

## NEW SERVICES OF PLUG-IN ELECTRIC VEHICLES CHARGING STATIONS

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### ABSTRACT

EVs use an electric motor for traction, and chemical batteries, fuel cells, ultra capacitors, and/or flywheels for their corresponding energy sources. The EV has many advantages over the conventional internal combustion engine vehicle (ICEV), such as absence of emissions, high efficiency, independence from petroleum, and quiet and smooth operation. In the near future, as the number of Plug-in Electric Vehicle (PEV) drivers continues to increase, offering PEV charging services in your parking garage will no longer be optional. This paper presents new parking lot services, as an important element affecting the electricity retail market, that can make for PEV owners to encourage more of them to use of these charging stations.

### INTRODUCTION

There are growing concerns around the world about energy independence and global warming issues. For this reason, the governments and supports of environment decided to reduce atmospheric pollutants. the bulk of the efforts is to reduce the oil-fuelled vehicles and replace them with electric vehicles. EVs use an electric motor for traction, and chemical batteries, fuel cells, ultra capacitors, and/or flywheels for their corresponding energy sources. The EV has many advantages over the conventional internal combustion engine vehicle (ICEV), such as absence of emissions, high efficiency, independence from petroleum, and quiet and smooth operation. The operational and fundamental principles in EVs and ICEVs are similar. There are, however, some differences between ICEVs and EVs, such as the use of a gasoline tank versus batteries, ICE versus electric motor, and different transmission requirements. As the price of batteries decrease and the amount of personal distributed generation increases, consumers are likely to be interested in either selling power obtained from i) nightly charging at cheap prices or ii) their own generation such as photovoltaic or small wind turbines. Storage is especially beneficial for wind power, since its power generation fluctuates greatly throughout a given day.[1-2] Since Electric vehicles are likely to be parked in some type of parking lot during the day, a parking lot capable of selling this excess power would be needed. In large parking lots with hundreds of vehicles, selling power in bulk could allow the parking lot operator to enter the peak power market where the best prices are available. A typical parking lot setup is shown in Figure1.

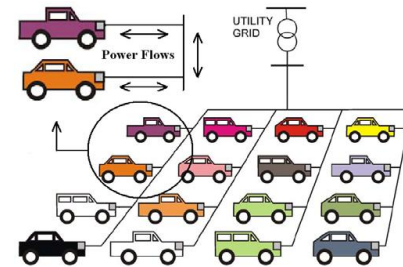


Fig1. example of a parking lot diagram

In the near future, as the number of Plug-in Electric Vehicle (PEV) drivers continues to increase, offering PEV charging services in your parking garage will no longer be optional. However, establishing an PEV charging service that fits in with your current business and operational models, and doesn't require adding IT resources and staff, may prove challenging. How do you scale efficiently to meet growing demand for PEV charging to maximize your return on investment while keeping costs down? Charge Point's advanced features automate and streamline many of the manual tasks associated with managing PEV charging operations, minimizing costs while providing you with an additional revenue stream. For example, you can easily download usage information and import it into other systems for invoicing. With Charge Point, you can provide multiple payment options to customers to set yourself apart from competing garages collect at the station via Charge Point card or credit card, and charge more for reserved stations. Also, you'll attract new customers as drivers browse your stations on the Charge Point online map, consult their navigation systems and mobile apps for parking and charging availability. The additional revenue can be generated with valuable new services by parking lots like the following :[5-7]

- Attract new customers who use Charge Point's online map or mobile apps to locate stations.
- Download usage information and import it into other systems for invoicing, and provide multiple payment options to customers.
- Collect at the station via credit card or Charge Point card.

Set up services and fees that parking lot provides :

- Combine per-hour and per-kWh charges
- Charge by plug-in time or actual charging time.
- Specify pricing rules for different groups.
- Charge more for reserved stations.

This paper presents new parking lot services, as an important element affecting the electricity retail market,

that can make for PEV owners to encourage more of them to use of these charging stations.

## CHARGING BASICS

If you want to establish a charging station, you need to know about electric vehicle supply equipment (EVSE, Figure 2). There are various types of EVSE which differ based on communication capabilities and how quickly they can charge a vehicle and EVSE can be installed at homes, workplaces, private fleet facilities, and public stations. This section describes the typical EVSE options [4].



Fig2. electric vehicle supply equipment

### Types of Charging Equipment (EVSE)

EVSE is the equipment used to deliver electrical energy from an electricity source (such as the electricity running to the electrical outlets at a business) to a PEV. EVSE communicates with the PEV to ensure that an appropriate and safe flow of electricity is supplied. EVSE for PEVs is classified into several categories by the rate at which the batteries are charged. Two types — Level 1 and Level 2 — provide alternating-current (AC) electricity to the vehicle, with the vehicle's onboard equipment (charger) converting AC to the direct current (DC) needed to charge the batteries. The other type — DC fast charging — provides DC electricity directly to the vehicle. Charging times range from less than 30 minutes to 20 hours or more, based on the type or level of EVSE; the type of battery, its energy capacity, and how depleted it is; and the size of the vehicle's internal charger. EVs generally have more battery capacity than PHEVs, so charging a fully depleted EV takes longer than charging a fully depleted PHEV. Many medium- and heavy-duty PEV manufacturers are adopting light-duty charging standards or commercially available standards developed for other uses. However, some manufacturers are introducing alternative charging configurations in their medium- and heavy-duty PEVs, so EVSE options and performance may be different for these vehicles[2-3].

### Charging Station Benefits

There are many benefits to owning or hosting a charging station, which depend on your site characteristics as well as your goals and values. For example, a retail business may host a charging station to increase customer visits

and revenue, whereas a municipality may host a station for the public health benefits associated with increased PEV use. Each benefit in the following list is or may become available to one or more types of station host.

### Customer Attraction and Retention, Corporate Branding

Offering charging is a direct way to attract and retain new, PEV-driving customers. In addition, many consumers believe it is important to purchase products with environmental benefits and to frequent environmentally responsible companies. Hosting a charging station is a highly visible way to state your organization's environmental values, which may help contribute to a "green" image that attracts and retains customers who share these values.

### User Charging and Parking Fees

Charging-station hosts have the opportunity to generate revenue directly from people who use their services. Although the selling of electricity by non-utility organizations is prohibited in most parts of the United States, there are various ways to collect revenue for charging, such as subscription-based, pay-per-charge, and pay for parking systems. Using these types of systems typically requires installation of advanced EVSE products[2].

### Employee Attraction and Retention

Companies that offer charging may be able to attract and retain employees who want to charge PEVs during the day. In addition, it is very important to many employees even those who don't drive PEVs that their employers are proactive with transportation planning.

### Fleet Cost Savings

An organization may want to serve its own fleet with charging stations in addition to serving the public. A PEV fleet can realize substantial operating-cost savings.

### Advertising Opportunities

Each time a PEV driver visits a charging station is an opportunity to advertise to that driver. A station host could advertise its own products or services in this way or sell advertising space to another organization.

### Contribution to LEED Certification

Installing a charging station contributes toward attaining LEED (Leadership in Energy and Environmental Design) certification. LEED is an internationally recognized system for rating the energy and environmental performance of buildings. Becoming LEED certified may contribute to improving an organization's image and thus attract environmentally conscious customers and employees[4-5].

## Charging Station Costs

The costs of owning and operating a charging station include equipment, installation, maintenance, and electricity costs. You can reduce these costs by taking advantage of discounts and incentives.

### Equipment

EVSE products vary in the types of features they offer and the corresponding prices.<sup>2</sup> Prices shown here are for equipment only and do not include installation costs. The most basic Level 2 products have only standard safety features and status lights. More advanced, “smart” Level 2 products have features such as enhanced displays, charging timers, communications capabilities, and keypads. “Intelligent” or networked Level 2 products have enhanced durability and ergonomics as well as features like payment card readers, billing software, advanced displays, wireless communication, automated diagnostics, computer-controlled power flow, internal metering, and smart-grid compatibility. DC fast-charging products are similar to intelligent or networked Level 2 products but cost substantially more because of the additional hardware requirements associated with their high-power operation. However, manufacturers are working to decrease costs substantially.

### Parking Garages

Because they already charge customers for parking, parking garages are ideally situated to generate revenue directly from PEV-driving customers. In addition, the existing electrical wiring and structure (e.g., walls and low ceilings) of many garages can reduce station installation complexity and cost.

### Office Parks

As noted in the *Charging Station Benefits* section, charging stations can help companies attract and retain employees, enhance “green” corporate branding, and serve their own fleet of PEVs. Employees based at office parks are likely to charge for several uninterrupted hours consistently, which should make charging station use relatively predictable.

### Utilities

Utilities have a vested interest in guiding the development of PEV charging infrastructure, and they are implementing various charging-related strategies. Utilities that are not required to decouple electricity sales may receive direct financial benefits from increased PEV charging and may even establish their own charging stations. “Smart-charging” incentives provide PEV owners with convenient, low-cost charging in exchange for giving the utility some control over the charging schedule for grid-stabilization purposes. When designing charging strategies, utilities must work within the restrictions created by their state Public Utility Commissions.

### Home Owners’ Associations

Like office parks, multi-family housing units host long-term parking. Level 2 or even low-cost Level 1 EVSE may be appropriate for meeting overnight charging needs. The presence of charging stations could add value to the residences and entice environmentally conscious buyers. However, because not all residents benefit directly from the charging stations, home owners’ associations have to determine how to distribute the costs equitably.

### Governments

Government entities have led the early development of PEV charging infrastructure. Although governments install charging stations to benefit their jurisdictions rather than generate profits, they may charge fees as a way to offset costs of station installation and operation.

## CHARG POINT

The first ChargePoint charging stations are installed and available for charging in downtown San Jose.[8] Since its first charging station installation, Coulomb charging stations have been in more than 27 US states, Canada and Europe. In January 2009, the company's first charging stations were deployed and installed by REJ Electric Co. in downtown San Jose that drivers can access through a prepaid plan. The company is working with entities in Las Vegas Nevada, New York and Florida to do something similar there.[5,7] ChargePoint, the company that developed the largest and most open EV charging network in the world, now also provides best-in-class services to help you at all stages of implementing an EV charging solution that is right for your business. Backing up these service products is the largest and most experienced support team in the industry. With access control, flexible pricing and advanced cloud services, ChargePoint makes EV charging good for your business. With ground-breaking features and advanced functionality, ChargePoint makes it easier than ever to monitor and track charging station usage and costs, create viable pricing structures for charging services and inspire driver loyalty.

### ChargePoint Assure

High quality service and support starts with high quality products, site preparation and installation. Even though ChargePoint® charging stations are the most advanced and reliable in the world, site conditions, utilization, accidents and sometimes even equipment failures can cause unanticipated costs and efforts to resolve. For these reasons, ChargePoint has developed and offers the best warranty in the industry. Each ChargePoint station comes with 1 year of ChargePoint Assure coverage—the industry’s first and most comprehensive Parts and On-Site Labor warranty at no extra cost. To keep your stations online and to ensure an enjoyable experience for

both the driver as well as the station owner, we go beyond the typical warranty break fix features. We've included station management, station performance metrics reporting and unlimited software configuration changes at no additional cost. We back our performance with a Service Level response time commitment and a 98% annual station uptime commitment. We even cover labor costs for items typically excluded from most warranties like vandalism, abuse and accidents. Ongoing station management service is a key part of Assure. The annual Cloud Services Subscription is required for all ChargePoint stations and gives you, the station owner, access to a rich set of data and analytic tools to monitor the usage of your charging stations, identify problems, and assess how well your stations are meeting your business goals. You can easily add new stations, and design and modify your station policies, however with Assure, you may request these changes be performed on your behalf by our expert staff. With the station management service from ChargePoint Assure, you can request the day-to-day management of your stations be performed by the ChargePoint team for hands-off management. That's a full year of no worry support. If a station fails due to a manufacturing defect we roll our service team to repair or replace that product on site. Want more years of worry free support? Purchase 1 to 4 additional years of ChargePoint Assure coverage for as little as 10% of list price per year.

**Key benefits of ChargePoint Assure:**

- ++ Unlimited software configuration changes
- ++ 98% annual uptime guarantee with non-performance penalty
- ++ 1 business day response time to station failures or 1 business day from Parts arrival when required
- ++ Monthly summary reports and detailed quarterly reports of your station's performance metrics
- ++ Proactive station monitoring and dispatch
- ++ Labor coverage for station equipment issues typically not covered by warranty such as vandalism, abuse and accidents caused by reckless drivers or snow plows

**Site Qualification Survey and Installation Services**

To ensure your station installation is performed to the highest quality standards and at the lowest possible cost, ChargePoint has partnered with select national operations & maintenance partners (O&M partners). These partners are contractually committed to providing the highest level of service using personnel that have been trained and certified by ChargePoint. Using these Partners to survey your site, and complete the site preparation and station installation automatically qualifies your site for ChargePoint's Assure Parts and Labor warranty. If you choose to employ an installation contractor other than the ChargePoint O&M partner, validating the installation quality to obtain the Assure warranty involves having a ChargePoint validating the

site preparation and installation following completion by the independent contractor or internal customer installer.[5]

**Key benefits of SQS:**

- ++ Electrical capacity assessment to determine requirements for trenching, panels, transformers, and wiring
- ++ Assessment of local and state permit requirements
- ++ Analysis of available cellular coverage
- ++ A comprehensive quote for turnkey design, permitting, site preparation, station installation and site validation

**CONCLUSION**

You now know the basics about PEVs and public charging stations. In a time of volatile petroleum prices and heightened environmental concerns, many people may see PEVs as a convenient way to reduce driving costs while being environmentally responsible. The number of available PEV models and the number of PEVs on the street are growing rapidly, as is the need for additional charging stations. Now may be a good time to consider hosting a charging station and becoming part of the electric transportation future. This paper presented new parking lot services, as an important element affecting the electricity retail market, that can make for PEV owners to encourage more of them to use of these charging stations.

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