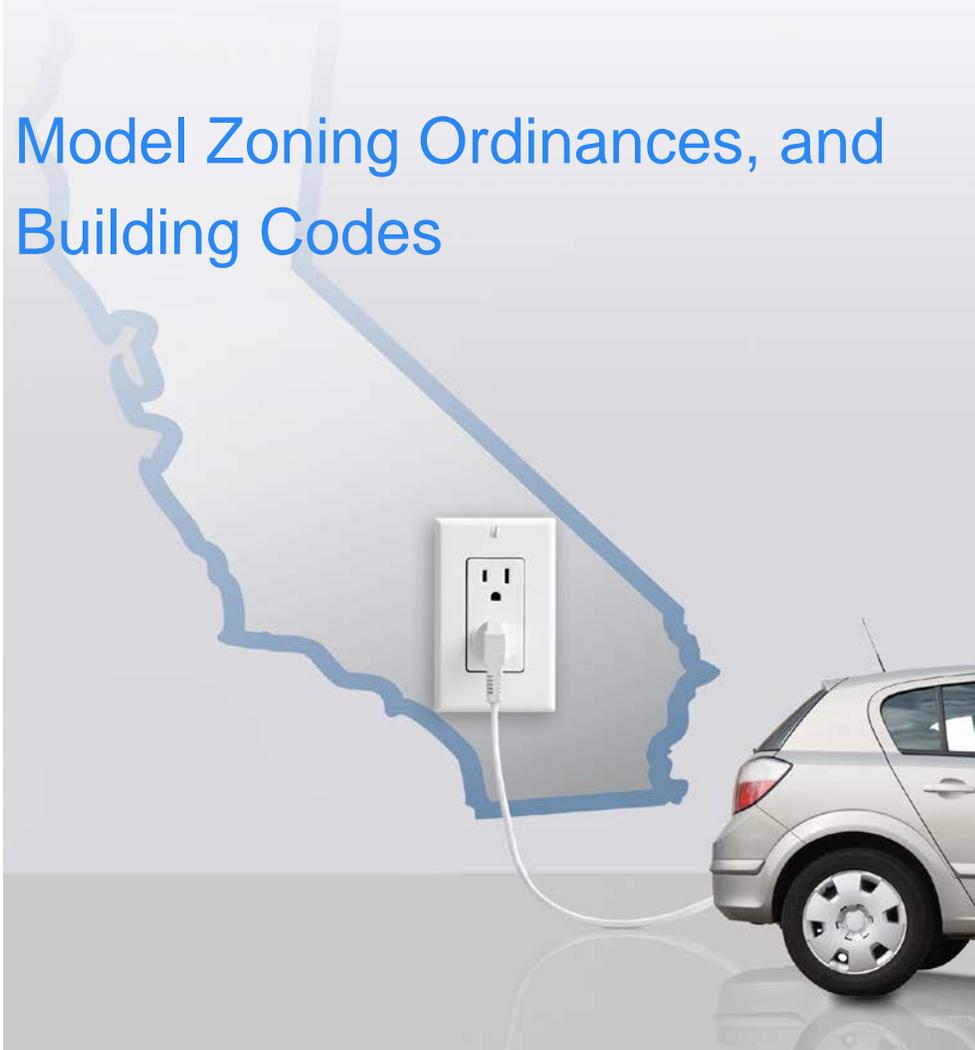


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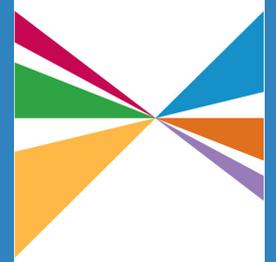
**Luskin
Center**
FOR INNOVATION

Southern California Plug-in Electric Vehicle Readiness Plan

Model Zoning Ordinances, and
Building Codes



SOUTHERN CALIFORNIA



ASSOCIATION of
GOVERNMENTS

Prepared for
the Southern
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Association of
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10 Zoning Policies for PEV Readiness

10.1 Introduction

Zoning codes regulate what types of land uses and densities are appropriate for different neighborhoods. As such, zoning codes are the most powerful tool cities have to incentivize certain types of development, including placement of charging stations. The goal of zoning for PEVs should be to ensure that charging is an allowed land use in as many types of zoning districts as possible, either as an accessory or principal use as appropriate. Planners should also consider reducing parking requirements in exchange for installation of charging units or allowing PEV charging spaces to count towards minimum parking requirements.

Another reason to consider zoning for PEVs is to make zoning ordinances compatible with PEV-ready building codes. Many cities have begun to adopt building codes that require PEV-ready wiring in new construction, but their zoning ordinances may not even list PEV charging as a use.

What follows is a discussion of the two main zoning levers for PEV charging: designation as a permitted land use, and incentives for developers to install charging equipment and/or designated PEV parking spaces. Designating PEV charging as a principal or accessory land use will help ensure that different charging levels carry the appropriate type of planning review for the zones in which they are located. Developers can be encouraged to incorporate PEV charging units by allowing the spaces to count towards minimum parking requirements, by reducing the parking requirements, or by allowing spaces for neighborhood electric vehicles (NEVs) to count towards parking requirements.

Zoning generally determines the number of parking spaces required for a certain land use, though some cities have used building codes to specify the number of spaces that need to have PEV-ready wiring in new construction. Further guidance on building codes is provided in [Chapter 11](#).

10.2 Charging as an allowed use

PEV charging should be widely allowed in different zoning districts because it is compatible and complementary to many land uses. With the exception of stand-alone fast charging, PEV fueling does not fundamentally alter the purpose or interfere with the use of a land parcel. PEV charging complements existing land uses in that it facilitates transportation modes that were previously not accommodated by those land uses.

If a property is to be used in a way that is not specified as an allowed use in a certain zone, some cities may require the property owner to apply for a use permit. Uses are generally classified as a principal use or an accessory use. Principal uses describe the basic purpose of a site—for example, a bookstore. Accessory uses, such as a small café within a bookstore, are subordinate to the primary use of a site. The designation as an accessory use is intended to circumvent the need for additional parking requirements and review. Many cities will require a simple planning clearance for an accessory use to verify that it is indeed not the dominant use of the site.

Some cities may not see a need to specify PEV charging as either a principal or accessory use in any of their zoning districts. They may view Level 1 and Level 2 charging as an accessory use by default and only require a plan check and electrical permit. Other cities may wish to clarify that charging is an accessory or outright permitted use because unless stated otherwise, planners may interpret this to mean that some sort of use permit is required. Different use permits are subject to different fees and levels of review, which may require the individual planner to make a determination. Eliminating a requirement for a separate planning permit for PEV charging in addition to a building and/or electrical permit can reduce the time and cost of installing chargers. Alternatively, listing PEV charging as a principal or accessory use will guide planners in how to process planning permits if they are required.

Cities should examine their land use mix and determine which zoning districts, if any, to prioritize for explicit permission in the zoning ordinance for different types of charging. Cities may want to do this as part of a general land use or zoning ordinance update. For example, *Ready, Set, Charge, California!* suggests Level 1, Level 2 and DC Fast charging be considered an outright permitted use in commercial, industrial and institutional zoning districts and as accessory uses in low-density residential districts (*Ready, Set, Charge, California! A Guide to EV-Ready Communities* 2011). Some cities may only need to clarify charging as an accessory use in non-residential settings to ensure that the principal use of the site is not changed and that traffic flows are not affected by drivers coming to the site solely for PEV charging. Please see [Chapter 3](#) for a discussion of the power requirements for different charging levels and [Chapter 8](#) for a discussion of the lengths of time that cars are typically parked and able to charge at various location types. These factors will help cities and utilities tailor permitted levels of charging to zones with sufficient electrical capacity.

Local jurisdictions should also tailor any conditions attached to charging as a permitted use to the type of construction or level of access that will accompany charging. For example, it may not

be necessary to require signage as a condition of charging being allowed as a permitted use if the charging is intended for single-family use.

Zoning ordinances from the City of San Jacinto and the City of Lancaster are excerpted below. San Jacinto's proposed ordinance specifies which charge levels are allowed in which zones, while Lancaster's does not. Lancaster's industrial and recreational park zones are governed by the same language used for commercial zones in specifying PEV charging as an accessory use.

10.2.1 San Jacinto (proposed)

- 1. Level 1 and 2 electric vehicle charging stations are an allowed use in all zones.*
- 2. Level 3 electric vehicle charging stations are an allowed use in Commercial and Office Zones, Industrial Zones and Special Purpose Zones, as defined in Article 2 (Zones, Allowable Land Uses, and Zone-Specific Standards). (San Jacinto Development Code 2012)*

10.2.2 Lancaster

An electric vehicle charging station (EVCS) shall be allowed within any legal single-family or multiple-family residential garage or carport subject to all applicable city code requirements in addition to the following:

- a. The EVCS shall be protected as necessary to prevent damage by automobiles; and*
- b. The EVCS shall be designed to:*
 - Be safe for use during inclement weather, and*
 - Be tamper-resistant to prevent injury particularly to children, and*
 - Be resistant to potential damage by vandalism,*
 - Be equipped with a mechanism to prevent the theft of electricity by an unauthorized user;*
- c. The EVCS shall have complete instructions and appropriate warnings posted in an unobstructed location next to each EVCS.*

An electric vehicle charging station (EVCS) shall be permitted as an accessory use within any existing legal single-family or multiple-family residential garage or carport, or within any existing legal commercial parking space in a parking lot or in a parking garage, subject to all applicable city code requirements and the following:

- 1. Electric vehicle charging stations (EVCS) for public use shall be subject to the following requirements:*
 - a. The EVCSs shall be located in a manner which will be easily seen by the public for*

informational and security purposes and shall be illuminated during evening business hours; and

b. Be located in desirable and convenient parking locations which will serve as an incentive for the use of electric vehicles; and

c. The EVCS pedestals shall be protected as necessary to prevent damage by automobiles; and

d. The EVCS pedestals shall be designed to minimize potential damage by vandalism and to be safe for use in inclement weather; and

e. Complete instructions and appropriate warnings concerning the use of the EVCS shall be posted on a sign in a prominent location on each station for use by the operator; and

f. One standard non-illuminated sign, not to exceed 4 square feet in area and 10 feet in height, may be posted for the purpose of identifying the location of each cluster of EVCSs; and

g. The EVCS may be on a timer that limits the use of the station to the normal business hours of the use(s) which it serves to preclude unauthorized use after business hours.

2. *Electric vehicle charging stations for private use shall:*

a. Be located in a manner which will not allow public access to the charging station; and

b. Comply with subsections G.1.c., d. and e. of this section. (Lancaster Municipal Code)

10.3 Development incentives

PEV charging provides many public benefits, including reductions in greenhouse gas emissions, improvements in neighborhood air quality, and reductions in noise pollution. Planners should consider these benefits when negotiating with developers who want to build more densely on a site than the zoning code would normally allow. Cities often use density bonuses to obtain public benefits such as contributions to parks, open space, or affordable housing. Cities may consider including PEV-ready wiring or charging units as an option for obtaining a density bonus.

Zoning codes specify the minimum number of parking spaces that must be provided for different land uses. Complying with minimum parking requirements can be a challenge for business owners and developers. In a commercial building with many different businesses and shared parking, a business owner applying for a development or use permit may have to demonstrate that there are a sufficient number of existing spaces to serve his or her customers. For developers, the construction of new parking spaces can add significant costs and/or reduce the amount of leasable or sellable floor area.

Business owners and developers may be encouraged to install PEV charging units if they count

towards minimum parking requirements. An example of proposed code language from the City of San Jacinto is excerpted below:

10.3.1 San Jacinto (proposed)

The parking spaces associated with the electric vehicle charging stations located within parking lots or garages may be included in meeting the calculation of the minimum parking spaces required in compliance with Chapter 17.330 (Off-Street Parking and Loading Standards).

Small-battery, low-speed neighborhood electric vehicles, or NEVs, are being explored as alternatives to mass transit in suburban areas. Similar in appearance to golf carts, these vehicles have rechargeable batteries and are intended to reduce emissions from short local trips. Zoning codes can encourage NEV use by allowing smaller-than-standard parking spaces to count toward minimum parking requirements. The following ordinance from the City of San Clemente applies to NEVs in its North Beach Parking Overlay district.

10.3.2 San Clemente

Parking for Neighborhood Electric Vehicles (NEV), as defined in Vehicle Code Section 385.5, may be applied toward the total required parking at a maximum of 4% and not more than 8 spaces of the required number of parking spaces for a project through the approval of a Site Plan Permit. Additional NEV spaces can be provided however those spaces will not apply to the required parking. NEV spaces shall be located in areas of parking lots that cannot accommodate a standard parking space, unless the required number of standard spaces has been satisfied. (San Clemente Municipal Code)

Local jurisdictions can also allow a *reduced* number of required parking spaces in exchange for the installation of charging units. Business and property owners, developers, and local planners will have to consider the impact of reduced parking on tenants, customers, and the surrounding neighborhood. In jurisdictions that also require PEV-ready wiring for a minimum number of parking spaces in new construction, allowing the site host to install charging units in exchange for providing fewer parking spaces may reduce the overall number of PEV-ready spaces. While this may further encourage the installation of charging units in the short term, it may reduce the number of PEV-ready spaces in the longer term.

Ready, Set, Charge, California! suggests reducing required parking in downtown cores or job centers “where new housing developments could rely on both car-sharing programs and shared parking agreements with existing public or private parking facility owners for nighttime and weekend use.” PEV car-share parking could allow the developer or property owner to receive parking requirement reductions in exchange for providing charging on site (*Ready, Set, Charge, California! A Guide to EV-Ready Communities* 2011).

[Chapter 11](#) provides guidance on requiring a minimum percentage of parking spaces in new construction to be made PEV-ready with appropriate conduit and/or wiring. Requiring existing

parking areas to be retrofitted with PEV wiring and/or charging units could be costly. As noted in *Ready, Set, Charge, California!*, the State of Hawaii requires such retrofitting for large existing parking facilities. However, the state allows owners of multiple parking lots within a jurisdiction to meet the total number of required PEV spaces across their parking lots, even if one or more of the properties has fewer such spaces than would normally be required. Hawaii's statute is excerpted below.

10.3.3 Hawaii

All public, private, and government parking facilities that are available for use by the general public and have at least one hundred parking spaces shall designate one per cent of parking spaces exclusively for electric vehicles by December 31, 2011, provided that at least one of the parking spaces designated for electric vehicles is located near the building entrance and is equipped with an electric vehicle charging unit. Spaces shall be designated, clearly marked, and the exclusive designation enforced. The electric vehicle charging units shall meet recognized standards, including SAE J1772 of the Society of Automotive Engineers. Owners of multiple parking lots within the State may designate and electrify fewer parking spaces than required in one or more of their owned properties as long as the scheduled requirement is met for the total number of aggregate spaces on all of their owned properties.

When the number of registered electric vehicles in the State reaches five thousand, the spaces designated for electric vehicles shall increase to two per cent of parking spaces. The number of spaces designated for electric vehicles shall continue to increase by one per cent for each additional five thousand electric vehicles registered in the State until the percentage reaches ten per cent of parking spaces.

For the purposes of this section, "electric vehicle" means an electric vehicle or neighborhood electric vehicle with an electric vehicle license plate. (Hawaii Revised Statutes)

10.4 Recommendations

The following recommendations are intended to facilitate PEV charging through zoning and parking policies. These recommendations are intended to be adapted to reflect local land use priorities for PEV charging and anticipated PEV demand, which may vary greatly among cities. Additional resources on building codes and parking policies are provided in [Chapter 11](#) and [Chapter 13](#) of this document. Local jurisdictions should consult the Southern California PEV Atlas that accompanies this document for local PEV demand projections.

1. Cities should allow charging as an accessory use that does not require more than a simple planning clearance, as long as charging is not the primary purpose of the site.
2. Installation of chargers should be allowed as an outright permitted or accessory use as appropriate in zones that present the most significant local opportunities for PEV charging.

3. Charging spaces designated for PEVs or NEVs should be able to meet the minimum parking requirements for business owners and developers. Planners should consider reducing parking requirements in exchange for the site host providing PEV charging spaces.
4. Cities should require a minimum percentage of parking spaces in new construction be PEV-ready based on current and anticipated PEV demand.
5. Zoning ordinances that allow charging as a permitted or accessory use should tailor any additional conditions of installation to the type of building specified in the ordinance. For example, it may not be necessary to require signage and protection against damage to the charging unit as a condition of permitting charging in single-family zones.

10.5 Additional resources

The Bay Area Climate Collaborative's *Ready, Set, Charge, California! A Guide to EV-Ready Communities* (2011) provides sample zoning code and minimum parking requirement provisions for PEV charging.

http://www.baclimate.org/images/stories/actionareas/ev/guidelines/readysetcharge_evguidelines.pdf

- Section 2.2 (Community-wide programs, policies and incentives)
- Section 3.2.1 (Sample zoning code provisions)

10.6 References

Hawaii Revised Statutes. Part IV, Chapter 291-71. http://www.capitol.hawaii.gov/hrscurrent/Vol05_Ch0261-0319/HRS0291/HRS_0291-0071.htm.

Lancaster Municipal Code. Section 17.08.050. http://library.municode.com/HTML/16042/level3/TIT17ZO_CH17.08REZO_ARTIINOURMEHIDEREZO.html#TIT17ZO_CH17.08REZO_ARTIINOURMEHIDEREZO_17.08.050ACTEUS.

———. Section 17.12.050. http://library.municode.com/HTML/16042/level3/TIT17ZO_CH17.12COZO_ARTIIGECOCZO.html#TIT17ZO_CH17.12COZO_ARTIIGECOCZO_17.12.050ACUS.

Ready, Set, Charge, California! A Guide to EV-Ready Communities. 2011. http://www.baclimate.org/images/stories/actionareas/ev/readysetcharge_evguidelines.pdf.

San Clemente Municipal Code. Section 17.56.080. http://library.municode.com/HTML/16606/level2/TIT17ZO_CH17.56OVDIST.html#TIT17ZO_CH17.56OVDIST_17.56.080NOBPAOVP.

San Jacinto Development Code. 2012. Errata Sheet, Item A-4. <http://sanjacintoca.us/sirepub/cache/2/ij2om0ersj3anlvmh2rcyo55/3746110182012113208313.PDF>.

11 Building Codes for PEV Readiness

11.1 Introduction

Cities can use building codes to advance PEV adoption in a way that ensures safe, cost-effective installation of charging equipment. By updating building codes to require PEV-ready wiring in new construction, cities can help meet future demand for charging and reduce or eliminate the costs associated with later retrofitting. In addition to these benefits, PEV building readiness codes advance equity by ensuring access to charging for multi-family building residents and the disabled. Building codes related to PEVs can also provide guidance on a number of issues including (California Plug-in Electric Vehicle Collaborative 2012; Advanced Energy 2011):

- The number of circuits needed and service panel requirements
- Placement of electric meters
- Sourcing of electricity for on-street and lot parking
- The impact of charging infrastructure on building electrical loads and local electrical distribution
- Allocation and sizing of parking spaces to accommodate charging infrastructure
- Compliance with the Americans with Disabilities Act (ADA)

About two-thirds of local government agencies and utilities surveyed by the California Plug-in Electric Vehicle Collaborative have not adopted building code requirements for EVSE installations (California Plug-in Electric Vehicle Collaborative 2012). Of those that do have building code requirements for EVSE installations, 92% do not have unique code requirements for new construction in addition to requirements for pre-existing buildings.³³

Codes provide construction standards according to building uses. These uses can be classified as residential or non-residential. Residential buildings are often classified into two categories: one- or two-family homes and townhouses, and multi-family (also called multi-unit) dwellings. Non-

³³ California Plug-in Electric Vehicle Readiness Survey results reported as of September 4, 2012. Response rates to these questions ranged from 29–37%.

residential buildings can include business, industrial, institutional and mercantile (retail) uses. The types of building codes a city will need to prepare for PEV infrastructure will depend in part on the kinds of land uses and occupancies that are most commonly found in that city.

A building code's applicability generally falls along a continuum of scope and cost-effectiveness. The continuum ranges from new construction (the narrowest scope and the most cost-effective), to remodels involving a certain percentage of a structure, and finally to retrofits (the widest scope and potentially most costly, because it applies to existing buildings as well as new construction).

Planning for PEVs is an inherently uncertain exercise. The number of PEVs on the road in the future, their battery sizes and charging requirements, and the timeframe in which they will become more ubiquitous is difficult to predict with certainty. Vehicle and charging technology will evolve more quickly than the average lifespan of a building. What follows is a discussion of California's voluntary building code governing electric vehicle charging infrastructure and some examples of how cities have tailored this standard or strengthened it at the local level.

11.2 CALGreen

California's green building code provides guidance on *voluntary* measures municipalities can adopt if they want to require PEV charging readiness in newly-constructed buildings. A limitation of CALGreen is that its residential measures only apply to low-rise residential buildings of three stories or fewer. The California Department of Housing and Community Development has proposed extending CALGreen's provisions to cover high-rise as well as low-rise residential construction beginning in 2014. (California Department of Housing and Community Development 2012). Cities can adopt the measures in CALGreen or adapt them to reflect local priorities. For example, the City of Santa Monica has adopted the measures in CALGreen and has redefined "low-rise residential" to mean buildings of six stories or less (Santa Monica Municipal Code 2010).

For one- and two-family dwellings, the code calls for **installation of a raceway**³⁴ to accommodate a dedicated branch circuit. For multifamily residential dwellings of three stories or less, CALGreen also calls for a **minimum number of parking spaces** to be capable of supporting PEV charging. The CALGreen code language is excerpted below (California Building Standards Commission 2012 Supplement):

- **A4.106.6.1 One-and two-family dwellings.** *Install a listed raceway to accommodate a dedicated branch circuit. The raceway shall not be less than trade size 1. The raceway shall be securely fastened at the main service or subpanel and shall terminate in close proximity to the proposed location of the charging system into a listed cabinet, box or*

34 The term "raceway" is sometimes used interchangeably with "conduit." A raceway is a channel, often a rectangular wall-mounted tubular casing, designed expressly for holding wires or cables and protecting them from damage. (Davis 1998-2012)

enclosure. Raceways are required to be continuous at enclosed or concealed areas and spaces. A raceway may terminate in an attic or other approved location when it can be demonstrated that the area is accessible and no removal of materials is necessary to complete the final installation.

- **A4.106.6.2 Multifamily dwellings.** At least 3 percent of the total parking spaces, but not less than one, shall be capable of supporting future electric vehicle supply equipment (EVSE).³⁵
 - o **A4.106.6.2.1 Single charging space required.** When only a single charging space is required, install a listed raceway capable of accommodating a dedicated branch circuit. The raceway shall not be less than trade size 1. The raceway shall be securely fastened at the main service or subpanel and shall terminate in close proximity to the proposed location of the charging system into a listed cabinet, box or enclosure.
 - o **A4.106.6.2.2 Multiple charging spaces required.** When multiple charging spaces are required, plans shall include the location(s) and type of the EVSE, raceway method(s), wiring schematics and electrical calculations to verify that the electrical system has sufficient capacity to simultaneously charge all the electrical vehicles at all designated EV charging spaces at their full rated amperage. Plan design shall be based upon Level 2³⁶ EVSE at its maximum operating ampacity. Only underground raceways and related underground equipment are required to be installed at the time of construction.

CALGreen also offers municipalities a voluntary standard for PEV charging at **commercial, retail** and other **non-residential** locations, as excerpted here (California Building Standards Commission 2012 Supplement):

- **A5.106.5.3 Electric vehicle charging.** Provide facilities meeting Section 406.7 (Electric Vehicle) of the California Building Code and as follows:
 - o **A5.106.5.3.1 Electric vehicle supply wiring.** For each space required in [Table A5.106.5.3.1](#), provide panel capacity and dedicated conduit for one 208/240V 40 amp circuit terminating within 5 feet of the midline of each parking space.

35 Electric vehicle supply equipment may refer to charging stations, cords, or building wiring intended to power electric vehicles. The California Electrical Code defines EVSE as “conductors...and the electric vehicle connectors, attachment plugs, and all other fittings, devices, power outlets, or apparatus installed specifically for the purpose of delivering energy from the premises wiring to the electric vehicle.”

36 Charging levels refer to the voltage provided by charging unit. The higher the voltage, the more quickly a battery can be powered. Level 1 charging uses 120 volts to provide at least 12 amperes of current and 1.44-1.92 kilowatts of power. Level 1 charging is available through a standard household outlet. Level 2 charging uses 240 volts (or 208 volts in commercial locations) to provide up to 80 amperes of current and 19.2 kilowatts of power for battery use (U.S. Department of Energy 2012). Typical amperages for Level 2 current range from 15-40A. See [Chapter 3](#) for a more detailed description of charging levels.

Table A5.106.5.3.1:

TOTAL NUMBER OF PARKING SPACES*	NUMBER OF REQUIRED SPACES
1–50	1
51–200	2
201 and over	4

**In a parking garage, the total number of parking spaces is for each individual floor or level.*

11.3 Local ordinances in the South Coast region

Once adopted by cities, the CALGreen voluntary measures become requirements for new construction. Some cities in the Southern California Association of Governments (SCAG) region have adopted or adapted the voluntary EVSE measures presented in CALGreen. These ordinances require and prescribe standards for 1) panel capacity, outlets, conduits, meters and/or charging units, each of which represent progressively higher levels of PEV readiness; and 2) the number of parking spaces to be served by charging infrastructure. The higher the upfront commitment by a city to facilitating this type of charging access, the fewer costly retrofits³⁷ will be required in the long run, and the more flexible PEV drivers can be in their charging habits.³⁸

11.3.1 Panel capacity and outlets

The most basic level of PEV readiness relates to electric service panel capacity. The ability of electrical panels to handle PEV charging load depends on the age and size of the building as well as what other load demands are placed on the panels. Existing 120-volt outlets in a parking area may be sufficient to provide charging, particularly for smaller-battery PHEVs, without the need for additional panel service. Many building codes require new buildings to provide 240-volt outlets, but cities should consider allowing 120-volt outlets, or a mix of 120- and 240-volt outlets, to serve a range of battery sizes and commutes. In particular, if cities are considering requiring PEV-ready retrofits, 120-volt outlets could be a more cost-effective

37 Published cost estimates for retrofits vary widely depending on site type and complexity of installation. Estimates for Level 2 single-family range from \$1,500 - \$4,000 (Ready, Set, Charge, California! A Guide to EV-Ready Communities 2011) while Level 2 in multi-unit dwellings and commercial settings can range from \$3,600 - \$11,000 (Peterson 2011).

38 Cities may also consider expanding the size of future electrical rooms to accommodate conduits for PEV charging. The City of Vancouver, Canada has adopted the following code language: “The electrical room in a multi-family building, or in the multi-family component of a mixed-use building that in either case includes three or more dwelling units, must include sufficient space for the future installation of electrical equipment necessary to provide a receptacle to accommodate use by electric charging equipment for 100% of the parking stalls that are for use by owners or occupiers of the building or of the residential component of the building.”(Ready, Set, Charge, California! A Guide to EV-Ready Communities 2011)

option. Incorporating more opportunities for 120-volt charging would also reduce the need for special 240-volt charging units, since 120-volt outlets can be used with the cords that currently come with PEVs. The lower voltage would allow for more outlets to be installed using the same amount of power (Balmin, Bonett, and Kirkeby 2012).

Alternatively, property owners can evaluate whether lower-cost charging can be provided through multiplex or multi-arm stations that can charge more than one car simultaneously, or in a programmed queue. While such solutions may present a higher upfront cost, the unit cost per driver is much lower.

The need to upgrade electrical panels in existing buildings may be reduced by the use of energy management software, which can balance the additional load brought by PEV charging. The National Electrical Code required electrical capacity for charging equipment to reflect the full load charging capability of the equipment, plus an additional 25% capacity buffer, in order to prevent circuit overload (National Fire Protection Association 2011). However, a tentative interim amendment to the code allows the maximum electric vehicle supply equipment load on a service panel or feeder to reflect the maximum load permitted by an automatic load management system (National Fire Protection Association 2011). Cities should consider updating local electrical codes to allow this potentially lower-cost alternative to adding capacity.

New construction provides an opportunity to examine the building's total projected load from PEVs and other sources and to offset this load with energy efficiency upgrades. Panel capacity can also be made available for PEVs by installing energy-efficient lighting and HVAC systems. A qualified electrical contractor should be retained to assess sites and calculate electrical loads, particularly for more complex installations that serve multiple vehicles in MUDs or commercial buildings. (Biddick et al. 2012; California Plug-in Electric Vehicle Collaborative 2012; Ready, Set, Charge, California! A Guide to EV-Ready Communities 2011)

11.3.2 Conduits and meters

The laying of conduit capable of carrying future wires or cables from the electrical room to the charging unit represents the next step in PEV building readiness. Codes requiring 120-volt outlets into which PEVs can plug in directly, or 240-volt outlets to connect Level 2 chargers to wiring and conduits, will bring buildings even closer to PEV readiness. Providing space in the electrical room for additional future meters will help multi-unit dwellers can take advantage of special utility rates for PEV charging. However, requiring additional meters at single-family homes can have unintended consequences, as they may enable conversion of properties to unapproved multi-family rentals or home businesses. Utilities are exploring the use of software that allows sub-metering of PEV charging on one meter.

11.3.3 Charging units

The City of Lancaster's code is notable in that it requires not only PEV-ready wiring in new construction, but even requires the installation of some ready-to-use charge stations. Cities may

wish to consider whether to require ready-to-use charge stations, when to require them, or how many to require. In doing so, they should strive to minimize cost and ensure that stations are not underused. They should consider evolving technology as well as current demand (see the Southern California PEV Atlas that accompanies this document for COG-level PEV projections).

Excerpted below are local building codes from the SCAG region that are mostly related to PEV readiness in wiring and parking space allocation. Los Angeles' code requires PEV-ready wiring for new single- and multifamily buildings and charging capacity for at least 5% of parking spaces (for multifamily buildings). Rolling Hills Estates' EVSE requirement nominally applies to all new residential units, but in practice was intended for single-family homes and townhouses with attached garages. The city of Temecula's ordinance is also intended for PEV conduits in single-family homes. Other considerations that may relate to building codes, such as PEV parking space design, signage, and ADA compliance, are reviewed in other chapters of this document.

11.3.4 Beverly Hills

Provide facilities meeting section 406.7 (Electric Vehicle) of the California building code and as follows:

One 120 VAC 20 amp and one 208/240V 40 amp, grounded AC outlets or panel capacity for one 120 VAC 20 amp and one 208/240V 40 amp, grounded AC outlet and conduit installed for future outlets for each dwelling unit. Electric vehicle supply shall be provided and may be installed in a stall provided to comply with the code minimum parking requirements. Dwelling unit shall be defined by the California building code.

Exception: Apartment buildings and apartment units. (Beverly Hills Municipal Code 2011)

11.3.5 Lancaster

New residential development shall provide for EVCS in the manner prescribed as follows:

- 1. Garages serving each new single-family residence and each unit of a duplex shall be constructed with a gang box³⁹ (4 inches by 4 inches) connected to a conduit linking the garage to the electrical service, in a manner approved by the building and safety official, to allow for the future installation of electric vehicle supply equipment to provide an EVCS for use by the resident.*
- 2. In new multiple-family projects of 10 dwelling units or less, 20% of the total parking spaces required (all of the 20% shall be located within the required covered parking) shall be provided with a gang box (4 inches by 4 inches) connected to a conduit linking the covered parking spaces or garages with the electrical service, in a manner approved by the building and safety official, to allow for the future installation of electric vehicle supply equipment to provide EVCSs at such time as it is needed for use by residents.*

³⁹ The term "gang box" also refers to an electrical box, which "enclose(s) wire connections for applications such as a light switch, electrical outlet or light fixture" (The Home Depot).

EVCSs shall be provided in disabled person parking spaces in accordance with state requirements.

- 3. In new multiple-family projects of more than 10 dwelling units, 10% of the total parking spaces required (all of the 10% shall be located within the required covered parking) shall be provided with a gang box (4 inches by 4 inches) connected to a conduit linking the covered parking spaces or garages with the electrical service, in a manner approved by the building and safety official. Of the total gang boxes provided, 50% shall have the necessary electric vehicle supply equipment installed to provide active EVCSs ready for use by residents. The remainder shall be installed at such time as they are needed for use by residents. EVCSs shall be provided in disabled person parking spaces in accordance with state requirements. (Lancaster Municipal Code)*

New commercial development shall provide for electric vehicle charging stations in the manner prescribed as follows:

a) New residential uses shall provide EVCSs in accordance with Section 17.08.150T.

b) New commercial, industrial, and other uses with the building or land area, capacity, or numbers of employees listed herein shall provide the electrical service capacity necessary and all conduits and related equipment necessary to ultimately serve 2% of the total parking spaces with EVCSs in a manner approved by the building and safety official. Of these parking spaces, 1/2 shall initially be provided with the electric vehicle supply equipment necessary to function as on-line EVCSs upon completion of the project. The remainder shall be installed at such time as they are needed for use by customers, employees or other users. EVCSs shall be provided in disabled person parking spaces in accordance with state requirements.

- 1. Construction of a hospital of 500 or more beds, or expansion of a hospital of that size by 20% or more.*
- 2. Construction of a post-secondary school (college), public or private, for 3,000 or more students, or expansion of an existing facility having a capacity of 3,000 or more students by an addition of at least 20%.*
- 3. Hotels or motels with 500 or more rooms.*
- 4. Industrial, manufacturing, or processing plants or industrial parks that employ more than 1,000 persons, occupy more than 40 acres of land, or contain more than 650,000 square feet of gross floor area.*
- 5. Office buildings or office parks that employ more than 1,000 persons or contain more than 250,000 square feet of gross floor area.*
- 6. Shopping centers or trade centers that employ 1,000 or more persons or contain 500,000 square feet of gross floor area.*

7. *Sports, entertainment, or recreation facilities that accommodate at least 4,000 persons per performance or that contain 1,500 or more fixed seats.*
8. *Transit projects (including but not limited to transit stations and park and ride lots). (Lancaster Municipal Code)*

11.3.6 City of Los Angeles

1. *For one- or two- family dwellings and townhouses, provide a minimum of:*

- a) *One 208/240 V 40 amp, grounded AC outlet, for each dwelling unit or*
- b) *Panel capacity and conduit for the future installation of a 208/240 V 40 amp, grounded AC outlet, for each dwelling unit.*

The electrical outlet or conduit termination shall be located adjacent to the parking area.

2. *For other residential occupancies where there is a common parking area, provide one of the following:*

- a) *A minimum number of 208/240 V 40 amp, grounded AC outlets equal to 5 percent of the total number of parking spaces. The outlets shall be located within the parking area or*
- b) *Panel capacity and conduit for future installation of electrical outlets. The panel capacity and conduit size shall be designed to accommodate the future installation, and allow the simultaneous charging, of a minimum number of 208/240 V 40 amp, grounded AC outlets, that is equal to 5 percent of the total number of parking spaces. The conduit shall terminate within the parking area; or*
- c) *Additional service capacity, space for future meters, and conduit for future installation of electrical outlets. The service capacity and conduit size shall be designed to accommodate the future installation, and allow the simultaneous charging, of a minimum number of 208/240 V 40 amp, grounded AC outlets, that is equal to 5 percent of the total number of parking spaces. The conduit shall terminate within the parking area.*

When the application of the 5 percent results in a fractional space, round up to the next whole number. (Los Angeles Municipal Code 2010)

11.3.7 Rolling Hills Estates

Any new residential construction, including an addition to a residential structure of greater than fifty percent of the existing floor area, including the primary garage, and/or any demolition of greater than fifty percent of the lineal walls of a residential structure within a twelve-month period, shall require the installation of a two hundred twenty volt dedicated electrical outlet in

the garage for the purposes of charging an electric vehicle. (Rolling Hills Estates Municipal Code)

11.3.8 Temecula

Circuits for electric vehicle charging stations shall meet all the requirements of California Electrical Code Article 625⁴⁰. Residential garages shall have a minimum three quarter (3/4) inch metal flex conduit ran from meter box to the garage fire wall and terminated in a metal box at forty-two (42) inches above finished floor for future electric vehicle charging station. (Temecula Municipal Code)

11.3.9 Torrance (proposed)

- *That all new residential units shall be equipped with the required electrical conduit to accommodate at least one Level 2 electric vehicle charging capability within designated parking areas for said unit(s). [Community Development Department staff requested that the Planning Commission also consider the CALGreen 3% requirement to avoid new findings, public noticing and additional local amendment proceedings].*

Residential parking development standards:

- *Charging units located with residentially developed properties must either be provided within an enclosed structure, affixed to a permitted structure or located adjacent to a required parking space, provided exterior charging units do not encroach into any required setback by more than 12 inches.*

Commercial industrial parking regulations:

- *an EV parking space requirement for new construction or properties significantly remodeled...and which provide 50 or more parking spaces, shall be required to provide and maintain at least 2% of available parking spaces as electric vehicle parking spaces equipped with either Level 2 or [higher] charging infrastructure.*
- *Required signage specifications for electric vehicle parking spaces, to clearly mark spaces as electric vehicle parking, contact information for charging station (Community Development Department Recommendations to the Torrance Planning Commission, June 6, 2012, Agenda Item No. 15A, Case No. LUS12-00001).*

11.4 Conclusion

The building codes we present in this chapter reflect early attempts to support PEV readiness. The steps taken by these municipalities to date reflect the impracticality, due to cost recovery

⁴⁰ For the model California Electrical Code language on PEV charging, see <http://rrdocs.nfpa.org/rrserver/browser?title=/NFPACA/CaliforniaElectricalCode2010>

and implementation issues, of mandating charging equipment installation in existing residential buildings. These codes will need to evolve over time and adapt to market conditions.

11.5 Recommendations

The following recommendations are intended to facilitate PEV charging through building codes. These recommendations should be adapted to reflect local land use opportunities for PEV charging and anticipated PEV demand, which may vary greatly among cities. Guidance on assessing local land use opportunities is provided in [Chapter 4](#), [Chapter 5](#), [Chapter 6](#), [Chapter 7](#), and [Chapter 8](#). Additional resources on zoning and parking policies are provided in [Chapter 10](#) and [Chapter 13](#) of this document. Local jurisdictions should consult the Southern California PEV Atlas that accompanies this document for local PEV demand projections and maps of employment and commercial density.

1. Consider expanding the range of new buildings to which PEV readiness codes apply beyond CalGreen's low-rise designation.
2. Allow Level 1 or Level 2 charging capability to satisfy PEV readiness requirements in building codes.
3. Require the laying of conduit capable of carrying future wires or cables from the electrical room to the charging unit in new construction.
4. Consider present PEV charging demand in determining whether to require installation of ready-to-use charging stations in addition to PEV-ready wiring for new single and multi-unit dwellings.
5. Require a certain minimum percentage of parking spaces in new construction be wired to be PEV-ready for single-family homes or MUDs, if these land uses present significant opportunities locally.
6. Require a certain minimum percentage of parking spaces in new construction be wired to be PEV-ready in commercial or industrial buildings, if these opportunities represent significant opportunities locally.
7. Consider updating electrical codes to allow the sizing of electrical service to charging systems to reflect the load permitted by an automated energy management system.

11.6 Additional resources

There are many resources available for planners seeking detailed implementation guidance for PEV-ready buildings, including:

Ready, Set, Charge, California! A Guide to EV-Ready Communities (2011). http://www.baclimate.org/images/stories/actionareas/ev/guidelines/readysetcharge_evguidelines.pdf

- Section 3.5 (Building and Electrical Code Guidance)
- Section 3.6 (Signage)
- Section 5.3 (Electrical Requirements)

Building codes specify whether pre-wiring or installation of electric vehicle supply equipment (EVSE) is required for new construction or existing buildings. If cities decide to require EVSE readiness, they should do so in compliance with the standards specified in the California Electrical Code.

California Electrical Code (2010). <http://rrdocs.nfpa.org/rrserver/browser?title=/NFPACA/CaliforniaElectricalCode2010>

- Article 625, Electric Vehicle Charging System
- Article 626, Electrified Truck Parking Spaces

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