CALIFORNIA ENERGY COMMISSION

California Energy Commission

Clean Transportation Program

FINAL PROJECT REPORT

Bay Area Charge Ahead Project I

Prepared for: California Energy Commission

PROSPECT Silicon Valley

PARTNER TO CLEAN TECH INNOVATORS

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Mike Harrigan
Rafael Reyes
Primary Authors

Prospect Silicon Valley
1608 Las Plumas Ave
San Jose, CA 95133
(408) 273-9224
Prospect Silicon Valley is available at www.prospectsv.org

Agreement Number: ARV-13-043

Lindsee Tanimoto
Commission Agreement Manager

Mark Wenzel
Office Manager
ADVANCED VEHICLE INFRASTRUCTURE

Hannon Rasool
Deputy Director
FUELS AND TRANSPORTATION

Drew Bohan
Executive Director

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    - City of Cupertino
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    - City of Menlo Park
    - City of Mountain View
    - City of Palo Alto
    - City of Sunnyvale
    - County of San Mateo
    - Stanford University

PREFACE

Assembly Bill 118 (Núñez, Chapter 750, Statutes of 2007) created the Clean Transportation Program. The statute authorizes the California Energy Commission (CEC) to develop and deploy alternative and renewable fuels and advanced transportation technologies to help attain the state's climate change policies. Assembly Bill 8 (Perea, Chapter 401, Statutes of 2013) reauthorizes the Clean Transportation Program through January 1, 2024, and specifies that the CEC allocate up to $20 million per year (or up to 20 percent of each fiscal year's funds) in funding for hydrogen station development until at least 100 stations are operational.

The Clean Transportation Program has an annual budget of about $100 million and provides financial support for projects that:

- Reduce California's use and dependence on petroleum transportation fuels and increase the use of alternative and renewable fuels and advanced vehicle technologies.
- Produce sustainable alternative and renewable low-carbon fuels in California.
- Expand alternative fueling infrastructure and fueling stations.
- Improve the efficiency, performance and market viability of alternative light-, medium-, and heavy-duty vehicle technologies.
- Retrofit medium- and heavy-duty on-road and nonroad vehicle fleets to alternative technologies or fuel use.
- Expand the alternative fueling infrastructure available to existing fleets, public transit, and transportation corridors.
- Establish workforce-training programs and conduct public outreach on the benefits of alternative transportation fuels and vehicle technologies.

To be eligible for funding under the Clean Transportation Program, a project must be consistent with the CEC's annual Clean Transportation Program Investment Plan Update. The CEC issued PON-13-606 to expand electric vehicle charging infrastructure. In response to PON-13-606, the recipient submitted an application which was proposed for funding in the CEC's notice of proposed awards July 3, 2014 and the agreement was executed as ARV-13-043 on July 11, 2014.

ABSTRACT

The Bay Area Charge Ahead Project 1 installed 39 dual-port electric vehicle charging stations in nine communities and twenty-two separate sites located in the San Francisco Bay Area. Sites were located in the cities of Campbell, Cupertino, Los Gatos, Menlo Park, Mountain View, Palo Alto, Sunnyvale; the County of San Mateo; and Stanford University.

The purpose of project was to improve the availability of electric vehicle charging in publicly accessible locations thus promoting the use of fuel-efficient and non-polluting plug-in electric vehicles. The project investigated the effect of assessing fees to electric vehicle drivers for use of the charging stations as well as various fee structures. The project tracked the process and cost of purchasing, installing, operating, and maintaining charging.

Site Hosts (local government agencies) were selected for this project based on need and ability to provide locations and commitment to continuing the operation of the stations when the project is complete. ChargePoint supplied the charging stations at a 25 percent discount which provided most the matching funding. ABM supplied the installation engineering and labor. To do so, ABM signed a Site Host Agreement with each participating agency prior to installation. Each charging station supplied data that was analyzed by the Prime Contractor for usage based on date, time, and amount of power supplied.

Keywords: Bay Area Charge Ahead Project 1, electric vehicle, charging station, ABM, peak usage, demand charge.

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EXECUTIVE SUMMARY

The Bay Area Charge Ahead Project 1 installed 39 dual-port electric vehicle charging stations (for a total of 78 charging ports) in nine communities and twenty-four separate sites located in the San Francisco Bay Area. The communities included the following:

- City of Campbell – 2 sites, 4 ports
- City of Cupertino – 2 sites, 8 ports
- City of Los Gatos – 4 sites, 8 ports
- City of Menlo Park – 2 sites, 8 ports
- City of Mountain View- 1 site, 10 ports
- City of Palo Alto – 6 sites, 16 ports
- City of Sunnyvale – 3 sites, 8 ports
- County of San Mateo – 3 sites, 6 ports
- Stanford University – 1 site, 10 ports

Objectives

The purpose of project was to improve the availability of electric vehicle charging in publicly accessible locations thus promoting the use of fuel-efficient and non-polluting plug-in electric vehicles.

A secondary objective of the project was to investigate the effect of assessing fees to electric vehicle drivers for use of the charging stations as well as the effectiveness of different types of fee structures.

A third objective was to track the process and cost of purchasing, installing, operating, and maintaining charging stations in parking lots/garages that were not originally designed for electric vehicle charging.

A fourth objective was to determine the potential for minimizing electrical utility demand charges.

Methodology

Site Hosts, which are city and county agencies that own parking properties, were selected for this project based on established need, the ability to provide locations, commitment to continuing the operation of the stations when the project is complete, and the ability to pay for software licenses and additional installation charges (if necessary). ChargePoint supplied the charging stations at a 25 percent discount which provided most the matching funding. ABM supplied the installation engineering and labor. To do so, ABM signed a Site Host Agreement with each participating agency prior to installation.

Data Collection

Each charging station supplied usage data via the ChargePoint network and a special ChargePoint account that provided anonymized usage monitoring. The data was collected and analyzed by the Prime Contractor over a period of time to determine usage patterns and energy consumed by plug-in electric vehicles that used the system.

CHAPTER 1:
The Bay Area Charge Ahead Project

1.1 Problem Statement

Since the passage of Assembly Bill 32, counties, municipalities, and regional public agencies have sought ways to reduce Greenhouse Gas Emissions across all key sectors of the economy, especially the transportation sector, which accounts for approximately 53 percent of regional emissions. In support of these emissions reduction goals, the Bay Area Charge Ahead Project (BayCAP) was developed to support build-out of a robust region-wide charging network for Plug-in Electric Vehicles (PEV), aligned with the PEV Readiness Plan recently completed under the oversight of the Bay Area Electric Vehicle Strategic Council and the Bay Area Air Quality Management District. The Readiness Plan indicates that there is an immediate need for 1,000-2,000 more publicly accessible charge ports in the region in the 2014-15 period to accommodate the rapid growth in PEVs (expected to reach more than 35,000 in 2015 and 100,000+ by 2020.)

1.2 Goals of the Project

The goals of the BayCAP project were to:

- Develop a ubiquitous, convenient, sustainable, and well-maintained region-wide PEV charger network
- Reduce greenhouse gas emissions and improve air quality
- Increase market penetration of PEVs

1.3 Objectives of the Project

The objectives of the BayCAP project were to cost-effectively achieve the following:

- Provide, install, and provision PEV charging ports in 22 key Destination Sites -- in locations that are easily accessible to the public, safe, well lit, well maintained, and likely to be well-utilized.
- Coordinate with local and regional agencies and site owners to support regional plans for PEV charging and integrate with California's network of existing and planned stations.
- Train and support site hosts on siting, Americans with Disabilities Act access, usage of station hardware and software, operations and maintenance, and pricing strategies to enable site hosts to generate adequate revenue to cover operations and maintenance costs, maximize station usage, reliability, and "up-time," and to ensure customer convenience.
- Track and measure station adoption and utilization rates over the duration of the project.
- Track and calculate equivalent greenhouse gas emission reductions, air quality improvements, and gasoline displaced by grant funding, with special reference to air quality in disadvantaged communities.
- Analyze usage trends to plan future station locations in the region based on siting principles and data in the Bay Area PEV Readiness Plan.

- Demonstrate utilization of Level 2 chargers in demand management applications that enable site hosts to minimize energy costs and manage grid impacts.
- Support the regional "Experience Electric" Campaign to grow PEV sales, achieving the regional goal of 100,000 Electric Vehicles (EV) deployed by 2020.

1.4 Prime Contractor: Bay Area Climate Collaborative

The Silicon Valley Leadership Group, dba Bay Area Climate Collaborative , was the Prime Contractor for the BayCAP1 project. The Bay Area Climate Collaborative was responsible for administration, periodic reporting and invoicing, data collection and analysis, providing site host personnel training, and this final report. The Bay Area Climate Collaborative provided coordination between the Major Subcontractor and the Site Hosts. It should be noted that during the project, in January 2015, the Bay Area Climate Collaborative was merged with Prospect Silicon Valley.

1.5 Major Subcontractor: ABM

ABM was chosen to be the Major Subcontractor for the BayCAP project. ABM is a ChargePoint distributor, reseller, and installer. ABM provided the charging stations, site engineering, installation, and commissioning of the charging stations. ChargePoint, the manufacturer of the charging stations provided a 25 percent discount on the charging stations which was passed through by ABM to the project in the form of matching funds. ABM also provided matching funds in the form of reduced maintenance pricing and warranty costs.

1.6 Site Hosts

Site Hosts are agencies that provided the locations for the charging stations to be installed. Seven of the Site Hosts were cities, one was a County, and one was a university. The Site Hosts were determined prior to the grant award based on the need for charging stations, available locations that met the objectives of the grant, and commitment to provide necessary permits and funds to operate and maintain the charging stations for the duration of the project.

Although locations were specified prior to the grant award, it was necessary to change some of the locations due to inadequate electrical service and/or prohibitively high installation cost and complexity. Table 1 shows the complete list of site host locations.

1.6.1 List of Site Hosts and Station Locations

Table 1: List of Site Host Locations

Site Host	Site Address	City	# Ports	# Sites
City of Campbell	1 W. Campbell Ave	Campbell	2	2
	77 Harrison Ave	Campbell	2	
City of Cupertino	10185 N Stelling Rd	Cupertino	4	2
	10800 Torre Ave	Cupertino	4	
City of Los Gatos	1-29 Pageant Way	Los Gatos	2	
	41 Miles Ave	Los Gatos	2	4
	950 University Ave	Los Gatos	2	
	1-199 Boone Ln	Los Gatos	2	
City of Menlo Park	400-598 Mielke Way	Menlo Park	4	2
	1148 Crane	Menlo Park	4	
City of Mountain View	850 California St	Mountain View	10	1
City of Palo Alto	520 Webster St	Palo Alto	6	
	528 High St	Palo Alto	2	4
	250 Hamilton Ave	Palo Alto	2	
	400 Cambridge Ave	Palo Alto	6	
City of Sunnyvale	586 All America Way	Sunnyvale	4	
	200 W Evelyn St	Sunnyvale	2	3
	121 W Evelyn St	Sunnyvale	2	
County of San Mateo	30 Tower Rd	San Mateo	2	
	620 Airport Way	San Mateo	2	3
	555 County Center	Redwood City	2	
Stanford University	320 Panama St	Stanford	10	1
TOTAL			78	22

Source: Prospect Silicon Valley

1.7 Site Host Agreements

Each of the Site Hosts signed a Site Host Agreement with the Major Subcontractor prior to the installation of the charging stations. The Site Host Agreement set out the terms and conditions for installing the charging stations. A sample copy of the Site Host Agreement is in Appendix A.

1.7.1 Site Host Responsibilities

- Providing the locations for the charging stations that met the objectives of the project in terms of public access.
- Providing building permits for installing the stations.
- Providing electricity for powering the stations and charging the electric vehicles.
- Paying for software licenses required by the charging station manufacturer. The software gives the site hosts network access to each charging station to control user authentication, set usage fees, and monitor usage data.
- Paying for out-of-scope installation expenses where needed to install in originally identified location – or provide alternative location within original cost parameters.

1.8 Installation

Once site locations were finalized and Site Host Agreements were completed, the Major Subcontractor proceeded to install the charging stations. The installation of the charging stations took about one to two weeks including commissioning of the stations. However, the entire installation process took nearly two years to complete due to these factors:

- Lengthy negotiation and review period for completion of many of the Host Site Agreements with city attorneys
- Identification of electrical capacity requirements and (in some cases) utility service upgrades
- Authorization of additional funds (in some cases where needed) to complete the installation process
- Permitting
- Identification of new sites (in some cases) due to cost and complexity issues associated with the initially chosen sites.

The Major Subcontractor worked with each Site Host individually and completed the installation at each site as it became available. Thus, many of the stations began operation early in the project while some were installed closer to the end of the project.

After each charging station was installed, commissioning was required. This process involved testing and connection (typically via cellular networks) to the ChargePoint Network. Once commissioned, the station was immediately available for use by the public.

1.9 Data Collection and Analysis

Each charging port provides usage information through the ChargePoint Network. The usage information includes a time-stamps for plugging in, plugging out, energy consumed, and duration of energy delivery. Note that the duration of energy delivery does not necessarily correspond to the amount of time that the vehicle was plugged in. A vehicle may require only an hour of charging but may be plugged in for a longer period of time.

ChargePoint provides access to the usage data through a web portal and a sophisticated report generation system. Normally the data from the stations is available only to the owners of the stations. However, for the BayCAP1 project a special ChargePoint account was created that allowed the Prime Contractor to aggregate data from all of the stations that were installed as part of the BayCAP1 project. It should be noted that data from the charging stations is kept in a database so that all usage from the beginning of the project to the present time is available for analysis.

CHAPTER 2:
Analysis of EV Charging Station Utilization

2.1 Pricing Policy

BayCAP1 required that participating agencies or site hosts devise a means to encourage moving electric vehicles to a different parking spot once charging was complete. The purpose of this requirement was to ensure that the charging stations were available to those most in need of charging and encouraging drivers to vacate stations when charging needs were satisfied. A secondary goal was to discourage electric vehicles that did not need to be charged from parking in an EV parking spot. In areas where parking is difficult to find, many EV drivers choose charging station equipped parking spots even though they do not actually need to charge their vehicles.

To accomplish these goals, it was recommended that the site hosts develop a policy to charge a fee for charging vehicles. Furthermore, it was also recommended that the fees increase after a certain period of time and/or after the vehicle was fully charged.

The ChargePoint charging stations and ChargePoint network that were used in the project provide a simple and flexible means for the agencies to establish fees. The fees can be based on any or all of the following criteria:

1. Connection time (how long the vehicle is connected to the station regardless of whether the vehicle is charging or fully charged);
2. Energy delivered (kilowatt hours delivered to the vehicle);
3. A one-time connection fees

These three fee schemes can be combined. For example, San Jose has established a connection fee of $1.25 plus an energy fee of $.25/kilowatt hour (kWh). Also, the ChargePoint system provides a means of increasing the fee after a certain period of time.

Most agencies chose to charge a parking fee (hourly fee) plus an energy fee. In some cases, they chose to increase the parking fee after a reasonable time of 2-4 hours. This encourages the owner to move the vehicle once the charging is complete. However, two of the agencies did not charge a fee for the use of the charging stations. Palo Alto had an installed base of charging stations that had been historically offered at no charge to users, and it did not make sense to charge for some stations and not for others. While Palo Alto has been encouraged to begin charging fees, the period of time when the chargers were offered with no fee provided an opportunity to compare the "no fee" policy to the "fee-based" policy. For this comparison, we chose two similar cities, Palo Alto and Berkeley. Both have a dense downtown core with municipal parking garages where the charging stations are installed. The demographics of both cities are similar. But while Palo Alto does not charge a fee, Berkeley implemented a fee structure.

2.1.1 Free Charging: Palo Alto Free Stations

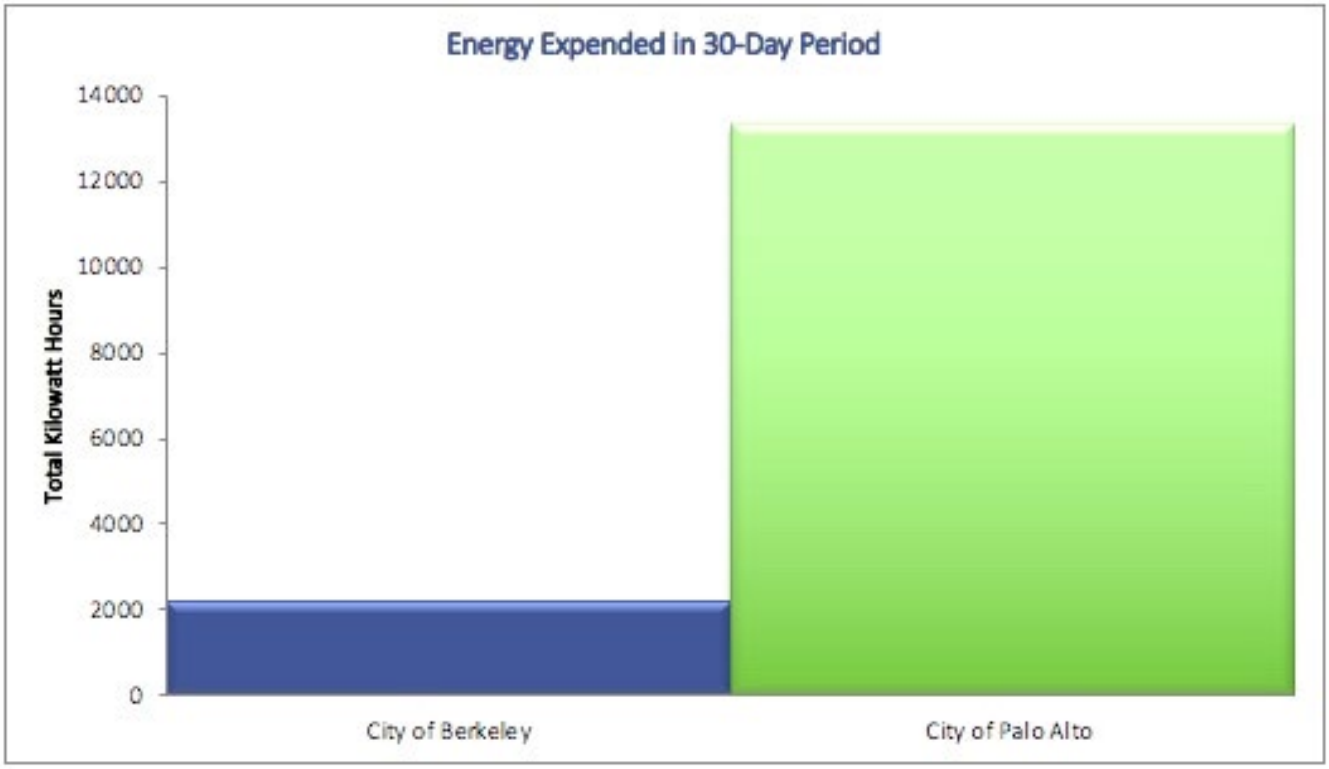
The City of Palo Alto is currently providing free charging to residents. As a result, the six BayCAP stations in Palo Alto are much more highly utilized than any other stations in the project. While this may at first seem like a good thing, it works against the goal of providing as much availability as possible to as many vehicles as possible. Vehicles in Palo Alto stayed at

the charging stations longer and there were fewer "unique users" during the analysis period which implies that the same drivers used the locations repeatedly during the analysis period.

To illustrate the effect of free charging on overall utilization, we compared overall usage for the six Palo Alto stations over a 30-day period compared to the six BayCAP stations in the City of Berkeley, shown in Figures 1, 2 and 3. As mentioned above, in both cases the stations are located in downtown areas where parking is competitive, however the average charging session in Berkeley was just over an hour and a half and costs $3.01 compared to charging in Palo Alto, which was free and lasted as much as 4 hours.

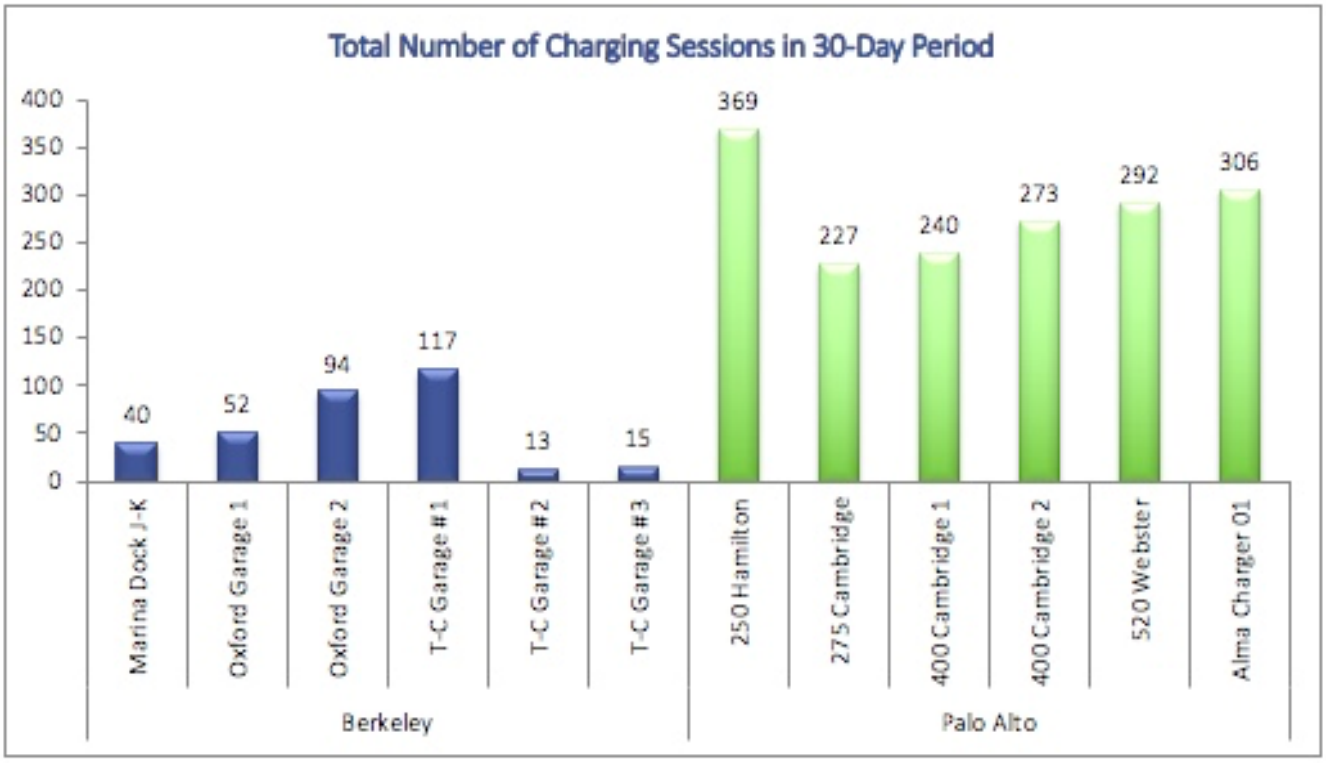
Palo Alto's six BayCAP stations accommodated 1376 more charging sessions than the City of Berkeley's six stations, expending 11086 kWh of electricity more than in Berkeley stations.

Figure 1: Energy Expended in 30-Day Period



Source: BayCAP Analysis and Lessons Learned 9/2016

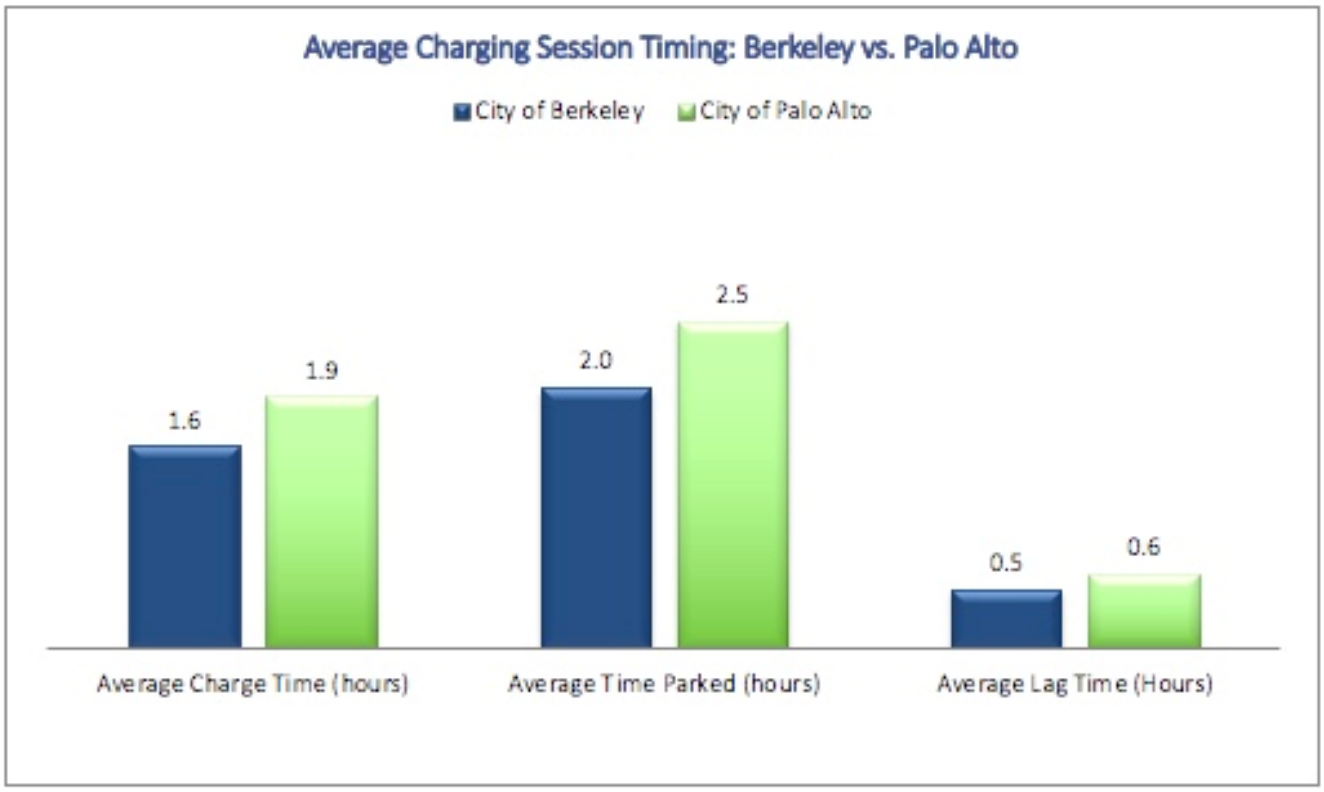
Figure 2: Total Charging Sessions in 30-Day Period



Source: BayCAP Analysis and Lessons Learned 9/2016

In Palo Alto, the average charging session lasts 23 minutes longer, and vehicles remain parked at stations 31 minutes longer than at Berkeley stations.

Figure 3: Average Charging Session Time – Berkeley vs. Palo Alto



Source: BayCAP Analysis and Lessons Learned 9/2016

2.1.2 Analysis

This data indicates that charging a fee results in lower usage of the EV charging stations. However, high utilization is not inherently better. It can be inferred that charging stations in Berkeley are *more available* for use by electric vehicles that genuinely need to be charged rather than by electric vehicles that are taking advantage of the parking spots reserved for electric vehicles in crowded parking garages. Further investigation revealed that EV owners who lived in or near downtown Palo Alto were taking advantage of the free charging by parking their cars overnight at city-owned charging stations. This information is based on data showing that the same vehicles used the same location on a nightly basis and remained plugged in overnight. This may reflect on the fact that most residential housing in downtown Palo Alto is in multi-unit developments, most of which do not have charging stations installed in their parking garages. If this assumption is correct, it leads to the conclusion that there remains an unmet need for EV charging at multi-unit dwellings.

2.1.3 Effect of Pricing on Behavior

One of the key benefits of fee-based charging is that it encourages owners to move their vehicles once charging is complete. Note that in Berkeley the average time parked was 30 minutes less than in Palo Alto. It is believed that Palo Alto lag times would have been even higher if they did not have a 4-hour parking limitation for all their downtown garages.

2.2 Operating Costs Covered by Fees

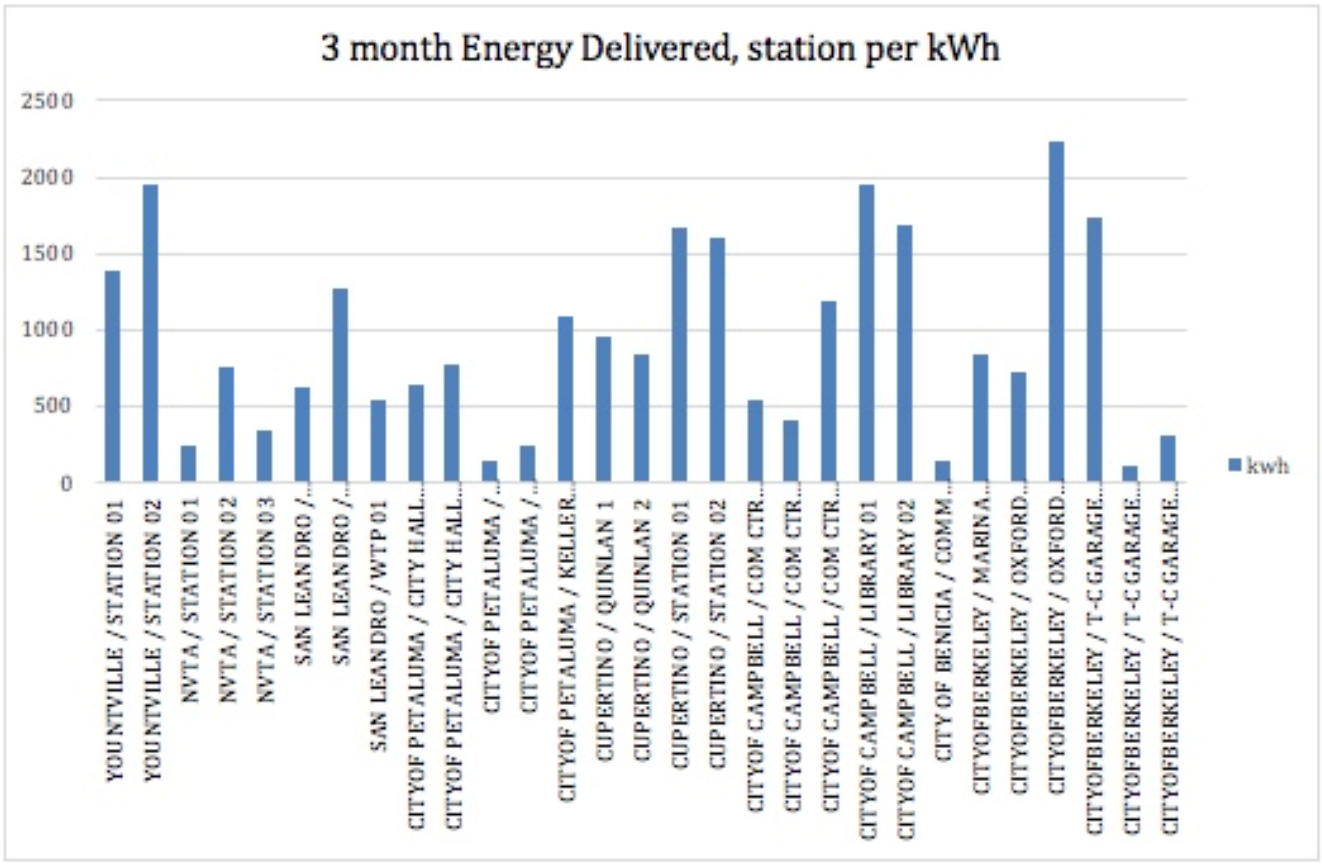
While the cost of acquisition and installation was mostly covered by BayCAP, the property owners in the program have to cover the cost of maintaining and operating the stations. This is an additional reason why property owners are encouraged to charge a fee for EV charging. Data collected from the property owners that are assessing charging fees show that the fees will cover the cost of Maintenance and Operation.

At the time that the data analysis was undertaken, eight organizations that were assessing fees had three or more months of usage data available, and three organizations that were NOT assessing fees had three or more months of usage data available. We used these data sets to illustrate how assessing fees can offset the cost of maintenance and operations.

Average station usage and fee data for eight organizations that are assessing charging fees. (29 stations, 58 ports monitored between April 23, 2016 and July 22, 2016).

Figure 4 shows a bar chart showing actual usage by station over the three-month analysis period for the eight cities that are assessing fees for EV charging. Note that several cities have multiple stations.

Figure 4: 3 Month Energy Delivered at Selected Stations



Source: BayCAP Analysis and Lessons Learned 9/2016

Table 2 shows the aggregate usage of the 29 stations shown in the bar chart above.

Table 2: Aggregate Usage and Costs for Stations with Fees

Connection Duration	9,570 Hours
Charging Time	6,406 Hours
Energy Delivered	12,436 kWh
Fees Collected	$12,560
Estimated Electricity Cost (@ $0.20/kWh)[1]	$2,487
Maintenance Costs (service contract)	$3,900
Estimated Net (Fees Collected – O&M)	$6,173
Estimated annual net profit per station, before demand charges	$851

Source: BayCAP Analysis and Lessons Learned 9/2016

1 PG&E tariffs in use vary, however the most common tariffs are A-1, A6, A-10, and E-19 which offer a range of electrical costs from $0.08 to $0.54 per kWh based on time-of-use and rate schedule. For purposes of the analysis a high estimated average cost of $0.20/kWh was used based on actual rates charged during the analysis period. The calculations do not include demand charges which can vary significantly based on the total load associated with the meter serving the EVSE.

Table 3 shows the average station usage and fee data for three organizations that are NOT assessing charging fees. (10 stations, 20 ports monitored between April 23, 2016 and July 22, 2016).

Table 3: Aggregate Usage and Costs for Stations without Fees

Connection Duration	14,957 Hours
Charging Time	9816 Hours
Energy Delivered	53,053 kWh
Fees Collected	0
Estimated Electricity Cost (@ $0.20/kWh)1	$10,610
Maintenance Costs (service contract)	$1,000
Estimated Net (Fees Collected – O&M)	-$11,610
Estimated annual net loss per station, before demand charges	-$4,644

Source: BayCAP Analysis and Lessons Learned 9/2016

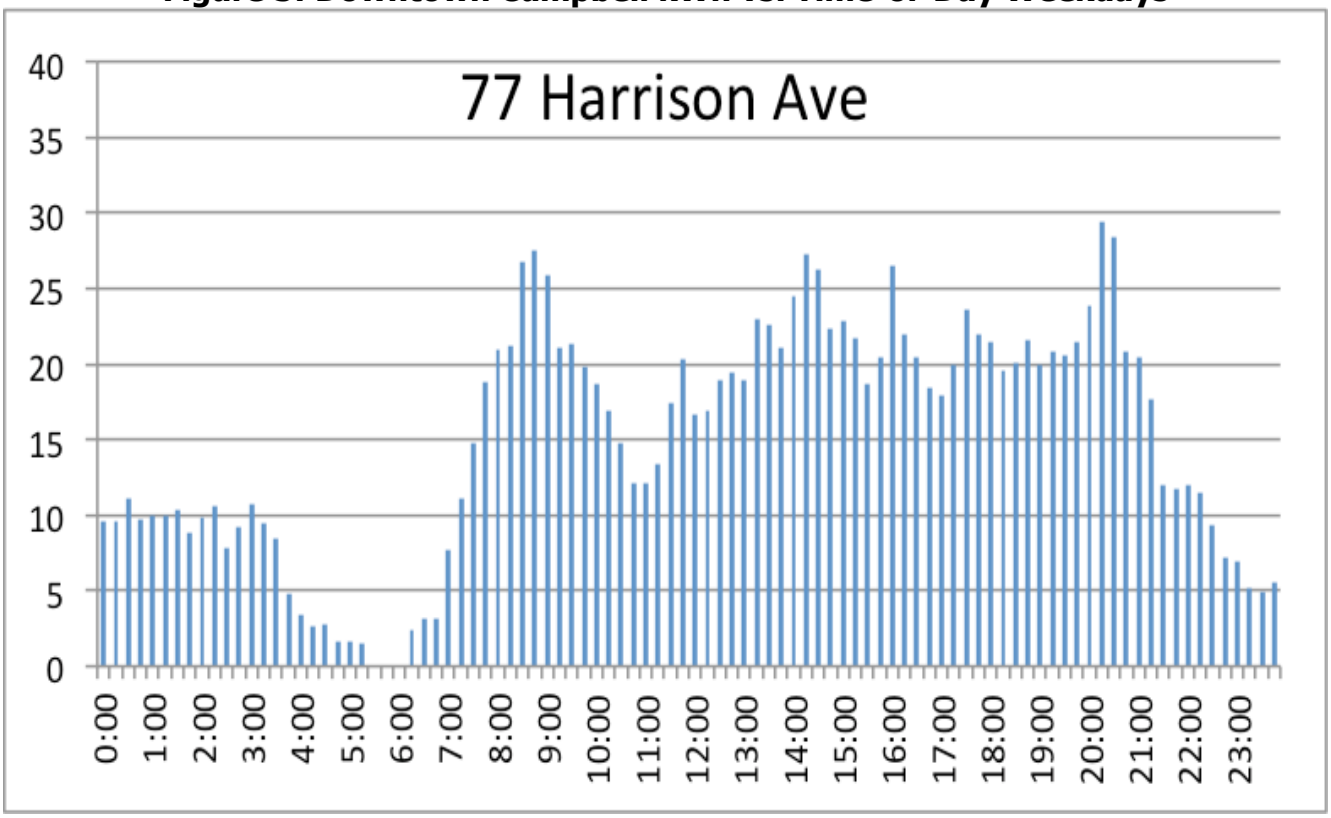
The communities that are assessing fees paid for all operating and maintenance costs and netted an estimated $850 per year per station. The organizations that are NOT assessing fees had estimated losses of nearly $4,644 per year per station.

Due to this finding it is recommended that communities assess a fee for charging electric vehicles. The main reason for this is that if the charging stations become a loss for the community to maintain and operate, they will be subject to abandonment in future years due to budget constraints.

2.3 Multiple Daily Usage Peaks

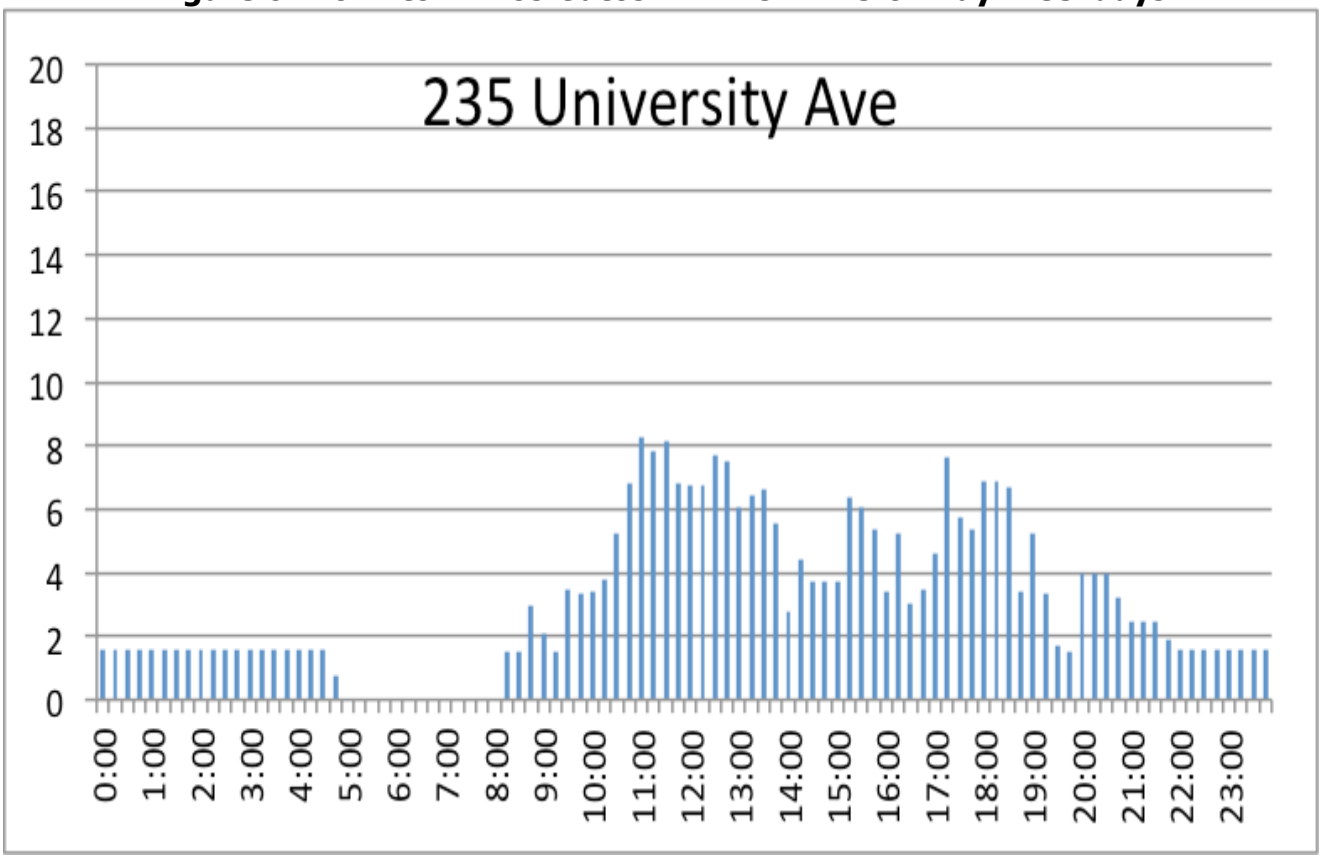
Data indicates that most stations have four daily usage peaks: mid-morning, late morning, early afternoon and late afternoon. It is also interesting that these peaks tend to be nearly equal. Figures 5, 6 and 7 show some typical charging station usage patterns. The vertical axis is kilowatt-hours delivered to EVs and the horizontal axis is time of day in 24-hour format (note that vertical scales differ between the charts).

Figure 5: Downtown Campbell kWh vs. Time-of-Day Weekdays



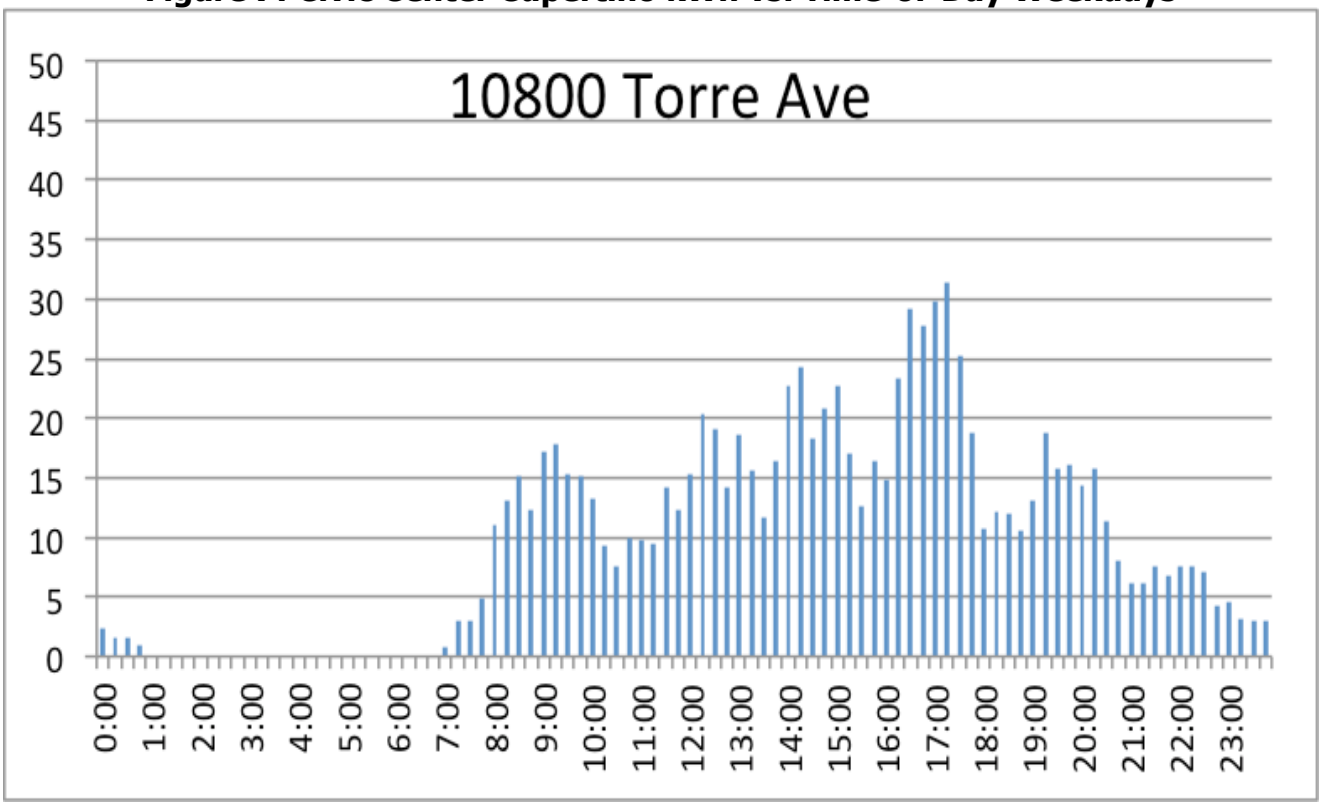
Source: BayCAP Analysis and Lessons Learned 9/2016

Figure 6: Downtown Los Gatos kWh vs. Time-of-Day Weekdays



Source: BayCAP Analysis and Lessons Learned 9/2016

Figure 7: Civic Center Cupertino kWh vs. Time-of-Day Weekdays



Source: BayCAP Analysis and Lessons Learned 9/2016

2.3.1 Analysis

This suggests several things: 1) peak demand charges can be somewhat minimized through reasonable distribution – if there were a single peak it would likely be much higher which would cause higher demand charges; 2) fee-based charging is encouraging usage among a variety of use cases (fleet vehicles, shoppers and employees). Employees tend to charge when arriving to work (the first peak), shoppers charge throughout the day (second and third peaks, and fleet vehicles tend to charge at the end of the work day (fourth peak); 3) usage of solar energy would likely be an effective way to curtail facility and grid impacts of the charging stations, especially if the solar power were augmented by local energy storage.

2.4 Profile of a Typical Station

One of the goals of BayCAP was to document the usage characteristics of the typical EV charging station. For this analysis we eliminated some of the stations due to extremely high or low usage levels and averaged the remaining usage statistics.

Table 4 shows the usage characteristics for the "typical" charging port in BayCAP[2] (each charging station has 2 charging ports):

2 Not all charging stations in BayCAP were installed and commissioned at the time this data was collected. However, the number of active stations is sufficient to provide guidance on average usage.

Table 4: Typical Port Usage

Average sessions/month	139 (4.3/day)
Average energy delivered per session	7.26 kWh
Average greenhouse gas savings per session	3.05 kg
Average charge time per session	1.76 hours
Average plug-in time per session	2.39 hours

Source: BayCAP Analysis and Lessons Learned 9/2016

CHAPTER 3:
Project Outcomes

The BayCAP1 project lasted nearly three years during which time 39 dual-port charging stations were installed at 22 host sites. These 39 charging stations added 78 Level 2 charging ports in publicly accessible parking lots and parking garages in 9 communities in the San Francisco Bay Area. The vast majority of these stations are serving more than 2 charging sessions per day while generating sufficient income for the participating site hosts to continue operating and maintaining the charging stations indefinitely. A description of the project outcomes follows.

3.1 Provide, Install, and Provision of PEV Charging Ports in 21 Key Destination Sites (Objective 1)

The project was installed 39 charging stations (for a total of 78 ports) at 22 key locations. The nine site host communities determined the locations that would best serve their community. The users of the stations varied from community to community. In some cases, the users were people who needed to charge their vehicles while shopping, attending meetings, or going to appointments. In other cases, the users were employees who needed to charge their vehicles while at work. In a few cases the charging stations are being used by residents who do not have access to a charging station at home.

3.2 Coordinate with Local and Regional Agencies and Site Owners to Support Regional Plans for PEV Charging (Objective 2)

The project coordinators worked with each community to find sites that supported the overall regional plan. The regional plan called for substantial increase in the availability of Level 2 charging stations in publicly accessible parking lots and garages. The project focused on two key areas: 1) areas where the demand for charging was very high – typically downtown areas; and 2) more remote areas where EV drivers did not feel comfortable taking their EVs due to lack of charging facilities – these were typically suburban and/or perimeter areas in the Bay Area.

3.3 Train and Support Site Hosts (Objective 3)

Most of the site host communities had not yet installed EV charging stations in their garages and had little experience regarding things such as Americans with Disabilities Act (ADA) access, usage of station hardware and software, operations and maintenance, and pricing strategies. The project held a series of training sessions in the form of webinars for the site hosts that covered these topics. In addition, the Major Subcontractor spent time with each site host to train them on remotely managing their charging stations. The result of these training sessions is that each site host (9 communities) is now able to manage their stations effectively. Using the ChargePoint network portal they are able to set pricing, monitor usage, and detect problems that the stations may be encountering. The experience gained during the installation enabled the communities to feel confident in moving ahead with additional charging stations as well as understand many of the considerations regarding signage, accessibility, and location determination.

3.4 Track and Measure Station Adoption and Utilization Rates (Objective 4)

The Prime Contractor set up a special ChargePoint Network portal to monitor all stations that are part of the project for usage. As a result of this ability it was very easy to determine usage in terms of number of sessions per day, amount of energy delivered by each station each day, peak periods, and which stations were being underutilized.

3.5 Track and Calculate Equivalent Greenhouse Gas Emission Reductions, Air Quality Improvements, and Gasoline Displaced by Grant Funding (Objective 5)

The same special ChargePoint Network portal that is discussed in 3.4 is used for determining total amounts of energy that is being delivered by the BayCAP charging stations. Analysis of the energy data provides a basis for determining air quality improvements and greenhouse gas reduction based on the amount of fossil fuels that are displaced by electricity.

3.6 Analyze Usage Trends to Plan Future Station Locations (Objective 6)

The usage trends show that the dense downtown areas of the site host communities still have insufficient EV charging capacity. Based on that information, it would seem that the best thing to do would be to replicate the project to add even more stations. However, most of the site hosts discovered that they had insufficient electrical service to add more charging stations to the existing locations. The location of future stations will have to be planned around areas that have high levels of electrical service. This would indicate that new or renovated parking garages should be constructed with a plan to add charging stations to a much higher percentage of the available parking spots than the current garages can support. This would require a higher level of electrical service as well as pre-wiring parking spots to accept the charging stations.

3.7 Demonstrate Utilization of Level 2 Chargers in Demand Management Applications (Objective 7)

This objective was only partially realized. The main issue here is that most of the host sites could not support enough charging stations to influence demand charges from the utility companies. The Analysis section shows that average demand was very consistent throughout the day. Had there been very high peaks and low valleys in the demand over the course of a day there may have been more opportunity for exploring this area. However, one lesson that was learned is that in order to monitor and, eventually control, EV charging it is necessary to have networked charging stations. The network provides the necessary communications channels to determine the current use and these same channels can be used to attenuate charging if there is a grid demand problem.

3.8 Support the Regional "Experience Electric" Campaign to Grow PEV Sales (Objective 8)

PEV sales grew substantially during the project period. We believe that the availability of charging stations in public parking lots has had a positive effect on consumer confidence in electric vehicles. Areas that need further development include multi-dwelling unit housing and employer parking lots.

CHAPTER 4:
Conclusions and Recommendations

Analysis of the data collected from the BayCAP EV charging stations indicate that this project has been very successful. With only a few exceptions the charging stations are being highly utilized in terms of energy delivered and number of individual sessions per day. The benefit to the Bay Area is that more people can use EVs for their day-to-day errands and commutes. This in turn lowers the amount of fossil fuel that is being used as transportation fuel and substantially reduces greenhouse gases and other tailpipe emissions.

Charging stations receive significant utilization when properly sited. Once installation was completed the EV charging stations started being used immediately by the public in most locations, demonstrating that public EV charging infrastructure receives significant utilization when properly sited. Dense downtown areas showed a higher usage level and longer dwell times than more rural and/or suburban areas. In urban areas, the users are typically shoppers who do not stay all day. In rural and suburban areas, the charging stations are mostly used by employees of local businesses and or local residents. These use cases are typically longer duration and often lead to the vehicle parking and staying connected to a charging station for a longer period of time than is required for fully charging the vehicle. Typical station utilization:

- 4.3 charging sessions per day
- 31.2-kilowatt hour delivered per day
- 7.26-kilowatt hour delivered per session
- 61.3 unique users per month

The following is a list of conclusions and recommendations based on the experience gained from BayCAP.

4.1 Installation Process

4.1.1 Lesson Learned

The permitting process varied widely from jurisdiction to jurisdiction which caused unanticipated costs and delays. Each agency had a different process for applying for building permits to add the charging stations. In some cases, the permit process was very smooth but in others there was a longer process that required engineering documents to be provided before the permit was issued. Engineering documents can represent a significant expense of several hundred dollars or more per site and can be a significant factor in adding unnecessary delay and site host cost.

4.2 Pricing

4.2.1 Lesson Learned

Most of the host sites were initially in favor of not assessing fees for charging of EVs. The thought process was that free charging would encourage EV use and many communities who already had charging stations had been following this course of action. In this project, it was discovered that assessing a fee for EV charging had several benefits:

1. **Encourages drivers to move their cars when charging was complete**. This makes the charging station available for other EV drivers who need to charge.

2. **Discourages drivers from using the charging station if their car doesn't need to be charged**. Many drivers will "top up" if there is no cost for using the charging station even though their car may not need to be charged in order for them to complete their trip. Also, in areas that have parking shortages EV drivers will use the EV equipped parking spot rather than a non-equipped spot due to availability. Again, assessing a fee will discourage this behavior and make charging stations available to those who need them.
3. **Provides funds for operation and maintenance**. Although electricity cost is fairly low, the charging stations have some additional operating costs such as the monthly network fee and maintenance costs such as extended warranty. Communities are always budget conscious and by funding maintenance and operation through usage fees provides an ongoing revenue stream to ensure that the charging station doesn't fall into disrepair or become the victim of budget cutting.
4. **Encourage site hosts to assess fees for charging** to maximize availability to drivers actually in need of charging (and not merely in need of a parking space). The most effective fees are time-based fees (e.g.: $1.00 per hour) with an increase in the hourly amount after a period of time, usually 2-4 hours. Other methods of ensuring maximum availability of the charging station include limiting the amount of time to park at the station (by law or by escalating fees).

4.3 Installation Costs

4.3.1 Lesson Learned

BayCAP assumed that the average cost to install a dual-port charging station would be about $5,000. In nearly half the cases this was insufficient, and the site host community had to make up the difference. The average cost to install, including labor and miscellaneous parts and materials was $6,240. There were some outliers (extremely high-priced installations) that drove the average price up so it should be noted that the median price was $5,650. Also note that these prices do not include any costs associated with ADA compliance, signage or parking lot striping.

One of the difficulties faced in installing EV charging stations is that it is nearly impossible to predict the installation cost of a specific station without doing an initial site survey to determine some of the variables such as distance from the panel, trenching, and available electrical service. However, the decision to set a specific amount of funds aside for installation ($5000/station) was instrumental in ensuring that costs were contained. If a specific installation was determined to cost more than the amount funded the communities has the choice of re-siting the stations or making up the differences themselves.

4.4 Data Collection

4.4.1 Lesson Learned

Site usage data was easily accessed because the charging stations selected use a cloud-based application to control the stations as well as monitor usage. Historical data is available so that future projects can look at usage data from the beginning of the project up to the present time. This capability is essential to the success of the project as well as informing future projects.

4.5 Program Structure

4.5.1 Lesson Learned

The BayCAP program took a unique approach in identifying the equipment supplier and the equipment installation partner as part of the program which resulted in time saved after the grant was awarded. The installation partner was a major subcontractor in the grant, and this streamlined the management of the grant by eliminating negotiations and payment by the individual host agencies. The end result was a savings in both time and cost of the project with a secondary benefit of being a more attractive program for the host agencies to participate in.

4.6 Further Recommendations

Encourage normalization of permitting process to minimize project complexity. Some local governments have already streamlined the permitting process and treat electric vehicle charging stations the same as any electrical appliance. In these cases, "over the counter" permits and self-inspection of finished work was typically accepted. In other locations the permitting process required extensive electrical engineering documents that required multiple site visits as well as visits to the permitting agency and a final inspection before activation of the charging station. Streamlining the permit/inspection process will encourage more charging station installation because it reduces the cost and complexity of the project.

Explore cost sharing of adding electrical service with public utilities to reduce installation costs to site hosts. In several cases there was insufficient electrical service to the site where the charging stations were to be installed. This resulted in charging station be located in less than optimal locations (i.e., the stations were located where electrical service was available) or spending additional money to augment the existing electrical service. Local utilities such as Pacific Gas & Electric have proposed adding the cost of providing additional electrical service to the rate base which would provide funding to run service, conduit, and wiring to potential charging station locations. Adoption of these proposals would reduce the cost to property owners who wish to add charging stations to their parking properties.

Consider including charging installations as part of broader energy efficiency programs funded utility funds. During the course of installing the electric vehicle supply equipment in the participating communities, we were frequently asked by the communities if there would be further programs to install electric vehicle supply equipment. The most frequent request was for multitenant buildings where it is generally thought that installing equipment is difficult, complex, and/or too expensive.

Monitor grid dynamics to inform public electric vehicle charging. As the electrical grid shifts toward renewables, public electric vehicle charging may play an important part in balancing the supply and demand of electricity on the grid. Already we are seeing a shift in peak grid demand from early afternoon to late afternoon and early evening. This trend will continue as renewables are added which means that public electric vehicle charging may be called upon to shift toward the newly emerging supply peak from noon until mid-afternoon.

Continue to monitor utilization rates. The penetration of electric vehicles is still in a rapid growth phase. In addition, new models are about to become available that have much larger batteries (i.e.: Chevrolet Bolt, Tesla Model 3). These two facts may have a substantial effect on public charging. In order to inform future projects, it is recommended that continual monitoring of the electric vehicle charging station usage statistics be undertaken.

GLOSSARY

AMERICANS WITH DISABILITIES ACT (ADA)—One of the most significant federal laws governing discrimination against persons with disabilities, passed in 1990. Prohibits discrimination against individuals with disabilities in employment, housing, education, and access to public services. The ADA defines a disability as any of the following: 1. "a physical or mental impairment that substantially limits one or more of the major life activities of the individual." 2. "a record of such impairment." or 3. "being regarded as having such an impairment."

BAY AREA CHARGE AHEAD PROJECT (BayCAP 1 and 2)–A pair of CEC funded projects worth over $1 million to install over 150 EV charging ports at destination parking locations throughout the Bay Area. "BayCAP" provides EV charging for drivers who need or want to drive their EVs beyond the normal EV charging range thus encouraging more people to adopt EVs and use them for their daily needs.

CALIFORNIA ENERGY COMMISSION (CEC)—The state agency established by the Warren-Alquist State Energy Resources Conservation and Development Act in 1974 (Public Resources Code, Sections 25000 et seq.) responsible for energy policy. The CEC's five major areas of responsibilities are:

1. Forecasting future statewide energy needs.
2. Licensing power plants sufficient to meet those needs.
3. Promoting energy conservation and efficiency measures.
4. Developing renewable and alternative energy resources, including providing assistance to develop clean transportation fuels.
5. Planning for and directing state response to energy emergencies.

Funding for the CEC's activities comes from the Energy Resources Program Account, Federal Petroleum Violation Escrow Account, and other sources.

ELECTRIC VEHICLE (EV)—A broad category that includes all vehicles that are fully powered by electricity or an electric motor.

ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE)—Infrastructure designed to supply power to EVs. EVSE can charge a wide variety of EVs, including BEVs and PHEVs.

PLUG-IN ELECTRIC VEHICLE (PEV)—A general term for any car that runs at least partially on battery power and is recharged from the electricity grid. There are two different types of PEVs to choose from—pure battery electric and plug-in hybrid vehicles.

APPENDIX A:
Site Host Agreement Template

Bay Area Charge Ahead Project 2 – Approval to Proceed

Table 5 shows a preliminary information form for installation of equipment at site host.

Table 5: Installation of Level 2 Electric Vehicle Supply Equipment (EVSE)

Date	
Site Host Entity	
Address of Site Host Entity	
Primary Contact Name & Title	
Primary Contact Phone	
Primary Contact Email	
Authorizing Official Name & Title	
Authorizing Official Phone	
Authorizing Official E-mail	

Source: Prospect Silicon Valley

I. Project Summary

The Bay Area Charge Ahead Project 2 (BayCAP2) is a multi-jurisdictional project led by the California EV Alliance to procure and install Level 2 Electric Vehicle Supply Equipment – a.k.a., EV chargers – in specified locations throughout the greater Bay Area. The project is funded by the California Energy Commission (CEC) via the PON-13-606 solicitation award approved on May 14, 2014. Upon completion, the Bay Area Charge Ahead 2 project will install a total of 38 dual port Level 2 chargers, for a total of 74 Level 2 charge ports, including **_____ charging stations (with a total of ___ charge ports)** located in the **City of _____ .**

II. Purpose of this Approval to Proceed

This document provides the approval for ABM to ship and install the CEC-funded Level 2 charging stations at the approved addresses identified by the Site Host; and identifies for each of the relevant parties (the California EV Alliance, the Site Host, ABM, and ChargePoint) the roles, responsibilities, terms, and conditions for installation, maintenance, and operation of the charging stations.

III. Partner Roles

1. **The California EV Alliance** – a California nonprofit corporation, is the awardee of California Energy Commission grant support. California EV Alliance will provide overall

project management services, including contract oversight, fiscal administration, and reporting to the CEC. California EV Alliance has contracted with ABM for charging installation services, and with the Bay Area Climate Collaborative for project management support.

2. **Site Hosts:** Site hosts for the EV charging stations in the BayCAP2 project include the cities of Benicia, Berkeley, Fremont, Hayward, St. Helena, Yountville, Petaluma, San Leandro, the Napa County Transportation and Planning Authority, and Barker Pacific (a commercial property owner located in the Hamilton Landing area of Novato.)
3. **ABM**, a national leader in EV infrastructure and energy management services, will provide installation, commissioning, and maintenance services for the project charging stations, and will provide a portion of the required matching funds.
4. **ChargePoint** – a leading charging equipment manufacturer – will provide Level 2 networked chargers and network operating services, including payment processing, cloud-based charge station information services, and software upgrades.
5. **The Site Host Entity** will:
   A. **Complete required California Environmental Quality Act documentation** specified by the California Energy Commission (CEC).
   B. **Provide access to charge station locations in their jurisdiction** designated in the PON-13-606 application (or a suitable alternative in the event that the original site is deemed infeasible to install.)
   C. **Provide all necessary permits for the project**
   D. **Collaboratively identify the most appropriate location for the chargers within the designated site**, taking into account convenience for both the EV driver and other users of the facility, visibility, accessibility, and installation cost. (Please note that site cost guidelines are highlighted below in the Siting Requirements and Scope of Work sections.) In the event that a location preferred by the Site Host cannot be installed by ABM within the project budget, a new site will be selected which is responsive to the Siting Guidelines indicated below. The California EV Alliance will assist the parties in coming to consensus on final siting as needed.
   E. **Provide charging station signage (per the requirements defined below) and striping (where needed to clearly designate the space for EV use)**. A minimum of one sign per EVSE-equipped parking space is required by the California Energy Commission and California EV Alliance, which shall indicate that the space is "reserved for EV charging." The relevant signage must comply with the Manual on Uniform Traffic Control Devices and California Vehicle Codes, ensuring that signs are high enough, easily visible, and provide clear and accurate information on parking and charging policies.
   F. **Provide adequate electrical capacity** and any other items deemed necessary to complete the EVSE installation that are otherwise excluded from the standard ABM installation services as specified in the Siting Requirements and Scope of Work sections of this Agreement. Any such items or services, if needed, will be further specified in this agreement (following the joint site inspection by ABM and the Site Host). Additional items (if any) to be provided for by the Site Host shall be summarized. Items (if any) that are contracted for with ABM for an additional fee are summarized in the form of a work order.

G. **Oversee installation with ABM**, and assign an administrative contact authorized to set up the ChargePoint online station management account before the stations are activated.

H. **Contract with ChargePoint to provide charge station network operating services** during the 2014-2016 project performance period – as defined in the attached Master Software Services Agreement and in fulfillment of CEC local match requirements affirmed in the Site Host Letter of Participation included as part of the CEC PON-13-606 grant submittal. The ChargePoint Master Software Services Agreement needs to be "accepted" online as part of the EV station activation process after payment is made. As a reference, a copy of the ChargePoint Master Software Services Agreement is attached to this document.

I. **Maintain public accessibility for all chargers** on a 24/7 basis.

J. **Maintain stations in good operating condition** during the 2014-2016 project operating period.

K. **Operate the chargers in compliance with a *Site Host Pricing Policy*** that meets grant requirements defined in the California EV Alliance response to PON-13-606 and summarized herein.

IV. Siting Requirements

ABM will install Level 2 ChargePoint charging stations at the designated sites identified through collaboration between the Site Host and ABM. In the event that these sites are deemed by ABM to be cost-prohibitive, or pose other obstacles to effective installation, maintenance, or operation, a new site will be identified that meets the selection criteria identified by the CEC and by the California EV Alliance, and which is mutually satisfactory to the Site Host, CEC, California EV Alliance, and ABM. Alternatively, the Site Host may choose to perform or contract additional services as outlined below in Section V/Additional Services:

- **Location**: Select a high-demand, high-visibility location that conforms to CEC criteria for safety, ease of access/ingress, shelter, lighting, and ADA access.
- **Electricity**: Select a location where Alternating Current Level 2 (240V/40A) electrical supply is or can be made available with relative ease and minimal cost. (Note that the average cost of installation is projected at a market value of approximately $4500 per site, which will limit panel upgrades and conduit runs.) More cost details are available in the ABM Scope of Work (Section V).
- **Equipment Protection**: EV chargers should be placed where they can be best protected from physical damage by such measures as curbs, wheel stops, setbacks, bumper guards, and concrete-filled steel bollards, while simultaneously taking into consideration ease of access to the charger, mobility of users, and foot traffic in the area.
- **Public Safety**: Chargers should be located in areas with proper ventilation and away from potential hazards including traffic, explosive materials, flammable vapors, liquids and gases, combustible dust or fibers, materials that ignite spontaneously on contact with air, flood-prone areas, and areas that might be prone to vandalism.
- **Duration of Use**: Alternating Current Level 2 charger sites should focus on locations where PEV owners will be parked for significant, though shorter, periods of time (e.g., one to six hours).
- **Shelter**: When possible, choose locations with nearby shelter to protect users from weather when connecting their vehicle to the charger. (However, chargers are designed

to be safely operated in exposed locations in the rain, with no danger of electrical shock.)

- **Accessibility**: To the extent feasible, EV charger locations within a site will be accessible in accordance with the draft Governor's Office of Planning & Research guidelines on ADA access.
- **Security:** Locations should be selected that are secure for users at all times of day and night and relatively secure from vandalism (e.g., in well-lighted, well-traveled areas.)
- **Cell Coverage:** Chargers require cell phone signals for networked operation and repeaters may be installed to provide signals if the site does not have coverage.

If no qualifying site is identified within the Site Host jurisdiction that satisfies the requirements of all parties, then the California EV Alliance, with the concurrence of the California Energy Commission, may propose a new site in another jurisdiction.

V. ABM Scope of Work

Under contract with the California EV Alliance, ABM will provide the following installation and related services at designated Site Host locations:

- Turn-key EVSE installation project management
- Delivery, installation and activation of ChargePoint stations
- Site analysis, station placement recommendation (in collaboration with Site Hosts), engineering, and installation management
- Quarterly maintenance (see description herein)
- ChargePoint warranty support
- Provide proper insurance and liability coverage information to Site Hosts as per standard contractor requirements.

ABM installation services funded by the BayCAP2 program will be provided within the parameters outlined below for each Site Host. All chargers in the program are ChargePoint dual-port Level 2 stations (see illustration below). Station configuration and installation profile options are listed below:

- **Wall-Mount vs. Pedestal-Mount Configurations:** ChargePoint CT4023 Wall-Mount OR CT4021 Bollard-Mount units will be provided as appropriate to siting circumstances. Please note that the "bollard-mount" units are also interchangeably referred to as "pedestal mount." These units are NOT to be confused with *protective bollards,* which are separate devices such as a metal or concrete pole or blocking device, which may be installed separately to prevent damage to the charging station.
- **"Gateway" vs. "Drone" Charging Station Models:** Each ChargePoint CT 4000 series model is available as either: a) a "Gateway" unit, which includes the internal cellular communications equipment to connect to the public network; or, b) as a "Drone" unit that wirelessly communicates to the Gateway when installed within appropriate proximity and line-of-site locations. Multiple Drone units are typically added near one Gateway unit to form a multi-station charging group or array. Note that slight variations in the maximum length of conduit indicated in the scenarios below (Options 1-3) may be accommodated in limited situations at the sole discretion of ABM and California EV Alliance. Standard installation options include:
- **Installation Profile Option #1: Surface Mount Installation**

Install Pedestal ("Bollard") or Wall-Mounted dual charging station on existing concrete with anchors. Two (2) 40 Amp Standard Circuit Breakers will be provided and installed in existing electrical panel with available space and amperage. Two (2) 60 Amp Disconnects will serve as local disconnecting means. A maximum of eighty (80) feet of ¾" Electrical Metallic Tubing surface mount conduit and wire will be provided and installed.

- **Installation Profile Option #2: Underground Installation**

  Install Pedestal ("Bollard") dual charging station on new concrete base. One (1) new concrete base will be constructed per charger. Two (2) 40-amp standard circuit breakers will be provided and installed in existing electrical panel with available space and amperage. Two (2) 60 Amp Disconnects will serve as local power disconnecting means. A maximum of forty-five (45) feet of underground trenching in planter and ¾" PVC underground conduit and wire will be provided and installed from existing electrical panel to new concrete base.

- **Installation Profile Option #3: Partial Surface and Underground Installation**

  Install Pedestal ("Bollard") dual charging station on new concrete base. One (1) new concrete base will be constructed. Two (2) 40-amp standard circuit breakers will be provided and installed in existing electrical panel with available space and amperage. Two (2) 60 Amp Disconnects will serve as local disconnecting means. A maximum of forty (40) feet of ¾" Electrical Metallic Tubing surface mount conduit and wire will be provided and installed onto the existing structure with straps in surface mounted configuration -- and a maximum of up to twenty-five (25) feet of underground trenching will be provided in planter and ¾" PVC underground conduit and wire will be installed from structure to new concrete base of EVSE.

- **Additional ABM or Site Host Provided Services**

  a) The Site Host may also opt to self-perform additional scope beyond Installation Profile Option #1, #2, or #3. This additional scope, if needed, is referenced later in this document.

  b) If upon the site survey conducted by ABM, it is determined that there is additional required work beyond the scope detailed in Installation Profile Options #1, #2, or #3 above, ABM will provide an additional estimate for costs to complete the EVSE installation.

  c) In the event that the Site Host's site does not have sufficient electrical infrastructure to support the addition of EV charging infrastructure, ABM may offer options or potential solutions that would help reduce or balance current electrical loads within a facility. Some options are designed to free up electrical capacity while others are designed to minimize peak load spikes and their resulting demand fees. Any such solutions will be implemented only upon Site Host approval.

  d) In the case of additional services by either party, ABM will cooperate with the Site Host to coordinate satisfactory completion of the installation of the EVSE pursuant to the requirements of the project.

- **ABM Exclusions and Qualifications**

  Unless specifically noted otherwise:

a) Electrical design work to accommodate non-standard configurations is excluded and will be charged as additional as required, with agreement of Site Host.
b) Electrical permit, plan check fees, and utility charges are excluded and must be paid by Site Host where required.
c) Pricing is based on existing electrical system having adequate physical space and amperage available.
d) Excludes any underground work such as excavating, concrete or asphalt cutting and patching.
e) Excludes cellular signal booster for equipment without adequate cellular connection.
f) Excludes concrete coring of walls, floor, ceiling of building or parking structures
g) Excludes x-ray or radar detection of concealed obstacles within a concrete slab in either a post tension slab or rebar supported slab.
h) Excludes protective barriers i.e. post barriers (bollards) or wheel stops.
i) Excludes pull boxes or intermediate junction boxes for primary electrical feeds to EV chargers or any low voltage or signal wiring.
j) Excludes landscape repair or restoration.
k) Excludes any cosmetic enhancements such as paint or parking lot striping.
l) Excludes any parking lot, access ramp or access path re-configuration or leveling that may be required to create ADA accessible spaces.

VI. ABM Warranty, Installation Services, and Limitations

- **Warranty:** ABM labor and construction material are under warranty for one year after installation; all new work is done to local National Electrical Code code requirements. ABM is not responsible for the condition or capacity of the existing electrical systems. ABM is not responsible for any vandalism that occurs during or after the installation of materials. The cost of City permits and electrical engineering and engineered drawings (if applicable) are not included as part of the CEC-funded installation, although regular construction drawings are included. The CEC prohibits use of its funds for permitting. Local site hosts must cover permit costs.
- **Signal Boosting Equipment:** At times, signal boosting antennae may be required for the wireless features of ChargePoint EV charging stations to function properly. Due to the nature of wireless signals, possible interference, line of sight obstructions, etc., one or more antennae could be needed. During the original site visit, ABM will make efforts to determine the need for signal boosting equipment and will provide such equipment to the extent feasible within the overall project cost framework. However, it is possible that supplementary signal boosting equipment may be needed in the future. If the need should arise, or if the cost exceeds what is feasible within the CEC grant cost parameters, a proposal can be provided for signal boosting equipment.
- **ADA and Accessibility Requirements:** All ADA requirements determined by municipal or state agencies are the responsibility of the Site Host. ABM is responsible for the installation of the electrical system(s) necessary to the specific scope outlined for the EV chargers specified. It does not include surface modifications, striping removal, re-striping, etc. that may be necessary to comply with ADA or Accessibility Requirements. Also, any material changes to the electrical scope caused by ADA or Accessibility requirements are considered as additional to ABM services provided through CEC funding. The guidelines to be followed are the draft "Plug-In Electric Vehicles: Universal Charging Access Guidelines and Best Practices" published by the

State of California, Governor's Office of Planning and Research, available at http://opr.ca.gov/docs/PEV_Access_Guidelines.pdf. In the event that the state issues new guidelines prior to installation, the new guidelines will be used to define ADA requirements.

- **Wheel Stops and Bollards:** Reasonable measures will be taken to install stations in a safe location set back to avoid contact from vehicles. As noted above, protective bollards and wheel stops are not included in the standard ABM work scope. If additional protection is desired or required by the City, bollards or wheel stops can be procured and installed with the city's own resources or a proposal can be provided by ABM.

VII. ABM Terms and Conditions

A. **INDEMNIFICATION.** ABM will defend, indemnify and save harmless the Site Host, its officers, agents and employees from any and all claims, demands, damages, costs, expenses (including attorney's fees), judgments or liabilities arising out of this Agreement or occasioned by the performance or attempted performance of the provisions hereof; including, but not limited to, any act or omission to act on ABM's part, or that of ABM's agents or employees or other independent contractors directly responsible to ABM, but only to the extent same are caused by the negligence, misconduct, or fault of ABM, ABM's agents or employees or other independent contractors directly responsible to ABM. ABM shall notify both the Site Host's Designee and Purchasing immediately in the event of any accident or injury arising out of or in connection with this Contract.

B. **Contractor Access to Site:** The Site Host shall permit ABM ("Contractor"), free and timely access to areas and equipment, and allow Contractor to start and stop the equipment as necessary to perform required services. All planned work under this Agreement will be performed during Contractor's normal working hours.

C. **Workmanship & Warranty:** Contractor warrants that the workmanship hereunder shall be free from defects for one year from date of installation. If any replacement part or item of equipment proves defective, Contractor will extend to Customer the benefits of any warranty Contractor has received from the manufacturer. Removal and reinstallation of any equipment or materials repaired or replaced not under a manufacturer's warranty will be at Customer's expense and at the rates then in effect.

D. **Alteration to Scope of Work:** Any alteration to, or deviation from, the scope of work in this Agreement involving extra work, cost of material or labor will become an extra charge (fixed-price amount or on a time-and-material basis at Contractor's rates then in effect) over the sum stated in this Agreement.

E. **Liability for Delay:** Contractor shall not be liable for any delay, loss, damage, or detention caused by unavailability of machinery, equipment or materials, delay of carriers, strikes, including those by Contractor's employees, lockouts, civil or military authority, priority regulations, insurrection or riot, action of the elements, forces of nature, or by any cause beyond its control.

F. **OSHA Provisions:** Site Host shall make available to Contractor's personnel all pertinent Material Safety Data Sheets pursuant to Occupational Safety and Health Adminstration's Hazard Communication Standard Regulations.

G. **Toxic and Hazardous Substances:** Site Host's obligation under this proposal; and any subsequent contract does not include the identification, abatement or removal of asbestos or any other toxic or hazardous substances, hazardous wastes or hazardous materials. In the event such substances, wastes, or materials are encountered, Contractor's sole obligation will be to notify the Site Host of their existence. Contractor

shall have the right thereafter to suspend its work until such substances, wastes, or materials and the resultant hazards are removed. The time for completion of the work shall be extended to the extent caused by the suspension and the contract price equitably adjusted.

H. **Damage Limitation:** UNDER NO CIRCUMSTANCES, WHETHER ARISING IN CONTRACT, TORT (INCLUDING NEGLIGENCE), EQUITY OR OTHERWISE, WILL CONTRACTOR BE RESPONSIBLE FOR LOSS OF USE, LOSS OF PROFIT, INCREASED OPERATING OR MAINTENANCE EXPENSES, CLAIMS OF SITE HOST'S TENANTS OR CLIENTS, OR ANY SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES.

VIII. ABM Preventive Maintenance Program and Funding

The California Energy Commission requires that applications for funding under PON-13-606 "must include a maintenance plan for continued reliable operation and unforeseen breakdowns of the electric vehicle supply equipment." (Application Guidelines, p. 9) To fulfill this requirement, the California EV Alliance has negotiated a maintenance plan with ABM to cover Site Host charging stations for a two-year period following their installation. (Note that the formal term of the CEC project is anticipated to be from the date of execution of the CEC contract with the California EV Alliance through June 30, 2016.) To cover Year 1 of the project period, ABM will donate (as local match) the entire value of the maintenance plan based on its Manufacturers' Suggested Retail Price (MSRP), which is $200 per charge port for the year. In Year 2, ABM will discount the Plan by 50 percent, providing $100 per charge port as match, while CEC funds will provide the balance of $100 per port to ensure continuity of maintenance across all charging stations in the Project. Table 6 outlines the funding commitments of ABM and the CEC:

Table 6: BayCAP2 Maintenance Plan: Discount Pricing in Program Years 1 - 2

Program Year	**Annual MSRP Maintenance Plan** (per Charge Port for quarterly inspection)	**ABM Local Match** (50% discount for BayCAP Quarterly Plan)	**Site Host Contribution**	**CEC Funding**	**% Discount to Site Host**
Year 1	$200	$200	$0	$0	100%
Year 2	$200	$100	$0	$100	100%

Source: Prospect Silicon Valley

ABM Maintenance Scope of Work

- **Software Monitoring:** ABM will monitor on a daily basis the ChargePoint network software to detect failure modes and promptly address the problem, either through software adjustments or dispatch of a technician to the site, if authorized by the site host.
- **Software Upgrades:** ABM will work with ChargePoint to ensure rapid and seamless deployment of software upgrades.
- **Monitoring and re-programming of pricing:** ABM will assist Site Hosts in monitoring (and re-programming as necessary) their pricing approach to EV parking and charging services.

- **Monitor and report key EVSE data:** ABM will monitor and report key EVSE utilization data, including charge session frequency, length, energy utilization, and payment history.
- **Quarterly On-site Maintenance Scope of Work:** An ABM technician will visit Site Host locations in person on a quarterly basis to undertake the following maintenance activities:
    - **Maintain equipment finishes:** ABM will clean the display, head and pedestal/base unit with ABM Green Care cleanser and microfiber cloth; inspect and clean cord and J-1772 receptacle, apply cable protective Green Care coating, and clean aluminum and plastic parts with microfiber cloths and Green Care cleansers. (Note that ABM Green Care products are Leadership in Energy and Environmental Design certified for green maintenance processes.)
    - **Activate "ChargePoint" session** and perform visual inspection of electrical components and initiate the charging station self-test processes. Minor repairs and recalibration can often be done on site while technician is performing service to eliminate return trips and minimize down time of the equipment.
- **ChargePoint warranty repair work:** Charging station warranty related repair work will be processed through ChargePoint if such repairs are the responsibility of the manufacturer.
- **Non-Warranty work – option of pre-authorized work:** All non-warranty work such as vandalism repair or damage to EVSE equipment shall be estimated prior to repairs. At the option of the Site Host, this work could be immediately addressed under a "Not to Exceed" threshold of $750.00 (or other amount) pre-approved by the site host. If authorized, ABM will perform work on a time and materials basis. Any agreement for pre-authorized repairs (if so desired) will be executed by ABM and the Site Host independently of this Authorization to Proceed.

IX. Network Services Fees

The ChargePoint network services fee is $230 per year per port, and covers software upgrades, station programming, cellular connections, and 24/7 driver support. THE TWO-YEAR NETWORK SERVICES FEE MUST BE PAID IN FULL PRIOR TO THE COMMISSIONING OF CHARGING STATIONS. ABM will invoice the Site Host on behalf of ChargePoint and shall provide proof of Site Host payment within 30 days to the California EV Alliance in fulfillment of CEC project reporting requirements.

X. ChargePoint One Year Warranty and Optional Extended Warranty

The first year ChargePoint warranty is included free with all charging stations included in the Project. An optional extended warranty covers one or two additional years (parts only) for $660 per Charging Station per year. ChargePoint equipment warranty details are provided in this document. If a Site Host wishes to extend the ChargePoint warranty, it must be specified at the time of equipment order and paid within 30 days.

XI. Site Host Pricing Policy Requirements

The California Energy Commission requires Site Hosts to implement a plan to optimize the use of the charging site to allow multiple EVs to use the charging equipment during a typical day, and to prohibit utilization of a charging station "beyond a reasonable period of time." In alignment with this goal, the Site Host shall implement the Pricing Plan identified in their Letter of Participation included in response to the CEC solicitation PON-13-606. The standard (default) Plan developed for all BayCAP project participants calls for the following elements to

be administered by the Site Host. (Note that variations from this Plan may be acceptable but must be approved by the California EV Alliance and included as part of this Notice to Proceed.)

A. **Fee-Based Charging:** Site hosts shall set charging rates between $1.00 and $1.50 per hour for use of the charger. This may or may not include separate charges for parking per the jurisdiction's usual parking policies. Fees may be calculated based on duration of stay, energy consumed, or a combination of the two.

B. **Graduated Pricing Based on Duration of Stay:** Site hosts shall raise the fee for occupying the EVSE-equipped space by a sufficient increment to encourage turnover of the space and thus greater availability and utilization (in charging mode) for EV drivers. It is recommended that this approach be implemented after approximately four hours of charging at the lower cost rate – particularly in cases where utilization rates are observed to be very high (70 percent or more) and available alternative charging facilities are limited. Site hosts may also consider a lower evening or weekend rate for EVs (similar to most existing parking policies) to encourage responsible off-peak use. (In particular, lots proximate to multi-unit residential buildings could provide a lower-cost overnight rate with a higher daytime rate that incentivizes overnight EVSE users to make way for daytime visitors and commuters.)

C. **EVSE Revenue and Cost Monitoring:** Pricing strategies should be reviewed on a semi-annual basis to ensure that expenses for sustaining charger operations are covered to the maximum extent feasible and appropriate. In most cases, fees for charger operations set in the $1/hr. range (or equivalent kWh) should be adequate to cover energy costs, transaction fees, the ChargePoint network services fee, and (beginning with Year 3 of the Project) the (optional) continuation of the ABM Maintenance Plan. In rare cases where the charger is not yet being well-utilized, there may be a modest operating subsidy required.

XII. Disposition of Equipment: Charging stations and related equipment installed by ABM at Host Sites are considered to be the property of the Site Host upon delivery at the Site. Per CEC Terms and Conditions, the Site Host shall use the equipment in the project for which it was acquired as long as needed, and the Site Host shall not encumber the property without CEC approval. When no longer needed for the original project or program, the Site Host shall contact the California Energy Commission for disposition instructions.

Table 7 shows a summary of equipment and services provided under the agreement.

Table 7: Summary of Equipment and Services Provided Under This Agreement

CITY OF _____ **Summary of Charging Station Installation Agreements for ChargePoint (CPI) Charging Stations and ChargePoint Network Services and ABM Maintenance Services**	
Description	**Cost**
A. Total Quantity and Type of Charging Stations **_____ ChargePoint CT 4021-GW1 "Gateway" dual port Level 2 Charging Station(s) (wall-mounted)** **_____ ChargePoint CT 4023-GW1 "Gateway" dual port Level 2 Charging Station(s) (pedestal mounted)** **_____ ChargePoint CT 4021 "drone" dual port Level 2 Charging Station(s) (wall-mounted)** **_____ ChargePoint CT 4023 "drone" dual port Level 2 Charging Station(s) (pedestal-mounted)** **TOTAL: _____ChargePoint CT 4000 Charging Stations providing a total of _____ Charging Ports** **Complete product specifications and details are available at http://www.chargepoint.com/files/CT4000-Data-Sheet.pdf**	Paid by CEC with CPI discount as local match
B. Location of Charging Stations (Please summarize Site and Charger information below -- adding space if needed) **Site Host Address #1:** (include facility name/ if any, street address, city, and zip code): **Station Location Description #1** (location on lot where EVSE is to be installed)**:** **ChargePoint Units to be Installed at this Site** (# of units and model #, see following page for model info):	

Table 7: Summary of Equipment and Services Provided Under this Agreement (Cont'd)

Description	Cost
Other Site Information (provided by ABM and Site Host following Site Inspection): **Site Host Address #2:** (include facility name/ if any, street address, city, and zip code): **Station Location Description #2:** **ChargePoint Units to be Installed at this Site (# and model):** **Other Site Information:**	
C. Required Two-Year ChargePoint Network Services Agreement: **($230 per port x 2 years x total number of ports = total price)** ▪ Payment for the ChargePoint agreement must be made direct to ABM via the process described below. ▪ Following receipt of payment by ABM, a ChargePoint user ID, temporary password, and URL for the user log-in page will be sent via e-mail to the designated Administrator at the Host Site. ▪ To complete the ChargePoint network services activation, the Site Host Administrator must log-in at the designated URL, provide the registration information requested, and acknowledge and accept the ChargePoint Master Software Services Agreement. This process must be completed before stations can be utilized. *This document includes a sample ChargePoint Master Software Services Agreement.* ▪ If the Site Host is unable to enter into the Master Software Services Agreement via the ChargePoint website, please request a hard copy contract from Ken Sapp at ABM at ken.sapp@abm.com or (949) 330-1542.	**$**

Table 7: Summary of Equipment and Services Provided Under this Agreement (Cont'd)

Description	Cost
D. Included Two-Year ABM Cleaning and Maintenance Service ▪ ($200 per year per charge port – included as local match)	**$**
E. Optional: 2nd or 2nd/3rd Year ChargePoint Extended Warranty (parts only)**:** **(# of Charging Stations x $660 per year x # of years = total price.) Note** that the warranty is priced on the basis of charging stations rather than charging ports, i.e., a dual port charging station is $660/year.	**Paid by ABM**
F. Additional (optional) installation or equipment upgrades specified in below (including parts and services):	**$**
Total Costs Paid by Site Host (sum of Sections C, E, and F above)**:**	**$**
	$

Source: Prospect Silicon Valley

Billing Information

Billing Contact Name: _____ Phone: _____

E-mail: _____

Authorization: We instruct **ABM Electrical Power Solutions, LLC** or subsidiaries to proceed with scheduling and performing the work described in the attached proposal.

Proposed date to begin work: _____

Host Entity Name (for billing and payment purposes): _____

Amount: (Insert "total costs paid by site host" itemized above):_____

Payment will be made to ABM by: (check one option below)

____ **Company check** before project start date: **Check number**: _____

____ **Purchase or Service order**: _____ **P.O. Number**: _____

____ **Credit or Debit card**: ___Visa ___Mastercard Other: _____

Card Number: _____

Billing Address: _____

Optional Additional Infrastructure Services Provided by ABM

Table 8 shows sample additional electrical upgrades and infrastructure services.

Table 8: Sample Additional Electrical Upgrade & Installation Infrastructure Services

▪ **Install _____ Wheel Stop(s)** ▪ **Install _____ Protective Bollard(s)** ▪ **Transformer _____ KVA** ▪ **Wall Core Qty _____** ▪ **Floor Core Qty _____**	▪ **J - Box Qty _____** ▪ **Trenching _____ ft** ▪ **Concrete Cut/Patch _____ ft** ▪ **Asphalt Cut/Patch _____ ft** ▪ **Landscape Repair _____ ft**

Source: Prospect Silicon Valley

Description of Work to be Performed: _____

_____

Materials List: _____

_____

Materials $: _____

Labor $: _____

Tax $: _____

Total $: _____

Note: All work performed to local and NEC requirements by California State Certified Electricians.

ABM Electrical Power Solutions, LLC Terms and Conditions

The following items are in addition to Section VII – ABM Terms and Conditions within this BayCAP Approval to Proceed document. Authorization to proceed with the work outlined in this quotation shall constitute Site Host ("Buyer's") acceptance of these terms and conditions in full. Oral authorizations to proceed must be confirmed to ABM Electrical Power Solutions in writing (Fax or e-mail) within 24 hours. If there is a conflict or discrepancy between terms and conditions in the Buyer's purchase authorization and this quotation, this quotation shall prevail unless specifically authorized, in writing, by ABM Electrical Power Services, LLC

Terms of Payment: 1. Terms are net thirty (30) days. Any invoice not paid within thirty (30) days from the date of invoice will be subject to a service charge equal to the lesser of One and One-half percent (1.5 percent) per month on account balances or the maximum percentage permitted by law. **2.** At ABM Electrical Power Solution's option, customers may be invoiced on a monthly basis for services provided over more than one month. **3**. All pricing and payment terms contained herein are contingent upon a favorable Credit Report for the customer/client to whom this quotation is provided. Upon receipt of a less than favorable credit report ABM Electrical Power Solutions reserves the right to withdraw this proposal, modify the pricing, or require payment when services are rendered, or advance payment of the total job quotation before providing services. **4.** For material purchases in excess of $50,000, ABM Electrical Power Solutions reserves the option to invoice 50 percent of the total at the time of material order and the remaining 50 percent at the time of material delivery. **5.** Customer agrees to pay ABM Electrical Power Solutions, to the extent permitted by applicable law, all costs and expenses, including but not limited to reasonable attorney's fees, incurred by ABM Electrical Power Solutions in connection with any collection activities or actions to collect unpaid invoices under this quotation.

Delays: ABM Electrical Power Solutions shall not be liable for delays or performance resulting from causes beyond its reasonable control, acts of God, acts or omissions of Buyer, fire, strike or other labor difficulty. Should there be a delay, the date of delivery or performance shall be extended.

Cancellation: Notice of cancellation of services to be performed must be received thirty-six (36) hours prior to the agreed upon date and time. Unless such notification is provided, charges will be incurred. These charges will be ABM Electrical Power Solution's cost plus ten percent (10 percent) and will include any rental equipment for the Project.

Disclaimer: ABM Electrical Power Solutions assumes no responsibility for any damage or injury to any property caused directly or indirectly as a result of ABM Electrical Power Solutions performing its duties under this agreement except such damage or injury that may be held to result solely and directly from or out of: Any grossly negligent performance by ABM Electrical Power Solutions in its obligations under this Agreement or any willful misconduct on the part of ABM Electrical Power Solutions, its agents or employees.

Responsibility: All services are performed in accordance with industry standards, project specifications and/or National Electrical Testing Association specifications. Where remediation is beyond the scope of normal reliability testing, and where corrective action is required, such services will be quoted separately.

Assignment: ABM Electrical Power Solutions reserves the right to assign this project in part or in total to an affiliated entity.

Termination: An order may be terminated only by mutual written agreement between Buyer and ABM Electrical Power Solutions and only upon payment of costs and expenses already incurred by ABM Electrical Power Solutions

Safety: ABM Electrical Power Solutions agrees to comply with all applicable federal, state, local, National Electric Codes and project safety rules and regulations. ABM Electrical Power Solutions reserves the right not to perform work that in its opinion violates Occupational Safety and Health Administration Electrical Safety-Related Work Practices; Final Rule or other safety rules and regulations.

Standby Time: When ABM Electrical Power Solutions service personnel are on the job site but unable to perform services requested because of circumstances beyond ABM Electrical Power Solutions control, the customer may be charged standby time at the applicable rate for each such ABM Electrical Power Solutions service person (up to a maximum of eight (8) hours per day per person).

Liability: ABM Electrical Power Services, LLC. and its contractors and suppliers of any tier, shall not be liable in contract, in tort or otherwise for damage or loss of property or equipment, loss of profits or revenue, loss of use of equipment or power system, cost of capital, cost of purchased or replacement power or temporary equipment (including additional expenses incurred in using existing facilities), claims of customers of Buyer, or for any special, indirect, incidental, or consequential damages of any kind, whether arising in or based on contract, tort, statute, strict liability, warranty or otherwise.

Warranties: All material and equipment delivered and/or installed will be the products of reputable manufacturers. ABM Electrical Power Solutions MAKES NO WARRANTY, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE WHICH ARE HEREBY EXPRESSLY EXCLUDED, CONCERNING MATERIAL AND EQUIPMENT MANUFACTURED BY OTHERS. ABM Electrical Power Solutions sells and delivers all materials and equipment not manufactured by it "AS IS," but ABM Electrical Power Solutions will use its best reasonable efforts to obtain from the manufacturer, in accordance with the manufacturer's customary practices, the repair or replacement of any material or equipment which may prove defective in workmanship or material. The foregoing shall be the exclusive remedy of Buyer and the sole obligation of AB Electrical Power Solutions with respect to material and equipment manufactured by others. Further, ABM Electrical Power Solutions warranties its labor for one (1) year.

Site Host Commitment to Perform Site Preparation Services

NOTE: This is needed ONLY if the Site Host and ABM mutually determine that additional services must be performed by the Site Host to enable successful installation of EVSE.

Project(s): _____

Site Addresses: _____

Site Addresses: _____

Site Addresses: _____

Site Host Contact Name & Title: _____

Site Host Phone: _____ **Site Host E-mail:** _____

Acknowledgement: We hereby acknowledge that the following additional work is required to meet the terms and conditions of the CEC-funded charging station installation project described herein, and that this work shall be conducted by the Site Host, at the Host's own expense, using the Host's own resources, contractors (if applicable), and personnel.

Scope of Work: _____

Proposed date to begin work: _____

Proposed date to complete work: _____

Authorized Signature: _____

Printed Name: _____

Title (Please Print): _____

Date: _____

ChargePoint Warranty Information

ChargePoint Master Software Services Agreement

APPROVAL TO PROCEED

The signatures below indicate agreement by all named parties with this Approval to Proceed with the installation of charging equipment and related services under the terms and conditions outlined in this document and in the Bay Area Charge Ahead Project grant application and award from the California Energy Commission.

Please note that this agreement is contingent upon and only goes into force after execution of all necessary agreements between the CEC and the California EV Alliance, and the subsequent execution of valid agreements between the California EV Alliance and ABM. If in the event that these superior agreements are not completed successfully with mutual consent between the parties, then ABM is not obligated to provide the equipment nor services identified in this agreement.

Site Host Authorized Signature **Printed Name & Title**

Date

ABM Authorized Signature **Printed Name & Title**

Date

APPENDIX B:
Selected Photos of Completed Installations

Figures 8 through 24 show selected photos of complete installations from locations of the Bay Area Charge Ahead Project.

City of Campbell

Figure 8: Campbell Library

Source: Mike Harrigan

Figure 9: Winchester Parking Lot

Source: Mike Harrigan

City of Cupertino

Figure 10: Cupertino City Hall

Source: Mike Harrigan

Figure 11: Cupertino Library

Source: Mike Harrigan

Figure 12: Los Gatos Boone Lane

Source: PlugShare

Figure 13: Los Gatos Miles Ave

Source: PlugShare

Figure 14: Menlo Park Parking Plaza 2

Source: Mike Harrigan

Figure 15: Menlo Park Civic Center

Source: Mike Harrigan

Figure 16: Mountain View

Source: ABM

Figure 17: Mountain View

Source: ABM

Figure 18: Palo Alto Hamilton Garage

Source: ABM

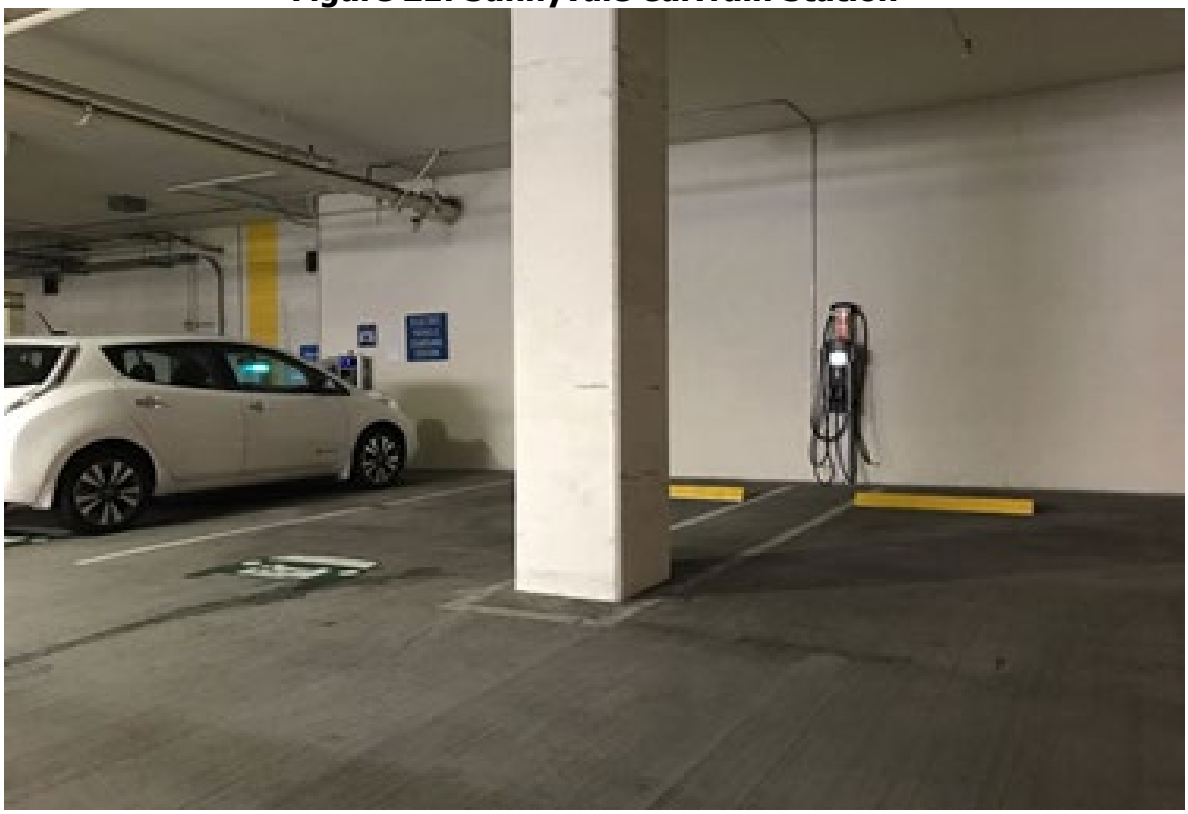
Figure 19: Palo Alto Webster Garage

Source: ABM

Figure 20: Sunnyvale Town Center

Source: ABM

Figure 21: Sunnyvale CalTrain Station



Source: ABM

San Mateo County

Figure 22: San Mateo City Public Garage

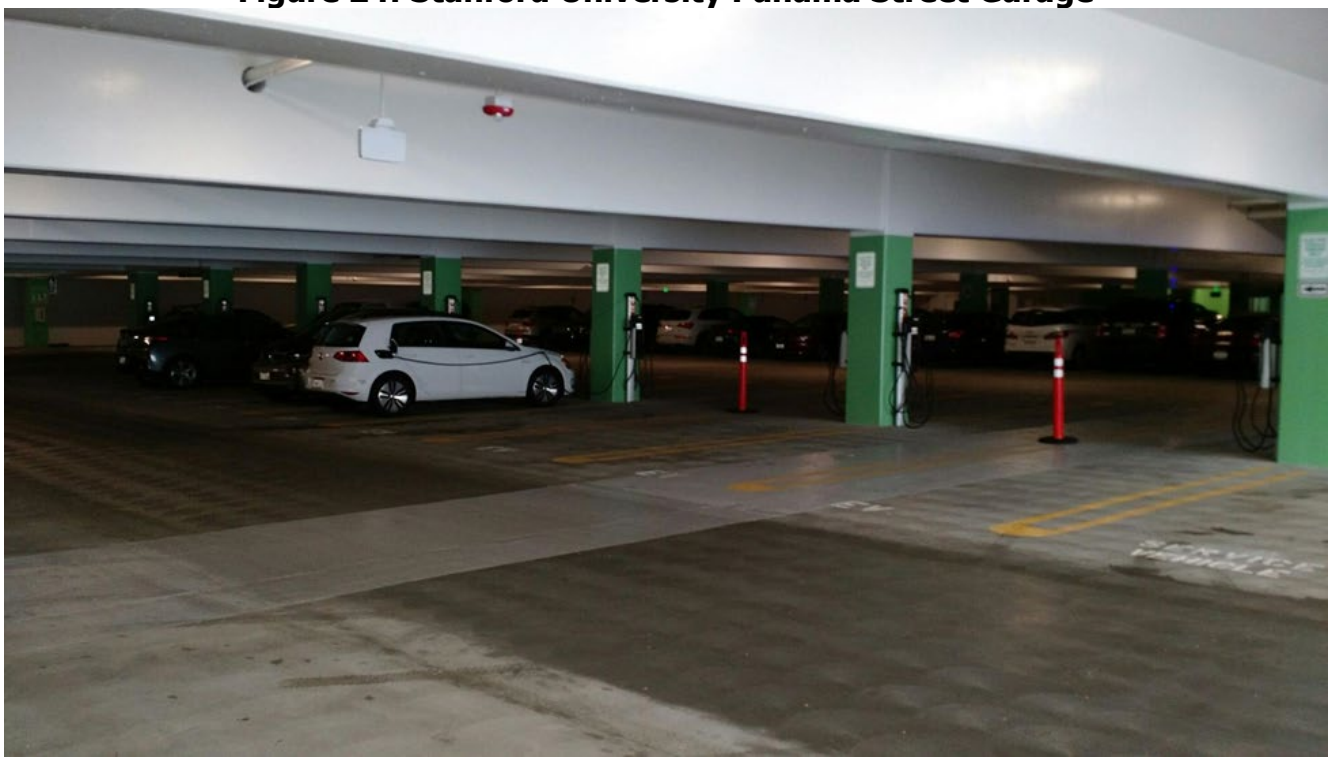
Source: ABM

Figure 23: San Mateo City Tower Road

Source: ABM

Stanford University

Figure 24: Stanford University Panama Street Garage



Source: Stanford University