

# ELECTRIFY YOUR BUSINESS

Moving Forward With Electric Vehicles  
A BAY AREA BUSINESS GUIDE



This report is a joint effort of the Business Council on Climate Change (BC3) and the Bay Area Council (BAC) in partnership with EVadvise, a private independent Bay Area electric vehicle charging infrastructure advisory firm.

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## List of Abbreviations

ABAG	Association of Bay Area Governments
ATD	Advanced Technology Demonstration
BEV	Battery Electric Vehicle
CEC	California Energy Commission
DOE	Department of Energy
EV	Electric Vehicle
EREV	Extended Range Electric Vehicle
EVCS	Electric Vehicle Charging Station (same as EVSE)
EVSE	Electric Vehicle Service Equipment (same as EVCS)
GHG	Greenhouse Gas
HOV	High Occupancy Vehicle
ICE	Internal Combustion Engine – gas powered
kWh	kilowatt hour
O&M	Operations and Maintenance costs
PHEV	Plug-in Hybrid Electric Vehicle

## EXECUTIVE SUMMARY

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This guide, *Electrify Your Business*, aims to catalyze the adoption of electric vehicles in the Bay Area by providing business decision makers with a concise guide to understanding the impact of vehicle electrification. The guide targets a broad range of businesses, from major international corporations to small business owners. It presents the costs and business benefits of purchasing electric vehicles (EV) and EV charging infrastructure.

To help you become EV ready, this guide lists key suppliers and support companies, identifies available funding opportunities, and outlines key steps in the installation process of EV charging stations (EVCS). We have included financial and implementation analyses to streamline the decision, justification, and installation process of implementing an EV readiness plan for your fleet, your employees, your customers, or parking lot visitors.

Californians recognize that environmental progress and economic expansion are not mutually exclusive; rather the state can grow its economy while reducing per capita levels of greenhouse gas (GHG) emissions. Californian companies are no different. In the Bay Area, firms are now moving to deploy EV infrastructure, and may experience real advantages, such as:

- Economics & financial savings – reducing operating costs and increasing their bottom line.
- Business growth – attracting new business and fostering job creation.
- Operating stability – minimizing the overall economic impact of global oil market volatility.

Bay Area businesses pay one of the highest prices nationally for gasoline. Companies will directly benefit from the shift away from a petroleum-driven world to one fueled by a domestic mix of cleaner, less-expensive, and more plentiful energy resources.

As the Bay Area is a leader in clean tech adoption, many auto manufacturers have targeted the Bay Area as one of the launch markets for new electric vehicle models. Drivers of electric vehicles—and those who aspire to drive electric vehicles—will be attracted to Bay Area companies and businesses with charging-enabled parking spots or car ports, powered directly by the grid or renewable energy sources.

The time is now for businesses to lead the transformation from petroleum powered vehicles to electric powered vehicles, by becoming EV ready. This guide will help you understand this significant transition, adopt a company EV strategy, and deploy EV charging infrastructure.

## VEHICLE ELECTRIFICATION

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The primary advantage of electric vehicles derives from replacing petroleum fuel-based engines with highly efficient electric motors. In both the industrial and consumer sectors, traditional gasoline powered internal combustion engine (ICE) vehicles are being replaced by new cleaner alternatives, including plug-in electric vehicles (EVs). This shift has the potential to significantly limit greenhouse gas (GHG) emissions and reduce our dependence on fossil fuels for transportation.

Nearly every major automotive manufacturer has announced plans to deliver an electric vehicle model within the next three years (see Appendix B for more details). In addition to several new entrants to the auto industry, a few models are already on the road. To support consumers and fleet operators of electric vehicles, EV charging infrastructure is becoming more available at home, at work, and in public locations.

As a hub of innovation, the Bay Area is in a prime position to drive the deployment of clean vehicles. Consequently, there has been a recent surge in preparation for the deployment of electric vehicles and EV charging infrastructure in municipalities throughout the Bay Area. A few models (the Chevrolet Volt and Nissan LEAF) have already been released in small numbers. The adoption and use of these early models will help accelerate the availability of pure battery electric vehicles (BEVs), plug-in hybrid electric vehicles (PHEVs), extended range electric vehicles (EREVs) and their supporting infrastructure.

### LOWERING CALIFORNIA'S EMISSIONS WITH ELECTRIC VEHICLES

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The transportation sector accounts for roughly 50 percent of criteria pollutants, including

carbon monoxide, carbon dioxide, sulfur dioxide, nitrogen oxides, ozone, and other hydrocarbons released into the atmosphere. Passenger vehicles account for over 25 percent of emissions in the Bay Area<sup>1</sup>. The transportation sector is a primary source of carcinogenic particles released into the atmosphere that increase smog.

Compared to other U.S. states, California's electricity is generated from a relatively clean mix of energy sources, including natural gas, coal, nuclear, hydroelectric, and a growing portion of renewable energies including solar and wind. Taking into account the carbon footprint of the source of electricity, a pure battery electric vehicle (BEV) such as the Zero Emission Nissan LEAF, Tesla Roadster, or Model S, can reduce GHG emissions by as much as 75 percent compared to traditional gasoline powered vehicles<sup>2</sup>. A plug-in hybrid electric vehicle (PHEV) with a 20-mile all electric range could reduce GHG emissions by 60 percent, depending on driving habits<sup>3</sup>.

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<sup>1</sup> "Source Inventory of Bay Area Green House Gas Emissions," Bay Area Air Quality Management District, February 2010, p19.

<sup>2</sup> Ryan W. McCarthy et al, "Taking Charge: Establishing California Leadership in the Plug-In Electric Vehicle Marketplace," California Plug-in Electric Vehicle Collaborative, December 2010, p13.

<sup>3</sup> Ibid, p13.

## U.S. DEPENDENCE ON OIL AND ECONOMIC IMPACT- BY THE NUMBERS

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- The U.S. transportation system consumes 14 million barrels per day<sup>4</sup>.
- Cars and light-duty trucks account for more than 40 percent of total U.S. oil consumption<sup>5</sup>.
- The U.S. driving population is expected to grow from approximately 240 million today to over 300 million people by 2035. This is a significant growth factor for petroleum demand.
- The United States imports more than 60 percent of its petroleum<sup>6</sup>.
- A \$1.00 increase in the price for a barrel of oil takes \$12 million directly out of the U.S. economy each day<sup>7</sup>.
- A \$5.00 increase in the price for a barrel of oil for three months takes \$5 billion out of the US economy<sup>8</sup>.
- When gas prices spiked to over \$4.50 a gallon in 2008, Californians spent \$6.5 billion more on gas than the previous year<sup>9</sup>.

## BAY AREA READINESS PLANS AND GOVERNMENT INCENTIVES

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Many Bay Area cities and towns are already planning and implementing EV deployment strategies. In parallel, businesses such as retail stores, hotels, real estate companies, entertainment and sports complexes, parking

garages, and just about every type of company facility from office building to large manufacturing plants is considering implementing EV readiness plans to promote and support EV demand trends.

Federal, state, regional, and local governments now offer incentives for purchasing electric vehicles and installing EV charging station infrastructure. California's clean vehicle policy has sparked the initial deployment of electrified fleets and mass EV charging station build-outs in government- and publicly-owned properties in municipalities across the state. Schools, airports, ferry stations, and car-share locations are also going electric.

BEVs have access, and PHEVs will have access, to high occupancy vehicle (HOV) lanes.<sup>10</sup> The Department of Energy (DOE), the California Energy Commission (CEC) and the Bay Area Air Quality Management District (BAAQMD) have sponsored financial incentives for Bay Area residents that purchase EVs and live in single family homes. In addition, personal and business federal and state tax incentives are offered to offset the purchase of electric vehicles, their electric vehicle supply equipment (EVSE) , and installation costs. The eligibility period varies for each program, and it is unknown for how long these benefits will continue (see Appendix C for tax credit information).

Finally, in partnership with local vendors and the University of California Institute of Transportation Studies, the Association of Bay Area Governments (ABAG) and the EV Communities Alliance are developing a

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<sup>4</sup> "Electrification Roadmap, Revolutionizing Transportation and Achieving Energy Security," Electrification Coalition, November 2009, p9.

<sup>5</sup> Ibid, p12.

<sup>6</sup> Ryan W. McCarthy et al, p11.

<sup>7</sup> Jason Grumet, as quoted in Nelson Schwartz, "Unrest in Egypt Unsettles Global Markets," New York Times, January 30, 2011.

<sup>8</sup> Ibid.

<sup>9</sup> Ryan W. McCarthy et al, p11.

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<sup>10</sup> White stickers for Pure Battery Electric Vehicles (BEV) will expire in January 2015; stickers (color yet to be determined) for PHEVs will run from January 2012 to 2015 with a limit of 40,000 stickers.

comprehensive EV charging network called the Greater Bay Area EV Corridor Project to provide electric vehicle owners with easy access to charging facilities across the nine-county Bay Area.

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### BAY AREA PROJECTIONS

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Industry and government forecasts suggest a strong clustering of EV adoption in the Bay Area. Using conventional (non plug-in) hybrid ownership as an EV purchaser indicator, it is expected that tens of thousands of new EVs could be purchased here within a few years. Estimates from ABAG and their partners suggest a level of EV penetration of over 60,000 of plug-in vehicles (high estimate) from 2011 to 2013 within the nine-county Bay Area region. Assuming a fifty-fifty split of BEVs and PHEVs, data indicates that EVs supported by the EV Corridor Project alone will save over 225,000 metric tons of CO<sub>2</sub> emissions and over 25 million gallons of petroleum consumption by the end of 2013. Please refer to the Association of Bay Area Governments (ABAG) site for more information.

According to PricewaterhouseCoopers' reports, and other industry data, there will be an influx of thousands, to tens of thousands of Bay Area EV drivers in the next few years.<sup>11</sup> This trend is expected to grow. If the price of gas continues to escalate, it is possible that hundreds of thousands of EVs may arrive to the Bay Area in the next ten years. San Francisco, Oakland, and San Jose (and their counties) have acted quickly to create and implement EV readiness plans, and have already initiated the installation of the first phase of EV charging stations in public locations. All combined, there are plans to

install thousands of EV charging stations in the Bay Area by the end of 2011.

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### A SNAPSHOT OF EV CHARGING INFRASTRUCTURE AWARDS IN THE BAY AREA

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Commercial businesses that own their land, or work closely with their property owners and managers are beginning to deploy EV charging stations. Corporate campuses such as Netflix, SAP, Apple, and Citrix Systems, are installing chargers for private employee use. Public use retailers like McDonalds, Safeway, Costco, and Best Buy, can use chargers to attract new clientele and maintain the existing customer base.

Similarly, numerous municipalities are deploying EV charging infrastructure to lead by example in support of local businesses, multi-tenant dwellings, and public center congregations. Additionally, San Francisco will be the first major U.S. city to deploy a battery swap station for a zero emission electric taxi project.

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<sup>11</sup>Cleantech Revolution: Building Smart Infrastructures," PricewaterhouseCoopers, December 2009.

The table below depicts a snapshot of award grant requests for information purposes only as it does not constitute a commitment to proceed or install equipment at this time.

Project Sponsor	Project Title	TFCA \$ Awarded	County	Project Type
350 Green	(12) Electric Vehicle Charge Spots and (6) DC Fast Chargers	\$99,996	SF, SM, SC	Alt Fuel
Better Place	(30) Electric Vehicle Charge Points	\$30,000	Santa Clara	Alt Fuel
Better Place	Zero Emission Electric Taxi Project	\$470,000	Santa Clara	ATD
Citrix	(6) Charging Points	\$12,000	Santa Clara	Alt Fuel
City & County of San Francisco	(60) Electric Vehicle Charge Spots	\$100,000	San Francisco	Alt Fuel
City CarShare	New Plug In 10kwh conversion	\$27,600	San Francisco	ATD
City of Palo Alto	(6) Electric Vehicle Charge Spots	\$12,000	Santa Clara	Alt Fuel
City of Redwood	(14) Charge Spots	\$20,000	San Mateo	Alt Fuel
County of Alameda	(15) Hybrid Vehicles & (4) NEV	\$43,816	Alameda	Alt Fuel
County of Alameda	(40) Electric Vehicle Charge Points	\$84,960	Alameda	Alt Fuel
County of Santa Clara	(40) Electric Vehicle Charge Points	\$85,720	Santa Clara	Alt Fuel
County of Sonoma	(30) Plug-in Hybrid Electric Vehicle Conversions & Electric Vehicle Charge Points	\$21,870	Sonoma	Alt Fuel
McDonalds	(54) Electric Vehicle Charging Spots	\$98,004	ALA, CC	Alt Fuel
Pacific Gas & Electric	(46) E-PTO Hybrid Utility Trucks Demonstration	\$403,803	Contra Costa	ATD
ProPark	(20) Charging stations	\$42,730	ALA, SF	Alt Fuel
<b>Total Award</b>		<b>\$1,552,499</b>		

Table 1: SUMMARY OF EV PROJECTS AWARDED MONEY THROUGH TRANSPORTATION FUND FOR CLEAN AIR (TFCA) REGIONAL FUND.

Table supplied by BAAQMD. Funding sources may include BAAQMD, DOE, CEC and MTC.

# THE BUSINESS CASE FOR ELECTRIC VEHICLES

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There are significant economic benefits to be gained from switching to electric vehicles. Electric vehicle-miles traveled are far less expensive than internal combustion engine vehicle-miles traveled. The total cost of vehicle maintenance and insurance is also less for electric vehicles. For these reasons, more and more drivers are making the decision to purchase EVs.

Lower ongoing maintenance costs from fewer moving parts and fluid replacement makes owning an EV cheaper to operate over the life of the vehicle. A Berkeley study conducted in 2008 compared the average cost of an ICE vehicle against an EV after 100,000 miles on the road. For a comparable \$25,000 electric vs. ICE vehicle, the maintenance savings could range from \$2,500–\$5,000 for the EV over the 100,000-mile life of the vehicle<sup>12</sup>. In addition, insurance costs for EVs are expected to be anywhere from \$1,000–\$2,000 less than those of an ICE<sup>13</sup>. While these savings are important to consumers, it is even more significant for fleet operators.

Today, the price of an EV is considerably more than a comparable ICE model with similar features. This is mostly due to high battery costs and lower volume production. Government incentives will help stimulate demand and supply by reducing upfront costs. Incentives may continue until economies of scale are reached and the production costs decrease. This in turn should cause the purchase price to decrease. (See Appendix C for information on government incentives). There are many different published estimates as to when price parity for EVs and ICEs will occur. Some say it

could take as little as three years, while others say as many as ten years. This variation is a result of the uncertainty in variables such as volume production milestones, costs for battery materials, battery technology breakthroughs, and the impact of overseas global suppliers entering the supply chain among others.

## VEHICLE COST COMPARISONS

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As noted previously, while the sticker price of EVs entering the market may look high initially, the existing federal and state tax incentives (for those who qualify) drop the price significantly. For example, the Nissan LEAF's base manufacturer selected retail price (MSRP) value is \$32,780, but the \$7,500 federal tax incentive reduces the cost to \$25,280. If you live in the state of California, an additional \$5,000 incentive may bring that down to \$20,280 if you qualify.<sup>14</sup> Compare that to the base MSRPs of a 2011 Prius (51 freeway and 48 city miles per gallon) at \$26,850, or a 2011 Ford Taurus (28 freeway and 18 city miles per gallon) at \$25,170.

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<sup>12</sup> Matt Draper et al. "Economic Impact of Electric Vehicle Adoption in the United States: Technical Brief v. 1." UC Berkeley Global Venture Lab, November 2008.

<sup>13</sup> Ibid.

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<sup>14</sup>For information on the EV tax incentives specific to your state, please see <http://www.pluginamerica.org/why-plug-vehicles/state-federal-incentives>.

	MSRP	Cost after Federal credit	Cost after CA and Federal Credit	Monthly Lease	Lease Down payment
<b>Nissan Leaf (99 mpg) – BEV</b>	\$32,780	\$25,280	\$20,280	\$349*	\$2,000
<b>Chevy Volt (96 mpg) – PHEV</b>	\$40,280	\$32,780	\$32,780	\$350*	\$2,500
<b>2011 Toyota Prius (51/48 mpg) – Hybrid</b>	\$26,850	\$26,850	\$26,850	\$562**	\$2,000
<b>2011 Ford Taurus (28/18 mpg) - ICE</b>	\$25,170	\$25,170	\$25,170	\$511**	\$2,000

\* Published lease price. Actual prices may vary.

\*\* Lease prices calculated using residual value of \$10,000, 15,000 miles driven/year for 36 month period

Table 2: PURCHASING PRICE OF BEV, PHEV, HYBRID, AND ICE AFTER GOVERNMENT INCENTIVES

### COST OF OPERATION: ELECTRIC VEHICLE VERSUS INTERNAL COMBUSTION ENGINE VEHICLE

It is important to recognize that **electricity rates vary** depending on rate structures, such as tiered or time of use plans. Most importantly, different rates apply during peak and off-peak hours. Electricity rates average about eight cents per kWh across the nation, but in California rates can be as low as 5 cents during off-peak charging at home with a separate EV-designated PG&E meter, and as high as 40–52 cents per kWh during peak hours with a tiered rate residential structure.

According to a Plug-In Electric Vehicle Collaborative study, “Taking Charge” (which assumes \$0.10/kWh and \$3.00 per gallon of gas)

the cost to drive 100 miles is as follows:

- BEV will cost \$2.50.
- PHEV will cost \$5.75.
- Conventional hybrid vehicle will cost \$6.50.
- Traditional gasoline vehicle will cost \$11.00.

At \$3.00 per gallon, the operating cost of a highly efficient ICE vehicle (30 miles per gallon) is 10 cents per mile. As of early 2011, prices in the Bay Area are \$3.85-\$4.00 per gallon for regular grade and the price of gasoline is expected to rise. Many predict it will go above \$4.00 per gallon and possibly even \$5.00 making the cost per mile even higher.

<b>COST OF OPERATION COMPARISON</b>	<b>Internal Combustion (ICE)</b> TYPE: 5 Passenger RANGE: 400 mi. with 16 Gallon tank GASOLINE: \$3.50 Gallon FUEL COST/TANK: \$56.00	<b>Battery Electric Vehicle (BEV)</b> TYPE: Nissan LEAF Approx; 1kWh = 4 mi. of driving distance RANGE: 96 mi. with 24kWh battery ELECTRICITY: \$0.056 / kWh (off-peak PG&E summer rate with "E9B" Plan) eFUEL COST: \$5.60 / 400 mi.	<b>Based on Usage Pattern Below</b>  TERM: 6 Yrs. USAGE: 18,000 mi. / Year TOTAL Mi.: 108,000
<b>FUEL</b>	<b>Gasoline (ICE)</b>	<b>Electric (BEV)</b>	<b>FUEL COST SAVINGS</b>
<b>Cost (Per Mile)</b>	<b>\$0.140</b> Average 25 MPG with Regular Gasoline Cost per mile is: \$56/400 = \$0.14	<b>\$0.014</b> Electricity cost of 5.6 cents per kWh 1kWh=4 Mi. of driving distance	<b>10X less</b>
<b>LIFETIME COSTS (6 yrs./108,000 mi.)</b>	\$15,120	\$1,512	<b>\$13,608 savings in 6 Yrs.</b>
<b>ON-GOING MAINTENANCE</b>	<b>Gasoline (ICE)</b>	<b>Electric (BEV)</b>	<b>MAINTENANCE SAVINGS</b>
<b>Est. Routine service and engine wear Lifetime Costs (6 Yrs./108,000mi.)</b>	~\$6,000	~\$2,000	<b>\$4,000 savings in 6 Yrs.</b>
<b>OWNERSHIP</b>	<b>Gasoline (ICE)</b>	<b>Electric (BEV)</b>	<b>OWNERSHIP SAVINGS</b>
<b>Est. Insurance (6 Yrs./108,000mi.)</b>	~\$6,000	~\$5,000	<b>\$1,000 savings in 6 Yrs.</b>
<b>Est. DMV Smog (6 Yrs./108,000)</b>	~\$400 "ballpark" est	~\$0	<b>\$400 savings in 6 Yrs.</b>
<b>TOTALS</b>	~\$27,520	~\$8,512	<b>~\$19,008/6 Yrs.</b>

Table 3: COST OF OPERATION COMPARISON: ICE vs. BEV

## DIRECT MONETARY BENEFITS OF IMPLEMENTING EV CHARGING STATION INFRASTRUCTURE

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In addition to these cost advantages, there are several other monetary benefits and incentives to motivate a business to deploy electric vehicle charging infrastructure including:

- **EV charging use fees:** A new opportunity to collect EV charging user fees, for profit, or to offset costs for electricity, installation, warranty, maintenance, and support costs for electric vehicle supply equipment (EVSE).
- **Collect paid-for-parking fees:** Collect parking fees in EV locations that presently offer free all day or hourly parking to increase public parking revenues from EV drivers.
- **Value of avoiding carbon emissions:** Create the opportunity to reduce GHG emissions and possibly trade carbon credits or offset carbon taxes in the future.
- **Capitalize on government grants:** Offset or eliminate the majority of implementation costs before the incentives expire.
- **Additional tax deductions:** If you qualify, there are direct federal and state tax credits for businesses and individuals (See Appendix C).

## INDIRECT MONETARY BENEFITS OF DEPLOYING EV CHARGING STATION INFRASTRUCTURE

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Installing EV charging stations yields several indirect monetary benefits that, while more difficult to measure, may have a significant impact on business development and strategy, from enhancing the company image to attracting and retaining employees.

- **Attract customers / vendors / strategic partners:** The parking lot is your company's first opportunity to make an impression. Without even entering the building, the display of EV charging stations in your parking lots makes a statement to visitors that your company is progressive and innovative.
- **Socially responsible branding:** Marquee EV parking stalls and decals, auto wraps, or other visual techniques exhibited on internal electric fleet vehicles become a rolling billboard for a company's commitment to sustainability.
- **Recruiting and retaining top talent:** Bright minds are looking to work for and with innovative companies that make an effort to support their professional and personal lives<sup>15</sup>.
- **Supporting the plug-in driving community:** Many early EV owners may not own their own garage or have access to dedicated parking in a condo or apartment complex. You can show your commitment to the community by serving as a charging hub for the plug-in driving community.
- **Positive employee and community perception:** Implementing an EV program is an opportunity to show that you support public health goals by doing your part to reduce tailpipe emissions.
- **Increased employee productivity:** Electric vehicle drivers are eligible for high occupancy vehicle (HOV) lane privileges. HOV access results in shorter commute times, and

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<sup>15</sup> Employers providing workplace charging to its employees may be considered as a benefit and would be subject to IRS tax laws.

potentially less stressed and happier employees.<sup>16</sup>

- **Possible contribution to Leadership in Energy and Environmental Design (LEED) points for green building initiatives:** Up to three LEED points are available under the New Construction Sustainable Sites Credit #4.3 “Alternative Transportation, Low-Emitting, and Fuel-Efficient Vehicles”.<sup>17</sup>

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<sup>16</sup> White stickers for Pure Battery Electric Vehicles (BEV) will expire in January 2015; stickers (color yet to be determined) for PHEVs will run from January 2012 to 2015. Use of these lanes by single drivers requires a “Clean Air Vehicle” sticker issued by the California Department of Motor Vehicles.

<sup>17</sup> One LEED point is awarded if alternative fuel vehicle refueling stations are provided for 3 percent of the total vehicle parking capacity of the site. Alternatively, LEED points are awarded if 5 percent of the total parking lot capacity is designated preferred parking for electric vehicles or if 3 percent of full-time occupants are provided electric vehicles and preferred parking for those vehicles.

	Company exec.	Property mgmt./ owner	H R	Retail GM	sustainability / CSR leader	Individual or Fleet Driver	Marketing and PR	Fleet Operator
<b>Direct Monetary:</b>								
Decreases operational costs	•			•	•	•		
Fed and State Tax Credits	•	•				•		
Government Grants	•	•						
Future carbon credits	•	•		•	•			
Possible increased profits							•	
Reduced fuel costs								•
<b>Employee Satisfaction</b>								
Decreased employee turnover	•		•					
Attract and retain talent	•		•					
Unique company benefit	•		•					
Enriched driving experience						•		•
<b>Branding Values</b>								
Sustainability initiative	•				•			
Improved, cool image	•		•	•	•	•	•	•
Possible increased profits	•			•	•		•	
LEED points	•	•			•			
Advertising opportunities						•	•	•
<b>Other advantages</b>								
HOV lanes-less commute time	•		•			•		•
GHG emissions reduction	•	•	•	•	•	•	•	•
Public health benefits	•	•	•	•	•	•	•	•
Energy independence	•	•	•	•	•	•	•	•

Table 4: BENEFITS TO STAKEHOLDERS

## DEPLOYING EV CHARGING STATIONS

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While homeowner garages are expected to be the primary charging point for EV drivers, public charging will be necessary to extend their vehicle trip or commute range. Moreover, public chargers at workplace, retail, and municipal locations may be the primary charging point for people living in multi-dwelling units. Without the deployment of a large number of residential, public, and business EVSEs, the demand and adoption rate for electric vehicles may be limited to technology enthusiasts and environmentalists in the short term. Parallel growth in both EVs and EVSEs is vital for widespread EV adoption.

Many publicly available reports refer to EV **stakeholders** as those directly involved in EVs and EV charging stations. The term stakeholders includes: utilities, users, governments, vendors, installers, and station hosts. **Hosts** are those who either own or operate EV charging stations available to customers, fleets, or employees.

In addition to the cross section of public and private sector groups who want to own and manage their EV charging stations, there are some vendors and independent third party hosting companies that can be

contracted to deploy the entire EV infrastructure in exchange for a monthly subscription, leasing, or contracting fee.

Various business models exist that trade off up-front capital expenditures with ongoing operating expenses. For investors who want EVSE availability for their users, but do not want to implement and manage EVSE themselves, they may lease or outsource the fee collection to third party hosting companies.



Electric vehicle charging stations courtesy of Coulomb Technologies and ParkPod

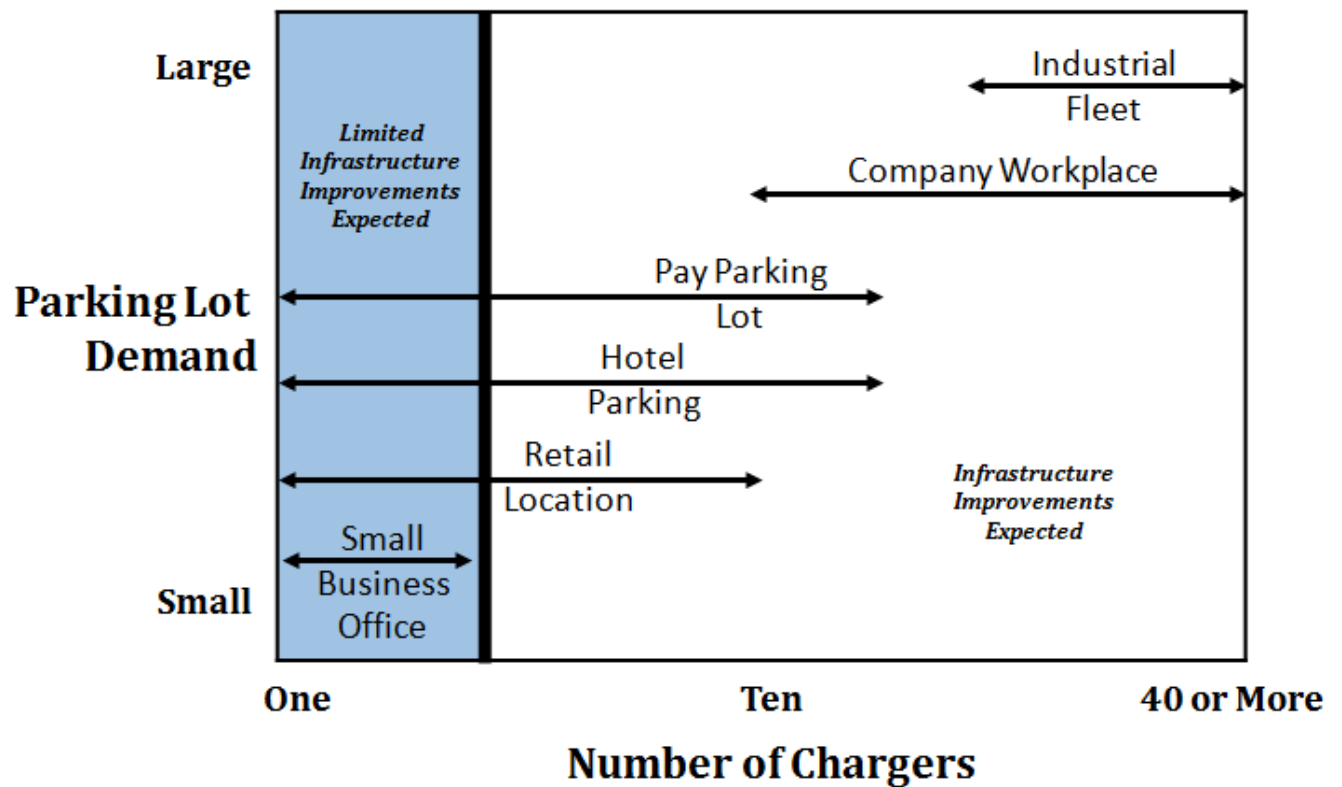


Figure 1: DECIDING HOW MANY CHARGERS YOUR COMPANY NEEDS

If your business does not own the property, it may be possible for your organization to partner with your parking lot owner or with a nearby business that owns a parking lot. When pursuing large-scale charger installations, utility and customer-side

infrastructure upgrades may be necessary to handle the increased electrical load.

Installing an EV charging station can take as little as a few weeks, but may take longer depending on permitting, vendor selection, and certified installer turnaround time.

## EV CHARGING LEVELS

<b>AC Level 1: “basic”, “slow”, or “trickle” charging</b>	110V (volts)-120V alternating current (AC), single phase, 15A (amps) continuous. This charging level is identical to plugging into a typical household electrical socket. It is most appropriate for smaller battery sizes such as in PHEVs. It takes from 10 to 20 hours to fully charge a BEV depending on battery size. Many EV charging stations have a Level 1 charger included in the Level 2 charger equipment.
<b>AC Level 2: “fast” or “quick” charging</b>	208V -240V alternating current (AC), single phase, typically 220V/30A continuous but up to 80A specified. This charging level is identical to plugging into a typical household electric clothes dryer socket. This is the most common public charging level and excellent to top off the battery in 1.5-3.0 hours or between 4-8 hours to fully charge a BEV.
<b>DC Fast Charge</b>	Converts three phase alternating current (AC) to direct current (DC) for ~80% to fully charge a BEV in 20-30 minutes. This charging level requires significant electrical infrastructure such as panel and service upgrades and is conducive for fast turnaround time locations and fleet vehicle charging depots. This is the most expensive to implement, most stressful to the grid, and the US connection standards are still being developed. Fast charging replenishes batteries faster, but it may shorten the life of the battery if this method is used regularly.

Table 5: EV CHARGING LEVELS

## EV CHARGING STATION - FEATURES

EVSE equipment is often classified by the following categories:

1. **Low feature (dumb) charging stations** have basic safety features and charge status indicating lights with a single charging level (<\$,1000 range for equipment).
2. **Medium feature (smart) charging stations** have more features including enhanced displays, charging timers, simultaneous charging levels, basic external communications software and additional inputs like keypads (<\$2,000 for equipment).
3. **High feature (intelligent or networked) charging stations** are durable and offer smart card and credit card readers,

advanced displays, cellular communication and auto service diagnostics, intelligent power flow, internal metering, and “gateway” master/slave configurations to communicate to the outside world as well as other stations that are close in proximity. They are also equipped with remote driver billing software, smart grid compatibility, ergonomic advances etc. (<\$5,000 for equipment).

4. **DC fast charging stations** include all of the advanced features of the “Intelligent” charging station but due to the intensity of service require robust hardware increasing the unit cost to \$15,000-\$40,000 and up to \$45,000-\$100,000+ with installation.

## EV PARKING DESIGNATION

Green building and fleet electrification goals at the federal, state, regional, and local levels are being supported by newly enacted policies and standards, such as laws that require designated parking spaces for alternative fuel vehicles. Many municipalities and businesses have implemented elements of California Building Standards Commission (CBSC) “CALGreen” already, which includes an optional section on EV charging stations.

Total Number of Parking Spaces	Number of Clean Air Spaces
0 to 9	0
10 to 25	1
26 to 50	3
51 to 75	6
76 to 100	8
101 to 150	11
151 to 200	16
201 and over	At least 8% of total

Table 6: CLEAN AIR PARKING SPACE GUIDELINES UNDER CALIFORNIA GREEN BUILDING STANDARDS CODE

Please refer to Cal Green Building Standards Code site for more information:  
[http://www.documents.dgs.ca.gov/bsc/2009/p/art11\\_2008\\_calgreen\\_code.pdf](http://www.documents.dgs.ca.gov/bsc/2009/p/art11_2008_calgreen_code.pdf).

## HOW TO SELECT A PARKING STALL LOCATION

1. Select high demand/visible locations (especially on the first few).
2. Ensure availability of electrical supply to provide for Level 2 (240V/40A).
3. Consider American Disability Act issues (reach, accessibility, barrier free route, slope of pavement, etc.)
4. Consider lighting and shelter for customers, so they are able to charge comfortably at night or in the rain (but this is not required).
5. If signage will be posted, ensure that signs comply with the Manual on Uniform Traffic Control Devices (MUTCD).
6. Select a site that will benefit the fleet as well as customers or employees.

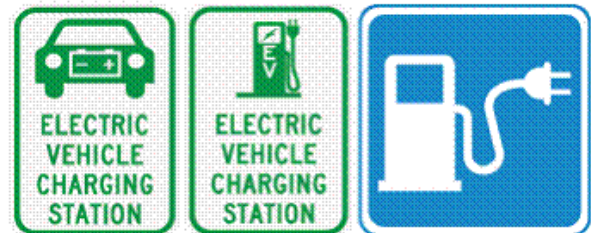


Figure 2: EV CHARGING STATION SIGN

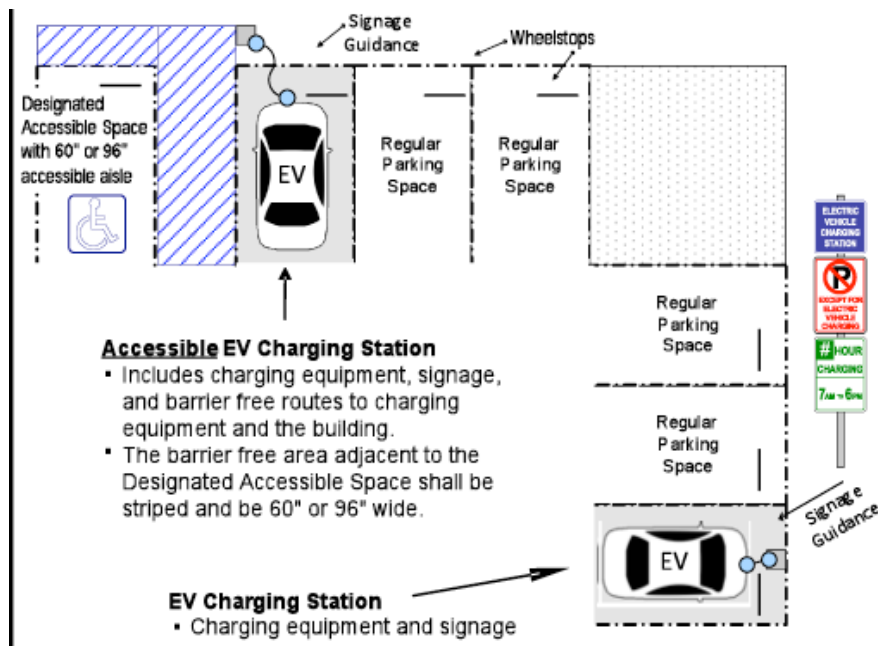


Figure 3: ONE EXAMPLE OF A PARKING STALL BEST PRACTICE LAYOUT. From Appendix B “ Model Installation Guides for Charging Stations” in “Electric Vehicle Infrastructure: A Guide for Local Governments in Washington State,” Department of Commerce and Puget Sound Regional Council. Full version available for download at: <http://psrc.org/transportation/ev/model-guidance>.

## INFRASTRUCTURE COST CONSIDERATIONS

When planning the deployment of EV charging station(s), it is most cost-effective to consider designs for both initial installation and future expansion. If expansion is anticipated, the initial installation work should include basic infrastructure (e.g. conduit, trenching, pull wire, available circuit breaker location in supply panel) for the future charger installations.

Cost variables include the following:

**Site Layout** (Distance from an adequate power supply to the charging site).

**Charging Level** (Level I, Level II, or DC Fast Charge).

**Trenching and Unwired Conduit** (based on distance).

**Electrical Panel Capacity** (controlled by building owner and provisioned by electrician).

**Area Electrical Capacity** (provisioned and controlled by utility).

**Wiring** (cost rises per linear foot).

For installations of one or two charging stations, it is likely that expenses will be limited to the time and materials required by the electrician. In the event that upgrades are necessary, such as a panel or meter upgrade, costs may increase significantly. For larger scale projects that require multiple high amperage circuits or complex trenching work, costs will be much higher.

The table below shows historical average installation costs. It is based on data collected over a ten-year period by Clean Fuel Connection, Inc. on its installation of public and private EV charging stations.

Chargers in Project	# Projects	Average Cost/Charger
Total	120	\$3,457
1 Charger Installation	41	\$4,841
2 Charger Installations	57	\$3,642
3-5 Charger Installations	18	\$2,893
6+ Charger Installations	4	\$2,227

Table 7: HISTORIC AVERAGE COST PER CHARGER. Courtesy of Clean Fuel Connection.

The following table also uses historical data and breaks it down into installation components: labor and materials (conduit, wire, breakers, etc.), permits, tax and freight. Analysis of more recent data suggests that costs have generally stayed about the same for labor while costs for equipment have come down considerably and permit fees and sales taxes have fluctuated.

	Labor	Materials	Permit	Tax	Freight	Total
Average Cost per Charger	\$2,243	\$1,096	\$ 64	\$242	\$46	\$3691
1 charger installation	\$3,191	\$1,613	\$119	\$314	\$56	\$5293
3-5 charger installation (per charger)	\$1,395	\$701	\$74	\$184	\$42	\$2396

Table 8: BREAKDOWN COSTS OF INSTALLATION PER CHARGER

EVSE equipment ranges in price from \$600 for a simple residential unit to about \$5,000+ for a high feature networked public charging unit today. EVSE pricing has been steadily declining since volumes have increased. Price is also determined by the performance level, administrative software, pre-paid warranty options, and service and support packages. Actual rate of charge is determined by both the charger and the vehicle's configuration.

### ANTICIPATED COST ESTIMATES PER EVSE PARKING STALL LOCATION

The estimates in Figure 4 below include stall striping/painting, signage, or any parking space improvements such as safety bollards. The cost assumptions for installation and equipment use historical numbers, but are adjusted for recent installation efficiencies, competition, and lower EVSE costs. The host is responsible for ongoing support and maintenance costs.

Some of the costs below represent estimates from ChargePoint America, a program sponsored by the Department of Energy and Coulomb Technologies. To receive a free unit through this program, the recipient must agree to be responsible for the installation costs and ensure the unit will be publicly accessible. Others are estimates for discounted installation from DOE certified installers whose quotes reflect incentives from the California Energy Commission. In the example below, we estimate the CEC grant to be \$2,300 per installation; however, there is no established fixed award by the CEC.

These sample estimates are for informational purposes only as some of these programs and/or other government funded programs may no longer be available.



Photos courtesy of Mike Calise at EVadvise and Jim Helmer of Lightmoves

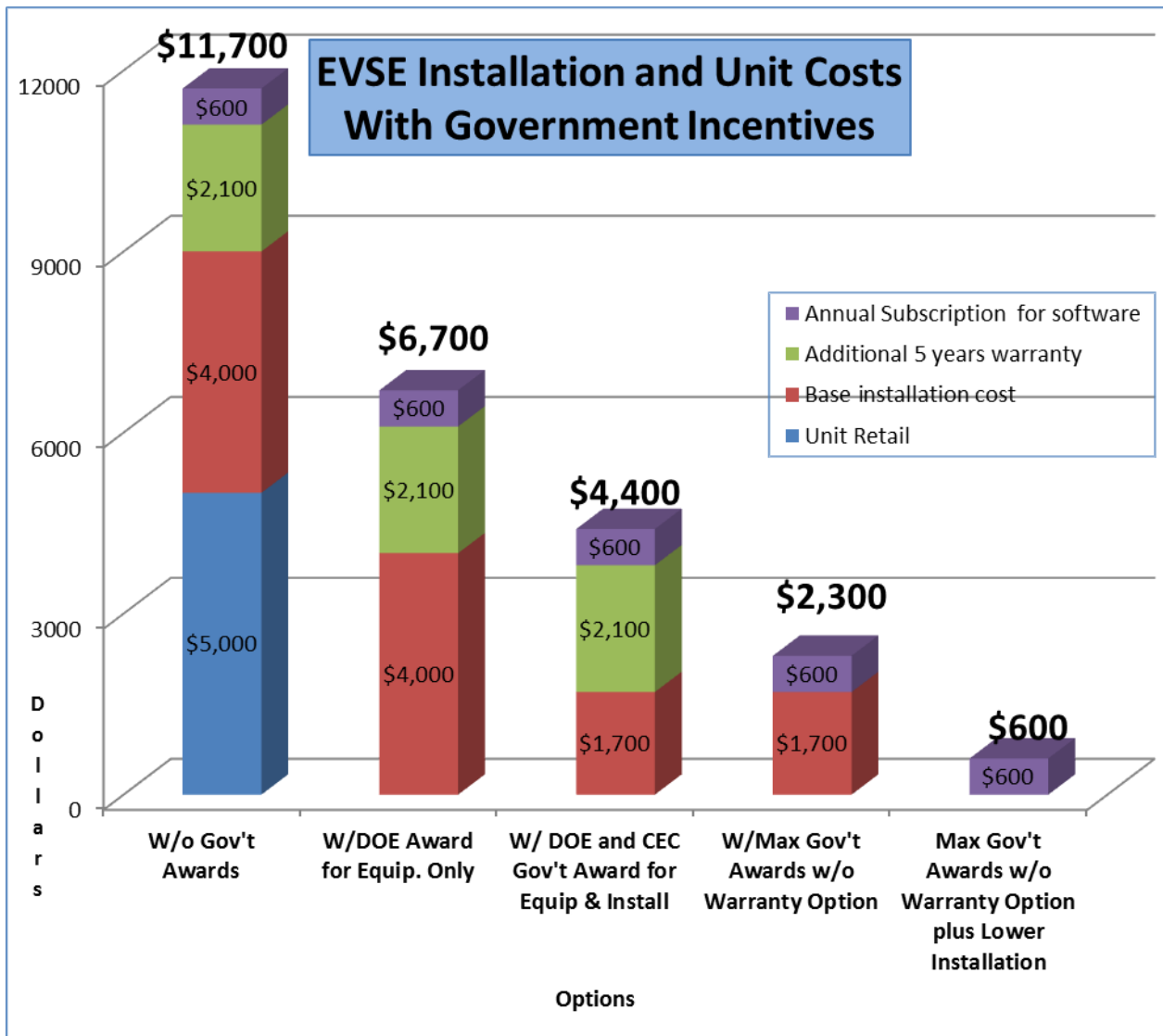


Figure 4: EVSE INSTALLATION AND UNIT COSTS WITH GOVERNMENT INCENTIVE OPTIONS

\*The \$11,700 cost before government grants typically applies to the cost of your first unit. Typical costs for subsequent units approach \$4,000 to \$8,000 without government grants.

\*\*Panel and supply upgrading, trenching, and permitting can range from \$1000 to possibly \$25,000+ depending on existing infrastructure deficiencies and trenching needs.

## EXAMPLE OF ONE VENDOR'S TYPICAL SERVICE FEES CHARGED TO THE DRIVER/USER

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Here is an example of one vendor's (Coulomb Technologies) service fees:

Using the enabled Flex Billing software application through the ChargePoint America Network, the EVSE "Host" (station owner or operator) charges a fee (time of use or flat fee, which can be set to free, per minute, per hour, per day, or virtually any scheme the host desires) to the User (driver) for the use of the EV Charging Equipment. Parking fees may be separate. The User (via 800#, ChargePass Card or RFID enabled Visa, M/C or Discover) is billed through their ChargePoint Network subscription or credit card. The Host separately pays for the increased EVSE electricity usage through their standard local utility bill. Coulomb Technologies settles via auto-deposit to the Host's bank account once per/month and the Host receives the total amount of the session less \$0.50 per transaction fee and 7.5% of the total session transaction for what they billed the User. The net balance of that transaction may be used to offset equipment, energy and installation costs, be reinvested in more EVSEs, or become a revenue generator. This billing scheme can be designed as a profit, breakeven, or loss depending on the Host's desired outcome. If it's designed as a breakeven or "loss leader" it may have other direct or indirect monetary benefits in related commerce or increased EV adoption.

Please note that many other service fee models exist from different vendors so please check with vendor specific versions.

**Example of typical EV charging sessions with various electricity rates applied. This example may be useful for EV charging station hosts that want to review the money flows and break even estimates. It is intended for**

**informational purposes only since there are many variations to this model.**

Assume **\$11,700** actual total for up-front installation and equipment costs including warranty, maintenance, signage and striping. This assumes no grants, no panel or meter upgrades, a short trenching requirement of less than 8 feet and a high end feature set EVSE for business applications.

Set the EV Charging Fee at **\$6.00 per Charging Session**, and driver is allowed a 2 hours of charging per session.

Host Costs/Fees Example:

Electricity costs for a 2 hour session would vary depending on the electricity rate and may be affected by peak vs. off-peak rates.

The following example uses three different electricity rates for illustration. Your actual costs may vary depending on your electricity rate plan and consumption patterns. California utilities have special electric vehicle rates for residential customers, but commercial customers may fall under a different rate schedule. At 5.6 cents /kWh (low off-peak rate) for a two hour typical EV charging session, the electricity cost would be:

**~\$0.37 for that session.**

At 12 cents /kWh (average rate) for a two hour typical EV charging session, the PG&E electricity costs would be:

**~\$0.79 for that session.**

At 28 cents /kWh (higher rate) for a two hour typical EV charging session, the electricity costs would be:

**~\$1.83 for that session.**

These rates vary but for simplicity, let's assume a higher average electricity rate to normalize the example for a \$3.00 cost and \$3.00 net fee (50%/50% split)

\$2.05 Typical electricity cost per session

\$ 0.50 Per transaction fee to vendor for networking capability

\$ 0.45 7.5% of Total transaction fee to Vendor (@\$6.00)

\$3.00 Debit to the Host – Charging cost per session

\$3.00 Credit to the Host - Charging Fee per session

At \$11,700 per station for implementation, and \$3.00 per session fee after expenses, it would take 3900 sessions for the Host to break even.

- Assuming an unrealistic projection of virtually full utilization at 5 sessions per day, each for a 2 hour session, (or minimum fee) or 10 hours per day utilized for 365 days, the Host would break even in just over two years (2.14 yrs).

- Assuming a challenging but more realistic projection of 2/5 utilization at 2 sessions per day for a 2 hour session, or 4 hours per day utilized for 365 days, the Host would break even in over five years (5.34 yrs)

- Assuming a realistic utilization projection of 1/5 utilization at 1 session every day for a 2 hour session (or minimum fee), or 2 hours per day utilized for 365 days, the Host would break even in over ten and a half years (10.68 yrs) and so on...

Remember even at \$11,700 per station with no grants, you may be eligible for federal business tax incentives of up to 30%. Therefore, the net breakeven examples above can be recalculated to take this into account.

Charger programming features exist in the charging station software that allow for flexibility in rate schemes and the host can experiment with charging a per hour, or minute rate versus a minimum flat fee for charging sessions. This may have the added benefit of a higher turnover rate so parking stalls stay available. If not, the host gets a favorable charging fee benefit from those drivers that choose to stay for longer periods of time. It may also be beneficial to offer an escalating hourly charging rate similar to city parking garage models if drivers stay longer than originally intended.

It is important to note that even if the hosting company had absolutely zero utilization (an extremely unlikely but theoretically possible event depending on location), it would still make a significant positive impact to many Bay Area residents as far reaching as a ~50 mile radius from its location, by offering an available EV Charging destination for those with ~100 range vehicles.

Aside from the direct income generated from EV charging fees, a more interesting aspect of charging station ROI is the potential increase in general customers who will spend money in other ways. Because the electricity costs to parking lot operators for charging infrastructure are relatively modest, many of them will offer free or discounted charging to customers, attracting more business in the process. These customers will in turn spend money on hotel stays, restaurant meals, retail shopping, etc. In this way, charging stations can pay for themselves rather quickly.

# BECOMING EV READY - FINAL STEPS

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## PRACTICAL DO-IT-YOURSELF CHECK LIST:

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For those who prefer a more practical list, here are ten easy steps to become EV ready:

1. Determine if you are eligible for any EVSE and/or installation incentives. Consult your business financial advisor for business tax credit information.
2. Determine a location for EV charging infrastructure; identify multiple locations and consider room for expansion. Refer to the section How to Select a Parking Stall Location on page 19 for more information.
3. Estimate labor and material costs using examples from this guide, keeping in mind that trenching and inadequate power supply may increase costs significantly.
4. **Important step:** Contact PG&E or another utility company to discuss plans to install EVSEs. This notice allows your utility to address grid infrastructure issues and field questions regarding costs you may incur associated with installation and/or use (e.g. electricity rates).
5. Conduct a site visit with your EV charging station certified electrician/contractor . Discuss installation obstacles, permits needed and electrical panel capacity. Request a firm quote.
6. Based on installation and EVSE cost, allocate budget, sign contracts, submit materials for incentives, and order charging station(s).
7. Electrician/contractor(s) obtains appropriate permits.
8. Electrician/contractor(s) schedule work, including:
  - a. Order and coordinate shipping dates for materials
  - b. Schedule trenching and installation.
  - c. Schedule paving, post/bollard installation, stripping
  - d. Parking stall improvements and signage
9. Electrician/contractor(s) complete installation and requests inspection with municipal inspection agency upon completion of project.
10. Plug in and charge! Advertise availability of EV charging stations to your target demographic (employees, customers, etc).

## THE SPEED AND EASE OF OUTSOURCING THE ENTIRE EV IMPLEMENTATION

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Another easy way to complete an EV project is to outsource it to a trusted third-party hosting company, EV advisory firm, or management consulting company. Find a company that has experience working with EV certified installers, regulatory agencies, and multiple EV charging vendors. They can assist or contract deployment steps including installation, equipment acquisition, incentives reviews, tax credits, utility requirements, and business models. They can assess your company's situation, budget constraints, physical location, timeline, and will make specific recommendations to get the project completed.

## CONCLUSION

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The time to electrify your business is now. Bay Area companies are financially incentivized to move forward on EV charging infrastructure opportunities. The direct and indirect monetary benefits are compelling, and as you increase business, you can prompt a fundamental change in the way we fuel transportation. Business, enterprises, and employers that act now will also reap the benefits of existing government grants, rebates, and tax credits specifically designed to enhance your EV project ROI.

This guide has provided a business case for electric vehicles, helpful financial and logistical implementation details, and a practical checklist for deploying EV charging infrastructure. Becoming “EV Ready,” includes:

- The purchase and installation of EV charging stations.
- Creating highly visible parking stalls that are easily accessible by employees, customers, or visitors.
- Conducting awareness programs to employees, customer base and parking lot visitors.
- Implementing additional perks and incentives that can support EV adoption within the Bay Area community.

As the Bay Area moves forward with vehicle electrification, we recommend that you take the first steps in becoming an EV stakeholder. The EV market is in its early stages, and many governments, businesses, and individuals started by adopting a “learn as you go” strategy. Your business now has the opportunity to play a critical role in the adoption and expansion of electric vehicles and EV charging infrastructure. We expect that with this guide, and a nominal investment, your Bay Area Business now has the opportunity to lead by example, to demonstrate your firm’s commitment to innovation and sustainability by becoming EV Ready.

## REFERENCES IN THE ORDER IN WHICH THEY INFLUENCE THIS DOCUMENT

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Plug-in Hybrid & Electric Vehicle (PH&EV) Research Center program of the Institute of Transportation Studies at the University of California, Davis under the guidance of the California Plug-In Electric Vehicle Collaborative. Taking Charge: Establishing California Leadership in the Plug-In Electric Vehicle Marketplace. December 2010. <http://www.evcollaborative.org>

Electric Vehicle Charging Infrastructure Deployment Guidelines for the Oregon I-5 Metro Areas of Portland Salem, Corvallis and Eugene. April 2010. <http://www.oregon.gov/odot/hwy/oipp/docs/evdeployguidelines3.1.pdf>

Rocky Mountain Institute. Plugging In: A Stakeholder Investment Guide for Public Electric-Vehicle Charging Infrastructure. July 2009. <http://projectgetready.com/resources/plugging-in-a-stakeholder-investment-guide-for-public-electric-vehicle-charging-infrastructure>.

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Pricewaterhouse Coopers. Cleantech Revolution: Building smart infrastructures. December 2009. <http://www.pwc.com/us/en/technology/publications/cleantech-infrastructures.jhtml>

UC Berkeley Global Venture Lab. Impact Analysis for Large-Scale Deployment of Electrical Vehicles in California. November, 2008. <http://www.cet.berkeley.edu/>.

Bay Area Air Quality Management District. Source Inventory of Bay Area Green House Gas Emissions. December 2008. <http://www.baaqmd.gov/>.

## APPENDICES

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### APPENDIX A: EV CHARGER COMPANIES AND CONTACT INFORMATION

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Company Name	Website	Phone Number	City, State
AeroVironment	<a href="http://www.avinc.com">www.avinc.com</a>	626-357-9983	Monrovia, CA
Aker Wade	<a href="http://www.akerwade.com">www.akerwade.com</a>	434-975-6001	Charlottesville, VA
ClipperCreek	<a href="http://www.clippercreek.com">www.clippercreek.com</a>	530-887-1674	Auburn, CA
Coulomb Technologies	<a href="http://www.coulombtech.com">www.coulombtech.com</a>	408-841-4500	Campbell, CA 95008
ECotality	<a href="http://www.ecotality.com">www.ecotality.com</a>	415-992-3000	San Francisco, CA
GE WattStation	<a href="http://www.geindustrial.com">www.geindustrial.com</a>	800-431-7867	Plainville, CT
ParkPod	<a href="http://us.parkpod.com">us.parkpod.com</a>	800-272-7838	San Francisco, CA
Schneider Electric	<a href="http://www.schneider-electric.us">www.schneider-electric.us</a>	847-397-2600	Palatine, IL
Shorepower	<a href="http://www.shorepower.com">www.shorepower.com</a>	503-892-7345	Portland, OR

APPENDIX B: ELECTRIC VEHICLE MANUFACTURERS

Make	Model	All Electric Range (mi.)	Battery Size (kW)	U.S. Target Intro Date
<b>Plug-In Hybrid Electric Vehicles</b>				
<b>Audi</b>	A1 Sportback	31-62		2011
<b>BYD Auto</b>	F3DM	60		2010
<b>Fisker</b>	Karma	50		2011
<b>Ford</b>	Escape	40	10	2012
<b>General Motors</b>	Chevrolet Volt	40	16	For sale now
<b>Hyundai</b>	Blue-Will	38		2012
<b>Toyota</b>	Prius Plug-In	12.4-18.6		2012
<b>Volvo</b>	V70	31		2012
<b>Battery Electric Vehicles</b>				
<b>BMW</b>	Active E	100		2011
<b>BYD Auto</b>	e6	205		2010
<b>Chrysler/Fiat</b>	Fiat 500	100		2012
<b>Coda Automotive</b>	Coda Sedan	90-120		2010
<b>Daimler</b>	Smart ED	72-90		2012
<b>Mercedes Benz BlueZero</b>	120	35		2011
<b>Ford</b>	Focus	100		2011
	Transit Connect	100		2011
	Tourneo Connect	100	21	2011
<b>Hyundai</b>	i10 Electric	100	16	2012
<b>Mitsubishi</b>	iMiEV	100	16	2010
<b>Nissan</b>	LEAF	100	24	For sale now
<b>Rolls Royce</b>	Electric Phantom			2010
<b>SAIC</b>	Roewe 750	125		2012
<b>Tesla Motors</b>	Roadster	220	56	For sale now
	Model S	160, 230, 300		2011
<b>Th!nk</b>	City	113		2010

## APPENDIX C: FEDERAL AND STATE TAX INCENTIVES

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The following federal and state tax credits are up to date as of April 2011. Please refer to the provided websites for the most current information.

### **For the installation of Electric Vehicle Supply Equipment**

Alternative Fuel Infrastructure Tax Credit - At commercial and residential sites, up to 30% of the cost of charging station installation may be covered by the federal government. The limit of credit per commercial sites is \$30,000 whereas the limit of credit per residential sites is \$1,000.

### **For the purchase of electric vehicles**

Qualified Plug-In Electric Drive Motor Vehicle Tax Credit - For each zero-emission plug-in hybrid or electric vehicle purchased, a tax credit between \$2500 and \$7500 dollars is available. The quantity of tax credit rewarded is based upon the battery capacity of the car purchased. The tax credit for a given electric vehicle will be reduced after the manufacturer has sold 200,000 units. For up to date information on the federal tax credit: <http://www.afdc.energy.gov/afdc/laws/law/US/409>. For up to date information on federal funding for specific electric vehicles please see: <http://fueleconomy.gov/feg/taxevb.shtml>

### **California State Rebate**

The Clean Vehicle Rebate Project, funded by Assembly Bill 118, provides rebates of up to \$5,000 per zero-emission or plug-in light duty vehicle. Additionally, certain zero-emission commercial vehicles are eligible for a rebate up to \$20,000. Only vehicles approved by the California Air Resources Board (ARB) are eligible for rebates. For more information on state EV tax rebates: <http://www.afdc.energy.gov/afdc/laws/law/CA/8161>. To apply for a state EV tax rebate please go to: [www.energycenter.org/cvrp](http://www.energycenter.org/cvrp)