California Energy Commission
Alternative and Renewable Fuel and Vehicle Technology Program
FINAL PROJECT REPORT

Electric Vehicle Charging Infrastructure
Fremont Bayside Business Park

Prepared for: California Energy Commission
Prepared by: Fremont Chamber of Commerce
Gridscape Solutions

California Energy Commission
Edmund G. Brown Jr., Governor
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Primary Author(s):

Cindy Bonior, Fremont Chamber of Commerce
Vipul Gore, Gridscape Solutions

Fremont Chamber of Commerce
39488 Stevenson Place, Suite 100
Fremont, CA 94539
510-795-2244
www.fremontbusiness.com

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Prepared for:
California Energy Commission

Miki Crowell
Project Manager

Kevin Barker
Deputy Director
FUELS AND TRANSPORTATION DIVISION

Drew Bohan
Executive Director

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ACKNOWLEDGEMENTS

The Fremont Chamber of Commerce in partnership with Gridscape Solutions recognizes the California Energy Commission for its support of this project. Furthermore, the chamber recognizes the following organizations. Their support was critical in the successful acquisition and execution of this project.

City of Fremont
Delta Products Corporation
Prologis, Inc.
Royal Electric, Inc.
PREFACE

Assembly Bill (AB) 118 (Núñez, Chapter 750, Statutes of 2007), created the Alternative and Renewable Fuel and Vehicle Technology Program (ARFVTP). The statute authorizes the California Energy Commission (Energy Commission) 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 ARFVTP through January 1, 2024, and specifies that the Energy Commission 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 ARFVTP 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 ARFVTP, a project must be consistent with the Energy Commission’s ARFVTP Investment Plan, updated annually. The Energy Commission issued PON-13-606 to provide funding opportunities for Electric Vehicle Charging Infrastructure. In response to PON-13-606, the recipient submitted an application that was proposed for funding in the Energy Commission’s notice of proposed awards July 13, 2014, and the agreement was executed as ARV-14-015 on September 15, 2014.
ABSTRACT

This final report documents the process, approach, extent of success, and effect associated with the installation of open payment electric vehicle charging stations at the Fremont Bayside Business Park made possible through the California Energy Commission grant ARV-14-015. This report also provides an overview of the data collected over 10 months, as well as various observations and challenges faced during the project.

The project results show that the installation of the charging stations provided a critical addition to the availability of charging stations in Fremont (Alameda County), a city underserved for publicly available charging stations relative to cities of similar size in the San Francisco Bay Area. The stations were designed to provide workplace charging service not only to the employees of the Bayside Business Park and Fremont residents, but commuters traveling the Interstate 880 and I-680 corridors.

**Keywords**: California Energy Commission, Fremont Chamber of Commerce, Gridscape Solutions, Inc., City of Fremont, electric vehicle charging stations, clean energy, public-private partnership, open payment, workplace charging, commuter charging service

Please use the following citation for this report:

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EXECUTIVE SUMMARY

This final report prepared for the California Energy Commission meets the reporting requirement of Agreement ARV-14-015 with the Fremont Chamber of Commerce in partnership with Gridscape Solutions, Inc. and Prologis, Inc. This project installed and operated two electric vehicle (EV) direct current quick-charge (DCQC) stations and six dual-port EV Level Two charging stations that are publicly accessible and networked to EV drivers on I-880 and I-680. This project also served to satisfy the Fremont Chamber of Commerce’s responsibility to its members by offering innovative solutions for fostering the continued growth and economic development of Fremont while demonstrating the Fremont Chamber of Commerce’s commitment to sustainability and the reduction of greenhouse gases.
CHAPTER 1: Project Introduction

Background
The Fremont Chamber of Commerce, along with partners Gridscape Solutions and Prologis Business Park, was awarded a California Energy Commission grant ARV-14-015 in 2014 to design, launch, and operate an open-payment, standards-compliant electric vehicle (EV) charging infrastructure at the Fremont Bayside Business Park near Interstate 880 and I-680.

The project included the deployment of two Delta direct current quick-charge (DCQC) stations and six dual Schneider Level Two (L2) stations controlled and managed by a Gridscape ePay kiosk at four locations in the park as shown in Figure 1 below.

![Figure 1: Project Location](Source: Fremont Chamber of Commerce)

The project proposal called for 10 L2 charging stations with 10 ports for charging. However, it was found during procurement that the 10 L2 stations could be replaced with 6 dual charge stations at a reduced cost, providing 12 ports for charging instead. The installation of the chargers and the system were completed in December 2015. The systems have operated for 13 months with no interruptions.

Project Description
The Fremont Chamber of Commerce was the applicant and lead partner in this project in collaboration with Fremont-based partners Gridscape Solutions and Prologis, Inc. Moreover, the project was supported by the City of Fremont, Delta Products, and Schneider Electric. The location partner, Prologis, Inc., is the owner and operator of the
commercial property known as Bayside Business Park. Gridscape Solutions is a smart energy solutions company that provided the technical expertise for this project, as well as the open payment kiosks. As project supporters, Delta Products Corporation provided leading-edge DCQC stations with SAE International “Combo” and CHAdeMO ports; Schneider Electric provided L2 stations; and the City of Fremont assisted with meeting municipal requirements and permitting.

The cost for construction and installation of these charging stations was $391,672. Of this amount, the partners and supporters provided a total of $86,320 in a combination of cash and in-kind services to offset the costs of construction, installation, and setup. The California Energy Commission grant, $305,352, covered the balance of the cost.
CHAPTER 2:
Installation and Deployment

The design, testing and configuration of the system was carried out at Gridscape Solutions in Fremont (Alameda County). System installation and was completed by December 2015, fully deployed and in service.

Direct Current Quick Charge Stations – Vince’s Café

Figure 2 shows the actual deployment of two Delta DCQC stations along with the Gridscape ePay Kiosk.

Figure 2: DCQC Stations at Vince’s Café

Source: Gridscape Solutions
Level Two Stations – Seabridge Boulevard

Figure 3 shows the actual deployment of three Schneider dual L2 stations at Seabridge Boulevard, along with the Gridscape ePay Kiosk system.

Figure 3: L2 Stations at Seabridge Boulevard

Source: Gridscape Solutions
Level Two Stations – Clipper Avenue (Clipper #1)
Figure 4 shows one Schneider dual L2 station deployed at Clipper Avenue (Clipper #1), along with the Gridscape ePay Kiosk system.

![Figure 4: L2 Stations at Clipper Avenue (Clipper #1)](source)

Source: Gridscape Solutions

Level Two Stations – Clipper Avenue (Clipper #2)
Figure 5 shows two L2 stations deployed at another location on Clipper Avenue (Clipper #2), along with the Gridscape ePay kiosk system.

![Figure 5: L2 Stations at Clipper Avenue (Clipper #2)](source)

Source: Gridscape Solutions

Ribbon Cutting Ceremony
Figure 6 shows the ribbon cutting ceremony held by the Fremont Chamber of Commerce on May 12, 2016. Fremont Mayor Bill Harrison, along with key city officials and project stakeholders, were present to celebrate the launch of the EV charging stations. The ceremony and project were announced via a press release on Business Wire.
PlugShare Availability

The availability of the newly installed EV chargers was announced on PlugShare in March 2016, shortly after deployment. PlugShare is a free application for iOS, Android, and the Web that allows users to find and review charging stations and to connect with other plug-in vehicle owners. PlugShare provides the most accurate and complete public charging map worldwide, with stations from every major network in North America. According to PlugShare, most new EV owners sign up for a PlugShare account. More information and product download can be found at www.plugshare.com.
CHAPTER 3: Final Inspection and Test Report

The final inspection and testing were carried out at each site before the launch in December 2015. The final inspection and testing was carried out by Pacific Gas and Electric, as well as the City of Fremont Planning Department, who issued the permits for installation of the chargers.

The following sections detail inspection findings at each site and subsequent test success.

DCQC Stations Inspection at Vince’s Café
PG&E personnel inspected and tested the DCQC stations installation site on December 2, 2015. The inspection followed deployment, and the following work was completed:

- Installed a separate utility meter for the DCQC stations at Vince’s Café service panel.
- Tested power quality of the three-phase 480 volt (V) circuit at the DCQC stations.
- Executed a test charge with the help of Gridscape Solutions engineers to ensure the circuits are safe for use.

City of Fremont inspectors inspected the site for construction as per permit conditions on December 7, 2015.

L2 Charger Inspection at Seabridge Boulevard and Clipper Avenue
PG&E personnel inspected and tested the Schneider L2 stations installation site on December 2, 2015. The inspection followed deployment, and the following work was completed:

- Installed a separate utility meter for L2 chargers at respective service panels.
- Tested power quality of the single-phase 240V circuit at chargers.
- Executed a test charge with the help of Gridscape Solutions engineers to ensure the circuits are safe for use.

City of Fremont inspectors inspected the site for construction as per permit conditions on December 7, 2015.
CHAPTER 4: Usage and Data Collection

Data collection started in December 2015 at all stations. The cost charged to EV drivers for charging their vehicles was agreed upon between Gridscape Solutions and the Prologis management team.

The primary users of these EV chargers are:

- Employees of the various companies in the Prologis Business Park.
- Visitors to the business park.
- Visitors to Vince's Café while dining.
- Commuters on I-880, as well as Fremont Boulevard.

Project team members have seen a steady increase in number of transactions per station across all charger locations over the last several months. The two main events that triggered the increase in usage are the availability of chargers on PlugShare and the ribbon cutting ceremony marketing blitz announcing the availability of the chargers.

Table 1 summarizes the data collected from December 2015 to September 2016 from this project.

<table>
<thead>
<tr>
<th></th>
<th># of DCQC Transactions</th>
<th># of L2 Transactions</th>
<th>Energy Dispensed in kWh</th>
<th>GHG Displaced in kg*</th>
<th>Revenue Collected</th>
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<td>Dec-15</td>
<td>4</td>
<td>8</td>
<td>82.45</td>
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<td>Jan-16</td>
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<td>9</td>
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*Values in the "GHG displaced" column were derived by using the Environmental Protection Agency's GHG calculator. The calculator is available at [https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator](https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator).

Source: Fremont Chamber of Commerce
There is a steady increase in the use of the chargers. Use is expected to double by the end of 2016 and at least triple by the end of 2017 because of the following reasons:

- The number of EVs on the road especially in zip codes 94539 and 94538 has doubled since launching this project, according to the City of Fremont.

- Fremont Boulevard has been extended all the way to the South Bay since opening of this project, making it a major commute road for commuters traveling from the South Bay to the East Bay. Many EV drivers now stop at the charging stations for a quick charge during commute hours.

- The chargers are listed on PlugShare, as well as all other major EV charging maps and apps. As a result, the awareness of these locations has increased significantly.

- The price of the chargers has been modified to more closely reflect market rates.

- Prologis and Gridscape plan to offer promotions in 2017 to attract more drivers to these stations.

From the project team's data collection through September 2016, the project has already displaced 2,931 kilograms (kg) of greenhouse gases (GHG) just within nine months. From the anticipated increase in charging sessions in 2017, the project team believes the number will continue growing.

Project team members expect the total revenue collected in 2016 to exceed $2,500 and will exceed $5,000 by the end of 2017, as the project has already collected $1,773 through September 2016.

The number of EVs in the business park has grown significantly. During an initial project survey, there were 20 EVs in the business park. Gridscape conducted a manual survey in December 2016, there were more than 100 EVs in the business park between 12 and 2 p.m. on a workday. The project team believes that the park will have more than 150 EVs in the business park by the end of 2017.
CHAPTER 5: Observations and Challenges

This project was a very successful public-private partnership project. It not only helped achieve the goals laid out by the City of Fremont Climate Action Plan,¹ but allowed a multitenancy business park to implement clean energy infrastructure to attract more business to its park.

At the start of the project, there were only 20 EVs in the Prologis business park. As of December 2016, there are more than 100 EVs found in the business park. Most of these EVs use these charging stations to charge their vehicles either during work hours or commute hours. One of the project goals was a 500 percent increase in EVs. Following the completion of this project, the project team has seen a 1000 percent increase in EVs in the business park.

Moreover, included in the project objective was providing amenities attractive to businesses and create a business environment more in line with ecofriendly values, ultimately attracting more businesses to Fremont. Since the project inception, the occupancy rate at the Prologis Bayside Business Park has grown from 88 percent to 96 percent. The average downtime on vacant units has decreased from six months to three months. The average lease rates have gone from $1.15 per square foot to $1.65 per square foot. One of the top reasons cited by lessees as to why they chose this park versus competitors is the amenities that are provided, including the charging stations. It has been a very successful project for the business park.

In spite of the success, there were several hurdles and challenges that needed to be overcome during this project. Also, several useful observations were made that could potentially develop future issues, thereby creating opportunities for further innovation in the future. The list of these observations and challenges is below along with recommendations for overcoming these challenges and optimizing opportunities to allow for more smooth deployment of such infrastructure in the future.

- The PG&E electric rates for commercial business are very high. Hence, it is not affordable for multitenancy business park to recoup its investment in EV charging infrastructure in this market. For example, the PG&E rate for the Prologis business park ranges from $0.14/hour at night to $0.21/hour during day time. At the current EV charging rates of $4.50 per direct current (DC) charging session and $0.49/hour for the Level Two station session, it is impossible to recoup the investment. The EV

charger equipment and installation of the equipment has been close to $300,000. At the current charging rates, the return on investment will be more than 10 years.

**Recommendation:** PG&E should create a special EV charging rate for businesses similar to its residential EV charging rate plan.

- The EV charging installation cost is still very high. The issue is that the chargers need to be placed at a visible location in the parking area where EV drivers can easily find them. However, the electric service panel serving those chargers are located very far from the charger location. This issue causes an immense unnecessary increase in construction and trenching cost, thereby escalating the installation cost. In this project, the EV charger cost was about $70,000, while the installation cost for those chargers was in excess of $125,000.

**Recommendation:** California building code for business and commercial construction should be modified to ensure that single-phase 240V, as well as three-phase 480V power, is available at parking lots close to building access where EV chargers are most likely to be deployed. This modification will reduce installation costs tremendously.

- The unavailability of three-phase 480V power at commercial locations in California is a significant inhibitor for launching DCQC infrastructure. In this project, the project team had to deploy special-purpose step-up transformers to establish three-phase 240V power to three-phase 480V power for the two DCQC stations.

**Recommendation:** California building code for business and commercial construction should be modified to include easy availability of three-phase 480V at locations where DC fast charging equipment is most likely to be deployed.

- Integration of a low-cost, open-payment system using credit cards was bit of a challenge in this project. Most of the micropayment credit card processing systems are not designed to be unattended. The project team was able to locate a few vendors who were interested in working with the team. However, it was challenging to integrate the back office systems seamlessly. Currently, subscription-based EV charging systems are more predominant, so credit card payment systems are a bit behind. Most of the existing gas stations have credit card-based systems, and that’s where the market needs to be.

**Recommendation:** Further proliferation of open-payment credit card-based EV charging payment systems should be made mandatory to allow greater market acceptance and more vendors in this market.

- Tenant businesses within business parks need to be educated and made more aware of EVs, and they should create programs to encourage employees to adopt EV transportation.

**Recommendation:** Multitenancy business parks should work closely with tenant businesses to create joint awareness programs.

- While the project team still hasn’t reached demand charge threshold at its site, it expects it to happen as the usage of the DCQC stations increases. Most of the DCQC
stations deployed have demand charges. This is a huge problem that inhibits growth of DCQC stations.

**Recommendation:** Eliminate demand charges for DCQC stations from all investor owned utilities. Alternatively, create plans that allow for DCQC infrastructure to be deployed with energy storage solutions that addresses demand charges.
CHAPTER 6: Conclusions

This project has been a huge success, not only for the Fremont Chamber of Commerce, but for all stakeholders involved, namely, the City of Fremont, Gridscape Solutions, Prologis Bayside Business Park, and Delta Products Corporation. It has been a great public-private partnership that has set the stage for more partnership projects in the future. The project team thanks the California Energy Commission for awarding such an important and prestigious project.

The project team has provided monthly reports as required to provide details of the project and its progress on a monthly basis. This final project report summarizes the team's findings, observations, and challenges faced during the project.

Project team members are proud that this project was completed on time and within budget, and they were able to meet the goals and objectives established during the bid process.

As mentioned in Chapter 4 of this report, the use of the chargers increased steadily during the data collection period through September 2016, and the use is expected to double by the end of 2016 and at least triple by the end of 2017 with the expected number of EVs in the park to be more than 150 by the end of 2017.

Once again, the project team thanks you for giving it an opportunity to work on this project.
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