AGENDA REPORT

TO: Sabrina B. Landreth
City Administrator

FROM: Darin Ranelletti
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SUBJECT: California Green Building Standards Code Adoption and Electric Vehicle Readiness Amendment

DATE: October 17, 2016

City Administrator Approval Date: 11/3/16

RECOMMENDATION

Staff Recommends That The City Council Conduct A Public Hearing And Upon Conclusion Adopt (1) A Resolution Of Findings Supporting Local Amendments To Sections 4.106.4 And 5.106.5.3 Of The 2016 Edition Of The California Green Building Standards Code To Comply With Changes To State Law And Adopting California Environmental Quality Act Exemption Findings; And (2) An Ordinance Adopting Local Amendments To Sections 4.106.4 And 5.106.5.3 Of The 2016 Edition Of The California Green Building Standards Code And Amending Oakland Municipal Code Chapter 15.04 To Include New Requirements For Plug-In Electric Vehicle Infrastructure To Comply With Changes To State Law And Adopting CEQA Exemption Findings.

EXECUTIVE SUMMARY

Vehicle electrification is an important strategy for climate action and air quality improvement, and a Priority Action in Oakland's Energy and Climate Action Plan (ECAP). Plug-in electric vehicles (PEVs) have been shown to reduce lifetime driving expenses for their owners, contributing to increased financial security. They are a key component in boosting local energy independence.

Local jurisdictions are required to enforce the mandatory 2016 California Green Building Standards Code (CALGreen) as of January 1, 2017. Jurisdictions are permitted to require more stringent provisions to address local conditions. Staff recommends that City Council adopt new local building code provisions that surpass the 2016 CALGreen standards, to boost PEV ownership by requiring higher levels of PEV infrastructure in all new multi-unit dwellings (MUDs) and nonresidential buildings. The recommended code changes will help ensure that all segments of the Oakland community have equitable access to electrified transportation.

The proposed modifications to Oakland Municipal Code ("OMC") Title 15 would satisfy and exceed CALGreen requirements for PEV infrastructure, meet anticipated local needs, and address the City's policy goals as set forth in the 2012 ECAP. The central components of the proposed amendments, all of which exceed CALGreen requirements, are as follows:

1. Increase the total number of spaces that are "PEV Ready" above CALGreen minimum requirements in all multifamily buildings and nonresidential buildings;
2. Require that a specific number of PEV Ready spaces are equipped with full electric circuits at the time of new construction to support installation of electric vehicle chargers in the near future with reduced time and expense;
3. Require that State accessibility requirements for planned PEV parking spaces are fulfilled at the time of new construction; and
4. Facilitate up to 100 percent of parking spaces in larger multifamily buildings being equipped with PEV chargers.

The cost of installing complete electric circuits during new construction to accommodate later installation of electric vehicle chargers typically ranges from $500-$5,000 less per PEV parking space than retrofitting and upgrading the electric service post-construction. The recommended revisions to OMC Title 15 will cost-effectively exceed CALGreen requirements, meet anticipated local needs, and increase electric vehicle readiness in new multi-unit dwellings (MUDs), to best support State and City of Oakland climate, sustainability, economic, and alternative transportation goals.

BACKGROUND / LEGISLATIVE HISTORY

Electric vehicle readiness is an important local, statewide, and national goal. California has set a goal of placing 1.5 million zero-emission vehicles on California roads by 2025. In 2013, the Bay Area Air Quality Management District (BAAQMD) published a Bay Area PEV Readiness Plan, which anticipates at least 246,900 electric vehicles on Bay Area roads by 2025. In December 2012, Oakland City Council adopted an Energy and Climate Action Plan (ECAP) that committed the city to reduce its greenhouse gas (GHG) emissions 36 percent below 2005 levels by 2020 through multiple measures, including reduced vehicle miles traveled and vehicle efficiency. ECAP Priority Action Item 37, "Plan for Electric Vehicle Infrastructure," includes developing new processes to support local use of electric vehicles.

The local building code is an important tool that the City can use to further its electric vehicle infrastructure goals, including those set forth in the ECAP. Local jurisdictions are required to enforce the California Building Standards Code, codified as Title 24 of the California Code of Regulations (hereafter, Title 24), whether or not the jurisdiction formally adopts the Code. The California Green Building Standards Code, known as CALGreen, is contained in Part 11 of Title 24. CALGreen contains mandatory requirements for PEV infrastructure in sections 4.106 and 5.106.5.3, which local jurisdictions are obligated to enforce along with the rest of the mandatory CALGreen standards. These mandatory standards were most recently updated in January 2016 and take effect January 1, 2017.

Local jurisdictions are permitted to adopt local amendments that exceed the State code to address local conditions. Local jurisdictions may not adopt or implement less stringent standards. California Health & Safety Code Section 17958.7 provides that before making any modifications to the California Green Building Standards Code or any other applicable provisions published by the State Building Standards Commission, a governing body must make an express finding that each such change or modification is reasonably necessary because of specified local conditions. The findings must be filed with the State Building Standards Commission before the local changes or modifications go into effect. Local codes may be based on model voluntary codes located in an appendix to CALGreen or may be tailored to best meet local needs. The recommended findings are set forth in Exhibit A to the proposed Resolution.

Oakland's ECAP notes that the City is working with other Bay Area communities to establish a regional hub for PEV ownership. It also identifies processes to facilitate PEV infrastructure as a strategy to support the City's energy and climate goals. The City obtained a grant from the California Energy Commission (CEC) on behalf of the City and other regional partners to address this priority via building codes and standards. This grant provides technical assistance, primarily provided by the City's contractor Energy Solutions, to provide cost-effectiveness evaluation of policy options, help draft potential local CALGreen amendments, and prepare a submittal to the California Building Standards Commission. The grant also supports evaluation of opportunities to streamline permitting and inspection processes.

ANALYSIS AND POLICY ALTERNATIVES

Vehicle electrification is an important strategy for climate action and air quality improvement, and is called out specifically in the ECAP. Plug-in electric vehicles (PEVs) have been shown to reduce lifetime driving expenses, contributing to increased financial security of their drivers. Given the large and growing share of renewable energy that powers Oakland's electricity grid, using electricity rather than gasoline to power personal automobiles is an important factor in building local energy independence and economic development.

Lack of PEV charging infrastructure is a key challenge for meeting California PEV adoption goals, as noted in the draft *California 2015 ZEV Action Plan*,[1] the 2013 *Bay Area PEV Readiness Plan* published by BAAQMD, and the City's ECAP. A majority of PEV drivers charge their cars at home,[2] but home charging is usually not an option for those living in multifamily buildings due to lack of infrastructure. Additionally, those traveling long distances for work or recreation need access to local charging options in order to feel comfortable relying on PEVs.

Oakland's stock of multifamily buildings is substantial. In 2013, approximately 33 percent of the City's housing stock was in multifamily dwellings in structures of five or more units, and 19 percent was in multifamily dwellings in structures of two to four units.[3] Numerous barriers discourage retrofitting multifamily buildings to accommodate PEV infrastructure, the greatest of which is the high cost of retrofits. There is also a disconnect between tenants who may be required to pay for the installation of infrastructure, and the building owners who actually own the infrastructure once it is installed. Finally, landlords and homeowners' associations often set insurance requirements or other conditions that discourage retrofit of PEV charging electrical infrastructure by tenants or condo owners. Facilitating later installation of electric vehicle chargers during initial construction is a critical path to overcoming these barriers.

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[1] Draft 2015 ZEV Action Plan, April 2015, Governor's Interagency Working Group on Zero-Emission Vehicles.

[2] U.S. Department of Energy. EV Everywhere Workplace Charging Challenge, 2014 Progress Report http://energy.gov/sites/prod/files/2014/11/f19/progress_report_final.pdf

[3] City of Oakland Housing Element 2015-2023

CALGreen and the local building code present important opportunities to influence the provision of PEV charging infrastructure. As described above, CALGreen represents a "floor" upon which cities can innovate to address local conditions and fulfill local policy goals. Oakland's unique context includes not only an increased rate of PEV adoption compared with the rest of the state, but, more importantly, a set of geological and climatic conditions that make our region particularly vulnerable to the effects of climate change. Disadvantaged communities, primarily living in the flood-prone areas of East and West Oakland, are especially vulnerable to those effects. Disadvantaged communities also tend to have less access to PEV charging due to a higher likelihood of living in older and/or multifamily buildings, which have the lowest prevalence of electric vehicle chargers (electric vehicle supply equipment, or EVSE) and the greatest barriers to installing EVSE. Given that PEVs generally have lower lifetime operating costs as compared to conventional vehicles and reduce local air pollution, it is imperative that the City act to facilitate PEV adoption in low-income communities.

Facilitating PEV infrastructure in new residential construction will directly benefit disadvantaged communities, both now and in the future. New affordable housing is being constructed on a yearly basis throughout the City. This includes multiple large developments currently under construction, and 340 units across three projects that received funding through the Affordable Housing and Sustainable Communities Program, part of the state's Cap and Trade system, in 2016. Additionally, housing permitted and built in the near term will likely be in use for at least 50-100 years, during which time occupancy and residential make-up can change dramatically. Finally, PEV infrastructure in nonresidential construction, including commercial, retail, and office buildings, can benefit Oaklanders from throughout the city and from all walks of life, including those who lack their own home charging systems.

Oakland's proven demand and the local need for dramatically improved PEV charging infrastructure, yield an important case for exceeding the CALGreen minimum provisions and implementing a strategic and intelligent set of local requirements.

CALGreen's minimum standards for PEV charging electrical infrastructure are not high enough to meet California PEV deployment goals and expected local demand. As Table 1 illustrates below, beginning on January 1, 2017, CALGreen will require that nonresidential buildings with more than 10 spaces, or all nonresidential building in jurisdictions adopting CALGreen's voluntary "Tier 2" requirements, install PEV readiness for the percentage of parking spaces listed. Under both the mandatory and voluntary CALGreen standards, multifamily buildings with fewer than 17 parking spaces are exempted from the requirements.

California will need to achieve a 12 percent state-wide PEV market share by 2025 to meet the California Air Resources Board (CARB) Zero Emission Vehicle program target of 1.5 million zero emission vehicles by 2025. The state is already ahead of CARB's expected PEV market share trajectory to that goal, with record sales levels in recent months.[4] The current sales rate of approximately four percent exceeds CARB's expected trajectory by about 50 percent,[5] so a 12

[4] The California fleet consists of 27 million vehicles per the 2013 California Energy Commission draft Integrated Energy Policy Report (p. 173), leading to an estimated 5% PEV deployment in 2025 in the on-road fleet and sales percentages of about 12%.

[5] See CARB "Staff Report: Initial Statement of Reasons for Rulemaking" September 2013 page 2 http://www.arb.ca.gov/regact/2013/zev2013/zev2013isor.pdf and the Plug in Electric Vehicle Collaborative

percent market share may actually be a floor, with the actual level of PEV ownership potentially much higher.

Table 1. Summary of CALGreen Mandatory and Voluntary PEV-Readiness Standards

	Nonresidential				Multifamily (unchanged)	
	Mandatory		Voluntary*			
			Tier 1	Tier 2		
	Current	Effective January 1, 2017	Effective January 1, 2017		Mandatory	Voluntary
Minimum threshold for standards to be effective	51 parking spaces	10 parking spaces	10 parking spaces	One parking space	17 units	17 units
Percent of new parking spaces that must be PEV-ready	3%	~6%**	~8%**	~10%**	3%	5%

** CALGreen voluntary standards provide either one or two options to exceed minimum code requirements. When two options are provided, they are labeled Tier 1 and Tier 2.*
*** The number of parking spaces that must be PEV-ready are assigned based on total parking spaces in a batch allocation system rather than an exact percentage, so some of the percentages shown here are approximate*

Moreover, PEV ownership rates in Oakland are 50 percent higher than statewide averages based on Department of Motor Vehicle registration data. The City of Oakland and other Bay Area communities form a hot spot for PEV ownership. According to data from the California Clean Vehicle Rebate Project, many of the City's zip codes, along with many zip codes in the immediate Bay Area, are in the highest tier of PEV rebate distribution. This trend is consistent with Oakland's leadership in climate action and new technology adoption.

According to the 2015 draft *California 2015* Zero Emission Vehicle Action Plan, "The State has completed an initial analysis of the number of electric vehicle charging stations needed to meet the Executive Order goals, which suggest upwards of 900,000 charge points may be needed by 2020." Thus, a dramatic increase in available PEV charging infrastructure needs to begin during implementation of the upcoming CALGreen code cycle.

Cost Savings Potential: Requiring higher levels of PEV charging infrastructure through local building standards is a highly cost-effective strategy to help address the need for Electric Vehicle Service Equipment (EVSE). A 2016 study conducted by Energy Solutions (see ***Attachment A***, Plug-In Electric Vehicle Infrastructure Cost Effectiveness Report) analyzed the cost effectiveness of installing PEV infrastructure in new construction versus later retrofit in four common building scenarios in Oakland, Fremont, and San Francisco. The four building scenarios (including one variant) were as follows:

- Scenario 1: Surface parking lot with trenching required, two PEV parking spaces
- Scenario 2: Enclosed parking, no trenching required, two PEV parking spaces
- Scenario 3: Enclosed parking, no trenching required, six PEV parking spaces
- Scenario 4: Enclosed parking, no trenching required, 12 PEV parking spaces

"Detailed Monthly Sales Chart", August 2016.
http://www.pevcollaborative.org/sites/all/themes/pev/files/8_august_PEV_cumulative.pdf

- Scenario 4B: Enclosed parking, no trenching required, 12 PEV parking spaces (this scenario is addressed in ***Attachment B***, Addendum to the Plug-In Electric Vehicle Infrastructure Cost Effectiveness Report)

The study examined the costs of installing two different levels of PEV infrastructure in each scenario: basic PEV readiness versus full circuits. The analysis shows that the cost of installing infrastructure during new construction ranges from $200 to $1,400 per PEV parking space depending on the building type and completeness of the electrical circuit installed, versus $1,000 to $6,300 for later retrofit in the same building types.

Cost Comparisons: Installing a complete circuit with a rating of 40-Amp 208/240-Volt during new construction saves $500-$5,000 per PEV parking space for the four common parking garage scenarios that Energy Solutions evaluated, as compared to retrofitting and upgrading the electric service post-construction. Table 2 shows the results for Scenarios One and Four, which the study found provide the highest and lowest amount of cost savings from installation during new construction compared to retrofit costs among the four scenarios that were evaluated. Scenario One addresses surface parking, while Scenario Four addresses an enclosed parking garage.

Table 2. Summary of PEV Infrastructure Cost-Effectiveness Report: High and Low Cost Scenarios (results are per parking space)

	New Construction	Retrofit	Savings
Scenario One: PEV Readiness	$800	$5,400	$4,600
Scenario One: Full Circuits	$1,300	$6,300	$5,000
Scenario Four: PEV Readiness	$500	$1,000	$500
Scenario Four: Full Circuits	$1,400	$1,900	$500

Based on the building scenarios examined, the Energy Solutions study demonstrates that the highest cost savings of approximately $5,000 per PEV parking space would occur for a surface parking lot (Scenario One) by ensuring PEV readiness during initial construction. Cost savings result primarily from obviating the need to install conduit in inaccessible areas (i.e. trenching through concrete and boring through walls) and ensuring that the electric panel capacity does not have to be upgraded when PEV chargers are needed. Installing hard-to-retrofit aspects of an electrical circuit during new construction can dramatically lower costs to facilitate longer term expansion with minimal expense. Installing below-grade or inaccessible conduits during new construction reduces the lifetime cost of that task by about 85%.[6] These costs are minimal compared to the overall costs of new construction, and would provide near-term cost savings as EVSE is easily installed with minimal disruption to accommodate demand by building tenants or users.

PEV Readiness versus Full Circuits: Staff further examined the costs of installing full electric circuits versus PEV readiness only. "PEV readiness," the standard included in CALGreen, refers to supplying empty raceway (housing for wires for electric circuits) in inaccessible locations, and installing sufficient electric panel capacity to support Electric Vehicle Service Equipment (EVSE) at a later date. Inaccessible raceway includes raceway that would need to be installed

[6] "Plug-In Electric Vehicle Infrastructure Cost-Effectiveness Report" July 20, 2016. See Table 6 PEV-Ready Retrofit and New Construction data excluding the balance of circuit cost category.

underground or below grade, passing through walls, and in any other inaccessible location. It excludes raceway that could easily be surface-mounted on a wall or ceiling. In PEV-ready spaces, the remaining required work to install EVSE includes completing the raceway (installing any additional conduit to reach the parking space), pulling wire through the raceway, installing a junction box, and installing the EVSE itself.

Conversely, in spaces provided with a "full circuit," the only remaining work is to install the EVSE itself. The range of costs for installing both PEV readiness only and full circuits is illustrated in Table 2. The average cost savings across all four scenarios in the report was $2,000 for installation during new construction versus later retrofit for full circuits, and $1,900 for PEV readiness. Installing full circuits rather than PEV readiness alone during new construction entails additional "soft cost" savings above those listed here.

Additional Opportunities for Reducing Cost: In multifamily buildings with more than 20 parking spaces, the per-parking space costs can be reduced further as electric load management technologies, now available on the market from numerous providers, can be used to efficiently allocate electric current drawn by multiple EVSE. This is done by either directing full current to each EVSE that is in use or, when more than a certain designated number of cars are charging simultaneously, reducing the current drawn by each vehicle. The result is that the electrical panel capacity does not have to increase for parking facilities with more than 20 spaces.[7] Since panel size is generally the greatest individual cost for PEV readiness, these technologies can have a sizeable impact on the proliferation of charging capacity in urban areas. The cost reductions that result from utilizing load management technologies are indicated in Energy Solutions' 2016 *Addendum to the Plug-In Electric Vehicle Infrastructure Cost Effectiveness Report*, included here as ***Attachment B***.

Policy Options: Multiple options were analyzed for modifying CALGreen to meet local needs (see Table 3). Staff recommends Option 2, a path that will maximize future charging capability while minimizing lifetime expenses for the installation of charging infrastructure.

Options Not Recommended: Option 1, is simple adoption of the CALGreen voluntary codes for both multi-family and nonresidential dwellings. This option represents an improvement over minimum standards, however, it is not recommend because:

1. These requirements, designed to be applicable throughout the state, do not address the higher rates of PEV ownership seen to date and expected to accelerate in Oakland.
2. The CALGreen voluntary code would omit residential buildings with between 3 and 16 units and provide infrastructure at only five percent of spaces, as shown in Table 1.
3. The nonresidential voluntary code provides infrastructure at up to ten percent of spaces, which is insufficient to meet state-wide PEV adoption goals and expected long-term local demand.
4. Option 1 has the potential to result in buildings that "prepare" for future PEV access, but that cannot install EVSE due to a failure to include State accessibility requirements, such as maximum slope, minimum vertical clearance, and accessible path of travel.

[7] Load management technologies have a further benefit as well, which is that they can used to reduce the provision of electricity during peak demand or during other times when the electric grid is overtaxed.

Table 3. Summary of Options for CALGreen PEV Readiness Code Amendments

	Spaces Triggered	PEV Readiness	Panel Capacity	Charger Installation	Accessibility
Option 1 (CALGreen Voluntary)	Voluntary nonresidential Tier 2 and multifamily requirements (see Table 1)	PEV-readiness (only empty inaccessible raceway when required)	Sufficient to supply all PEV-ready spaces required by CALGreen Voluntary nonresidential Tier 2 and multifamily requirements	None	Potential for lack of coordination with new State accessibility requirements
Option 2 (Staff recommen-dation)	Tiered requirements for multifamily and nonresidential based on number of parking spaces. 20% in nonresidential and multifamily buildings with 20 or fewer parking space; 100% in multifamily buildings with more than 20 spaces. Identical to CALGreen for single family residential	Combination of spaces with full circuits and with PEV-readiness	Sufficient to supply all required PEV-ready and full-circuit spaces in multifamily buildings with up to 20 spaces and in all nonresidential buildings. Sufficient to supply 20% of parking spaces in multifamily buildings with more than 20 spaces	None	Chapter 11B requirements are included (corresponds with State requirements)
Option 3 (Advanced Option)	Same as Option 2, or higher percentage of spaces required to be full-circuit-enabled	Same as Option 2	Same as Option 2	Required for all parking spaces with full circuits	Chapter 11B requirements are included (corresponds with State requirements)

Option 3 would introduce a requirement to install actual PEV charging stations in all full-circuit-enabled parking spaces in addition to electrical infrastructure, and could include greater requirements for installation of complete circuits. This option is not recommended at this time to allow staff to assess the benefits of the recommended building code proposal and other policies to encourage EVSE installation.

Recommended Option: Option 2, (detailed in Table 4) cost-effectively exceeds CALGreen requirements, while meeting anticipated local needs and addressing the City's 2012 ECAP policy goals. It balances the need for complete circuits in the near term to maximize cost savings and facilitate easy near-term EVSE installation, with the benefits of providing for future demands for additional PEV-ready spaces.

The option facilitates future conversion of spaces for PEV charging to accommodate growing numbers of PEVs by requiring installation of necessary components at the time of new construction, resulting in lower-cost conversions as need arises.

Table 4: Summary of Proposed PEV Infrastructure Requirements

Building Type	Full Electric Circuits	PEV-Ready	Electric Panel Capacity*
New multi-unit dwellings (MUDs) with more than 20 parking spaces	10 percent of parking spaces	Remaining 90 percent of parking spaces	Capacity to supply 20 percent of parking spaces (may be dispersed among up to 100 percent of spaces at lower amperage with voluntary load management system**)
New MUDs with 11-20 parking spaces and nonresidential facilities with 11 or more parking spaces	10 percent of parking spaces	Additional 10 percent of parking spaces	Capacity to supply 20 percent of spaces
New MUDs and nonresidential facilities with 2-10 parking spaces	2 parking spaces	NA	Capacity to supply 2 spaces
New MUDs and nonresidential facilities with 1 parking space	1 parking space	NA	Capacity to supply 1 space

* Panel Capacity refers to 40-Amp 208/240-Volt electric circuits for the indicated number of spaces.
** The electrical panel could supply up to 100% of spaces at 8-Amps per space by sharing available capacity.

Option 2 is the preferred recommendation because it would:

1. Require installation of full circuits for the expected PEV charging demand within the first few years of building operation.
2. Requires a greater number of PEV parking spaces over those mandated by CALGreen, to address the elevated local demand above the Statewide average.
3. Requires that developers install electrical raceways in new construction, that otherwise would be hard to install as a post-construction retrofit[8] in order to serve an additional 10 percent of parking spaces, or 90 percent (the remainder) of parking spaces for MUDs with more than 20 parking spaces. The proposed requirements for large MUDs are higher because of the critical challenge that those buildings have posed to providing widespread PEV charging, and load management technologies are widely available to facilitate PEV parking at levels greater than 20 percent at significantly reduced cost. Additionally, specific parking spaces are often assigned or permanently deeded to individual dwelling units, so enabling flexibility as to where EVSE can be installed is important.

Option 2 requires electrical panel capacity to supply the specified number of parking spaces with full current for PEV charging. For MUDs with more than 20 spaces, the electrical panel must provide capacity to support PEV charging at 20% of parking spaces, allowing a building owner to serve up to 100 percent of parking spaces by reducing charging rates when more than 20% are simultaneously utilized.

[8] This includes conduit that must be installed underground, below grade, passing through walls, and in any other inaccessible location and excludes raceway that could be readily installed later on a wall, ceiling, etc. Surface mounted raceways are not as expensive to retrofit and could be installed later as needed for these additional spaces.

Finally, Option 2 promotes equitable access by including requirements for accessible EVSE at the time of new construction for buildings subject to the accessibility requirements set forth in Chapter 11B of Part 2 under Title 24 of CALGreen.[9] These include the following:

- Maximum slope and minimum vertical clearance for accessible EVSE; and
- Design EVSE and parking areas to accommodate accessible travel from EVSE.

Chapter 11B requirements apply to parking for common and public use in certain buildings. As CALGreen is currently written, Chapter 11B is not triggered until EVSE is installed, which may occur after the building is constructed. However, the retrofits necessary to meet these requirements may be difficult or impractical once the building is in use, and if Chapter 11B applies, no EVSE may be installed unless the requirements for accessible EVSE are met. The proposed code amendment will prevent situations in which EVSE cannot be installed because building conditions render it impossible to meet Chapter 11B requirements.

FISCAL IMPACT

Staff does not expect any significant short- or long-term cost increases as a result of implementing the proposed changes. The proposed Ordinance does not add any requirements that would change the substance of the plan-check and inspection activities required of Building Services Division staff under CALGreen. As mentioned, these amendments will result in lifetime cost savings in the community, as electric vehicle chargers will now be installed without the need for costly retrofits or electrical capacity upgrades.

PUBLIC OUTREACH / INTEREST

Staff met with representatives of the developer community, and presented detailed descriptions of the new CALGreen requirements and the options staff was considering for increasing the PEV readiness requirements. Staff received clear feedback that the developer community was "more than ready" for dramatic increases in PEV readiness requirements.

One representative anticipated minor concern from some developers regarding the extra cost of including PEV readiness in a large percentage of parking spaces, and asked if the City would consider providing incentives or concessions to address those concerns. On October 4, 2016, the City updated its zoning requirements to reduce the minimum levels of required parking in a separate action from this ordinance. Staff anticipates that the cost savings to developers of a lowered parking requirement will more than offset the marginal increases in requiring PEV readiness at the levels recommended. Moreover, the lifetime cost savings from the reduced retrofit costs will more than offset those initial construction costs.

Staff also communicated with experts from organizations representing the interests of low income communities in the East Bay Area region, namely the Oakland-based Greenlining Institute and Richmond-based Community Housing Development Corporation. Both

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[9] Note that multifamily housing covered by Chapter 11A is required under CALGreen to include one parking space that meets slope and dimensions (section 4.106.4.2.2) requirements unless amended by a local jurisdiction to be stricter.

organizations' representatives cited electric vehicle ownership among low income residents as a key priority among environmental justice advocates for the same reasons discussed above; however, the lack of charging infrastructure in low income and multifamily housing was held out as a key barrier in implementing programs designed to accelerate PEV adoption in low income communities.

The City's Consultant also reached out to developer and industry stakeholders about the City's efforts to facilitate PEV infrastructure installation, and received feedback from two large industry stakeholders (ChargePoint and EVgo). Both stakeholders were supportive of the proposed option, citing the multiple hurdles associated with building retrofits as a key barrier to widespread installation of EVSE.

COORDINATION

This item has been coordinated among Oakland Public Works (OPW), the Department of Planning and Building, and the Office of the City Attorney (OCA). Staff from the Environmental Services Division within OPW, Planning, and Building worked together to develop and recommend options for an amended code. Staff from OCA reviewed and approved key sections of these documents. The Controller's Bureau was also consulted in the preparation of this report.

SUSTAINABLE OPPORTUNITIES

Economic: This measure is expected to provide local economic benefits. Direct benefits include local construction jobs to provide and maintain PEV infrastructure and reduced retrofit costs for building owners. In addition, local businesses and residents can realize the economic benefits from transitioning to PEVs due to the lower costs of operating their vehicles. Consumer cost savings from avoided petroleum purchases will likely increase the number of dollars that are retained within the local economy. Finally, PEV owners are more likely to purchase rooftop solar power or add capacity, providing another potential source of local construction employment.

Environmental: Each PEV will displace 2.6 tons per year of GHG emissions if powered by conventional electricity, and more if powered by renewable electricity.[10] PEVs will also reduce local impacts of air pollutants such as ozone and fine particulates.

Social Equity: This measure will enhance social equity by making PEV infrastructure more plentiful and equitably distributed throughout the city. Lack of convenient charging infrastructure is a primary barrier for many people who would otherwise own electric vehicles. A majority of PEV drivers charge their cars at home,[11] but home charging is generally not an option for individuals living in multifamily buildings. Installing EVSE in multifamily buildings once construction is completed is often cost-prohibitive, whereas ensuring that parking facilities are

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[10] "Plug-In Electric Vehicle Infrastructure Cost-Effectiveness Report" July 20, 2016. Prepared by E. Pike and J. Steuben, Energy Solutions, for the City of Oakland.
[11] U.S. Department of Energy. EV Everywhere Workplace Charging Challenge, 2014 Progress Report http://energy.gov/sites/prod/files/2014/11/f19/progress_report_final.pdf

PEV ready at the time of initial construction can cost one-half or one-third as much as the retrofit cost. Enabling multifamily housing and publicly-accessible nonresidential buildings to have plentiful PEV charging infrastructure will ensure that electric vehicle ownership is more accessible to all members of our community, regardless of income or housing status. As described above, electric vehicles reduce air pollution and are generally more cost-effective over the lifetime of the vehicle as compared to conventional vehicles. Expanding access to electric vehicles to lower-income and disadvantaged members of the community can reduce the health impacts related to air pollution disproportionately experienced by vulnerable populations, and increase the income security of low income populations.

<u>CEQA</u>

Staff has made the determination that the proposed amendments are exempt from the California Environmental Quality Act pursuant to CEQA Guidelines sections 15378; 15061(b)(3) (General Rule), 15301 (Existing Facilities), 15303 (New Construction or Conversion of Small Structures), and 15183 (Projects Consistent with a Community Plan, General Plan, or Zoning). Each of the foregoing provides a separate and independent basis for CEQA compliance and, when viewed collectively, provides an overall basis for CEQA compliance. The following is an analysis discussing the reasons why the proposed amendments are exempt from CEQA.

Staff has determined that the proposed amendments to the building code would not result in a significant effect on aesthetics, agriculture, air quality, biological or cultural resources, geology, hazards, hydrology, land use, noise, population, public services, recreation, traffic or utilities. Increasing requirements for PEV readiness in new construction and certain major alterations is expected to result in an overall reduction in both greenhouse gas (GHG) emissions and local air pollution. Specifically, a 2015 study by the Electric Power Research Institute (EPRI) and the Natural Resources Defense Council (NRDC) finds lower lifetime GHG emissions nation-wide from plug-in electric vehicles as compared with conventional gasoline-powered vehicles.[12] "Lifetime emissions" refers to the combined emissions caused by driving vehicles (i.e. tailpipe emissions) and extracting and preparing the energy source (i.e. extracting and refining petroleum and transporting the gas for conventional vehicles; or extracting and burning coal, natural gas, or other electricity sources, and transmitting the electricity, as well as manufacturing batteries, for electric vehicles). The disparity in lifetime emissions is even greater in California and in PG&E territory specifically, due to the large share of renewable energy used to power the electric grid. As the grid becomes cleaner over time per the State's increasing Renewable Portfolio Standard requirements, the lifetime and upstream emissions of electric vehicles and the energy required to power them will continue to plummet relative to conventional vehicles. With regards to local air quality, the EPRI-NRDC study finds that "there are small increases in emissions due to electricity generation, but these are more than offset by reductions in transportation emissions."

CEQA Guidelines Section 15378

Per CEQA Guidelines Section 15378, a "Project" means the whole of an action, which has a potential for resulting in either a direct physical change in the environment, or a reasonably

[12] EPRI and NRDC. Environmental Assessment of a Full Electric Transportation Portfolio. 2015.

foreseeable indirect physical change in the environment. The proposed amendments will not result in a direct or reasonably foreseeable indirect adverse physical change in the environment or a significant adverse effect on the environment. As described above, the proposed amendments would improve local air quality in Oakland and the region, reduce GHG emissions and increase energy reliability.

CEQA Guidelines Section 15061(b)(3)

As a separate and independent basis, the proposed amendments would not have a significant effect on the environment. As discussed above, the proposed amendments would reduce GHG emissions and local air pollution by transitioning away from fossil fuel consumption. Furthermore, the proposed amendments do not constitute an approval of new development and any future development would be subject to further future CEQA review.

CEQA Guidelines Section 15301

As a separate and independent basis, staff has concluded that the proposed amendments are exempt under CEQA Guidelines Section 15303 (Existing Facilities). This Section exempts minor alteration of existing public or private structures, facilities, and mechanical equipment. The types of "existing facilities" include interior or exterior alterations involving electrical conveyances as well as existing facilities used to provide electric power or other public utility services which would be similar to PEV infrastructure.

CEQA Guidelines Section 15303

As a separate and independent basis, staff has concluded that the proposed amendments are exempt under CEQA Guidelines Section 15303 (New Construction or Conversion of Small Structures). This Section exempts installation of small new equipment and facilities in small structures including water mains, sewage, electrical, gas, and other utility extensions to serve individual customers which would be similar to PEV infrastructure.

CEQA Guidelines Section 15183

Finally, again, as a separate and independent basis, staff has concluded the proposed amendments are exempt under CEQA Guidelines Section 15183 (Consistency with a Community Plan, General Plan, and Zoning). The proposed amendments are consistent with several adopted policies within the Open Space, Conservation and Recreation Element and Oakland's ECAP. Specifically, the proposed amendments support policies that to protect and manage energy resources and promote energy efficiency and a reliable energy network.

ACTION REQUESTED OF THE CITY COUNCIL

Staff Recommends that the City Council conduct a public hearing and adopt (1) a resolution of findings supporting local amendments to Sections 4.106.4 and 5.106.5.3 of the 2016 edition of the California Green Building Standards Code to comply with changes to State law and adopting CEQA exemption findings; and (2) an ordinance adopting local amendments to Sections 4.106.4 and 5.106.5.3 of the 2016 edition of the California Green Building Standards Code and amending the Oakland Municipal Code to add sections 15.04.1205 through 15.04.1235 to comply with changes to State Law and adopting CEQA exemption findings.

For questions regarding this report, please contact Shayna Hirshfield-Gold, Energy Policy Analyst, at 238-6954.

Respectfully submitted,

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Interim Director
Planning and Building Department

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Director, Oakland Public Works

Attachments (2):

A: Plug-In Electric Vehicle Infrastructure Cost Effectiveness Report
B: Addendum to the Plug-In Electric Vehicle Infrastructure Cost Effectiveness Report

Attachment A

Plug-In Electric Vehicle Infrastructure Cost-Effectiveness Report

July 20, 2016

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CONTENTS

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The authors wish to express appreciation to the following reviewers. Any errors are the responsibility of the authors:

Shayna Hirshfield-Gold, City of Oakland

Rachel DiFranco, City of Fremont

Barry Hooper, City and County of San Francisco

List of Tables

List of Figures

1. EXECUTIVE SUMMARY

This report describes the costs associated with including Plug-in Electric Vehicle (PEV) charging infrastructure during initial construction for multifamily and nonresidential projects compared to retrofitting this infrastructure. The report finds that installing infrastructure during initial construction is much more cost-effective.

The cost of installing PEV charging infrastructure during new construction ranges from $200 to $1,400 per PEV parking space depending on the building type and completeness of the electrical circuit installed to support PEV charging. Installing a complete circuit with a rating of 240 volts and 40 amps during new construction saves approximately $1,000-$1,600 per PEV parking space for the three *parking garage* scenarios that were evaluated. Additional, approximately $5,000 per PEV parking space can be saved for the *surface parking lot* scenario.

The cost calculations in this report are based on costs from industry reference materials and are not intended to represent the costs of any specific installation. Examples of avoided costs include breaking and repairing walls, upgrading electric service panels, additional permitting and inspections, and breaking and repairing parking surfaces and/or sidewalks (for the surface parking scenario). The report does not discuss costs outside of code compliance, such as the cost of the Electric Vehicle Service Equipment that plugs into the PEV, associated lighting, signage, any required bollards, etc.

2. PURPOSE

The purpose of the cost-effectiveness model and this summary report is to document the expected cost-effectiveness of installing PEV charging electric circuit infrastructure during new construction and major alterations of multifamily and nonresidential buildings. This documentation will assist local governments such as the City of Fremont, the City of Oakland, and the City and County of San Francisco in determining local building code requirements that support PEV infrastructure installation and facilitate PEV adoption to reduce greenhouse gases and other pollutants as well as reducing petroleum dependence.[1]

CALGreen building codes are formally adopted state-wide by the California Building Standards Commission (BSC) for residential and nonresidential buildings. The residential section is authored by the California Department of Housing and Community Development (HCD) and the nonresidential section is authored by the BSC. The current CALGreen building codes contain minimum statewide requirements for PEV-ready parking spaces in new construction (Title 24 Part 11 sections 4.106 and 5.106) including sufficient electrical panel capacity and conduit capacity as well as plans for the installation of the balance of the circuit. CALGreen also contains voluntary requirements that can serve as a model for local governments that wish to adopt them (Title 24 Part 11 sections A4.106 and A5.106). Table 1 summarizes the current code adopted in 2014 as well as the new nonresidential codes that take effect January 1, 2017. Local governments may choose to adopt voluntary codes, which then become mandatory in their jurisdiction, or tailored local codes.

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[1] Avoided emissions from displacing a typical vehicles' 15,600 miles annual range with electrically powered miles include 2.6 tons per year of avoided greenhouse gases. This value accounts for upstream emissions from electricity generation and oil production and refining. Annual mileage is from "Factors Influencing Vehicle Miles Traveled in California: Measurement and Analysis", Kent M. Hymel, 2014. Emissions rates for a baseline conventional vehicle and 2012 Nissan Leaf powered on California electricity are from Calculating Electric Drive Vehicle Greenhouse Gas Emissions, Ed Pike, 2012.

A lack of PEV charging infrastructure is a key challenge for meeting California PEV adoption goals as noted in the draft 2015 ZEV Action Plan.[2] Local governments can exceed state-wide CALGreen minimums by adopting CALGreen voluntary targets or adopting more aggressive local codes tailored to local circumstances to help achieve PEV adoption goals.

Table 1. Summary of CALGreen Mandatory and Voluntary PEV-Readiness Standards

	Non-Residential				**Multifamily**	
	Mandatory		**Voluntary Tier 1**	**Voluntary Tier 2**		
	Current	**Effective January 1, 2017**	**Effective January 1, 2017**		**Current Mandatory**	**Current Voluntary**
Minimum threshold for standards to be effective	51 parking spaces	10 parking spaces	10 parking spaces	One parking space	17 units	17 units
Percent of new parking spaces that must be PEV-ready	3%	~6%[3]	~8%	~10%	3%	5%

The CALGreen minimum state-wide standards are not high enough to meet California PEV deployment goals and expected local demand. California will need to achieve a 12% state-wide PEV market share by 2025 to meet the California Air Resources Board Zero Emission Vehicle program target of 1.5 million zero emission vehicles on the road by 2025 as shown in Figure 1.[4] California is already ahead of CARB's expected trajectory to that goal. The current sales rate of approximately 4% exceeds CARB's expected trajectory by about 50%,[5] so 12% may represent a floor with actual PEV market share potentially much higher. In addition, according to the 2015 draft ZEV Action Plan, "The State has completed an initial analysis of the number of electric vehicle charging stations needed to meet the Executive Order goals, which suggest upwards of 900,000 charge points may be needed by 2020." Thus, a dramatic increase in available PEV charging infrastructure needs to begin during implementation of the upcoming CALGreen code cycle.

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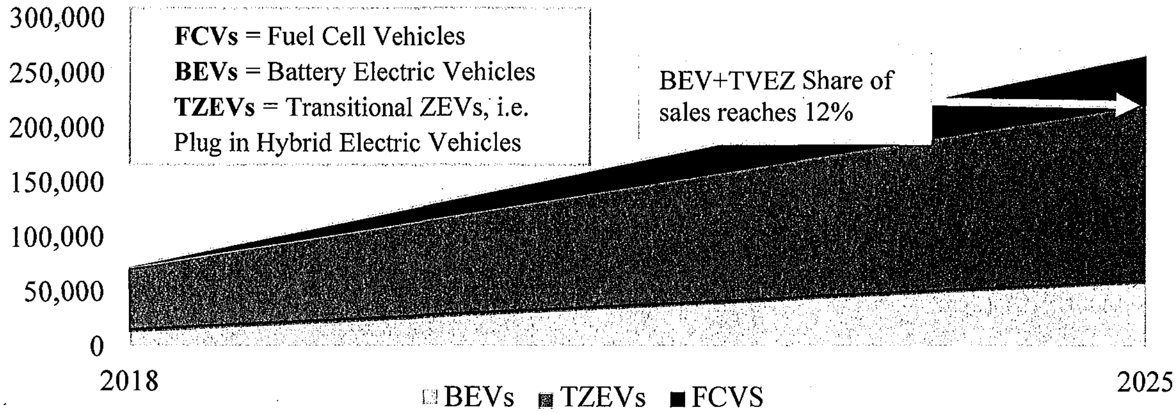
[2] Draft 2015 ZEV Action Plan, April 2015, Governor's Interagency Working Group on Zero-Emission Vehicles.

[3] The number of parking spaces that must be PEV-ready are assigned based on total parking space in a batch allocation system rather than an exact percentage, so some of the percentages shown here are approximate.

[4] The California fleet consists of 27 million vehicles per the 2013 California Energy Commission draft IPER report page 173, leading to an estimated 5% PEV deployment in 2025 and sales percentages much higher.

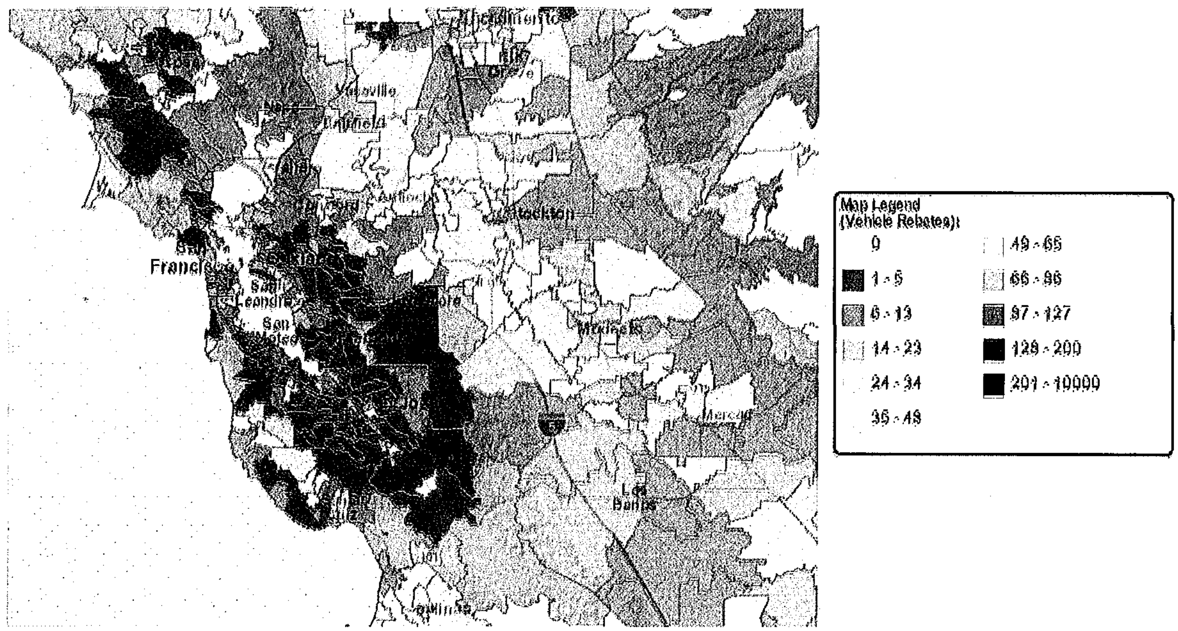
[5] See CARB "Staff Report: Initial Statement of Reasons for Rulemaking" September 2013 page 2 http://www.arb.ca.gov/regact/2013/zev2013/zev2013isor.pdf and the Plug in Electric Vehicle Collaborative "Detailed Monthly Sales Chart", April 2016 http://www.pevcollaborative.org/sites/all/themes/pev/files/4_april_2016_Dashboard_PEV_Sales.pdf

Figure 1. Annual Electric Vehicle Sales Under CARB Most Likely Compliance Pathway[6]



Bay Area communities such as Fremont, Oakland, and San Francisco currently have much higher PEV demand than statewide averages despite challenges such as very limited PEV charging infrastructure in multifamily housing. Figure 2 below shows that these communities and others form a regional PEV adoption "hot spot." This figure is based on PEV rebates per zip code. Since the number of households per zip code may vary this metric is a proxy for per capita adoption rates rather than an exact metric.

Figure 2. Number of California PEV Rebates per ZIP Code in California's Clean Vehicle Rebate Project[7]



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[6] This figure is based on CARB's "Staff Report: Initial Statement of Reasons Advance Clean Cars 2012 Proposed Amendments to the California Zero Emission Vehicle Program Regulations" December 7, 2011.

[7] Downloaded June 3, 2016 from California Clean Vehicle Rebate Program https://cleanvehiclerebate.org/eng/cvrp-rebate-map. Please note that not all PEVs sold in California are in the CVRP database, as not every vehicle is eligible and not every owner applies for a rebate. Also, although the Chevrolet Volt was commercially available in California as of December 2010, it was not eligible for CVRP until February 2012. At least 1,861 Volts were sold in California prior to Feb. 2012.Note that 219 of the 150,529 total state-wide rebates included in CVRP graphics include fuel cell electric vehicle rebates as of June 14, 2016.

3. SCENARIOS

Four different installation scenarios were evaluated in this report.

Each scenario was modeled for two levels of infrastructure: "PEV-ready" and a full electrical circuit. The "PEV-ready" provisions for each scenario include electrical service panel capacity, plans, and all underground conduits similar to the requirements included in the current CALGreen code. A complete PEV circuit adds wire, circuit breakers, termination point and surface conduit to the extent not provided by PEV-readiness standards.

The first two scenarios represent potential cost-savings from plugging the gap in the current CALGreen requirements for multifamily housing with between 3 and 16 dwelling units. The third scenario represents the cost-effectiveness of requiring that 10% of parking spaces in a representative 60-space parking facility are PEV spaces, as this percentage is similar to the CALGreen voluntary nonresidential code that was adopted January 2016. The final scenario represents a higher goal of requiring 20% PEV spaces in a facility of the same size.

The scenarios in this report include a greater focus on enclosed parking as compared to surface parking because new construction for Fremont, Oakland, and San Francisco is likely to focus on in-fill development with enclosed parking. All four scenarios are summarized in Table 2.

Table 2. Scenario Summary

	Scenario One	Scenario Two	Scenario Three	Scenario Four
Parking Type	Surface	Enclosed	Enclosed	Enclosed
PEV Parking Spaces	Two		Six	12
Base Case Panel	100-amp		225-amp	100-amp (two)
PEV-readiness Panel	200-amp		400-amp	400-amp (two)
Conduit Length (feet)	55	50	170	330
Trenching Required	Yes	No	No	No

Scenario One and Scenario Two assume a 24-vehicle surface parking lot with two PEV parking spaces[8] in either a surface parking area (Scenario One) or an enclosed garage (Scenario Two). This size of parking area is intended to represent multifamily developments with fewer than 16 dwelling units, which are currently exempt from CALGreen requirements for PEV-ready parking spaces (the results would likely also represent similar sized nonresidential parking areas). Twenty-one percent of new multifamily dwelling units are projected to be located at developments of this size or smaller based on research by Pacific Gas & Electric.[9] The number of PEV parking spaces is based on the current CALGreen multifamily voluntary Tier of 5% rounded up to two spaces.

[8] We use "PEV parking space" to mean a space that is either PEV-ready or is served by a full electrical circuit to support PEV charging.

[9] Pacific Gas & Electric December 2, 2013 letter to Mia Marvelli, Building Standards Commission and Emily Withers, California Department of Housing and Community Development.

To achieve PEV-readiness, the electric service panel would be upgraded from 100-amp to 200-amp. Additional PEV-readiness costs would also include breaking and repairing hardscape for 50 linear feet of conduit installation in Scenario One and installing a single underground conduit sufficient to accommodate two PEV charging spaces along with five feet of surface mounted conduit. A full circuit would add wire, breakers, and an outlet box; and for Scenario Two also surface mounted conduit.

Scenario Three assumes a two level, 60-space enclosed parking area with six PEV parking spaces, which could serve either a multifamily building or nonresidential parking area. This number of PEV parking spaces is equal to the CALGreen nonresidential voluntary Tier 2 code. A 225-amp main circuit breaker (3 wire, 3 pole) serving both floors to support elevator, lighting, and other loads would be required in the base case and would be upgraded to 400-amp to achieve PEV-readiness. Electrical circuits would pass through a six-inch-thick concrete wall on each floor, resulting in significant costs if installed as a retrofit. Installing a full circuit would also include circuit breakers and two sets of surface-mounted conduit and wire from an electrical room running 30 feet vertically between floors and 70 feet horizontally on each floor.

Scenario Four represents a two level, 60-space enclosed parking area with 12 PEV parking spaces, which exceeds current CALGreen requirements but could be selected by a local jurisdiction to match policy goals and expected local PEV demand. Two 100-amp main circuit breakers (3 wire, 3 pole) to support lighting and other loads would be required in the base case and would be upgraded to two 400-amp panels to achieve PEV-readiness. Electrical circuits would pass through a six-inch-thick wall, again resulting in significant costs if installed as a retrofit. A full circuit would include circuit breakers and two sets of surface-mounted conduit and wire from an electrical room running 30 feet vertically between floors and 150 feet inside each floor.

The components for each scenario will support 40-amp "Level 2," 110 V Level 1 charging, or a mix of both.[10] Appendix C lists the specific components included in each scenario. The scenarios do not include sub-metering or separate metering equipment, which are optional but could be selected by a building owner to access a special electricity rate.

4. RESULTS

The results of the cost-effectiveness analysis show that installing a complete electric circuit for PEV charging at time of construction provides the largest cost savings compared to retrofit costs. Including key elements of PEV-ready parking spaces such as underground conduit and sufficient electrical panel capacity in new construction provides large cost savings while minimizing upfront costs, which may be helpful for spaces that are expected to be needed in the longer term but not in the immediate future. This section focuses on Scenario Three and Scenario Four because they represent the highest levels of PEV-readiness in enclosed garages most common for urban in-fill development. Detailed results of all four scenarios are included in the Appendix.

This study estimates that retrofitting installation of full electric circuit infrastructure at an existing building costs about $1,900-$3,000 per parking space for the three enclosed parking scenarios (Scenarios Two, Three, and Four) and $6,300 per surface parking space for the surface parking scenario (Scenario One). The same

[10] The HCD considered requiring complete circuits (at a January 23, 2014 workshop) but ultimately did not adopt this higher level of PEV charging infrastructure in their final code language. However, this could be considered by local governments. If a significant amount of Level 1 charging is expected then including at least some PEV-ready spaces without a complete circuit may be desirable to allow flexibility to install either Level 1 or Level 2 in the future.

infrastructure costs about $1,300 per space for all four scenarios if installed during new construction for a significant savings. Alternatively, new buildings can include only components such as any underground conduit and upgraded panel capacity to be PEV-ready without installing the full circuit if the spaces won't be immediately used for PEV charging. PEV-ready spaces can be installed for an initial cost of about $300-$500 per space for parking garages as shown below, with an additional cost of about $900-$1,100 per space to complete them (additional details are shown in the Appendix). This later scenario results in slightly higher total costs than installing a complete circuit when a new building is constructed, but still results in overall significant savings per space compared to the retrofitting a circuit in a facility that is not PEV-ready.

Table 3. Cost Results per Parking Space (Oakland, California)

	New	Retrofit	Savings
Scenario One, Two PEV Circuits	$1,280	$6,260	$4,980
Scenario One, Two PEV-ready Spaces	$810	$5,420	$4,610
Scenario Two, Two PEV Circuits	$1,330	$2,980	$1,650
Scenario Two, Two PEV-ready Spaces	$200	$1,860	$1,660
Scenario Three, Six PEV Circuits	$1,160	$2,060	$900
Scenario Three, Six PEV-ready Spaces	$300	$1,190	$890
Scenario Four, 12 PEV Circuits	$1,380	$1,870	$490
Scenario Four, 12 PEV-ready Spaces	$540	$1,010	$470

The results for enclosed parking areas are illustrated in Figure 3 and Figure 4. The first provides an overview of total costs. The later summarizes the major categories of costs, which can include breaking and repairing parking lots and sidewalks, upgrading electrical service panels, obtaining permits and inspections, and installing electrical circuits or elements of electric circuits. Permitting and inspections are a common expense for all building types, though higher for retrofits as explained in the Appendix. Excavating, trenching, and repairing parking lot pavement and sidewalks is likely to be a common expense for outdoor surface parking retrofits due to the unavailability of walls or ceilings on which to mount conduit as shown by the detailed results for Scenario One (which are shown along with the other scenarios in the Appendix). Electrical panel upgrades will be required in some cases depending on existing panel capacity and PEV charging capacity needs. This analysis is not intended to address every possible site-specific cost. Actual costs for any specific installation will vary due to site-specific conditions.[11]

[11] We also note that PEV-readiness standards can reduce or avoid non-cost barriers such as coordinating between building owners/operators and tenants and a lack of education.

Figure 3. Cost Difference for Retrofit and New Construction (2016 dollars per PEV charging space)

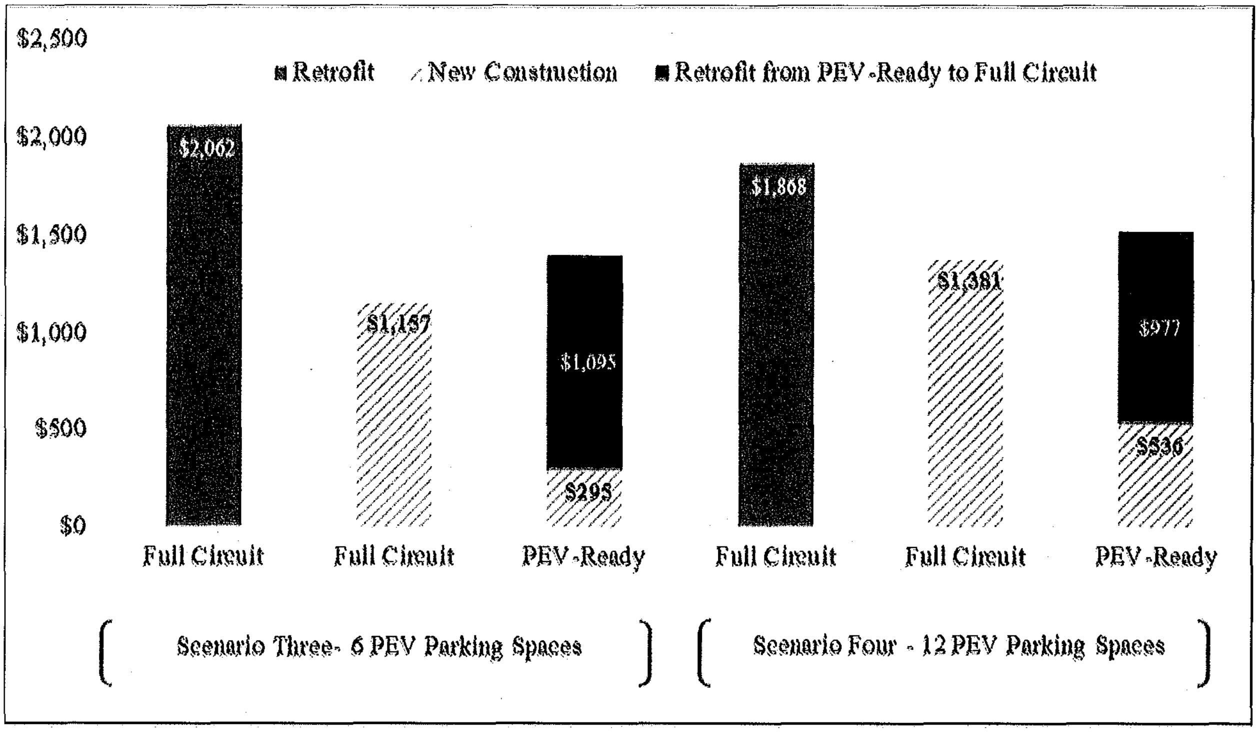
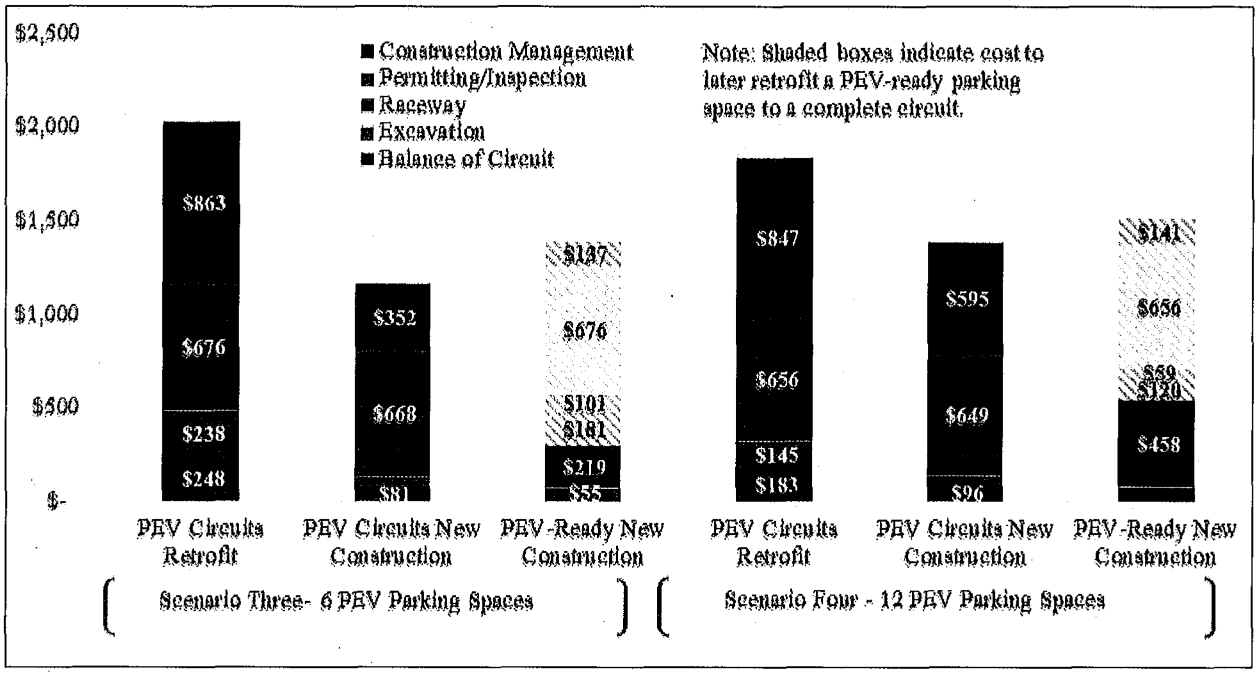


Figure 4. Cost by Work Type of New Construction vs. Retrofit (2016 dollars per PEV charging space)



The results indicate that applying PEV-readiness building codes to building alterations would also provide potential cost savings. For instance, installing underground conduits during parking area expansion or renovation could achieve much or all of the cost savings for demolition, excavation, and concrete and paving work shown for Scenario One in the Appendix. Requiring that new electrical service panels contain capacity for PEV charging could similarly avoid the cost of retrofitting expanded electrical service later for all of the scenarios evaluated in this report. Data from the Construction Industry Research Board indicates that alterations and additions represent about 21% of the value of permitted construction for both residential and nonresidential new construction.[12]

Costs shown earlier are based on construction cost estimates for Oakland, California. Table 4 shows examples of cost adjustment factors for several Bay Area cities. Table 5 shows that regional variations are modest compared to the overall benefits of installing PEV electric circuit infrastructure at the time of new construction. Cost factors are not available for the city of Fremont, so nearby Oakland and San Jose will likely provide a reasonable indicator of costs for Fremont.

Table 4. Regional Factors Compared to National Average[13]

	Oakland		San Francisco		San Jose	
	Labor	Materials	Labor	Materials	Labor	Materials
Cost Multiplier	1.260	1.085	1.404	1.107	1.313	1.058

Table 5. Regionally Adjusted Results per Parking Space for Two Enclosed Parking Scenarios

	Oakland		San Francisco		San Jose	
	New	Retrofit	New	Retrofit	New	Retrofit
Scenario 3 Six PEV Circuits	$1,160	$2,060	$1,261	$2,247	$1,185	$2,113
Scenario 3 Six PEV-ready Spaces	$300	$1,190	$322	$1,292	$302	$1,215
Scenario 4 12 PEV Circuits	$1,380	$1,870	$1,504	$2,034	$1,414	$1,913
Scenario 4 12 PEV-ready Spaces	$540	$1,010	$583	$1,098	$549	$1,033

5. METHODOLOGY

The cost-effectiveness model was developed in Microsoft Excel and utilizes spreadsheets that break each scenario and level of PEV infrastructure into individual tasks and quantities as shown in the Appendix. The model also contains estimates for the costs of each job task. Estimates of retrofit and new construction costs per job task are largely based on RS Means, a construction cost reference handbook, for hardware and related installation costs. Additional costs are based on a City of Oakland cost sheet and data from other jurisdictions on permitting and inspection fees and staff estimates for contractor labor for obtaining permitting and inspection. Additional data sources included feedback from industry and utility experts, engineering estimates, and direct experience to capture different tasks required for the scenarios that were analyzed. For additional details on the methodology and information specific to the PEV-readiness elements, please see Appendix C.

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[12] "Non-Residential Building Permits By Month", http://www.mychf.org/uploads/5/1/5/0/51506457/non-residential_cbia_website_04-2016.pdf, accessed 6-15-2016 and "Residential Building Permits By Month" http://www.mychf.org/uploads/5/1/5/0/51506457/residential_cbia_website_04-2016.pdf, accessed 6-15-2016.

[13] Sourced from RS Means Electrical Cost Data 2010 p482, national average =1.0

The cost-effectiveness model includes four hypothetical installation scenarios to allow easy comparison of costs between different levels of PEV-readiness for both new construction and retrofit projects. Actual project costs and configurations will likely vary from these cases, which are intended to provide representative examples for comparison purposes rather than estimate site-specific costs. The modeled costs exclude design work and other project-specific costs outside the scope of CALGreen building codes such as signage, lighting, pedestal mounting, bollards, wheel stops, longer conduit runs, and contingencies.[14] The model also does not include utility-side infrastructure such as sizing transformer pads and connections to accommodate potential swap-out for a larger capacity transformer.[15] The scenarios also do not include a separate utility sub-meter.[16]

6. Comparison to California PEVC Case Studies

The Plug-in Electric Vehicle Collaborative (PEVC) workplace charging study, "Amping up California Workplaces" (2013) reports a range of retrofit installation costs per charger for workplace charging, including both private and public parking. The costs for the enclosed parking PEV circuit retrofit case in the Plug-In Electric Vehicle Infrastructure Cost-Effectiveness Report tend to be closest to the low end of examples listed by the PEVC project ($2,300). This is likely because this report is intended to address common costs for certain scenarios and not a complete set of potential site-specific costs as noted earlier.[17] Thus, it may be conservative and the cost savings that would be achieved by PEV-readiness CALGreen standards may be greater than the figures presented in this report. The types of cost savings shown in this summary due to building codes are consistent with a PEVC document noting categories of significant expense for retrofitting PEV infrastructure in multi-unit housing.[18]

The surface parking costs in this Plug-in Electric Vehicle Infrastructure Cost-Effectiveness Report fall roughly in the middle of the cost estimates reported by the PEVC project. The PEVC report finds that "... if the installation entails trenching or asphalt and cement excavation, costs will increase. The cost of such work can easily exceed the cost of the EVSE unit itself." This finding is consistent with the results of the PEV-Readiness Cost-Effectiveness Report finding that asphalt and concrete removal and repair for the surface

[14] RS Means specifies a range of potential design costs, while noting that design costs will likely be 50% higher for alterations.

[15] We note that sizing a transformer pad and connections for a transformer with the capacity to accommodate expected future PEV charging load is a significant source of cost savings, even if a larger transformer is not actually installed until later when required to accommodate PEV load. We note that a report prepared by HCD – "Report on Electric Vehicle Readiness" dated November 2013 provides some data on transformer costs.

[16] A sub-meter may be a desirable add-on for some building owners or PEV drivers to allocate electricity costs and/or provide access to utility PEV charging electricity tariffs, though some special electricity rates for PEV owners are available through whole-house rates and utilities are also conducting pilots of metering via electric vehicle service equipment. We believe that builders wishing to install a socket for a sub-meter at the time of new construction may achieve cost savings compared to retrofits but we have not quantified this potential.

[17] California Plug-In Electric Vehicle Collaborative. 2013. "Amping up California Workplaces: 20 case studies on plug-in electric vehicle charging at work". November. http://www.evcollaborative.org/sites/all/themes/pev/files/WPC_Report4web.pdf.

[18] California Plug-In Electric Vehicle Collaborative. 2013. "Plug-in Electric Vehicle Charging Infrastructure Guidelines for Multi-unit Dwellings". November. http://www.evcollaborative.org/sites/all/themes/pev/files/MUD_Guidelines4web.pdf. This report notes that drilling through walls and parking decks at multifamily parking garages can be expensive.

parking examples are a major expense.

APPENDIX A: PEV PARKING SPACE COST DETAILS

The tables below summarize model results. See Appendix B and Appendix C for more details on the individual tasks included in each of the categories below.

Table 6. Scenario One Surface Parking

	PEV Circuits Retrofit	PEV Circuits New Construction	PEV-Ready Retrofit	PEV-Ready New Construction	Retrofit PEV-Ready to Full Circuit
Construction Management	$751	$90	$692	$56	$391
Permitting/Inspection	$610	$89	$610	$89	$254
Raceway	$432	$433	$432	$433	$0
Excavation	$114	$114	$114	$114	$0
Concrete/Paving	$977	$0	$977	$0	$0
Demolition	$2,284	$0	$1,965	$0	$0
Balance of Circuit	$1,095	$558	$630	$114	$465
Total	**$6,262**	**$1,284**	**$5,420**	**$807**	**$1,111**

Total cost for PEV-ready new construction plus retrofit PEV-ready to full circuit later is **$1,918.**

Table 7. Scenario Two Enclosed Parking

	PEV Circuits Retrofit	PEV Circuits New Construction	PEV-Ready Retrofit	PEV-Ready New Construction	Retrofit PEV-Ready to Full Circuit
Construction Management	$522	$93	$443	$14	$435
Permitting/Inspection	$640	$89	$640	$89	$254
Raceway	$581	$590	$0	$0	$581
Excavation	$0	$0	$0	$0	$0
Concrete/Paving	$0	$0	$0	$0	$0
Demolition	$145	$0	$145	$0	$0
Balance of Circuit	$1,095	$558	$630	$97	$465
Total	**$2,983**	**$1,330**	**$1,858**	**$201**	**$1,736**

Total cost for PEV-ready new construction plus retrofit PEV-ready to full circuit later is **$1,937.**

Table 8. Scenario Three Surface Parking

	PEV Circuits Retrofit	PEV Circuits New Construction	PEV-Ready Retrofit	PEV-Ready New Construction	Retrofit PEV-Ready to Full Circuit
Construction Management	$248	$81	$187	$21	$181
Permitting/Inspection	$238	$55	$238	$55	$101
Raceway	$676	$668	$0	$0	$676
Excavation	$0	$0	$0	$0	$0
Concrete/Paving	$0	$0	$0	$0	$0
Demolition	$35	$0	$35	$0	$0
Balance of Circuit	$863	$352	$727	$219	$137
Total	**$2,062**	**$1,157**	**$1,188**	**$295**	**$1,095**

Total cost for PEV-ready new construction plus retrofit PEV-ready to full circuit later is **$1,391.**

Table 9. Scenario Four Surface Parking

	PEV Circuits Retrofit	PEV Circuits New Construction	PEV-Ready Retrofit	PEV-Ready New Construction	Retrofit PEV-Ready to Full Circuit
Construction Management	$183	$96	$123	$37	$120
Permitting/Inspection	$145	$41	$145	$41	$59
Raceway	$656	$649	$0	$0	$656
Excavation	$0	$0	$0	$0	$0
Concrete/Paving	$0	$0	$0	$0	$0
Demolition	$37	$0	$37	$0	$0
Balance of Circuit	$847	$595	$706	$458	$141
Total	**$1,868**	**$1,381**	**$1,011**	**$536**	**$977**

Total cost for PEV-ready new construction plus retrofit PEV-ready to full circuit later is **$1,531.**

APPENDIX B: PERMITTING AND INSPECTION COSTS

The tables below summarize electrical and building permit and inspection costs. Additional information on data sources is described under the calculation methodology description in Appendix C.

Table 10. Electrical Permit and Inspection Cost Data

	Fees		
$110	Minimum inspection fee, which covers from 1 to 3 inspections		
$70	Application fee		
$8	Per circuit, including junction box		
$151	Basic electric service panel fee		
$50	Incremental fee per 100-amp increase in panel size		
15%	Records/Technology fee add-on		
$207	Total minimum electrical permit fee		
	source: City of Oakland fees as of June 1, 2016		
	Builder Staff Costs		
Retrofit PEV Circuit or PEV Ready	PEV Ready, New	Incremental Cost, New	
$100	$50	$25	Builder staff time to obtain new permit
$100	$50	$25	Builder staff time per inspection
$150	$0	$0	Electrical engineer staff time for load calculations

Table 11. Building Permit and Inspection Cost Data

	Fees	
$50	Basic fee	
$1.50	Per hundred dollars of project value up to $2000	
$0.75	Per hundred dollars of project value from $2000 up to $50,000	
	source: Estimates based on review of several jurisdiction's fee schedules	
	Builder Staff Costs	
Retrofit	Incremental Cost, New	
$100	$25	Builder staff time to obtain new permit
$100	$0	Builder staff time per inspection

Table 12. Total Permit and Inspection Cost Summary

		Retrofit			New (Incremental Costs)			Retrofit PEV Space to Circuit		
Scenario	**# of Circuits**	**Fee**	**Builder Staff Time**	**Total**	**Fee**	**Builder Staff Time**	**Total**	**Fee**	**Builder Staff Time**	**Total**
One	2	$489	$650	$1,139	$94	$75	$169	$284	$200	$484
Two	2	$436	$750	$1,186	$94	$75	$169	$284	$200	$484
Three	6	$587	$750	$1,337	$220	$100	$320	$325	$250	$575
Four	12	$779	$850	$1,629	$346	$125	$471	$370	$300	$670

APPENDIX C: CALCULATION METHODOLOGY

Data Sources

Estimates of retrofit and new construction costs were based on data from RS Means Quarter 3 2013, a construction cost reference handbook, for hardware and related installation costs; City of Oakland cost sheet for permitting fees; and staff estimates for contractor labor for obtaining permitting and inspection. Costs were escalated to 2016 using US Bureau of Labor Statistics Producer Price Index statistics for materials[19] and California Director of Industrial Relations labor costs for Oakland from 2013 to 2016.[20] Additional data sources included feedback from industry experts, engineering estimates and direct experience to capture different tasks required for the scenarios that were analyzed. Table 13 and Table 14 contain a list of all tasks included in the analysis.

General Assumptions

We made the following general assumptions:

- Cost estimates include a fixed general overhead and profit factor.[21] Overhead cost for smaller retrofit projects will likely be higher than PEV-readiness tasks bundled with new development. We added an estimated cost for project initiation and cost-estimation, assuming that most of this cost would be passed on to the customer and a portion would be absorbed by the contractor.
- Labor costs are based on union labor. The use of union labor can vary from project to project.
- Geographic adjustments are based on 2010 RS Means Electrical Cost Data page 465.
- In a number of cases RS Means contains minimum retrofit task costs.[22] In these cases the lesser of the minimum task cost or the sum of the actual task costs was applied. Where related tasks had separate minimum task costs but the labor crew could likely also perform a related task, we applied only one minimum labor charge.[23]

Permit and Inspection Fees

Permitting costs for breaking concrete and/or pavement in addition to electrical work are based on City of Oakland fees of $70 per application and a minimum of $110 per inspection plus a technology and records fee.[24] Electrical inspection fees can exceed the minimum depending on the capacity and quantity of electric

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[19] Material cost adjustment 2013 to 2016 are based on Producer Price Index category 1175 "Switchgrear, switchboard and industrial controls" relative index from Nov 2013 to March 2016 which shows virtually no change. http://www.bls.gov/ppi/ppidr201311.pdf

[20] See http://www.dir.ca.gov/OPRL/main.htm prevailing wage and superseded prevailing wage determinations for electrical job categories.

[21] Individual RS Means line items related to overhead (under General Requirements) are assumed to be addressed by overhead and profit.

[22] Minimum task costs are typically not relevant for new construction due to the overall project scale.

[23] For instance, we assume that a concrete sawing and demolition crew deployed for a day for a retrofit project could also drill concrete walls if concrete sawing required less than 8 hours (some additional equipment would be required).

[24] http://www2.oaklandnet.com/Government/o/PBN/OurOrganization/BuildingServices/s/Permits/index.htm

panels and number of circuits. The total estimated costs include rough and final building and electrical permit fees where applicable. Building permits are generally not required for converting PEV-ready spaces to full circuits, and the cost for adding work in new construction is assumed to be relatively low. Builder staff time for permit filing and inspections are included at $100/hour. Permit and inspection costs may vary between regions.

We assume a small additional amount of labor to accommodate an inspection of PEV-specific elements in new construction. Please see Appendix B for more details.

Paving and Conduit

Sidewalks are assumed to be four-inch-thick and made of concrete, and asphalt pavement is assumed to be a six-inch aggregate base and three-inch pavement.[25] Trenching is included for both new construction and retrofit surface parking. Conduits are assumed to serve two circuits each, whether below grade or surface mounted. No additional curbs or bollards are assumed.

Termination Point

The termination point is assumed to consist of an outlet box with a face plate and no electric vehicle service equipment (i.e. the unit that connects to the vehicle) installed at the time of construction. No termination point is included for the PEV-ready spaces.

Equipment Rentals

We assume one day of equipment rental for a backhoe, concrete mixer and asphalt spreader for surface parking retrofits. We assume a half-day of operating cost (labor and fuel) based on the expectation that this equipment may not be continuously utilized, and that workers could perform other tasks when that equipment was not in use.[26] A 40-horsepower backhoe was assumed to be sufficient for loading of excavated asphalt and concrete in the retrofit case.[27]

Task Descriptions

Task descriptions for each scenario are listed below in Table 13 and Table 14. The tables list tasks with a note to designate where the task applies to retrofits, new construction or both. Tasks are listed with a "0" quantity where they do not apply or are subsumed in cases where minimum job costs are assumed. A negative number indicates the avoidance of smaller electrical panel due to installation of a larger panel.

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[25] "Sidewalk Repair Manual". 2013. City of Portland Bureau of Transportation April. http://www.portlandoregon.gov/transportation/article/443054; Asphalt Paving Association of Idaho design guide: http://www.apai.net/cmdocs/apai/designguide/Chapter_5B.pdf.

[26] We assume that even if this equipment was needed for less than 8 hrs, it could not be demobilized and transportation to another job site in time for use on that alternate job site on the same day thus a full days cost would be incurred.

[27] A 40 hp backhoe with 3,300 lb lift capacity was assumed sufficient (Coyote C14 LB from www.specguideonline.com) which falls into the smallest bin listed in RS Means. Total mass of asphalt to be excavated was calculated at 14.5 tons at the National Asphalt Pavement Association: http://www.asphaltpavement.org/ and 40 hp backhoe lift capacity was assumed sufficient to economically excavate and lift both asphalt as well as additional concrete material to be removed in the retrofit case.

Table 13. Task Descriptions and Quantities for Scenario One and Scenario Two

Note: Construction type determines whether the task description and quantity applies to new construction (N), retrofit (R), or both (B) and the work type code denotes whether the work type corresponds to a circuit including panel and paint (C), demolition (D), excavation (E), fee (F), electric infrastructure (I), paving asphalt and concrete (P), or raceway (R).

Task Description	Construction Type[1]	Work Type	Unit[2]	Scenario 1 PEV Circuit	Scenario 1 PEV-Ready	Scenario 1 PEV-Ready to Circuit	Scenario 2 PEV Circuit	Scenario 2 PEV-Ready	Scenario 2 PEV-Ready to Circuit
				Quantity for Each Scenario					
Demolish, remove pavement & curb, remove bituminous pavement, 4" to 6" thick, excludes hauling and disposal fees	R	D	S.Y.	0	0	0	0	0	0
Demolish, remove pavement & curb, remove concrete curbs, plain, excludes hauling and disposal fees	R	D	L.F.	0	0	0	0	0	0
Demolish, remove pavement & curb, curbs, excludes hauling, minimum labor/equipment charge	R	D	Job	1	1	0	0	0	0
Selective demolition, rubbish handling, dumpster, 6 C.Y., 2 ton capacity, weekly rental, includes one dump per week, cost to be added to demolition cost.	R	D	Week	1	1	0	0	0	0
Deconstruction of concrete, floors, concrete slab on grade, plain, 4" thick, up to 2 stories, excludes handling, packaging or disposal costs	R	D	S.F.	50	50	0	0	0	0
Selective concrete demolition, reinforce less than 1% of cross-sectional area, break up into small pieces, excludes shoring, bracing, saw or torch cutting, loading, hauling, dumping	R	D	C.Y.	0.27	0.27	0	0	0	0
Selective concrete demolition, minimum labor/equipment charge	R	D	Job	0	0	0	0	0	0
C.I.P. concrete forms, slab on grade, bulkhead with keyway, wood, 6" high, 1 use, includes erecting, bracing, stripping and cleaning	R	C	L.F.	0	0	0	0	0	0
C.I.P. concrete forms, slab on grade, edge, wood, 7" to 12" high, 4 use, includes erecting, bracing, stripping and cleaning	R	C	SFCA	0	0	0	0	0	0

Task Description	Construction Type[1]	Work Type	Unit[2]	Scenario 1 PEV Circuit	Scenario 1 PEV-Ready	Scenario 1 PEV-Ready to Circuit	Scenario 2 PEV Circuit	Scenario 2 PEV-Ready	Scenario 2 PEV-Ready to Circuit
Reinforcing steel, in place, dowels, smooth, 12" long, 1/4" or 3/8" diameter, A615, grade 60	R	C	Ea.	0	0	0	0	0	0
Structural concrete, in place, slab on grade (3000 psi), 4" thick, includes concrete (Portland cement Type I), placing and textured finish, excludes forms and reinforcing	R	C	S.F.	0	0	0	0	0	0
Structural concrete, in place, minimum labor/equipment charge	R	P	Job	1	1	0	0	0	0
Chemical anchoring, for fastener 1-3/4" diameter x 12" embedment, includes epoxy cartridge, excludes layout, drilling & fastener	R	C	Ea.	2	2	0	2	2	0
Concrete sawing, concrete slabs, rod reinforced, up to 3" deep	R	D	L.F.	0	0	0	0	0	0
Concrete sawing, concrete, existing slab, rod reinforced, for each additional inch of depth over 3"	R	D	L.F.	0	0	0	0	0	0
Selective demolition, concrete slab cutting/sawing, minimum labor/equipment charge	R	D	Job	1	1	0	0	0	0
Concrete core drilling, core, reinforced concrete slab, 2" diameter, up to 6" thick slab, includes bit, layout and set up	R	D	Ea.	0	0	0	2	2	0
Branch meter devices, main circuit breaker, 400 A, electrical demolition, remove, includes circuit breaker	R	D	Ea.	0	0	0	0	0	0
Wire, copper, stranded, 600 volt, #8, type THW, in raceway	N	C	C.L.F.	1	0	1	1	0	1
Wire, copper, stranded, 600 volt, #8, type THW, in raceway	R	C	C.L.F.	1	0	1	1	0	1
Wire, minimum labor/equipment charge	R	C	Job	0	0	0	0	0	0
Outlet boxes, pressed steel, 4" square	R	C	Ea.	2	0	2	2	0	2
Outlet boxes, pressed steel, 4" square	N	C	Ea.	2	0	2	2	0	2
Outlet boxes, pressed steel, covers, blank, 4" square	R	C	Ea.	2	0	2	2	0	2
Outlet boxes, pressed steel, covers, blank, 4" square	N	C	Ea.	2	0	2	2	0	2

Task Description	Construction Type[1]	Work Type	Unit[2]	Scenario 1 PEV Circuit	Scenario 1 PEV-Ready	Scenario 1 PEV-Ready to Circuit	Scenario 2 PEV Circuit	Scenario 2 PEV-Ready	Scenario 2 PEV-Ready to Circuit
PVC conduit, schedule 40, 1-1/4" diameter, in concrete slab, includes terminations, fittings and supports	N	R	L.F.	0	0	0	0	0	0
PVC conduit, schedule 40, 1-1/4" diameter, in concrete slab, includes terminations, fittings and supports	R	R	L.F.	0	0	0	0	0	0
Rigid galvanized steel conduit, 2" diameter, in trench, includes terminations and fittings	R	R	L.F.	50	50	0	0	0	0
Rigid galvanized steel conduit, 2" diameter, in trench, includes terminations and fittings	N	R	L.F.	50	50	0	0	0	0
Rigid galvanized steel conduit, 1-1/4" diameter, to 15' H, includes 2 terminations, 2 elbows, 11 beam clamps, and 11 couplings per 100 LF	N	R	L.F.	5	5	0	50	0	50
Rigid galvanized steel conduit, 1" diameter, to 15' H, includes 2 terminations, 2 elbows, 11 beam clamps, and 11 couplings per 100 LF	N	R	L.F.	0	0	0	0	0	0
Intermediate metal conduit, 1-1/4" diameter, to 15' high, includes 2 terminations, 2 elbows, 11 beam clamps, and 11 couplings per 100 LF	R	R	L.F.	5	5	0	56	0	56
Intermediate metal conduit, 1" diameter, to 15' high, includes 2 terminations, 2 elbows, 11 beam clamps, and 11 couplings per 100 LF	R	R	L.F.	0	0	0	0	0	0
Conduit, to 15' high, minimum labor/equipment charge	R	R	job	0	0	0	0	0	0
Load interrupter switch, 2 position, 300 kVA & below w/CLF fuses, 4.8 kV, 600 amp, NEMA 1	B	I	Ea.	0	0	0	0	0	0
Cable lugs, for 2 feeders, 4.8 kV or 13.8 kV	B	I	Ea.	0	0	0	0	0	0
Transformer, dry-type, 3 phase 480 V primary 120/208 V secondary, 300 kVA	B	I	Ea.	0	0	0	0	0	0
Switchboards, distribution section, aluminum bus bars, 4 W, 120/208 or 277/480 V, 1200 amp, excludes breakers	N	I	Ea.	0	0	0	0	0	0

Task Description	Construction Type[1]	Work Type	Unit[2]	Scenario 1 PEV Circuit	Scenario 1 PEV-Ready	Scenario 1 PEV-Ready to Circuit	Scenario 2 PEV Circuit	Scenario 2 PEV-Ready	Scenario 2 PEV-Ready to Circuit
Load centers, 1 phase, 3 wire, main lugs, indoor, 120/240 V, 100 amp, 12 circuits, includes 20 A 1 pole plug-in breakers (additional to existing)	R	C	Ea.	1	1	0	1	1	0
Load centers, 1 phase, 3 wire, main lugs, indoor, 120/240 V, 200 amp, 16 circuits, includes 20 A 1 pole plug-in breakers	N	C	Ea.	1	1	0	1	1	0
Load centers, 1 phase, 3 wire, main lugs, indoor, 120/240 V, 100 amp, 12 circuits, includes 20 A 1 pole plug-in breakers (cost avoided by installing 200 amp panel at time of new construction)	N	C	Ea.	-1	-1	0	-1	-1	0
Circuit breakers, bolt-on, 10 k A I.C., 3 pole, 240 volt, 15 to 60 amp (commercial main breakers may have these pre-installed)	B	C	Ea.	2	0	2	2	0	2
Excavating, trench or continuous footing, common earth, 1/2 C.Y. excavator, 1' to 4' deep, excludes sheeting or dewatering	R	E	B.C.Y.	0	0	0	0	0	0
Excavating, trench backfill, 1 C.Y. bucket, minimal haul, front end loader, wheel mounted, excludes dewatering	R	E	L.C.Y.	0	0	0	0	0	0
Excavating, chain trencher, utility trench, common earth, 40 H.P., 16" wide, 24" deep, operator riding, includes backfill	B	E	L.F.	50	50	0	0	0	0
Excavating, chain trencher, utility trench, common earth, includes excavation and backfill, minimum labor/equipment charge	B	E	Job	1	1	0	0	0	0
Cycle hauling(wait, load, travel, unload or dump & return) time per cycle, excavated or borrow, loose cubic yards, 20 min load/wait/unload, 12 C.Y. truck, cycle 10 miles, 50 MPH, excludes loading equipment	R	P	L.C.Y.	1	1	0	0	0	0
Excavated or borrow, loose cubic yards, small excavation job, 8 C.Y. truck per hour, excludes loading equipment	R	D	Hr.	0	0	0	0	0	0

Task Description	Construction Type[1]	Work Type	Unit[2]	Scenario 1 PEV Circuit	Scenario 1 PEV-Ready	Scenario 1 PEV-Ready to Circuit	Scenario 2 PEV Circuit	Scenario 2 PEV-Ready	Scenario 2 PEV-Ready to Circuit
Asphaltic concrete paving, parking lots & driveways, 6" stone base, 2" binder course, 2" topping, no asphalt hauling included	R	P	S.F.	80	80	0	0	0	0
Painted pavement markings, acrylic waterborne, white or yellow, 4" wide, less than 3000 L.F.	R	C	L.F.	100	0	100	100	0	100
Painted pavement markings, acrylic waterborne, white or yellow, 4" wide, less than 3000 L.F.	N	C	L.F.	100	0	100	100	0	100
Add equipment minimum for concrete demo- assume labor minimum subsumed under saw cut minimum	R	D		1	1	0	0	0	0
Mobilization or demobilization, dozer, loader, backhoe or excavator, 70 H.P. to 150 H.P., up to 50 miles	R	d		2	2	0	0	0	0
Rent, asphalt distributor, trailer mounted, 38 HP diesel 2000 gallon, one day including 4 hours operating cost	R	d		1	1	0	0	0	0
Rent mixer power mortar & concrete gas 6 CF, 18 HP, one day including 4 hours operating cost	R	d		1	1	0	0	0	0
Rent core drill, electric, 2.5 H.P. 1" to 8" bit diameter, including hourly operating cost	R	d		0	0	0	1	1	0
Rent backhoe-loader 40 to 45 HP 5/8 CY capacity, one day including 4 hours operating cost	R	d		1	1	0	0	0	0
Main Circuit breaker, 3 pole 3 wire 100 amp	R	C	Ea.	0	0	0	0	0	0
Main Circuit breaker, 3 pole 3 wire 225 amp	N	C	Ea.	0	0	0	0	0	0
Main Circuit breaker, 3 pole 3 wire 225 amp	R	C	Ea.	0	0	0	0	0	0
Main Circuit breaker, 3 pole 3 wire 400 amp	N	C	Ea.	0	0	0	0	0	0
Main Circuit breaker, 3 pole 3 wire 400 amp	R	C	Ea.	0	0	0	0	0	0

1. Some codes that appear duplicative are retrofit in one case and new construction in another case.
2. Unit refers to quantity, such as linear foot (LF), hundred linear foot (CFL), square yard (SY), cubic yard (CY).

Table 14. Task Descriptions and Quantities for Scenario Three and Scenario Four

Note: Construction type determines whether the task description and quantity applies to new construction (N), retrofit (R), or both (B) and the work type code denotes whether the work type corresponds to a circuit including panel and paint (C), demolition (D), excavation (E), fee (F), electric infrastructure (I), paving asphalt and concrete (P), or raceway (R).

Task Description	Construction Type[1]	Work Type	Unit[2]	Scenario 3 Six PEV Circuits	Scenario 3 Six PEV-Ready Spaces	Scenario 3 Six PEV-Ready Spaces to Circuits	Scenario 4 Twelve PEV Circuits	Scenario 4 Twelve PEV-Ready Spaces	Scenario 4 Twelve PEV-Ready Spaces to Circuits
				Quantity for Each Scenario					
Demolish, remove pavement & curb, remove bituminous pavement, 4" to 6" thick, excludes hauling and disposal fees	R	D	S.Y.	0	0	0	0	0	0
Demolish, remove pavement & curb, remove concrete curbs, plain, excludes hauling and disposal fees	R	D	L.F.	0	0	0	0	0	0
Demolish, remove pavement & curb, curbs, excludes hauling, minimum labor/equipment charge	R	D	Job	0	0	0	0	0	0
Selective demolition, rubbish handling, dumpster, 6 C.Y., 2 ton capacity, weekly rental, includes one dump per week, cost to be added to demolition cost.	R	D	Week	0	0	0	0	0	0
Deconstruction of concrete, floors, concrete slab on grade, plain, 4" thick, up to 2 stories, excludes handling, packaging or disposal costs	R	D	S.F.	0	0	0	0	0	0
Selective concrete demolition, reinforce less than 1% of cross-sectional area, break up into small pieces, excludes shoring, bracing, saw or torch cutting, loading, hauling, dumping	R	D	C.Y.	0	0	0	0	0	0
Selective concrete demolition, minimum labor/equipment charge	R	D	Job	0	0	0	0	0	0

Task Description	Construction Type[1]	Work Type	Unit[2]	Scenario 3 Six PEV Circuits	Scenario 3 Six PEV-Ready Spaces	Scenario 3 Six PEV-Ready Spaces to Circuits	Scenario 4 Twelve PEV Circuits	Scenario 4 Twelve PEV-Ready Spaces	Scenario 4 Twelve PEV-Ready Spaces to Circuits
C.I.P. concrete forms, slab on grade, bulkhead with keyway, wood, 6" high, 1 use, includes erecting, bracing, stripping and cleaning	R	C	L.F.	0	0	0	0	0	0
C.I.P. concrete forms, slab on grade, edge, wood, 7" to 12" high, 4 use, includes erecting, bracing, stripping and cleaning	R	C	SFCA	0	0	0	0	0	0
Reinforcing steel, in place, dowels, smooth, 12" long, 1/4" or 3/8" diameter, A615, grade 60	R	C	Ea.	0	0	0	0	0	0
Structural concrete, in place, slab on grade (3000 psi), 4" thick, includes concrete (Portland cement Type I), placing and textured finish, excludes forms and reinforcing	R	C	S.F.	0	0	0	0	0	0
Structural concrete, in place, minimum labor/equipment charge	R	P	Job	0	0	0	0	0	0
Chemical anchoring, for fastener 1-3/4" diameter x 12" embedment, includes epoxy cartridge, excludes layout, drilling & fastener	R	C	Ea.	4	4	0	4	4	0
Concrete sawing, concrete slabs, rod reinforced, up to 3" deep	R	D	L.F.	0	0	0	0	0	0
Concrete sawing, concrete, existing slab, rod reinforced, for each additional inch of depth over 3"	R	D	L.F.	0	0	0	0	0	0
Selective demolition, concrete slab cutting/sawing, minimum labor/equipment charge	R	D	Job	0	0	0	0	0	0
Concrete core drilling, core, reinforced concrete slab, 2" diameter, up to 6" thick slab, includes bit, layout and set up	R	D	Ea.	2	2	0	2	2	0
Branch meter devices, main circuit breaker, 400 A, electrical demolition, remove, includes circuit breaker	R	D	Ea.	0	0	0	0	0	0
Wire, copper, stranded, 600 volt, #8, type THW, in raceway	N	C	C.L.F.	1.7	0	1.7	3.3	0	3.3
Wire, copper, stranded, 600 volt, #8, type THW, in raceway	R	C	C.L.F.	1.7	0	1.7	3.3	0	3.3
Wire, minimum labor/equipment charge	R	C	Job	0	0	0	0	0	0

Task Description	Construction Type[1]	Work Type	Unit[2]	Scenario 3 Six PEV Circuits	Scenario 3 Six PEV-Ready Spaces	Scenario 3 Six PEV-Ready Spaces to Circuits	Scenario 4 Twelve PEV Circuits	Scenario 4 Twelve PEV-Ready Spaces	Scenario 4 Twelve PEV-Ready Spaces to Circuits
Outlet boxes, pressed steel, 4" square	R	C	Ea.	6	0	6	12	0	12
Outlet boxes, pressed steel, 4" square	N	C	Ea.	6	0	6	12	0	12
Outlet boxes, pressed steel, covers, blank, 4" square	R	C	Ea.	6	0	6	12	0	12
Outlet boxes, pressed steel, covers, blank, 4" square	N	C	Ea.	6	0	6	12	0	12
PVC conduit, schedule 40, 1-1/4" diameter, in concrete slab, includes terminations, fittings and supports	N	R	L.F.	0	0	0	0	0	0
PVC conduit, schedule 40, 1-1/4" diameter, in concrete slab, includes terminations, fittings and supports	R	R	L.F.	0	0	0	0	0	0
Rigid galvanized steel conduit, 2" diameter, in trench, includes terminations and fittings	R	R	L.F.	0	0	0	0	0	0
Rigid galvanized steel conduit, 2" diameter, in trench, includes terminations and fittings	N	R	L.F.	0	0	0	0	0	0
Rigid galvanized steel conduit, 1-1/4" diameter, to 15' H, includes 2 terminations, 2 elbows, 11 beam clamps, and 11 couplings per 100 LF	N	R	L.F.	170	0	170	330	0	330
Rigid galvanized steel conduit, 1" diameter, to 15' H, includes 2 terminations, 2 elbows, 11 beam clamps, and 11 couplings per 100 LF	N	R	L.F.	0	0	0	0	0	0
Intermediate metal conduit, 1-1/4" diameter, to 15' high, includes 2 terminations, 2 elbows, 11 beam clamps, and 11 couplings per 100 LF	R	R	L.F.	195.5	0	195.5	379.5	0	379.5
Intermediate metal conduit, 1" diameter, to 15' high, includes 2 terminations, 2 elbows, 11 beam clamps, and 11 couplings per 100 LF	R	R	L.F.	0	0	0	0	0	0
Conduit, to 15' high, minimum labor/equipment charge	R	R	job	0	0	0	0	0	0
Load interrupter switch, 2 position, 300 kVA & below w/CLF fuses, 4.8 kV, 600 amp, NEMA 1	B	I	Ea.	0	0	0	0	0	0

Task Description	Construction Type[1]	Work Type	Unit[2]	Scenario 3 Six PEV Circuits	Scenario 3 Six PEV-Ready Spaces	Scenario 3 Six PEV-Ready Spaces to Circuits	Scenario 4 Twelve PEV Circuits	Scenario 4 Twelve PEV-Ready Spaces	Scenario 4 Twelve PEV-Ready Spaces to Circuits
Cable lugs, for 2 feeders, 4.8 kV or 13.8 kV	B	I	Ea.	0	0	0	0	0	0
Transformer, dry-type, 3 phase 480 V primary 120/208 V secondary, 300 kVA	B	I	Ea.	0	0	0	0	0	0
Switchboards, distribution section, aluminum bus bars, 4 W, 120/208 or 277/480 V, 1200 amp, excludes breakers	N	I	Ea.	0	0	0	0	0	0
Load centers, 1 phase, 3 wire, main lugs, indoor, 120/240 V, 100 amp, 12 circuits, includes 20 A 1 pole plug-in breakers (additional to existing)	R	C	Ea.	0	0	0	0	0	0
Load centers, 1 phase, 3 wire, main lugs, indoor, 120/240 V, 200 amp, 16 circuits, includes 20 A 1 pole plug-in breakers	N	C	Ea.	0	0	0	0	0	0
Load centers, 1 phase, 3 wire, main lugs, indoor, 120/240 V, 100 amp, 12 circuits, includes 20 A 1 pole plug-in breakers (cost avoided by installing 200 amp panel at time of new construction)	N	C	Ea.	0	0	0	0	0	0
Circuit breakers, bolt-on, 10 k A I.C., 3 pole, 240 volt, 15 to 60 amp (commercial main breakers may have these pre-installed)	B	C	Ea.	0	0	0	0	0	0
Excavating, trench or continuous footing, common earth, 1/2 C.Y. excavator, 1' to 4' deep, excludes sheeting or dewatering	R	E	B.C.Y.	0	0	0	0	0	0
Excavating, trench backfill, 1 C.Y. bucket, minimal haul, front end loader, wheel mounted, excludes dewatering	R	E	L.C.Y.	0	0	0	0	0	0
Excavating, chain trencher, utility trench, common earth, 40 H.P., 16" wide, 24" deep, operator riding, includes backfill	B	E	L.F.	0	0	0	0	0	0
Excavating, chain trencher, utility trench, common earth, includes excavation and backfill, minimum labor/equipment charge	B	E	Job	0	0	0	0	0	0

Task Description	Construction Type[1]	Work Type	Unit[2]	Scenario 3 Six PEV Circuits	Scenario 3 Six PEV-Ready Spaces	Scenario 3 Six PEV-Ready Spaces to Circuits	Scenario 4 Twelve PEV Circuits	Scenario 4 Twelve PEV-Ready Spaces	Scenario 4 Twelve PEV-Ready Spaces to Circuits
Cycle hauling(wait, load, travel, unload or dump & return) time per cycle, excavated or borrow, loose cubic yards, 20 min load/wait/unload, 12 C.Y. truck, cycle 10 miles, 50 MPH, excludes loading equipment	R	P	L.C.Y.	0	0	0	0	0	0
Excavated or borrow, loose cubic yards, small excavation job, 8 C.Y. truck per hour, excludes loading equipment	R	D	Hr.	0	0	0	0	0	0
Asphaltic concrete paving, parking lots & driveways, 6" stone base, 2" binder course, 2" topping, no asphalt hauling included	R	P	S.F.	0	0	0	0	0	0
Painted pavement markings, acrylic waterborne, white or yellow, 4" wide, less than 3000 L.F.	R	C	L.F.	200	0	200	600	0	600
Painted pavement markings, acrylic waterborne, white or yellow, 4" wide, less than 3000 L.F.	N	C	L.F.	200	0	200	600	0	600
Add equipment minimum for concrete demo- assume labor minimum subsumed under saw cut minimum	R	D		0	0	0	0	0	0
Mobilization or demobilization, dozer, loader, backhoe or excavator, 70 H.P. to 150 H.P., up to 50 miles	R	d		0	0	0	0	0	0
Rent, asphalt distributor, trailer mounted, 38 HP diesel 2000 gallon, one day including 4 hours operating cost	R	d		0	0	0	0	0	0
Rent mixer power mortar & concrete gas 6 CF, 18 HP, one day including 4 hours operating cost	R	d		0	0	0	0	0	0
Rent core drill, electric, 2.5 H.P. 1" to 8" bit diameter, including hourly operating cost	R	d		1	1	0	3	3	0
Rent backhoe-loader 40 to 45 HP 5/8 CY capacity, one day including 4 hours operating cost	R	d		0	0	0	0	0	0
Main Circuit breaker, 3 pole 3 wire 100 amp (a negative quantity indicates cost avoided by installing larger capacity unit)	N	C	Ea.	0	0	0	-2	-2	0

Task Description	Construction Type[1]	Work Type	Unit[2]	Scenario 3 Six PEV Circuits	Scenario 3 Six PEV-Ready Spaces	Scenario 3 Six PEV-Ready Spaces to Circuits	Scenario 4 Twelve PEV Circuits	Scenario 4 Twelve PEV-Ready Spaces	Scenario 4 Twelve PEV-Ready Spaces to Circuits
Main Circuit breaker, 3 pole 3 wire 100 amp	R	C	Ea.	0	0	0	0	0	0
Main Circuit breaker, 3 pole 3 wire 225 amp	N	C	Ea.	-1	-1	0	0	0	0
Main Circuit breaker, 3 pole 3 wire 225 amp	R	C	Ea.	0	0	0	0	0	0
Main Circuit breaker, 3 pole 3 wire 400 amp	N	C	Ea.	1	1	0	2	2	0
Main Circuit breaker, 3 pole 3 wire 400 amp	R	C	Ea.	1	1	0	2	2	0

1. Some codes that appear duplicative are retrofit in one case and new construction in another case.
2. Unit refers to quantity, such as linear foot (LF), hundred linear foot (CFL), square yard (SY), cubic yard (CY).

Attachment B

Addendum to the Plug-In Electric Vehicle Infrastructure Cost-Effectiveness Report: Scenario 4B

A variation on Scenario 4 of the Plug-In Electric Vehicle Infrastructure Cost-Effectiveness Report (labeled Scenario 4B in this addendum) was suggested during stakeholder feedback on local PEV infrastructure building code development, which is currently underway in the Bay Area cities of Oakland, Fremont, and San Francisco. Stakeholders were interested in the potential cost-effective installation of EVSE in up to 100% of parking spaces in certain large developments. Thus, this addendum to the July 20, 2016 Plug-in Electric Vehicle Infrastructure Cost-Effectiveness Report (see Attachment A) was developed. This addendum addresses potential building codes that would facilitate installation of EVSE in up to 100% of parking spaces at low cost by including certain key elements of PEV infrastructure at the time of original construction to facilitate eventual build-out of full circuits. Optional load management technology can leverage this additional infrastructure to serve expanded numbers of PEV parking spaces at low cost by obviating additional electrical panel capacity.

Scenario 4B Description

Scenario 4 would provide 12 PEV parking spaces (20 percent of spaces) at a 60-parking space, two-level, enclosed parking garage with 400-amp electrical panel capacity on each level (see Table 2 in the Plug-in Electric Vehicle Infrastructure Cost-Effectiveness Report for additional details). Scenario 4B would additionally require conduits located below grade or in otherwise inaccessible locations to be installed at the time of original construction as needed to serve the additional 80 percent of spaces (48 spaces). Thus, some level of PEV infrastructure readiness would be available to all 60 parking spaces.

Twenty percent of parking spaces would be served with a 208/240 volt 40-amp circuit in both Scenario 4 and Scenario 4B. The additional conduit installed in Scenario 4B would also facilitate an option to support charging at up to 100 percent of spaces at a lower level, with a 8-amp minimum simultaneously available for every circuit with an optional load management system (currently available on the market through range of providers in various forms).[1] The load management system need not be installed at the time of construction; it may be added later, at the option of the building owner, when more than 20% of parking spaces are needed for PEV parking. (In addition to expanding the number PEV parking spaces, load management systems could also potentially address peak demand issues, allowing more efficient management of electric load throughout the day.)

[1] EVSE would not necessarily operate at the full capacity of the available current because EVSE are considered continuous loads, which cannot draw the full available capacity under the California Electrical Code. Note that surface mounted conduit would also need to be installed.

Scenario 4B would be especially valuable in multi-family housing. In some buildings, the parking spaces are deeded or assigned to specific units. Scenario 4B would support broader PEV adoption because any specific parking space could be provided with PEV charging. This configuration would also facilitate additional PEV charging beyond 20 percent of parking spaces, allowing for dramatic future expansion of PEV charging in buildings constructed over the next three years prior to the next building code updates.

Cost impacts

The incremental cost of building codes to facilitate Scenario 4B would be small per PEV parking space. For instance, the cost to install 55 feet of underground conduit in new construction is about $550, as shown in Scenario 1 of the Plug-in Electric Vehicle Infrastructure Cost-Effectiveness Report, compared to a retrofit cost of $3,800 (excluding permitting/inspection and construction management). Every 100 feet of underground conduit that is required during new construction in Scenario 4B to address an additional 80% of spaces would likely cost about $1000, or about $20 for each of the 48 additional PEV parking space. While the exact amount of work and upfront cost will depend on site-specific factors, the cost will generally be low as most of the work can be deferred until the charging capacity is needed later, while avoiding the particularly expensive retrofit tasks.

Electric load management technology further minimizes the construction cost per additional PEV parking space, since additional PEV parking spaces can be served without additional panel capacity. This savings is important because electrical panel capacity is the primary driver of cost for the "balance of circuit" cost category.[2] Balance of circuit is the highest or second highest cost category for installing electric circuits in both retrofits and new construction for all four scenarios in the Plug-in Electric Vehicle Infrastructure Cost-Effectiveness Report (see Attachment A).

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[2] This category also includes wire and outlet boxes.

Approved as to Form and Legality

City Attorney

FILED
OFFICE OF THE CITY CLERK
OAKLAND

OAKLAND CITY COUNCIL

2016 NOV -3 PM 5: RESOLUTION No.____________C.M.S.

Introduced by Councilmember ______________

RESOLUTION OF FINDINGS SUPPORTING LOCAL AMENDMENTS TO SECTIONS 4.106.4 and 5.106.5.3 OF THE 2016 EDITION OF THE CALIFORNIA GREEN BUILDING STANDARDS CODE TO COMPLY WITH CHANGES TO STATE LAW AND ADOPTING CEQA EXEMPTION FINDINGS

WHEREAS, the State of California adopts a new California Building Standards Code, including, but not limited to, green building standards, every three years, which goes into effect throughout the State 180 days after publication. The California Building Standards Code is contained in Title 24 of the California Code of Regulations, and consists of several parts that are based upon model codes with amendments made by various State agencies. The California Green Building Standards Code is Part 11 of Title 24 of the California Code of Regulations. The 2016 California Green Building Standards Code will go into effect throughout California on January 1, 2017; and

WHEREAS, local jurisdictions are required to enforce the California Green Building Standards Code but they may also enact more stringent standards when reasonably necessary because of local conditions caused by climate, geology or topography. Section 101.7.1 of Part 11 of Title 24, known as the California Green Building Standards Code, provides that local climatic, geological, or topographical conditions include environmental conditions established by the local jurisdiction; and

WHEREAS, Oakland's green building standards are contained in Chapter 15 of the Oakland Municipal Code. In a separate companion ordinance, the City Council is considering incorporating certain provisions of the 2016 California Green Building Standards Code into Chapter 15 of the Oakland Municipal Code with local amendments; and

WHEREAS, California Health & Safety Code section 17958.7 provides that before making any changes or modifications to the California Green Building Standards Code and any other applicable provisions published by the State Building Standards Commission, the governing body must make an express finding that each such change or modification is reasonably necessary because of specified local conditions, and the findings must be filed with the State Building Standards Commission before the local changes or modifications can go into effect; and

WHEREAS, the actions contemplated in this Resolution are exempt from the California Environmental Quality Act (California Public Resources Code sections 21000 et seq.) pursuant to CEQA Guidelines section 15061(b)(3) (no significant effect on the environment); now, therefore, be it

RESOLVED: That the City of Oakland is unique among California communities with respect to local climatic, geological, topographical, environmental, and other conditions. A specific list of findings that support Oakland's modifications to the 2016 California Green Building Standards Code and a section-by-section correlation of each modification with a specific finding are contained in Exhibit A entitled "Standard Findings for City of Oakland Amendments," which is attached hereto and hereby declared to be a part of this Resolution as if set forth fully herein; and be it

FURTHER RESOLVED: That pursuant to California Health & Safety Code section 17958.7, the City Council finds and determines that the local conditions described in Exhibit A constitute a general summary of the most significant local conditions giving rise to the need for modification of the 2016 California Green Building Standards Code provisions published by the State Building Standards Commission; and be it

FURTHER RESOLVED: That the City Council further finds and determines that the proposed modifications are reasonably necessary based upon the local conditions set forth in Exhibit A, and that such modifications are required in order to provide specific and greater protections to the public health, safety and welfare than are afforded by the 2016 California Green Building Standards Code; and be it

FURTHER RESOLVED: That the City Council further finds and determines that the local amendments to certain provisions of the 2016 California Green Building Standards Code, as set forth in a separate companion ordinance adopting said amendments into Chapter 15 of the Oakland Municipal Code, impose substantially the same non-administrative regulatory requirements as, and are thus consistent with and more stringent than the 2016 California Green Building Standards Code requirements; and be it

FURTHER RESOLVED: That this Resolution shall become effective immediately, unless otherwise required by the Charter of the City of Oakland; and be it

FURTHER RESOLVED: That the Building Official of the City of Oakland is hereby directed to transmit this Resolution with the Exhibit A attachment, along with a copy of said separate companion ordinance adopting local amendments to certain provisions of the 2016 California Green Building Standards Code, to the California Building Standards Commission before January 1, 2017, pursuant to the applicable provisions of State law.

IN COUNCIL, OAKLAND, CALIFORNIA, ______________________________

PASSED BY THE FOLLOWING VOTE:

AYES - BROOKS, CAMPBELL WASHINGTON, GALLO, GUILLEN, KALB, KAPLAN, REID, AND PRESIDENT GIBSON MCELHANEY

NOES -

ABSENT -

ABSTENTION -

ATTEST: ______________________________
LaTonda Simmons
City Clerk and Clerk of the Council
of the City of Oakland, California

EXHIBIT A

STANDARD FINDINGS FOR CITY OF OAKLAND AMENDMENTS

The City Council of the City of Oakland finds that the local amendments to Sections 4.106.4 and 5.106.5.3 of the 2016 California Green Building Standards Code (identified in the attached table and explained in further detail in a separate companion ordinance) are reasonable and necessary as a result of the following local climatic, geological, topographical, environmental, and other conditions:

a. The City of Oakland is located in Climate Zone 3, which is characterized by periods of extremely hot, dry weather during the summer and fall months. During these months, emissions generated within or transported to the Bay Area can combine with abundant sunshine to create conditions conducive to the formation of pollutants, such as ozone and secondary particulates, such as nitrates and sulfates. During the winter, Oakland frequently experiences cold days with temperature inversions that trap certain air pollutants near the ground and exacerbate conditions leading to respiratory disease and other health risks. These local features contribute to the Bay Area's status as a "nonattainment area" under the federal Clean Air Act for ozone and particulate matter.

   The City of Oakland is located on the east side of San Francisco Bay. About two-thirds of Oakland is within a flat alluvial plain while the other third is located in the foothills of the East Bay Hill range. It is also a major port city and the regional transportation hub for the East Bay.

   Most Oakland residents have experienced the effects of poor air quality at one time or another. While the meteorology is generally favorable due to marine air traveling through the Golden Gate, the Oakland area is often considered a source for regional pollutants that contribute to elevated concentration in downward communities, due to its urban density and conglomeration of freeways in addition to the geographical and meteorological conditions described above. Personal vehicles are a major source of this pollution. Resident populations in West and East Oakland have been the subject of many recent public health studies related to industry, multiple freeways, diesel trucks and port operations. Most of these studies have concluded that there is a serious health risk due to poor air quality including respiratory problems such as asthma, heart ailments, suppressed resistance to disease, infant mortality and finally reduced life span. Oakland's geographic location, infrastructure, and many disadvantaged communities in the flatlands make it especially vulnerable to the climatic affects.

b. In June 2006, ICLEI – Local Governments for Sustainability in partnership with the Alameda County Waste Management Authority & Recycling Board (StopWaste.Org) and the Alameda County Conference of Mayors launched the Alameda County Protection Project. The City of Oakland committed to the project and embarked on an ongoing, coordinated effort to reduce the emissions that cause global warming, improve air quality, reduce waste, cut energy use and save money. In December 2012, Oakland City Council adopted an Energy and Climate Action Plan (ECAP) that committed the city to reducing community-wide greenhouse gas (GHG) emissions by 36% below 2005 levels by 2020, on the path to reducing GHG emissions by 83% below 2005 levels by 2050. While climate change is a global problem influenced by an array of interrelated factors, climate change is also a local problem with serious impacts foreseen for California, the Bay Area and City of Oakland. Local impacts include:

i. **Sea level rise:** Climate change is already affecting California and the Bay Area communities. In the last century, the San Francisco Bay water levels have risen 8 inches.[1] By 2100, they are likely to rise an additional 36 inches.[2] Sea levels offshore of Oakland are expected to rise between 11 and 24 inches by mid-century, and 36 to 66 inches by 2100. As a Bayfront city with an active commercial shipping seaport, international airport, and many communities at low elevations, the City of Oakland has long been vulnerable to flooding. Rising Bay waters already affect Oakland with periodic coastal flooding of low-lying shorelines, loss of valuable saltwater marshes, and salt water impacts to Oakland's wastewater treatment systems.[3] [4] [5] When heavy rains are coupled with higher-than-normal tides, tide levels can slow the drainage of runoff into San Francisco Bay, increasing the potential for urban stormwater flooding.

Rising sea levels represent new challenges to Oakland's future. As Bay water levels rise, the flooding frequency and areal extent will increase. Areas once considered to be outside of the floodplain will begin to experience periodic coastal and/or urban flooding. Sections of Oakland's shoreline built on Bay fill, such as the Port of Oakland and the Oakland International Airport, are increasingly vulnerable, because they are chronically subsiding and are at a higher risk of liquefaction during seismic events.

Modeling by the San Francisco Bay Conservation and Development Commission (SFBCDC) shows that under medium to medium-high greenhouse gas emissions scenarios, sections of Interstate 880, much of the Oakland International Airport (72-93%), portions of West Oakland, EBMUD's water treatment plant, areas around Lake Merritt, much of Oakland's shoreline, and areas near the coliseum would be underwater. The modeling also shows a drastic impact to the movement of goods from the Port

[1]National Oceanic and Atmospheric Administration (NOAA) Center for Operational Oceanographic Products and Services (CO-OPS). NOAA Sea-Level Trends 1987-2015. Accessed: https://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?stnid=9414290

[2]National Research Council (NRC). 2012. *Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future.*

[3]Bay Conservation and Development Commission (BCDC). 2014. *Adapting to Rising Tides Program: Preserving Shoreline Parks in the Face of Climate Change.*

[4]Bay Conservation and Development Commission (BCDC). 2015. *Adapting to Rising Tides. Alameda County Shoreline Assessment.*

[5]Grady, B. 2014. *Sea-Level Rise Threatens Oakland's Sewer System.* Climate Central. June 17, 2014. Accessed:http://www.climatecentral.org/news/sea-level-rise-oakland-sewer-17567

of Oakland, the third largest port in California. Further modeling by Researcher Matt Heberger of The Pacific Institute estimates that with a 55-inch sea level rise, the area in Oakland flooded by the unimpeded 100-year tide would be 8.6 square miles – over 15% of Oakland's land area.[6]

The most likely sea level rise projections, based on a moderate level of global greenhouse gas emissions and continued accelerating land ice melt patterns, result in temporary coastal flooding from extreme tides, urban and watershed flooding, accelerated loss of marshlands, daily tital inundation, enhanced King Tide flooding, and rising groundwater levels.

Many of Oakland's flatland areas, such as West Oakland, have industrial histories that have contributed to high levels of soil contamination. In these areas, rising groundwater levels will push toxics and ground contamination to the surface, resulting in serious public health concerns for local residents.

ii. **Impacts on water**: Water quality and quantity in Oakland are at risk as a result of changing temperatures. With warmer average temperatures, more winter precipitation will fall in the form of rain instead of snow, shortening the winter snowfall season in the Sierra's and accelerating the rate at which the snowpack melts in the spring. Not only does such snow melt increase the threat for spring flooding, it will decrease the Sierras' capacity as a natural water tower, resulting in decreased water availability for agricultural irrigation, hydro-electric generation and the general needs of a growing population.

The Sierra snow-pack is the origin of the Mokelumne River, the primary source of water for the jurisdictions within Alameda County including the City of Oakland. The East Bay Municipal Utility District (EBMUD) provides water and sewage treatment for Alameda County customers. In 2008, EBMUD staff conducted a study on climate change impacts on water quality and water supply for the EBMUD service area, with many of its findings relevant to the City of Oakland. That study found the Sacramento/San Joaquin River Delta and its aging levee system exceptionally susceptible to storm damage. Although EBMUD does not divert its water supply from the delta, failure of the delta's levees could result in catastrophic damage to EBMUD's nearby water supply aqueducts, interrupting water deliveries to EBMUD's service area, including Oakland.[7]

Rising water temperatures may affect water quality by promoting algae growth in Lake Merritt, the Estuary, and Oakland's many above ground creeks and marshes, resulting in increased algal by-products such as taste-and-odor compounds[8] and hypoxia.[9]

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[6] Heberger, Matt. 2009. <http://www.pacinst.org/reports/sea_level_rise/files/Ca_coast_yr2100_flood.html.>

[7] Wallis *et. al.*, EBMUD, 2008. Pp. 74.

[8] Wallis *et. al.*, EBMUD, 2008. Pp. 75.

iii. **Natural disasters:** Climate models predict a 4°F temperature increase in the next 20 to 40 years, with an increase in the number of long dry spells, as well as a 20-30% increase in precipitation in the spring and fall. More frequent and heavier precipitation causes flooding, mudslides and landslides, incurring considerable costs in damages to property, infrastructure and even human life.

As mentioned above, a large portion of Oakland is located in the foothills of the East Bay Hills range and many properties are located on extremely steep slopes. During winters with an extreme storm event or a series of storm events with heavy rainfall, Oakland typically experiences landslides in these areas due to saturated ground-water conditions. Approximately 43 landslides occurred in a single El Niño (extreme wet weather) season.[10]

An increasing number of wildfires, due to continued dry periods and high temperatures, are another expected impact of continued climate change. As indicated in Oakland's Safety Element, wildfires are the most severe fire hazard in Oakland, especially in the hills above the Warren Freeway. Because the Oakland Hills are a fire-dependent ecosystem, there is a severe wildfire every 10 to 20 years when the area's natural vegetation is dry and extremely flammable. Urbanization of Oakland's fire hazard areas has increased the potential for more frequent and severe wildfires with an additional likelihood of severe damage and loss of life. The 1991 fire is notorious for being the most destructive wildfire in California history. Several years of drier-than-average rainy seasons, likely caused in large part by climate change, have left California's forests with millions of dead trees. This phenomenon further exacerbates the risk of wildfire in the Oakland Hills.

iv. **Public health impact:** Warming temperatures and increased precipitation can also encourage mosquito-breeding, thus engendering diseases that come with mosquitoes, such as the West Nile Virus, a disease of growing concern in Oakland and the surrounding region.

Heat waves are also expected to have a major impact on public health and be a determinant factor of mortality. Increased temperatures also pose a risk to human health when coupled with high concentrations of ground-level ozone and other air pollutants, potentially leading to increased rates of asthma and other pulmonary diseases. These impacts may be particularly strong in Oakland's disadvantaged communities, which already experience elevated levels of asthma and other adverse health impacts due to a variety of environmental issues. The incidence of bad air days in California's urban

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[9] SFBCDC, 2009. Pp. 78.

[10] Coe, Jeffrey, Jonathan W. Godt, Dianne Brien, and Nicolas Houdre, 1999. "Map Showing Locations of Damaging Landslides in Alameda County, California, resulting from 1997-98 El Niño Rainstorm."

areas has increased, mostly in hot summer days. In the summer of 2006, the Bay Area Air Quality Management District (BAAQMD) registered 11 Spare the Air days for the region and exceeded the California 1-hour standard for ozone (set at 90 ppb) 18 times. As noted above, parts of Oakland are already impacted by poor air quality due to the adjacent port, major highway system, and industry within the city borders.

Impacts on plants and vegetation: Native plants and animals are at risk as temperatures rise and scientists are reporting more species moving to higher elevations or more northerly latitudes in response to climate change. This could affect the 31 plant and 20 animal species that are either in danger of extinction or present in very limited numbers and make Oakland their home. On the list of special status animals, there are two mammals, one reptile, fifteen birds, one fish, and one insect. Of these, 14 are federal special status and 19 are state special status creatures. Six threatened plant species in Oakland are state status and 14 plant species are federal status threatened, endangered, or rare plants.

The absence of these native species would allow invasive species of weeds and insects to gain a foothold in these areas and to threaten other native species and their habitat. This change would be particularly devastating to Oakland as wildlife actually composes nearly 20% of Oakland's total land area. Furthermore, these special species and their habitats as they are already struggling to survive in an infill, urban area.

c. The City of Oakland's local climatic, topographic, geological, and environmental conditions exacerbate the impacts of global climate change in several ways to make the adoption of advanced PEV Readiness code requirements reasonably necessary:

i. Rising summer temperatures and increasing urban density and automobile use increase overall air pollution and exacerbate the urban heat island effect, which are harmful for all Oaklanders. Urban heat and air pollution are particularly damaging for children, the sick and elderly, and disadvantaged populations. Eliminating the harmful pollution from conventional vehicles by enabling a switch to electrified transportation will result in a reduction in the criteria air pollutants and ground-level ozone that lead to asthma and other poor health outcomes.

ii. Burning of fossil fuels has contributed to the global and local hazards of climate change described above. Even in regions where the electric power grid is far "dirtier" than in northern California, such as on the East Coast of the United States where coal is the predominant energy source, electric vehicles result in an overall reduction in greenhouse gas (GHG) emissions due to the efficiency of electric transportation. In Oakland, where the electricity supplied by Pacific Gas and Electric Company (PG&E) is one of the cleanest electricity mixes in the country, electric vehicle use leads to an even more dramatic reduction in GHG emissions as compared to conventional vehicle use. Each PEV will displace 2.6 tons per year of greenhouse gas gases if powered by conventional electricity. As local renewable energy becomes increasingly prevalent, electric vehicle use comes even closer to representing a zero-net-energy form of transportation.

d. Increasing the adoption and use of plug-in electric vehicles (PEVs), including processes to facilitate installation of infrastructure, is a priority strategy identified in the City of Oakland Energy and Climate Action Plan (2012) to reduce greenhouse gas emissions citywide to 36% below 2005 levels by 2020. In addition, use of PEVs benefits the health, welfare and resiliency of the City of Oakland and its residents including reductions in pollutants contributing to ground level ozone, fine particulates, nitrogen oxides and toxic air pollutants.

   i. PEVs depend upon convenient access to charging, and the ability to serve electric vehicles in existing buildings is commonly limited by the electrical system capacity and availability of electric circuit in associated parking.
   ii. The most cost effective time to prepare building electrical infrastructure for PEV charging is when electric service is installed or upgraded due to construction. This is because workers are already on-site, expensive retrofits involving breaking into structures and pavement can be avoided, electrical panel and utility service upgrade costs are lower, permitting and administrative costs are lower, and it is more cost-effective to include such systems in existing construction financing.
   iii. Thus, the proposed local code amendments to provide PEV infrastructure are necessary to address the unique local circumstances identified above.

e. This PEV Readiness code amendment furthers the City of Oakland's efforts to enhance the community's social, economic, and environmental well-being, and to mitigate the efforts of global warming on the City of Oakland's weather, water supply, physical infrastructure, ecological diversity, human health, and economy.

Article III
Part 6 – California Green Building Standards Code
Non-Administrative (Technical) Amendments

Section	Title	Added to 2016 California Green Building Standards Code	Amended from 2016 California Green Building Standards Code	Justification (see above for key)
4.106.4 – Paragraph 2 under "Exemptions"	Electric Vehicle (EV) Charging for New Development		X	e
4.106.4.2	New multifamily dwellings		X	a-e
4.106.4.2.3	Full circuit		X	a-e
4.106.4.2.4	Inaccessible raceway		X	a-e
4.106.4.2.5	Electric Panel Capacity		X	a-e
4.106.4.2.6	Identification		X	a-e
4.106.4.2.7	Accessible EVCS requirements	X		d-e
5.106.5.3	Electric Vehicle (EV) charging		X	a-e
5.106.5.3.1	Full circuit		X	a-e
5.106.5.3.2	Inaccessible raceway		X	a-e
5.106.5.3.3	Electric Panel Capacity		X	a-e
5.106.5.3.4	Identification		X	a-e
5.106.4.3.6	Accessible EVCS requirements	X		d-e

INTRODUCED BY COUNCILMEMBER ____________ FILED OFFICE OF THE CITY CLERK OAKLAND

2016 NOV -3 PM 5: 1

APPROVED AS TO FORM AND LEGALITY

City Attorney

OAKLAND CITY COUNCIL

ORDINANCE NO. ____________ C.M.S.

ORDINANCE ADOPTING LOCAL AMENDMENTS TO SECTIONS 4.106.4 AND 5.106.5.3 OF THE 2016 EDITION OF THE CALIFORNIA GREEN BUILDING STANDARDS CODE AND AMENDING OAKLAND MUNICIPAL CODE CHAPTER 15.04 TO INCLUDE NEW REQUIREMENTS FOR PLUG-IN ELECTRIC VEHICLE INFRASTRUCTURE TO COMPLY WITH CHANGES TO STATE LAW AND ADOPTING CEQA EXEMPTION FINDINGS

WHEREAS, in October 2010, the Oakland City Council adopted a local Green Building Ordinance, which required compliance with green building standards for most project types including residential new construction and additions and alterations, and non-residential new construction additions and alterations; and

WHEREAS, in 2009, Oakland City Council adopted community-wide greenhouse gas (GHG) emissions reduction goals of 36% below 2005 levels by 2020 and 83% below 2005 levels by 2050; and

WHEREAS, in December 2012, the Oakland City Council adopted an Energy and Climate Action Plan (ECAP) that established pathways to achieve the city's 2020 GHG emissions reduction target through multiple measures including reduced vehicle miles traveled and vehicle efficiency; and

WHEREAS, the 2012 ECAP includes Priority Action Item 37, "Plan for Electric Vehicle Infrastructure," which includes developing new processes to support local use of electric vehicles; and

WHEREAS, increasing the adoption and use of electric vehicles will help the City of Oakland meet its GHG and air quality goals; and

WHEREAS, as stated in the 2012 ECAP, it is critical to both the economic and environmental health of the City of Oakland that the City provide leadership to the public and private sectors in green building and alternative transportation; and

WHEREAS, the State of California has set a goal of placing 1.5 million zero-emission vehicles on California roads by 2025; and

WHEREAS, in 2013, the Bay Area Air Quality Management District published a *Bay Area PEV Readiness Plan*, which anticipates at least 246,900 electric vehicles on Bay Area roads by 2025; and

WHEREAS, every three years, the State of California Department of Housing and Community Development and the Building Standards Commission prepare a triennial update to the California Green Building Standards Code, known as CALGreen, which cities must either adopt and enforce "as-is" or adopt with local amendments to require more stringent standards when reasonably necessary based on local climatic, geological, and topographical conditions; and

WHEREAS, the California Green Building Standards Code is Part 11 of Title 24 of the California Code of Regulations, and the 2016 California Green Building Standards Code will go into effect on January 1, 2017; and

WHEREAS, Oakland's green building standards are contained in the Oakland Building Code. In this Ordinance, Oakland incorporates Sections 4.106.4 and 5.106.5.3 of the 2016 California Green Building Standards Code into the Oakland Building Code with local amendments, and amends the Oakland Municipal Code by adding sections 15.04.1205 through 15.04.1235; and

WHEREAS, California Health & Safety Code section 17958.7 provides that before making any changes or modifications to the California Building Standards Code and any other applicable provisions published by the State Building Standards Commission, including, but not limited to, green building standards, the governing body must make an express finding that each such change or modification is reasonably necessary because of specified local conditions, and the findings must be filed with the State Building Standards Commission before the local changes or modifications can go into effect; and

WHEREAS, pursuant to California Health & Safety Code section 17958.7, the City Council, in a separate companion resolution, has made express findings that said non-administrative amendments, which are equivalent to or more stringent than the 2016 California Green Building Standards Code requirements, are reasonably necessary because of local climatic, topographic, and geologic conditions; and

WHEREAS, as a coastal and major port city, Oakland is vulnerable to sea level rise, and human activities releasing greenhouse gases into the atmosphere cause increases in worldwide average temperature, which contribute to melting of glaciers and thermal expansion of ocean water, resulting in rising sea levels; and

WHEREAS, disadvantaged, low income, minority, and vulnerable populations in Oakland, particularly in the flatlands, experience increased levels of air pollution caused by vehicle emissions and suffer from poorer health outcomes due to that exposure as compared with the rest of the population, and are particularly at risk of experiencing adverse impacts of rising sea levels; and

WHEREAS, Oakland is already experiencing the repercussions of excessive GHG emissions as rising sea levels threaten the City's shoreline and infrastructure, have caused significant erosion and increased impacts to infrastructure during extreme tides, and have caused the City to expend funds to modify the infrastructure system; and

WHEREAS, use of zero-emission electric vehicles benefits the health, welfare, and resiliency of Oakland and its residents due to reduced dependence of fossil fuels, reduced air pollution, reduced GHG emissions, and an increase in private transportation funding that can "cycle back" into the Oakland community; and

WHEREAS, in recent years, electric vehicle ownership and use have become increasingly common in the Bay Area and in Oakland particularly, with many residents, visitors, and employees recognizing the environmental benefits and lifetime financial savings of driving electric vehicles; and

WHEREAS, electric vehicles depend upon convenient access to charging, and the ability to serve electric vehicles in existing buildings is commonly limited by the electrical system capacity of the building; and

WHEREAS, the most cost-effective time to prepare building infrastructure for electric vehicle charging is during initial construction or during major alterations that include electric service upgrades; and

WHEREAS, upgrading buildings after construction to service electric vehicles can result in costs up to three times the cost of installing "PEV-Ready" infrastructure at the time of initial construction or during certain major alterations; and

WHEREAS, the proposed Ordinance is exempt from the California Environmental Quality Act pursuant to CEQA Guidelines sections 15378, 15061(b)(3) (General Rule), 15301 (Existing Facilities), 15303 (New Construction or Conversion of Small Structures), and 15183 (Projects Consistent with a Community Plan, General Plan, or Zoning). Each of the foregoing provides a separate and independent basis for CEQA compliance and, when viewed collectively, provides an overall basis for CEQA compliance; and

WHEREAS, after a duly noticed public meeting on November 15, 2016, the Community and Economic Development Committee voted to recommend the proposal to the City Council; and

WHEREAS, the City Council held a duly noticed public hearing on November 29, 2016, to consider the proposed amendments and all interested parties were provided an ample opportunity to participate in said hearing and express their views; and

WHEREAS, based on all written and oral reports and presentations to Council, including the Agenda Report and each of the Attachments thereto, the City Council finds and determines that the proposed local amendments to Sections 4.106.4 and 5.106.5.3 of the California Green Building Standards Code set forth herein are (1) reasonably necessary because of local climatic, geological, and topographic conditions, and (2) cost effective and will result in the diminution of lifetime GHG emissions as those who live, work, and visit in Oakland are able to switch from conventional to electric vehicles; and

NOW, THEREFORE, THE COUNCIL OF THE CITY OF THE OAKLAND DOES ORDAIN AS FOLLOWS:

SECTION 1. Recitals. The City Council finds and determines the preceding recitals to be true and correct and an integral part of the Council's decision, and hereby adopts and incorporates them into this Ordinance.

SECTION 2. California Environmental Quality Act. The City Council independently finds and determines that this action is exempt from the California Environmental Quality Act pursuant to CEQA Guidelines sections 15378, 15061(b)(3) (General Rule), 15301 (Existing Facilities), 15303 (New Construction or Conversion of Small Structures), and 15183 (Projects Consistent with a Community Plan, General Plan, or Zoning), each of which provides a separate and independent basis for CEQA clearance and when viewed collectively provide an overall basis for CEQA clearance. The Environmental Review Officer or designee shall file a Notice of Exemption with the appropriate agencies.

SECTION 3. Purpose and Intent. It is the purpose and intent of this Ordinance to expressly enact local amendments to Sections 4.106.4 and 5.106.5.3 of the 2016 California Green Building Standards Code to include increased requirements for electric vehicle readiness in both multifamily and nonresidential new construction, consistent with and exceeding the 2016 California Green Building Standards Code requirements, in order to preserve the public peace, health, safety, and general welfare of the citizens and residents of, and travelers through, the City of Oakland, as authorized by the California Health & Safety Code.

SECTION 4. Enactment of Local Amendments to Sections 4.106.4 and 5.106.5.3 of the 2016 California Green Building Standards Code (Amendments to Chapter 15.04 of the Oakland Municipal Code). The local amendments to Sections 4.106.4 and 5.106.5.3 of the 2016 California Green Building Standards Code are hereby enacted. The local amendments being enacted amend Oakland Municipal Code Chapter 15.04 to add Sections 15.04.3.11105 through 15.04.3.11135 as follows (additions are shown in double underline and deletions are shown as ~~strikethrough~~):

15.04.3.11105. In Section 4.106.4 of the California Green Building Standards Code, delete paragraph 2 under "Exemptions" in its entirety and replace with the following:

Exemptions

2. Where there is evidence substantiating that meeting the requirements will alter the local utility infrastructure design requirements on the utility side of the meter so as to increase the utility side cost to the homeowner or the developer by more than $400.00 per dwelling unit and $400.00 per parking space. In such cases, buildings subject to Section 4.106 shall maximize the quantity of EV charging infrastructure, without exceeding the limit above. Cost per parking space shall be determined by dividing total cost by total number of EV and non-EV parking spaces.

15.04.3.11110. In Section 4.106.4.2 of the California Green Building Standards Code, delete subparagraph 4.106.4.2 in its entirety and replace with the following:

4.106.4.2 New multifamily dwellings.

Where 3 or more multifamily dwellings are constructed on a site, install at least the following levels of PEV infrastructure. All EV charging electric infrastructure and EVSE (when installed) shall be in accordance with the *California Electrical Code.*

	Full Circuit	**Inaccessible Raceway Installed**	**Electric Panel Capacity**
Greater than 20 parking spaces	10 percent of parking spaces (rounded up)	Remaining 90 percent of parking spaces	Sufficient to supply 20 percent of spaces
16-20 or more	2 parking spaces	2 parking spaces	Sufficient to supply 4

parking spaces			parking spaces
11-15 parking spaces	2 parking spaces	1 parking spaces	Sufficient to supply 3 parking spaces
2-10 parking spaces	2 parking spaces	-	Sufficient to supply 2 parking spaces
1 parking space	1 parking space	-	Sufficient to supply 1 parking space

15.04.3.1115. [Intentionally omitted.]

15.04.3.11120. In Section 4.106.4.2 of the California Green Building Standards Code, delete subparagraphs numbered 4.106.4.2.3, 4.106.4.2.4, 4.106.4.2.5 and 4.106.5.2.6 in their entirety and replace with the following:

4.106.4.2.3 Full circuit.

Required full circuits shall be installed with 40-Amp 208/240-Volt capacity including raceway, electrical panel capacity, overprotection devices, wire and termination point such as a receptacle at the time of construction. The termination point shall be in close proximity to the proposed EV charger location. Where a single EV parking space is required, the raceway shall not be less than trade size 1 (nominal 1-inch inside diameter).

4.106.4.2.4 Inaccessible raceway.

Construction documents shall indicate wiring schematics, raceway methods, the raceway termination point and proposed location of future EV spaces and EV chargers. Raceways and related components that are planned to be installed underground, enclosed, inaccessible or in concealed areas and spaces shall be installed at the time of original construction.

4.106.4.2.5 Electrical Panel Capacity.

Electrical panels shall be installed with capacity to support one 40-Amp 208/240-Volt circuit for each parking space specified in 4.106.4.2 under "Electrical Panel Capacity". Construction documents shall verify that the electrical panel service capacity and electrical system, including any on-site distribution transformer(s), have sufficient capacity to simultaneously charge all EVs at all required EV spaces at 40-Amps.

Note: Panel capacity to install full circuits at the time of original construction as well as capacity to support future addition of additional circuits shall count towards satisfying this requirement. This requirement does not preclude building owners from allocating the required capacity to increase the number of EVCS and provide less than 40-Amp per vehicle.

4.106.4.2.6 Identification.

The service panel or subpanel circuit directory shall identify the overcurrent protective device space(s) reserved for future EV charging as "EV READY" for full circuits and otherwise "EV CAPABLE". The raceway termination location shall be permanently and visibly marked as "EV READY" for full circuits and otherwise "EV CAPABLE".

Notes:

1. The California Department of Transportation adopts and publishes the "California Manual on Uniform Traffic Control Devices (California MUTCD)" to provide uniform standards and specifications for all official traffic control devices in California. Zero Emission Vehicle Signs and Pavement Markings can be found in the New Policies & Directives Number 13-01. Website: http://www.dot.ca.gov/trafficops/policy/13-01.pdf.
2. See Vehicle Code Section 22511 for EV charging space signage in off-street parking facilities and for use of EV charging spaces.
3. The Governor's Office of Planning and Research (OPR) published a "Zero-Emission Vehicle Community Readiness Guidebook" which provides helpful information for local government, residents and businesses. Website: https://www.opr.ca.gov/docs/ZEV_Guidebook.pdf.

15.04.3.11125. In Section 4.106.4.2 of the California Green Building Standards Code, add new subsection 4.106.4.2.7:

4.106.4.2.7 Chapter 11B Accessible EVCS requirements.

Construction documents shall indicate how many accessible EVCS would be required under Title 24 Chapter 11B Table 11B-228.3.2.1, if applicable, in order to convert all EV capable and EV ready spaces required under 4.106 to EVCS. Construction documents shall also demonstrate that the facility is designed so that compliance with accessibility standards including 11B-812.5 accessible routes will be feasible for the required accessible EVCS at the time of EVCS installation. Surface slope for any area designated for accessible EVCS shall meet slope requirements in section 11B-812.3 at the time of original building construction and vertical clearance requirements in Section 11B-812-4.

Note: Section 11B-812 of the 2016 California Building Code requires that a facility providing EVCS for public and common use also provide one or more accessible EVCS as specified in Table 11B-228.3.2.1. Chapter 11B applies to certain facilities including but not limited to public accommodations and publicly funded housing (see section 1.9 of Part 2 of the California Building Code). Section 11B-812.4 requires that "Parking spaces, access aisles and vehicular routes serving them shall provide a vertical clearance of 98 inches (2489 mm) minimum." Section 11B-812.3 requires that parking spaces and access aisles meet maximum slope requirements of 1 unit vertical in 48 units horizontal (2.083 percent slope) in any direction at the time of new building construction or renovation. Section 11B-812.5 contains accessible route requirements. Section 4.106.4.2.7 requires that developers meet certain aspects of accessibility requirements at the time of new construction.

15.04.3.11130. In Section 5.106.5.3 of the California Green Building Standards Code, delete subparagraphs 5.106.5.3, 5.106.5.3.1, 5.106.5.3.2, 5.106.5.3.3 and 5.106.5.3.4 in their entirety and replace with the following:

SECTION 5.106.5.3

SITE DEVELOPMENT

5.106.5.3 Electric vehicle (EV) charging. Construction shall include EV charging electric infrastructure as specified in this section to facilitate future installation of EVSE. All EV charging electric infrastructure and EVSE (when installed) shall be in accordance with the *California Electrical Code.*

	Full Circuit	**Inaccessible Raceway Installed**	**Electric Panel Capacity**
Greater than 20 parking spaces	10 percent of parking spaces (rounded up)	10 percent of parking spaces (rounded up)	Sufficient to supply 20 percent of parking spaces
16-20 or more parking spaces	2 parking spaces	2 parking spaces	Sufficient to supply 4 parking spaces
11-15 parking spaces	2 parking spaces	1 parking spaces	Sufficient to supply 3 parking spaces
2-10 parking spaces	2 parking spaces	-	Sufficient to supply 2 parking spaces
1 parking space	1 parking space	-	Sufficient to supply 1 parking space

Exceptions: On a case-by-case basis where the local enforcing agency has determined EV charging and infrastructure is not feasible based upon one or more of the following conditions:

1. Where there is insufficient electrical supply.
2. Where there is evidence substantiating that meeting the requirements will alter the local utility infrastructure design requirements on the utility side of the meter so as to increase the utility side cost to the developer by more than $400.00 per parking space. In such cases, buildings subject to Section 5.106.5.3 shall maximize the quantity of EV infrastructure, without exceeding the limit above. Cost shall be determined by dividing total cost by total number of EV and non-EV parking spaces.

5.106.5.3.1 Full circuit.
Required full circuits shall be installed with 40-Amp 208/240-Volt capacity including raceway, electrical panel capacity, overprotection devices, wire and termination point such as a receptacle at the time of construction. The termination point shall be in close proximity to the proposed EV charger location. Where a single EV parking space is required, the raceway shall not be less than trade size 1 (nominal 1-inch inside diameter).

5.106.5.3.2 Inaccessible raceway.
Construction documents shall indicate wiring schematics, raceway methods, the raceway termination point and proposed location of future EV spaces and EV chargers. Raceways and related components that are planned to be installed underground, enclosed, inaccessible or in concealed areas and spaces shall be installed at the time of original construction.

5.106.5.3.3 Electrical Panel Capacity.
Electrical panels shall be installed with capacity to support one 40-Amp 208/240-Volt circuit for each parking space specified in 5.106.5.3 under "Electrical Panel Capacity". Construction documents shall verify that the electrical panel service capacity and electrical system, including any on-site distribution transformer(s), have sufficient capacity to simultaneously charge all EVs at all required EV spaces at 40-Amps.

Note: Panel capacity to install full circuits at the time of original construction as well as capacity to support future addition of additional circuits shall count towards satisfying this requirement. This requirement does not preclude building owners from allocating the required capacity to increase the number of EVCS and provide less than 40-Amp per vehicle.

5.106.5.3.4 Identification.
The service panel or subpanel circuit directory shall identify the overcurrent protective device space(s) reserved for future EV charging as "EV READY" for full circuits and otherwise "EV CAPABLE". The raceway termination location shall be permanently and visibly marked as "EV READY" for full circuits and otherwise "EV CAPABLE".

15.04.3.11135. In Section 5.106.5.3 of the California Green Building Standards Code, add new subsection 5.106.5.3.6:

5.106.5.3.6 Chapter 11B Accessible EVCS requirements.

Construction documents shall indicate how many accessible EVCS would be required under Title 24 Chapter 11B Table 11B-228.3.2.1, if applicable, in order to convert all EV capable and EV ready spaces required under 5.106.5.3 to EVCS. Construction documents shall also demonstrate that the facility is designed so that compliance with accessibility standards including 11B-812.5 accessible routes will be feasible for the required accessible EVCS at the time of EVCS installation. Surface slope for any area designated for accessible EVCS shall meet slope requirements in section 11B-812.3 at the time of original building construction and vertical clearance requirements in Section 11B-812.4.

Note: Section 11B-812 of the 2016 California Building Code requires that a facility providing EVCS for public and common use also provide one or more accessible EVCS as specified in Table 11B-228.3.2.1. Chapter 11B applies to certain facilities including but not limited to public accommodations and publicly funded housing (see section 1.9 of Part 2 of the California Building Code). Section 11B-812.4 requires that "Parking spaces, access aisles and vehicular routes serving them shall provide a vertical clearance of 98 inches (2489 mm) minimum." Section 11B-812.3 requires that parking spaces and access aisles meet maximum slope requirements of 1 unit vertical in 48 units horizontal (2.083 percent slope) in any direction at the time of new building construction or renovation. Section 11B-812.5 contains accessible route requirements. Section 5.106.5.3.5 requires that developers meet certain aspects of accessibility requirements at the time of new construction.

SECTION 5. Severability. The provisions of this Ordinance are severable, and if any clause, sentence, paragraph, provision, or part of this Ordinance, or the application of this Ordinance to any person, is held to be invalid or preempted by state or federal law, such holding shall not impair or invalidate the remainder of this Ordinance. If any provision of this Ordinance is held to be inapplicable, the provisions of this Ordinance shall nonetheless continue to apply with respect to all other covered development projects and applicants. It is hereby declared to be the legislative intent of the City Council that this Ordinance would have been adopted had such provisions not been included or such persons or circumstances been expressly excluded from its coverage.

SECTION 6. Effective and Operative Dates. This Ordinance shall become effective on and after its adoption by sufficient affirmative votes of the Council of the City of Oakland, as provided in the Charter of the City of Oakland, Section 216. This Ordinance shall take effect and be in full force on and after January 1, 2017. The Ordinance shall not apply to building/construction related permits already issued and not yet expired.

SECTION 7. Directions to the Building Official. Upon final passage of this Ordinance, the Building Official is hereby directed to transmit this Ordinance, along with the companion Resolution, to the State Building Standards Commission before January 1, 2017 pursuant to the applicable provisions of State law.

IN COUNCIL, OAKLAND, CALIFORNIA, ______________________________

PASSED BY THE FOLLOWING VOTE:

AYES- BROOKS, CAMPBELL WASHINGTON, GALLO, GUILLEN, KALB, KAPLAN, REID, AND PRESIDENT GIBSON MCELHANEY

NOES-

ABSENT-

ABSTENTION-

ATTEST: ______________________________
LaTonda Simmons
City Clerk and Clerk of the Council
of the City of Oakland, California

DATE OF ATTESTATION: ______________________________

Exhibit A-1

a. The City of Oakland is located in Climate Zone 3, which is characterized by periods of extremely hot, dry weather during the summer and fall months. During these months, emissions generated within or transported to the Bay Area can combine with abundant sunshine to create conditions conducive to the formation of pollutants, such as ozone and secondary particulates, such as nitrates and sulfates. During the winter, Oakland frequently experiences cold days with temperature inversions that trap certain air pollutants near the ground and exacerbate conditions leading to respiratory disease and other health risks. These local features contribute to the Bay Area's status as a "nonattainment area" under the federal Clean Air Act for ozone and particulate matter.

   The City of Oakland is located on the east side of San Francisco Bay. About two-thirds of Oakland is within a flat alluvial plain while the other third is located in the foothills of the East Bay Hill range. It is also a major port city and the regional transportation hub for the East Bay.

   Most Oakland residents have experienced the effects of poor air quality at one time or another. While the meteorology is generally favorable due to marine air traveling through the Golden Gate, the Oakland area is often considered a source for regional pollutants that contribute to elevated concentration in downward communities, due to its urban density and conglomeration of freeways in addition to the geographical and meteorological conditions described above. Personal vehicles are a major source of this pollution. Resident populations in West and East Oakland have been the subject of many recent public health studies related to industry, multiple freeways, diesel trucks and port operations. Most of these studies have concluded that there is a serious health risk due to poor air quality including respiratory problems such as asthma, heart ailments, suppressed resistance to disease, infant mortality and finally reduced life span. Oakland's geographic location, infrastructure, and many disadvantaged communities in the flatlands make it especially vulnerable to the climatic affects.

b. In June 2006, ICLEI – Local Governments for Sustainability in partnership with the Alameda County Waste Management Authority & Recycling Board (StopWaste.Org) and the Alameda County Conference of Mayors launched the Alameda County Protection Project. The City of Oakland committed to the project and embarked on an ongoing, coordinated effort to reduce the emissions that cause global warming, improve air quality, reduce waste, cut energy use and save money. In December 2012, Oakland City Council adopted an Energy and Climate Action Plan (ECAP) that committed the city to reducing community-wide greenhouse gas (GHG) emissions by 36% below 2005 levels by 2020, on the path to reducing GHG emissions by 83% below 2005 levels by 2050. While climate change is a global problem influenced by an array of interrelated factors, climate change is also a local problem with serious impacts foreseen for California, the Bay Area and City of Oakland. Local impacts include:

   i. **Sea level rise:** Climate change is already affecting California and the Bay Area communities. In the last century, the San Francisco Bay water levels have risen 8 inches.[1] By 2100, they are likely to rise an additional 36 inches.[2] Sea levels offshore of Oakland are expected to rise between 11 and 24 inches by mid-century, and 36 to 66 inches by 2100. As a Bayfront city with an active commercial shipping seaport, international airport, and many communities at low elevations, the City of Oakland has long been vulnerable to flooding. Rising Bay waters already affect Oakland with periodic coastal flooding of low-lying shorelines, loss of valuable saltwater marshes, and salt water impacts to Oakland's wastewater treatment systems.[3] [4] [5] When heavy rains are coupled with higher-than-normal tides, tide levels can slow the drainage of runoff into San Francisco Bay, increasing the potential for urban stormwater flooding.

Rising sea levels represent new challenges to Oakland's future. As Bay water levels rise, the flooding frequency and areal extent will increase. Areas once considered to be outside of the floodplain will begin to experience periodic coastal and/or urban flooding. Sections of Oakland's shoreline built on Bay fill, such as the Port of Oakland and the Oakland International Airport, are increasingly vulnerable, because they are chronically subsiding and are at a higher risk of liquefaction during seismic events.

Modeling by the San Francisco Bay Conservation and Development Commission (SFBCDC) shows that under medium to medium-high greenhouse gas emissions scenarios, sections of Interstate 880, much of the Oakland International Airport (72-93%), portions of West Oakland, EBMUD's water treatment plant, areas around Lake Merritt, much of Oakland's shoreline, and areas near the coliseum would be underwater. The modeling also shows a drastic impact to the movement of goods from the Port of Oakland, the third largest port in California. Further modeling by Researcher Matt Heberger of The Pacific Institute estimates that with a 55-inch sea level rise, the area in Oakland flooded by the unimpeded 100-year tide would be 8.6 square miles – over 15% of Oakland's land area.[6]

The most likely sea level rise projections, based on a moderate level of global greenhouse gas emissions and continued accelerating land ice melt patterns,

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[1] National Oceanic and Atmospheric Administration (NOAA) Center for Operational Oceanographic Products and Services (CO-OPS). NOAA Sea-Level Trends 1987-2015. Accessed: https://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?stnid=9414290

[2] National Research Council (NRC). 2012. *Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future.*

[3] Bay Conservation and Development Commission (BCDC). 2014. *Adapting to Rising Tides Program: Preserving Shoreline Parks in the Face of Climate Change.*

[4] Bay Conservation and Development Commission (BCDC). 2015. *Adapting to Rising Tides. Alameda County Shoreline Assessment.*

[5] Grady, B. 2014. *Sea-Level Rise Threatens Oakland's Sewer System.* Climate Central. June 17, 2014. Accessed:http://www.climatecentral.org/news/sea-level-rise-oakland-sewer-17567

[6] Heberger, Matt. 2009. <http://www.pacinst.org/reports/sea_level_rise/files/Ca_coast_yr2100_flood.html.>

result in temporary coastal flooding from extreme tides, urban and watershed flooding, accelerated loss of marshlands, daily tital inundation, enhanced King Tide flooding, and rising groundwater levels.

Many of Oakland's flatland areas, such as West Oakland, have industrial histories that have contributed to high levels of soil contamination. In these areas, rising groundwater levels will push toxics and ground contamination to the surface, resulting in serious public health concerns for local residents.

ii. **Impacts on water**: Water quality and quantity in Oakland are at risk as a result of changing temperatures. With warmer average temperatures, more winter precipitation will fall in the form of rain instead of snow, shortening the winter snowfall season in the Sierra's and accelerating the rate at which the snowpack melts in the spring. Not only does such snow melt increase the threat for spring flooding, it will decrease the Sierras' capacity as a natural water tower, resulting in decreased water availability for agricultural irrigation, hydro-electric generation and the general needs of a growing population.

The Sierra snow-pack is the origin of the Mokelumne River, the primary source of water for the jurisdictions within Alameda County including the City of Oakland. The East Bay Municipal Utility District (EBMUD) provides water and sewage treatment for Alameda County customers. In 2008, EBMUD staff conducted a study on climate change impacts on water quality and water supply for the EBMUD service area, with many of its findings relevant to the City of Oakland. That study found the Sacramento/San Joaquin River Delta and its aging levee system exceptionally susceptible to storm damage. Although EBMUD does not divert its water supply from the delta, failure of the delta's levees could result in catastrophic damage to EBMUD's nearby water supply aqueducts, interrupting water deliveries to EBMUD's service area, including Oakland.[7]

Rising water temperatures may affect water quality by promoting algae growth in Lake Merritt, the Estuary, and Oakland's many above ground creeks and marshes, resulting in increased algal by-products such as taste-and-odor compounds[8] and hypoxia.[9]

iii. **Natural disasters:** Climate models predict a 4°F temperature increase in the next 20 to 40 years, with an increase in the number of long dry spells, as well as a 20-30% increase in precipitation in the spring and fall. More frequent and heavier precipitation causes flooding, mudslides and landslides, incurring considerable costs in damages to property, infrastructure and even human life.

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[7] Wallis *et. al.*, EBMUD, 2008. Pp. 74.
[8] Wallis *et. al.*, EBMUD, 2008. Pp. 75.
[9] SFBCDC, 2009. Pp. 78.

As mentioned above, a large portion of Oakland is located in the foothills of the East Bay Hills range and many properties are located on extremely steep slopes. During winters with an extreme storm event or a series of storm events with heavy rainfall, Oakland typically experiences landslides in these areas due to saturated ground-water conditions. Approximately 43 landslides occurred in a single El Niño (extreme wet weather) season.[10]

An increasing number of wildfires, due to continued dry periods and high temperatures, are another expected impact of continued climate change. As indicated in Oakland's Safety Element, wildfires are the most severe fire hazard in Oakland, especially in the hills above the Warren Freeway. Because the Oakland Hills are a fire-dependent ecosystem, there is a severe wildfire every 10 to 20 years when the area's natural vegetation is dry and extremely flammable. Urbanization of Oakland's fire hazard areas has increased the potential for more frequent and severe wildfires with an additional likelihood of severe damage and loss of life. The 1991 fire is notorious for being the most destructive wildfire in California history. Several years of drier-than-average rainy seasons, likely caused in large part by climate change, have left California's forests with millions of dead trees. This phenomenon further exacerbates the risk of wildfire in the Oakland Hills.

iv. **Public health impact:** Warming temperatures and increased precipitation can also encourage mosquito-breeding, thus engendering diseases that come with mosquitoes, such as the West Nile Virus, a disease of growing concern in Oakland and the surrounding region.

Heat waves are also expected to have a major impact on public health and be a determinant factor of mortality. Increased temperatures also pose a risk to human health when coupled with high concentrations of ground-level ozone and other air pollutants, potentially leading to increased rates of asthma and other pulmonary diseases. These impacts may be particularly strong in Oakland's disadvantaged communities, which already experience elevated levels of asthma and other adverse health impacts due to a variety of environmental issues. The incidence of bad air days in California's urban areas has increased, mostly in hot summer days. In the summer of 2006, the Bay Area Air Quality Management District (BAAQMD) registered 11 Spare the Air days for the region and exceeded the California 1-hour standard for ozone (set at 90 ppb) 18 times. As noted above, parts of Oakland are already impacted by poor air quality due to the adjacent port, major highway system, and industry within the city borders.

Impacts on plants and vegetation: Native plants and animals are at risk as temperatures rise and scientists are reporting more species moving to higher

[10] Coe, Jeffrey, Jonathan W. Godt, Dianne Brien, and Nicolas Houdre, 1999. "Map Showing Locations of Damaging Landslides in Alameda County, California, resulting from 1997-98 El Niño Rainstorm."

elevations or more northerly latitudes in response to climate change. This could affect the 31 plant and 20 animal species that are either in danger of extinction or present in very limited numbers and make Oakland their home. On the list of special status animals, there are two mammals, one reptile, fifteen birds, one fish, and one insect. Of these, 14 are federal special status and 19 are state special status creatures. Six threatened plant species in Oakland are state status and 14 plant species are federal status threatened, endangered, or rare plants.

The absence of these native species would allow invasive species of weeds and insects to gain a foothold in these areas and to threaten other native species and their habitat. This change would be particularly devastating to Oakland as wildlife actually composes nearly 20% of Oakland's total land area. Furthermore, these special species and their habitats as they are already struggling to survive in an infill, urban area.

c. The City of Oakland's local climatic, topographic, and geological conditions exacerbate the impacts of global climate change in several ways to make the adoption of advanced PEV Readiness code requirements reasonably necessary:

   i. Rising summer temperatures and increasing urban density and automobile use increase overall air pollution and exacerbate the urban heat island effect, which are harmful for all Oaklanders. Urban heat and air pollution are particularly damaging for children, the sick and elderly, and disadvantaged populations. Eliminating the harmful pollution from conventional vehicles by enabling a switch to electrified transportation will result in a reduction in the criteria air pollutants and ground-level ozone that lead to asthma and other poor health outcomes.

   ii. Burning of fossil fuels has contributed to the global and local hazards of climate change described above. Even in regions where the electric power grid is far "dirtier" than in northern California, such as on the East Coast of the United States where coal is the predominant energy source, electric vehicles result in an overall reduction in greenhouse gas (GHG) emissions due to the efficiency of electric transportation. In Oakland, where the electricity supplied by Pacific Gas and Electric Company (PG&E) is one of the cleanest electricity mixes in the country, electric vehicle use leads to an even more dramatic reduction in GHG emissions as compared to conventional vehicle use. Each PEV will displace 2.6 tons per year of greenhouse gas gases if powered by conventional electricity. As local renewable energy becomes increasingly prevalent, electric vehicle use comes even closer to representing a zero-net-energy form of transportation.

d. Increasing the adoption and use of plug-in electric vehicles (PEVs), including processes to facilitate installation of infrastructure, is a priority strategy identified in the City of Oakland Energy and Climate Action Plan (2012) to reduce greenhouse gas emissions citywide to 36% below 2005 levels by 2020. In addition, use of PEVs benefits the health, welfare and resiliency of the City of Oakland and its residents including reductions in pollutants contributing to ground level ozone, fine particulates, nitrogen oxides and toxic air pollutants.

i. PEVs depend upon convenient access to charging, and the ability to serve electric vehicles in existing buildings is commonly limited by the electrical system capacity and availability of electric circuit in associated parking.

ii. The most cost effective time to prepare building electrical infrastructure for PEV charging is when electric service is installed or upgraded due to construction. This is because workers are already on-site, expensive retrofits involving breaking into structures and pavement can be avoided, electrical panel and utility service upgrade costs are lower, permitting and administrative costs are lower, and it is more cost-effective to include such systems in existing construction financing.

iii. Thus, the proposed local code amendments to provide PEV infrastructure are necessary to address the unique local circumstances identified above.

e. This PEV Readiness code amendment furthers the City of Oakland's efforts to enhance the community's social, economic, and environmental well-being, and to mitigate the efforts of global warming on the City of Oakland's weather, water supply, physical infrastructure, ecological diversity, human health, and economy.