

Building electric vehicle charging stations in the City by the Bay

Application Note



Testing Functions Case Study

As easy as plugging in your cell phone—that's the idea.

Just drive up to the ParkPod electric vehicle (EV) charging station, plug in and go about your business: check into your hotel room, watch a movie, grab dinner, shop for groceries or walk the mall. When you return (or the charge station sends you a text message) your car is charged and ready to roll.

That's the concept two San Francisco Bay Area pioneers, ParkPod and Metropolitan Electrical Construction, Inc., are bringing to property owners. Installing the stations is straightforward electrical work. But getting that far, with the property owner's blessing and the permits needed to build a new electric vehicle charging station—that takes some finesse.

Long just a pipe(less) dream, plug-in vehicles like the Nissan Leaf, Chevy Volt, Mitsubishi "I," Ford Focus and Navistar urban delivery truck are hitting the road. Soon thousands of EV drivers far from their home garages will be looking for "opportunity charging" facilities like the ParkPod station that Metropolitan Electric recently installed at one of San Francisco's luxury hotels.

In many ways it's an ideal setup: hotel guests hand their keys to parking valets who plug in the chargers, monitor progress and, when charging is done, relocate the vehicles to make room for the next customer. The cost of the service goes on the customer's hotel bill or credit card.

But that's just one of many charger concepts, said Tom Brigham, Vice President of Business Development for ParkPod. The key is to find the right mix of benefits for the property owners and their EV-driving guests, customers or employees. Finding the right locations and making the sale is a job shared by ParkPod and Metropolitan—either partner may take the lead.

Opportunities in charging

"The emerging model is you plug in at home. It costs you about 75 cents per 'gallon' equivalent," Brigham said. "If you can also do opportunity charging when you're driving around, it extends your range a lot. Instead of looking for a gas station, you charge your vehicle where you have to go anyway, such as the mall, a restaurant, a hotel for a meeting or a parking garage. The parking operator may offer this for free as an incentive, but even if they charge you a few bucks, it's still going to be cheaper for you as a rule."

How long does charging take? "The average-size battery is like the Chevy Volt," Brigham said. "Depending on some variables and assuming it's not totally empty, you should be able to charge it in about an hour and a half—maximum two hours at Level II speed, and perfect time for shopping or lunch. The Nissan Leaf, if it's close to empty, will take around three to four hours."

Tools: 1587 Insulation Multimeter

Applications: Check voltage available at EV charging station, confirm voltage at panel, check for ground faults and shorts, conduct final testing

Customer: ParkPod and Metropolitan Electrical Construction, Inc.

If charging stations are a good deal for EV drivers, do they make financial sense for property owners? EVs are rare for now, and no one wants to install a charger that won't be needed. But Brigham, who spends his days talking with property owners about costs and benefits, sees some patterns emerging.

"Hotels, parking lot companies and commercial building operators are interested," Brigham said. "Retail and malls are sort of interested, but they don't have the hospitality attitude of the hotels. A lot of commercial building operators want to provide this for free." Commercial building owners and their tenants see charging stations as a way to keep tenants and their employees happy, while adding to their green credibility.

Charge for a charge?

Power for an average charge costs the property owner about \$1.50, Brigham said, cheap enough that some operators may provide the service free as a way to attract additional customers. For others, just having chargers available can build business. At that San Francisco hotel, for instance, hybrid drivers checked in solely because an Internet search showed the hotel had a ParkPod installation.

The cost of installation is a key factor driving property owner decisions. Metropolitan Electric provides the estimates. With three divisions handling a wide spectrum of electrical projects, cell phone infrastructure jobs and data communication projects, Metropolitan has ample skills for the job.

It's all about location, said Metropolitan's Mike Kraft, Senior Project Manager. First, where is the closest available 240 V power? If only 480 V is available, add a transformer. Calculate the wire gauge required and the length and type of conduit, junction boxes and fittings, figure installation of a CAT V data connection, add labor and you have a number. But that number won't be the same everywhere.

Local code requirements and permitting processes can make a big cost difference, Kraft said. In San Francisco, for instance, installations near the waterfront are governed by Port of San Francisco requirements, including demand for complete installation drawings, which can double the cost.

Plugging in to new revenue

With owner approval, the installation proceeds. ParkPod charging stations are designed in California and manufactured in Germany. They come in floor-mount models that can charge one or two vehicles at a time, and in wall-mount models. They're categorized as "Level II" chargers and run on 240 V, 30 A power. And as their streamlined design suggests, they are way smarter than your average electrical plug.

The ParkPod models have an LED status indicator to show if the station is available, charging is ongoing or charging is complete. They can read RFID smart cards for user authentication. Units in a group can be linked through a wireless network, and the group can be connected to the Internet or a local server.



Keith Wood checks the voltage available at the ParkPod charging station, using his Fluke 1587 Insulation Multimeter.

Upgrades are done by uploading new software or firmware. They are GPS-enabled to make finding a charger easy, and they can even signal if they are available or busy.



Tom Brigham shows off the latest ParkPod vehicle charging station, which can be mounted on a wall or on a modular base.

on each leg of the three-phase service. "I made sure that the breaker I was going to install wasn't on highly loaded legs, and I checked the voltage at the panel, of course," Wood said. "Another subcontractor for ParkPod came in and checked the whole unit out before we turned on the power," he added, "they tested the voltage and made sure everything inside was the way it was set up at the factory." With installation complete, it's time for users to get charged up—and for property owners to start counting the benefits. "It can be a revenue generator," said ParkPod's Brigham. "There have been studies on this: three to four bucks for a charge is something EV drivers are happy to pay. If you assume steady use that's 40 bucks a day for the whole charger, and it starts to add up. All of sudden it's \$1200 a month. After a while it pays for itself, and if you have a bank of these it can be a nice little revenue source."

Installations "don't really get much simpler," said Keith Wood, foreman electrician for Metropolitan and a veteran of 40 years in the industry. Wood handled the hotel installation. "The unit was fed from an 80-amp breaker," he said. "We used number four conductors, which are good for in

excess of 80 amps. The run was a little more than 100 feet (30.5 meters), so voltage drop wasn't even a consideration."

Wood used his Fluke digital multimeter (DMM) to confirm voltage at the panel and check for ground faults and shorts, and his clamp meter to measure load

Installing a car charging station? Here's what you need

It's a straightforward job, said Keith Wood, foreman electrician for Metropolitan Electrical Construction, Inc., in San Francisco. Step by step:

- Locate the closest 220 V electrical panel with enough spare capacity to power the charging station. (For example, a ParkPod charger used around 35 amps for each side of a dual unit.)
- Use your Fluke digital multimeter to measure the actual voltage available at the panel, and your Fluke clamp meter to measure load on each leg of the three-phase service.
- Measure the distance from the panel to where the charging station will be placed [a Fluke laser distance meter would be perfect for this], then calculate the wire gauge needed to provide the necessary amperage capacity.
- Install the breaker, conduit, conductors, and charging station hardware.
- Conduct final testing and put unit in service.



Wood uses his Fluke 337 Clamp Meter to verify that amperage available at the panel is adequate to supply the charging station.

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