADA minimum requirements are critically important to guarantee people with disabilities equitable access to clean mobility options in public spaces. In multi-family residential properties that are not open to the public, however, these requirements can create barriers to scaling EVSE:

- The requirement of two ADA-accessible spaces (one van-accessible and one standard accessible) for five electrified spaces will result in the loss of one 8’ parking space (striped for van unloading), which may be a significant issue for properties where tenant parking is limited.
- Parking lot restriping and curb modifications will increase the cost of installation.
- Although CBC section 11B-812.8.1 does not require the van-accessible space to have an international symbol of accessibility posted (anyone may park there and use the charger), if five or more chargers are installed,

²³ California AB-1796 Rental property: Electric vehicle charging stations. CA Civil Code Section 1947.6 (b4).

CBC section 11B-812.8.2 does require the van-accessible space to be labeled with the international symbol of accessibility. The required accessible-only space may then result in unused EVSE infrastructure, as a resident using the designated ADA space must have a disability placard issued by the state.

To reduce installation costs and parking impacts and to ensure maximum utilization of EVSE infrastructure, it would be helpful if the ADA exemption in CBC Section 11b 228.3.2 were extended to EVSE that are intended to be assigned to more than one tenant or EV driver in a private multi-family parking lots that are not open to the public.

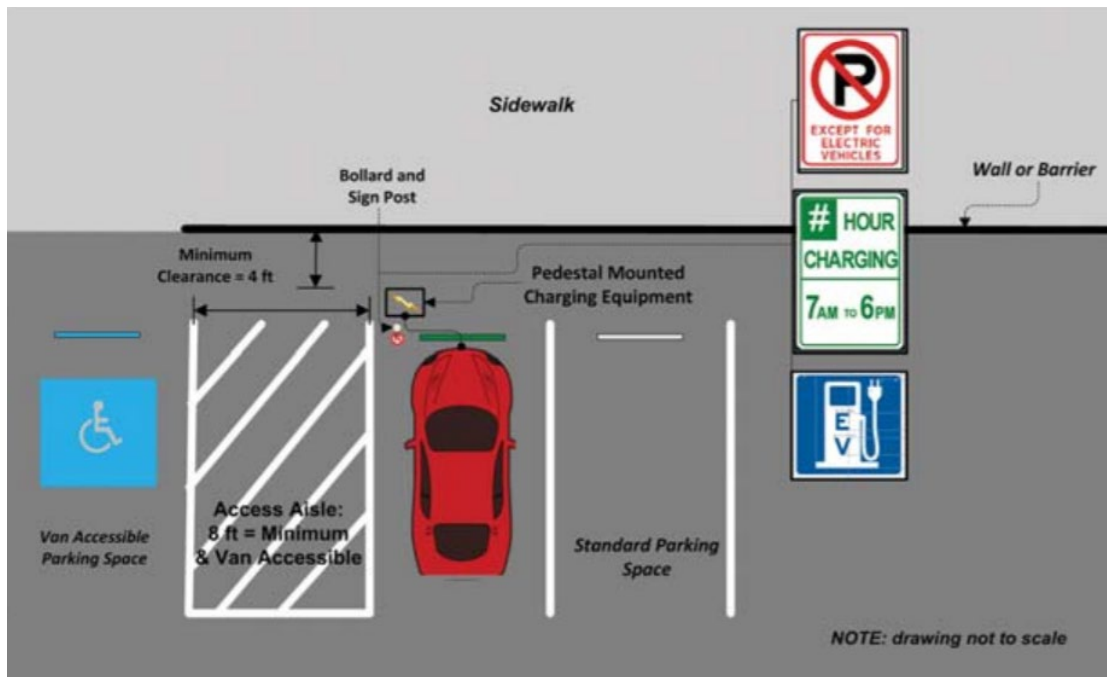


Image courtesy of www.calbo.org

Potential to Increase EV Charging at Multi-Family Properties

In Santa Clara County (excluding the city of San Jose), 77% of multi-family properties have fewer than twenty units. In Santa Clara County, multi-family residential properties with between three and 19 units make up more than 51% of the units available on the rental market.²⁴ To equitably serve both owners and tenants in the multi-family residential market segment, a direct-installation EV charging program could prioritize recruiting and serving the needs of these smaller properties. Properties with fewer than twenty units are likely to be older and to have less available panel capacity, necessitating a low-power charging solution that allows residents to charge overnight at home.

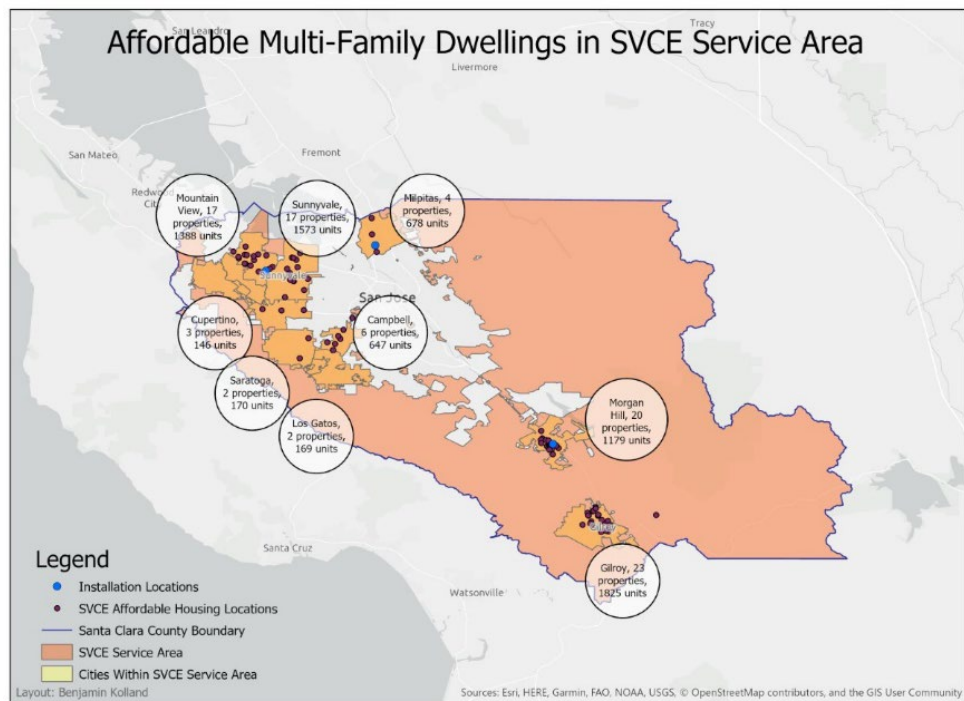
Figure 4. Number of units by property type in Santa Clara County, excluding the city of San Jose (source: CoStar 2020).

Property Type	No. of Multi-Family Properties under 20 Units	No. of Multi-Family Properties over 20 Units	TOTAL No. of Properties
Low-Rise	2,493	343	2,836
High-Rise	0	9	9
Mid-Rise	5	79	84
Garden	84	337	421
TOTAL	2,582	768	3,350

Installation Opportunities in Affordable Multi-Family Housing Developments

The California Housing Partnership maintains a database of subsidized, affordable developments financed or assisted by HUD, LIHTC, and USDA. There are 94 such developments in SVCE's service area, with a total of 7,775 rental units. These units are reserved for low-income residents: those whose income is less than 50% of the area median income (AMI).

Although the low- or no-cost direct-installation program model demonstrated in this pilot is technically applicable to and effective for all multi-family properties in SVCE territory, it is particularly well-suited to rental properties serving low- and moderate-income residents. If just 30% of multi-family properties in SVCE's service area were renting to low- and moderate-income residents, we estimate that 1,000 multi-family properties could be candidates for an equity-centered approach.



²⁴ U.S. Census Bureau, 2017. American Community Survey, Housing Units in Structure.

Key Lessons and Recommendations

Viability of Low-Cost and Low-Power Equipment Configurations as Compared to L2

The installation cost of L1 “smart outlet” installation ranged from \$1,383 to \$3,235/unit when a panel upgrade was required. The average cost was \$2,309. Thus the pilot confirmed that a networked, low-power solution can be installed for an average cost of \$2,500/charging port even when electrical panel upgrades are needed to free up space for more circuit breakers.

The inclusion of an L2 charging solution at the Murphy Ranch Apartments showed that a direct-installation program that allows for one-third of installations to be L2 EVSE when power is available, and the extra cost for short conduit runs across concrete, increases the average cost per EV charging port to \$3,411.

Pilot Site Location	Power Level	Cost per EV Charging Port Installed
Montevista Apartments	L1 (1.92 kW)	\$1,383
Sylvan Square Apartments	L1 (1.92 kW)	\$3,235
Murphy Ranch Apartments	L2 (7.2 kW)	\$5,614
Average Cost per Installed EV Charging Port		\$3,411

Although the basis of this average cost is limited to a comparison of three sites with only two electrical contractors, the average falls within the range of construction estimates generated for nine multi-family properties in EBCE’s service area, which found that the average cost of installation for L1 was \$2,035, and the average installation cost per L2 EVSE was almost double that, at \$4,005.²⁵ We expect the costs per Installed EV charging port presented here to be at the low end of the market. These case studies do not reflect the total costs of direct-installation wrap-around services. Because all charging units are assigned to resident EV drivers, the average cost per charging port installed in this pilot does not reflect the additional costs of ADA compliance, required by the building code when EV charging ports are shared among residents.

In terms of cost per charging unit, at the time the of the pilot’s conclusion, two networked L1 smart-outlet units had achieved UL listing and were available on the market for between \$400 and \$800 each, with the higher range reflecting the Plugzio unit with one or more years of cellular fees built into the purchase price.²⁶ The Evercharge 30-amp L2 EVSE installed at Murphy Ranch cost \$1,975/each (including the mounting pedestal), more than twice as much as the L1 Plugzio unit.

Energy Efficiency Gains Provide Opportunities to Install EV Charging Stations

If Montevista had not been participating in a site-lighting retrofit, we would not have been able to install even one low-power EV charging unit there. Understanding the efficiency gains from this case study deepened our awareness that a direct-installation program will be more successful in identifying and pre-qualifying properties suitable for EV charging by targeting older properties that have previously participated in energy efficiency programs. Power meter data were critical for proving this use case to the permitting agency, as load calculations would have been based on a deemed formula in the building code.

²⁵ Ecology Action, November 2020. [Innovation In Electric Vehicle Charging For Multi-Unit Dwellings](#): Report prepared for East Bay Community Energy.

²⁶ <https://www.plugzio.com/>; <https://www.orangecharger.com>

Direct Installation Support for Multi-Family Management and Staff is Critical for Scaling

The pilot confirmed property operators' need for the end-to-end-service set that was offered by the program team. A high level of support is needed from project start to finish regardless of project size, therefore program delivery costs per port will be higher at properties with fewer charging ports.

- The majority of support hours are expended during site acquisition. Before a project agreement for installation is signed, significant time is invested in conducting technical site assessment, educating multi-family property staff, and learning the operational preferences of community managers and facilities staff. Meetings must be scheduled to ensure the property's operations team understands the program offering, any limiting factors discovered during the technical site assessment, and the EV charging solution being recommended to meet both their operational preferences and any site constraints.
- During the permitting process, time is invested in pre-construction meetings between the multi-family property team and the contractor, identification of site logistics and resident parking concerns, and responses to comments from permit agencies.
- During and after construction, supporting community managers on system commissioning is critical. Community managers must be trained to use the third-party payment software. Community managers also need support to create tracking systems that include the locations and serial numbers of chargers installed on house panels. Vendors often do not have resident-facing signup instructions, other than their service agreements, and so communication documents that instruct the residents of that specific community on how to sign up to gain access to an EV charging unit must be produced.

EV Charging Costs to Residents Can Vary Greatly

All of the multi-family property owners participating in this pilot wanted to recoup the cost of electricity from EV charging and pass the costs of cellular and software fees on to their resident EV drivers. The energy costs they recover vary greatly with the rate schedules assigned to their house panel supplying power to the EV charging ports. Murphy Ranch's residents were charged \$0.3125 per kWh, while Montevista's house panels were on a less expensive rate schedule and charged residents 0.12 per kWh.

The EV parking rental lease agreement of \$95/month at Sylvan Square was the most expensive charging option for renters in the pilot. A resident at Sylvan Square with a 25 mile/day commute and \$14 per month in networking and software fees would have needed to pay only \$83/month for the property owner to break even at A-6 rates. It is possible that the two EV drivers who lived at Sylvan square at the time of project completion did not request to be assigned to a Plugzio unit because the cost of \$95/month had been set too high. We recommend setting reasonable limits for property operators on the allowable charges to end users as a condition of program participation.

"Stacking" Incentives Can Present Barriers to Multi-Family Property Operators and EV Service Providers

Ecology Action applied to the BAAQMD Charge! program for a grant of \$18,000 for the Murphy Ranch property, citing our SVCE Innovation Onramp grant as providing a 20% match. The Charge! grant was ultimately incompatible for co-funding all three pilot projects for several reasons:

- The end date of the SVCE grant fell before the official award date of the BAAQMD Charge! grant, and the Charge! grant did not allow any construction costs between the solicitation announcement and the award.
- L1 was allowed but required shared parking and charging.
- A usage of 22,500 kWh/year/EVSE was required for multi-family projects outside of AB 617 geography. The affordable-housing properties in the pilot were outside of the AB 617 geography, and no residents of those projects owned EVs.

This experience reinforced our understanding that competitive grant opportunities are often out of temporal alignment with each other and can't be depended on for match-funding for smaller, low-power projects.

Incentives are needed for used EVs and plug-in hybrids to increase EV adoption by low-income renters



Resident successfully purchases a used EV with state and local incentives reserved for low-income households.

The time between installation and full charger utilization can be minimized by actively supporting lower-income residents to learn about programs to help with the purchase or lease of an EV. Households earning less than 80% of the area median income (AMI) often do not have the savings for large down payments or the capacity for monthly payments over \$300, as required to purchase a new EV with a starting price of \$32,000. Lower-income residents are also more likely to lack access to credit to finance the cost of a new vehicle. As such, they are unable to take advantage of the state-funded [Clean Vehicle Rebate Project \(CVRP\)](#) and [Clean Fuel Rewards Program](#), which provide rebates for the purchase of new EVs and plug-in hybrids.

An effective strategy to encourage low- and moderate-income renters to consider an EV for their next vehicle purchase is the offering of financial incentives that reduce costs at the point of sale for less expensive, used EVs and plug-in hybrids. As higher-income residents sell used EVs and plug-in hybrids on the private market, more used, clean vehicles will become available at prices below dealership offerings. An incentive or voucher program that allows the used-EV

incentive payment to go directly to a private seller with a bill of sale or copy of title transfer, would reduce purchase prices and financing costs for lower-income buyers. A regional, online used-EV marketplace for both private sellers would make it easier for people to shop for EVs. Conventional used EV rebate programs are also helpful for influencing lower income residents to consider purchasing their first EV, but do not provide a down payment or reduce the amount a resident must finance for the purchase.²⁷

The Value of Pairing EVSE Installation with Resident Outreach and Engagement Needs Further Investigation

The purchase of a car is a major household expense. For many low- and moderate-income families, a car is purchased when the cost of repairing the current vehicle becomes more than the household can bear and reliable transportation is an urgent need. The decision to retire or sell a vehicle and purchase another depends on many factors outside the control of an EV resident outreach program. The covid-19 pandemic affected people's employment and financial security, which may have further impacted timelines for decisions about major household purchases. The economic uncertainty generated by the pandemic made it difficult to gauge whether our outreach to encourage individuals to take the next steps toward the purchase of an EV would have been more successful in a time of greater financial security.

Although the pandemic hindered our in-person outreach to help low-income residents purchase their first EVs, we are confident that our perseverance, including door-to-door flyer canvassing and educational webinar, raised awareness about clean vehicle resources and the availability of EV charging in the pilot communities. We highly recommend that any EV charging direct-installation programs in affordable- and moderate-income multi-family housing incorporate EV education and resident support for accessing grants and incentives. While acknowledging that these efforts often do not result in an immediate increase in EV ownership, they are a part of a long-term, community-based social-marketing strategy that builds residents' knowledge so that they can make more informed decisions when they are ready to make a car purchase. When residents see their neighbors within the apartment community charging their cars, these "trusted sources" also raise EV awareness and pique curiosity. We are hopeful that a one-year evaluation of this pilot will show increased EV ownership and usage of the EV charging ports installed at the Innovation Onramp pilot sites.

²⁷ See <https://www.peninsulacleanenergy.com/usedev/> for an example of a conventional used EV rebate program model. 'Conventional' refers to a program that pays a rebate to the buyer after the purchase is made.

Conclusion

SVCE and community choice aggregators play a unique role in the communities they serve to increase equitable access to EV ownership and EV charging for multi-family renters. The work completed under this Innovation Onramp contract confirmed and supplied further important cost and operational details that will be critical to scaling a direct installation-style offering. Although the program was able to pair resident outreach to increase EV awareness with technical and financial assistance for multi-family EV charging installations as intended, the potential for success of this program component could not be established due to the covid-19 shelter-in-place orders, which hindered our ability to conduct in-person outreach at project sites. Notwithstanding that, the demonstration has informed several refinements and a go-forward plan for deployment at scale that could begin as early as 2022. SVCE will continue to track EV ownership and uptake through its own evaluation of the pilot sites over time, which may reveal how the existence of EV chargers and resident outreach groundwork laid by Ecology Action and GRID Alternatives result in statistically relevant difference in charger utilization compared to other similar multi-family properties. We believe this SVCE investment will be instrumental in helping leverage millions of dollars in potential government investments over the next decade and has paved the way for accelerating equitable EV ownership among renters of multi-family apartment communities.

Additional Information

Pilot funding was provided by the Silicon Valley Clean Energy (SVCE) Innovation Onramp program. SVCE is a not-for-profit, community-owned agency providing clean electricity from renewable and carbon-free sources to 13 Santa Clara County jurisdictions. Learn more at <https://www.svcleanenergy.org/>

Electric Vehicle Charging is Coming Soon to Montevista!



Do you pay too much for gas and vehicle repairs?

Now is the time to consider buying or leasing an electric vehicle or plug-in hybrid! Up to \$10,000 in grants and rebates are available to help you purchase a new or used clean vehicle.

Funding and installation provided by:



Learn how you can afford an electric vehicle and get access to an EV charging station!

Complete a survey at ecoact.org/evsurvey, scan the QR code, or request a paper survey by completing the information on the reverse page and dropping your request in the office drop box.



All residents who participate in the survey will be entered into a drawing to win an electric bike!

Montevista Community Manager,
Please provide me with a printed Electric Vehicle survey form!*

Name: _____

Unit Number: _____

Phone Number: _____

Email Address: _____

* Your contact information will be provided to Ecology Action and GRID Alternatives for the purpose of providing you with information about signing up to access an EV charging unit and/or applying for grants and incentives to help you purchase an electric vehicle or plug-in hybrid.

Questions? Contact

GRID Alternatives at 510-646-9843 or BAcleanmobility@gridalternatives.org

Affordable Electric Vehicle (EV) Workshop



Residents of **Montevista Apartments** may be eligible for grants and **rebates of up to \$14,000** to buy or lease a new or used electric vehicle.

Learn about EVs, EV rebates and EV charging available at Montevista!

Saturday, Oct 2, 1pm
Online Zoom Workshop

Register at
forms.office.com/r/JTUY35mbth
or scan the QR code!



Access Clean California
Less pollution, more power



Helping
people
act now.





Resident Survey for Electric Vehicle Ownership and Charging

Your property owner is installing electric vehicle charging stations so that residents who own or lease electric vehicles or plug-in hybrids will have a reliable place to charge. We are surveying all of the residents here because we want to let you know about the many rebates that are available to help you purchase an electric vehicle or plug in hybrid.

This survey will take about 5 minutes to complete. After you submit, you will be entered into to win a raffle for an electric bike!

* Required

Resident Information

1. Apartment Community Name *

2. Unit # or Address *

3. What is your experience with electric vehicles and plug-in hybrid electric vehicles? (A plug-in hybrid is a car whose battery can be recharged by plugging it into an electrical outlet, and also uses gasoline when the battery is drained) *

- ☐ I currently own an electric car or plug-in hybrid
- ☐ I have driven or been a passenger in an electric car or plug-in hybrid
- ☐ I have looked up information about electric cars online
- ☐ I have no experience with electric cars

Current Mode of Transportation

This set of questions will ask you about your current mode of transportation

4. What is your most frequent mode of transportation? *

- ☐ Gas-powered vehicle
- ☐ Hybrid vehicle (Prius)
- ☐ All-electric vehicle or plug-in hybrid electric vehicle
- ☐ Public transportation
- ☐ Bicycle
- ☐ Walking

5. How many miles per day do you drive or commute? *

- ☐ Under 25 miles per day
- ☐ 25-50 miles per day
- ☐ 50-75 miles per day
- ☐ 75-100 miles per day
- ☐ More than 100 miles per day

6. How old is the vehicle you drive the most? *

- ☐ I don't own a vehicle
- ☐ More than 15 years old
- ☐ Less than 15 years old

7. What is the current condition of the vehicle you drive the most? *

- ☐ I don't own a vehicle
- ☐ My vehicle needs major repairs that will cost more than \$5,000
- ☐ My vehicle needs a few minor repairs
- ☐ My vehicle is running great with no problems.

8. Are you considering buying or leasing a vehicle in the next year? *

- ☐ Yes
- ☐ No
- ☐ Maybe

Electric Vehicle Charging & Ownership Opportunities

This set of questions will ask about your interest in learning more about electric vehicle programs and incentives

9. Bay Area residents that purchase electric vehicles or plug-in hybrids can be eligible for more than \$10K in grants and rebates, and can also drive in carpool lanes and use Fastrak express lanes. With incentives, the cost of buying a clean vehicle may be lower than buying a gas vehicle. Would you like to learn more about electric vehicle rebates? *

☐ Yes, Please contact me at the phone number or e-mail below

☐ No

10. Would you like to test drive an electric vehicle? *

☐ Yes

☐ No

☐ Maybe

11. When electric vehicle charging stations are available to residents in the parking lot, would you be willing to consider buying an electric vehicle or plug-in hybrid? *

☐ Yes

☐ No

☐ Maybe

☐ I already own an electric vehicle or plug-in hybrid and I need access to a charging station

Household Information

Note that these questions are optional, but we need this information to determine your eligibility for electric vehicle grants and rebates

12. How many people live in your household?

(Include yourself, your spouse, and any family members that you claim as dependents on your taxes)

The value must be a number

13. What was your total household income (\$) that you reported last year on your federal taxes?

If you haven't yet filed taxes for 2020, report your household income from 2019.

The value must be a number

Resident Contact Information

Thank you for providing your contact information so that we can follow-up with more information!

14. First and Last Name *

15. Email Address

16. Phone Number *

17. What are the best days and times to contact you by phone? *

18. Do you have any concerns or questions about the electric vehicle charging stations that will be available for you in the parking lot?

