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Site Owners of Electric Vehicle Charging Stations on Commercial Properties

Best Practices Guide

New York State Energy Research and Development Authority

December 2015

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Best Practices Guide

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New York State Energy Research and Development Authority

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Table of Contents

Cover photo and photo to the right:
An EV charging station at the Chadwick Bay Marina in Dunkirk, NY.

Courtesy of Energetics Incorporated


PARKING
ONLY
10 MINUTE LIMIT
ALL OTHERS
WILL BE
CRUSHED
AND
MELTED
ChargePoint

1. Introduction

Electric vehicle (EV) charging stations are commonly found at stores, office buildings, and all types of parking facilities. This guide is for commercial site owners considering installation of an EV charging station. It addresses topics such as determining if a location is a good fit for an EV charging station, which type of charging station to purchase, where to place it in the parking lot, who can install it, and how to manage its operations. This document incorporates best practices and lessons learned from EV charging stations that have been installed through the New York State Energy Research and Development Authority's (NYSERDA) program for deploying EV charging stations.

2. What are the criteria for a cost-effective EV charging station?

For a cost-effective and successful charging station installation, site owners should consider how much use they can expect and how much benefit EV drivers can get from charging while parked at that location. Offering charging can help increase visits; keep customers for longer durations; serve as a good perk for tenants, employees, or residents; and generate revenue through charging fees and advertising. The best way to ensure that your charging station is used is to know that a resident, employee, or regular client owns an EV and wants to charge it at your location. This interest is easier to predict for workplaces or multifamily buildings, but EV drivers often seek out charging locations as they go about their everyday routines at, for example, restaurants, stores, and entertainment venues. The New York State EV Registration Map (see Figure 1) can give you a sense of how many EV drivers live near you.

Other considerations weigh into whether your site may be a good place to install a charging station. Consider the time an EV driver would typically spend parked at that location. Level 2 stations, the most commonly installed stations, provide between 10 and 20 miles of range for every hour of charging, so short stays don't offer as much of a charging benefit to EV drivers. If you lease your building or have a

Figure 1. Number of plug-in electric vehicles in New York State as of January 1, 2015, by county

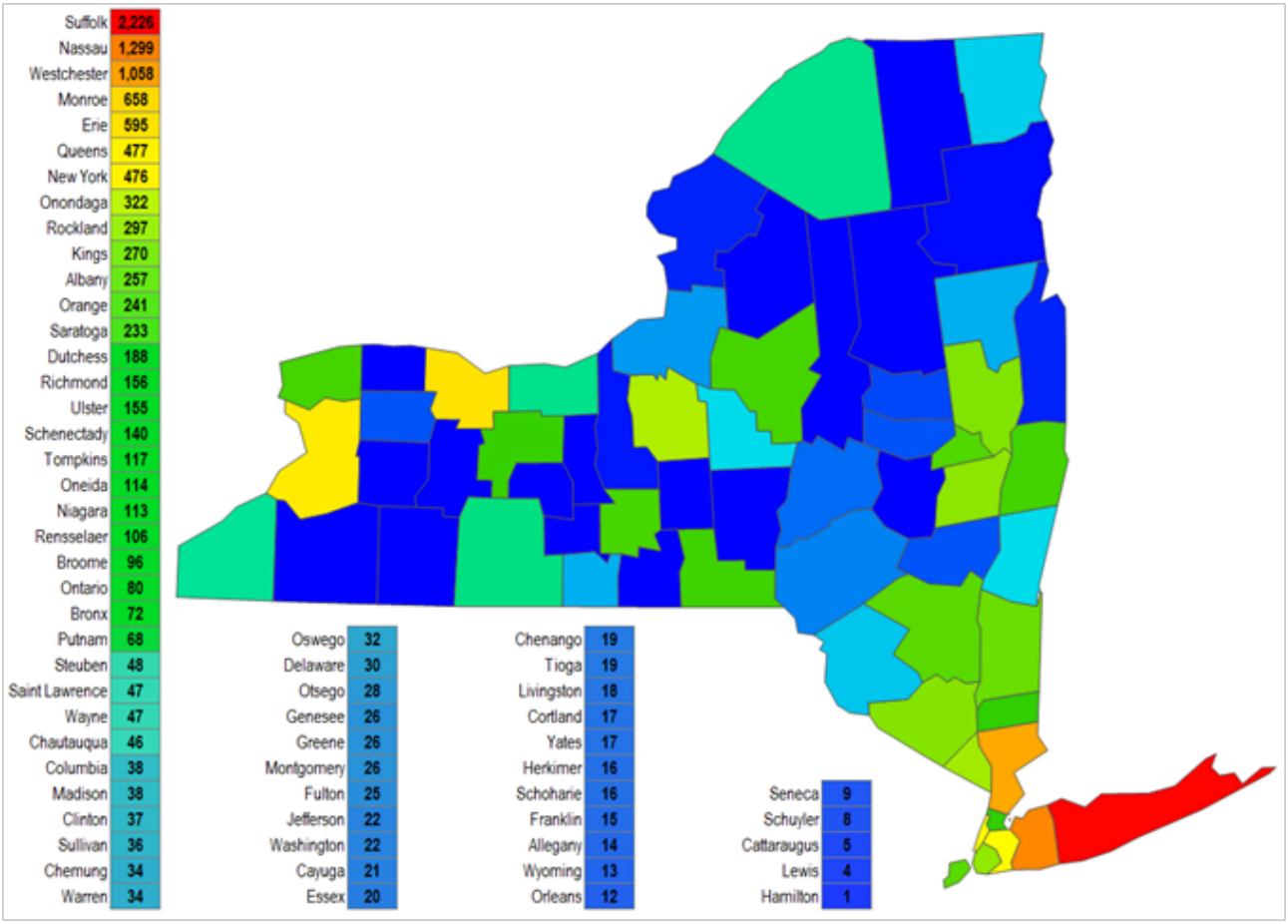


Figure 2. Many Kohl's department stores across the New York State offer free electric vehicle charging to customers
Courtesy Energetics Incorporated

third-party operated parking facility, you should work out arrangements to clarify ownership, operation, and revenue in advance. Additional important factors include, but are not limited to:

- Patterns of travel in an area; an area's demographics, which may be correlated with characteristics typical of EV owners
- The nature of a potential charging station location, whether it is public parking lots or garages, retail locations, leisure destinations, multifamily housing, hotels, transit centers, or other institutions.

Select examples of charging station locations across New York State are shown in Figure2 and 3. For more in-depth information on factors that make a good EV charging location read the Charging Station Cluster Analysis (**nyserda.ny.gov/-/media/Files/Programs/ChargeNY/EVSE-Cluster-Analysis.pdf**).

3. What level of EV charging station should be installed?

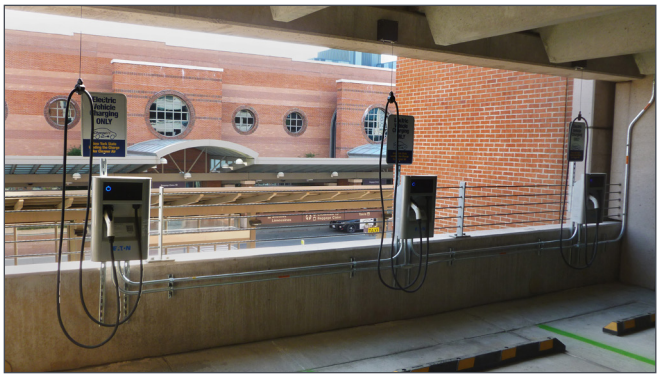
The charging requirements at each location determine the type of charging station that should be installed. As illustrated on page 4 by Figure 4, most EV drivers will charge their vehicles at home the majority of the time. However, EV drivers also seek public charging infrastructure to use at work, around town, and on longer trips. Many of these chargers come with an option to purchase a subscription to a charging network that can collect payments from users and limits use of the station to charging network members. There is often no fee for EV drivers to become a member, and there is also an option to activate the station using a toll-free number for anyone that does

Figure 3. Examples of EV charging station locations
Courtesy Energetics Incorporated

Homewood-Suites, Colonie

Vent Fitness, Albany

University at Buffalo



Albany Airport

Windham Mountain Ski Resort

not have a network card.
In addition to listing the station on its network maps for EV drivers, the network (for a subscription fee around $20 to $30 per month per charging outlet) will track station usage and enable the owner to bill for use.

The most common station ownership model is for the host site to own the station. However, third-party charging station service providers offer a different business model, in which they pay for the installation, operate the station, and share some of the profits with the host site. Some charging station manufacturers, third-party charging station service providers, and charging station network providers offer a lease option as well.

Level 2 charging stations are a popular choice for commercial installations because they typically offer better durability and more features, such as a cord management system that keeps the cord off the ground when not in use (Figure 5 on next page) and network connections for tracking use, establishing payments, or making reservations. Most manufacturers offer charging stations that can be wall-mounted or installed as a stand-alone pedestal. They often have models with either a single or double charging port per station. Level 2 charging stations provide 10 to 20 miles of range per hour of charging, a sufficient boost for EV drivers parked for a few hours. The equipment costs between $2,000 and $10,000, with more features available at the higher end of this range.

Figure 4. Most EV charging happens at home using slower chargers, while public chargers are used less frequently but provide faster charges

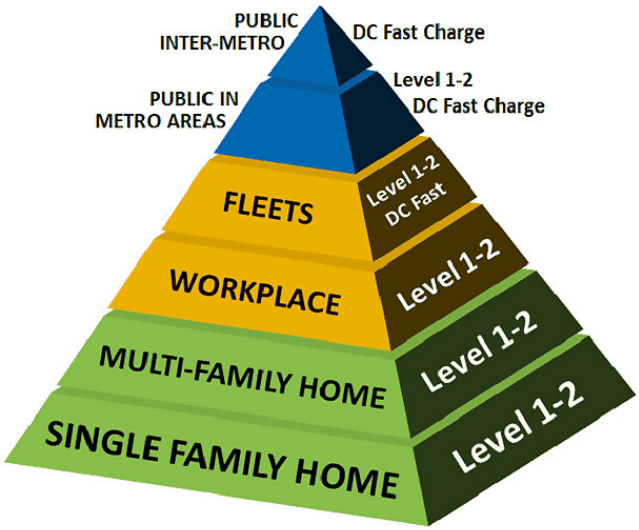


Figure 5. An EV charging station with cord management | Courtesy Energetics Incorporated

In multifamily homes and workplaces (or longer term parking at airports and other transit hubs), EV drivers park for an extended period of time and may not require Level 2 charging. This is especially true for drivers of plug-in hybrid electric vehicles that have smaller battery packs or battery electric vehicle drivers that regularly charge at another location and don't require a full charge each time they park at these locations.

To reduce the costs for the stations and their installation, Level 1 stations, which provide two to five miles of range per hour of charging time, might be a better option. With the same electrical service and panel, two Level 1 stations can be installed instead of one Level 2 station and cost a lot less. (Level 1 electric vehicle supply equipment [EVSE] is less than $1,000). Many EVs come with portable Level 1 EVSE that can be used as long as the parking lot provides a 120-volt outlet on a dedicated circuit for it to be plugged in. The power draw by Level 1 stations is much less, so there is less electrical expense to the host. However, because of their simplicity, most Level 1 stations do not have the option for a subscription on a charging network and cannot easily bill EV drivers for usage.

4. What installation factors should be considered?

A number of factors influence charging station installation costs, which can often exceed the cost of the hardware itself. These factors should be considered when determining site viability and the ideal location to install the charging station on the property. The largest factor is usually the currently available electrical service. All new charging station installations should have a load analysis performed on the facility's electrical demand to determine if there is capacity to add EV charging stations.

Level 2 stations will need a dedicated 240-volt (40 amp) circuit. Upgrading electrical service, if needed, adds significant cost to the installation. A longer distance between the electrical panel and the EV charging station means increased installation costs because it increases the amount of necessary trenching (and repair), conduit, and wire. Example installations are shown in Figure 6 and Figure 7.

Although it is desirable to minimize the distance between the electrical panel and EV charging station as much as possible, where a charging station is located on a property can impact how it is used. For example, placing charging station parking spaces in the back of a building might discourage their use, but other customers may be upset if a charging station

Figure 6. These charging station installations (noted by red arrows) are sited in convenient, but not prime parking spaces that minimize conduit runs to reduce costs
Courtesy Energetics Incorporated

is installed in prime parking spaces that often remain vacant because there are few EV drivers. Charging stations in prime parking spaces are also more likely to be occupied by non-EVs, as shown in Figure 8.

Other considerations have less impact on installation costs, but are important to ensure that the charging station is well integrated into the parking lot. Be sure to think about the path of the charging cord when in use so it is not a tripping hazard and consider your parking lot management practices. For example, when selecting a site, be sure the charging station will not impede pavement cleaning or snow plowing. On page 6, Figure 9 shows spaces where snow is piled in the winter or where equipment might be

Figure 7. Charging stations at parking spaces away from a building require longer trenching through pavement (red lines indicate distance) and could disrupt traffic flow during construction|
Courtesy Energetics Incorporated

Figure 8. These examples (see red arrows) show charging stations that were installed in prime parking spaces that were traditionally used by non-EV drivers
Courtesy Energetics Incorporated

Figure 9. Snow management practices must be considered because snow accumulation can obstruct access to EV charging and snow plows can cause damage to charging stations
Courtesy Energetics Incorporated

stored that can block access to the charging station. For more in-depth information on considerations for charging station installations, read Site Design for Electric Vehicle Charging Stations (**nyserda.ny.gov/-/media/Files/Programs/ChargeNY/Site-Design-for-EV-Charging-Stations.pdf**).

5. What factors figure into an installation estimate?

5.1 Electrical Factors

Only an electrician can determine the final electrical installation costs of an individual situation because several factors figure into it. Owners can help by identifying the electrical panels and conduits in the building or on the property and current electrical loads for an electrician to assess. In general, installation costs are much higher if additional electrical panel modifications or new service to the facility are needed. For example, older, outdated panels may need to be replaced and updated before a charging station can be safely added to the system (Figure 11).

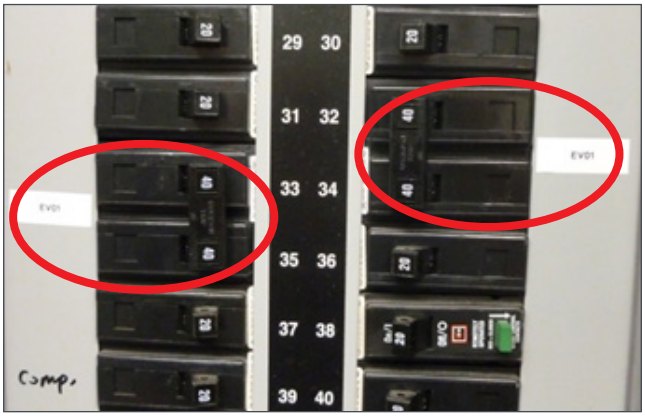
As shown in Figure 10, it is also good to note whether the electrical panel has available breaker slots or some marked as spares that could be used for the charging stations. A single Level 2 charging station will require two breaker slots for its 240-volt circuit and a dual port charging station will need four slots. Each Level 1 charging station will only require a single breaker slot for a 120-volt circuit.

Available space in the electrical panel can indicate, but does not necessarily guarantee, whether there is sufficient capacity with the current electrical service to add the charging station(s) without requiring an upgrade from the utility. The electrician will determine the available electrical capacity with a load calculation

Figure 10 Older electrical panels, such as these examples, may require upgrades to meet today's electrical codes
Courtesy Energetics Incorporated



Figure 11. Level 2 Charging Station 240-volt (40 amp) circuits breakers and examples of empty breaker slots
Courtesy Energetics Incorporated



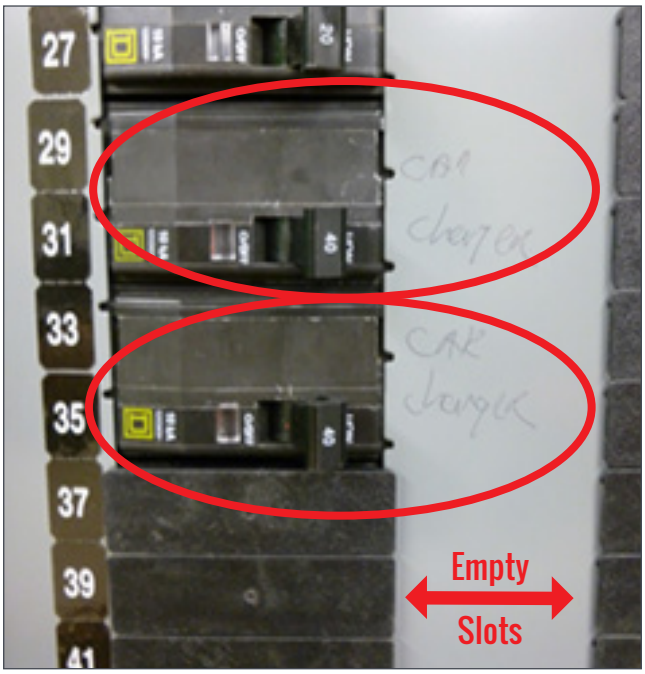


Figure 12. Charging station circuits may require an added subpanel, such as this one, if space in the main panel is limited
Courtesy Energetics Incorporated

and could add a small subpanel (see Figure 12) for the charging station circuit(s) if there is sufficient capacity with the existing service but no space in the main panel.

Identifying all electrical panels at the facility will help the electrician to assess viability and/or planning of an installation. These panels come in many shapes and sizes and can be tied directly to the grid or used as sub-panels to further distribute power from larger panels. The electrician may determine that one panel is better to work with than another, or one may offer a shorter electrical run to a good charging station location, reducing costs.

All externally run and most internally run electrical wire will have conduit for protection. It will be routed along ceilings and walls inside, pass through the building foundation or walls, and buried underground until it reaches the station. Inside the facility, the length of the run, obstacles (e.g., concrete walls, metal I-beams, lights, or fire suppression systems), and accessibility should be observed. For outdoor routing, the length of the run, immovable objects (e.g., landscaping, tree roots, ponds, or buildings), manmade surfaces (e.g., concrete or pavement), utility lines (e.g., electrical, water, or gas), and any other obstacles that may complicate trenching should be observed as best as possible. Trenching through grass, dirt, or gravel is easy to dig and repair. Most contractors will tunnel under a short concrete sidewalk, but some will cut into it and repair. Wire runs across parking lot pavement are typically longer and could be accomplished by tunneling under or cutting and repairing. Samples of trenching work are shown on page 8 in Figure 13 for dirt, Figure 14 for concrete walkways, and Figure 15 for pavement.

5.2 Networking and Physical Protection

Although electrical considerations figure heavily into installation, two additional factors are important. First, cellular signal strength is an important factor for networked EV charging station installations. Key features on a networked station (e.g., fault notifications, in-use status, user authentication, payments, or reservations) will not be available if the station cannot communicate with the central network via cellular signals. When considering where to place the station on the property, use a cell phone to test the available strength and determine if an alternative location might have a better signal. Charging station installations in remote locations or in underground garages may have more difficulty acquiring a good cellular connection. If the charging station cannot be moved into a place with a better cellular signal, some charging manufacturers offer equipment with alternative cellular providers that may have better

Figure 13. Trenching through dirt is considered the easiest outdoor installation of a charging station
Courtesy Energetics Incorporated

Figure 14. Charging stations can be installed by cutting and repairing (left and center photos) and tunneling under (right) concrete walkways
Courtesy Energetics Incorporated

Figure 15. Installing charging stations in parking lots usually requires either cutting and repairing (left and center) and tunneling under (right) pavement
Courtesy Energetics Incorporated

strength at that location. Extended antennae or cell signal boosters can also be used, but these will add to the cost of the station installation.

Second, some form of charging station protection should be used to prevent cars, snow plows, or sweepers from hitting the station or snagging the charging cords. Mounting the station above the bumper level on a wall or behind a curb is helpful, but an additional tire stop or bollard would provide additional protection (Figure 16).

It is also useful to install a post for signage while the station is being put in. If the location of the station on the property is not obvious to EV drivers, additional directional signage throughout the property can be useful, but will add additional cost.

6. What criteria are important to consider in selecting an electrical installer?

The installation of an EV charging station is not significantly different from most electrical work, but using an electrical contractor with knowledge and experience with this technology may lead to a better installation. As with any electrical work, always use a licensed electrician to ensure they have the proper electrical training and experience. Insurance is also important, as a charging station can be an expensive

Figure 16. Bollards, tire stops, and sign posts can be used to protect charging stations and electrical cords from physical damage
Courtesy Energetics Incorporated

Figure 17. EV general service signs, regulatory signs, and trailblazing sign
Images 1-3 (left) courtesy of MUTCD, Images 4-5 (right) courtesy Energetics Incorporated

piece of equipment to replace should something go wrong. When possible, obtain quotes from multiple electricians to compare prices and experience. Consider the installation technique being quoted as some may specify cutting and repair for trenching work whereas others may want to tunnel under so it looks neater.

While charging stations are a relatively new technology, many electricians have experience installing these systems. Ask for references and prior work examples to assess their quality of work. Some electrical contractors are certified installers for a certain charging station manufacturer, and some might have training through the Electric Vehicle Infrastructure Training Program (EVITP; **www.evitp.org**) or another general charging station installation course. EVITP is a structured platform for delivering training and certification for the installation of EV charging stations in and around residential, commercial, and public facilities. The EVITP training consists of 24 hours of class time and comprehensively addresses the requirements, regulations, products, and strategies to master successful, expert, and professional customer relations, installation, and maintenance of EV charging infrastructure. The EVITP training highlights Article 625 of the National Electric Code, which specifically applies to EV charging stations, along with other relevant articles involved in the electrical installation process.

7. What are best practices for operating and maintaining the charging station?

7.1 Policies

Charging station parking spaces should be available for EVs, so it is good to establish a policy that specifies enforcement and consequences to restrict other vehicles from parking in these spaces. As demand for parking spaces with charging stations increases, further restrictions may be implemented, such as ensuring that EVs parked there are actually charging or setting a time limit for how long an EV can charge there.

When an EV charging station is placed at a prime parking spot, cars with gasoline internal combustion engines (ICEs) may use this convenient parking space not knowing that it is reserved for EV charging; EV advocates call this being “ICEd.” To ensure EV drivers can easily navigate to charging stations and are not “ICEd” when they arrive, effective signage should be used. However, although a sign can inform drivers of the policy, enforcing policy through tickets or towing of unauthorized vehicles may be necessary.

For more in-depth information on policy options read the Planning Policy Tool Guide (**nyserda.ny.gov/-/media/Files/Programs/ChargeNY/Planning-and-Policy-Tool-Guide.pdf**).

7.2 Signage

Effective signage helps EV drivers navigate to EV charging station spaces and helps to prevent EV charging spaces from being occupied by non-EVs (Figure 17). Signs in private parking facilities are not required to meet Federal Highway Administration (FHWA) Manual on Uniform Traffic Control Devices (MUTCD) standards, but owners and operators are encouraged to do so because it promotes uniformity and clarity. A blue general service sign should be used to provide general guidance to the charging station (using white arrows) and to identify the EV charging space. Regulatory signs are used to enforce which vehicles are eligible to park in charging station parking spots, as well as the time duration that EVs are permitted to park and/or charge at the station. Trailblazing (special) signs are used to provide drivers and visitors with additional information (e.g., funding

source, tourism or economic development info, or sponsorship) and can include any logos, shapes, and colors as part of the signage theme at the site. Another effective strategy for distinguishing the EV charging space is to paint the entire space green or mark the pavement with an EV charging symbol.

For more in-depth information on EV charging station signage, read the Charging Station Signage Overview (**nyserda.ny.gov/-/media/Files/Programs/ChargeNY/EVSE-Signage-Overview.pdf**).

7.3 Usage Fees and Advertising Revenue

Establishing a fee for the use of the charging station may depend in part on the venue where it is operating. Site owners should weigh whether their clientele would be willing to pay extra for EV charging and whether they need to generate revenue from use or whether the charging station creates value in other ways.

Charging station fees can be per hour, per session, or per unit of electricity. If charging per hour, the cost of energy may vary widely by charging session because different EVs receive electricity at different rates. Charging per session is usually more appropriate for workplace charging or charging stations that have very short, regular sessions. Charging by unit of energy (usually kilowatt-hour [kWh]) accurately accounts for the true cost of electricity for the charging station owner, but does not give an incentive for a car that is fully charged to leave the space. Some site owners have tried combinations of these approaches, such as charging a flat rate for the first two hours, then an increasing rate for longer sessions. Some locations might prefer to offer free charging, either as an additional draw or to lower operating expenses by not needing to join a charging station network.

Charging stations offer a number of ways to generate value beyond just charging for use. Installing charging stations can attract EV drivers who then patronize your business, retain valuable employees, and provide a sense of your environmental stewardship. In addition, some station owners have sold advertising space on their charging stations, creating a new revenue stream.

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