CALIFORNIA ENERGY COMMISSION

CALIFORNIA NATURAL RESOURCES AGENCY

California Energy Commission

Clean Transportation Program

FINAL PROJECT REPORT

San Mateo County Community District EV Charging Project

Prepared for: California Energy Commission

Prepared by: Schneider Electric, Inc.

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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-11-602 to provide funding opportunities under the ARFVT Program for the installation of EV charging infrastructure at three sites of the San Mateo County Community College District to increase the quality, accessibility, and accountability of electric vehicle charging stations at Skyline College, College of San Mateo, and Cañada College. In response to PON-11-602, the recipient submitted an application which was proposed for funding in the CEC's notice of proposed awards 2012 and the agreement was executed as ARV-12-038 on June 13, 2012.

ABSTRACT

In the San Mateo County Community College District Electric Vehicle Charging Project, Schneider Electric, Inc. partnered with San Mateo County Community College District to bring electric vehicle charging stations to three colleges. The three colleges are Skyline College, located in San Bruno CA., College of San Mateo, located in San Mateo CA., and Cañada College located in Redwood City CA. The project installed three dual port Level 2 charging stations at each college and one single port Level 2 charging station at Skyline College. This totals 19 new Level 2 charging ports across the three campuses, with a minimum of one American Disabilities Act compliant per college.

During a one-year period from January 1, 2014 to December 30, 2014, there were a total of 8,044 accumulated sessions reported at the nine dual-port Level 2 charging stations. During these sessions, there was an accumulated savings of 7,110 gasoline gallon equivalent and an accumulated savings of 23,793 kilograms of greenhouse gases.

Based on a combination of national, state, regional, and local market trends as well as ongoing monitoring and analysis of usage of the charging infrastructure, additional EV infrastructure is planned for the future. San Mateo County Community College District anticipates adding 10 more charging stations available to electric vehicle drivers by the middle of 2016.

Keywords: Electric vehicles, EVlink, dual-port, charging station.

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EXECUTIVE SUMMARY

In the San Mateo County Community College District EV Charging Project, Schneider Electric, Inc. partnered with San Mateo County Community College District to bring electric vehicle charging stations to three colleges. The three colleges are Skyline College, located in San Bruno, California, College of San Mateo, located in San Mateo, California, and Cañada College located in Redwood City, California. The three colleges have a combined student population of over 25,000 and over 1500 employees. The project installed three dual port Level 2 charging stations at each college and one additional single port Level 2 charging station at Skyline College. This totals 19 new Level 2 charging ports across the three campuses, with a minimum of one ADA compliant per College.

During the course of the project period, the project achieved the following principal operational goals and objectives:

- Goal 1: Increased the quality, accessibility and accountability of EV charging stations at the San Mateo County Community College District site facilities:
    - Addressed the current need for EV charging services on campus; and,
    - Documented usage of EV charging station usage for both CEC reporting needs and educational experience for faculty, staff and students.

- Goal 2: Created a public/private partnership model for accessible, fee-free EV charging services:
    - Provided information on the partnership model to promote its replication; and,
    - Supported a dynamic partnership between Schneider Electric and San Mateo County Community College District.

The administration of the project occurred jointly, with Schneider taking lead responsibility for communicating with, and submitting deliverables to the California Energy Commission (CEC). The site assessment, procuring permitting, developing installation plans, and completing installation was the responsibility of the San Mateo County Community College District facilities department with consultation from Schneider. Key District collaborators and Schneider staff were responsible for general reporting, including match to the CEC. Schneider provided in-depth training to the District to complete commissioning of the charging stations. Schneider will maintain a two-year warranty with full replacement and onsite service guarantee. Upon installation and commissioning of the level 2 electric vehicle charging stations on campus, the San Mateo County Community College District now owns and operates the EV charging stations.

Data collection was the responsibility of the District and performed by each of the three college sites. Key faculty and workforce development staff on all three campuses prepared the data collection test plan and incorporated the collection of data and analysis into coursework for students studying in Environmental Science and Technology. This has enabled the District to collect robust data on project usage, charging behavior and environmental benefits, and to report findings to the CEC and the campus community.

Schneider and the District developed the data collection test plan by collecting one year of throughput, usage, and operations data from the project from January to December 2014. Data collection was gathered on the number of vehicles using each charging station per day, the number of days per year the stations were used, the assessment of air emission reductions and the development of the project's carbon intensity values for life-cycle greenhouse gas emissions. Besides providing the basic required data for the project, the Schneider and District partnership installed stations capable of collecting and continuously monitoring the charging station including tracking the charging session data on how long and how often the charger is used.

During a one-year period, from January 1st, 2014 and December 30th, 2014, there were a total of 8,044 accumulated sessions reported at the nine dual-port Level 2 charging stations. During these sessions, there was an accumulated savings of 7,110 gasoline gallon equivalent and an accumulated savings of 23,793 kilograms of greenhouse gases.

Chapter 1

1.1 Purpose of project

The purpose of the project was to increase the quality, accessibility, and accountability of electric vehicle (EV) infrastructure by establishing EV charging stations at Skyline College, College of San Mateo, and Cañada College.

During the course of the project period, the project achieved the following principal operational goals and objectives:

- Goal 1: Increased the quality, accessibility and accountability of EV charging stations at the San Mateo County Community College District (SMCCCD) site facilities:
    - Addressed the current need for EV charging services on campus; and,
    - Documented usage of EV charging station usage for both California Energy Commission (CEC) reporting needs and educational experience for faculty, staff and students.
- Goal 2: Created a public/private partnership model for accessible, fee-free EV charging services:
    - Provided information on the partnership model to promote its replication; and,
    - Supported a dynamic partnership between Schneider Electric, Inc. and SMCCCD.

1.2 Project Approach

The SMCCC EV Charging Project provided EV charging access as well as key EV educational opportunity for the campus and greater community. The SMCCCD installed EV charging stations on all three college campuses in high use and very visible parking areas. The 10 Level 2 charging stations were placed on each campus in accessible sites. The sites are in high usage parking areas for use by staff, students and visitors and has one charging port at an ADA compliant parking area.

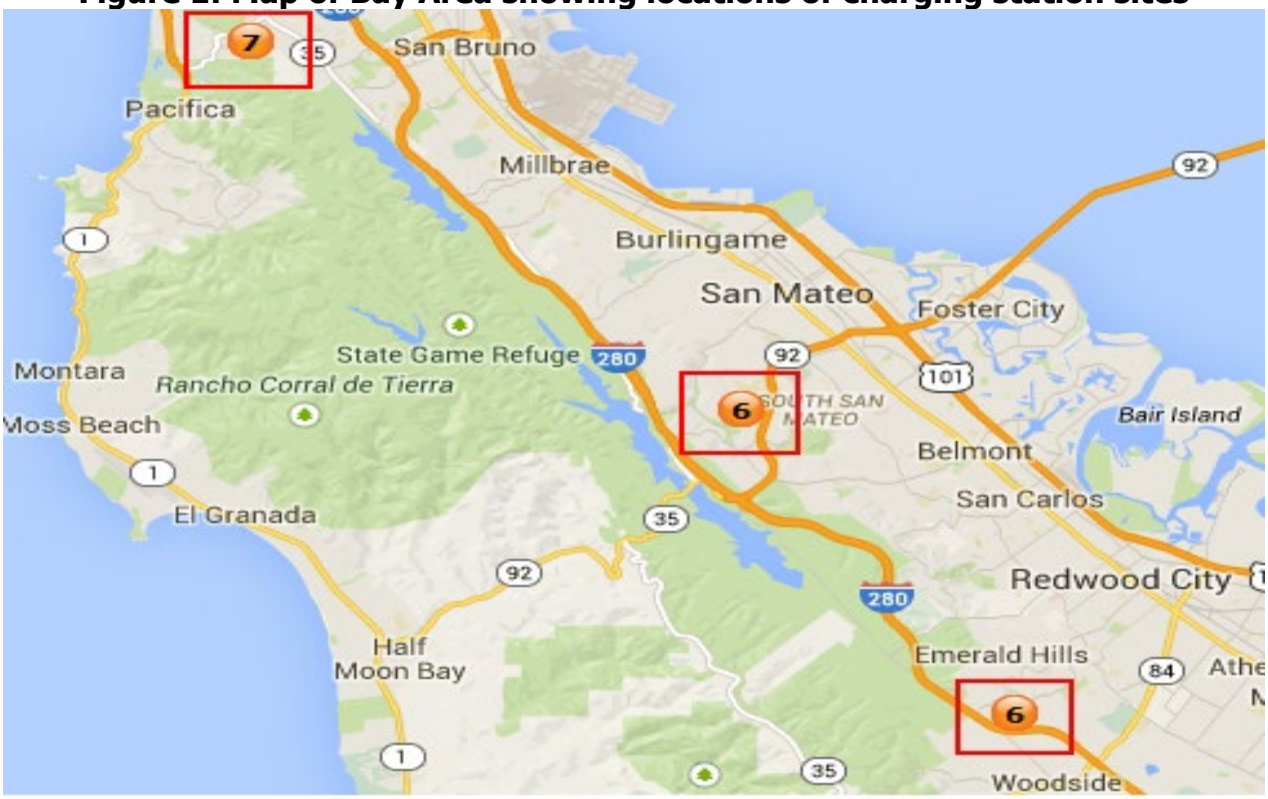
The College of San Mateo has over 10,000 students and 400 faculty and staff. The three dual port Level 2 EV charging stations is located at Galileo lot 8. This lot is high usage and visibility. The placement of the EV charging stations at this placement provides for optimal usage with those needing Americans with Disabilities Act requirements.

At Cañada College, three dual port Level 2 EV charging stations will be located parking lot one. These are very high use and visible parking areas of the campus. Cañada College serves over 7,000 students, faculty, and staff. The College hosts the following large events every year with an estimated attendance of over 25,000 visitors. Additionally, the college draws a large number of daily visitors to the Library/Learning Center and at events.

At Skyline College, the three dual port and one single port Level 2 EV charging stations are located in Parking Lot M, which is adjacent to the main college drop off and the most used entrance into the campus. This College serves over 11,000 students, faculty and staff each year.

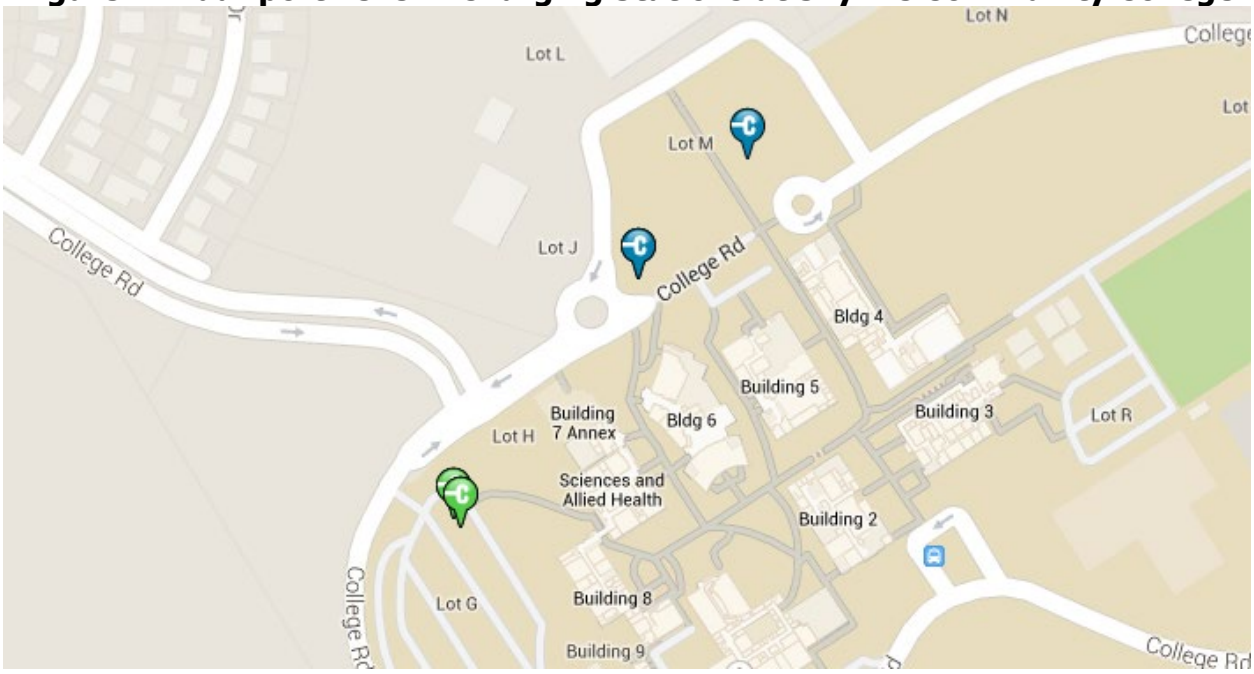
Figures 1 through 7 show the location of all ten dual-port level 2 charging stations.

Figure 1: Map of Bay Area showing locations of charging station sites



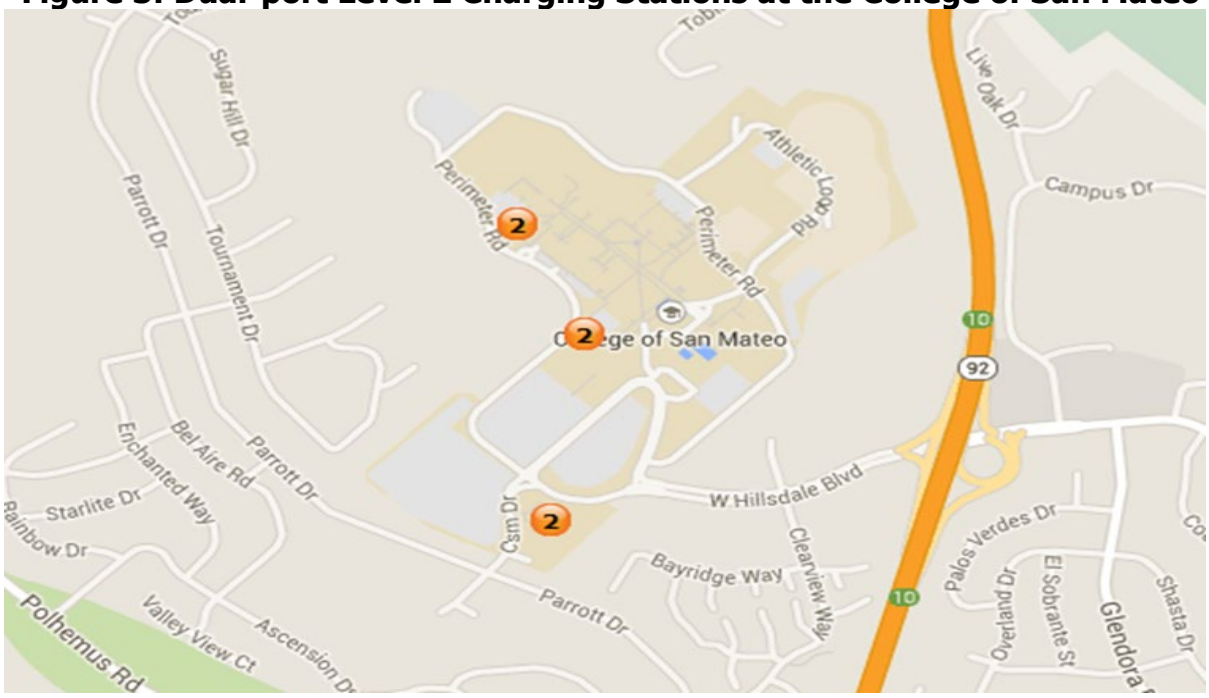
Source: Schneider Electric, Inc.

Figure 2: Dual-port Level 2 Charging Stations at Skyline Community College



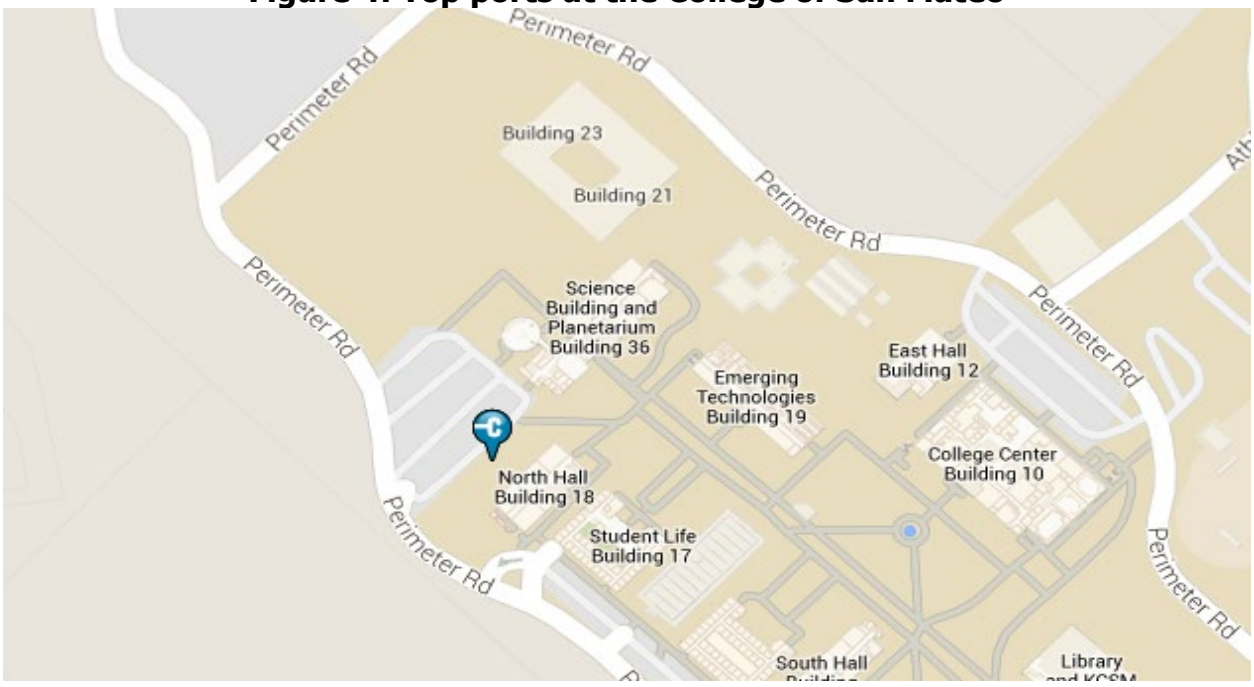
Source: Schneider Electric, Inc.

Figure 3: Dual-port Level 2 Charging Stations at the College of San Mateo



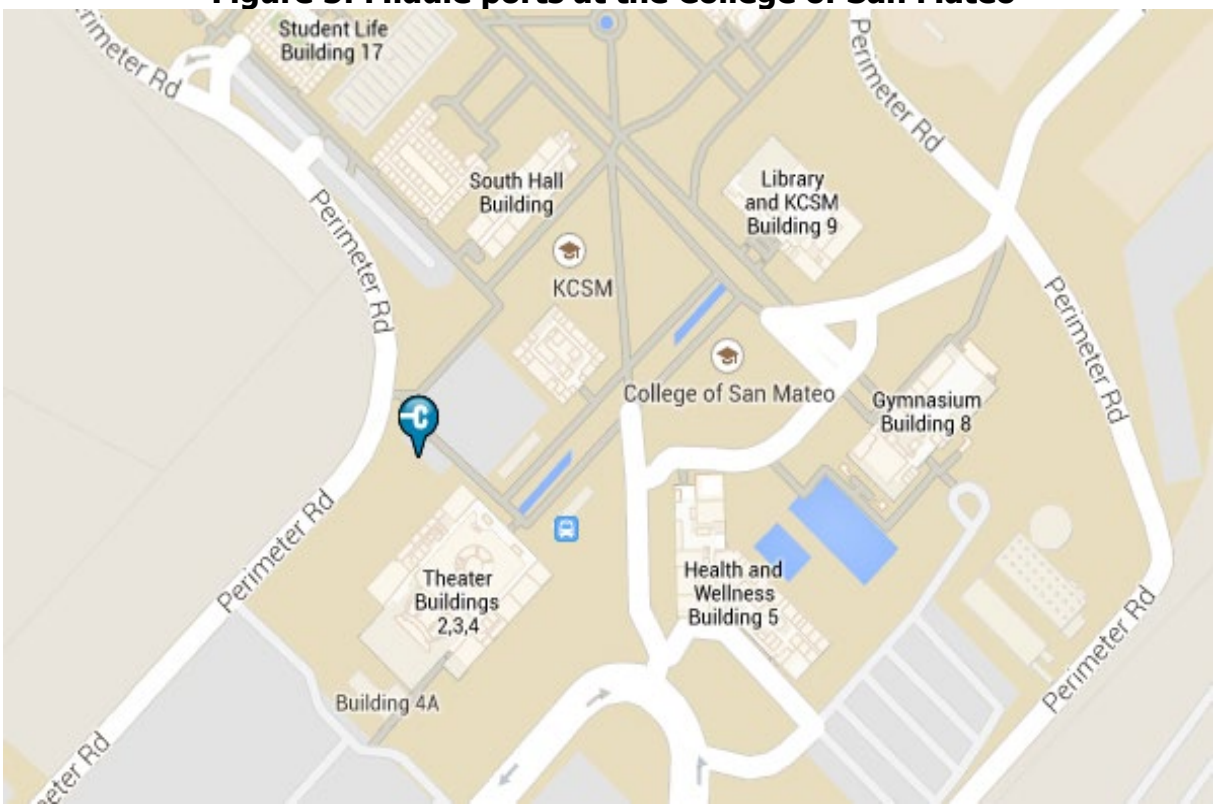
Source: Schneider Electric, Inc.

Figure 4: Top ports at the College of San Mateo



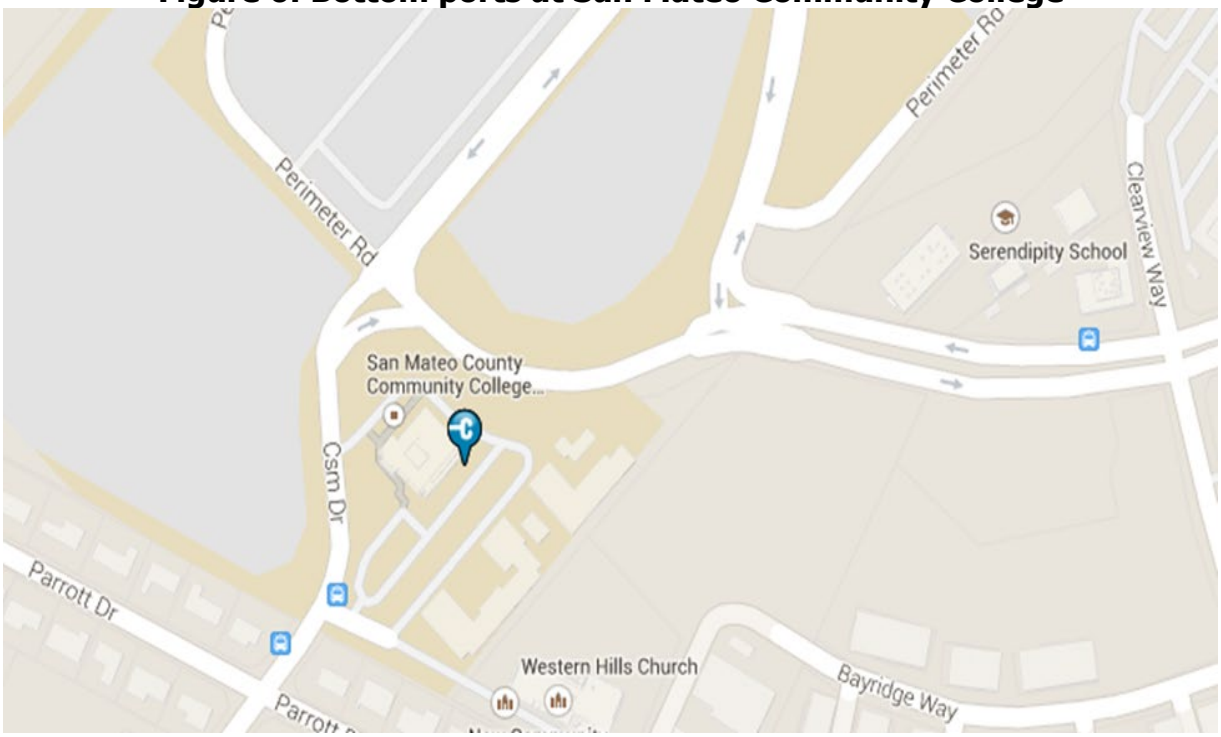
Source: Schneider Electric, Inc.

Figure 5: Middle ports at the College of San Mateo



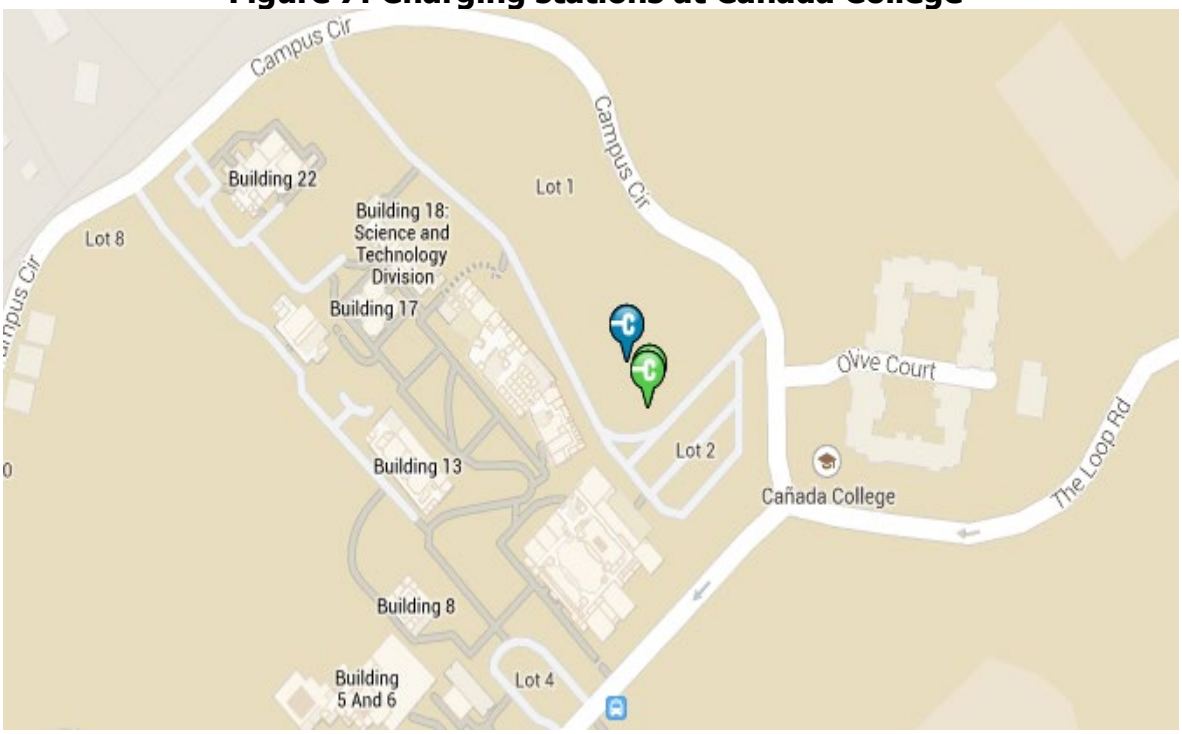
Source: Schneider Electric, Inc.

Figure 6: Bottom ports at San Mateo Community College



Source: Schneider Electric, Inc.

Figure 7: Charging stations at Canada College



Source: Schneider Electric, Inc.

Figure 8 through 14 shows images of the installed dual-port level charging stations at SMCCCD sites.

Figure 8: Installed dual-port Level 2 Charging Station

Source: Schneider Electric, Inc.

Figure 9: Installed dual-port Level 2 Charging Station

Source: Schneider Electric, Inc.

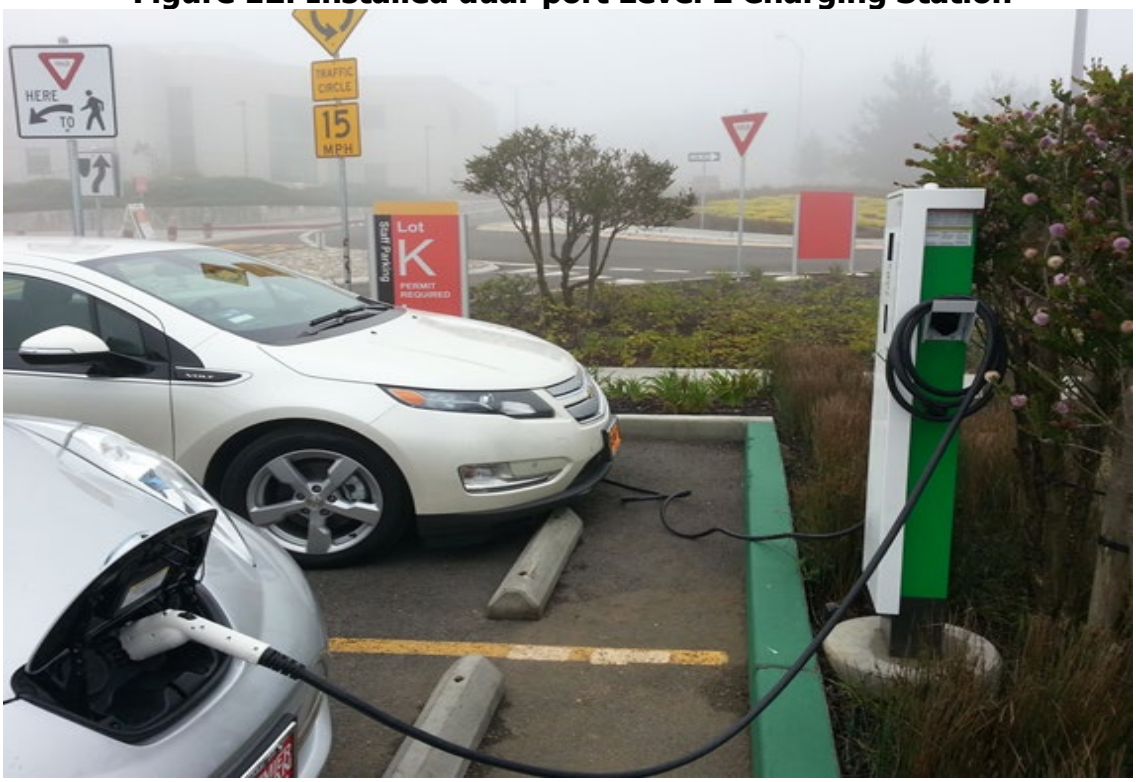
Figure 10: Installed dual-port Level 2 Charging Station

Source: Schneider Electric, Inc.

Figure 11: Installed dual-port Level 2 Charging Station

Source: Schneider Electric

Figure 12: Installed dual-port Level 2 Charging Station



Source: Schneider Electric, Inc.

Figure 13: Installed dual-port Level 2 Charging Station

Source: Schneider Electric, Inc.

Figure 14: Installed dual-port Level 2 Charging Station

Source: Schneider Electric, Inc.

CHAPTER 2

2.1 Activities and Results

Schneider and the SMCCCD delivered this project in partnership. The administration of the project occurred jointly, with Schneider taking lead responsibility for communicating with, and submitting deliverables to the CEC. The site assessment, procurement of permits, development of installation plans, and completion of installation was the responsibility of the SMCCCD facilities department with consultation from Schneider. Key college collaborators and Schneider staff were responsible for general reporting, including match, to the CEC. Schneider provided in-depth training to the College to complete commissioning of the charging stations. Schneider will maintain a two-year warranty with full replacement and onsite service guarantee. Upon installation and commissioning of the level 2 EV charging stations on campus, the SMCCCD would own and operate the EV charging stations.

Data collection was the responsibility of the SMCCCD and performed by each of the three college sites. Key faculty and workforce development staff on all three campuses prepared the data collection test plan and incorporated the collection of data and analysis into coursework for students studying in Environmental Science and Technology. This has enabled the SMCCCD to collect robust data on project usage, charging behavior and environmental benefits, and to report findings to the CEC and the campus community.

Charger and usage data was collected automatically through cellular General Packet Radio Service modem. The product architecture consists of an EV charging station cluster to include a minimum of one gateway unit tied to multiple non-gateway units. The gateway unit is tied to the data collection secure server using a cellular modem, which draws charger and usage data from non-gateway unit through low range wireless technology based on ZigBee.

Schneider and SMCCD developed the data collection test plan by collecting one year of throughput, usage, and operations data from the project from January to December 2014. Data collection was focused on gathering information on the number of vehicles using each charging station per day, the number of days per year the stations were used, the assessment of air emission reductions and the development of the project's carbon intensity values for life-cycle greenhouse gas emissions. Besides providing the basic required data for the project, the Schneider and SMCCCD partnership installed stations capable of collecting and continuously monitoring the charging station, including tracking the charging session data on how long and how often the charger is used.

The result of the project was the installation and completion of nine dual-port Level 2 charging stations and one single port charging station at the three SMCCCD sites. During a one-year period from January 1, 2014 and December 30, 2014, there were a total of 8,044 accumulated sessions reported at the nine dual-port Level 2 charging stations. During these sessions, there was an accumulated savings of 7,110 gasoline gallon equivalent (GGE) and an accumulated savings of 23,793 kilograms of greenhouse gases (GHGs).

2.2 Data Collection

Table 1 shows a summary of the charging sessions details tracked from January 1 to December 31, 2014. From January to October, the usage and GHG/GGE savings increased by 110%. November and December saw a slight decrease in usage due to the holidays, which is was also experienced by 95% of all EV customers during these months. In January 2015, usage increased above the usage levels from October 2014.

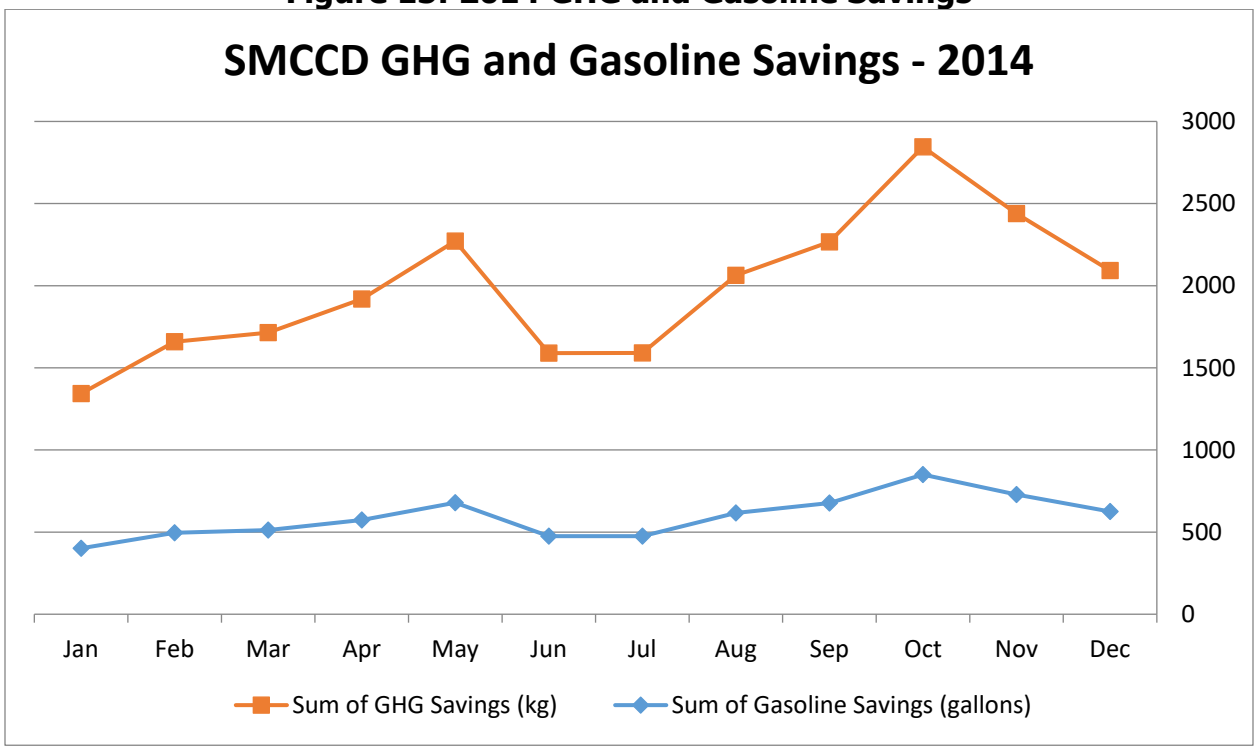
Table 1: 2014 GHG and Gasoline Savings

Months	Sum of Gasoline Savings (gallons)	Sum of GHG Savings (kilograms)
Jan	**401.354**	**1343.195**
Feb	**495.629**	**1658.656**
Mar	**512.101**	**1713.838**
Apr	**573.493**	**1919.264**
May	**678.833**	**2271.734**
Jun	**475.023**	**1589.749**
Jul	**475.36**	**1590.831**
Aug	**616.53**	**2063.241**
Sep	**677.282**	**2266.588**
Oct	**850.046**	**2844.766**
Nov	**728.723**	**2438.781**
Dec	**625.291**	**2092.571**
Grand Total	**7109.665**	**23793.214**

Source: Schneider Electric, Inc.

Figure 15 shows a chart of the 2014 GHG and GGE savings. The graph shows a steady increase in savings with a steadier increase beginning in July. The decrease in usage shown in November and December is due to holiday and vacation time. If the chart continued into January 2015, the graph would show a sharp increase above the usage shown in October.

Figure 15: 2014 GHG and Gasoline Savings



Source: Schneider Electric

Chapter 3

3.1 Advancements in Science

The project did not result in any specific advancements in science. However, since 2009, Schneider has worked to develop this unique EVlink charging solution for electric vehicles. Schneider's EVlink infrastructure solutions allows vehicle batteries to be charged safely, and optimizes the charging load according to the vehicle's needs and the power available in the grid.

The basic EVlink product line was launched in the United States in 2011.The next generation of EVlink – networked and with communication devices – was released in June 2012. Due to the built-in telecommunications system, the chargers inform users of their availability, charging status, and energy usage and send information to the vehicle's owner as well as the Schneider database when the charging process is complete. The SMCCCD charging stations are equipped with this next generation of EVlink, which is networked and with communication devices, and has served as a project to evaluate the new technology in an effort to continually improve the EV technology.

3.2 Public Assessment

In an effort to encourage employees to switch to electric vehicles, an "EV Rally" was held to mark the completion of the project and to generate interests and awareness. The rally consisted of a ribbon cutting and an electric vehicle tour of charging facilities at each campus. Local EV alliance members, representatives from the CEC, Pacific Gas and Electric Company, Schneider, members of the community and college staff, students and administrators were all present.

Chapter 4

4.1 Observations & Conclusions

Based on a combination of national, state, regional and local market trends as well as ongoing monitoring and analysis of usage of the charging infrastructure, additional EV infrastructure is planned for the future. SMCCCD anticipates adding 10 more charging stations available to EV drivers by the middle of 2016.

The data extracted over the course of a year showed that certain charging stations had more usage than others. The district office and College of San Mateo received the most usage as it is the main campus location in San Mateo. The other stations are located at the satellite campuses and these stations received less traffic. As there is more demand at the District Office and the College of San Mateo, upon expansion in the future, more charging stations will be installed at these high usage locations.

4.2 Recommendations

During the project period, SMCCCD encountered two issues. 1) The internal connector overheated at Skyline College. The action we took was to replace the station and all cables and power wires internal to other stations. The downtime to replace the station was five days, and the down time for station updates was one hour each. This happened in September 2014 and subsequent upgrades. 2) The non-gateway station was not communicating to the ChargePoint Network. The action taken was to replace the station. The downtime to replace the station was of two hours. This took place in January 2015.

Although it is unlikely that we could have prevented these issues, we did learn that training to customers in understanding station issues and troubleshooting procedures is imperative. Schneider has developed a service package that assists in coordinating station recovery and updates.

GLOSSARY

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 Energy Commission'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.

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

GASOLINE GALLON EQUIVALENT (GGE)—The amount of alternative fuel it takes to equal the energy content of one liquid gallon of gasoline. GGE allows consumers to compare the energy content of competing fuels against a commonly known fuel—gasoline. GGE also compares gasoline to fuels sold as a gas (natural gas, propane, and hydrogen) and electricity.

GREENHOUSE GAS (GHG)—Any gas that absorbs infrared radiation in the atmosphere. Greenhouse gases include water vapor, carbon dioxide (CO2), methane (CH4), nitrous oxide (NOx), halogenated fluorocarbons (HCFCs), ozone (O3), perfluorinated carbons (PFCs), and hydrofluorocarbons (HFCs).

SAN MATEO COUNTY COMMUNITY COLLEGE DISTRICT (SMCCCD)— A three college district located in the Silicon Valley between San Francisco and San Jose. The colleges serve more than 31,000 students each year and offer degree, transfer, and vocational-technical programs.