CALIFORNIA ENERGY COMMISSION

CALIFORNIA NATURAL RESOURCES AGENCY

California Energy Commission

Clean Transportation Program

**FINAL PROJECT REPORT**

# Burbank Charge 'N' Go Project

## Electric Vehicle Curbside Charging

**Prepared for: California Energy Commission**

**Prepared by: City of Burbank, Department of Water and Power**

CITY OF BURBANK Water and Power Since 1913

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# California Energy Commission

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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-13-606 to provide funding for 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-13-042 on April 16, 2014.

# ABSTRACT

The City of Burbank, Department of Water and Power commenced its Electric Vehicle program in 2011 with the installation of 11 electric vehicle chargers in parking lots, mostly in downtown Burbank. Through pricing and service experimentation, and feedback from drivers, the Department created a curbside charging concept in order to expand the charger network and meet multiple charging scenarios and needs.

With assistance from a California Energy Commission grant, in 2015 the Department installed 16 curbside chargers, bringing the total number of Department-operated public chargers to 27, throughout the 17-square mile area of Burbank. The chargers are located on the sidewalk in the public right of way and adjacent to public street parking spaces.

Burbank Water and Power's implementation of the curbside program depended on coordination with the Public Works Department for charger siting and parking space repurposing, the Police Department for enforcement, and the University of California, Los Angeles Luskin Center for optimal siting and usage analysis, and outreach to local businesses. In addition, the curbside program offers pricing and service conveniences such as off-peak pricing, retractable charging cords, and credit card payment options.

Curbside charging offers some advantages over parking lot charging, including additional usage by multi-unit dwelling residents, and for corridor travel. In addition, drivers may prefer faster Level 2 chargers over slower Level 1 chargers, but still cite charger availability and parking enforcement as a concern.

Burbank Water and Power continues to monitor usage of both the curbside and parking lot chargers, with the eventual goal of further cost-effective expansion of the charger network. The curbside electric vehicle program offers a model for charging infrastructure that is state sponsored, public agency-operated, and publicly available.

**Keywords:** California Energy Commission, City of Burbank, Burbank Water and Power, Electric Vehicles, Curbside Chargers

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# EXECUTIVE SUMMARY

## Introduction

The California Energy Commission's Clean Transportation Program funds projects to meet the harmonious goals of greenhouse gas emissions reductions related to AB 32, and 1.5 million zero emissions vehicles on the road by 2025 related to the Governor Brown's zero emissions vehicles Action Plan.

As an electric utility, Burbank Water and Power, a department of the City of Burbank, is well-positioned to implement projects that will help to achieve both goals, while also fulfilling the core mission of the utility - providing reliable, affordable, and sustainable service to the residents and businesses of the city.

## Background and Purpose

Burbank Water and Power commenced its Electric Vehicle program in 2011 with the installation of 11 electric vehicle chargers in parking lots, mostly in downtown Burbank. Through subsequent pricing and service experimentation, and feedback from drivers, Burbank Water and Power created a curbside charging concept to expand the charger network and meet multiple charging scenarios and needs, including the siting of chargers that would be proximate and accessible to residents of multi-unit dwellings. These public chargers, along with BWP's electric vehicle charger rebates and Time of Use pricing options, work together to increase electric vehicle penetration and help meet the State's goals regarding electric vehicle adoption.

In 2015, with assistance from a Clean Transportation Program grant, Burbank Water and Power installed 16 curbside chargers, bringing the total number of its owned and operated public chargers to 27, throughout the 17-square mile area of Burbank. The curbside chargers are located on the sidewalk in the public right of way and adjacent to public street parking spaces.

## Results and Findings

Curbside charging offers some advantages over parking lot charging, including additional usage by multiple unit dwelling residents, and for corridor travel. In addition, drivers may prefer faster Level 2 chargers that are generally available to the public over slower Level 1 chargers that are generally available at home and the workplace. Furthermore, as electric vehicle drivers still cite charger availability and parking enforcement as a concern, curbside charging may be advantageous since the City of Burbank can conduct parking enforcement with greater ease and speed.

Prior to installing the chargers, Burbank Water and Power contracted with the University of California, Los Angeles Luskin Center for Innovation for site analyses to evaluate the preferred curbside locations identified by city staff to determine if these sites were optimal sites for maximal charger use, and if there were other sites that may be better choices. Some of sites were not selected because of this analysis, and other preferred sites identified by University of California, Los Angeles were not used due to additional costs associated with the location of available power supplies.

Implementation of the curbside program necessitated additional internal and external coordination due to the need to establish new public policies and public outreach required to finalize the curbside locations. Burbank Water and Power's curbside program depended on coordination with the Public Works Department for charger siting within the public right of way; parking space repurposing, signage, and updating the existing parking policy; and with the Police Department for enforcement. Non-curbside chargers that are typically sited in parking lots may only require a right-of entry agreement with the parking lot or property owner or operator; which may be a lengthy process, but it is typically with only one entity. Curbside projects required interaction with multiple departments and public noticing given the public location of the chargers, not required of chargers located within parking lots. Being a full-service City with its own electricity generation may have eased the coordination effort as opposed to a City that would need coordinate with other outside electric service providers.

The University of California, Los Angeles Luskin Center measured the utilization of the curbside chargers, with regards to charging sessions and energy disbursed, in total and by location. In addition, the usage of the existing parking lot chargers provided a baseline against which to compare curbside charger usage. After six-months of utilization, usage continues to increase, and customer satisfaction remains high with the curbside chargers, and BWP's overall electric vehicle program. Outreach to local businesses to discuss the benefits of the project and reassure their patrons that these public street parking spaces were being re-purposed and not removed was also an important aspect of the project.

Burbank Water and Power sought and incorporated feedback from electric vehicle customers to help shape the curbside program and in the selection of curbside locations. We feel this outreach and the data provided the University of California, Los Angeles Luskin Center for Innovation regarding traffic volumes and electric vehicle ownership contributed significantly to the success of this program.

## Conclusions

Burbank Water and Power developed its electric vehicle program to accomplish four primary goals: 1) balance the grid, 2) enhance customer service, 3) reduce range anxiety, and 4) promote clean technologies that reduce greenhouse gas emission. After six months of implementation and activity, the curbside charging program, as part of the overall electric vehicle program, is continuing to accomplish these four goals.

First, electric vehicle charging gives Burbank Water and Power an additional source of electric load to offset decreases in electric sales due to energy efficiency and distributed generation. BWP can continue to incentivize and absorb additional charger usage during off-peak hours without significant impacts to the grid.

In addition to the new source of load, Burbank Water and Power is now able to offer electric vehicle charging as a new service to both existing customers and those visiting from outside the city. Burbank businesses that are proximate to the chargers can entice their employees with electric vehicles to use the nearby public chargers, especially if their workplace is not feasible for workplace charging.

The public chargers also serve the purpose of reducing range anxiety in a city and region where light-duty passenger vehicles are the primary mode of transportation. electric vehicle drivers can now feel confident that there is an electric vehicle charger within one mile of any location in the city.

The electric vehicle program to promote charger usage and electric vehicle adoption coincides with Burbank Water and Power's electric system bringing on more renewable energy, currently at 33 percent of load and increasing to 50 percent by 2030. Thus, transportation-related emissions will continue to decrease, including greenhouse gas emissions and criteria pollutants.

Burbank Water and Power continues to monitor usage of both the curbside and parking lot chargers, with the eventual goal of further cost-effective expansion of the charger network. BWP believes the curbside program is a model for charging infrastructure that is supported by state programs, public agency-operated, and publicly available.

# CHAPTER 1:
# BWP's Electric Vehicle Charging Program

## Project Overview

The City of Burbank, Department of Water and Power (BWP) instituted its electric vehicle (EV) program in 2011 with the installation of publicly-owned and operated EV charging stations. As a result of the program's resounding success, BWP proposed to expand the program beyond conventional charger siting and explore the use of curbside chargers. The chargers would be located on the sidewalk in the public right of way and adjacent to public street parking spaces. The curbside chargers would serve multiple charging needs, including corridor charging, destination charging, workplace charging, and multiple unit dwellings (MUD).

BWP's EV Charge N' Go project included the installation of sixteen Level 2 chargers at eight sites located curbside at diverse locations along major streets in Burbank. This project increases the number of BWP's public EV chargers to 27 and provides another service offering to Burbank's residents, businesses, and visitors.

## Current Activities

BWP is a community-owned utility serving the City of Burbank since 1913 with safe, reliable, affordable, and sustainable electric and water service. As an electric utility, BWP is well-positioned to implement a strategy of transportation electrification, providing cleaner electric energy to fuel our community's transportation needs. Through the installation of public chargers, charger rebates, and time-of-use (TOU) pricing, BWP has been promoting greater adoption of battery and plug-in EV. The community benefits through cleaner air, reduced greenhouse gas (GHG) emissions, and reduced household expenses for residents. BWP also benefits through a new source of electric demand that can provide grid stability as the state mandates the increased use of renewable energy and customers increasingly reduce their reliance on the electric grid through rooftop solar.

BWP began our EV program in 2011 with the installation of eleven chargers utilizing off-street parking at six convenient sites, five in downtown Burbank and one at a shopping center off the 134 Freeway. Since the chargers were installed in December 2011, utilization of these chargers has doubled every year and these EV-only parking spaces are now occupied more than fifty percent of the time.

in order to provide Burbank residents with the flexibility to charge their EVs at home in addition to in the public, BWP also began offering both a $100 bill credit for Level 1 or 2 charging equipment, and an optional, early-adopter whole home TOU rate for EV drivers to charge their vehicles at off-peak hours at night for less than the standard per kilowatt-hours (kWh) rate. Through these incentives, BWP has been able to track EV penetration and gather customer data for planning and market research purposes. As of July 1, 2015, BWP replaced the bill credit, and instituted a new rebate program, providing up to $500 for Level 2 charging equipment for residents, and up to $1,000 for businesses.

Through our EV program and the support of the City's Burbank2035 General Plan, which supports EVs and the required infrastructure, BWP has become recognized as a leader in the EV marketplace. BWP staff have given presentations at several utility and energy services-

focused conferences to summarize our program and activities, furthering industry knowledge and promoting implementation at public utilities, both large and small.

## Curbside Concept

EV chargers have historically been located in off-street parking lots, which are adjacent to drivers' end destinations and offer more space for charging equipment. However, parking lots are generally owned and operated by third-parties, requiring permission for BWP and other entities to install charging equipment. While verbal permission can be received by BWP fairly easily, the development and approval of a formal right-of-entry agreement can take months; BWP has two recent experiences that have collectively taken more than three years. By comparison, all 16 curbside chargers were designed, permitted, installed, and operational within six-months.

Using the curbside concept, BWP sought to streamline the installation process, experiment with charger siting and placement, and increase the physical visibility of chargers among EV drivers and the general public. As the entire Burbank community, inclusive of EV drivers, residents, business owners, employees, and patrons, and visitors begin to see Burbank's EV chargers as permanent and reliable infrastructure, they are more likely to accept EVs as a standard form of transportation and consider the lease or purchase of an EV.

The siting and placement of curbside chargers may also be more convenient for EV drivers by increasing visibility and ease of access. In contrast, EV drivers may spend extra time driving around a parking lot looking for the charger due to fact that physical signage and smartphone charging apps may not have the precise location of the charger in a parking lot. Furthermore, parking enforcement officers will be better able to ensure the charging sites are not being occupied for too long and/or by non-electric vehicles with a curbside charger.

The City's curbside chargers were located on major streets having at least two lanes in each direction to provide easier access to and from freeways and partially address corridor charging. Corridor charging is typically facilitated through Direct Current (DC) Fast Chargers, which can charge compatible cars from a depleted battery to full charge in about 30 minutes, so that EV drivers are able to get to their end destination using freeways with little more time at a charging station than they would have at a gas station. However, corridor charging can also be addressed using Level 2 chargers installed at curbside locations that are proximate – less than a half mile away – to freeways. Level 2 chargers are also an important and viable option for corridor use due to the fact that the equipment and installation costs are significantly less than DC chargers and some electric vehicles are not able to use DC chargers.

## Curbside vs. Parking Lot

For EVs to gain public acceptance as something more than a commuter car and increase in penetration, BWP and EV charger installers need to ensure that public chargers address all charging needs. This includes corridor charging, destination charging, workplace charging, and residential MUD. While parking lot chargers have certain advantages, curbside chargers may be more comprehensive in terms of addressing all charging scenarios.

Table 1 shows whether curbside and parking lot chargers address each of the various charging scenarios.

**Table 1: Curbside Versus Parking Lot**

| Charging Scenario / Site Type | Curbside | Parking Lot |
|---|---|---|
| Corridor | Yes | No |
| Destination | Yes | Yes |
| Workplace – Large Business | No | Yes |
| Workplace – Small Business | Yes | Yes |
| MUD – Large | Yes | Yes |
| MUD - Small | Yes | Yes |

Source: Burbank Water and Power

# CHAPTER 2:
# Curbside Program Implementation

The implementation of the curbside charging project consisted of four phases: 1) site selection and outreach, and 2) equipment selection, and construction and installation, and 3) parking enforcement and 4) data collection. Each of the phases are described in detail below.

## Site Selection Overview

After the success of the initial EV program, BWP sought to expand the program by installing publicly available EV chargers at new sites through Burbank. BWP staff toured the city and used the following criteria to select potential charging location sites - proximity to freeways, destinations, and MUDs, electrical infrastructure access, unmet charging needs, and accessibility and safety. BWP also relied on the results of an online survey sent to Burbank community members and EV market participants. From this process, BWP selected an initial list of 11 charging locations (Table 2).

**Table 2: Final Proposed Charging Locations**

| Site # | Site Address - Proposal | Site Address - Actual | Land Use |
|---|---|---|---|
| 1 | 2128 N Glenoaks Blvd | 2116 N Glenoaks Blvd. | Commercial / Single Family |
| 2 | 558 N Glenoaks Blvd | 520 N Glenoaks Blvd. | Commercial / Multifamily |
| 3 | 530 S Glenoaks Blvd | 537 S Glenoaks Blvd. | Commercial |
| 4 | 1024 N Hollywood Way | 1026 N Hollywood Way | Commercial / Single Family |
| 5 | 1011 N San Fernando Blvd | 1104 N San Fernando Blvd | Commercial Retail |
| 6 | 335 N Buena Vista St | 351 N Buena Vista St | Park / Library / Single Family |
| 7 | 1071 W Alameda Ave | 1113 W Alameda Ave | Commercial |
| 8 | 2030 N Hollywood Way | 2034 N Hollywood Way | Commercial / Single Family |
| 9 | 3475 Warner Blvd | Not Applicable | Studios |
| 10 | 164 N Glenoaks Blvd | Not Applicable | Municipal / Commercial |
| 11 | 2879 Parkside Ave | Not Applicable | Studios |

Source: Burbank Water and Power

## Final Charging Location Sites

Once BWP selected site locations based on geographic coverage and EV driver feedback, the sites were then validated using the University of California, Los Angeles (UCLA) Luskin Center for Innovation's modeling methods focused on maximizing charge station utilization by identifying travel patterns between census tracts where EV drivers actually reside, work and shop[1]. This was combined with land use data on local densities of workplaces, MUDs and retail establishments, and data on pre-existing charging station locations. Finally, demographics data and the characteristic of the local transportation system were used as described in the

[1] DeShazo, JR PhD., and Chiachia Song, 2015. *Site Selection Planning for Curbside Plug-in Electric Vehicle Charging in Burbank.* Luskin Center for Innovation, University of California, Los Angeles.

Southern California PEV (Plug-in Electric Vehicle) Readiness Plan (written by the UCLA Luskin Center and winner of the 2013 Planning Excellence Award by the Los Angeles section of the American Planning Association).[2]

The UCLA Luskin Center for Innovation's analysis gave each location a relative utilization score, indicating the estimate level of charger usage relative to another location. The utilization scored was based on a statistical model of charge station utilization based on the utilization rates of other Burbank charging stations as well as 210 other charging stations within Los Angeles County. Additional characteristics used for initial site selection also included multiple criteria including, land use, traffic volumes, proximity to social and work resources, the proximity to multi-family unit dwellings, and proximity to freeways. Based on the utilization score, installation cost estimates, and ability to satisfy multiple charging scenarios, BWP selected eight locations as final curbside charger sites; detailed information about each site is provided hereafter.

The final eight sites selected were:

- 2116 N Glenoaks Blvd
- 520 N Glenoaks Blvd
- 537 S Glenoaks Blvd
- 1026 N Hollywood Way
- 1104 N San Fernando
- 340 N Buena Vista St
- 1113 W Alameda Ave
- 2034 N Hollywood Way

### 2116 N Glenoaks Blvd

This curbside charger location serves as a destination charger located near food services, community services (Masonic Temple, Scientology Mission) and centered between several MUDs on nearby streets. The charger in this location provides EV owners a location to charge their car while visiting one of the nearby businesses or for MUD residents to charge their EVs without reducing street parking adjacent to the MUD property. These characteristics are listed in Table 3.

- Utilization Score: 0.68
- Predominant Adjusted Land Use: Commercial retail surrounded by single family homes
- PEV Density by Trips: 3.7 (morning), 3.2 (midday)

[2] Southern California Plug-In Electric Vehicle Readiness Plan, UCLA Luskin Center for Innovation https://www.scag.ca.gov/Documents/SCAG-Southern%20CA%20PEV%20Readiness%20Plan.pdf

**Table 3: 2116 N. Glenoaks Blvd Characteristics**

| | |
|---|---|
| **Local Driver Characteristics** | |
| EV registrations (w/in 1,000 ft.) | 2.0 vehicles |
| Income level | $56,800 |
| Single family residential units | 174 |
| Multi-unit dwellings | 70 |
| **Visibility** | |
| Distance to nearest major intersection | 3,224 ft. |
| **Accessibility** | |
| Distance to nearest freeway ramp | 2,058 ft. |

Source: UCLA Luskin Center

### 520 N. Glenoaks Blvd.

This curbside charger location serves as a destination charger located near retail businesses, Burbank High School, and is centered between several MUDs on nearby streets. This charger provides EV owners a location to charge their car while visiting one of the nearby businesses or for MUD residents to charge their EVs without reducing street parking adjacent to the MUD property. These characteristics are listed in Table 4.

- Utilization Score: 0.83
- Predominant Adjusted Land Use: Commercial retail surrounded by MUDs
- PEV Density by Trips: 3.2 (morning), 3.6 (midday)

**Table 4: 520 N. Glenoaks Blvd. Characteristics**

| | |
|---|---|
| **Local Driver Characteristics** | |
| PEV registrations (w/in 1,000 ft) | 0.9 vehicles |
| Income level | $53,431.70 |
| Single family residential units | 88 |
| Multi-unit dwellings | 141 |
| **Visibility** | |
| Distance to nearest major intersection | 801 ft. |
| **Accessibility** | |
| Distance to nearest freeway ramp | 2,087 ft. |

Source: UCLA Luskin Center

### 537 S Glenoaks Blvd

This curbside site in located near MUDs, small retail businesses and small business employers. These characteristics are listed in Table 5.

- Utilization Score: 0.97
- Predominant Adjusted Land Use: Commercial retail surrounded by multi-unit dwellings
- PEV Density by Trips: 4.0 (morning), 3.3 (midday)

**Table 5: 537 S. Glenoaks Blvd. Characteristics**

| **Local Driver Characteristics** | |
|---|---|
| PEV registrations (w/in 1,000 ft.) | 1.6 vehicles |
| Income level | $47,486 |
| Single family residential units | 151 |
| Multi-unit dwellings | 141 |
| **Visibility** | |
| Distance to nearest major intersection | 1,928 ft. |
| **Accessibility** | |
| Distance to nearest freeway ramp | 2,732 ft. |

Source: UCLA Luskin Center

### 1026 N. Hollywood Way

This charging location is in a busy, retail shopping area of Burbank. Nearby are a popular deli/bakery, retail stores and banking. Two blocks away are several MUDs and other residential areas. The site is approximately 1 mile from the Ventura freeway (SR134), and also supports workplace charging for employees of the retail businesses. These characteristics are listed in Table 6.

- Utilization Score: 0.75
- Predominant Adjusted Land Use: Commercial retail surrounded by single family homes
- PEV Density by Trips: 2.1 (morning), 2.1 (midday)

**Table 6: 1026 Hollywood Way Characteristics**

| **Local Driver Characteristics** | |
|---|---|
| PEV registrations (w/in 1,000 ft.) | 2.8 vehicles |
| Income level | $73,232.50 |
| Single family residential units | 159 |
| Multi-unit dwellings | 62 |
| **Visibility** | |
| Distance to nearest major intersection | 400 ft. |
| **Accessibility** | |
| Distance to nearest freeway ramp | 6,414 ft. |

Source: UCLA Luskin Center

### 104 N. San Fernando Blvd.

This location supports the charging needs of those visiting this very busy retail area that includes a grocery store, Kmart, CVS Pharmacy, and numerous eateries and stores. This location is approximately ½ mile from the Burbank Media Center Shopping Center and Mall. The Burbank Mall currently has parking lot chargers that are heavily utilized by EV drivers visiting the shopping center and area.

This new charger site is located within ¼ mile of the Interstate 5 freeway and is along the arterial street traveled by those going to the Burbank International Airport and the Metrolink station. This is a heavily visited retail area that serves multiple charging purposes (e.g. destination, corridor, workplace charging with public access). Many local driver characteristics

do not apply to this location due to its surrounding land use. These characteristics are listed in Table 7.

- Utilization Score: 0.72
- Predominant Adjusted Land Use: Commercial retail
- PEV Density by Trips: N/A

**Table 7: 1104 N. San Fernando Blvd. Characteristics**

| **Local Driver Characteristics** | |
|---|---|
| PEV registrations (w/in 1,000 ft.) | N/A |
| Income level | N/A |
| Single family residential units | N/A |
| Multi-unit dwellings | N/A |
| **Visibility** | |
| Distance to nearest major intersection | N/A |
| **Accessibility** | |
| Distance to nearest freeway ramp | 1,320 ft. |

Source: UCLA Luskin Center

### 340 N. Buena Vista St.

This charging location is adjacent to the Abraham Lincoln Park, Buena Vista Library, and MUDs, and is within less than 1 mile of the Ventura Freeway (SR134). The Park and the Library are very well visited, providing an excellent location for EV drivers. It is also located within less than 1 mile from the proposed charger near Johnny Carson Park. This is important for those EV drivers needing a charger, only to find it occupied; having multiple chargers within a given area helps ease anxiety associated with searching for a charger. This was an important concern for respondents to the online survey. These characteristics are shown in Table 8.

- Utilization Score: 0.84
- Predominant Adjusted Land Use: Municipal buildings and single-family homes
- PEV Density by Trips: 8.0 (morning), 3.9 (midday)

**Table 8: 340 N. Buena Vista St. Characteristics**

| **Local Driver Characteristics** | |
|---|---|
| EV registrations (w/in 1,000 ft.) | 5.6 vehicles |
| Income level | $71,238.70 |
| Single family residential units | 215 |
| Multi-unit dwellings | 162 |
| **Visibility** | |
| Distance to nearest major intersection | 1,329 ft. |
| **Accessibility** | |
| Distance to nearest freeway ramp | 4,655 ft. |

Source: UCLA Luskin Center 1

### 1113 W. Alameda Blvd.

This charging location is adjacent to the Burbank branch of the AutoClub of Southern California, and across from a shopping mall and Starbucks. Additionally, this location is conveniently located near a MUD complex for evening/night charging. These characteristics are shown in Table 9.

- Utilization Score: 0.85
- Predominant Adjusted Land Use: Commercial retail
- PEV Density by Trips: 10.8 (morning), 4.4 (midday)

**Table 9: 1113 W. Alameda Blvd. Characteristics**

| | |
|---|---|
| **Local Driver Characteristics** | |
| EV registrations (w/in 1,000 ft.) | 3.0 vehicles |
| Income level | $61,815 |
| Single family residential units | 58 |
| Multi-unit dwellings | 17 |
| **Visibility** | |
| Distance to nearest major intersection | 2,713 ft. |
| **Accessibility** | |
| Distance to nearest freeway ramp | 3,522 ft. |

Source: UCLA Luskin Center

### 2034 N. Hollywood Way

This charging location is adjacent to the Burbank Athletic Club, as well as retail businesses on both sides Hollywood Way and Victory Blvd, the cross street. These characteristics are shown in Table 10.

- Utilization Score: 0.83
- Predominant Adjusted Land Use: Commercial retail surrounded by single family homes
- PEV Density by Trips: 2.0 (morning), 1.8 (midday)

**Table 10: 2034 N. Hollywood Way Characteristics**

| | |
|---|---|
| **Local Driver Characteristics** | |
| EV registrations (w/in 1,000 ft.) | 1.0 vehicles |
| Income level | $72,896.50 |
| Single family residential units | 155 |
| Multi-unit dwellings | 11 |
| **Visibility** | |
| Distance to nearest major intersection | 137 ft. |
| **Accessibility** | |
| Distance to nearest freeway ramp | 7,256 ft. |

Source: UCLA Luskin Center

## Alternative Charging Location Sites

BWP also included three alternate locations based on a similar methodology and with similar characteristics in the event that any of the preferred locations were not able to include in the final project.

These sites were:

- 3475 Warner Blvd.
- 164 N. Glenoaks Blvd.
- 2879 Parkside Avenue
- 3475 Warner Blvd.

Located curbside to the main gate to the Warner Bros. Studios provides an excellent location for workplace charging for employees and public charging for visitor of the Studios. Additionally, this location is conveniently located near a MUD complex for evening/night charging. Warner Bros. Studio was very supportive of this location during project discussions. This location will be evaluated for the potential use of a multiplex charging unit in the future. These characteristics are shown in Table 11.

- Utilization Score: 1.02
- Predominant Adjusted Land Use: Entertainment studios
- PEV Density by Trips: 11.6 (morning), 3.5 (midday)

**Table 11: 3475 Warner Blvd. Characteristics**

| | |
|---|---|
| **Local Driver Characteristics** | |
| EV registrations (w/in 1,000 ft.) | 2.3 vehicles |
| Income level | $81,987 |
| Single family residential units | 21 |
| Multi-unit dwellings | 16 |
| **Visibility** | |
| Distance to nearest major intersection | 1,018 ft. |
| **Accessibility** | |
| Distance to nearest freeway ramp | 698 ft. |

Source: UCLA Luskin Center

164 N Glenoaks Blvd

This location was selected to serve as a destination, corridor, workplace charging and for MUD residents, plus the added benefit of being located at the Burbank Central Library. These characteristics are shown in Table 12.

- Utilization Score: 0.74
- Predominant Adjusted Land Use: Municipal buildings and commercial retail
- PEV Density by Trips: 4.3 (morning), 3.6 (midday)

**Table 12: 164 N. Glenoaks Blvd. Characteristics**

| **Local Driver Characteristics** | |
|---|---|
| EV registrations (w/in 1,000 ft.) | 0.7 vehicles |
| Income level | $35,854 |
| Single family residential units | 41 |
| Multi-unit dwellings | 3 |
| **Visibility** | |
| Distance to nearest major intersection | 528 ft. |
| **Accessibility** | |
| Distance to nearest freeway ramp | 2,534 ft. |

Source: UCLA Luskin Center

2879 Parkside Avenue (aka Johnny Carson Park)

The Johnny Carson Park is one of Burbank's largest and most utilized parks within the City. This park is bordered by California Highway 134 (aka Ventura Freeway) between the W. Riverside Drive and Bob Hope Drive exits, Bob Hope Dr., Parkside Drive, and the Providence St. Joseph's Medical Center and Providence High School. This Park hosts events year around that attract thousands of visitors and is located near the heavily visited NBC/Disney and Warner Bros. Studios.

This location has the benefit of serving a variety of EV owner needs including destination charging while visiting the park, St. Joseph's Hospital, or the Studios (collectively, Warner Bros. and NBC/Disney Studios); workplace charging with public access by workers and visitors of the adjacent businesses and Studios; and corridor charging. These characteristics are shown in Table 13.

- Utilization Score: 0.98
- Predominant Adjusted Land Use: Public park, studios
- PEV Density by Trips: 23.2 (morning), 7.4 (midday)

**Table 13: 2879 Parkside Avenue Characteristics**

| **Local Driver Characteristics** | |
|---|---|
| EV registrations (w/in 1,000 ft.) | 3.4 vehicles |
| Income level | $81,987 |
| Single family residential units | 0 |
| Multi-unit dwellings | 0 |
| **Visibility** | |
| Distance to nearest major intersection | 1,483 ft. |
| **Accessibility** | |
| Distance to nearest freeway ramp | 1,010 ft. |

Source: UCLA Luskin Center

## Final Site Outreach

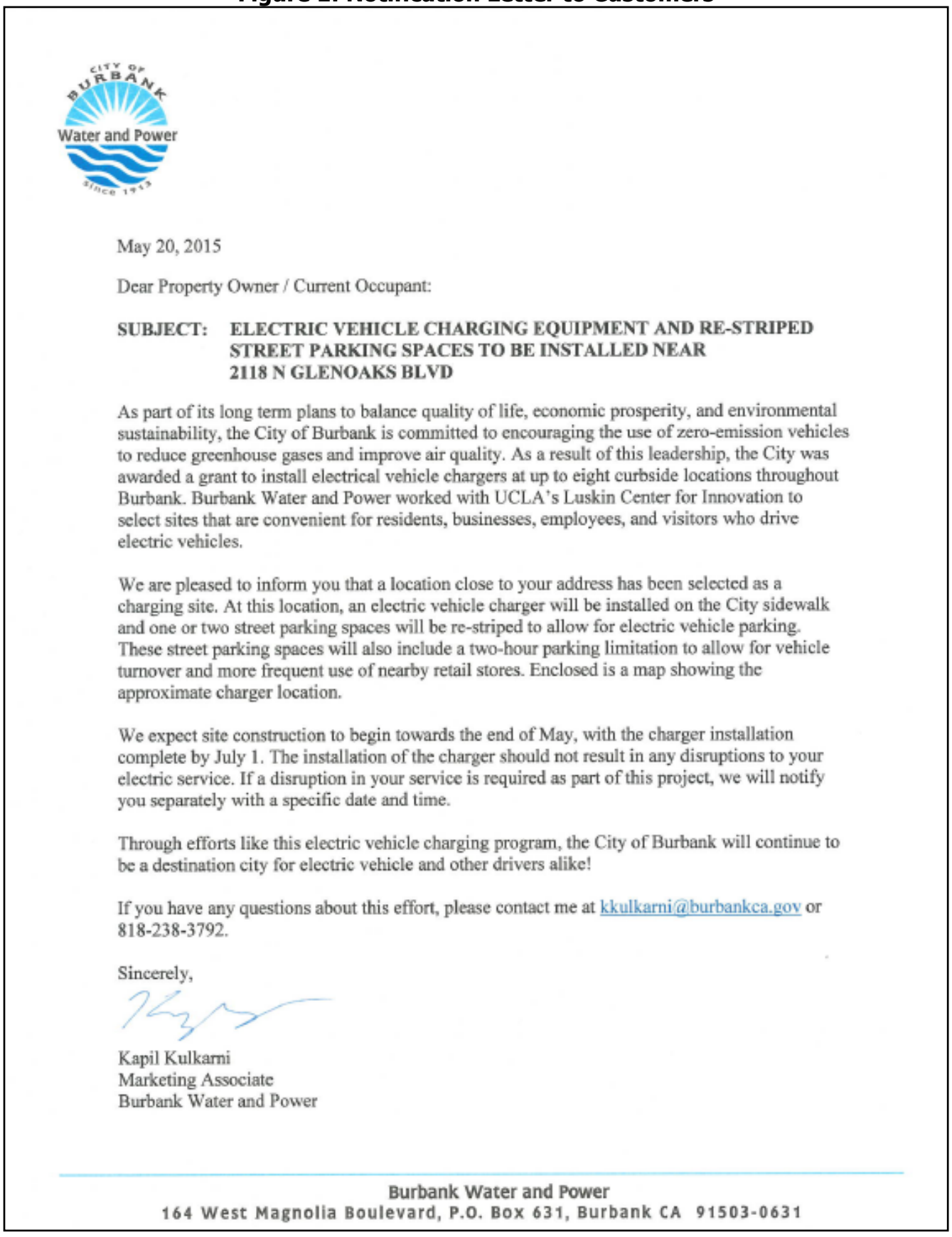
To determine the final eight sites BWP met with the Public Works Department's Traffic and Parking Divisions to physically inspect each site and ensure that each site had adequate, additional, on-street or off-street parking to handle the assignment of two parking spots to electric vehicles charging and parking only. Despite the relative benefits of the 3479 Warner

Blvd and 2879 Parkside Ave sites, they were not selected as part of the final sites, because the location of the electrical power source was more than hundred feet from the charger; which increased the construction costs to three times greater than the other final sites selected. The 164 N Glenoaks Blvd site was not selected as a final site due to proximity to an existing parking lot charger at 301 E Olive St. Based on existing utilization data for this site, it was determined that an additional charger was not needed, and the current charger was sufficient.

After the final sites were selected, BWP identified 73 buildings and properties within one block of each of the eight charging sites to be re-striped for electric vehicles only. Letters and a map of the proposed charger location were mailed to potentially impacted residents, businesses, property current occupants, and property owners notifying them of the intent to install an electric vehicle charger at or near their property. The letter discussed Burbank's commitment to zero emissions vehicles, the grant funding that would reduce the cost of the project by two-thirds, and the overall benefits of the project – clean air, and increased vehicle traffic and business at each site.

Figures 1 and 2 are images of two documents – a notification letter and a map of the proposed charger location – that were sent to 25 residents, businesses, and property owners considered proximate to the charger site at 2128 N Glenoaks Blvd.

**Figure 1: Notification Letter to Customers**



May 20, 2015

Dear Property Owner / Current Occupant:

**SUBJECT: ELECTRIC VEHICLE CHARGING EQUIPMENT AND RE-STRIPED STREET PARKING SPACES TO BE INSTALLED NEAR 2118 N GLENOAKS BLVD**

As part of its long term plans to balance quality of life, economic prosperity, and environmental sustainability, the City of Burbank is committed to encouraging the use of zero-emission vehicles to reduce greenhouse gases and improve air quality. As a result of this leadership, the City was awarded a grant to install electrical vehicle chargers at up to eight curbside locations throughout Burbank. Burbank Water and Power worked with UCLA's Luskin Center for Innovation to select sites that are convenient for residents, businesses, employees, and visitors who drive electric vehicles.

We are pleased to inform you that a location close to your address has been selected as a charging site. At this location, an electric vehicle charger will be installed on the City sidewalk and one or two street parking spaces will be re-striped to allow for electric vehicle parking. These street parking spaces will also include a two-hour parking limitation to allow for vehicle turnover and more frequent use of nearby retail stores. Enclosed is a map showing the approximate charger location.

We expect site construction to begin towards the end of May, with the charger installation complete by July 1. The installation of the charger should not result in any disruptions to your electric service. If a disruption in your service is required as part of this project, we will notify you separately with a specific date and time.

Through efforts like this electric vehicle charging program, the City of Burbank will continue to be a destination city for electric vehicle and other drivers alike!

If you have any questions about this effort, please contact me at kkulkarni@burbankca.gov or 818-238-3792.

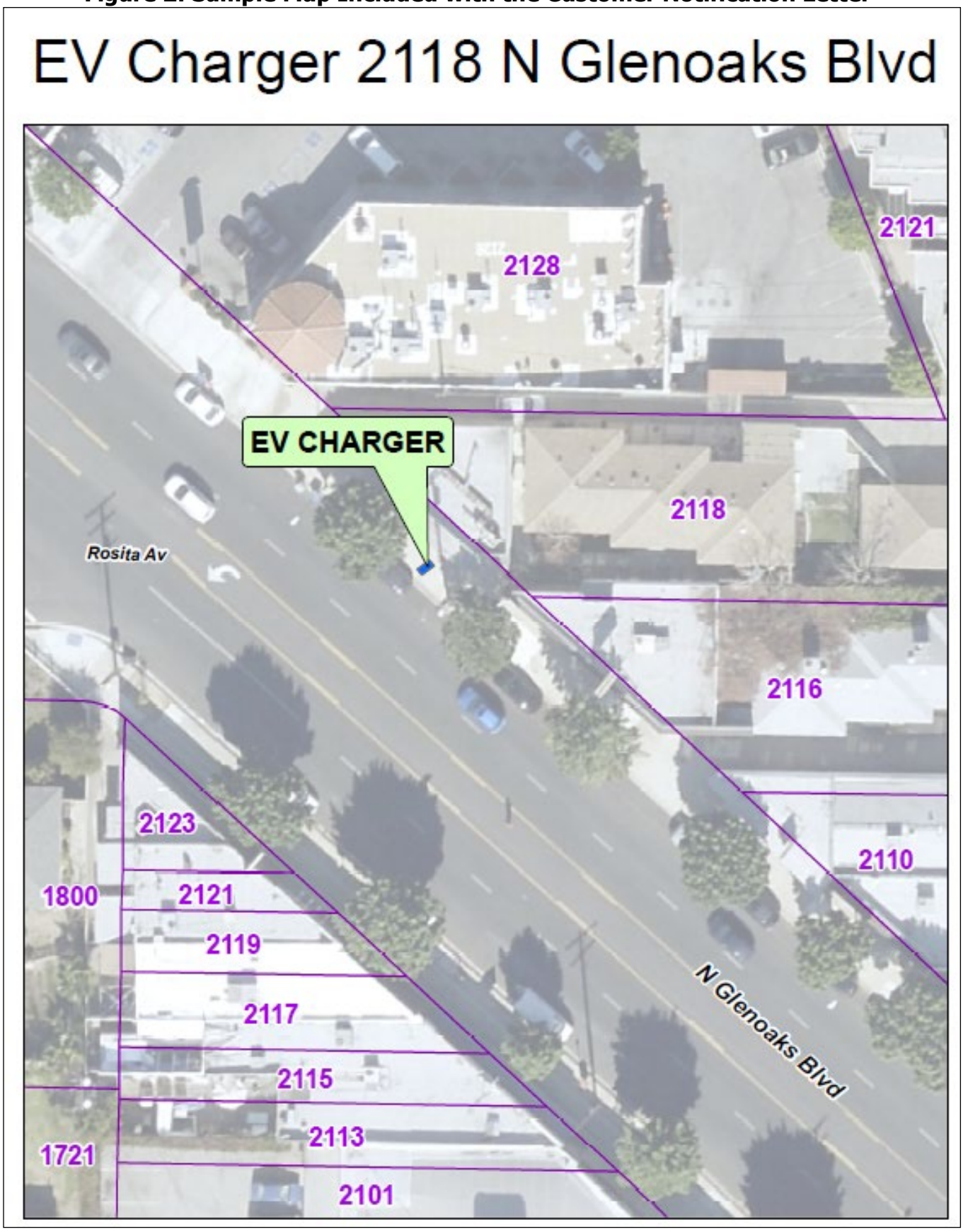
Sincerely,

Kapil Kulkarni
Marketing Associate
Burbank Water and Power

Burbank Water and Power
164 West Magnolia Boulevard, P.O. Box 631, Burbank CA 91503-0631

Source: Burbank Water and Power [1]

**Figure 2: Sample Map Included with the Customer Notification Letter**




Source: Burbank Water and Power

Burbank Water and Power and other City departments have received periodic complaints about the public parking spaces being repurposed into EV-only charging spaces. City staff continue to educate business owners as well as their employees and patrons on the necessity of such parking, and the thorough vetting that took place to ensure adequate public street parking even with the dedicated EV-only parking spaces.

In the future, BWP plans to increase outreach efforts for curbside charging, in order to minimize customer complaints and ensure that the chargers are being sited at locations that do not adversely impact existing parking and traffic patterns. At the same time, BWP will make sure that charger locations are sited in order to maximize visibility, accessibility, availability, and usage for current and future EV drivers.

## Equipment Selection

The vehicle charging equipment was selected through a competitive bid process sponsored by the Southern California Public Power Authority of which Burbank is a member. It is through this process that Greenlots was selected as the equipment supplier and the service provider for the ongoing operations.

BWP selected a dual Level 2 charger (Figure 3) that uses the GreenLots SKY platform software, and the AutoCoil charger hardware manufactured by EVSE LLC, a subsidiary of Control Module Inc. The selected charger is able to simultaneously charge two EVs per charger station and the AutoCoil device with retractable cords minimize the potential that the 20-foot cord could be a tripping or safety hazard when the charger is not in use. Integration with a credit card reader for ease of customer use is also a valuable feature of these units.

**Figure 3: EVSE, LLC Auto Coil, Dual Level 2 Charger**

Photo Credit: Greenlots

## Installation Requirements

After the final site locations were identified, completing the engineering design for the installation of the chargers was the next step. In order to complete the design, the best source of a power feed had to be determined. In most cases, existing overhead transformers were able to be utilized, but in a few cases new transformers dedicated to the curbside were required as part of the design. Once the power source was established, the locations for the pull-boxes, meter sections, and chargers could be determined.

Coordination with the City of Burbank Public Works Department, Traffic Division was required to determine if there were any parking restrictions in the installation areas, to develop the proper signage, and develop policies to allow for parking enforcement. In this case, an amendment to the municipal parking code was required to allow for enforcement of curbside EV parking zones.

Ensuring proper permitting was vital for the installations. An excavation permit was required for each charger location, as well as an electric permit from the building division.

Construction for the charger locations was fairly simple. The City opted to utilize a contractor for all of the underground work, and city line mechanics and electricians for the electrical work.

During construction, trenches were inspected by BWP line crews and City of Burbank Public Works inspectors. Meter pedestals were inspected by the City of Burbank Building inspectors. To verify that the contractor, Dynalectric, was following correct prevailing wage labor laws, interviews were conducted with Dynalectric workers onsite at the job locations and the payroll documentation reviewed by Sylvir Consulting, Inc.

All electrical work was completed by BWP personnel. All overhead transformers, overhead conductor, and conductors in risers were installed by line mechanics. Conductors in conduit and the chargers were installed by BWP electricians. Meters were installed by technicians from the BWP meter shop.

Charger installations had a few setbacks. Upon activation by Greenlots, three ports on the eight dual port chargers were not communicating back to Greenlots. After a few days, the communication issues were resolved, and all eight chargers were brought online.

## Ongoing Maintenance and Other Issues

Maintenance is handled internally by BWP electricians. There were significant issues with charger faults, most commonly requiring BWP staff to power cycle the chargers onsite. This was a weekly issue, with up to 4 ports faulting per week, between August 2015 through February 2016. One charger required a replacement of its communication module, which was provided free of charge by Greenlots. Four chargers have also had their pulley assemblies replaced to prevent further faults, with costs covered by Greenlots.

The issues surrounding the faults seem to have been resolved, with only a few occurring monthly since February 2016. These more recent faults are thought to be occurring due to user errors.

## Parking Enforcement

After the 2011 pilot program of parking lot chargers a survey of participants identified charger availability and parking enforcement as a significant issue. Many of the parking lot chargers

are located in private parking lots with limited to no enforcement of parking restrictions, such as a non-electric vehicle parking in an electric vehicle charger parking space. Furthermore, private parking lot operators may be hesitant to issue warnings or tow non-electric vehicles that park in EV only parking spaces over concerns of alienating the employees and patrons of nearby businesses.

At the same time, the lack of enforcement would also alienate charger users by limiting their charging options, and potentially leaving both EV drivers and the charger assets stranded. The curbside charging concept was born to address this issue and the City began evaluating the legal and public policies prior to the grant program to determine if it was feasible for a public agency to offer such infrastructure and services.

The City Attorney's Office was responsible for developing the ordinance that would codify the proposed parking restrictions regarding charging and time limits into the City's ordinance. The Parking Control section of the Burbank Police Department is responsible for conducting enforcement of parking restrictions, including parking of non-electric or non-charging vehicles in restricted parking spots, in the City of Burbank.

Prior to the implementation of the curbside charging project, the existing Burbank Municipal Code prohibited stopping or parking in a parking space designated for electric vehicles if the vehicle was not electric or hybrid electric. There were no further restrictions on that parking space, which could have resulted in an electric vehicle parking in such designated space all day. The new ordinance tightened the existing code to allow electric vehicles or hybrid-electric vehicles only when "connected for electric charging purposes" to park in the designated stall. In other words, only vehicles being charged can park in these spaces.

The "connected for electric charging purposes" test comes from California Vehicle Code Section 22511 which allows a local authority to designate stalls or spaces in an off-street parking facility owned or operated by that local authority for the exclusive purpose of charging and parking a vehicle that is "connected for electric charging purposes". This ordinance satisfies this Vehicle Code section. California Vehicle Code Section 22511 also allows a city to tow violating vehicles if proper signage is posted (Figure 4); however, the City is not considering towing at this time.

**Figure 4: City of Burbank Parking Enforcement Signs**


Photo Credit: City of Burbank

While the City has the authority to prohibit stopping and parking in any space of vehicles (including non- electric vehicles), this ordinance establishes uniform standards for both on-street and off-street spaces. The City has regulated electric vehicle parking spaces in the public off-street parking facility for years, without limiting the use of the space by that electric vehicle. As stated, all electric vehicles parking spaces will only allow those vehicles to park while "connected for electric charging purposes". The ordinance was presented to the Burbank City Council on August 18, 2015, approved and adopted unanimously the following week, and went into effect (after the requisite 31 day waiting period) on September 26, 2015.

Since the chargers were installed and the ordinance took effect, parking control officers have been conducting pro-active enforcement of observed violations. The officers also respond to calls for service, when violations are reported. Parking violations can be reported to the Police Department's non-emergency phone number at; response times depend on call volume and staffing. Through the first eight months of the curbside program, parking officers issued 12 citations, with the fine for a violation set at $43.00.

In communications with the Burbank Police Department, they believe the process is working. Ultimately, the City and the Burbank Police Department strive for voluntary compliance with the law. To achieve this, the City believes that additional education for the businesses where the stations are located, and the public will be necessary. Once the public has a better understanding of the restrictions, the number of violations will decrease over time.

## Data Collection

Throughout the curbside project, and especially once the chargers were installed, the most important task was to ensure that charger utilization data could continue to be collected and monitored. The most immediate use of the data was to monitor charger status and availability, especially with regards to inoperable chargers and potential repairs. Since 2014, BWP has chosen to have our own electricians and other staff conduct maintenance on all of Burbank's public chargers. Therefore, BWP's real-time access to the chargers through the Greenlots network was critical to ensure that the chargers were operating correctly and could be used by the public.

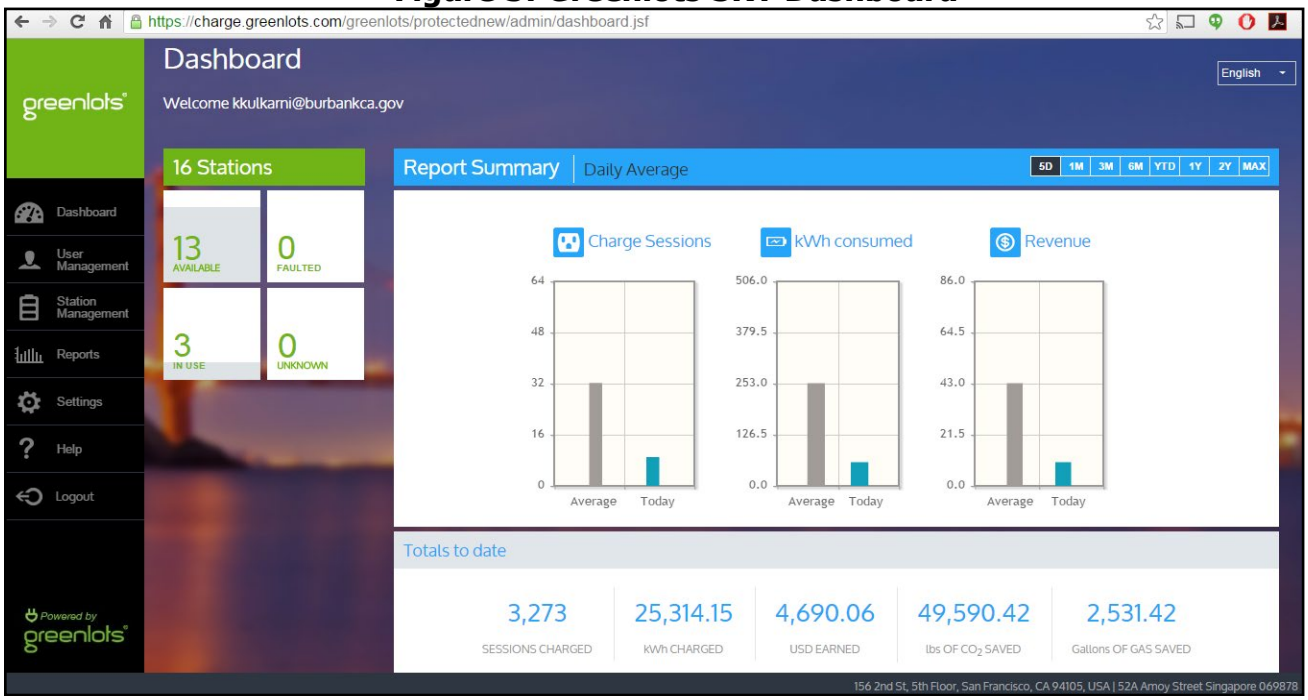
Over the long term, the data will be used to evaluate the success of the project and help inform the future direction of BWP's Electric Vehicle Charging program. The primary source of data is through BWP's license and use of the Greenlots' SKY platform, with backup and validation through BWP's use of a standard utility electric meter installed for each dual Level 2 charger at each site.

The Greenlots SKY platform provides web-based charger control and back office services, including data collection. The data collection is real-time and includes the date and time of usage and total kWh for each charging session, at each charging site. The SKY platform also supports multiple payment methods on all Open Charge Point Protocol-compliant hardware.

BWP validates the Greenlots data through installed electric meters, whose data is uploaded daily to our Meter Data Management system. Both systems collect energy consumption and time of use data, with the Greenlots system being used for more sophisticated analysis, as it records additional data for each charging transaction, including length of transaction, payment type, and revenue generated.

Figure 5 is a screenshot of BWP's access to the Greenlots SKY dashboard, showing real-time data for Burbank's curbside chargers.

**Figure 5: Greenlots SKY Dashboard**




Source: Greenlots and Burbank Water and Power

For the comparison of curbside charging usage with parking lot charger usage, BWP utilized data from ChargePoint's web-based platform. ChargePoint's platform also includes control and back office services, including data collection. The data collection is real-time and includes the date and time of usage and total kWh for each charging session, at each charging site.

As similarly with the Greenlots data, Burbank Water and Power validates the Charge Point data through installed electric meters, whose data is uploaded daily to our Meter Data Management system. Both systems collect energy consumption and time of use data, with the Charge Point system being used for more sophisticated analysis, as it records additional data for each charging transaction, including length of transaction, payment type, and revenue generated.

## Customer Charging Fee Structure

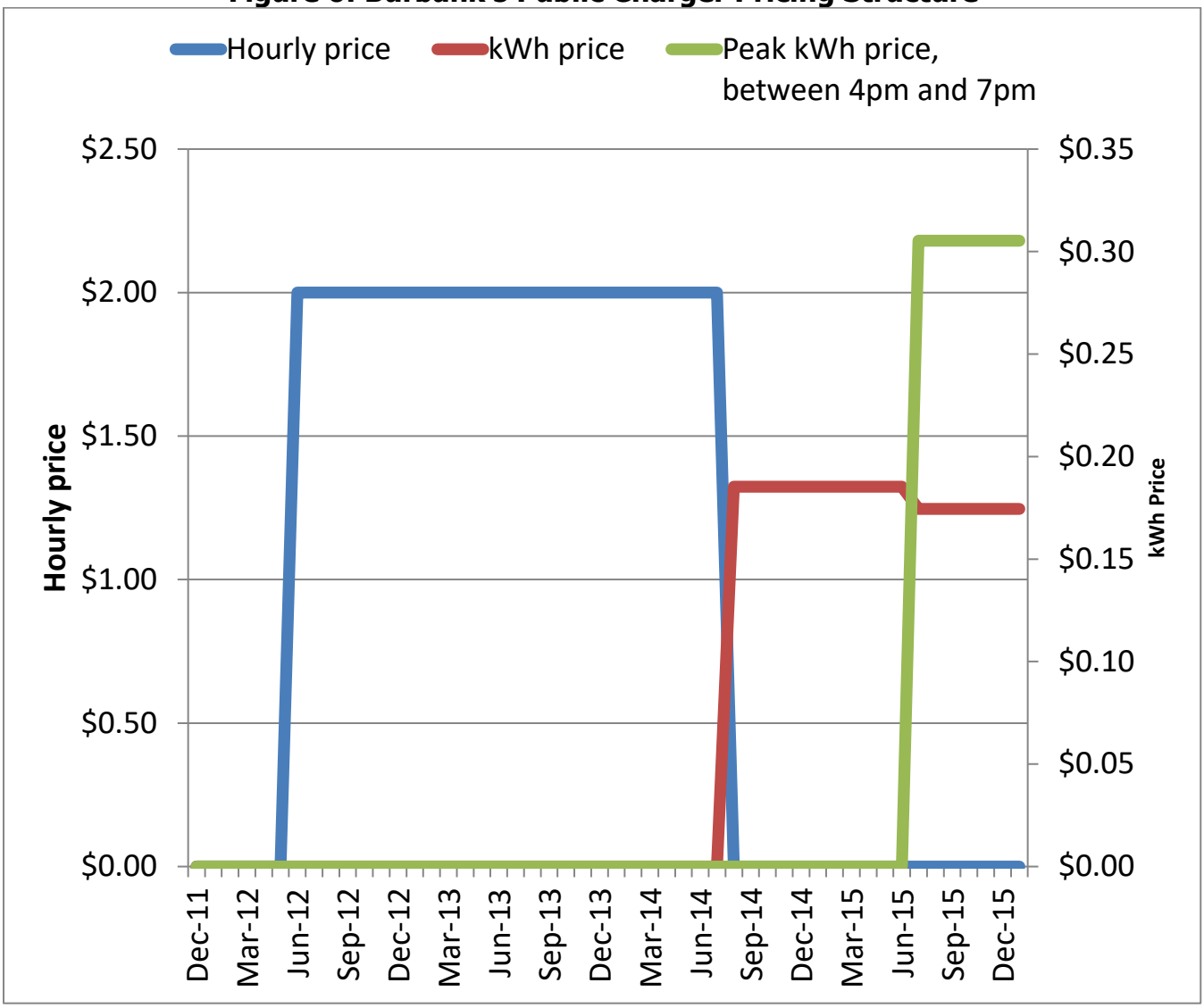
Much of the demand for public charging can stem from the pricing structure; as a result, BWP instituted a charging holiday of six-months – where drivers could use the chargers for free – after the parking lot chargers were installed in December 2011. Naturally, as awareness of the chargers increased, monthly usage of more than 2,000 kWh peaked right at the time when the charging holiday ended, and BWP implemented our long-planned rate of $2 per hour. Once this pricing was implemented, monthly usage of the chargers did not surpass the peak until nearly one-year later.

BWP also heard feedback that the hourly pricing discouraged charger use by plug-in hybrid EVs, since these vehicles have smaller batteries and can take longer to charge, thereby increasing the driver's cost. Thus, BWP implemented a cost-of-service based flat charging rate of $0.1853 per kWh, in July 2014. EV drivers were now able to purchase as much energy as they wanted, without regard to how long the charger was connected to the EV. However, the per kWh rate also removed the price signal for drivers to move their EVs once they were done charging. Overall, this led to a doubling of charger usage from the previous year, which is attributable to both the pricing change and market changes, including more EVs on the road.

In July 2015, BWP instituted TOU pricing, which brings the charging rates more in line with our rate design principles and sends a price signal to the customer related to the cost of electricity during peak periods. The addition of peak pricing also helps to alleviate California's "Duck Curve", where customer solar PV generation in the afternoon leads to a steep ramp up in the amount of electricity required to be supplied by the utility in the evening. This results in a daily load profile that resembles a duck and necessitates a closer look at electricity and charger usage, and rate design, and the need to incorporate the proper pricing into public infrastructure.

Figure 6 shows the history of BWP's Public Charger pricing structure, with the previous hourly price shown on the left axis, and the current kWh pricing shown on the right axis.

**Figure 6: Burbank's Public Charger Pricing Structure**




Source: Burbank Water and Power

# CHAPTER 3:
# Curbside Program Analysis

As with all our initiatives, including other energy efficiency and load management programs, BWP primarily measures the success of our EV Charging program based on charger activity. Through our data collection process, including the Greenlots dashboard, BWP can identify which charging stations are currently in use or inoperable, and record, store, and analyze charging activity, including number of sessions, location and time of charger use, kWh consumed, and customer information.

The chargers were installed and operational on July 31, 2015, and BWP began collecting curbside charging activity data during the six-month analysis period, between August 1, 2015 and January 31, 2016.

Charger activity is dependent on customer usage, and a customer's decision to use a BWP public charger depends on many factors, including awareness, destination, time of day, availability, and cost. Soon after the chargers became operational, BWP began its marketing campaign to increase awareness of the chargers, for both current EV drivers as well as those who may drive one in the future.

At the conclusion of the six-month analysis period, BWP conducted a customer participation survey to gauge the satisfaction of EV drivers and receive feedback on our EV program from both EV and non-EV drivers.

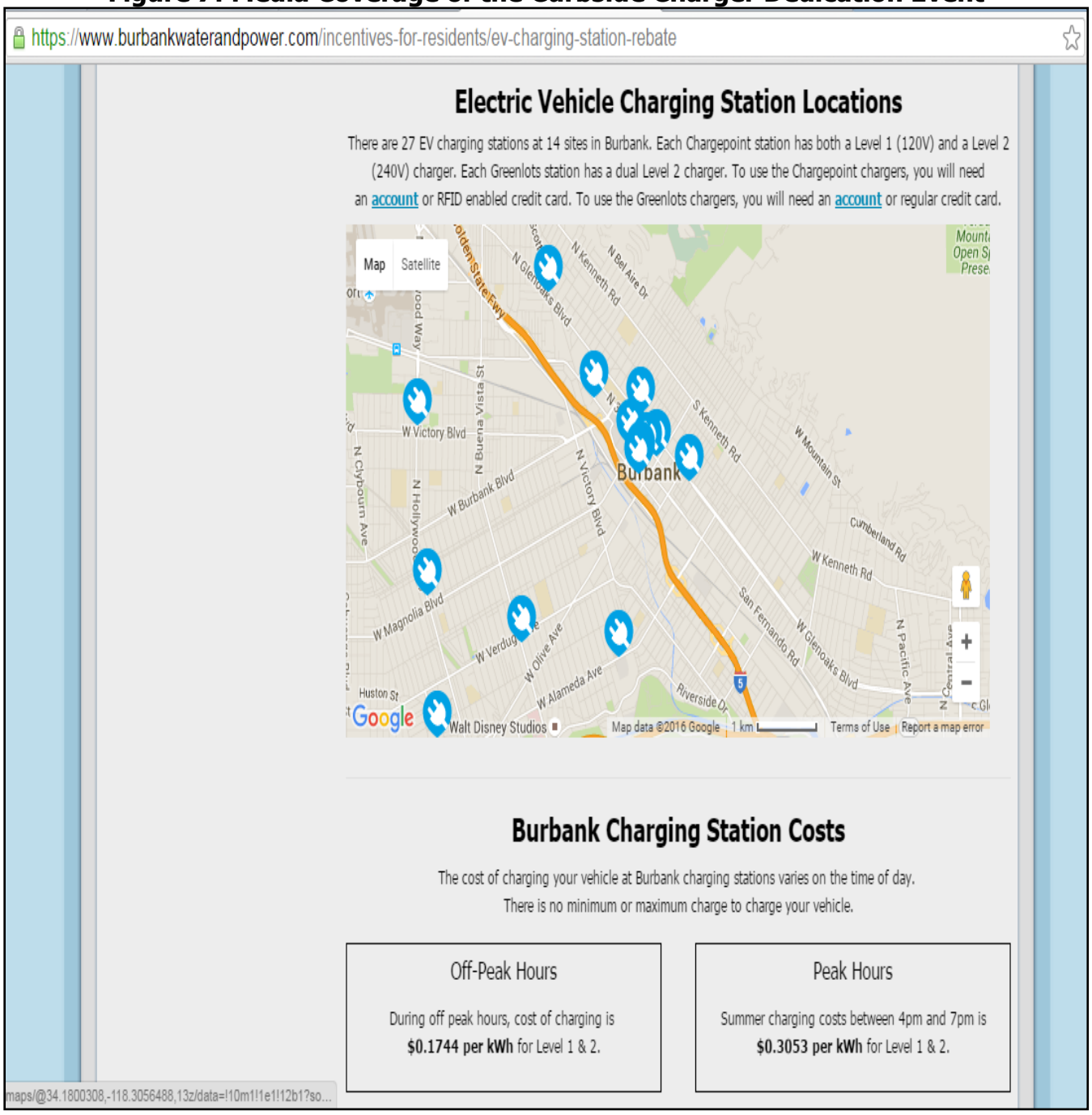
The analysis of the curbside charging project consisted of three phases: 1) marketing campaign summary, 2) curbside program analysis, and 3) customer participation survey. Each of the phases is described in detail below.

## Marketing Campaign Summary

Once the chargers were installed and operational, BWP's main task was to make sure that EV drivers were aware of the new chargers. BWP included an interactive map of the new chargers, information on how to use them, and charging costs on our website. Here is a screenshot of the BWP Electric Vehicle Charging website.

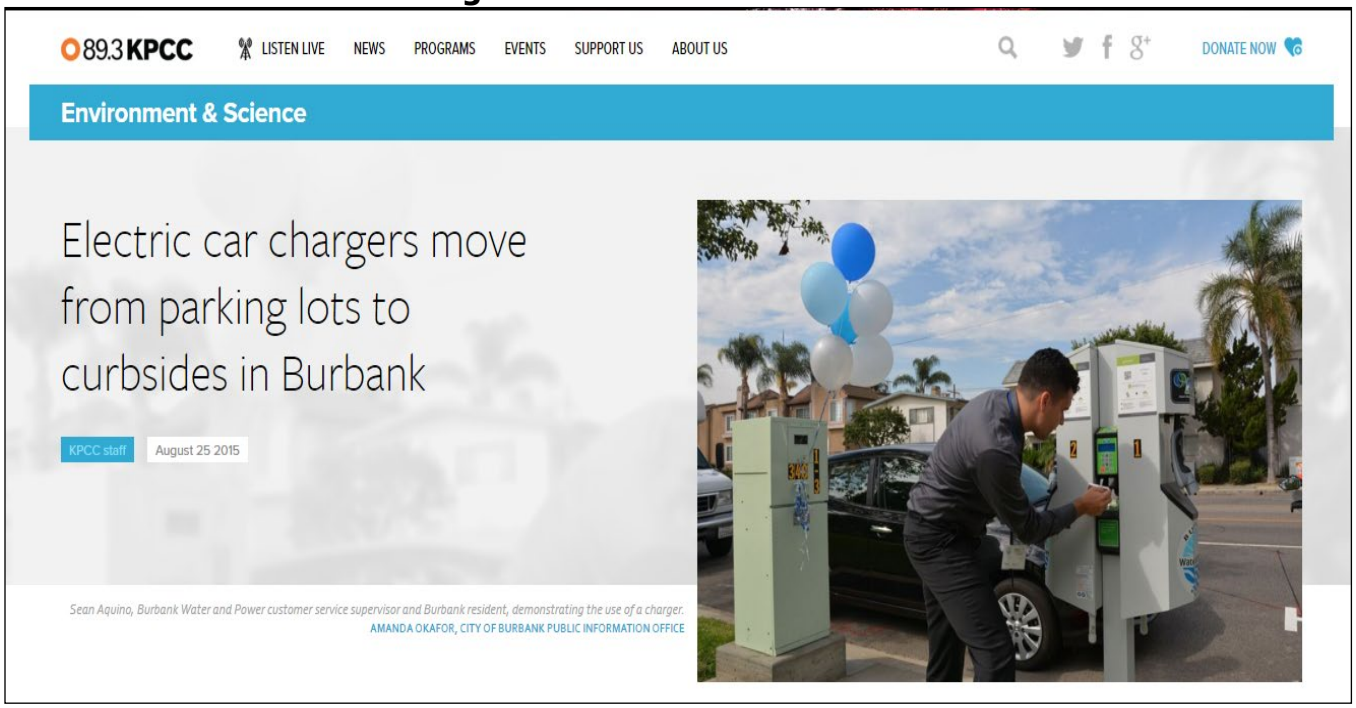
A ribbon cutting ceremony was also held on August 25, 2015, which included a bus tour of two of the charging locations. The event's attendees included BWP staff, Burbank City Council members, CEC Commissioner and staff, and other EV market participants. As a result of the event, BWP staff fielded nearly a dozen media inquiries, and was able to publicize both the curbside chargers and the overall EV Charging Program to the general public. Figures 7 and 8 shows screenshots of a news segment that appeared on both the KPCC radio station and website.

**Figure 7: Media Coverage of the Curbside Charger Dedication Event**




Source: Burbank Water and Power

**Figure 8: Media News Release**




Source: KPCC website https://www.scpr.org/news/2015/08/25/53987/electric-car-chargers-move-from-parking-lots-to-cu/

BWP also publicized the curbside chargers through our quarterly newsletter, which is mailed to each of Burbank 50,000 addresses – both residential and business customers. The October 2015 issue featured an article on the dedication event and included information on the curbside chargers and overall EV Charging program; included in Figure 9. The January 2016 issue featured a follow-up article on the EV Charging program.

**Figure 9: Burbank Water and Power Newsletter, October 2015**

# Say Goodbye to Range Anxiety!

**Burbank has 27 Public Charging Stations! See BurbankWaterAndPower.com for locations.**

On August 25, Burbank Mayor Bob Frutos and California Energy Commissioner Janea Scott cut the ribbon on the Buena Vista Library EV charging station, one of Burbank's eight new curbside EV charging stations. Funded largely from a generous grant from the CEC, BWP was able to add these chargers to the City's growing number of public electric vehicle charging locations. Burbank now boasts 27 public charging stations at 14 different sites located throughout the city.

What sets these newest chargers apart is that they are located at curbsides and can charge two EVs simultaneously. Burbank has designated electric vehicle parking spaces at the new stations with up to 2 hours free parking.

The CEC awarded Burbank $165,000 to encourage drivers to swap gas-powered vehicles for zero-emission electric vehicles. "Making the charging infrastructure available and more visible will help reduce range anxiety," said Commissioner Scott. Range anxiety is the concern that the EV's electrical charge will run out before the destination or next charging location is reached.

## Is an electric vehicle in your future?

If so, don't forget that BWP offers rebates for EV chargers. Up to $500 for Burbank residents and $1,000 for Burbank businesses! For more information, visit us online at **BurbankWaterAndPower.com.**

## Did you know?

According to data provided by PlugShare, an app and website with a database of more than 26,000 charging stations, there are more curbside electric vehicle charging locations registered in Burbank than in any other city in the country!

***Above:** All smiles at the ribbon-cutting event: Vice Mayor Jess Talamantes, CEC Commissioner Janea Scott, Mayor Bob Frutos and Councilwoman Emily Gabel-Luddy*

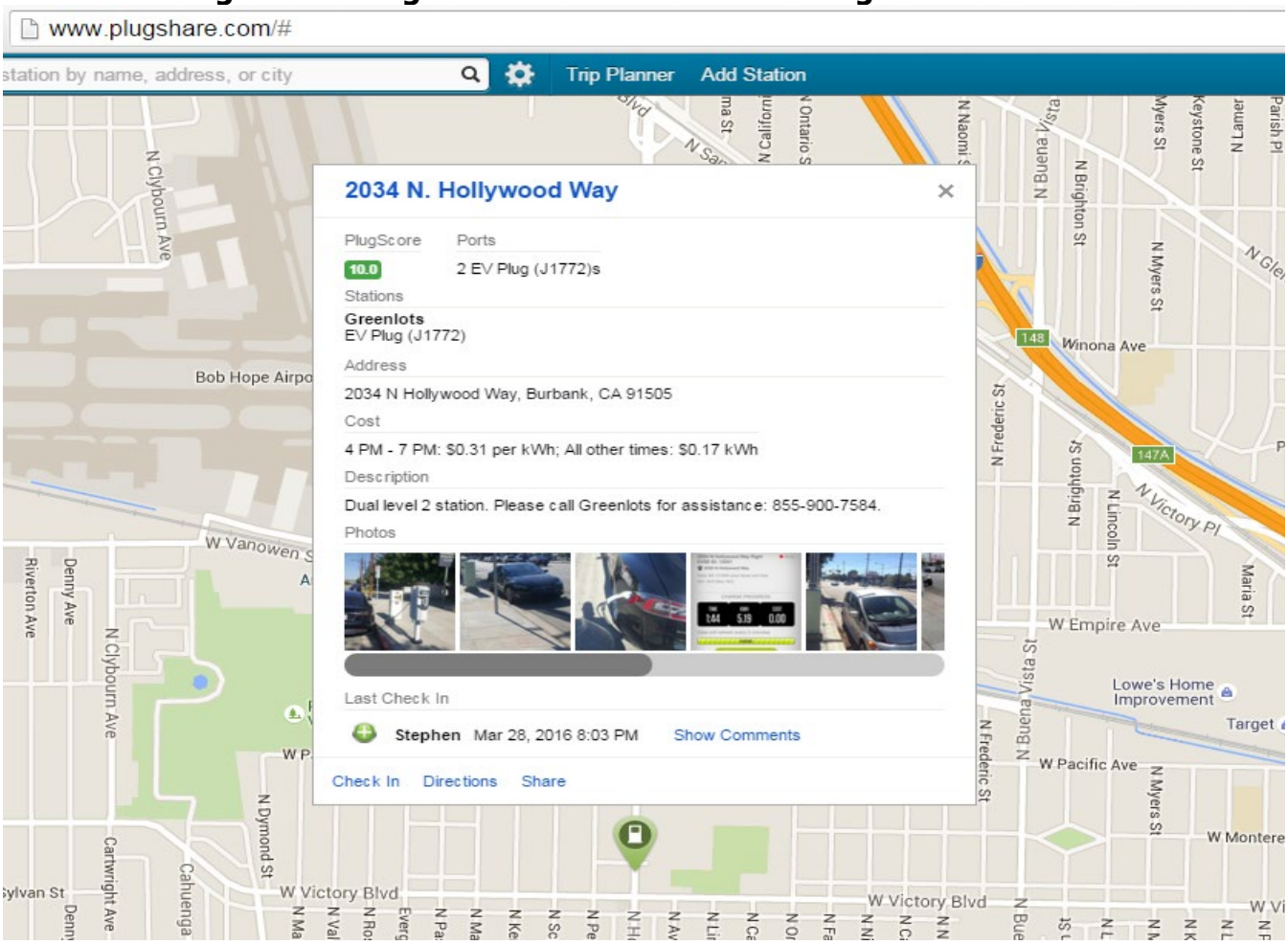
Source: Burbank Power and Water

BWP also worked with Greenlots to make sure the stations would appear on the Plugshare smartphone app, in addition to the Greenlots app. Plugshare is a leading EV driver resource,

whose app contains a nationwide interactive directory of more than 32,000 charging stations, complete with information on charging station type, hours and availability, pricing, as well as user comments and satisfaction.

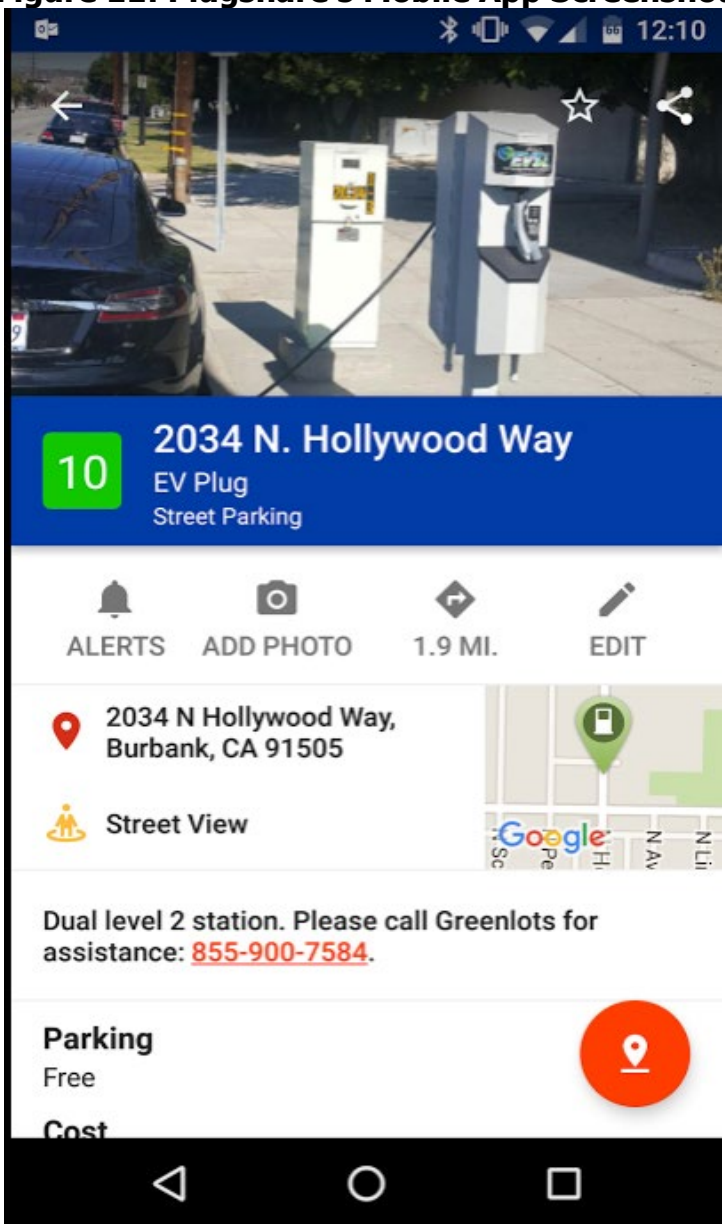
Figure 10 and 11 are screenshots – the desktop version is in Figure 10, and the mobile version is in Figure 11 – of what Plugshare website and app users would see for information regarding the 2034 N. Hollywood Way charger.

**Figure 10: Plugshare's Electric Vehicle Charger Information**




Source: Plugshare website

**Figure 11: Plugshare's Mobile App Screenshot**



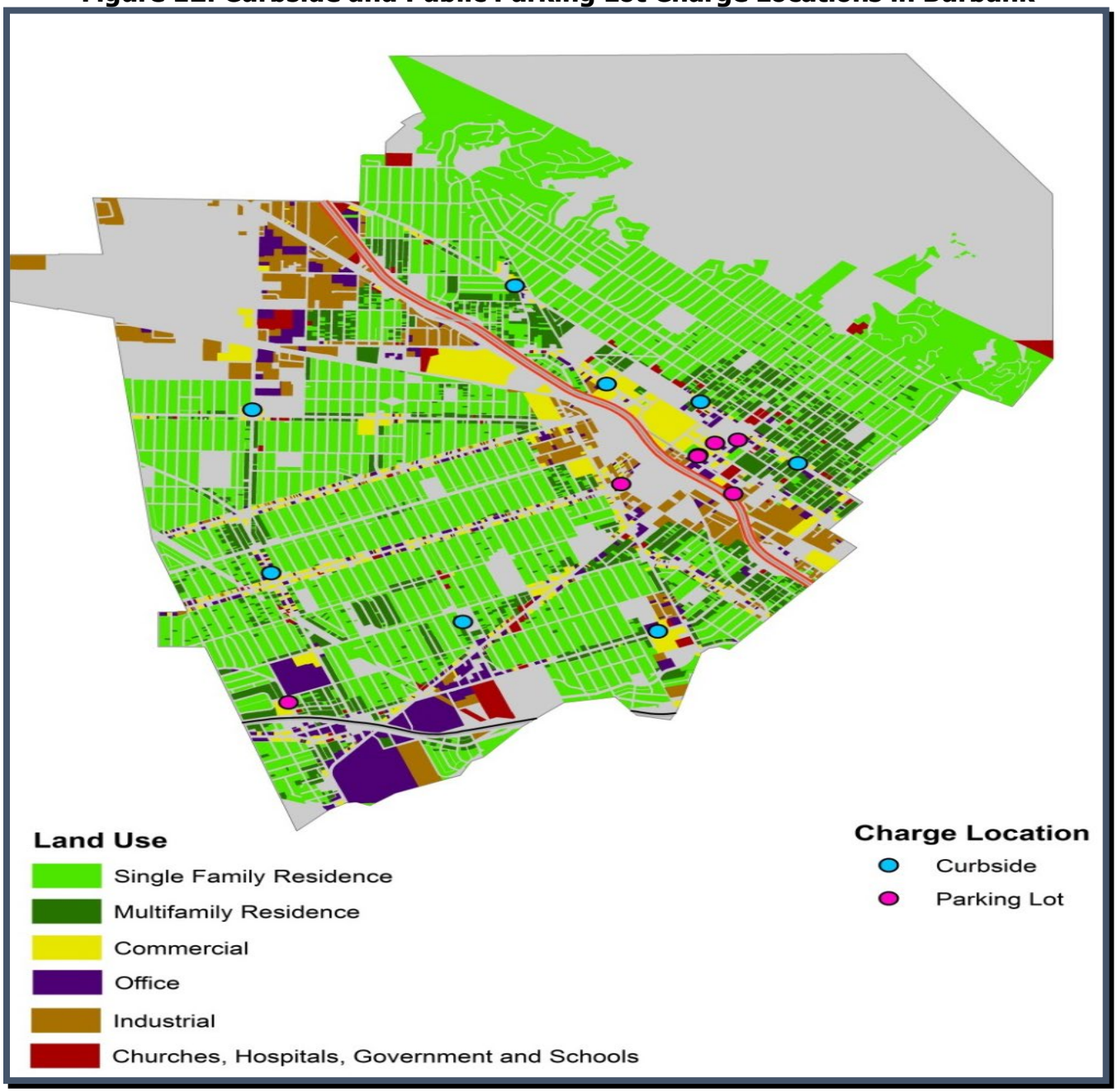

Source: Plugshare Mobile App

## Curbside Program Analysis Summary

The data and analyses provided in this section are predominately the result of Dr. J.R. DeShazo and Alex Turek of the UCLA Luskin Center for Innovation.

By July 31, 2015, Burbank Water and Power had installed all eight dual-port public curbside chargers throughout the city of Burbank. Figure 12 on the following page shows the location of each of the eight curbside charger locations and the six parking lot charger locations. This Figure also shows the land use types for the entire city of Burbank, and the areas surrounding the 14 charger locations. While the parking lot charger locations are mostly concentrated in the downtown commercial area, the curbside charger locations are dispersed throughout the city, and adjacent to land use types that will ensure usage by all types of EV drivers and charging scenarios, including corridor, destination, workplace, and residential MUD charging. In total, the curbside chargers have supported 2,795 charge sessions and over 6,270 hours of dwell time, during the analysis period of August 1, 2015 through January 31, 2016.

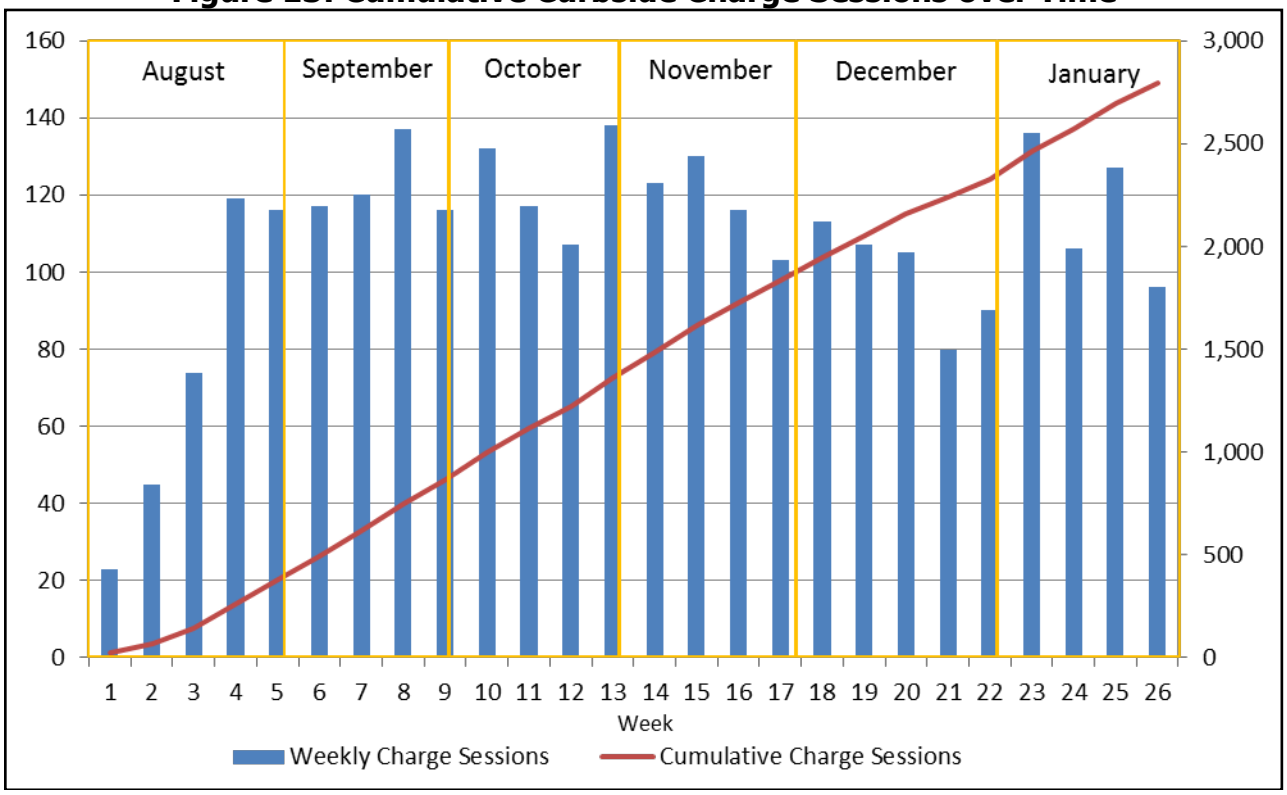
**Figure 12: Curbside and Public Parking Lot Charge Locations in Burbank**




Source: UCLA Luskin Center

Curbside charger sessions increased significantly in the first four weeks of service reaching a peak at the end of September and fluctuating thereafter. Charging sessions in December lagged in total number of charges, hitting a low during the holiday season at the end of month. Figure 13 shows the cumulative charging sessions.

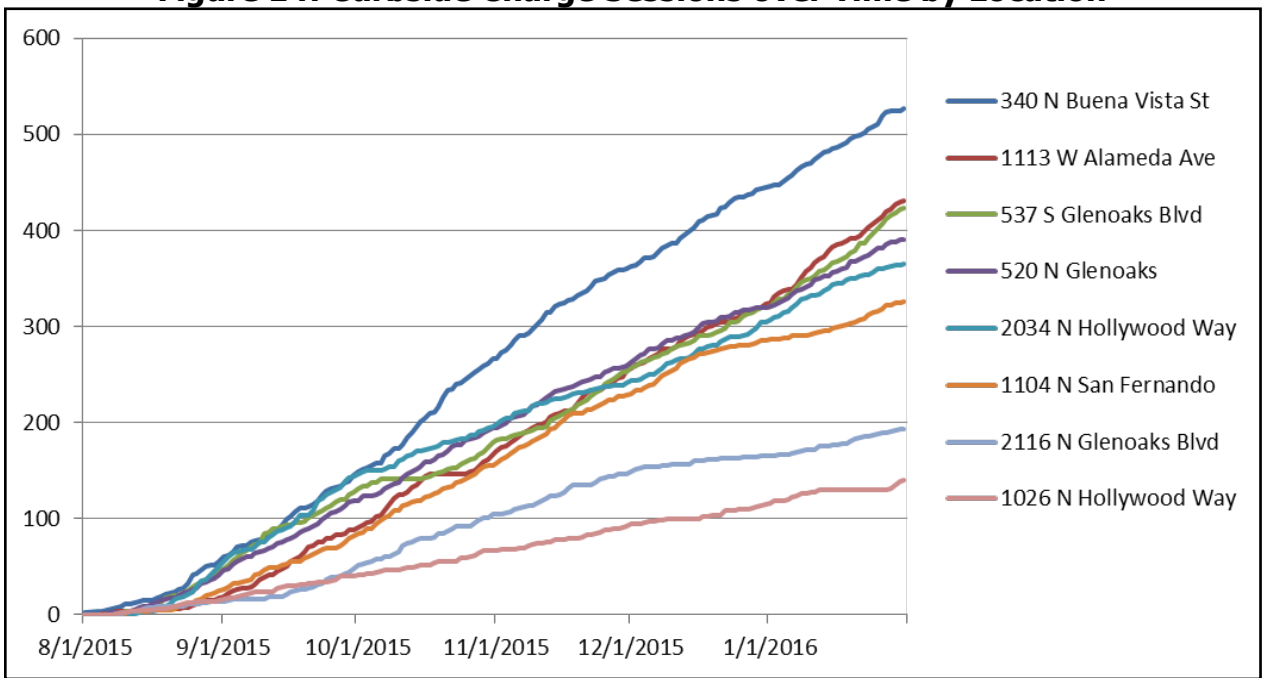
**Figure 13: Cumulative Curbside Charge Sessions over Time**




Source: UCLA Luskin Center

Figure 14 shows that the station at 340 N Buena Vista is the most popular location, followed by five other locations whose usage patterns have been consistent since project inception. Two of the curbside locations have been lagging the others in terms of usage. The highest utilization location is the 340 North Buena Vista Street site with 537 charge sessions (see Table 14 on page 43).

**Figure 14: Curbside Charge Sessions over Time by Location**




Source: UCLA Luskin Center

**Table 14: Curbside Charge Sessions and Dwell Time by Location**

| Code | Street | Total Charge Sessions | Total Dwell Time (minutes) | Average Dwell Time (minutes) |
|---|---|---|---|---|
| 1 | 1113 W Alameda Ave | 431 | 73,980 | 172 |
| 2 | 340 N Buena Vista St | 527 | 68,844 | 131 |
| 3 | 537 S Glenoaks Blvd | 423 | 62,906 | 149 |
| 4 | 520 N Glenoaks Blvd | 390 | 55,942 | 143 |
| 5 | 1104 N San Fernando | 326 | 43,390 | 133 |
| 6 | 2034 N Hollywood Way | 365 | 31,335 | 86 |
| 7 | 2116 N Glenoaks Blvd | 193 | 20,177 | 105 |
| 8 | 1026 N Hollywood Way | 140 | 19,840 | 142 |
| | | 2,795 | 376,414 | 1,061 |

Source: UCLA Luskin Center.

The charge sessions were mostly evenly split between the left and right charge port as shown in Table 15. The chargers at 1113 West Alameda Avenue experienced the highest total dwell time, as well as the highest average dwell time by a significant margin; interestingly, the right charge port hosted more than double the number of charge sessions and total dwell time. The chargers at 537 South Glenoaks Boulevard are the third most used chargers for both total charge sessions and total dwell time.

The chargers at 2116 North Glenoaks Boulevard and 1026 North Hollywood Way lag far behind the other charge sites with less than half the number of charge sessions than the combined average of the other 6 charge sites. The 2116 North Glenoaks Boulevard left charge port experienced the lowest number of charge sessions across individual charge ports with only 41 sessions.

**Table 15: Curbside Charge Sessions over Time by Location**

| Code | Street | Total Charge Events | Rank | Total Dwell Time (minutes) | Rank | Average Dwell Time (minutes) |
|---|---|---|---|---|---|---|
| 1 | 1113 W Alameda Ave Left | 140 | 11 | 20,993 | 8 | 150 |
| 1 | 1113 W Alameda Ave Right | 291 | 1 | 52,986 | 1 | 182 |
| 2 | 340 N Buena Vista St Left | 237 | 5 | 31,631 | 5 | 133 |
| 2 | 340 N Buena Vista St Right | 290 | 2 | 37,213 | 3 | 128 |
| 3 | 537 S Glenoaks Blvd Left | 191 | 8 | 28,771 | 6 | 151 |
| 3 | 537 S Glenoaks Blvd Right | 232 | 6 | 34,135 | 4 | 147 |
| 4 | 520 N Glenoaks Left | 148 | 10 | 18,146 | 10 | 123 |
| 4 | 520 N Glenoaks Right | 242 | 4 | 37,795 | 2 | 156 |
| 5 | 1104 N San Fernando Left | 228 | 7 | 22,709 | 7 | 100 |
| 5 | 1104 N San Fernando Right | 98 | 13 | 20,681 | 9 | 211 |
| 6 | 2034 N Hollywood Way Left | 245 | 3 | 18,129 | 11 | 74 |
| 6 | 2034 N Hollywood Way Right | 120 | 12 | 13,206 | 14 | 110 |
| 7 | 2116 N Glenoaks Blvd Left | 41 | 16 | 5,274 | 15 | 129 |
| 7 | 2116 N Glenoaks Blvd Right | 152 | 9 | 14,904 | 13 | 98 |
| 8 | 1026 N Hollywood Way Left | 53 | 15 | 4,480 | 16 | 85 |
| 8 | 1026 N Hollywood Way Right | 87 | 14 | 15,360 | 12 | 177 |

Source: UCLA Luskin Center

The curbside chargers displayed similar temporal charge patterns with a few notable anomalies. Most charge sites experienced a significant majority of charge sessions during the week versus the weekend, with around 80 percent of charge sessions occurring between Monday and Friday; 537 South Glenoaks Boulevard is an exception, with 33 percent of charging occurring on the weekend as shown in Table 16.

**Table 16: Share of Charge Sessions by Day per Charge Location**

| Street | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday |
|---|---|---|---|---|---|---|---|
| 1113 W Alameda Ave | 13% | 11% | 8% | 24% | 26% | 13% | 6% |
| 340 N Buena Vista St | 18% | 15% | 17% | 15% | 15% | 12% | 9% |
| 537 S Glenoaks Blvd | 9% | 17% | 19% | 13% | 10% | 15% | 18% |
| 520 N Glenoaks Blvd | 14% | 17% | 15% | 16% | 13% | 8% | 16% |
| 1104 N San Fernando | 12% | 11% | 14% | 12% | 31% | 10% | 11% |
| 2034 N Hollywood Way | 16% | 17% | 16% | 14% | 15% | 14% | 8% |
| 2116 N Glenoaks Blvd | 17% | 18% | 20% | 16% | 12% | 10% | 8% |
| 1026 N Hollywood Way | 23% | 20% | 4% | 7% | 25% | 14% | 7% |

Source: UCLA Luskin Center

The stations at 340 North Buena Vista Street, 1104 North San Fernando, 2034 North Hollywood Way, 2116 North Glenoaks Boulevard appear to encourage more charging during workplace hours, 9am to 5pm, all with over 50 percent of charge sessions coming between 9am and 5pm as shown below in Table 17. The station at 537 South Glenoaks Boulevard and 520 North Glenoaks Boulevard experience a significant share of charge sessions after work hours from 5pm to 11pm.

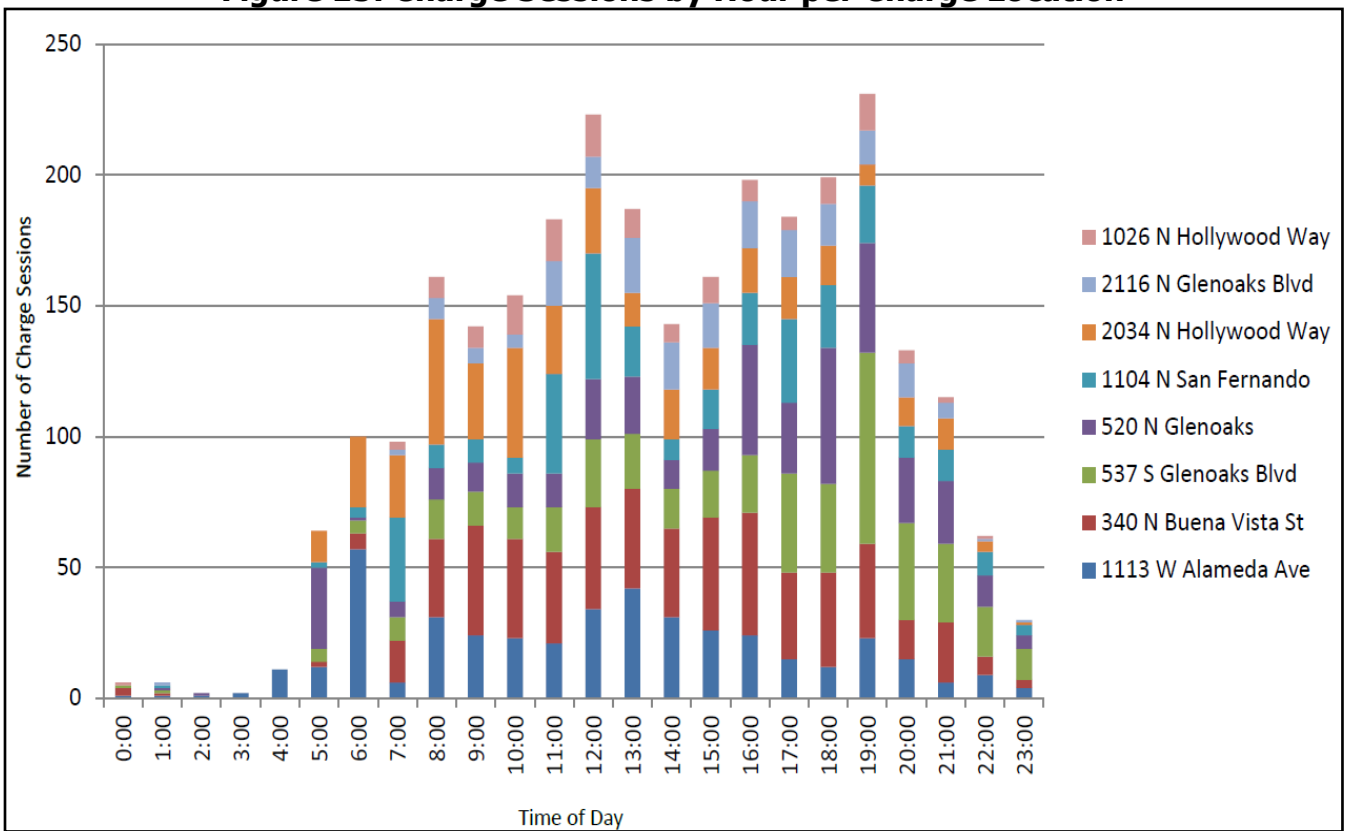
**Table 17: Share of Charge Sessions by Time of Day per Charge Location**

| Street | Early AM 7am - 9am | AM 9am -noon | Early PM noon - 5pm | PM 5pm - 11pm | Overnight 11pm - 7am |
|---|---|---|---|---|---|
| 1113 W Alameda Ave | 13% | 10% | 33% | 37% | 6% |
| 340 N Buena Vista St | 10% | 23% | 32% | 31% | 4% |
| 537 S Glenoaks Blvd | 6% | 9% | 21% | 59% | 5% |
| 520 N Glenoaks Blvd | 4% | 11% | 33% | 47% | 5% |
| 1104 N San Fernando | 16% | 8% | 47% | 29% | 0% |
| 2034 N Hollywood Way | 22% | 26% | 32% | 16% | 4% |
| 2116 N Glenoaks Blvd | 3% | 15% | 44% | 37% | 1% |
| 1026 N Hollywood Way | 21% | 24% | 21% | 34% | 0% |

Source: UCLA Luskin Center

The two most popular times for curbside charging for the network of chargers is the noon and 7 pm hours as shown in Figure 15 and Figure 16. The noon spike is driven by a significant uptick at the 1104 North San Fernando site, and the 7pm spike is due primarily to an increase in charge sessions at the 537 South Glenoaks Boulevard location.

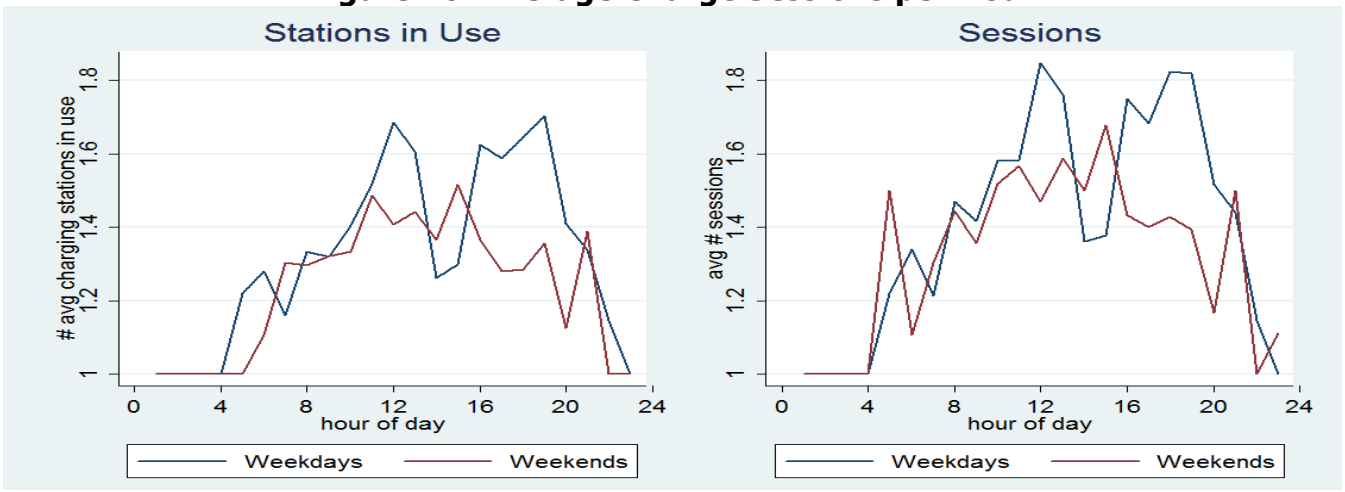
**Figure 15: Charge Sessions by Hour per Charge Location**




Source: UCLA Luskin Center

Figure 16 shows average charge sessions and per hour. The left graph shows on an average weekday/weekend how many stations have a session started in each hour. The right graph shows on an average weekday/weekend, how many sessions in total are started in each hour.

**Figure 16: Average Charge Sessions per Hour**

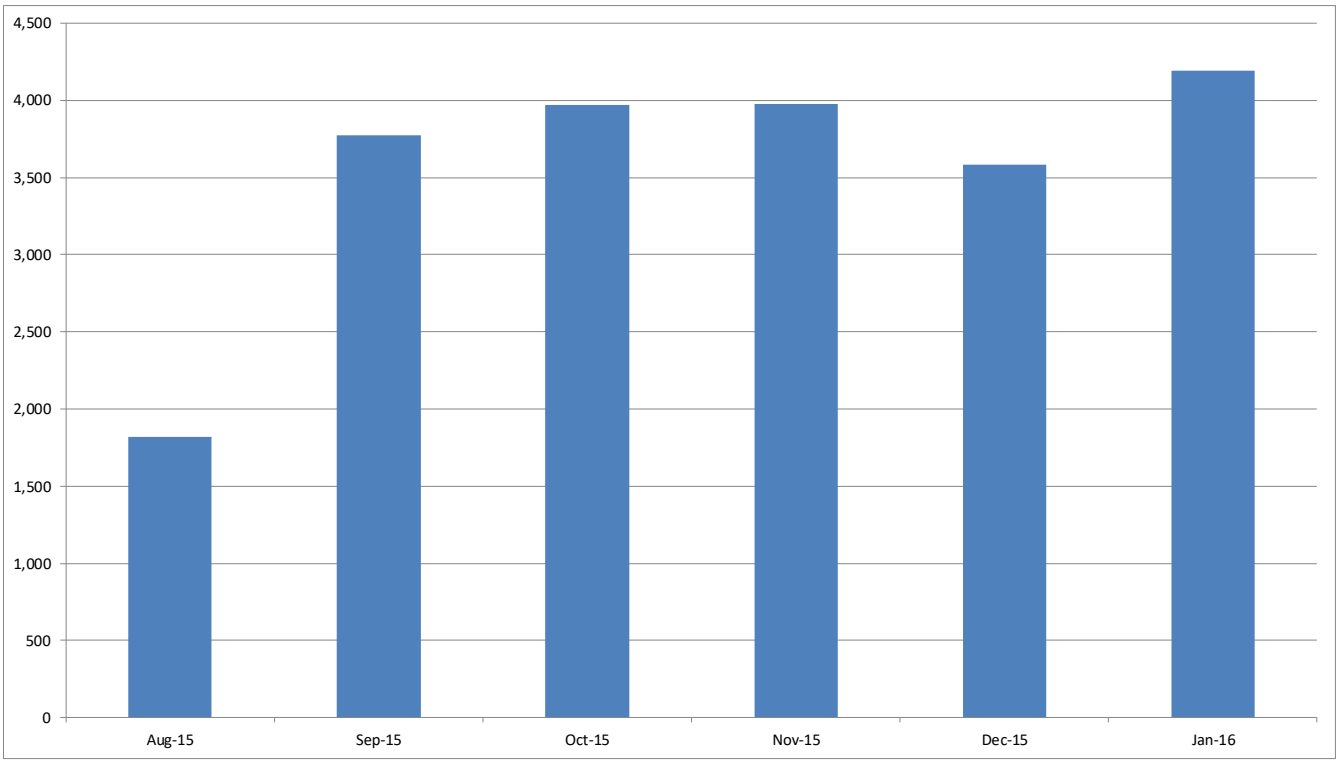



Source: UCLA Luskin Center

## Total Curbside Charger Usage and Revenue Summary

Figure 17 shows usage in kWh from when the chargers became available at the beginning of August 2015 through January 2016, the end of the six-month data collection and analysis period. The curbside chargers total 21,312 kWh over the analysis period.

**Figure 17: Charger Usage in kWh**

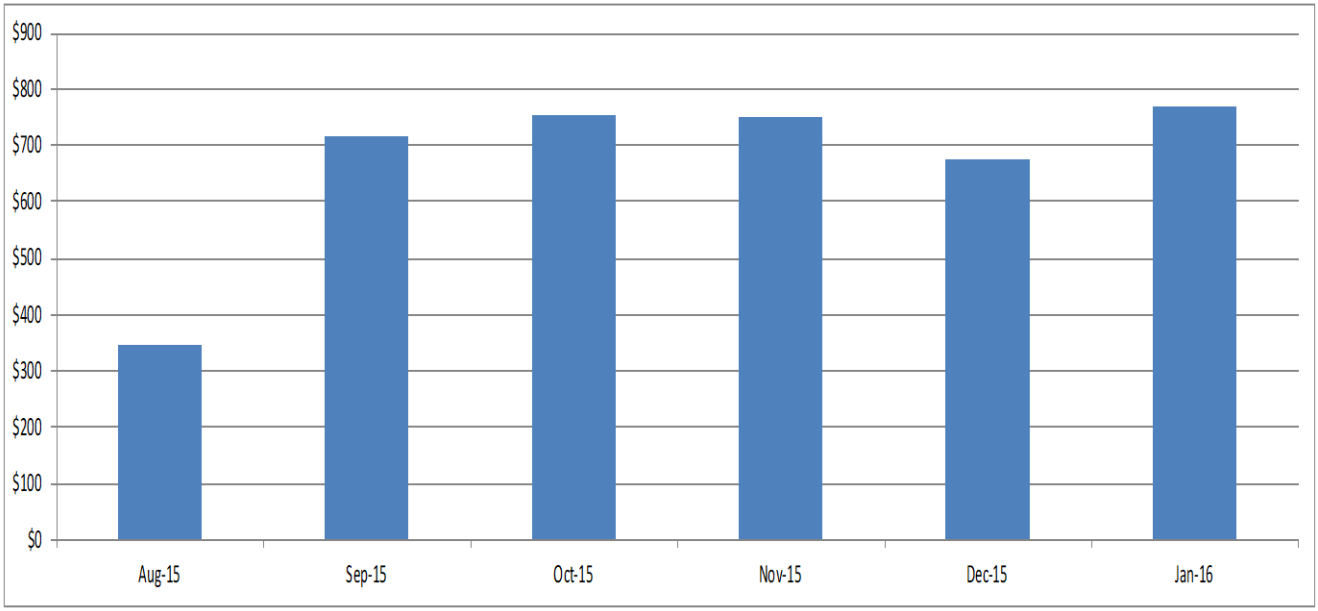



Source: Burbank Water and Power

Assuming a conservative estimate of $8,000 of gross revenue for a full year and using a very conservative assumption that usage will stay flat, then BWP's gross revenue would equal its investment in about ten years. However, our experience has shown that EV penetration and charger usage has been doubling every year. Using this assumption, BWP's gross revenue will equal its investment in a little more than three years, and the total combined project cost (BWP's share plus the grant) in five years. However, BWP has not yet calculated the long-term operation and maintenance costs that would offset the gross revenue.

As usage has increased, revenue has increased as well. Figure 18 shows charger revenue since project completion and totals $4,000 for six months.

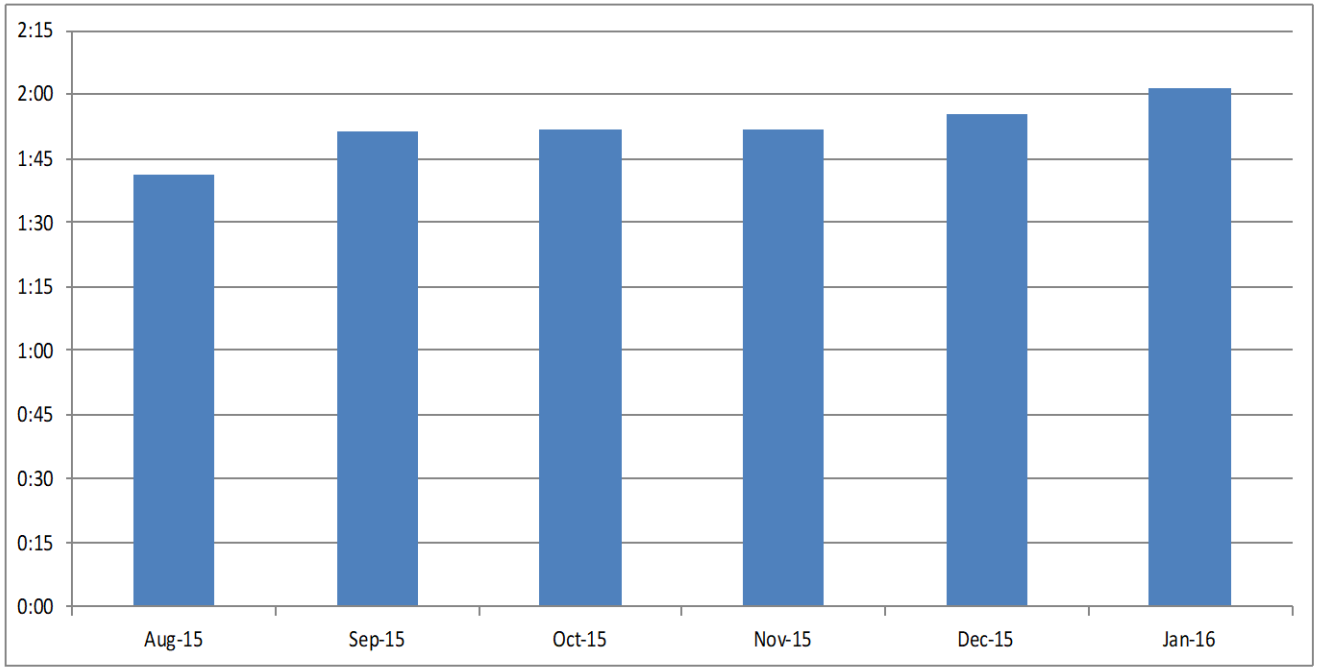
**Figure 18: Monthly Charger Revenue**




Source: Burbank Water and Power

As a result of increased charger usage, average charging session has also increased, from about 1:40 (one hour and forty minutes) to about 2:00 (two hours). Over time, we expect the 2:00 average charging session to stay constant, given the two-hour parking restriction at each of the charger stations. Figure 19 shows average charging session duration by month.

**Figure 19: Monthly Average Charging Session Duration**




Source: Burbank Water and Power

Throughout the analysis period, charger usage has far exceeded BWP's initial estimates. The initial estimates provided in the original project proposal were based on the pilot project of parking lot chargers. Table 18 details and compares the chargers estimated usage with actual usage.

**Table 18: Curbside Charger Estimated and Actual Use**

| Metric | Estimate | Actual |
|---|---|---|
| Average number of charge sessions per station per month | 38 | 58 per location / 29 per connector |
| Average charge session duration (in H:MM) | 1:30 | 1:54 |
| Average kWh per session per station | 6.5 | 7.6 |

Source: Burbank Water and Power.

BWP's initial installations as part of the EV Charger program provided customers with two primary methods of payment – through the charger vendor Charge Point's radio frequency ID (RFID) card or smartphone application. Customer feedback indicates multiple payment options is very important, thus BWP installed the curbside chargers with the ability to handle multiple payment options through the charger vendor Greenlot's RFID card (through the smartphone or separate card) or Greenlots smartphone application, or through an agnostic credit card reader.

Table 19 describes the payment options available through the curbside chargers.

**Table 19: Curbside Charger Payment Options**

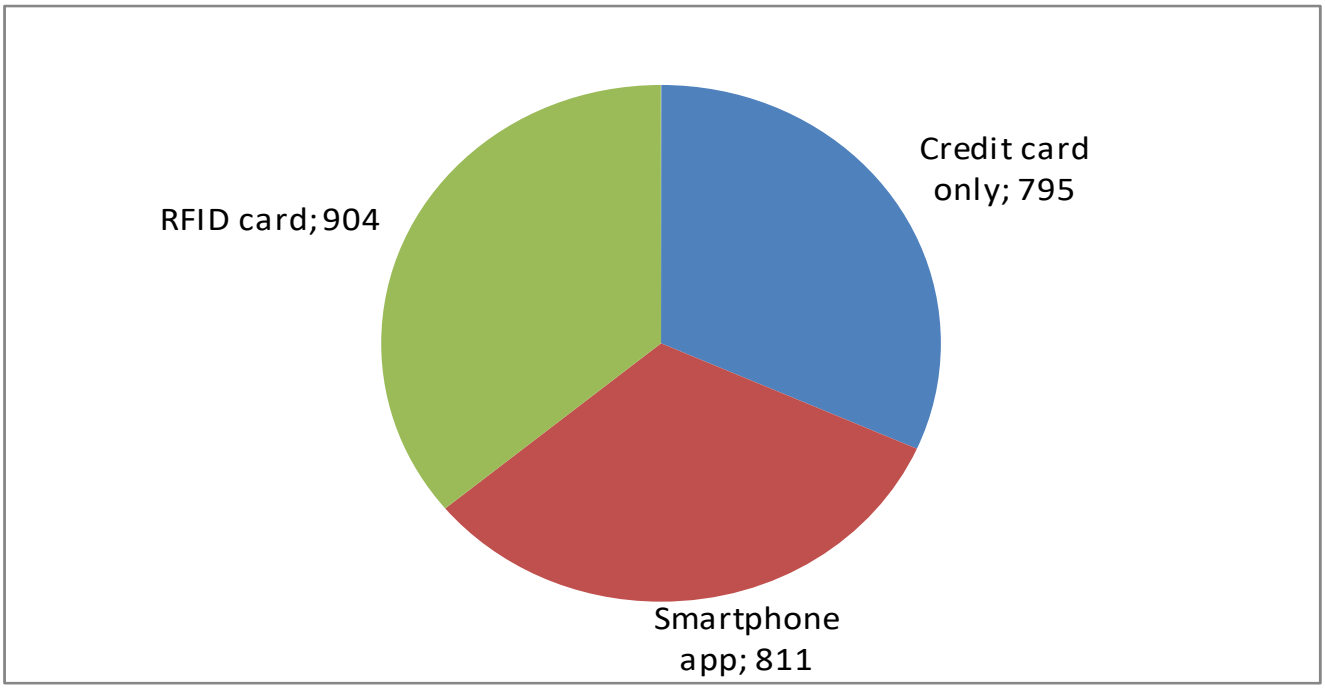
| | Credit Card | RFID |
|---|---|---|
| Charger Device | Customer uses any credit card – does not need Greenlots smartphone app or RFID card | N/A |
| Mobile Phone | Customer uses Greenlots smartphone app linked to credit card | Customer uses RFID card or RFID function within Greenlots smartphone app – linked to multiple payment options |

Source: Burbank Water and Power.

The credit card reader makes it possible for a customer to use the curbside charger without a smartphone application or vendor-specific RFID card, thereby making the transaction similar to or as easy as any of the millions of credit card transactions completed daily at gas stations throughout the country.

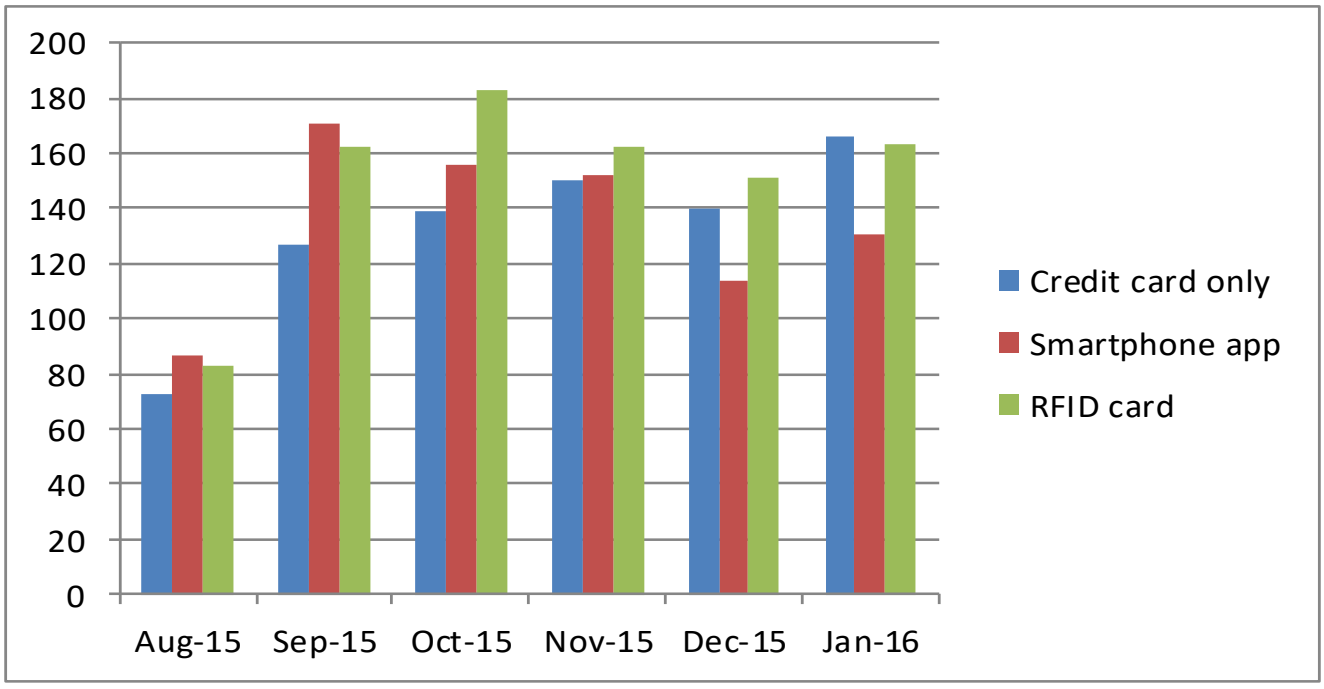
Figure 20 shows charger payment by type, with each of the three payment options being used fairly equally. Figure 21 shows that the share of transactions by credit card reader has been increasing over time, as customers become more familiar with their payment options.

**Figure 20: Charger Payment by Type**




Source: Burbank Water and Power

**Figure 21: Charger Payment by Type by Month**



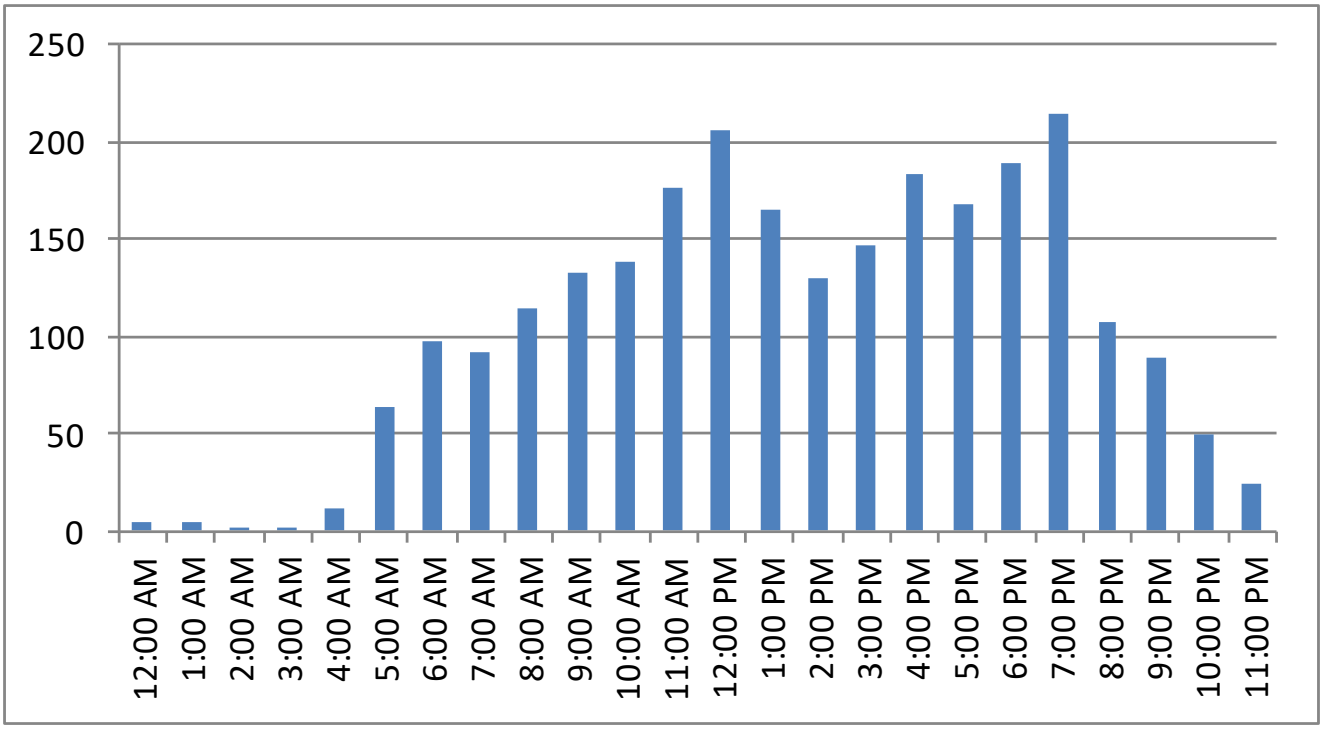

Source: Burbank Water and Power.

One major objective of the curbside project was to place the chargers at sites proximate to multi-unit dwellings (MUDs). Without detailed customer surveys on each transaction and extensive market research, it is difficult to determine how much of the chargers' usage is by MUD residents; however, many of the chargers that are located near MUDs, show several sessions that start after 6:00 pm – roughly the end of the daily commute. It is believed this pattern of usage indicates that the chargers may be being used by MUD residents when they

get home from their daily commutes. In addition, the most popular time to charge throughout the day occurs between 7:00 pm and 8:00 pm and could also indicate use by MUD residents as opposed to corridor, destination, or workplace charging, which typically occur earlier in the day. BWP also conducted a customer survey to which several respondents indicated they lived in MUDs and relied predominantly on public chargers. This is discussed further in the Customer Participation Survey section beginning on page 59.

Figure 22 shows charger session start time by hour of the day.

**Figure 22: Charger Session Start Time by Hour of Day**

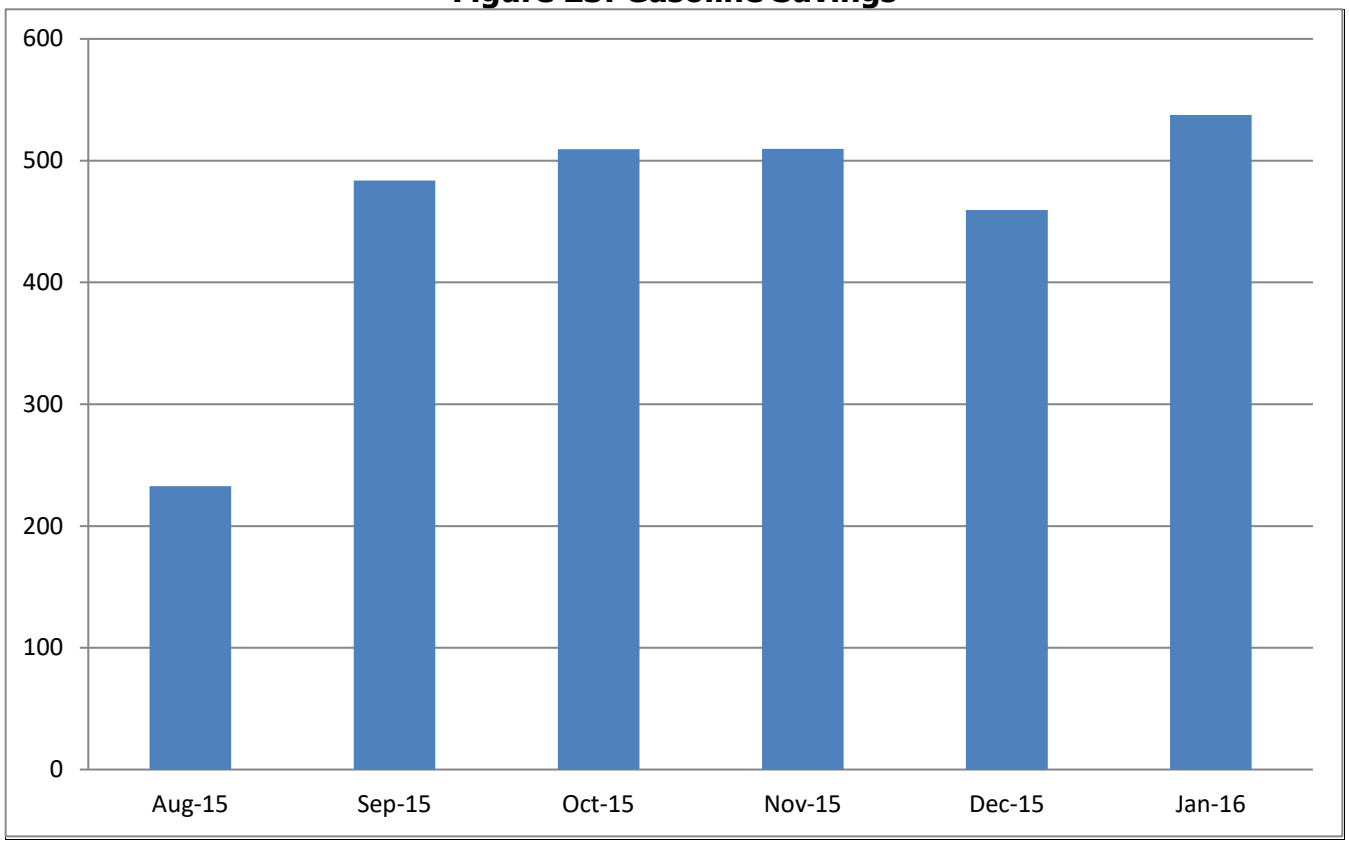



Source: Burbank Water and Power

The community also benefits through gasoline savings; as electric fuel is significantly cheaper than gasoline fuel. Figure 23 details the gasoline savings in gallons that have been saved or avoided through EVs and use of the public curbside chargers. Through the six-month analysis period, a range of 1,756 and 2,756 gallons have been avoided. The lower end estimate of gallons saved is based on average fuel economy of 36.4 miles per gallon for new passenger's cars and 3 miles per kWh. Combined with the $4,000 in revenue generated, this equates to a $1.47 per gallon equivalent when using the curbside chargers. This compares to an average gasoline cost of between $2.30 and more than $3.00 per gallon at a gas station during the analysis period.[3]

[3] Available at http://fuelgaugereport.aaa.com/states/california/california-metro/

**Figure 23: Gasoline Savings**



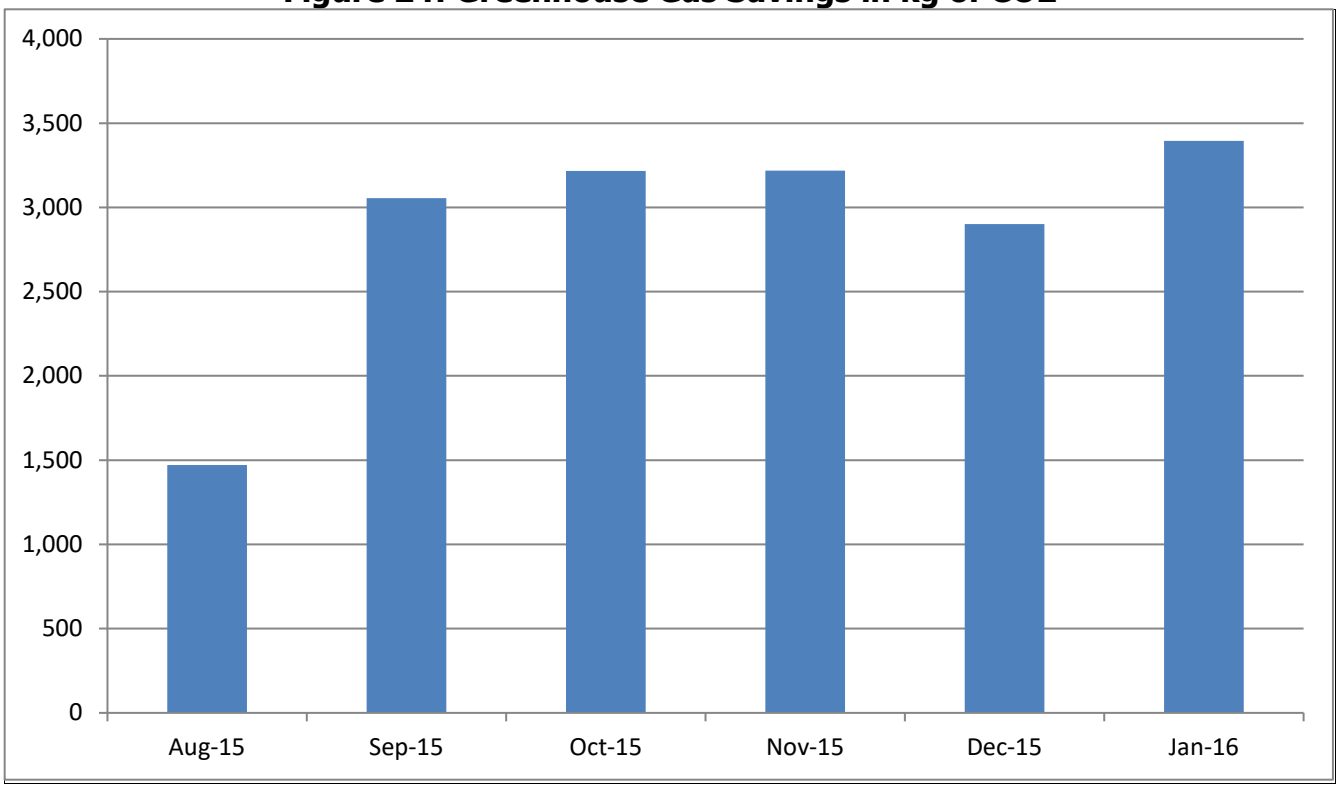

Source: Burbank Water and Power

## Greenhouse Gas Emission Savings

The curbside chargers have also provided the Burbank community with environmental benefits. EVs that are fueled using public chargers in Burbank, where nearly 35 percent of the city's electricity is from renewable sources, produce fewer greenhouse gas emissions than non-EVs that are fueled through gasoline. Figure 24 details the greenhouse gas emissions in kilograms of carbon dioxide (CO2) that have been saved or avoided through EVs and use of the public curbside chargers. Through the six-month analysis period, 17,255 kilograms, or more than 17 metric tons, of CO2 have been avoided.[4]

[4] Based on the City of Burbank, Department of Water and Power's submission of transportation-related electric fuel produced to the California Air Resources Board's Low Carbon Fuel Standard program, we have assumed 1,235 kWh per metric ton of $CO_2$ avoided.

**Figure 24: Greenhouse Gas Savings in kg of CO2**




Source: Burbank Water and Power through data submitted through the Low Carbon Fuel Standard program.

## Curbside Program Compared to Parking Lot Chargers

The curbside charger utilization was compared to the usage of existing parking lot chargers for additional context. The parking lot chargers were installed three and a half years before the curbside chargers and have been known to the community as part of the BWP utility and charging infrastructure.

When comparing the curbside chargers to the parking lot chargers (Table 20), the parking lot chargers generate far more charge sessions per day, although this may be due to their greater time in service.

**Table 20: Average Charge Sessions per Day per Charge Station Type**

| Day | Curbside Station | Parking Lot Station |
|---|---|---|
| Sunday | 2.26 | 6.39 |
| Monday | 2.44 | 7.60 |
| Tuesday | 2.51 | 7.67 |
| Wednesday | 2.65 | 7.76 |
| Thursday | 2.59 | 7.56 |
| Friday | 2.36 | 7.77 |
| Saturday | 2.27 | 6.81 |

Source: UCLA Luskin Center

Furthermore, total dwell time in a parking lot station almost triples that in a curbside station, with approximately 800-900 minutes (13-15 hours) compared to 300-400 minutes (5-6 hours). See Table 21 for the detailed breakdown.

**Table 21: Total Dwell Time per Day per Charge Station Type**

| | Curbside Station | Parking Lot Station | |
|---|---|---|---|
| **Day** | **Total Dwell Time (minutes)** | **Charging Time (minutes)** | **Total Dwell Time (minutes)** |
| Sunday | 282.71 | 586.20 | 767.75 |
| Monday | 322.63 | 691.14 | 897.49 |
| Tuesday | 312.04 | 676.83 | 858.84 |
| Wednesday | 331.67 | 721.41 | 903.20 |
| Thursday | 346.24 | 722.96 | 927.56 |
| Friday | 405.15 | 688.61 | 875.23 |
| Saturday | 303.35 | 604.12 | 764.32 |

Source: UCLA Luskin Center.

Table 22 shows curbside chargers possess a greater share of very short dwell times (<10 minutes) when compared to parking lot chargers; indicating these chargers are likely being used for quick charges along routes. This is not an unexpected phenomenon.

Finally, both curbside chargers and parking lot charge stations experience fewer charge sessions on weekends than on weekdays. This is interesting from the perspective of destination charging typical of parking lot stations since it would seem logical that there may be increase in parking lot station utilization on the weekends.

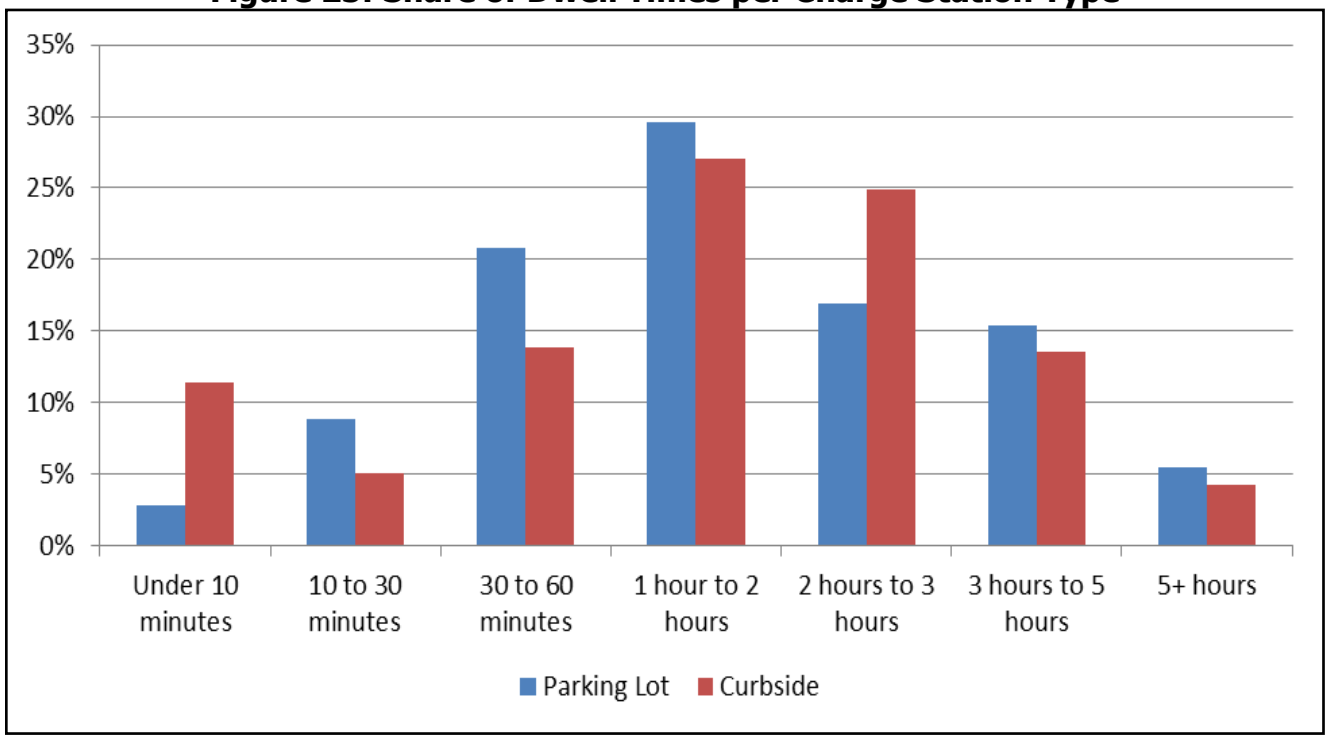
**Table 22: Average Dwell Time per Charge Session per Day per Charge Station Type**

| | Curbside Station | Parking Lot Station | |
|---|---|---|---|
| **Day** | **Total Duration** | **Charging Time** | **Total Duration** |
| Sunday | 126.72 | 98.94 | 129.58 |
| Monday | 146.66 | 95.64 | 122.47 |
| Tuesday | 129.50 | 93.66 | 119.03 |
| Wednesday | 126.70 | 100.41 | 123.84 |
| Thursday | 138.09 | 102.35 | 129.41 |
| Friday | 174.82 | 97.78 | 125.34 |
| Saturday | 131.28 | 96.66 | 123.28 |

Source: UCLA Luskin Center.

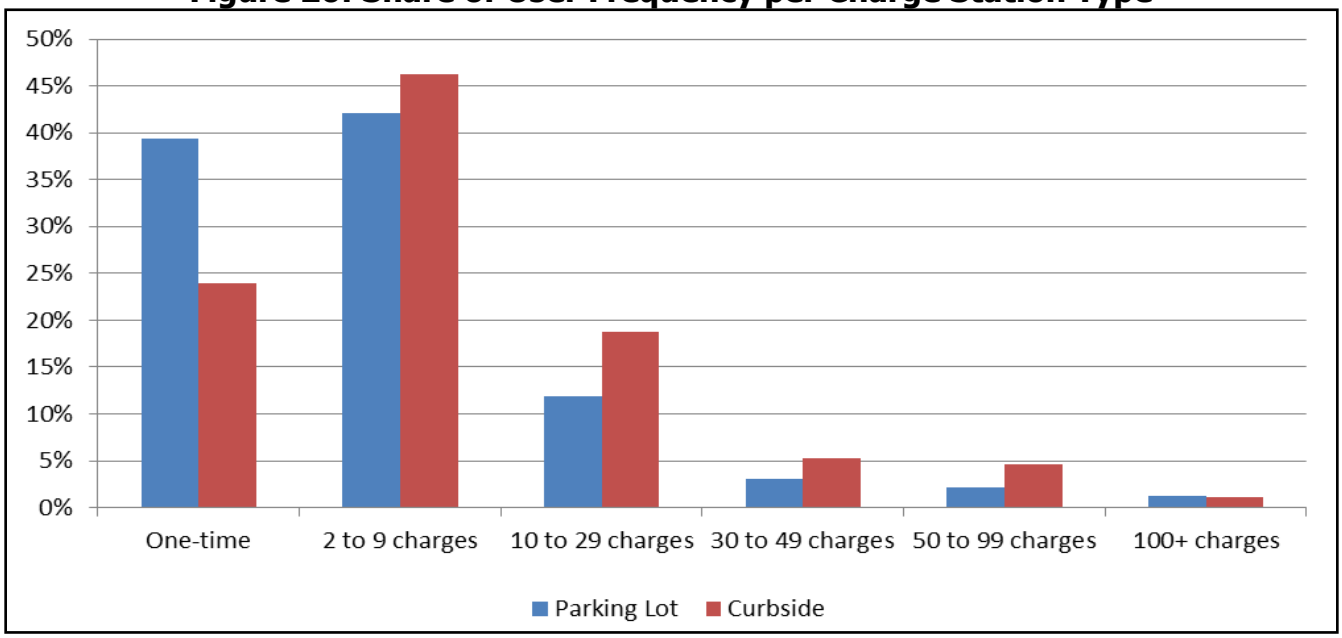
Curbside chargers also have a greater share of repeat users with over 30 percent of charge sessions conducted by drivers who have used the curbside charger network at least 10 times or more. The greater percentage of repeat users of curbside chargers versus parking lot chargers could indicate usage by EV drivers who reside or work near a curbside charger (Figure 25) and have made a habit of using them (Figure 26).

**Figure 25: Share of Dwell Times per Charge Station Type**




Source: UCLA Luskin Center

**Figure 26: Share of User Frequency per Charge Station Type**




Source: UCLA Luskin Center

When the UCLA Luskin Center compared the utilization of the first six-months of curbside chargers to the first six-months of the parking lot chargers, the two publicly available charge types show largely similar patterns as shown below in Table 23, Table 24, and Table 25.

**Table 23: Average Number of Charge Sessions per Day, by Charge Station Location Type for the First Six Months of Operation**

| Day | Curbside Station | Parking Lot Station |
|---|---|---|
| Sunday | 2.26 | 2.27 |
| Monday | 2.44 | 1.94 |
| Tuesday | 2.51 | 2.37 |
| Wednesday | 2.65 | 2.02 |
| Thursday | 2.59 | 2.34 |
| Friday | 2.36 | 2.63 |
| Saturday | 2.27 | 3.08 |

Source: UCLA Luskin Center

**Table 24: Total Dwell Time per Day per Charge Station Type, First Six Months of Operation**

| | Curbside Station | Parking Lot Station | |
|---|---|---|---|
| Day | Total Duration | Charging Time | Total Duration |
| Sunday | 282.71 | 162.24 | 200.01 |
| Monday | 322.63 | 155.79 | 202.41 |
| Tuesday | 312.04 | 193.50 | 254.00 |
| Wednesday | 331.67 | 176.38 | 230.46 |
| Thursday | 346.24 | 165.85 | 191.17 |
| Friday | 405.15 | 185.76 | 234.85 |
| Saturday | 303.35 | 211.10 | 275.94 |

Source: UCLA Luskin Center

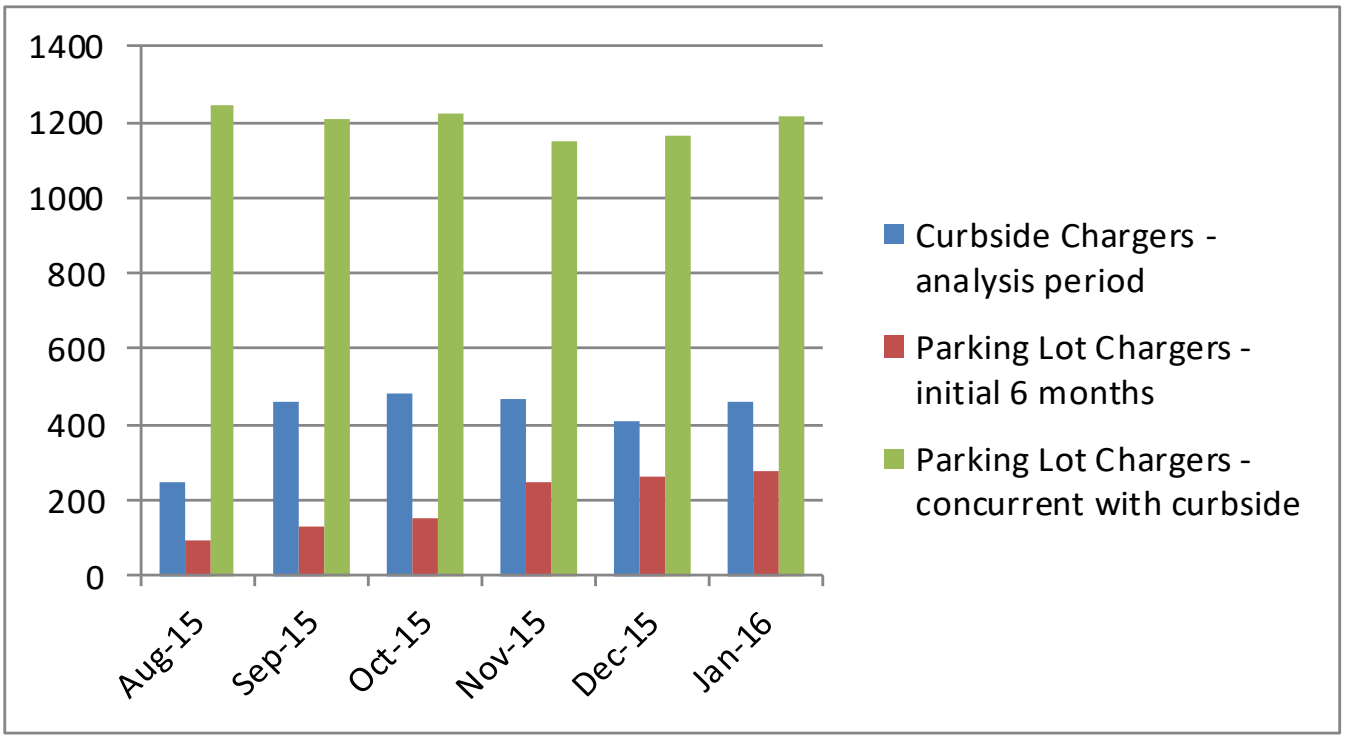
**Table 25: Average Dwell Time per Day per Charge Station Type, First Six Months of Operation**

| | Curbside Station | Parking Lot Station | |
|---|---|---|---|
| Day | Total Duration | Charging Time | Total Duration |
| Sunday | 126.72 | 77.03 | 96.74 |
| Monday | 146.66 | 84.70 | 111.58 |
| Tuesday | 129.50 | 101.92 | 135.33 |
| Wednesday | 126.70 | 97.34 | 127.91 |
| Thursday | 138.09 | 91.06 | 102.94 |
| Friday | 174.82 | 84.46 | 106.60 |
| Saturday | 131.28 | 72.67 | 91.95 |

Source: UCLA Luskin Center

The graph in Figure 27 compares the curbside chargers' total sessions during the six-month analysis period – August 2015 through January 2016 – with parking lot charger total sessions, both during its initial six months – December 2011 through May 2012 – and during the concurrent six months with the initial phase of the curbside program.

**Figure 27: Curbside vs Parking Lot – Total Sessions**




Source: Burbank Water and Power

The above graph highlights a few findings.

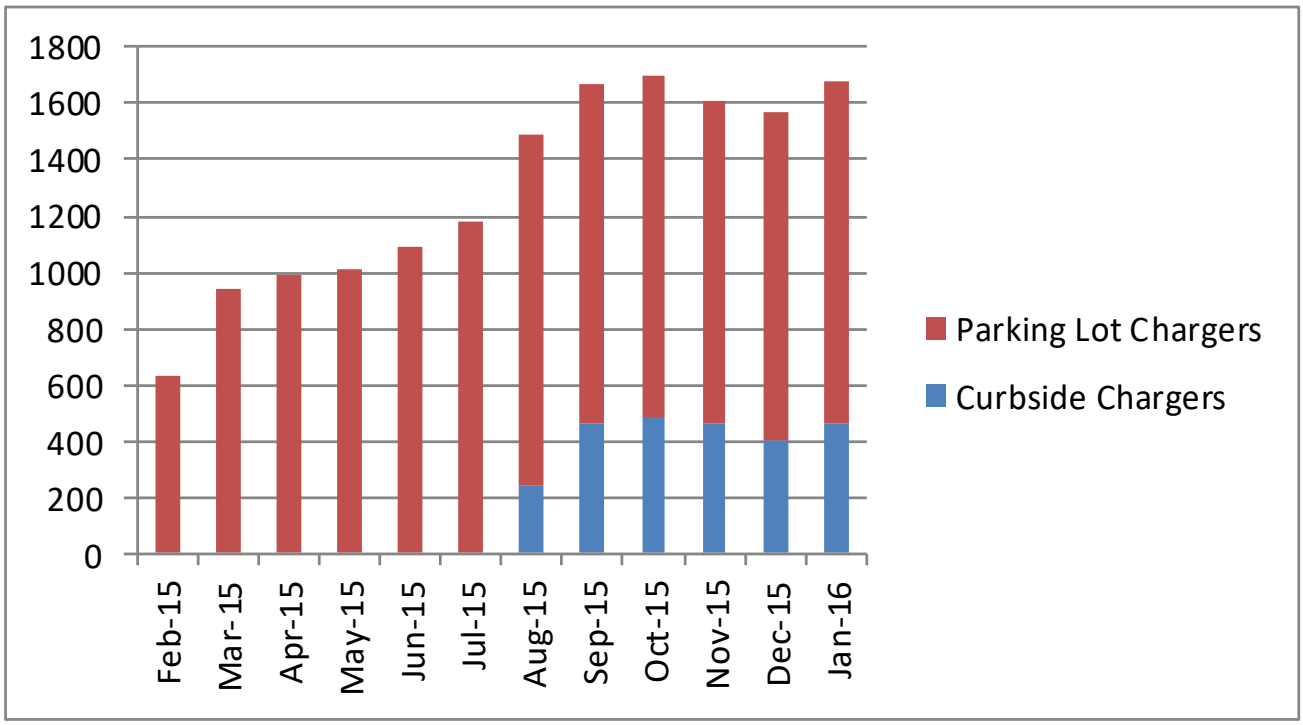
Parking lot chargers' total sessions decreased overall slightly between August 2015 and January 2016. This may indicate that the curbside chargers were cannibalizing parking lot chargers. In other words, curbside chargers were not attracting new users of public chargers, but EV drivers were simply switching from using parking lot chargers to using curbside chargers. This is not necessarily bad news; it could be that for certain drivers, curbside chargers are more convenient than parking lot chargers – i.e. closer to their destination, easier to park, etc.

While parking lot charger usage increased steadily in the first six months of installation, curbside charger usage has stayed consistent from the second month to the sixth month. This could be another indicator of some cannibalization from the parking lot chargers.

The above parking lot charger data also includes utilization of Level 1 chargers, which is a charging option built into each parking lot charging station. Each parking lot charging station contains one Level 1 charger and one Level 2 charger. As Level 1 charger usage makes up less than one percent of charger sessions, we have included this data as customers may use Level 1 charging until Level 2 charging becomes available for their charging session.

Figure 28 shows the total public charger sessions from February 2015 to January 2016.

**Figure 28: Total Public Charger Sessions**



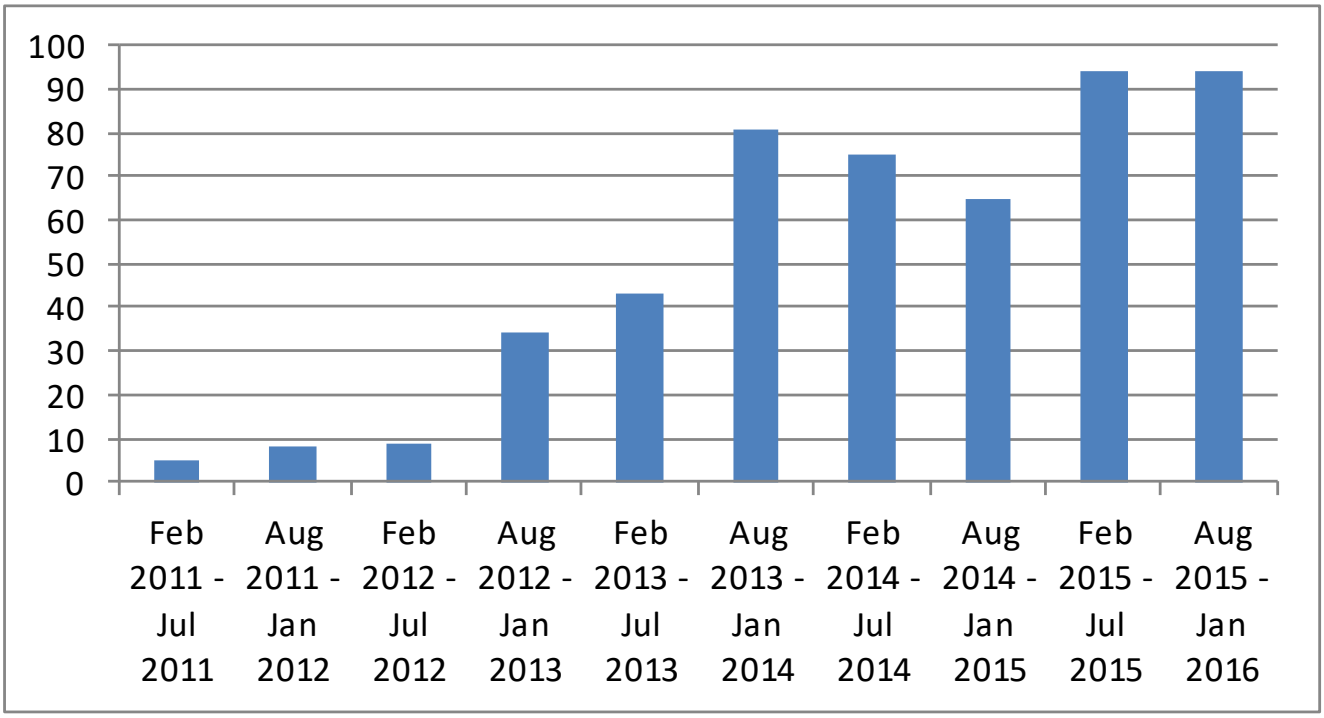

Source: Burbank Water and Power

An important observation is the decrease in charger activity in November and December 2015, compared to one month earlier – October – and one month later – January 2016. The decrease occurs as a result of the holiday season – families spending more time at home and less time driving locally; and based on historical analysis of prior years' this typically occurs each year. BWP may be able to increase charger usage during this period with increased promotion and possible reductions in pricing in the future.

In order to measure the possible cannibalization, we can also look at any changes in the EV market using both public charger usage and new EV registrations. The following figure shows total public charging sessions in Burbank for the six-month analysis period, as well as the prior six-month period. The increase in overall public charger usage includes a nearly 30 percent increase in August 2015 when the curbside chargers became operational versus the previous month. An explanation for this increase may be the result of curbside chargers being selected over the parking lot chargers; however, the curbside chargers may be attracting new users who otherwise would not use public chargers due to limited accessibility and availability.

Figure 29 shows the number of new rebates for EVs registered in Burbank, provided through the state's Clean Vehicle Rebate Project. The graph compares the analysis period in six-month intervals. While the number of new EVs in Burbank did not increase during the analysis period, overall, the EV market is increasing, likely leading to additional public charger usage.

**Figure 29: Burbank Registered EV Rebates**




Source: Center for Sustainable Energy (2016)[4]

## Customer Participation Survey

In March 2016, following the conclusion of the six-month data collection period, BWP developed an online customer participation survey and distributed it to nearly 24,000 email addresses. The objectives of the survey were to confirm usage and measure satisfaction among charger users, help determine program expansion, and identify barriers to increased charger usage and EV adoption.

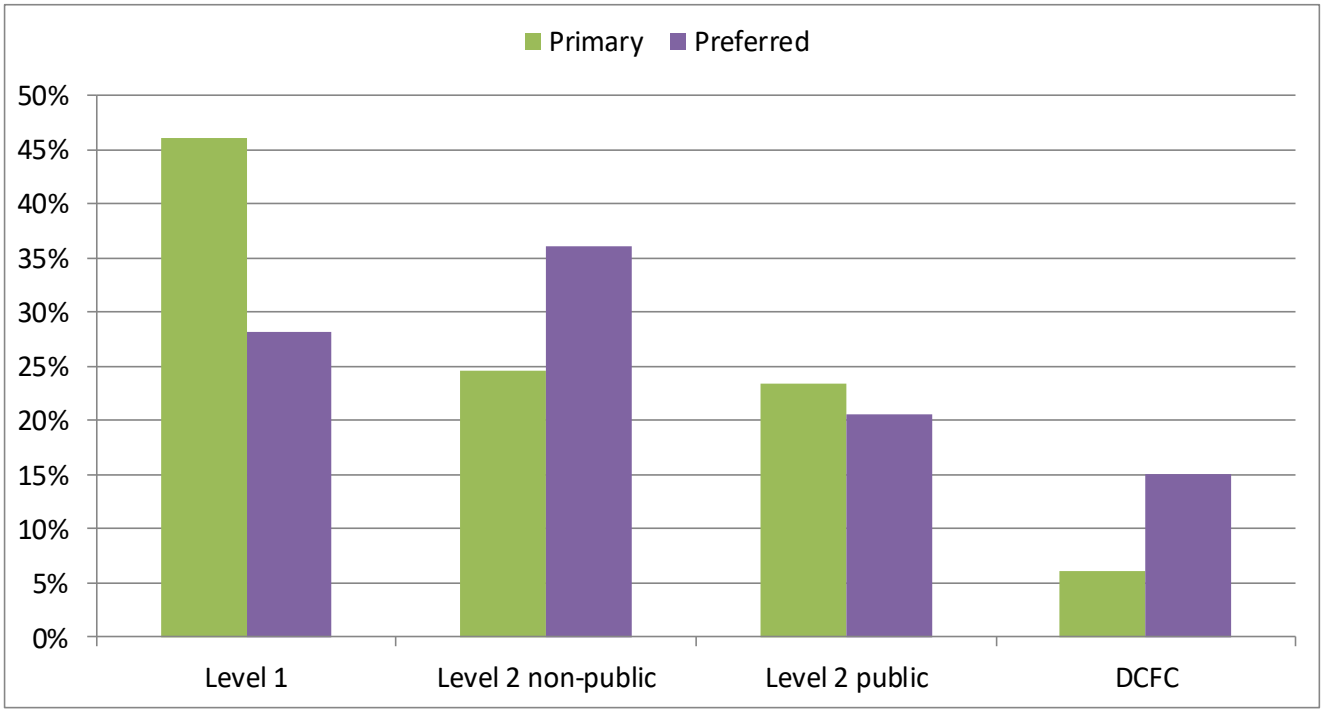
Among the recipients, more than 200 of them were confirmed curbside EV charger users whose email addresses were captured through the Greenlots system. BWP also sent the survey to more than 23,500 customers whose email addresses were captured and stored in the BWP customer information and billing system. More than 95 percent of these customers are Burbank residents; BWP also assumed that a similar percentage were non-EV drivers. The survey was sent to this group in order to gauge the opinion of future EV drivers.

More than 1,100 responses were received, indicating both a robust response rate, nearly five percent, and a significant and representative sample.

The following graph (Figure 30) shows the responding customers' primary method of charging their vehicle, as well as their preferred method. While nearly half of all customers currently charge their vehicles using a Level 1 charger connected to a standard electrical outlet, nearly 75 percent of customers would prefer to use faster charging options, including Level 2 and Level 3 – Direct Current Fast Charger.

[4] California Air Resources Board Clean Vehicle Rebate Project, Rebate Statistics. Data last updated February 16, 2016. Retrieved February 23, 2016. https://cleanvehiclerebate.org/rebate-statistics

**Figure 30: Customer Survey of Charging Preference**




Source: Burbank Water and Power

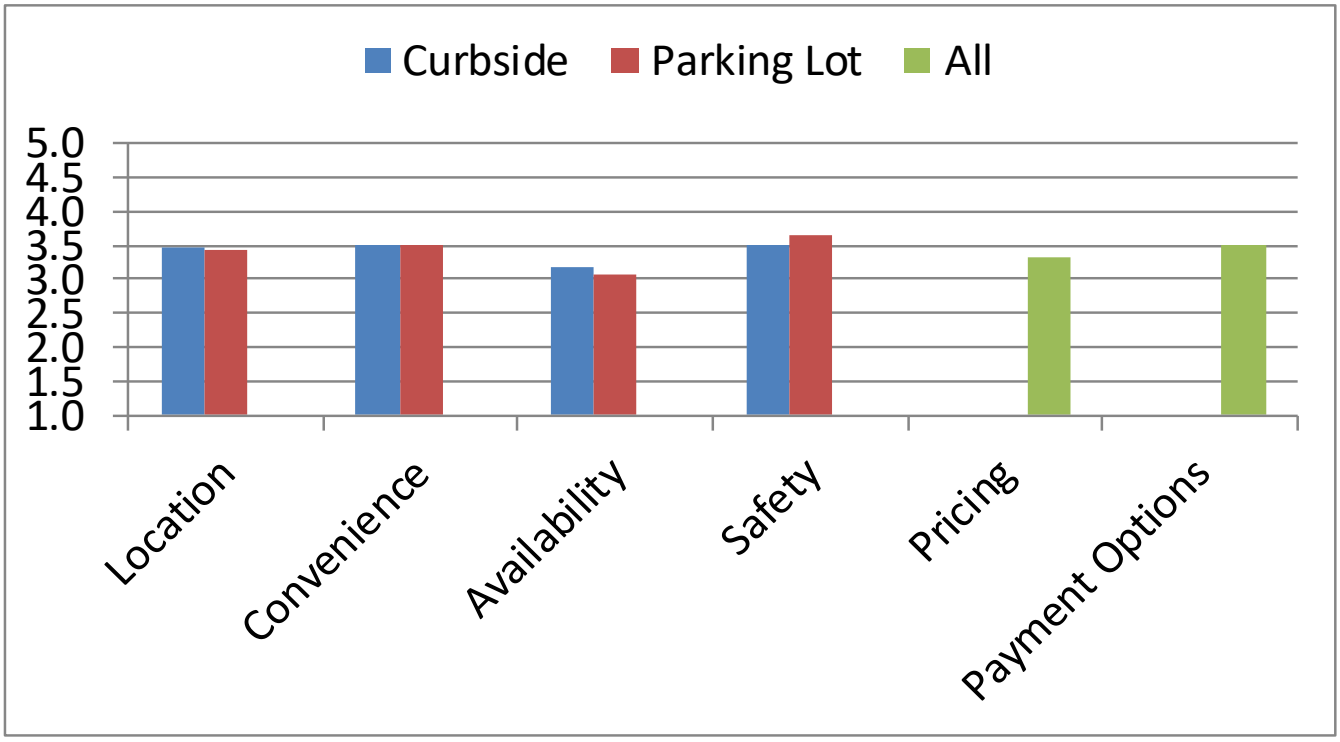
The responses to the question regarding "Primary" method of charging adhere to charging best practices, including the use of Level 1 charging at homes and workplaces. This is due to the long residence times – at least eight hours or more – that most vehicles – electric and non-electric – spend stationary and not in use, either at home or the office.

However, it seems that most customers would prefer the option of faster charging, such that the car is fully charged in four hours or less. This would allow customers to use their electric vehicle in the same way as a non-electric vehicle; for example, to run errands during the day or after work, or to ensure a full charge for the commute home, which Level 1 charging cannot typically provide.

Overall, the responses seem to indicate that while Level 1 charging should continue to be a best practice for homes and workplaces, Level 2 charging will still need to be promoted, such as through rebates, and built by utilities, service providers and employers. In addition, utilities and service providers should continue to develop and install public charging networks.

The table in Figure 31 shows customer satisfaction for the curbside chargers, parking lot chargers, and Burbank's electric vehicle charging services and features. The results are on a scale of "1" to "5", with "5" indicating "Very Satisfied" and "1" indicating "Very Dissatisfied. While the actual ratings indicate overall satisfaction with both the curbside chargers and charging program, the relative ratings may be more significant since the availability of the chargers has the lowest satisfaction scores. This underscores customers' requests for additional enforcement at public chargers, including parking citations or towing for non-electric vehicles and for electric vehicles that are not actively charging.

**Figure 31: Customer Satisfaction Survey**




Source: Burbank Water and Power

Customer satisfaction with the location, convenience, and safety of the curbside chargers seem to be higher, as compared to availability. While relative dissatisfaction with the pricing may be due to the desire for free public charging, the relatively higher ratings for payment options indicate that customers understand the economics of paid public charging but appreciate the multiple payment options.

Of particular interest was the charging habits of users living in MUDs. When asked whether or not the EV owner lived in a MUD, 26 percent responded this was the case; and 60 percent responded they primarily used public chargers to charge their vehicles.

It was also learned that 10 percent of the EV owners using the public chargers did not live in Burbank.

# CHAPTER 4:
# Curbside Program Findings and Recommendations

BWP developed its Electric Vehicle Charging Program with four general goals in mind: 1) balance the grid, 2) enhance customer service, 3) reduce range anxiety, and 4) clean the environment. The curbside charging project, after six months of implementation and activity, has shown the potential to accomplish these four goals, as described below.

EV charging gives BWP an additional source of electric load, as a way to offset the increasing use of energy efficiency and distributed generation. More importantly, as EV charging can generally occur independent of time and weather (as opposed to air conditioning), BWP can continue to incent charger usage during off-peak hours or when there is excess electric system capacity. As EV penetration continues to increase exponentially, BWP can absorb this load without significant impacts to the grid, other customers, or the Burbank community.

In addition to the new source of load, BWP is now able to offer EV charging as a new service. Burbank residents and businesses that are accustomed to 99.999 percent electric reliability, among the lowest electric and water rates in the regional, and fiber optic services can now also use EV chargers that fit perfectly with BWP's mission of reliable, affordable, and sustainable services. Furthermore, Burbank businesses that are proximate to the chargers can entice their employees with EVs to use the nearby public chargers, especially if their workplace is not feasible for workplace charging.

The public chargers also serve the purpose of reducing range anxiety in a city and region where light-duty passenger vehicles are the primary mode of transportation. Burbank residents, business employees, and visitors who previously charged their EVs outside of the city can now feel confident that there is an EV charger within one-mile of any location in the city. These chargers can now fill their vehicle batteries from 20 percent to 80 percent in about two hours at a cost of about two dollars and get them to their next destination with minimum inconvenience and maximum ease.

The EV program to promote charger usage and EV adoption coincides with BWP's electric system bringing on more renewable energy, currently at 33 percent of load and increasing to 50 percent by 2030. As a result, transportation-related emissions will continue to decrease, including greenhouse gas emissions and criteria pollutants. This will contribute to meeting the State's 2030 Climate Commitment, as well as making the air cleaner in Burbank and the Los Angeles region.

As BWP continues to implement and evolve the EV program, the curbside program has demonstrated the ability to achieve the above goals, as well as to provide other multiple benefits, as described below.

## Program Goals

### Regional Readiness Plan and Integration with California's Charger Network

In developing the curbside concept and for overall project planning, BWP sought to utilize and maximize existing resources to ensure the successful implementation of the unique curbside

concept. Therefore, BWP contracted with the Luskin Center for Innovation to apply their travel model from the Southern California Plug-In Electric Vehicle Readiness Plan to our curbside project, including site selection and utilization analysis.

In addition, BWP sought to incorporate other best practices from the Readiness plan, including the use of dedicated parking for curbside charging. The use of dedicated parking ensures continued access by EV drivers to individual chargers, as well as the charging network. In addition, customer and driver satisfaction increases as a result of charger availability and reliability.

The Readiness plan also discusses best practices regarding public charging infrastructure. The curbside project expands and builds on BWP's efforts to implement a public charging infrastructure. Public charging alleviates existing EV drivers' range anxiety and entices future EV drivers by giving them another reason, beyond rebates and fuel savings, to purchase or lease an EV.

## Address All Charging Scenarios

BWP's first efforts in 2011 to build a public charging infrastructure was mostly focused on destination charging – to put the chargers where the most drivers would go. As a result, nine of the 11 chargers were installed in large parking structures or lots in downtown Burbank, which attracts a majority of Burbank residents and out of town visitors. These chargers were located in a commercial land use area, with limited access to residents and visitors of other land use types. For example, a resident of the western Burbank zip code of 91506 may be able to use the chargers when visiting the downtown area but would not be able to rely on them for more periodic charging.

With the curbside project, BWP sought to expand the network to ensure access to other types of charging, including for corridor, small business workplace, and MUD residents. The curbside chargers are located proximate to all land use types, including the hard-to-reach segments of MUDs and small businesses. BWP and the UCLA Luskin Center's analysis has shown usage by each of these segments, based on the charger location and time of day.

## Continuous Improvement Process

BWP also incorporated lessons from the initial demonstration project into the curbside project, in order to optimize demand for, and utilization of the curbside and existing chargers. Perhaps the most significant factor in charging station usage, besides location, is the pricing structure. BWP has continued to review carefully the pricing structure, and revise it according to market conditions, best practice rate design, and customer input. The current TOU pricing structure works well to maximize usage of the charging stations, while generating service revenue for BWP, with minimal to no impact to non-participants. BWP will continue to analyze and implement various pricing structures that are cost-effective to both the utility and to customers and will result in greater charger usage and EV adoption. BWP will also continue to study new service features, such as reservation charging, and introduce them as requested or necessary.

## Expand Public Charging Infrastructure

The service revenue from existing chargers also helps to generate funds for new charging projects, including expansion of the public charger network. An expanded network in Burbank can help contribute to the state's goals regarding number of EVs and chargers. Public chargers have many advantages over non-public chargers, the most significant of which is that public chargers are available to all EV drivers and are not located in private or workplace parking

structures or lots. Public chargers are also more likely to be incorporated into EV market resources for EV drivers and resources, such as Plugshare.

Public chargers are also more visible to the public, especially to non-EV drivers, who may be more likely to purchase an EV once they are aware of public charging options. In addition, public chargers are more likely to be accessible, available, and maintained, given the City's resources for infrastructure development and parking enforcement, and BWP's resources for maintenance by trained and experienced electricians.

# Overall Findings and Recommendations

## Utility Impacts

BWP's EV Charge N Go project was conceived and developed in order to diversify the types of public charger locations, address additional charging scenarios, and provide additional options for EV drivers. Curbside charging is also a way for utilities to potentially reduce the cost and amount of time necessary to site and install chargers in publicly accessible areas.

Charger siting requires physical space – for the equipment as well as a parking space for the EV – which is often scarce, especially in urban areas. In addition, public utilities need to spend time identifying property owners who are willing to give up valuable physical space in return for the potential of increased activity and business at their property. This uncertain process can lead to delays and can often result in cancelations of once-promising charger projects. If public utilities and cities are able to use unused space on the sidewalk in the public right-of-way to install the equipment, then excess existing parking spaces can be used and converted to EV-only parking spaces.

A future topic of study would be to determine how the cost of curbside chargers compares to traditional parking lot chargers. While equipment costs do not vary much and can be less than 25 percent of the total project cost, more information is needed to determine whether the cost of bringing power to the charger, or the actual installation of the charger, is more for curbside chargers compared to parking lot chargers.

Overall, increased and continued usage of, and satisfaction with the curbside chargers, as well as of the parking lot chargers, has demonstrated the on-going need for public and destination chargers. BWP, through its development and implementation of the curbside charging program, has demonstrated that this model can be replicated by other public utilities and agencies, and can also benefit from funding and other support from the State.

## Customer Impacts

Curbside chargers may also be more convenient for EV drivers. When curbside chargers are located on major streets, EV drivers are able to visually identify available chargers while driving. This type of identification is not always available with parking lot chargers. In addition, curbside chargers are more likely to be used in various charging scenarios than parking lot chargers, which are primarily used for destination charging. Curbside chargers that are sited correctly can be used for destination, corridor, and workplace charging. In addition, curbside chargers that are placed on major streets and that are adjacent to MUD properties are more convenient for MUD residents than parking lot chargers.

Additional data collection, beyond the six-month analysis period, and further research is needed to determine how curbside chargers are used in various charging scenarios. BWP's customer participation survey in conjunction with UCLA's ongoing analysis should yield

additional findings regarding the curbside project that can help inform further expansion of the public charger network.

## Community Impacts

As the EV market grows through EV penetration and newly installed chargers, the community benefits of reduced greenhouse gas emissions and other pollutants, and reduced transportation expenses will continue to accumulate. As BWP has opted into the California Air Resources Board's Low Carbon Fuel Standard program, the electric fuel provided in kWh can be converted to credits for greenhouse gas emissions avoided and sold at a market price. The funds can then be used to expand BWP's EV charging infrastructure.

In addition to the reduced gasoline expenses for EV drivers, the community benefits through increased electric reliability. As charger usage increases, the impact on the utility's electric load can be managed through charger pricing and policies that encourage off-peak charger usage. A stable electric load results in consistent electric rates for EV charging, and a more favorable outlook for EVs as gasoline prices increase in the long-term.

## Next Steps

Burbank Water and Power continues to promote the electric vehicle charging program and increase public awareness by providing electric vehicle rebates, including information on multiple websites, in the utility newsletter, and by participating in conferences and workshops presenting the program and sharing experiences.

EV curbside charger utilization continues to increase significantly. The number of curbside charging sessions was 2,510 between August 2015 through January 2016, and from February 2016 through July 2016 the number of charging sessions was 3,956-a 58 percent increase! During the same timeframes, kilowatt hour usage was 21,313 kWh and 35,448 kWh respectively-a 66 percent increase! This increase in charging has generated revenues of $6,347 for the February 2016 through July 2016 term; an increase of 58 percent over the six-month study period of August 2015-January 2016. Based on the continued monitoring of curbside utilization and the dramatic increases, this project has been very successful and EV owners are very receptive to this type of charger.

It is also worth reporting that when reviewing the utilization data for the parking lot chargers and the curbside chargers for the entire year term, each six-month period actually shows an increase in parking lot charging as well. The increase was 15 percent when comparing the February 2016 through July 2016 term to the August 2015 through January 2016 term. So, while there may be some EV owners who are opting to charge at curbside chargers over parking lot chargers, overall charger utilization has increased regardless of the location. This is likely due to the increase in marketing and the increase in the availability of charging units allowing for more EV and plug-in hybrid car owners to use them.

Electric vehicle charging is proving to be an increasing need for the public and it is clear from the results of this project and the continuing increases in utilization, investing in this infrastructure and providing this service is necessary to support increased market penetration for electric vehicles. As such, Burbank Water and Power will continue to evaluate future locations and expansion of the electric vehicle charging infrastructure throughout the City.

# GLOSSARY

CARBON DIOXIDE (CO2)—A colorless, odorless, nonpoisonous gas that is a normal part of the air. Carbon dioxide is exhaled by humans and animals and is absorbed by green growing things and by the sea. CO2 is the greenhouse gas whose concentration is being most affected directly by human activities. CO2 also serves as the reference to compare all other greenhouse gases (see carbon dioxide equivalent).

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.

BURBANK WATER AND POWER (BWP)— BWP is a not-for-profit organization owned by the citizens of Burbank. BWP'S mission is to provide reliable, affordable and sustainable water and electric services.[5]

DIRECT CURRENT (DC)—A charge of electricity that flows in one direction and is the type of power that comes from a battery.

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

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).

KILOWATT-HOUR (kWh)—The most commonly used unit of measure telling the amount of electricity consumed over time, means one kilowatt of electricity supplied for one hour. In 1989, a typical California household consumed 534 kWh in an average month.

[5] BWP About Us Website https://www.burbankwaterandpower.com/about-us/about-bwp

MULTIPLE-UNIT DWELLINGS (MUD)—A classification of housing where multiple separate housing units for residential inhabitants are contained within one building or several buildings within one complex.[6]

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.

TIME-OF-USE (TOU)—PG&E rate plans that can reduce expenses by shifting energy use to partial-peak or off-peak hours of the day. Rates during partial-peak and off-peak hours are lower than rates during peak hours.

UNIVERSITY OF CALIFORNIA, LOS ANGELES (UCLA)—A public research university located in Los Angeles, California. It is one of the 10 campuses in the University of California (UC) system.

[6] Multiple-family residential Wikipedia https://en.wikipedia.org/wiki/Multi-family_residential