EVmatch: The Revere

Campbell, California

Property Profile

The Revere features 168 apartments with ground floor retail. Built in 2015 with a mixture of studio, one- and two-bedroom floorplans. The property has dedicated residential parking as well as shared parking for retail customers. Campbell, California is in the heart of Silicon Valley, within a short drive to many major employers and light rail to downtown San Jose and Santa Clara. The Revere is located within walking distance of a grocery store and a major retail center. It has nearby access to the Los Gatos Creek trail.

Charging Barriers

The building owners wanted to be competitive in the market and offer electric vehicle (EV) charging as an amenity. With uncertain demand for charging, the property looked for a low-cost shared use solution to test the technology and monitor demand.

Technology Solution Summary

EVmatch (https://www.evmatch.com/) is a software developer that manages charging station use via a reservation-based system. The reservation-based system is a key feature because it: 1) ensures EV drivers that they will have charging when and where they need it, and 2) maximizes charging station throughput to fully utilize the hardware and electric infrastructure. Charge sessions can be reserved to allow users to plan routes/charging. The company's service started with sharing of personal/home charging stations and has now expanded to include managing charging at commercial locations and multi-unit dwellings (MUDs) (apartments and condominiums). For MUDs and other commercial locations, the EVmatch system includes low-cost, but robust and reliable Enel X JuiceBox Alternating Current (AC) Level 2 smart charging stations (also referred to as electric vehicle charging equipment [EVSE]) that include EVmatch's low-fee software (Figure 1). Three charging power levels are available: 7.7 kilowatt (kW), 9.6 kW, and 11.5 kW. EVmatch is also working with other station suppliers to offer additional models. Users interact with EVmatch's system via a mobile phone app that: 1) locates charging stations, 2) reserves charging

Figure 1: EVmatch stations outside MUD building

sessions, and 3) extends charge sessions (if needed) and if the following time slot is available. Multiple EVmatch managed charging stations can be installed at a MUD, in the same location or in separate locations. EVmatch's management portal allows MUD Property Managers to set pricing, (optional) idle fees, and other privileges. The MUD property can also set up/configure different user groups (e.g., MUD

residents and public) and set availability. For example, public access may be allowed during the day but restricted at night when MUD residents need the charging stations. The public use fee can also be different/higher than for MUD residents. This multi-user profile can be useful for increasing usage and revenue from the stations. The EVmatch system handles the customer billing for charging session fees and reimburses the MUD property (less fees) every month or every quarter.

Charging Analysis

Due to the COVID-19 pandemic, and the charging stations being installed during it, the charging stations only had a few charging sessions per week. EVmatch could not provide an indication of The Revere residents vs. others. The data did not indicate regular charging usage, demonstrating the challenges of installing charging stations without clearly identified tenants who will use the stations. The vast majority of charging sessions were by a single user with a Tesla Model 3 (Figure 2).

The parking area also has several 120 VAC outlets that allow for AC Level 1 charging. These can especially be useful for residents with plug-in hybrid vehicles (low battery energy capacity) and/or frequent charges after short trips. One of the retail tenants, a salon, was likely closed for much of the data collection period. There was not enough data over the data collection time period to determine if any of the EVmatch charging station users were MUD residents or business customers.
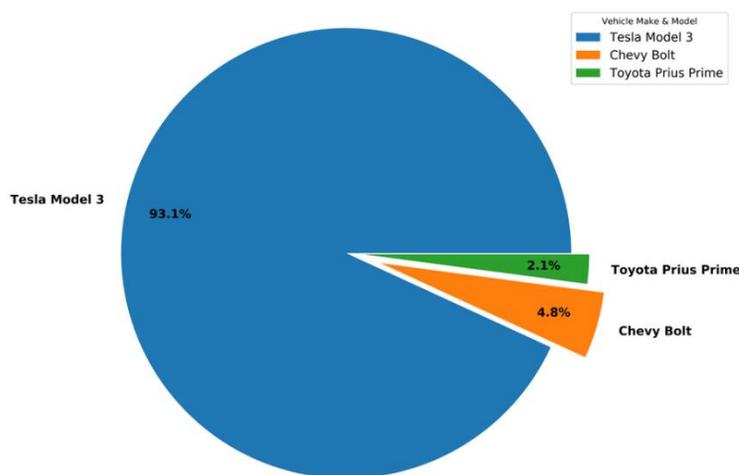

Figure 2. Energy provided by vehicle make and model

The charging stations at the Revere went into service during the height of the COVID and have not yet established a regular usage pattern. Additional months of data will hopefully so more usage and could possibly indicate if any new residents purchase vehicles. The timing of station installation was largely dictated by grant funding.

Business Case Analysis

As newer construction, the property was built with the electrical capacity for at least a few stations, likely five or six based on California Green Building Code. Grant funding from Silicon Valley Clean Energy, the community choice energy provider helped to offset the cost of the stations. The charging fee is set to recover average electricity costs and could offset service fees with more usage.

This business case analysis summary using the available provided data includes the following components:

1) <u>Initial costs:</u> charging station capital cost, charging station installation cost, electrical infrastructure work cost, and commissioning/activation costs

2) <u>Monthly costs:</u> electric costs, charging station service provider fees, charging station usage fees, and MUD property revenue

Here we compare the initial costs, operating costs, and revenue generation of the EVmatch charging stations to those of other standard high- non-networked charging stations.

At the time of the demonstration The Revere had two single-port EVmatch-managed charging station with integrated cable management. The cost comparison reflects this installation configuration for all technology examples. EVmatch uses Enel X JuiceBox networked charging stations and adds functionality via software. The business case analysis uses the same installation configuration as at The Revere and the same standard alternative technology options other innovative charging technology business case analyses for all technology examples for consistency.

Initial Costs

Table 1 shows a breakdown of the initial one-time costs to purchase and install each charging station option. Four options are shown: 1) the Vehicle Charging Innovations for Multi-Unit Dwellings project (VCI-MUD) project innovative charging hardware option; the EVmatch system, 2) a typical standard high-feature public-access type charging station; the ChargePoint CT-4000, 3) a typical standard medium-feature MUD-property type charging station; the ChargePoint CPF-50, and 4) a typical standard non-networked charging station; the Clipper Creek HCS-40. All technology options require the same electrical power, so the electrical infrastructure costs were assumed to be the same.

Table 1. The Revere charging station options initial cost comparison

INITIAL COSTS				
EVSE Type	VCI-MUD Innovative Charging Technology	High-Cost/ Feature	Low-Cost/ Feature	Non-Networked
Example Model	EVmatch-managed Enel X JuiceBox Pro	ChargePoint CT-4000	ChargePoint CPF-50	Clipper Creek HCS-40
Charging Station	$2,608	$7,210	$4,655	$2,589[3]
Router	$1,365[1]	$1,365[1]	$1,365[1]	$0
EVSE Installation	$300[2]	$1,200	$1,200	$400
Electrical Infrastructure	$2,117	$2,117	$2,117	$2,117
Commissioning	$0	$349	$0	$0
TOTAL INITIAL COST	**$6,390**	**$12,241**	**$9,337**	**$5,971**

[1]Includes both capital ($500) and installation ($865) costs.
[2]Assumed to be $300. Infrastructure costs were combined with installation costs in the data.
[3]Includes costs for a dual-mount pedestal with cable management.

Monthly Costs and Revenue

EVmatch allows the MUD property to set their own charging session pricing structure. Usage fees can be set to offset the charging station costs, or higher to generate revenue. The Revere currently charges residents $0.24/kilowatt-hour (kWh). The same session pricing scheme was assumed for the other charging station types, except for the non-networked unit where billing residents is not an option. Table 2 shows a breakdown of the monthly costs involved with each charging station option and monthly revenue generated from charging session fees. Net revenue is calculated as the monthly session revenue less service provider fees, and monthly electricity costs. Energy costs were calculated based on the assumption that electrical rates remain constant.

Table 2. The Revere charging station options monthly cost comparison

AVERAGE MONTHLY FEES				
EVSE Type	**VCI-MUD Innovative Charging Technology**	**High-Cost/ Feature**	**Low-Cost/Feature**	**Non-Networked**
Example Model	EVmatch-managed Enel X	ChargePoint CT-4000	ChargePoint CPF-50	Clipper Creek HCS-40
Subscription and Data	$33	$55	$37	$0
Maintenance	$0	$62	$33	$0
Warranty	$0	$0[1]	$0[1]	$0
Energy Cost (kWh)	$17	$17	$17	$17
TOTAL AVERAGE MONTHLY FEES	**$51**	**$134**	**$87**	**$17**
AVERAGE MONTHLY REVENUE				
Session Usage Fee	$0.24/kWh	$0.24/kWh	$0.24/kWh	None
TOTAL SESSION REVENUE	**$28**	**$28**	**$28**	**$0**
Revenue Fee	$6	$0	$0	$0
NET REVENUE	**-$28**	**-$105**	**-$59**	**-$17**

[1]Included in charging station maintenance fee

Estimated 10-Year Costs Summary

The total estimated costs for each EVSE type over 10 years are summarized in Table 3 and Figure 3. Costs were calculated under the assumption of double the current monthly usage for the entire 10-year period (anticipating increased demand in the future).

Table 3. The Revere estimated 10-year cost summary

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| EVSE Type	VCI-MUD Innovative Charging Technology	High-Cost/ Feature	Low-Cost/ Feature	Non-Networked
Example Model	EVmatch-managed Enel X	ChargePoint CT-4000	ChargePoint CPF-50	Clipper Creek HCS-40
Capital Costs	$6,390	$12,241	$9,337	$5,941
Electricity Costs	$4,132	$4,132	$4,132	$4,132
Service Provider Fees	$4,000	$13,980	$8,380	$0
TOTAL COST	$14,522	$30,353	$21,849	$10,103
PAYBACK PERIOD	n/a	n/a	n/a	n/a
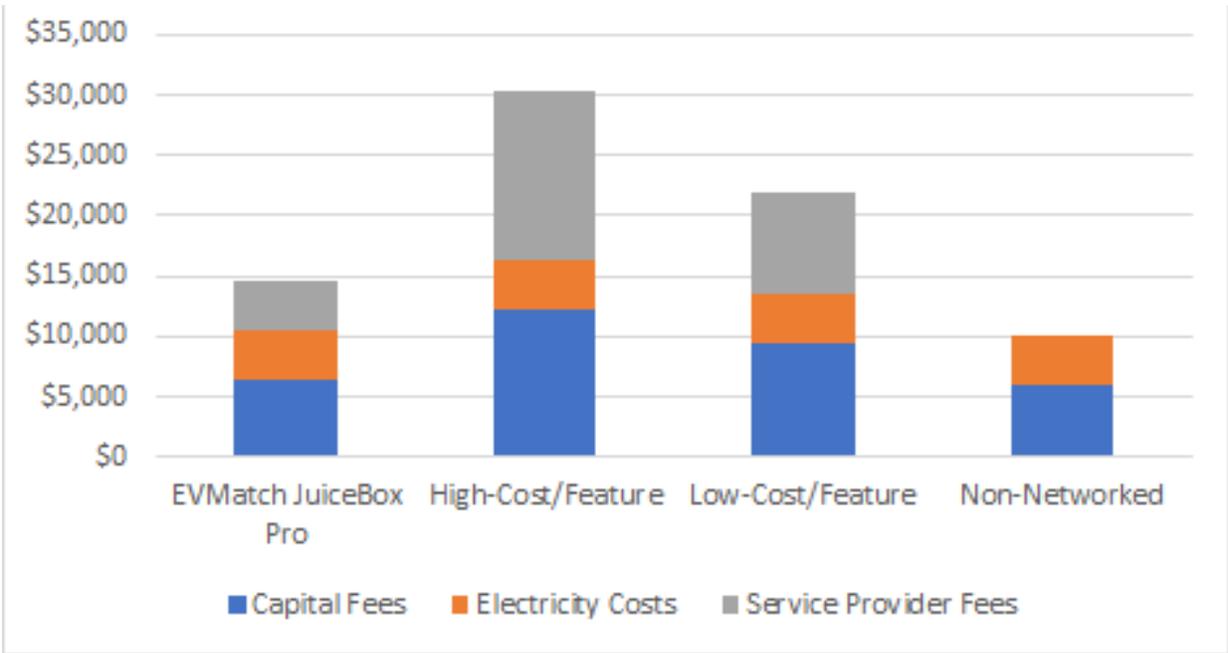
Figure 3. The Revere 10-year cost analysis summary plot

Cost Analysis without Location-Dependent

Some costs are installation-specific (region, state, building). These costs include permitting, electrical infrastructure upgrades/installation, charging station installation, and electricity. These costs vary by location but remain similar between EVSE type. Table 4 and Table 5 are modifications of Table 1 and Table 2 with the location dependent costs removed. The intent of this is to show a more equal comparison for VCI-MUD Toolkit users to build off for their specific location conditions.

Table 4. The Revere charging station options initial cost comparison with location-dependent costs removed

INITIAL COSTS				
EVSE Type	VCI-MUD Innovative Charging Technology	High-Cost/ Feature	Low-Cost/ Feature	Non-Networked
Example Model	EVmatch-managed Enel X	ChargePoint CT-4000	ChargePoint CPF-50	Clipper Creek HCS-40
Charging Stations	$2,608	$7,210	$4,655	$2,589
Router	$500	$500	$500	$0
Site Validation	$0	$599	$599	$0
Commissioning/ Network Activation	$0	$349	$0	$0
TOTAL INITIAL COSTS	**$3,108**	**$8,658**	**$5,754**	**$2,589**

Table 5. The Revere charging station options monthly cost comparison with location-dependent costs removed

AVERAGE MONTHLY FEES				
EVSE Type	VCI-MUD Innovative Charging Technology	High-Cost/ Feature	Low-Cost/ Feature	Non-Networked
Example Model	EVmatch-managed Enel X	ChargePoint CT-4000	ChargePoint CPF-50	Clipper Creek HCS-40
Subscription and Data	$33	$55	$37	$0
Maintenance	$0	$62	$33	$0
Warranty	$0	$0[1]	$0[1]	$0
TOTAL AVERAGE MONTHLY FEES	**$33**	**$117**	**$70**	**$0**
AVERAGE MONTHLY REVENUE				
Session Usage Fee	$0.24/kWh	$0.24/kWh	$0.24/kWh	None
TOTAL MONTHLY SESSION REVENUE	**$28**	**$28**	**$28**	**$0**
Revenue Fee	$6	$0	$0	$0
TOTAL NET MONTHLY REVENUE	**-$11**	**-$88**	**-$42**	**$0**

[1] Included in charging station maintenance fee

Resident Survey

A web survey was designed and deployed that asked questions to all about residents' car ownership (current/planned), usage, feedback on preferred pricing approaches and levels, awareness about the

demonstration charging stations and their use. The survey was open to all residents, whether they had a car or not and whether they had an EV or not. A total of 47 residents responded to the web survey. The survey results indicate that the residents of The Revere heavily rely on their personal vehicles for transportation. Over 95% of survey respondents at The Revere owned a car and 62% indicated that they use their car daily to travel an average of 29 miles a day. Of the residents that responded and own a car, half of them drive plug-in electric vehicles. A large portion of the charging for these vehicles is happening at home (42%), followed by work (27%), and other public charging stations (18%). A total of 38% of residents indicated that they charge their vehicle three (3) times a week and 72% of the sessions last until the vehicle is fully recharged. These charging behavior statistics show that around half the EV driving residents at The Revere would need access to MUD charging stations at least 2-3 times a week. Since most residents wait to fully recharge their battery before unplugging and it is not feasible to provide a charging station for every resident, it is important to reduce dwell time after a charging session and make the charging station available to other users. This could be accomplished in several ways, but a possible solution could be to implement a reservation system for the charging stations where certain residents have access to charging stations on certain days of the week.

Some of the other survey results can also be used to guide future EV charging infrastructure development at The Revere. 69% of residents feel that the community needs additional charging stations indicating that the demand is already exceeding the currently available charging infrastructure. In addition, 78% of residents indicated that they are interested in purchasing a plug-in electric vehicle within the next three (3) years, but 67% said they would not do so if their community did not have charging stations. This shows that the availability of MUD charging stations has a significant influence on the adoption of plug-in electric vehicles. The availability of EV charging stations is also likely going to be a significant factor for attracting new residents.