



The Electrician's Guide:

Installing Electric Vehicle Charging Stations at Commercial and Multi-Family Properties

Preparing a commercial facility such as a factory, office building, retail business or multi-family dwelling including apartments and condominiums for electric vehicle (EV) charging requires the collaboration of several parties to help our mutual customers make the right decisions for their specific situations. Southern California Edison, electricians, customers, and cities each play important roles in this process.

This guide provides useful information on the process for preparing property owners, management companies, homeowners associations (HOA) and EV owners for safe and reliable charging in a commercial setting.

Before you assess your customers' electrical panel and wiring needs, please ensure that customers who live in our service territory contact us to learn about our rate plan options and how each rate plan may affect their facility's panel, wiring, and EV charging options.



For any questions you may have, or to discuss next steps for your site, contact your SCE Account Representative, or call:

1-800-990-7788



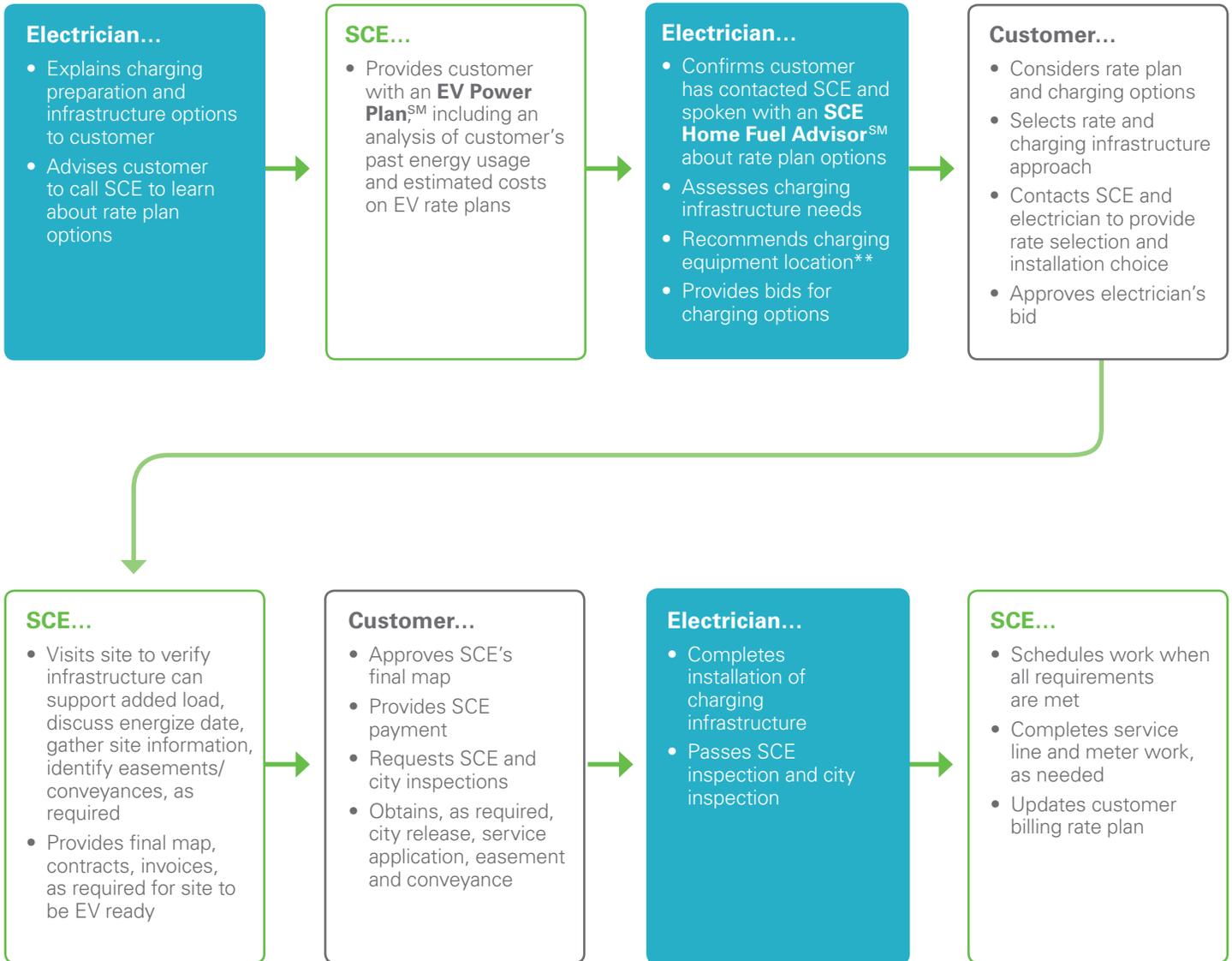
For step-by-step training modules, customer handouts and more, visit:

[sce.com/evinstall](https://www.sce.com/evinstall)

The term "electrician," as used throughout this guide, includes entities such as independent electricians, electrical contractors and third parties offering end-to-end EV services.

Commercial EV Installation Process*

The flowchart below illustrates the basic processes we use to prepare commercial and multi-family dwelling properties for EV charging. Also shown are the points at which electricians play an especially important role in moving the installation process forward.



*For additional information or assistance with DC Fast Charging installations, contact SCE at 1-800-990-7788, Monday – Friday 8 a.m. – 5 p.m.

**SCE is not responsible for determining location of charging equipment.

Typical Available Commercial Rates for EV Charging¹

Small Business $\leq 20 \text{ kW}$	Medium Business $> 20 \text{ kW} \leq 500 \text{ kW}$	Large Business $> 500 \text{ kW}$
<p>GS-1</p> <ul style="list-style-type: none"> Single meter for EV charging and all other facility loads 	<p>GS-2</p> <ul style="list-style-type: none"> Single meter for EV charging and all other facility loads 	
<p>TOU-GS-1</p> <ul style="list-style-type: none"> Single meter for EV charging and all other facility loads Time-of-use rate higher during the day and lower at night 	<p>TOU-GS-3</p> <ul style="list-style-type: none"> Single meter for EV charging and all other facility loads Time-of-use rate higher during the day and lower at night 	<p>TOU-8</p> <ul style="list-style-type: none"> Single meter for EV charging and all other facility loads Time-of-use rate higher during the day and lower at night 
<p>TOU-EV-3 (EV Demand $\leq 20 \text{ kW}$)</p> <ul style="list-style-type: none"> Time-of-use rate higher during the day and lower at night Only EV load qualifies for this rate Facility remains on current commercial rate EV charging load metered separately from facility load EV load requires separate meter panel EV load must be served from existing service line and transformer 		
<p>TOU-EV-4 (EV Demand $> 20 \text{ kW} \leq 500 \text{ kW}$)</p> <ul style="list-style-type: none"> Time-of-use rate higher during the day and lower at night Only EV load qualifies for this rate Facility remains on current commercial rate EV charging load metered separately from facility load EV load requires separate meter panel Separate service line/transformer location may be provided, as applicable 		

¹ Beginning January 2014, most GS-1 and GS-2, PA-1 and PA-2 accounts will be transitioned to mandatory TOU rates. SCE will provide further notice and full details of this change.

Understanding Demand Charges for EV Charging Applications

As automakers bring increasing numbers of plug-in electric car models to market, businesses and government organizations may consider high-powered Direct Current (DC) fast chargers. These fast chargers commonly require a 480-volt connection (or other commercial voltage) and can refuel an EV up to 80% of capacity in approximately 20 to 30 minutes. In addition, some transit authorities are considering or testing electric bus fleets, where the bus and charging technology may require high-powered charging.

SCE business customers should understand how fast charging could affect their electric bill. An SCE representative can help your customers identify the key factors that drive their energy costs. We can provide a customized rate analysis to help your customers determine the most cost-effective rate plan for EV charging for their business. We can also assess their energy management program to help them minimize the impact of EV charging on their bottom line.

What Are Demand Charges?

Customers that place higher demands onto the system will be more costly to serve than others, as utilities must size distribution systems accordingly. Under the current tariffs approved by the California Public Utilities Commission, these costs are passed on to specific customers through so-called demand charges.

Demand charges reflect a measure of power calculated in kilowatts (kW). They are different than energy consumption charges, measured in kilowatt-hours (kWh).

For example, if you turn on 10, 100-watt light bulbs, they immediately place a demand on the power system for 1,000 watts of electricity (or 1 kW). If you leave these bulbs on for 1 hour, they will consume 1,000 watt-hours (or 1 kWh) of energy on your meter.

There are two kinds of demand charges used to price commercial service.

1. The **time-related demand charge** applies only during SCE's summer season. This charge helps recover part of our higher costs of providing transmission and distribution service during the high-demand time periods. This per-kW charge is applied to the greatest amount of metered demand in each summer season billing period.
2. The **facilities-related demand charge** is also billed on a per-kW basis, but is in effect year-round regardless of the time the demand is placed onto the system. It is applied to the greatest amount of metered demand in each billing period, and is necessary to recover costs for the installed transmission and distribution facilities required to serve customers' highest demand throughout the year.

How Can You Determine Demand (kW)?

If you know how many kWh your customer will use during a period of time, such as kWh divided by one hour, you can determine demand. In the case of fast chargers, where demand needs to be calculated for a period of less than one hour, a simple division is required. For example, if a customer with an electric vehicle uses a DC fast charger to consume 20 kWh in 30 minutes, the demand can be calculated as follows:

$$\frac{20 \text{ kWh}}{.5 \text{ Hours}} = 40 \text{ kW}$$

Understanding Demand Charges for EV Charging Applications

(continued)

The actual amount of the demand charges applied to your customer's account will vary based on the metered demand and applicable rate plan. Please refer to the rate section of your customer's pricing schedule (<http://www.sce.com/aboutsce/regulatory/tariffbooks/ratespricing/default.htm>) and advise the customer to contact their SCE Account Representative if additional clarification is needed.

What Is Load Factor and Why Does It Matter?

Load factor is not reflected on your customer's bill, but is a term used to reflect the steadiness and efficiency of electrical usage over time. It is a function of the amount of energy used (kWh) and demand level required (kW) over time. A better (higher) load factor means demand is spread over more kWh, effectively lowering the impact of the demand on the system, thus lowering demand charges on your monthly electricity bill.

Your customers can achieve a lower cost per kWh with an improved load factor — using more energy for the same amount of demand, or alternatively lower demand for the same amount of usage.

What Steps Can I Take to Mitigate Demand Charges?

Consider the following options to help increase your load factor and reduce the impact of monthly demand charges, including:

Colocation

Operators of charging equipment may want to consider deploying charging infrastructure on sites with pre-existing high load factor (without significantly increasing demand as a result of the new charging equipment).

Load Diversification

Diversification refers to keeping demand low by spreading it over as many kWh as possible, either manually or with the use of technology. Diversification may be possible by training operators to limit the amount and/or time of charging. For example, a fleet of buses could be charged sequentially rather than simultaneously to limit demand.

Energy Storage Solutions

A more capital-intensive option is to deploy energy storage solutions that charge or store energy at low-demand levels for long periods of time. The storage solution can then be used on peak or when demand is greater than usual to recharge batteries.

Your Trusted Energy Advisor

Electricity is an important line item in many businesses' budgets and understanding demand charges can potentially have a significant impact on their bottom line. We can assist your customers in developing solutions to meet their businesses needs, including helping them safely and reliably provide electric vehicle charging, manage their demand and improve the entire facility's energy efficiency. For an introduction to EV charging and rates, visit sce.com/ev4business. For additional questions — including on demand charges — or to discuss next steps for your customer's site, advise your customer to contact their SCE Account Representative or call **1-800-990-7788**.

Typical Available Commercial Voltage Levels for EV Charging

Single-phase Service

Charging Level	Voltage	Minimum Load Required	Maximum Load Allowed
I	120 volts	None	1-15 amp & 1-20 amp branch circuit
II	120/208 volts	None	200 amp main switch
	120/240 volts	None	600 amp main switch
III	NA	NA	NA

Three-phase Service

Charging Level	Voltage	Minimum Connected Load Required	Maximum Demand Allowed	Maximum Main Switch Capacity Allowed
I	NA	NA	NA	NA
II	120/208 volts	15 kVA	1,000 kVA	2,800 amps
	120/240 volts	15 kVA	1,000 kVA	2,400 amps
III	277/480 volts	25 kVA	3,000 kVA	4,000 amps

For additional information or assistance with DC Fast Charging installations, contact SCE at 1-800-990-7788, Monday – Friday 8 a.m. – 5 p.m.

Common EV Charging Installation Scenarios

This section provides an overview of several commercial EV charging installation scenarios that are provided for illustrative purposes. These select scenarios represent possible charging installation options but do not represent an exhaustive set nor are they the only possible solutions we recommend.

We offer the following best practices to help electricians serve our mutual customer and facilitate preparing the residence for safe and reliable EV charging:

- Encourage customers who live in our service territory to contact us to learn about their rate plan options and how each rate plan may affect their panel, wiring, and EV charging options.
- To help facilitate the customer's rate and panel decisions, the electrician should be familiar with how our rates impact installation options and costs.
- Our Electrical Service Requirements is a tool to answer questions pertaining to electrical service connections and installation of customer's service wiring and equipment. We encourage electricians to stay current with the quarterly updates.
- Avoid delays and customer frustration by providing two estimates for one and two meter installations as required by our EV rates.
- Install a new panel, if required, **but** only after obtaining the Service Planner's approval for panel location.
- To eliminate delays and misunderstanding, we strongly recommend participating in the Service Planner's customer visit, if required, either in-person or by phone.
- Be prepared when requesting an EV permit by learning the local authority's EV permit requirements and cost in advance, as they tend to vary considerably.
- Coordinate, in advance, the local authority's inspection to avoid delays. However, be mindful of recent budget cuts and inspection staff workday reductions in some authorities.

Scenarios 1 - 4

In certain commercial situations, our mutual customer, the property owner, management company or HOA of a multi-family dwelling (e.g., apartments, condominiums), may decide to provide EV charging for its residents/tenants. It is critical for the electrician to encourage the customer to contact us to discuss our commercial EV rates to determine what rate will best fit the customer's situation before proceeding further because each rate plan may affect their facility panel, wiring, and electric vehicle charging options.

- In Scenarios 1 - 3, the property owner, management company or HOA can choose to provide EV charging under its existing commercial rate or elect to choose one of our commercial EV rates.
- Scenario 4 depicts a unique situation when space is available for the property owner, management company or HOA to provide residents/tenants with separate, dedicated meters for EV charging in their assigned parking area, as well as for their residence. Residents/tenants may then be eligible for our TOU-EV-1 rate which requires a separate, dedicated meter to track EV usage.
- The electrician's assessment of the customer's readiness to charge EVs is very complex, due to the numerous decisions facing the customer, such as:
 - Which make and type of charging station best fits the customer's needs?
 - Should the customer install charging stations for every tenant?
 - What is the best payment method for residents charging EVs?
 - Does the customer install the entire EV charging infrastructure now or in phases?
 - Who will own the charging station? (e.g. HOA? 3rd party provider? Resident/Tenant?)
 - Who will maintain the charging stations? (e.g. HOA? 3rd party provider? Resident/Tenant?)

Based on the customer's response to these questions, the electrician can provide the customer an EV charging installation plan and estimate. Given the potential size and complexity of these scenarios, the electrician is encouraged to work closely with the local authority having jurisdiction and with us, particularly if EV charging is provided under TOU-EV-1, TOU-EV-3 or TOU-EV-4 rates which will require our approval of the electrician's plan.

Scenario 1

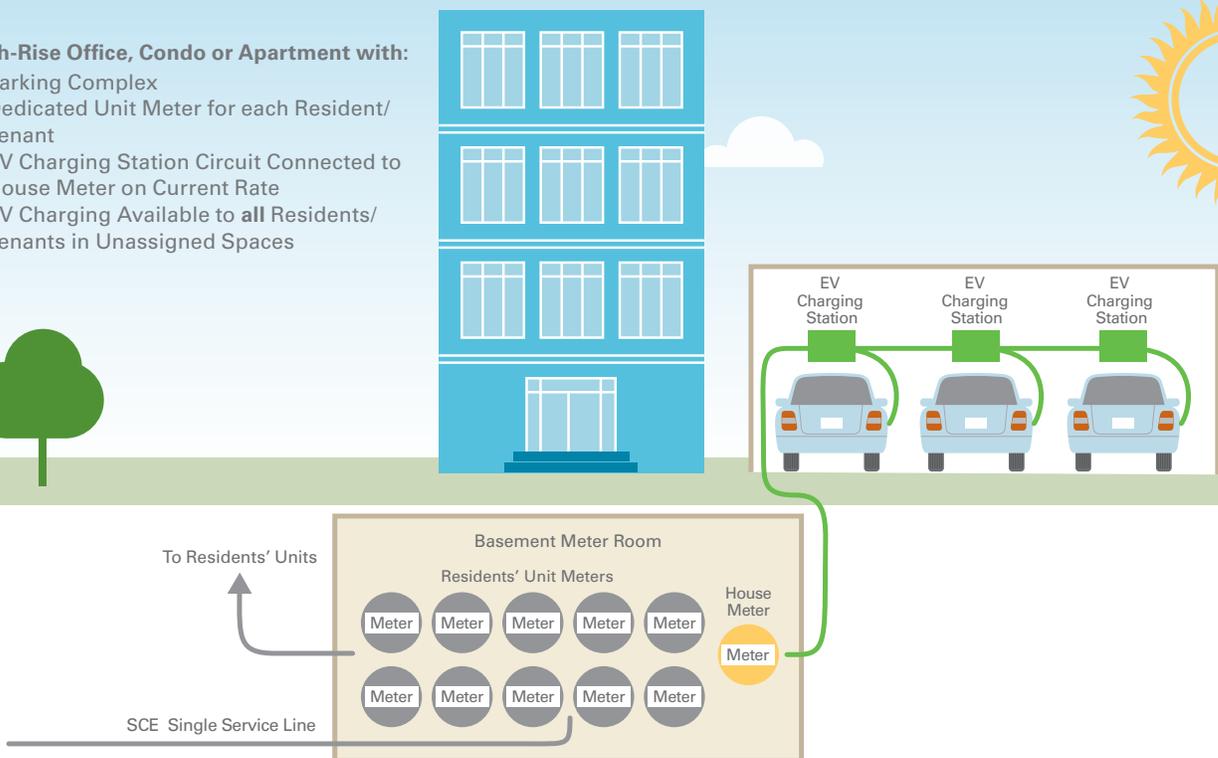
Charging EVs on the House Meter

The commercial property owner, management company, or HOA has decided to provide EV charging at a number of unassigned parking spaces for use by its residents/tenants but does **not** want to separate the EV charging usage from the site's house meter which tracks electric usage for items such as property lighting, elevator, and swimming pool pump. There are multiple options in this scenario:

- GS-1 rate or TOU-GS-1 rate when total demand ≤ 20 kW
- GS-2 rate or TOU-GS-3 rate when total demand > 20 kW ≤ 500 kW
- TOU-8 rate when total demand > 500 kW

High-Rise Office, Condo or Apartment with:

- Parking Complex
- Dedicated Unit Meter for each Resident/Tenant
- EV Charging Station Circuit Connected to House Meter on Current Rate
- EV Charging Available to **all** Residents/Tenants in Unassigned Spaces



Your final electric car charging solution may vary depending on a number of factors. In some cases you and/or SCE may need to upgrade infrastructure to support charging, which may result in additional costs.

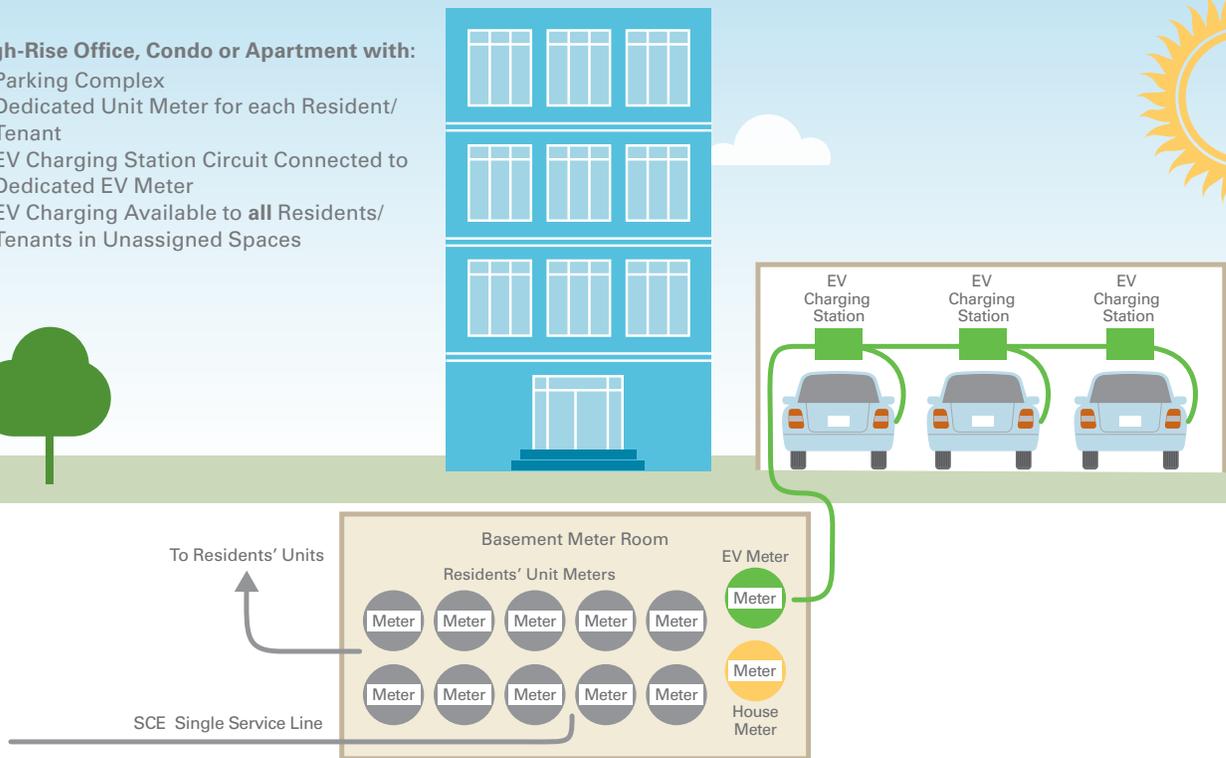
Scenario 2

Charging EVs on a Separate Meter When EV Demand ≤ 20 kW

The commercial property owner, management company, or HOA has decided to provide EV charging at a number of unassigned parking spaces for the use of all its residents/tenants. Customer wants to be able to separate the EV charging usage from their other facility electric loads, such as property lighting and the swimming pool pump that will remain on the current commercial rate. This scenario will require the installation of a separate, dedicated electric panel and meter for the TOU-EV-3 rate that must be served from the existing service line.

High-Rise Office, Condo or Apartment with:

- Parking Complex
- Dedicated Unit Meter for each Resident/Tenant
- EV Charging Station Circuit Connected to Dedicated EV Meter
- EV Charging Available to **all** Residents/Tenants in Unassigned Spaces



Your final electric car charging solution may vary depending on a number of factors. In some cases you and/or SCE may need to upgrade infrastructure to support charging, which may result in additional costs.

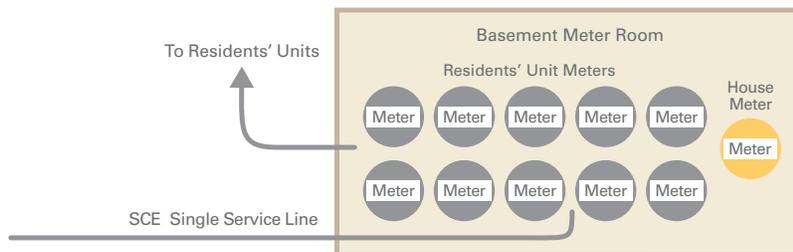
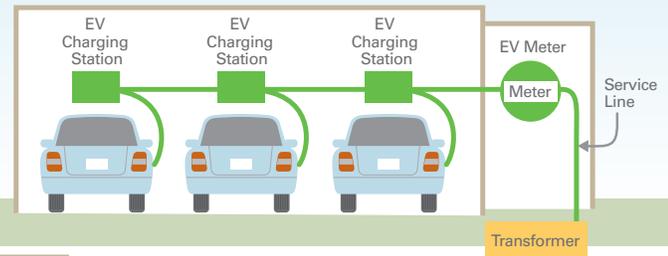
Scenario 3

Charging EVs on a Separate Meter When EV Demand > 20 kW ≤ 500 kW

The commercial property owner, management company, or HOA has decided to provide EV charging at a number of unassigned parking spaces for the use of all its residents/tenants. Customer wants to be able to separate the EV charging usage from their other facility electric loads, such as property lighting and the swimming pool pump that will remain on the current commercial rate. This scenario will require the installation of a separate, dedicated electric panel and meter for the TOU-EV-4 rate that can have a separate service line/transformer location, as applicable.

High-Rise Office, Condo or Apartment with:

- Parking Complex
- Dedicated Unit Meter for each Resident/Tenant
- EV Charging Station Circuit Connected to Dedicated EV Meter
- Separate Service Line/Transformer Location may be provided, as applicable
- EV Charging Available to **all** Residents/Tenants in Unassigned Spaces



Your final electric car charging solution may vary depending on a number of factors. In some cases you and/or SCE may need to upgrade infrastructure to support charging, which may result in additional costs.

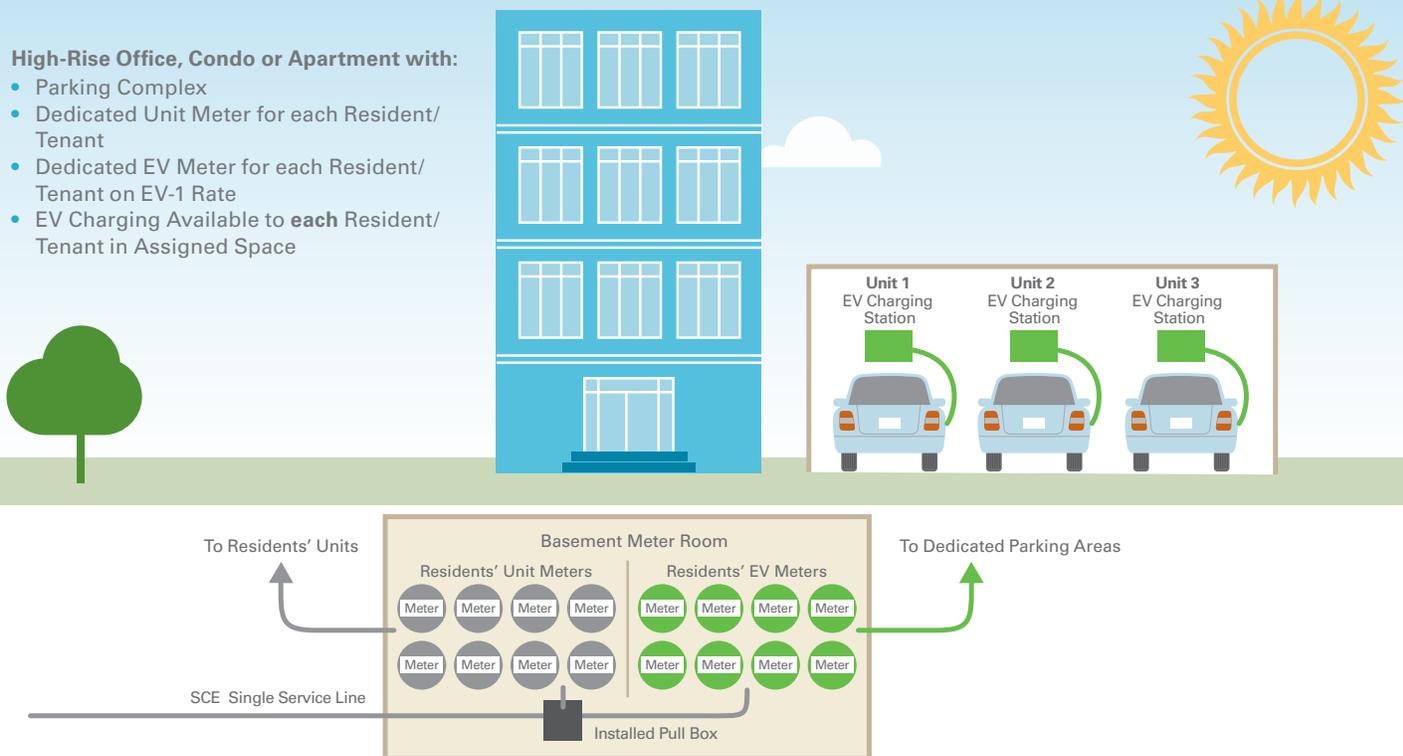
Scenario 4

Charging EVs on Dedicated Tenant/Resident Meters

The commercial property owner, management company, or HOA chooses to provide each resident/ tenant who owns an EV a dedicated second meter and an EV charging station at the resident's dedicated parking area under our Single Family Residential EV Plan, the TOU-EV-1 rate.

High-Rise Office, Condo or Apartment with:

- Parking Complex
- Dedicated Unit Meter for each Resident/ Tenant
- Dedicated EV Meter for each Resident/ Tenant on EV-1 Rate
- EV Charging Available to **each** Resident/ Tenant in Assigned Space



Your final electric car charging solution may vary depending on a number of factors. In some cases you and/or SCE may need to upgrade infrastructure to support charging, which may result in additional costs.

Scenarios 5 - 6

In certain situations, as illustrated in Scenarios 5 and 6, it may be possible for a resident/tenant of a commercial facility or multi-family dwelling to qualify for our single family residential EV rates. In these instances, **the resident/tenant is SCE's and the electrician's customer**, not the property owner, management company or HOA. However, it is a best practice to consult with the property owner, management company or HOA, as appropriate, for approval before proceeding with the installation.

- Scenario 5: Multi-family dwelling residents choose to charge their electric vehicle at Level I in their dedicated parking area with an existing 120 volt circuit and outlet that is connected to their electric service panel.
- Scenario 6: Multi-family dwelling residents without an existing, dedicated 120 volt circuit and outlet may choose Level I or Level II charging. However, this requires the resident to install new conduit and 120 volt or 240 volt wiring from its electric service panel to their dedicated, parking area.

The electrician is encouraged to work closely with the local authority having jurisdiction and with us, particularly if EV charging will require installing a new panel which will require our approval of the electrician's plan before installation.

Scenario 5

Level I- 120 Volt EV Charging

Multi-family dwelling residents living in a condo/apartment who have a dedicated garage, carport or parking space and a 120 volt electric outlet with sufficient capacity at the dedicated parking area that is connected to the unit's existing electric panel and meter, may be able to charge an EV in the dedicated parking area at Level I - 120 volts on the existing domestic rate. Consult with their property owner, management company or HOA, as necessary, about their interest in charging their vehicle in their designated parking area, including any required electrical work.

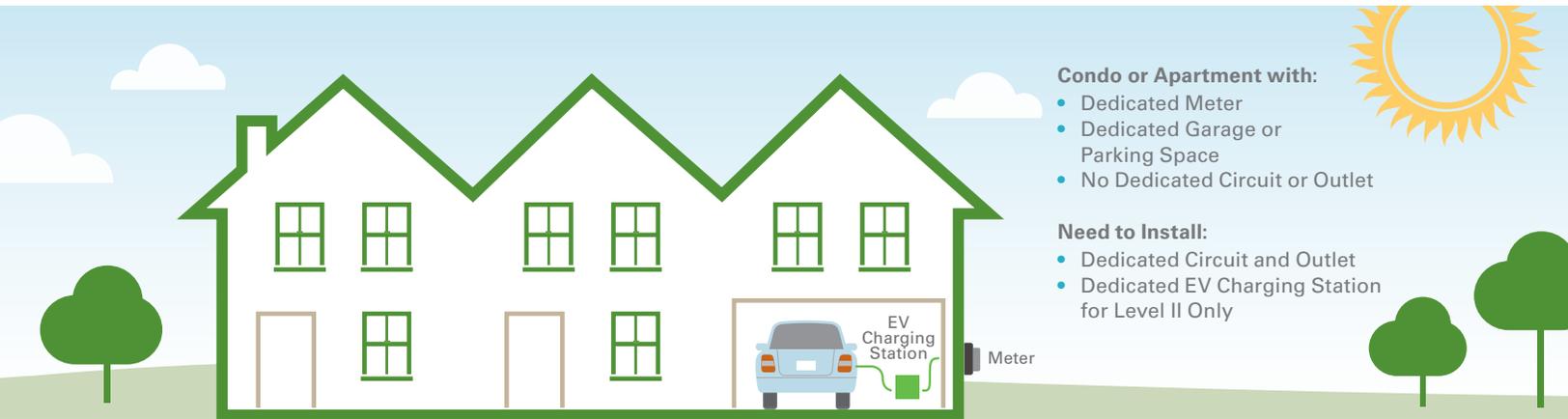


Your final electric car charging solution may vary depending on a number of factors. In some cases you and/or SCE may need to upgrade infrastructure to support charging, which may result in additional costs.

Scenario 6

Installing a New Circuit for Level I-120 Volt or Level II-240 Volt EV Charging

Multi-family dwelling residents living in a condo/apartment who do **not** have an existing electric outlet at their dedicated parking area that is connected to their unit's panel and meter, may be able to charge their EV by installing a new Level I -120 volt or Level II -240 volt circuit from their existing electric panel to their dedicated parking area. Consult with their property owner, management company or HOA, as necessary, about their interest in charging their vehicle in their designated parking area, including any required electrical work.



Your final electric car charging solution may vary depending on a number of factors. In some cases you and/or SCE may need to upgrade infrastructure to support charging, which may result in additional costs.