

# Electric Vehicle Infrastructure

*A Guide for Local Governments in Washington State*



JULY 2010

**Model Ordinance, Model Development Regulations, and Guidance Related to Electric Vehicle Infrastructure and Batteries per RCW 47.80.090 and 43.31.970**

## APPENDICES



**Department of Commerce**  
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**PSRC**

## TECHNICAL ADVISORY COMMITTEE MEMBERS

The following people were members of the technical advisory committee and contributed to the preparation of this report:

Ivan Miller, Puget Sound Regional Council, Co-Chair  
Gustavo Collantes, Washington Department of Commerce, Co-Chair  
Dick Alford, City of Seattle, Planning  
Ray Allshouse, City of Shoreline  
Ryan Dicks, Pierce County  
Jeff Doyle, Washington State Department of Transportation  
Mike Estey, City of Seattle, Transportation  
Ben Farrow, Puget Sound Energy  
Rich Feldman, Ecotality North America  
Anne Fritzel, Washington Department of Commerce  
Doug Griffith, Washington Labor and Industries  
David Holmes, Avista Utilities  
Stephen Johnsen, Seattle Electric Vehicle Association  
Ron Johnston-Rodriguez, Port of Chelan  
Bob Lloyd, City of Bellevue  
Dave Tyler, City of Everett

## CONSULTANT TEAM

Anna Nelson, Brent Carson, Katie Cote — GordonDerr LLP  
Dan Davids, Jeanne Trombly, Marc Geller — Plug In America  
Jim Helmer — LightMoves

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For additional copies of this document please contact: **Puget Sound Regional Council** • Information Center  
1011 Western Avenue, Suite 500 • Seattle, WA 98104-1035  
206-464-7532 • fax 206-587-4825 • [info@psrc.org](mailto:info@psrc.org) • [www.psrc.org](http://www.psrc.org)

**Washington Department of Commerce** • Energy Policy Division  
1011 Plum Street SW • Olympia, WA 98504-2525  
360-725-3000 • [www.commerce.wa.gov](http://www.commerce.wa.gov)

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# Appendices

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# Appendix A. House Bill 1481 as Codified in the Revised Code of Washington

SECTION	REVISED CODE OF WASHINGTON	SUMMARY OF SECTION
1	<p><b>RCW 47.80.090</b>                      Regional transportation planning organizations – Electric vehicle infrastructure – Findings.                      (Title 47.80 – Public highways and transportation – Regional transportation planning organizations)</p>	<p>The purpose of HB 1481 is to encourage the transition to electric vehicle use and to expedite the establishment of a convenient and cost-effective electric vehicle infrastructure that such a transition necessitates. The Legislature agreed that the development of a convenient infrastructure to recharge plug-in electric vehicles is essential to increase consumer acceptance of these vehicles. The state’s success in encouraging this transition will serve as an economic stimulus to the creation of short-term and long-term jobs as the entire automobile industry and its associated direct and indirect jobs transform over time from combustion to electric vehicles.</p>
2	<p><b>RCW 47.80.090</b>                      Regional transportation planning organizations – Electric vehicle infrastructure.                      (Title 47.80 – Public highways and transportation – Regional transportation planning organizations)</p>	<p>The Puget Sound Regional Council (PSRC) is required to seek federal or private funding related to planning for electric vehicle infrastructure deployment. These efforts should include:</p> <ul style="list-style-type: none"> <li>• Development of short-term and long-term plans for how state and local governments may include electric vehicle infrastructure in parking facilities;</li> <li>• Consultations with the State Building Code Council and the Department of Labor and Industries to coordinate state standards to ensure that appropriate electric circuitry may be installed to support electric vehicle infrastructure;</li> <li>• Consultation with the Workforce Development Council and the Higher Education Coordinating Board to ensure the development of educational and training opportunities related to electric vehicles;</li> <li>• Development of an implementation plan for counties over 500,000 in population to achieve 10 percent electric vehicle-ready parking by December 31, 2018; and</li> <li>• Development of model ordinances and guidance for local governments related to the siting and installation for electric vehicle infrastructure.</li> </ul> <p>Any plans and recommendations developed by PSRC must be submitted to the Legislature by December 31, 2010, or as soon as practicable after securing any federal or private funding. Priority will be given to the development of model ordinances and guidance for local governments related to the siting and installation of electric vehicle infrastructure.</p>
3	<p><b>RCW 82.29A.125</b>                      Exemptions – Electric vehicle infrastructure.  <i>(Expires January 1, 2020.)</i>                      (Title 82.29A – RCW Excise taxes – Leasehold excise tax)</p>	<p>Electric vehicle infrastructure is exempt from leasehold excise tax.</p>

SECTION	REVISED CODE OF WASHINGTON	SUMMARY OF SECTION
4	<p><b>RCW 82.08.816</b> Exemptions – Electric vehicle batteries and infrastructure. <i>(Expires January 1, 2020.)</i> (Title 82.08 – Excise taxes – Retail sales tax)</p>	<p>The sale of electric vehicle batteries or the installation of electric vehicle infrastructure is exempt from retail sales and use tax.</p>
5	<p><b>RCW 82.12.816</b> Exemptions – Electric vehicle batteries and infrastructure. <i>(Expires January 1, 2020.)</i> (Title 82.12 – Excise taxes – Use tax)</p>	<p>The sale of electric vehicle batteries or the installation of electric vehicle infrastructure is exempt from retail sales and use tax.</p>
6	<p><b>RCW 79.13.100</b> Battery charging, battery exchange and rapid charging stations. (Title 79.13 – Public lands – Land leases)</p>	<p>State and local governments may lease public property for electric vehicle infrastructure.</p>
7	<p><b>RCW 43.19.648</b> Publicly owned vehicles, vessels, and construction equipment – Fuel usage – Tires. (Title 43.19 – State government – Executive – Department of general administration)</p>	<p>By June 2015, all state agencies and local government subdivisions of the state, to the extent determined practicable by the rules adopted by the department of commerce, pursuant to RCW 43.325.080, are required to satisfy one hundred percent of their fuel usage for operating publicly owned vessels, vehicles, and construction equipment from electricity or biofuel. State agencies must achieve 40 percent by June 1, 2013. Per 43.325.080, Commerce is to adopt rules by June 2010.</p>
8	<p><b>RCW 43.21C.410</b> Battery charging and exchange station installation. (Title 43.21c – State government – Executive – State environmental policy)</p>	<p>Battery charging stations and battery exchange stations will not lose their categorically exempt status under the State Environmental Policy Act (SEPA) as a result of their being parts of a larger proposal under the SEPA rules.</p>
9	<p><b>RCW 35.63.126</b> Development regulations – Jurisdictions specified – Electric vehicle infrastructure – City retrofitting incentive programs. (Title 35.63 – Cities and towns – Planning commissions)</p>	<p>See Figure 1: Map of Requirements for Local Governments Under HB 1481.</p> <p>By July 1, 2010, electric vehicle infrastructure must be allowed under the development regulations of a local jurisdiction if: (1) the jurisdiction is adjacent to Interstate 5 (I-5), Interstate 90 (I-90), Interstate 405 (I-405), or State Route 520 (SR 520) and has a population of over 20,000 in a county with a population of over one million five hundred thousand; (2) the jurisdiction is adjacent to I-5 and is located in a county with a population greater than 600,000; or (3) the jurisdiction is adjacent to I-5 and located in a county with a state capitol within its borders.</p> <p>By July 1, 2011, or six months after a model ordinance is distributed, whichever is later, all jurisdictions adjacent to I-5, I-90, I-405, or SR 520 must allow electric vehicle infrastructure and battery charging stations under their development regulations as a use in all areas, except those areas zoned for residential, resource use, or critical areas. A jurisdiction may adopt and apply other development regulations that do not have the effect of precluding the siting of electric vehicle infrastructure or battery charging stations in areas where that use is allowed.</p> <p>Cities may adopt incentive programs to encourage retrofitting of existing structures with electric outlets capable of charging electric vehicles.</p>

SECTION	REVISED CODE OF WASHINGTON	SUMMARY OF SECTION
10	<p><b>RCW 35A.63.107</b>            Development regulations – Jurisdictions specified            – Electric vehicle infrastructure.            (Title 35A.63 – Optional municipal code – Planning and zoning in code cities)</p>	<p>Same as section 9, for code cities.</p>
11	<p><b>RCW 36.70.695</b>            Development regulations – Jurisdictions specified            – Electric vehicle infrastructure            (Title 36.70 – Counties – Planning enabling act)</p>	<p>Same as section 13, but for County areas within 1 mile of highways.</p>
12	<p><b>RCW 36.70A.695</b>            Development regulations – Jurisdictions specified            – Electric vehicle infrastructure            (Title 36.70A – Counties – Growth management – Planning by selected counties and cities)</p>	<p>Same as section 9 and 10, for GMA planning jurisdictions.</p>
13	<p><b>RCW 35.63.127</b>            Development regulations – Jurisdictions specified            – Electric vehicle infrastructure – County retrofitting incentive programs.            (Title 35.63 – Cities and towns – Planning commissions)</p>	<p>Same as section 11, but for County areas within 1 mile of highways. Also, counties may adopt incentive programs to encourage retrofitting of existing structures with electric outlets capable of charging electric vehicles.</p>
14	<p><b>RCW 47.38.070</b>            Electric vehicle infrastructure.            (Title 47.38 – Public highways and transportation – Roadside areas – Safety rest areas)</p>	<p>An alternative fuels corridor pilot project is authorized for up to five locations in the state. The Washington State Department of Transportation (WSDOT) may enter into partnership agreements with public and private entities for the use of land and facilities along state routes and within interstate highway rights-of-way. The pilot project must:</p> <ul style="list-style-type: none"> <li>• Limit renewable fuel and vehicle technology offerings to those fuels or vehicle technologies with a forecasted demand over the next 15 years that are approved by the WSDOT;</li> <li>• Ensure that the site does not compete with existing retail businesses in the same geographic area for the provision of the same refueling services, recharging technologies, or other retail commercial activities;</li> <li>• Provide existing truck stop operators and truck refueling businesses with a right of first refusal over the offering of refueling services for certain types of trucks within the same geographic area as the pilot project site;</li> <li>• Ensure that any commercial activities at host sites do not materially affect the revenues forecast for vending operations offered by the department of services for the blind; and</li> <li>• Regulate the internal rate of return from the partnership.</li> </ul> <p>The duration of the pilot project is limited to the term of years reasonably necessary for the partnership to recover the cost of capital investments, plus the regulated internal rate of return. The WSDOT is not responsible for providing capital equipment or operating refueling and recharging services.</p>

SECTION	REVISED CODE OF WASHINGTON	SUMMARY OF SECTION
15	<p><b>RCW 47.38.075</b>            Electrical outlets for electric vehicles at rest areas – Battery exchange and charging station installation and operation.            (Title 47.38 – Public highways and transportation – Roadside areas – Safety rest areas)</p>	<p>By December 31, 2015, the state must, to the extent practicable:</p> <ul style="list-style-type: none"> <li>• Install charging outlets capable of charging electric vehicles in each of the state’s fleet parking and maintenance facilities;</li> <li>• Install charging outlets capable of charging electric vehicles in the all-state operated highway rest stops; and</li> <li>• Install or lease space for installation of a battery exchange and charging station in appropriate state-operated highway rest stops.</li> </ul>
16	<p><b>RCW 19.27.540</b>            Electric vehicle infrastructure requirements.            (Title 19.27 – Business regulations – Miscellaneous – State building code.)</p>	<p>State Building Code Council to adopt rules for electric vehicle infrastructure (EVI) requirements. Such rules must consider applicable national and international standards and be consistent with rules adopted under RCW 19.28.281.</p>
17	<p><b>RCW 19.28.281</b>            Electric vehicle infrastructure – Rule adoption.            (Title 19.28 – Business regulations – Miscellaneous – Electricians and electrical installations.)</p>	<p>Department of Labor and Industries to adopt rules for the installation of EVI. The rules must be consistent with rules adopted under RCW 19.27.540.</p>
18	<p><b>RCW 43.31.970</b>            Electric vehicle infrastructure.            (Title 43.31 – State government – Executive – Department of commerce.)</p>	<p>Similar to section 2e. Commerce to develop model ordinances, model development regulations, and guidance. Commerce to distribute to local governments when completed.</p>

# Appendix B. Model Guides for Charging Stations

It is recommended that government permitting agencies provide installation guides to the public to help explain the process of installing EV charging infrastructure. The model installation guides included in this appendix are provided in a format that can be revised to meet the needs of a permitting agency.

This appendix includes two installation guides: “Electric Vehicle Charging Station at a Single Family Residence” and “Electric Vehicle Charging at a Commercial or Employee Parking Lot.” At a minimum, the following revisions should be made to each of the installation guides to make it applicable to a specific jurisdiction:

- Insert the appropriate jurisdiction logo into the heading on Page 1.
- Insert the appropriate jurisdiction and department name in the footer on Pages 1-4.
- Insert the appropriate code citation for local EV ordinance on Page \_\_\_\_\_ [Insert Page #] (Commercial or Employee Parking Lot installation guide only).
- Insert hyperlinks to applicable EV ordinance and electrical code on Page \_\_\_\_\_ [Insert Page #].
- Insert appropriate contact information for permitting agency on Page \_\_\_\_\_ [Insert Page #].

Additional revisions can provide more detail on such topics as accessibility, permitting authority, or other topics and code citations of special importance to a jurisdiction. The installation guides present basic information applicable across the state, including references to minimum electrical standards set by the Department of Labor and Industries. Although the installation guides are for informational purposes only, and are not meant as a substitute for adopted codes, it may be appropriate to revise sections of these documents to highlight or reference local electrical, permitting, parking, or other standards. Below are some examples of additional information a local jurisdiction may choose to include in the installation guides.

## Accessibility

The Commercial or Employee Parking Lot installation guide includes a reference to minimum suggested accessibility standards and guidelines. A jurisdiction may wish to add additional information describing local accessibility requirements as they relate to EV charging stations, including accessible reach and barrier-free routes in parking lots.

## Permitting Authority

Throughout most of Washington State, the Department of Labor and Industries is the authority having jurisdiction over electrical permitting. However, there are several cities, many of which are in the Puget Sound area, which conduct their own electrical permitting. Government agencies using these model installation guides may wish to add specific information on the permitting authority in their city or county. Such revisions can be added to the final section of the installation guide (Section 4 for “Single Family Residential” and Section 3 for “Commercial or Employee Parking Lot”). The following is a list of cities that have authority over electrical permitting.

Aberdeen	Federal Way	Milton	SeaTac
Bellingham	Kirkland	Mountlake Terrace	Seattle
Bellevue	Lacey	Normandy Park	Spokane
Burien	Longview	Olympia	Tacoma Power*
Des Moines	Lynnwood	Port Angeles	Tukwila
Eatonville	Marysville	Redmond	Vancouver
Everett	Mercer Island	Renton	

\* The jurisdiction of Tacoma Power includes some areas of unincorporated Pierce County.

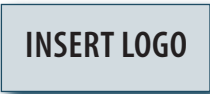
## Electrical Safety and At-Home Charging

Jurisdictions may choose to add additional considerations regarding electrical safety and charging station use. Important additional electrical information includes the following:

When charging an EV, only supply equipment that has been properly tested, and labeled or listed for that purpose, shall be used. This means that all materials, devices, appliances, and equipment be of a type that conforms to applicable standards. Look for labeling such as “For Use with Electric Vehicles” or “Ventilation Not Required” and completely read and understand charging station location requirements from your supplier(s). Electric codes contain special provisions for personnel safety and circuit overload protection. You should consult or hire only licensed electricians and obtain proper permits when having electrical equipment installed for charging your electric vehicle.

Jurisdictions may choose to add additional information on circuit use during at-home Level 1 charging. Such information could include the following:

When charging at Level 1 (120V with a 15- or 20-amp breaker), one should never use an ordinary extension cord. Only the cord set provided by the EV auto dealer should be used. This cord set contains the special connector that mates with the charging inlet on the EV. The connector contains important safety and communications features, such as de-energizing if the cord is strained or inadvertently pulled from the vehicle inlet. The cord is constructed with the proper gauge wire and an internal protection device near the plug that goes into the wall outlet. While a dedicated circuit (a circuit for only one electrical device) for 120V charging is not mandated by the National Electric Code at the time of this writing, it is highly advised that no other electrical loads be placed on the same circuit when charging an EV. Avoiding having any other electrical appliances on this circuit will prevent overloading and tripping a circuit breaker, as well as ensure a consistent charging level over the course of each charge. When charging at Level 2 (240 V and a 40- to 100-amp breaker), a dedicated, hard-wired circuit is always required. To avoid tripping or driving over charging equipment, always locate and store charging equipment, cords, and coupler on a wall or other mounting device.



# Installation Guide for Charging Stations

## Electric Vehicle Charging at a Single-Family Residence

Congratulations on joining the exciting transition to electric vehicles! As a current or future electric vehicle owner, you can look forward to convenient overnight “fueling” by plugging your car in at home. This guide provides important information to help you plan and install necessary charging equipment.

### 1. Charging times and specifications. — *Charging times vary by battery capacity and voltage.*

The time and equipment required to charge an Electric Vehicle (EV) varies based on the capacity of the vehicle’s battery and the level of electric power available. Most future EV drivers will choose to drive one of the two major categories of electric vehicles: a battery electric vehicle or a plug-in hybrid electric vehicle. These two types of EVs are described below. Generally, battery electric vehicles contain batteries with more capacity and require heavier duty charging equipment than plug-in hybrid electric vehicles. See Table 1 on Page 2 for more information on charging levels.

**Battery Electric Vehicle (BEV).** BEVs are zero-emission vehicles that run exclusively on a powerful, large capacity battery that pulls energy from the electric grid. Because electricity is the only source of energy for BEVs, for normal daily driving you will likely need to install a Level 2 charging station (see Figure 1 and Figure 3). Level 2 is likely to be the best option given the reduced charging times.

**Plug-In Hybrid Electric Vehicle (PHEV).** PHEVs are vehicles that run on both electricity from the grid and an internal combustion engine. Depending on its design, the internal combustion engine either shares in powering the EV by alternating back and forth with the electric motor, or it is used to recharge the battery once the all-electric range has expired. The latter type is often referred to as an extended-range electric vehicle or “EREV.” The battery in a PHEV generally has less capacity than the battery in a BEV, and depending upon your daily



**Figure 1. A typical wall-mounted Level 2 home charging station inside a garage.** Photo courtesy of Clean Fuel Connection, Inc.

driving needs, a dedicated circuit for a Level 1 charging system will take longer but may be adequate.

A third category of EV, **Electric Scooters and Motorcycles**, is made up of two-wheeled lightweight vehicles. This category of EVs is similar to BEVs, because they are powered completely by an electric battery. However, their light weight allows for a less powerful battery. Currently, electric scooters and motorcycles only accept Level 1 charging equipment.

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**Table 1. EV Electrical Requirements and Charging Times**

LEVEL	ELECTRICAL REQUIREMENTS	TIME*
1	Requires a standard 15- or 20-amp breaker on a 120-volt circuit with a ground fault interrupter (GFI). To avoid overloading your circuit and breaker when charging, the circuit should not be used for any other purposes. If installing a dedicated circuit, a 20-amp breaker is recommended. This level of charging can provide approximately 3-6 miles of range for 1 hour of charging.	16-32 hrs (BEVs)  3-15 hrs (PHEVs)
2	Requires a dedicated 40-amp or higher breaker on a 240-volt circuit with a GFI, such as those required for ovens or dryers. A wall-mounted charging station assembly will be required. EV charging stations are “continuous load” devices as defined by the National Electrical Code. The contact points for typical 240 volt outlets, such as those used for dryers or ovens, are not designed for continuous loads, or for repetitive plugging and unplugging as would be normal with EV charging. Plugging a vehicle directly into a 240-volt outlet is considered hazardous and is not allowed under any circumstances. This level of charging can provide approximately 15-25 miles of range for 1 hour of charging.	4-6 hrs (BEVs)  1-2 hrs (PHEVs)

\* Charging times are approximate and vary widely due to different battery sizes and specifications. The times represent a full charge of your vehicle’s battery and are shown for comparison purposes only. To determine which charging level best suits your vehicle and driving needs, consult your EV dealer to understand the approximate mileage range gained per hour of charging.

## 2. Making your home EV-ready. – *Preparations can be easy and inexpensive.*

Before purchasing an EV, carefully plan where and when you want to do your charging. Will you charge inside a garage or at an outdoor carport? Will you charge at night when your home’s electrical use is low, or will you need to charge during the day when electrical use is usually higher? To avoid trip hazards, choose a location for your charging station away from doors and walkways. Make sure



**Figure 2. The J1772 connector will be the standard charging plug for all new electric vehicles.** Photo courtesy of Nissan.

there is a clear path to and from the car without passing over the charging cord. If you will be charging outside or in a detached garage, consider there may be additional costs associated with bringing electricity to the charging station and to protecting all equipment from the elements.

A licensed electrician can help you calculate your home’s electrical capacity and loads. However, you should first check with your auto dealer to see if this electrical calculation may be provided as a free or low- cost service to you. You should also discuss with your utility provider whether special rate structures are available for nighttime charging and whether you will need to have a separate meter track electricity used for EV charging.

The amount of energy flowing to your home is measured as amperage, or amps. If your home’s amperage is not sufficient to supply energy to both your home and your EV charging station, you will need to consult with your utility company to determine the steps required to upgrade your service to higher amperage. There may be an additional cost associated with a service upgrade.

Once you determine that the electrical service to your home is sufficient, your next step is to determine the capacity of your home’s electrical panel. The electrical panel divides the amperage flowing into your home into circuits dedicated for various uses. Each circuit has a fuse or circuit breaker with

a specific amperage, normally 15-20 amps. Each fuse or circuit breaker is connected to one or more outlets, lights, or appliances. A standard household electrical panel has a capacity of around 125 amps, although this could vary based on electric codes, residence size, heating method or other factors. Look to see whether all of your circuits are assigned a use. Charging your EV may require dedicating one or more empty circuits for charging.

The strength of the electrical current flowing out of a circuit is measured as voltage, or volts. A standard household circuit of 120 volts can provide power to several uses, such as lights and small appliances, or one larger use, such as a dishwasher or refrigerator. For larger appliances, such as ovens or clothes dryers, two standard circuits are combined into a 240-volt circuit. This will appear as a double, or two-poled, circuit breaker on your electrical panel.

For Level 1 nighttime charging on a circuit used only for charging and not for any other electrical appliance, charging will be slower but is likely to be possible without electrical service upgrades.

As noted in Table 1, Level 2 charging will significantly reduce charging times. For Level 2 charging, older electrical panels with screw-in fuses and old or new panels with less than 125 amps will need to be upgraded. Amperage is likely displayed somewhere on the panel itself. The panel must have two empty circuits available for installing a new two-pole circuit breaker. Note that even if your panel appears to have empty circuit slots, this does not necessarily mean there is enough available amperage to add new circuits. In some cases, you may need a panel capacity greater than 125 amps for Level 2 charging. This would be the case if you have a large home with high electricity demand or if you need to operate several electrical appliances while charging (e.g. a hot tub or a tankless water heater).

### 3. Are permits required for EV charging?

– BEVs – *yes, permits are required.*

If you will be driving a BEV, or if you want your PHEV to charge faster, you will need Level 2 charging from a 240-volt circuit. As explained in Table 1, for Level 2 charging, you can't legally plug your car into an open 240-volt outlet; rather, you will need to

install a charging station in your garage or parking area (see Figure 1 and Figure 3). Charging stations may be provided as an option with the purchase of your EV or you may choose to purchase one from a separate company. The car will be connected to the charging station by a special electrical cord and connector (see Figure 2). In existing homes, electrical permits will be required to install a charging station.

#### **Charging PHEVs — Generally, no permits are required.**

If you buy a PHEV and decide to use Level 1 charging, your EV manufacturer will provide a special cord set with the standard three-prong plug on one end and a special car connector on the other end. This cord is specially designed for charging purposes and should always stay with your vehicle. Use this cord only when charging from a Level 1 circuit. If you use an existing electrical circuit, no other electrical loads should occur during charging (i.e., nothing else using that circuit should be running or switched on), otherwise you are likely to trip the circuit breaker.

If you decide to install a dedicated Level 1 or Level 2 circuit solely intended for charging in your garage or outside to a carport, you will need to obtain an electrical permit for this work. See information below regarding permitting. If you decide you need faster charging for your PHEV, see the next section.



**Figure 3: A wall-mounted Level 2 home charging station in a carport. Outdoor home charging stations can also be Level 1 and may not require covering.** Photo courtesy of Plug In America.

#### 4. How do I get a permit and inspection? – *Permits can be straightforward and easy to obtain; all work must be inspected.*

Before beginning to install a new dedicated circuit, your Level 2 charging equipment, or conducting any other electrical upgrades or installations, you will need to ensure an electrical work permit is in place.

All electrical work must be inspected and approved by the authority having jurisdiction (AHJ). Labor & Industries inspects electrical permits throughout Washington State, but some jurisdictions do their own inspections. These jurisdictions can be viewed on the Labor and Industries website at:

<http://www.lni.wa.gov/TradesLicensing/Electrical/FeePermlnsp/CityInspectors/default.asp>

It is the installer's responsibility to obtain electrical permits and request inspections. Only property owners or their licensed electrical contractors can buy an electrical permit and perform electrical work. You can find out if you, as a property owner, qualify to perform electrical work on your property, or if you will be required to hire a licensed electrician, by referring to RCW 19.28.261. If a homeowner chooses to perform electrical work on their property, it is their responsibility to ensure that all materials, devices, appliances and equipment are of a type that conforms to applicable standards.

If you feel unsure or are not qualified to do your own electrical work, you should hire a licensed electrical contractor. You can ensure electrical contractors are properly licensed and are using certified electricians by checking their status at:

<http://www.lni.wa.gov/TradesLicensing/Contractors/HireCon/default.asp>

Prior to concealing any portion of the electrical installation, the installer must request an electrical inspection from the AHJ. Any corrections written during the inspection will need to be repaired and a re-inspection will be required. You must receive final approval from the electrical inspector before energizing your EV charging system.

Permitting requirements vary among inspection authorities. As mentioned above, check to make sure you know which electrical permitting jurisdiction

covers your property before preparing your permit application.

- *[Insert Hyperlink to applicable EV ordinance]*
- *[Insert Hyperlink to Electrical Code]*

To purchase a Labor and Industries electrical permit or call for an electrical inspection visit:

<http://www.lni.wa.gov/TradesLicensing/Electrical/FeePermlnsp/PermitInspect/Default.asp>

#### 5. Charging an EV away from home. – *You can also charge your EV at a public charging station.*

Some EV drivers may want to take advantage of charging opportunities at their workplace or at various public locations, such as shopping centers and public parking lots, and downtown areas. Also, if you are planning a trip that will be a longer distance than your EV's range, it is important to know about charging opportunities along your route.

The U.S. Department of Energy has funded a number of electric vehicle infrastructure projects in the central Puget Sound region. With these investments, over 1,500 Level 2 charging stations will be available in public locations throughout the central Puget Sound and Olympia area. As EV use becomes more widespread, additional privately funded charging stations will be installed at commercial or employee parking lots. Your EV dealer may be able to help you determine the location of public charging stations near your home. In the future, it may also be possible to access information regarding the location and availability of public charging stations through GPS mapping applications.

See the Installation Guide for Charging Stations: Electric Vehicle Charging at a Commercial or Employee Parking Lot, for information on and considerations for installing publicly available charging stations.

#### CONTACT INFORMATION:

*Insert information for permit authority:*

- Name
- Phone numbers — is there a question hotline?
- Address
- Hours and days of services
- Additional information



# Installation Guide for Charging Stations

## Electric Vehicle Charging at a Commercial or Employee Parking Lot

Congratulations on joining the exciting transition to electric vehicles! Adding an electric vehicle (EV) charging station to your commercial or employee parking lot will set you apart as a pioneer in clean energy transportation. Because cars are often parked at work or for shopping several hours each day, parking lots are an ideal place to install a charging station. This guide provides useful planning tips toward a successful installation.

### 1. Charging times and specifications. — *Charging times vary by battery capacity and voltage.*

Future EV drivers will likely be driving either a battery electric vehicle or a plug-in hybrid electric vehicle. These two types of EVs are described below. Generally, battery electric vehicles contain batteries with more capacity and require heavier-duty charging equipment than plug-in hybrid electric vehicles (see Table 1 on Page 2 for information on electrical requirements and charging times).

**Battery Electric Vehicle (BEV).** BEVs are zero-emission vehicles that run exclusively on a powerful, large capacity battery that pulls energy from the electric grid. Because electricity is the only source of energy for BEVs, normal daily driving will likely require a Level 2 charging station (see Figure 1).

**Plug-In Hybrid Electric Vehicle (PHEV).** PHEVs are vehicles that run on both electricity from the grid and an internal combustion engine. Depending on its design, the internal combustion engine either shares in powering the EV by alternating back and forth with the electric motor, or it is used to recharge the battery once the all-electric range has expired. The latter type is often referred to as an extended-range electric vehicle or “EREV.” The battery in a PHEV generally has less capacity than the battery in a BEV, and depending upon the daily driving needs of the EV driver, a Level 1 charging system may be adequate.

A third category of EV, **Electric Scooters and Motorcycles**, is made up of two-wheeled lightweight vehicles. This category of EVs is similar to BEVs, because they are powered completely by an electric



Figure 1. A typical pedestal-style charging station in a surface parking lot. Photo courtesy of ECOTALITY.

battery. However, their light weight results in a less powerful battery. Currently, electric scooters and motorcycles accept only Level 1 charging equipment.

**Charging Levels and Length of Stay.** Before you decide to install a Level 1 or 2 charging station (or a combination of both), it is important to understand how the electric vehicle industry is evolving. Battery capacities will continue to increase and heavier-duty chargers will become more common.

If your typical customer will need charging for medium length stays (2-4 hours), such as visits to shopping malls, movie theaters, or sports venues, then Level 2 charging would be advised. Level 2 charging may offer the most efficient and cost-effective level of charging, because it can efficiently charge BEVs and PHEVs using a 240-volt circuit and can also provide 120-volt Level 1 slow charging.

#### INSIDE THIS GUIDE

Charging times and specifications.....Page 1  
Making your parking lot EV-ready .....Page 2  
How to obtain a permit and inspection.....Page 4

**Table 1. EV Electrical Requirements and Charging Times**

LEVEL	ELECTRICAL REQUIREMENTS (FOR ONE STATION)	TIME*
1	Requires a standard 15- or 20-amp breaker on a 120-volt circuit with a ground fault interrupter (GFI). To avoid overloading your circuit and breaker when charging, the circuit should not be used for any other purposes. If installing a dedicated circuit, a 20-amp breaker is recommended.	16-32 hrs (BEVs)
		3-15 hrs (PHEVs)
2	Requires a dedicated 40-amp or higher breaker on a 240-volt circuit with a GFI. A charging station is typically installed on a pedestal or wall.  (EV charging stations are “continuous load” devices as defined by the National Electrical Code. The contact points for typical 240-volt outlets, such as those used for dryers or ovens, are not designed for continuous loads or for repetitive plugging and unplugging as would be normal with EV charging. Plugging a vehicle directly into a 240-volt outlet is considered hazardous and is not allowed under any circumstances.)	4-6 hrs (BEVs)
		1-2 hrs (PHEVs)
3	Requires a 60-amp or higher dedicated breaker on a 480-volt circuit with special grounding equipment. (National standards are still under development and will not be available until 2011-2012.)	25-40 min (BEVs)  20 min (PHEVs)

\* Charging times are approximate and vary widely due to different battery sizes and specifications. The times represent a full charge of a vehicle’s range and are shown for comparison purposes only. To determine which charging level is most appropriate for your commercial or employee lot, consult an EV dealer to understand the mileage range gained per hour of charging among various vehicles.

If your typical customer will need charging for very long stays (over 8 hours), such as all-day employee parking or long-term airport parking, then a Level 1 charging station may be adequate. If you choose Level 1, however, you should plan ahead now to be able to easily upgrade to Level 2. Be aware also that installing a standard Level 1 charging outlet in a commercial or employee lot may inadvertently invite use by non-EV individuals, such as recreational vehicles, construction equipment, or outdoor



**Figure 2. The J1772 connector will be the standard charging plug for all new electric vehicles.** Photo courtesy of Nissan.

appliances. It is recommended that property owners offering Level 1 charging install adequate signage and monitor their charging spaces to ensure intended use.

A third type of charging station, referred to as “Level 3,” is also available. This type of charging system is more powerful than Level 1 and Level 2 charging but is also more expensive. Level 3 charging provides direct current to EV batteries and a full charge in 20 to 40 minutes. The speed at which Level 3 charging replenishes an EV can extend the functionality of an electric vehicle to allow people to travel beyond their normal driving needs. An EV dealer or charging station vendor can provide you with more information on Level 3 charging stations.

## 2. Making your parking lot EV-ready.

**Utility Coordination.** A licensed electrician can assist in determining your electrical capacity and loads. However, you may want to first check with charging station vendors to see if these electrical calculations may be provided as a free or low-cost service to you. It may be useful to contact your utility to discuss establishing a dedicated meter for EV charging stations to help you track the energy cost associated with charging. The direct sale of electricity by owners and operators of electric vehicle infrastructure could trigger the jurisdiction of the Utilities and Transportation Commission and additional regulatory hurdles. However, you may

be able to recover some of your investment cost by charging a flat fee based upon the hours of use of an EV charging space.

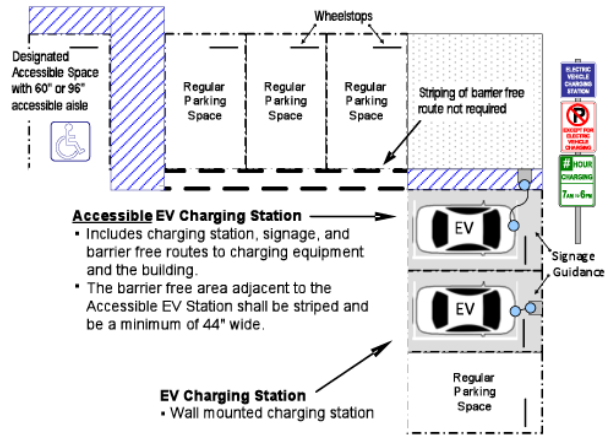
**Charging Station Location and Design.** There are several important considerations when choosing the location and design of your charging station. For example, the location should be easy to find and conveniently accessed. In a very large parking lot, such as at a shopping mall, it may be more beneficial to place a few charging stations at several locations, rather than all the charging stations in one place. Consider directional signage to guide your customers or employees to the charging stations. Locating existing utilities, excavating trenches, and installing electrical equipment and replacing asphalt can be expensive, so it is important to understand the approximate costs for this type of work early in your planning.

Certain design elements can enhance the quality of the user's experience, such as clear signage and good lighting. Lighting can help customers read instructions and information about the charging station, while also improving safety and helping prevent vandalism. Refer to the Electric Vehicle Charging Station Installation Checklist for other design considerations [\[insert hyperlink to Checklist\]](#).

Installing wheelstops will help protect the charging equipment while positioning the EV in the best place for charging (see Figure 3). Locating a car close to the charging station reduces the likelihood of a trip hazard caused by an outstretched charging cord. See [\[insert local EV code citation\]](#) for installation details for parking lot EV charging stations.

**Signage.** Directional signage helps direct drivers to a charging station stall and can inform drivers of any parking restrictions. When deciding how to regulate parking at an EV charging stall, it is important to consider overall impacts to parking supply. Property owners will need to install signage indicating that a space is only for charging EVs and not for general parking.

**Accessibility.** When siting one or multiple EV charging stations, you must provide for accessibility for disabled persons. Your local permitting agency can assist you in determining accessibility requirements, including locating the charging equipment within



**Figure 3. Example of a surface parking lot layout showing locations for EV charging stations and accessibility considerations.**

accessible reach. Your first station should be located and designed to meet clearance and route requirements for barrier-free access to the charging station equipment (see Figure 3). It is not necessary to designate the space exclusively for the use of disabled persons. Locating the first station adjacent to a designated space for the disabled is a good option.

**Cost Recovery.** Each property owner may choose whether to offer charging as a complementary service or to charge a flat fee for use of the parking space. If you wish to charge a fee, the vendor providing the charging system can also assist with the development of a fee collection plan. Options for fee collection may include: credit/debit card readers; pay-to-park kiosks; radio-frequency identification cards linked to a subscription service, and standard parking meters.

**Data Collection and Communications.** When installing a new charging station, certain types of data collection will be required and some will be optional. The state and your electric utility company will require some data to be collected, such as location, amount and time of energy consumed, and possibly who used it. As a business owner, it may be useful to include internet access to your station, to assist potential customers to locate and determine the charging levels you offer and availability of the equipment. You might also want to discuss with charging station vendors the option of allowing users to track the progress of their charge through their cell phone. Researching all required

and optional data and communications options will help you and your users get the most benefit from your charging station investment.

**Maintenance Plan.** A maintenance plan should be created for each parking lot containing charging stations. At minimum, each charging station should clearly display contact information for the station manager in case of charger malfunction or damage. If a charging station includes a card reader or pay-to-park kiosk, regular maintenance of these systems will ensure the security of financial information.

**Contractor Assistance.** The previous sections discuss important design considerations when planning an EV charging station. The design phase will likely require assistance from one or more trades-people. For example, a licensed electrician should prepare electrical load calculations, recommend electrical system upgrades, and help prepare plans for permitting, and an engineer may also be required to design trenching, parking lot striping, signage plans, lighting, shelter, and other components.

### **3. How to obtain a permit and inspection. — *Permits can be straightforward and easy to obtain; all work must be inspected.***

Before beginning to install your charging equipment or conducting any other electrical upgrades or installations, you will need to ensure that an electrical work permit is in place.

All electrical work must be inspected and approved by the authority having jurisdiction (AHJ). Labor & Industries inspects electrical permits throughout Washington State, but some jurisdictions do their own inspections. These jurisdictions can be viewed on the Labor and Industries website at: <http://www.lni.wa.gov/TradesLicensing/Electrical/FeePermlnsp/CityInspectors/default.asp>

It is the installer's responsibility to obtain electrical permits and request inspections. Only property owners or their electrical contractors can buy an electrical permit and perform electrical work. You can find out if you, as a property owner, or your employee qualify to perform electrical work on your property, or if you will be required to hire an electrical contractor, by referring to RCW 19.28.261.

If a property owner chooses to perform electrical work on their property, it is their responsibility to ensure that all materials, devices, appliances and equipment are of a type that conforms to applicable standards.

If you feel unsure or are not qualified to do your own electrical work, you should hire a licensed electrical contractor. You can ensure electrical contractors are properly licensed and are using certified electricians by checking their status and violation history at: <http://www.lni.wa.gov/TradesLicensing/Contractors/HireCon/default.asp>

Prior to concealing any portion of the electrical installation, the installer must request an electrical inspection from the AHJ. Any corrections written during the inspection will need to be repaired and a re-inspection will be required. You must receive final approval from the electrical inspector before energizing your EV charging system.

Permitting requirements vary between inspection authorities. As mentioned above, check to make sure you know which electrical permitting jurisdiction covers your property before preparing your permit application.

- *[Insert Hyperlink to applicable EV ordinance]*
- *[Insert Hyperlink to Electrical Code]*

To purchase a Labor and Industries electrical permit or call for an electrical inspection visit: <http://www.lni.wa.gov/TradesLicensing/Electrical/FeePermlnsp/PermitInspect/Default.asp>

#### **CONTACT INFORMATION:**

*Insert information for permit authority:*

- Name
- Phone numbers — is there a question hotline?
- Address
- Hours and days of services
- Additional information

# Appendix C. Model Electric Vehicle Charging Station Installation Checklist

It is recommended that government permitting agencies develop an installation checklist for all electric vehicle infrastructure permit applicants to complete as part of the permit application process. The **Electric Vehicle Charging Station Installation Checklist** should contain the following information at a minimum.

- Site location — Evaluate the site, giving consideration to its perceived relative importance and usage compared to other nearby parking facilities. Note that charging stations need not be located in prime locations (i.e., close to building entrances) and may instead be better suited for locations adjacent to existing electrical services.
- User base — When feasible, evaluate the charging needs for potential users of the site. This evaluation should include, if available, how far users drive to get to the site and how long they are most likely to leave their vehicles parked there. This can affect the number of charging stations, as well as the appropriate charging level provided.
- Charging level(s) — Plan for and match charging levels (1, 2 or 3 ) to the user base for the site (for example, Level 1 for parking times typically greater than four hours; Level 2 for shorter times).
- Considerations for locating charging stations
  - Adjacency to accessible parking spaces
  - Accessible route to building or elevator
  - Electrical service supply (voltage, amperage, distance, etc.)
  - Access to single or multiple building entry points
  - Clustering or dispersing multiple charging stations
  - Availability of lighting
  - Shelter considerations
  - Directional and charging space signage
  - Days and hours of operation and enforceability
- Future expansion
  - For most public locations, Level 2 will be the appropriate charging level. However, if Level 1 charging stations are provided, consider installing conduit and supply capacity that allows for future upgrading to Level 2 charging at minimal additional circuitry expense.
  - In the event additional charging stations will be needed, plan in advance the likely locations and install basic infrastructure where feasible in the initial installation.
- Fee for charging — Determine if and how a fee will be set, collected and administered for charging purposes (see discussion of Cost Recovery in the Commercial Installation Guide in Appendix B).
- Maintenance — Understand the maintenance requirements and who will perform maintenance on the battery charging stations, electrical supply equipment, signage and provision of emergency contact information. Include maintenance contact information on the charging station equipment.
- Charging station information — Determine what kind and how information should be shared with potential users, including but not limited to station location, station status, and cost to charge.



# Appendix D. Research Memorandum

During the process of developing this Model Document, the consultant team conducted “best practices” research on a number of topics. These research memoranda are listed below. In addition, a subcommittee of the technical advisory committee was formed to research and consider issues related to the collection and analysis of data from charging infrastructure. These research memoranda are also listed below.

(PDF PAGE #)

<b>Appendix D.1. Code Compilation</b> .....	Page 23
Compiled adopted and draft electric vehicle (EV) ordinances, regulations and guidance in other states and cities. This resulted in the identification and compilation of over 40 national and international resource documents. These initial resources and other resources gathered subsequent to the initial research are identified in the Resource Documents (Section 3) list. This appendix includes a listing of codes by location, by topic, and identifies EV, EVI, and battery practices in use or under consideration in other states and regions.	
<b>Appendix D.2. Agency Interviews</b> .....	Page 51
Conducted interviews with contacts in each of the agencies having ordinances, regulations and guidance. This included permitting, public works, and utility staff.	
<b>Appendix D.3. Battery Research</b> .....	Page 73
Conducted research and summarized status of handling, recycling and storage of EV batteries and equipment with a focus on the need for State regulation, local government code, and/or guidance.	
<b>Appendix D.4. EV Driver Survey</b> .....	Page 79
Conducted a web-based EV consumer survey to assess key consumer issues to be considered in the Model Document. Survey areas included demographics, vehicle ownership and use, charging station installation experience, charging patterns, and others.	
<b>Appendix D.5. Data Collection Subcommittee</b> .....	Page 91
A Data Collection Subcommittee met twice during the process to discuss potential roles and regulations related to EVI and data collection. Reports from these meetings are included in this appendix.	



## MEMORANDUM

**TO:** Ivan Miller, Puget Sound Regional Council  
Gustavo Collantes, Washington State Department of Commerce

**FROM:** Dan Davids, Plug In America

**CC:** Jim Helmer, LightMoves  
Anna Nelson, GordonDerr LLP

**DATE:** March 22, 2010

**SUBJECT:** **Electric Vehicle Infrastructure Code Research**

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### INTRODUCTION

During the 2009 legislative session, the Washington State Legislature passed Second Substitute House Bill 1481(2SHB 1481), an Act relating to electric vehicles. Sections 2 and 18 of the Act require the development of model ordinances, model development regulations, and guidance for local governments for siting and installing electric vehicle infrastructure (EVI), particularly regarding battery charging stations, and for appropriate handling, recycling, and storage of electric vehicle batteries and equipment.

The purpose of this memorandum is to provide information regarding background research that the consulting team has conducted and summarized, to be used in recommendations for development of model ordinances, model development regulations, and guidance relating to electric vehicles and infrastructure.

### OVERVIEW

Plug In America collaborated with LightMoves to research codes, ordinances, incentives, state laws, standards, white papers and other guiding documents from past efforts of jurisdictions and other agencies across the country, as well as some international, national and local jurisdictions. The task included examining the known universe of ordinances, regulations and guidance and evaluating which aspects of the research would be most useful for inclusion in the models and guidance. It also identified those codes that would provide the highest value for follow-up with agencies to discuss and document best practices and lessons learned (*see March 22, 2010 memorandum from LightMoves on Local Government Electric Vehicle Infrastructure Phone Interviews*). This information is summarized in **Attachment A**, EVI Code Compilation by Location. The full text of multiple key codes, ordinances, incentives, standards, white papers and other guiding documents is contained in **Attachment C**, EVI Code Compilation. The task also

included organization of the assembled information by topic to provide an information base to be used in development of model regulations and guidance. This information is summarized in **Attachment B**, EVI Code Compilation by Topic.

## **ANALYSIS**

### Data Gathering

Initial research was directed at jurisdictions known by the consultant team to have enacted policies on electric vehicles. Efforts focused mainly on jurisdictions in the United States, but also included pertinent Canadian jurisdictions, and to a limited extent, European locations. Research tools included the internet and direct communications with individuals via email and telephone.

### Data Organization:

**Attachment A** summarizes by **location** data associated with, or initiated by a particular public agency, whether a specific city-initiated resolution, incentive or policy document, or a statewide ruling or national standard. An initial list identified some 40 jurisdictions or public agencies who were then contacted either by email, telephone, or both. Contacts at this stage quickly led to the consideration of other relevant state-wide or national documents. References to the National Electric Code (NEC) and the ADA guidelines for EV charging stations have been noted.

Location data is color-coded according to assessment of relevance. Rows shaded green indicate a location warranting further contact and in-depth reading of the background document. Rows shaded yellow are considered marginally useful. Rows shaded red are deemed not to be that useful to the project but are included for full documentation. The document is dynamic, subject to changes as additional information is gathered.

**Attachment B** takes the data from **Attachment A** and rearranges it by **topic** so that the information is easily accessible according to its intended use. For instance, Hawaii's statewide ordinance includes several components potentially useful for this project, such as incentivized parking and tax exemptions. For this reason, Hawaii appears in more than one row. Organizing the data in this manner also helps illuminate the number of jurisdictions that have initiated activities in a particular topic area.

### Document Organization:

Research that has led to the discovery of a particular document includes a link to the document for further investigation. As applicable, documents in **Attachment B** are coded for consideration in the development of model regulations and guidance. **Attachment C** contains the index of supporting documents, together with the documents.

## **CONCLUSION**

The consultant team anticipated that no city in the United States had yet implemented a comprehensive building or zoning ordinance addressing electric vehicle infrastructure and battery handling. The team is confident that this is indeed the case. The research did, however, produce useful information concerning specific initiatives, such as parking ordinances, as well as other proposed efforts underway.

As **Attachment B** shows, cities and states are more likely to have addressed the topics of parking, incentives and HOV lane access rather than to have adopted comprehensive changes in zoning and

building codes. Two cities, Atlanta and Sacramento, had formally adopted parking requirements in the late 1990s and early 2000s that were “pulled off the books” due to uncertainties in the near-term market for EVs. Financial incentives for EV drivers range from direct purchase rebates to free parking. Non-financial incentives include such things as HOV lane access and less restrictive parking time limits. Few disincentives were found in law or ordinance.

Several city representatives, such as those from Santa Monica and Orlando, stated that there is active discussion around the need to convene working groups to initiate formalized electric vehicle policies. In some cases, white papers have been written for the purpose of policy direction. One such study was completed recently by the city of New York.

In short, no city in the United States has developed or adopted comprehensive ordinances addressing electric vehicle use and charging infrastructure. Vancouver, B.C., Canada remains the only city in North America that has initiated and adopted actual ordinance language. Vancouver’s ordinance will require new residential construction to provide an electrical circuit for home charging. It will also require multi-dwelling-unit buildings to set aside a specific percentage of occupancy for electric-vehicle parking and charging. This Vancouver ordinance does not yet extend to commercial or retail locations.

## **RECOMMENDATION**

Recommendations for consideration in drafting model ordinances, model regulations and guidance relating to electric vehicles and infrastructure are outlined below. These recommendations took into consideration the points of view of the following stakeholder groups:

- Plug-in Electric Vehicle Drivers/Owners/Operators
- Charging Station Site Hosts
- Vehicle, Battery, and Charging Station Manufacturers
- Electric Utilities
- Municipalities & Regulators

These recommendations further embody and are based upon best practices related to the following aspects of electric vehicle infrastructure:

- Safety – Building and Equipment Standards (NEC, SAE, UL)
- Latest Technology - Telematics, Smart Grid & Demand Management, Battery Chemistries
- Usability - Universal Access, Signage, Data Availability, PUC (resale of kwh, TOU/EV rates)
- Ease of Implementation - Comprehensiveness, Enhancements to Existing Law, New Enabling Law, No Regulatory Barriers
- Effectiveness - Site-selection Priority, Cost for User, Installation and Operation,

An online web-based survey will also be conducted by the consultant team in early April to query the experience of drivers of electric vehicles across the country. This information will be summarized for use in future recommendations.

While the primary task is to make recommendations for use by local governments, the team finds that certain changes to laws at both state and federal levels may additionally be helpful or required to achieve the desired outcome of widespread acceptance of electric-vehicle technology into the marketplace. Based upon the team’s research, knowledge and skills in the area of electrified transportation, the following recommendations identify relevant subject areas. This list is meant to aid in the discussion and be considered more fully in the development of the model regulations and guidance. With 2SHB 1481 in

mind, these recommendations will be identified in the model regulations and guidance as either “Required”, “Basic” or “Enhanced”. If a local government adopts the “Required” model regulations, they can demonstrate consistency with 2SHB 1481. The “Basic” option includes both the “Required” model regulations and supporting model regulations that assist jurisdictions to efficiently allow EVI. The “Enhanced” option goes beyond allowing EVI to actively encouraging and requiring EVI.

#### Recommendations for Local Authorities:

1. EV purchase incentives
  - a. Support tax credits, rebates, licensing fee reductions, and HOV lane access
2. EV practical-usage incentives
  - a. Implement free parking in municipal lots and garages
  - b. Implement free, and/or less restrictive on-street parking (e.g., longer time limits)
  - c. Exempt EVs from urban-congestion restrictions and fees (if/when implemented)
3. Single-family attached and detached dwelling infrastructure (i.e. single owner control of dwelling)
  - a. Streamline permit processing for home charging installation (e.g., priority handling, fast turnaround, over-the-counter and/or online permits, centralized coordination, permit czar, contractor-level or designated-representative sign-offs)
  - b. Implement a low, flat or no-fee permit rate structure
  - c. Require that new houses be “EV-ready” (minimum Level II circuit installation)
4. Multi-unit-dwellings infrastructure (i.e. site and building controlled by multiple owners and/or residents)
  - a. Streamline permit processing (e.g., priority handling, fast turnaround, over-the-counter and/or online permits, centralized coordination, permit czar, contractor-level or designated-representative sign-offs)
  - b. Implement a low, flat or no-fee permit rate structure
  - c. Encourage and incentivize developers, building owners, and condominium associations to install charging stations and/or enabling infrastructure
  - d. Revise new-construction and major remodel building code to require electrical conduit installation between service panel and a percentage of parking spaces (formulas to be defined)
5. Workplace-charging infrastructure
  - a. Encourage and promote workplace charging station installation
  - b. Work with corporate sustainability offices to promote charging station installation
  - c. Require new and remodeled workplace parking to install electrical conduit between the service panel and a percentage of parking spaces (formulas to be defined)
6. Public-charging infrastructure - includes all locations designated for public use including municipal and private parking lots (such as retail, commercial and industrial facilities) as well as on-street parking and workplace visitor parking.
  - a. Streamline permit processing (e.g., priority handling, fast turnaround, over-the-counter and/or online permits, centralized coordination, permit czar, contractor-level or designated-representative sign-offs)
  - b. Implement low, flat, or no-fee permit rate structure
  - c. Conform to signage and demarcation standards
  - d. Enact enforcement ordinances for plug-in-vehicle-only parking
  - e. Ensure acceptance for any levels of charging infrastructure deployment
  - f. Ensure compliance with Americans with Disabilities Act requirements, as appropriate
  - g. Review Level III siting options and identify barriers to development within jurisdiction
  - h. Review exchange station siting options and identify barriers to development within jurisdiction

- i. Require a level of real-time station status-reporting capability using a standardized communication protocol (data structure and content to be determined)
- j. Require interoperability and open access to charging stations (no technical or other barriers to use by anyone in the general EV driving public)

Recommendations for State Authorities:

1. Revise appropriate acts/laws to give owners a limited right to charging infrastructure in multi-unit dwellings (similar to solar rights in other states)
2. Revise appropriate acts/laws to allow pass-through of electrical usage (kwh) charges to owners and tenants
3. Revise appropriate laws to create a plug-in electric vehicle license plate, required to be in place in order to utilize any of the plug-in electric vehicle provisions put in place throughout the state (at the city, county, or state level)

Recommendations for Federal Authorities:

1. ARRA - Extend expiration date for tax incentives for installation of electric-vehicle charging infrastructure

**ATTACHMENTS**

**ATTACHMENT A:** EVI Code Compilation by Location

**ATTACHMENT B:** EVI Code Compilation by Topic

**ATTACHMENT C:** EV, EVI and Battery Practices in Other States

**ATTACHMENT D:** EVI Code Compilation (Note: see PSRC Website and Resources Section of Model Document for Updated Code Compilation)

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**ATTACHMENT A  
EVI CODE COMPILATION BY LOCATION**

COLOR KEY:							
	High Value	Moderate Value	Low Value				
Ranking	Location	Contact Name	Email	Phone #	Notes	Link	Document Code and Details
1	Austin	Robert Spiller, Austin Transportation Director; Austin Librach	conservation@austinenergy.com	(512) 974-7092	LightMoves Interview. Has EV rebate program. \$500 for EVs, \$250 for scooters, \$150 for motorcycles, and \$100 for bicycles. -Program expires 10/31/10 and they expect the program to be extended.	<a href="http://www.ci.austin.tx.us/cleancities/evr/guidelines.htm">http://www.ci.austin.tx.us/cleancities/evr/guidelines.htm</a>	A_Austin TX - EV Rebate 2008.htm
1	Boise	Karen Gallagher, Boise Transportation Dept.; Kathleen Lacey, Boise Transportation Dept.	kgallagher@cityofboise.org; klacey@cityofboise.org	(208) 384-3910 (208) 384-3835	LightMoves Interview. Has Zero Emission Vehicle Parking Code. Offers limited free parking at city meters for electric and zero emission vehicles.	<a href="http://www.cityofboise.org/city_clerk/102808/o-53-08.pdf">http://www.cityofboise.org/city_clerk/102808/o-53-08.pdf</a>	A_Boise_2008
1	Davis	Fleet Manager Dan Doolan; Sustainability Coordinator Mitch Sears	msears@cityofdavis.org	Parks/Service Department: (530) 757-5656	LightMoves Interview. Mitch Sears, indicated nothing formalized ad hoc. However, found an electric vehicle code in place on internet (see link 1) -Set up "Alternative Vehicle Task Force" to encourage community EV use, which has since ceased operating. (What did it accomplish?) -Maintains four charging stations - Has EV-Only parking -see links - Has 18 EVs in its fleet (15 GEM cars, 2 Miles, 1 electric gator) which are subsidized through grants from Yolo-Solano AQMD	<a href="http://cityofdavis.org/cmo/citycode/print_section.cfm?chapter=22&amp;section=16">http://cityofdavis.org/cmo/citycode/print_section.cfm?chapter=22&amp;section=16</a> <a href="http://cityofdavis.org/cmo/citycode/detail.cfm?p=22&amp;q=2396">http://cityofdavis.org/cmo/citycode/detail.cfm?p=22&amp;q=2396</a>	A_Davis_Parking_dateunknown.pdf A_Davis_PkngEngineerDirective.pdf
1	Hawaii	Margaret Larson	margaret.s.larson@dbedt.hawaii.gov	(415) 420-8584	Of note in the currently proposed legislation are: HB 2346 expands definition of "bicycle" to include electrically assisted bicycles HB2679 extends taxing/fees to above SB 2231 general excise tax exemption on EVs and EV charging systems July 1 2010 to Jan 1 2020 SB 2358 HOV lane access for hybrids, PHEVs, and "energy efficient" vehicles SB 2927 changes parking space references to electric vehicles to "green vehicles" or "G-vehicles"	<a href="http://www.hawaiicleanenergyinitiative.org/bill_status.html">www.hawaiicleanenergyinitiative.org/bill_status.html</a> <a href="http://www.hawaiicleanenergyinitiative.org/pdfs/sb_202_cs1.pdf">www.hawaiicleanenergyinitiative.org/pdfs/sb_202_cs1.pdf</a> <a href="http://www.hawaiicleanenergyinitiative.org/policy.html">www.hawaiicleanenergyinitiative.org/policy.html</a>	A_Hawaii_SB1202_2009.pdf A_Hawaii_RevisedStatute_2009.pdf A_Hawaii_ev-act-290-1997.pdf
1	London	na - internet only	ev@london.gov.uk		EVs given 100% exemption from the "congestion charge," amounting to 1700 pounds per year. - details on parking incentives at <a href="http://www.electricparking.com">www.electricparking.com</a> . The burroughs of Westminster and Hamilton are offering parking incentives -Proposal for charging infrastructure in 20% of city parking spaces -Proposal for 1,000 EVs in city fleet by 2015 -City working to install 25,000 public charge points by 2015, 90% of which will be in workplace parking lots - Details of strategy are outlined in a comprehensive white paper "London's EV Infrastructure Strategy":	<a href="http://www.london.gov.uk/electricvehicles/docs/GLA_ELI_Strategy_09_V05.pdf">http://www.london.gov.uk/electricvehicles/docs/GLA_ELI_Strategy_09_V05.pdf</a>  <a href="http://www.london.gov.uk/electricvehicles">www.london.gov.uk/electricvehicles</a>	Summary, pgs 7-8. Detail pgs 14-39 D_London_2009.pdf

**ATTACHMENT A  
EVI CODE COMPILATION BY LOCATION**

ATTACHMENT A EVI CODE COMPILATION BY LOCATION							
COLOR KEY:	High Value	Moderate Value	Low Value				
Ranking	Location	Contact Name	Email	Phone #	Notes	Link	Document Code and Details
1	Minnesota	Matt Burriss, MN House Researcher		(651) 296-5045	Law passed in May 2009. Cutting state-owned vehicle emissions 25% by 2010 and 50% by 2015. Rule states that all charging stations installed must work for every EV model, and be equipped with bi-directional charging capability. State intends to begin purchasing EVs once they are commercially available and no more than 10% more expensive than comparable gasoline models.	<a href="https://www.revisor.mn.gov/laws/?id=134&amp;year=2009&amp;type=0">https://www.revisor.mn.gov/laws/?id=134&amp;year=2009&amp;type=0</a>	A_Minnesota_2009.mht
1	New York City	Stu Loeser/Jason Post, Media Contact re: PlaNYC EV study; Thomas Maguire, Director of Studies & Strategic Planning; Glen Price, Director of Studies & Implementation	tmaguire@dot.nyc.gov; gprice@planning.nyc.gov	(212) 788-2958; (212) 442-1504; (212) 720-3491	January 2010 released city report w/help from McKinsey "Exploring Electric Vehicle Adoption in New York City" -Study suggested tailoring early policy action to helping early adopters enter EV market, rather than on general public -Survey suggested idea of giving recognition to EV adopters (ie. planting a tree in their name). Respondents also voiced desire for easy/convenient process for charging installation -DOES NOT RECOMMEND tax credits or public charging infrastructure (early adopters willing to pay more alter driving habits).	<a href="http://www.nyc.gov/html/planyc2030/downloads/pdf/electric_vehicle_adoption_study_2010-01.pdf">http://www.nyc.gov/html/planyc2030/downloads/pdf/electric_vehicle_adoption_study_2010-01.pdf</a>  Bloomberg press statement: <a href="http://www.nyc.gov/portal/site/nycgov/menuitem.c0935b9a57bb4ef3daf2f1c701c789a0/index.jsp?pagelD=mayor_press_release&amp;catID=1194&amp;doc_name=http%3A%2F%2Fwww.nyc.gov%2Fhtml%2Fom%2Fhtml%2F2010a%2Fpr010.html&amp;cc=unused1978&amp;rc=1194&amp;ndi=1">http://www.nyc.gov/portal/site/nycgov/menuitem.c0935b9a57bb4ef3daf2f1c701c789a0/index.jsp?pagelD=mayor_press_release&amp;catID=1194&amp;doc_name=http%3A%2F%2Fwww.nyc.gov%2Fhtml%2Fom%2Fhtml%2F2010a%2Fpr010.html&amp;cc=unused1978&amp;rc=1194&amp;ndi=1</a>	Summary 4-5. Pg 19 very important. Pgs 6-18 are detail. W_NewYorkCity_2010.pdf
1	Oregon	Jeff Cogen, Chairperson of Alternative Fuel Vehicle Infrastructure Working Group	jeff.cogen@co.multnomah.or.us	(503) 988-5219	White paper: "Final Report of the Alternative Fuel Vehicle Infrastructure Working Group, January 2010". Working group was convened by Governor Kulongoski via Executive Order. Recommendations include establishing purchase standards for state-funded fleets, creating a free home audit program for residential installations, including EV manufacturing in the Business Energy Tax Credit, and creating a new state tax credit for EV purchases and infrastructure installations	<a href="http://governor.oregon.gov/Gov/pdf/afvi_wg_final_report.pdf">http://governor.oregon.gov/Gov/pdf/afvi_wg_final_report.pdf</a>	Summary 4-5. Detail pgs 9-40. W_Oregon_2010.pdf
1	Portland	Roy Kaufman; James Mast, Portland Development Commission EV expert; Katja Dillman, Transportation Policy team in Mayor's office	Roy.Kaufmann@ci.portland.or.us; mastj@pdc.us; katja.dillman@portland.ci.or.us	(503) 823-4799 (kaufman)	LightMoves Interview. One of five test markets for the LEAF. As partner in \$100M grant, Portland will release 1k vehicles and install 2.5k charging stations -Oregon has statewide standards for design and installation of EV charging equipment (link to right)	<a href="http://arcweb.sos.state.or.us/rules/OAR_S_900/OAR_918/918_311.html">http://arcweb.sos.state.or.us/rules/OAR_S_900/OAR_918/918_311.html</a>	Scroll 3/4 down to sect. 918-311-0065 A_Oregon_Building Codes Division_2010.mht
1	Portland (utility)	Jeff Hammon & Rick Durst	jeffrey.hammon@pgn.com	(503) 464-7638	He and Rick Durst are the two people working to make Portland EV-ready. Very pro-active. Working on uniform signage. Good response. Also, Clackamas County is in contact with JH wants to be included in loop.	<a href="http://www.cbs.state.or.us/bcd/programs/electrical/alternate_methods/09-01_am.pdf">http://www.cbs.state.or.us/bcd/programs/electrical/alternate_methods/09-01_am.pdf</a>	A_OregonBuildingCodes_2009.pdf

**ATTACHMENT A  
EVI CODE COMPILATION BY LOCATION**

COLOR KEY:							
	High Value	Moderate Value	Low Value				
Ranking	Location	Contact Name	Email	Phone #	Notes	Link	Document Code and Details
1	Sacramento	Bill Boyce	bboyce@smud.org	(916) 732-6981	LightMoves interview. Bill Boyce emailed a resolution that was passed in the late 1990s. Also reported to Jim that Sacramento has no current mandates for EV infrastructure as part of new development, but it did have a regulation adopted in 1994 that required electric circuits and panel capacity for a 240V-40amp line to the garage for all new residential construction. This regulation has not been enforced though, for a lack of EVs. Not able to show documentation.	uploaded	A_Sacramento_1994.doc
1	San Francisco	Bond Yee, Bob Hayden	<a href="mailto:bob.hayden@sfgov.org">bob.hayden@sfgov.org</a>	415-355-3740	LightMoves Interview. Unique financing program to help up front capital costs by enabling buyers to pay off energy efficiency retrofits via property taxes. Trying to get EVs qualified for this program. Passed a resolution in 2000 in support of EVs and supporting state-mandated quota for EVs.	<a href="http://www.sfbos.org/ftp/uploadedfiles/bdsupvrs/resolutions00/r0715-00.pdf">http://www.sfbos.org/ftp/uploadedfiles/bdsupvrs/resolutions00/r0715-00.pdf</a>	A_SanFranciscoResolution_2000.pdf
1	San Jose	Laura Stuchinsky, Sustainability officer with DOT; Randy Turner, Deputy Dir of General Services (fleet)	<a href="mailto:laura.stuchinsky@sanjoseca.gov">laura.stuchinsky@sanjoseca.gov</a>		Has free parking for any EV of San Jose resident in public parking lots and meters; has free parking ordinance for hybrids if purchased within city; goal of 100% fleet to Alt. Fuel by 2012; has PHEV in parking fleet; on-street charging utilizing streetlight poles in front of city hall and in front of a school and off-street parking in public parking garages; no regulations on developers	phone interview by Jim	
1	Vacaville	Brian McLean	bmclean@cityofvacaville.com	(707) 449-5330	Lightmoves interview. Has EV lease pay-down program, designed to lower lease payments for EV drivers. Achieved through grant funding. Has lowered monthly EV lease payments by over half. Provides up to \$6k in incentives -EVs allowed to go solo in the carpool lane -EVs also exempt from bridge tolls -City leases 24 RAV-4 EVs	<a href="http://www.cityofvacaville.com/departments/public_works/documents/EV%20Program.pdf">http://www.cityofvacaville.com/departments/public_works/documents/EV%20Program.pdf</a>	A_VacavilleIncentive_2004_2009.pdf
1	Vancouver BC	Brain Beck	brian.beck@vancouver.ca		LightMoves interview. Implementing EV charging stipulations in latest building codes: 20% of multi-family parking stalls are equipped with EV charging equipment; all single family homes must have EV charging capacity; A Nissan rollout city -Working to obtain Mitsubishi EVs for city fleet -Applied to federal gov't to run charging pilot program -	<a href="http://www.vancouver.ca/cityclerk/documents/infrastructure_report_penv3.pdf">Infrastructure Report: http://www.vancouver.ca/cityclerk/documents/infrastructure_report_penv3.pdf</a>  Infrastructure Guidelines: <a href="http://www.bchydro.com/etc/medialib/internet/documents/environment/EVcharging_infrastructure_guidelines09.Par.0001.File.EV%20Charging%20Infrastructure%20Guidelines-BC-Aug09.pdf">http://www.bchydro.com/etc/medialib/internet/documents/environment/EVcharging_infrastructure_guidelines09.Par.0001.File.EV%20Charging%20Infrastructure%20Guidelines-BC-Aug09.pdf</a>	Pgs 4, 5, 1/2 down 6 are most relevant for Doc 1. For Doc 2, see pgs 4, 11, 13-16, overall this doc is oriented more toward installers

**ATTACHMENT A  
EVI CODE COMPILATION BY LOCATION**

COLOR KEY:							
	High Value	Moderate Value	Low Value				
Ranking	Location	Contact Name	Email	Phone #	Notes	Link	Document Code and Details
1	Vancouver BC	Don Chandler	<a href="mailto:domchandler@shaw.ca">domchandler@shaw.ca</a>		Here is an insert out of his article that we will discuss: As we're under taking proposals for more revisions to the electrical code ( to define demand load calculations for the dedicated circuits and specifically include emerging electric vehicle charging equipment such as the new plug defined by SAE J1772), we hope to reconcile these by-laws into a more uniform approach that requires a completed connection for a percentage of all residential parking stalls in both houses, bike storage rooms and condos.	Document to be uploaded	A_Vancouver_O-2009.pdf
2	Atlanta	Don Francis, formerly of GA Power & Light	<a href="mailto:dfrancis@bellsouth.net">dfrancis@bellsouth.net</a>	(404) 906-0656	In 2002 Atlanta added to their zoning ordinance requirement for 3 stations per 100 parking spots in special zoning districts (retail areas trying to promote walk-ability where parking lots in back, storefronts near sidewalks) When EVs were killed, the city removed it from the books. Now city is starting to revive the idea.	na	
2	Delaware	na	na	na	DD:Possibly first state to pass legislation having to do with V2G possibly because the leading academician wrt V2G is professor Willett Kempton from the University of Delaware. They have a test program in the works for actual V2G. DD: Keep in mind that real consumer and utility-ready V2G is still many years away. DSM has to come first. Our colleague Dave Kaplan knows the most about V2G, imho.	<a href="http://www.greencarcongress.com/2010/01/delaware-v2g-20100122.html">www.greencarcongress.com/2010/01/delaware-v2g-20100122.html</a>	D_DelawareV2G_2010
2	Harvard University	Kelly Sims Gallagher; Erich Muehlegger	<a href="mailto:erich_muehlegger@harvard.edu">erich_muehlegger@harvard.edu</a>		White Paper: "Going Green to Get Green: Incentives and Consumer Adoption of Hybrid Vehicle Technology"	<a href="http://cbev.research.yale.edu/uploads/File/Gallagher_Muehlegger.pdf">http://cbev.research.yale.edu/uploads/File/Gallagher_Muehlegger.pdf</a>	W_Harvard_2007
2	Houston	James Tillman	<a href="mailto:james.tillman@cityofhouston.net">james.tillman@cityofhouston.net</a>		-Mayor Bill White & Reliant Energy released 10 public charging stations in 11/09. -Eventually hope to deploy 400 Level 3 charging stations. - Working toward establishing preferred, certified electricians for installation. -Spring 2010, Houston plans to convert 5 Priuses to PHEVs. -Looking into establishing electric downtown "motor pool fleet" for city use - Program is called "Power of the Plug-In" - Looking into various incentives like HOV access and preferred parking	<a href="http://projectgetready.com/city/partner-city/houston-texas">http://projectgetready.com/city/partner-city/houston-texas</a>	D_Houston_2010.mht
2	Illinois	Brian Levin fm Carbon Day and Hal Emalfarb, legal counsel for ESB Attorneys at Law			Brian is with Carbon Day, part of Green Corridor project (10 states). Has emailed legislation written by Hal - we have copy.	uploaded doc	D_IllinoisModelStatute_2010.pdf
2	Indianapolis	Paul Mitchell; CEO of Energy Systems Network	<a href="mailto:pmitchell@cincorp.com">pmitchell@cincorp.com</a>	(317) 532-4774	Asking state for cost recovery plan for EV demo in Summer 2010	<a href="http://projectgetready.com/city/partner-city/indianapolis-region">http://projectgetready.com/city/partner-city/indianapolis-region</a>	D_Indianapolis_2010.mht

**ATTACHMENT A  
EVI CODE COMPILATION BY LOCATION**

COLOR KEY:	High Value	Moderate Value	Low Value				
Ranking	Location	Contact Name	Email	Phone #	Notes	Link	Document Code and Details
2	Issaquah WA	Trish Heinonen, Long Range Planning Manager David Fujimoto, RCO Office Manager	<a href="mailto:trishh@ci.issaquah.wa.us">trishh@ci.issaquah.wa.us</a> <a href="mailto:davidf@ci.issaquah.wa.us">davidf@ci.issaquah.wa.us</a>	(425) 837-3095; (425) 837-3412	Joint effort of City's Long Range Planning Dept and Resource Conservation Office, a division of Public Works Engineering.		
2	Massachusetts	State Department of Environment		(617) 626-1000	Installation guide for electric vehicle charging equipment in Massachusetts	<a href="http://www.mass.gov/Eocca/docs/door/carger1.pdf">http://www.mass.gov/Eocca/docs/door/carger1.pdf</a>	W_Massachusetts_2000
2	Orlando	John Parker, Senior Environmental Specialist, Orange County Environmental Protection Division	john.parker@ocfl.net	(407) 836-1445	With Nissan, is promoting the "Zero Emission Mobility Project". Launched on 2/2/10. -Used \$50k DOE grant to convert existing hybrids to PHEVs -Studying a variety of projects including charging stations at hotels, conversion of 10% of rental car fleet to electric, carpool/toll booth breaks for EVs -Working actively to expedite the permitting process -Orlando has pilot solar powered charging unit and fleet PHEVs	<a href="http://www.ocfl.net/cms/DEPT/CEsvcs/epd/GelReadyCentralFlorida.htm">www.ocfl.net/cms/DEPT/CEsvcs/epd/GelReadyCentralFlorida.htm</a>	D_Florida_2010.mht
2	Pierce County, WA	Tiffany O'Dell, Associate Planner	todell@co.pierce.wa.us	(253) 798-7027	Exhibit B to Ordinance to County Council - includes electric vehicle battery exchanges & charging stations as an allowed use throughout use tables except in residential and resource zones.		
2	Raleigh	Anne Tazwell, Alt. Fuels Program Manager; Jeff Barghout; Robert Underhill	cleantransportation@ncsu.edu; JBarghout@AdvancedEnergy.org; RUnderhill@AdvancedEnergy.org	(919) 513-7831; (919) 857-9006; (919) 857-9037	Home to the Clean Fuel Advanced Technologies Program	<a href="http://www.ncsc.ncsu.edu/cleantransportation/CFATproject.htm">http://www.ncsc.ncsu.edu/cleantransportation/CFATproject.htm</a> <a href="http://www.afdc.energy.gov/afdc/programs/view_ind.php/NC/6195">http://www.afdc.energy.gov/afdc/programs/view_ind.php/NC/6195</a>	
2	Rohnert Park, CA	Office of Public Works and Community Services		(707) 588-3300	Has instituted "Zero Emission Mobility Program", consisting of obtaining an electric city fleet and installing public charging infrastructure -Status of grants needed to pay for the projects? -Rep from Public Works dept. had no idea	<a href="http://www.ci.rohnert-park.ca.us/index.aspx?page=520">http://www.ci.rohnert-park.ca.us/index.aspx?page=520</a>	
2	Salt Lake City	Tim Harpst, Transportation Director	tim.harpst@slcgov.com	(801) 535-6630	Tim sent email - said not really that active. Have installed a few EVSEs in parking facility. But will send info on legislation that city council has taken. Has sent emails that Jim will read.	jim	
2	Santa Monica	Rick Sikes, Fleet Superintendent; Susan Munves, Green Building Program Administrator	susan.munves@smgov.net rick.sikes@smgov.net	(310) 458-8514 (rick); (310) 458-8229 (susan)	Susan reports that a multi-department team has just started to assemble to address updating city codes and documents to reflect emerging EV rollout. Susan is primary contact person, not Rick. Nothing has been codified but they are keenly aware of what needs to happen to make EV infrastructure more ready.	City's Sustainable City Plan: <a href="http://www.smgov.net/Departments/OSE/Categories/Sustainability/Sustainable_City_Plan.aspx">http://www.smgov.net/Departments/OSE/Categories/Sustainability/Sustainable_City_Plan.aspx</a>  Emissions Fuels Policy: <a href="http://www01.smgov.net/cityclerk/council/information_items/2008/ReduceEmissionsFuelsPolicy.pdf">http://www01.smgov.net/cityclerk/council/information_items/2008/ReduceEmissionsFuelsPolicy.pdf</a>	Doc 1 not very relevant. Doc 2, pg 8. Doc 3, not very relevant

**ATTACHMENT A  
EVI CODE COMPILATION BY LOCATION**

COLOR KEY:							
	High Value	Moderate Value	Low Value				
Ranking	Location	Contact Name	Email	Phone #	Notes	Link	Document Code and Details
						Free parking of ZEVs & HOV decaled vehicles at meters: <a href="http://www.qcode.us/codes/santamonica/view.php?topic=3-3_16-3_16_120&amp;highlightWords=parking+meter+decal&amp;frames=on">http://www.qcode.us/codes/santamonica/view.php?topic=3-3_16-3_16_120&amp;highlightWords=parking+meter+decal&amp;frames=on</a>	
2	Tacoma, WA	Diane Wiatr, Long-Range Planning Division, Seattle, WA	dwiatr@cityoftacoma.org	(253) 591-5380	2010 Annual Amendment Application No. 2010-08 Electric Vehicle Infrastructure: amend the regulatory code by adding dev regs for electric vehicle charging stations and amend the comp plan to add language to support electric vehicles and their charging infrastructure	<a href="http://cms.cityoftacoma.org/Planning/2010%20Annual%20Amendment/PublicHearing/C5b_ElectricVehicle.pdf">http://cms.cityoftacoma.org/Planning/2010%20Annual%20Amendment/PublicHearing/C5b_ElectricVehicle.pdf</a>	D_Tacoma_2009
2	Virginia	David Diamond	ddiamond@lmi.org		White Paper: "Impact of High Occupancy Lane Incentives for Hybrids in Virginia"	<a href="http://www.nctr.usf.edu/jpt/pdf/JPT11-4Diamond.pdf">http://www.nctr.usf.edu/jpt/pdf/JPT11-4Diamond.pdf</a>	W_Virginia_2008
3	Cincinnati	Micah Vieux	micah@cleanfuelsohio.org		Micah is part of a team that wants to develop a statewide initiative. No city-specific found yet. He said Ohio is about 10 years behind the rest of the nation.	na	
3	Colorado - Denver	Matthew Marshall; City & County of Denver	Matthew.marshall@denvergov.org	(720) 913-1516	Income tax credit 85% of the difference btw. price of alt-fuel car and similar gasoline car. Capped at \$6k, increasing to \$7.5k by 2012. - Grants available to cities to install EV charging infrastructure. -US/China "Eco Partnership" - Goal of 7k EVs by 2013 -Businesses encouraged to get electric fleets, provide charging infrastructure -CO plug in vehicle working group (bark, no bite) -Plan for quick turnaround of EV permitting -Pilot project converting one parking enforcement Jeep to full BEV -Was rejected from Clean Cities Grant that would have resulted in extensive EV infrastructure	<a href="http://www.afdc.energy.gov/afdc/progs/ind_state_laws.php/CO/ELEC">http://www.afdc.energy.gov/afdc/progs/ind_state_laws.php/CO/ELEC</a>	
3	Los Angeles	Carlo Fuente, Department of Water and Power	carlo.fuente@lacity.org		The City of L.A. has active use of EVs in Department of Water and Power, up to 300 EVs in carpool, meter reading and field operations...no public charging points, no private regulations.	na	
3	Madison		www.cityofmadison.com		Has NEV language in their Municipal code	na	
3	Palm Springs	Michelle Mician; Head of Palm Springs Sustainability Commission		(760) 323-8214	Mizell Senior Center Project (meals on wheels) - 3 EVs in fleet, procured through comm. devel. block grant -Has developed a NEV street map - No real ordinances to speak of	na	
3	Rhode Island	Al Dahlberg	albert_dahlberg@yahoo.com	(401) 524-1151	Has goal of 10,000 EVs in Rhode Island by 2015	<a href="http://www.pitchengine.com/rockymountaininstitute/rocky-mountain-institute-the-state-of-rhode-island-the-city-of-providence-and-national-grid-announce-joint-effort-at-northeast-auto-show-to-bring-plug-in-electric-vehicles-to-the-ocean-state-42503/">http://www.pitchengine.com/rockymountaininstitute/rocky-mountain-institute-the-state-of-rhode-island-the-city-of-providence-and-national-grid-announce-joint-effort-at-northeast-auto-show-to-bring-plug-in-electric-vehicles-to-the-ocean-state-42503/</a>	

**ATTACHMENT A  
EVI CODE COMPILATION BY LOCATION**

COLOR KEY:							
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Ranking	Location	Contact Name	Email	Phone #	Notes	Link	Document Code and Details
3	Santa Fe, NM	Cary Weiner, Renewable Energy Planner	csweiner@santafenm.gov	(505) 955-6337	Electric vehicle rental program (Dragonfly Express) -Considering installing charging stations for private EVs in future		

<sup>1</sup>See Attachment C: EVI Code Compilation.  
A=Adopted Code  
D=Draft Code  
W=White Paper  
M=Miscellaneous

**ATTACHMENT B**  
**EVI Code Compilation by Topic**  
**March 22, 2010**

#	Topic	Details	Source	Location	Status	Proposed Model Regulations Chapter <sup>1</sup>	Link or Document Code in Attachment C
1	ADA compliance	Task force clarifies accessibility requirements	Task Force	Oregon	A	Building	M_Oregon Advisory Team Memo_2-10.doc
2	ADA compliance	Reportedly what others' following in the nation.	California State Department of Architects	CA + national	A	Building	A_CA_ADA_2008
3	Building codes - existing, retrofit and remodeling	Illinois Model Law - condos shall have at least 10%	Hal Emalfarb draft legislation	Illinois	D	Building and Zoning	D_Illinois Model Statute_2010
4	Building codes - existing, retrofit and remodeling	Provides guidelines for new residential and condo construction	Vancouver Ordinance	Vancouver, BC Canada	A	Building and Zoning	M_Vancouver_Chandler_2009 M_Vancouver_Deployment_Guidelines_2009 A_Vancouver_O_2009
5	Building codes - new construction	Illinois Model Law - houses and condos	Hal Emalfarb draft legislation	Illinois	D	Building and Zoning	D_Illinois Model Statute_2010
6	Building codes - new construction	EVSEs required in new homes and 20% of parking in multi-family	Vancouver Ordinance	Vancouver, BC, Canada	A	Building and Zoning	M_Vancouver_Chandler_2009 M_Vancouver_Deployment_Guidelines_2009 A_Vancouver_O_2009
7	Charging Stations	must have bi-directional charging capability and stations must work with all EV models	Minnesota Office of the Revisor of Statutes	Minnesota	A	Utilities	A_Minnesota_2009
8	Charging Stations	Installation issues	Installation Instruction Manual	Massachusetts	M		M_Massachusetts_2000.pdf

<sup>1</sup>See Attachment C: EVI Code Compilation.  
A=Adopted Code  
D=Draft Code  
W=White Paper  
M=Miscellaneous

**ATTACHMENT B**  
**EVI Code Compilation by Topic**  
**March 22, 2010**

#	Topic	Details	Source	Location	Status	Proposed Model Regulations Chapter <sup>1</sup>	Link or Document Code in Attachment C
9	Charging Stations	Statewide standards for design and installation of charging stations		Oregon	A	Building, Zoning and Public Works	A_OregonPressReleaseBuildingCodes_2008.pdf
10	Disincentives	Road tax on EVs	Proposed legislation - not approved	Washington State	D		<a href="http://apps.leg.wa.gov/billinfo/summary.aspx?bill=6377&amp;year=2009">http://apps.leg.wa.gov/billinfo/summary.aspx?bill=6377&amp;year=2009</a> <a href="http://apps.leg.wa.gov/documents/billdocs/2009-10/Pdf/Bills/Senate%20Bills/6377.pdf">http://apps.leg.wa.gov/documents/billdocs/2009-10/Pdf/Bills/Senate%20Bills/6377.pdf</a>
11	Disincentives	Car surcharge on EVs	Proposed legislation - not approved	Washington State	D		SB 6377
12	Electrical Code	Clarifies code issues between state and NEC	Building Codes Division	Oregon	A	Building and Utilities	A_OregonBuildingCodes_2009.pdf
13	Incentives (all)	Good analysis comparing different types of incentives for maximum impact. Only focuses on hybrid vehicles, not electric.	Kennedy School of Government Student Policy Paper: "Going Green to Get Green."	Harvard, MA	W		W_Harvard_2007
14	Incentives (Financial)	Congestion charge exemption		London, UK	D		D_London_2009
15	Incentives (Financial)	Sustainable Financing Program where property owners who invest over \$5,000 in energy efficiency projects to their home receive up front funding from the City and the loan is repaid at a low interest rate over 20 years on the property tax bill. Electric vehicle charging stations and retrofit costs qualify under this program.	Jim interview with Bob Hayden	San Francisco, CA	A		na

**ATTACHMENT B**  
**EVI Code Compilation by Topic**  
**March 22, 2010**

<sup>1</sup>See Attachment C: EVI Code Compilation.  
A=Adopted Code  
D=Draft Code  
W=White Paper  
M=Miscellaneous

#	Topic	Details	Source	Location	Status	Proposed Model Regulations Chapter <sup>1</sup>	Link or Document Code in Attachment C
16	Incentives (Financial)	City rebate program	City and Utility initiative	Austin, TX	A		A_Austin TX - EV Rebate 2008
17	Incentives (Financial)	Has EV lease pay-down program that has lowered monthly lease payments by half	City of Vacaville	Vacaville, CA	A		A_VacavilleIncentive_2004_2009
18	Incentives (Financial)	General excise tax exemption on EVs and EV charging systems	State legislation	Hawaii	A		A_Hawaii_SB1202_2009.pdf
19	Incentives (Financial)	White Paper recommends tax credits	Oregon Task Force	Oregon, WA	W		W_Oregon_2010.pdf
20	Incentives (HOV access)	Policy paper that examines market impact of hybrids by offering HOV lane access.	"Impact of High Occupancy Lane Incentives for Hybrids in Virginia"	Virginia	W		W_Virginia_2008
21	Incentives (HOV access)	HOV lane access for EVs even when solo driver	Vacaville Department of Public Works	Vacaville, CA	A		A_VacavilleIncentive_2004_2009
22	Incentives (HOV access)	HOV lane access for PHEVs	State legislation	Hawaii	A		A_Hawaii_SB1202_2009.pdf A_Hawaii-Revised Statute_2009
23	Incentives (HOV access)	CA legislation is considering what types of vehicles get HOV access; EVs under consideration	no formal bill introduced yet	California	D		na

<sup>1</sup>See Attachment C: EVI Code Compilation.  
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**ATTACHMENT B**  
**EVI Code Compilation by Topic**  
**March 22, 2010**

#	Topic	Details	Source	Location	Status	Proposed Model Regulations Chapter <sup>1</sup>	Link or Document Code in Attachment C
24	Incentives (Parking)	Free parking at meters	City of Davis	Davis, CA	A	Vehicles and Traffic	A_Davis_Parking_dateunknown
25	Incentives (Parking)	Free parking at meters	1997 EV Act	Hawaii	A	Vehicles and Traffic	A_Hawaii_ev-act-290-1997
26	Incentives (Parking)	Free parking in city lots for EVs	Interview with City of San Jose	San Jose, CA	A	Vehicles and Traffic	A_SanJoseParknigResolution.pdf
27	NEC compliance	National Electric Code		National	A	Utilities	A_NEC6252008.pdf
28	Parking Signage	Chandler reports that the adopted national sign is going International - might be worth researching.	Don Chandler of the Vancouver Electric Vehicle Assn	Canada	D		na
29	Parking Signage	Creates EV Parking Sign regulations	City of Davis	Davis, CA	A	Building, Public Works and Zoning	A_Davis_Pkng Engineer Directive
30	Parking Signage	JH: initiated contact w/ Federal Manual on Uniform Traffic Control Devices Committee (MUTCDC). Every State must adhere to federal signage regulations, but can add supplements. Done through State DOTs (WashDOT). Need to include this in model O. For spaces to be enforceable with a fine, the State will need to have adopted.	Conversations and emails with JH, DD and PGE representatives	Portland, OR & CA	D	Building, Public Works and Zoning	sample signs available upon request

<sup>1</sup>See Attachment C: EVI Code Compilation.  
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**ATTACHMENT B**  
**EVI Code Compilation by Topic**  
**March 22, 2010**

#	Topic	Details	Source	Location	Status	Proposed Model Regulations Chapter <sup>1</sup>	Link or Document Code in Attachment C
31	Parking Spaces	1 out 100 spaces are to be for EVs now, this number increases to 2 after EVs reach a certain number.	Hawaii legislation	Hawaii	A	Building, Public Works and Zoning	A_Hawaii-SB1202_2009
32	Parking Spaces	Zero emission parking code	<a href="http://www.cityofboise.org/city_clerk/102808/o-53-08.pdf">http://www.cityofboise.org/city_clerk/102808/o-53-08.pdf</a>	Boise, ID	A		A_Boise_2008
33	Parking Spaces	Parking incentives	<a href="http://www.electricparking.com">http://www.electricparking.com</a>	London, UK	D		D_London_2009.pdf
34	Permitting of Charging Stations	Proposal to offer free permitting for EVSE installations, similar to free permitting for solar installations.	Bill Boyce, SMUD	Sacramento	D	Procedures	<a href="http://www.cityofsacramento.org/dsd/reference/fees/photovoltaic-ordinance.cfm">http://www.cityofsacramento.org/dsd/reference/fees/photovoltaic-ordinance.cfm</a>
35	Permitting of Charging Stations	Coordination among agencies in dense metropolitan areas to expedite and make EVSE permitting uniform	Bay Area EV Corridor, coordinated by Clean Cities	San Francisco San Jose Oakland, CA	D	Public Works	D_SanFranciscoBayArea_2008.htm
36	Permitting of Charging Stations	E-permitting allows a participating electrical contractor to purchase such a permit on line, 24/7, for any jurisdiction that is participating.	Don Clements, memo	Oregon	A	Public Works	A_Clements_2-10.doc
37	PUC Rulemaking	Determining resale of electricity via charging stations	California Public Utilities Commission Rulemaking	California	D		D_CaliforniaCPUCRulemaking_2009.doc W_CA_CPUC_2009.pdf
38	PUC Rulemaking	Determined resale of electricity via charging stations is legal	Hawaii statewide ordinance	Hawaii	A		A_Hawaii_Revised Statute_2009
39	Resolutions	City councils adopting broad support language	Resolution and Press Release	Sacramento San Francisco	A		A_Sacramento_1994.pdf A_SanFranciscoResolution_2000.pdf

<sup>1</sup>See Attachment C: EVI Code Compilation.  
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**ATTACHMENT B**  
**EVI Code Compilation by Topic**  
**March 22, 2010**

#	Topic	Details	Source	Location	Status	Proposed Model Regulations Chapter <sup>1</sup>	Link or Document Code in Attachment C
40	Towing	Non-EVs can get towed if parking in EV charging spots.	CA Vehicle Code	California	A	Vehicles and Traffic	A_CaliforniaVehicleCode_2003.docx

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## ATTACHMENT C

### EV Code Compilation: EV, EVI, and Battery Practices in Other States and Regions

This attachment provides a listing of practices identified through the code compilation research and other research findings. These practices should **NOT** be interpreted as recommended by the respective agencies or technical advisory committee. Rather, they are provided in the guidance **only** in order to show the range of practices being used or considered in other areas to promote electric vehicle infrastructure and electric vehicles.

The practices include potential incentives, regulations and standards, and studies that could be implemented at the local, regional, and state level. As such, they could take the form of plans, regulations, or additional guidance.

LOCAL GOVERNMENT PRACTICES
<b>Incentives</b>
Implement electric vehicle (EV) parking incentives, such as free and/or less restrictive parking (e.g., longer time limits) in municipal lots, garages, and on-street parking.
As authorized in RCW 36.70A.695(4), consider including the following development regulation incentives: <ul style="list-style-type: none"><li>o Bonus height, site coverage, floor area ratio, and transferable development rights (TDRs) for use in urban growth areas.</li></ul>
In addition to the incentives in RCW 36.70A.695(4), consider the following: <ul style="list-style-type: none"><li>o Use incentives to encourage retrofitting of commercial parking lots to accommodate electric vehicle infrastructure (EVI).</li><li>o Provide reduced permit fees for permits retrofitting existing residential development.</li><li>o Allow charging infrastructure to be exempt from site coverage requirements.</li><li>o Offer a reduction in parking requirement to commercial or multi-family developments where parking spaces are converted to EV charging stations.</li></ul>
Promote workplace charging infrastructure installations for employees and public uses.
<b>Sources:</b> <ul style="list-style-type: none"><li>o City of Austin, Texas, Electric Vehicle Incentives – Guidelines, Dealerships, and Vehicles (2008).</li><li>o City of Boise, Idaho, Administrative Services Manager (John Eichmann) Memorandum to Mayor and Council recommending approval of Zero Emission Vehicle (ZEV) Parking Ordinance amending Boise City Code 10-17 to enable limited free parking at parking meters for Zero Emission Vehicles (2008).</li><li>o City of Davis, California Municipal Code 22.16.0 Electric Vehicles.</li><li>o State of Hawaii, Revised Statutes §291-71 Designation of parking spaces for electric vehicles; charging units and §291-72 Parking spaces reserved for electric vehicles; penalties (2009) (effective 01-01-12).</li><li>o State of Hawaii, S.B. No. 1202, <i>A Bill for an Act relating to Transportation Energy Initiatives</i> (2009).</li><li>o City of Sacramento, California, <i>Resolution No. 94189 of the Sacramento City Council Supporting Electric Vehicle Readiness Program</i> (04-12-94).</li><li>o City of San Diego, California, <i>Council Policy 600-27 Affordable Housing/In-Fill Housing and Sustainable Building Expedite Program</i> (05-20-03); <i>Council Policy 900-14, Sustainable Building Policy</i> (05-20-03); <i>Resolution No. 715-00</i> (07-28-00).</li><li>o City and County of San Francisco, California, <i>Resolution No. 715-00, File No. 001399; Resolution encouraging California Governor Gray Davis to uphold the existing California Air Resources Board zero emission vehicle mandate, which requires that at least four percent of</i></li></ul>

## LOCAL GOVERNMENT PRACTICES

*the 2003 model year passenger cars and light duty trucks offered for sale in California be zero emission vehicles (08-07-00).*

- o City of San Jose, California, *Resolution No. 74769 – A Resolution of the Council of the City of San Jose Amending the Master Parking Rate Schedule to Increase Flexibility in Setting Parking Rates at the Convention Center and Almaden/Woz Parking Lots for Events at the Convention Center; and Repeal Resolution No. 74210 Effective on July 1, 2009 (01-27-09).*
- o County of Sonoma, California, *Building Green Policy, Resolution No. 08-0947 (11-04-08). Draft Resolution Adopting Guidelines, Rating Systems and Compliance Thresholds for the Sonoma County Green Building Program* proposed to be adopted 02-2010.
- o City of Vacaville, California, *City of Vacaville's Electric Vehicle (EV) Program (2004).*
- o City of Vancouver, British Columbia, Canada, *Building By-Law No. 9936 amending Building By-law No. 9419 §13.2.1 Electric Vehicle Charging; §13.2.1.1 Parking Stalls; §13.2.1.2 Electrical Room (04-20-11).*
- o City of Vancouver, British Columbia, Canada, *Policy Report Development and Building Report on Electric Vehicle Charging (06-22-09).*
- o Kelly Sims Gallagher and Erich J. Muehlegger, John F. Kennedy School of Government, Harvard University, *Giving Green to Get Green? Incentives and Consumer Adoption of Hybrid Vehicle Technology (October 2007).*

## Development Regulations

Determine ratio of parking spaces to be EV-ready in single-family dwellings, multifamily dwellings, mixed-use buildings and other uses, such as retail, hotel or office space, in part based on the electric vehicle market share.

Require remodeled non-residential parking to install electrical conduit between the service panel and a percentage of parking spaces (formulas to be defined) to make future installation less costly.

Create design standards for public roads within subdivisions and frontage improvements (only if unique provision not covered elsewhere in other Chapters) that enable eventual implementation of EVI.

Create design standards for public common areas (e.g., identify a requirement for EV charging for parking associated with neighborhood parks; refer to other Chapters, such as Zoning and Public Works for siting design standards).

Require new or a percentage of new single-family and townhome construction to be "EV-ready" (minimum Level 2 circuit installation).

Require new or a percentage of new apartment and mixed use construction to have minimum Level 1 and Level 2 circuit installation. Determine parking ratios for each charging levels.

Monitor the EV industry and if necessary amend any regulations or guidance that the local government has previously adopted.

Establish streets, sidewalks, and public works standards and guidance documents for installation of EVI in the public right-of-way, public parking facilities, government fleet parking facilities, and on private properties where EV charging is deemed a priority.

<b>LOCAL GOVERNMENT PRACTICES</b>
<p><i>Sources:</i></p> <ul style="list-style-type: none"> <li>○ City of Davis, California Municipal Code 22.16.0 <i>Electric Vehicles</i>.</li> <li>○ City of Vancouver, British Columbia, Canada, <i>Building By-Law No. 9936 amending Building By-Law No. 9419 §13.2.1 Electric Vehicle Charging; §13.2.1.1 Parking Stalls; §13.2.1.2 Electrical Room (04-20-11)</i>.</li> <li>○ City of Vancouver, British Columbia, Canada, Policy Report Development and Building <i>Report on Electric Vehicle Charging (06-22-09)</i>.</li> </ul>
<p><b>Rules and Procedures</b></p>
<p>Streamline permit processing (e.g., priority handling, fast turnaround, over-the-counter and/or online permits, centralized coordinating, permit czar, contractor-level or designated-rep sign offs) for EVI installation or retrofitting.</p>
<p>Implement a low, flat or no-fee permit rate structure on a temporary basis until the electric vehicle industry becomes more established.</p>
<p>Implement data collection protocols through EVI vendor permitting as they are established by the State (see State Guidance – Data Collection, in the following tables).</p>
<p><i>Sources:</i></p> <ul style="list-style-type: none"> <li>○ City of San Diego, California, <i>Council Policy 600-27 Affordable Housing/In-Fill Housing and Sustainable Building Expedite Program (05-20-03); Council Policy 900-14, Sustainable Building Policy (05-20-03); Resolution No. 715-00 (07-28-00)</i>.</li> <li>○ County of Sonoma, California, <i>Building Green Policy, Resolution No. 08-0947 (11-04-08)</i>. Draft <i>Resolution Adopting Guidelines, Rating Systems and Compliance Thresholds for the Sonoma County Green Building Program (proposed to be adopted 02-2010)</i>.</li> </ul>
<p><b>Research and Programs</b></p>
<p>For batteries, provide consumers with appropriate levels of information on the handling of EV batteries and map systems of all reuse and recycle centers and battery exchange stations.</p>
<p>Conduct demonstration projects that integrate battery storage systems with the electrical grid and plug-in vehicles. Take actions that would support the integration of smart grid development with houses and plug-in vehicles and the placement of smart charging stations in public places.</p>
<p>Explore ways in which to provide education and outreach on EV and PHEV issues. Through the internet, public access TV, print media, public service announcements, and community workshops, provide education and safety tips on plug-in vehicles and battery management.</p>
<p>Educate consumers shopping for electric vehicles that the best measure of efficiency of an electric vehicle is miles per kilowatt-hours, which compares to miles per gallon for internal combustion engines.</p>
<p>Consider Zero Emission Parking Zones, which could be created by local governments as a way of reserving parking for zero-emission vehicles. See, for example, the City of Boise's Zero Emission Vehicle Parking Ordinance, Boise City Code 10-17.</p>

## LOCAL GOVERNMENT PRACTICES

### Sources:

- o City of Houston, Texas, *Project Get Ready: Preparing Cities for the Plug-in Electric Vehicle: Power of the Plug-in Program* (11-17-09).
- o City of Indianapolis, Indiana, *Project Get Ready: Preparing Cities for the Plug-in Electric Vehicle – Indianapolis Region: Project Plug-In* (2010).
- o City of New York, *PlaNYC Exploring Electric Vehicle Adoption in New York City* (January 2010).
- o City of Tacoma, Washington, Community and Economic Development Dept., Annual Amendment Application No. 2010-08, *Electric Vehicle Infrastructure* (01-25-10).
- o City of Toronto, Ontario, Canada, *The Toronto Atmospheric Fund – Fleetwise Program* (1998-2010).
- o Don Chandler, Past President, Vancouver Electric Vehicle Association, *Pulling the Copper* (November 2009).
- o Electric Transportation Engineering Corporation, sponsored by Natural Resources Canada, *Electric Vehicle Charging Infrastructure Deployment Guidelines British Columbia* (July 2009).
- o Enid Joffe, Clean Fuel Connection, *The EVSE Installation Process, The 35 Day Challenge*, (03-31-10).
- o eTec, an ECotality company, *Electric Vehicle Charging Infrastructure Deployment Guidelines for The Central Puget Sound Area* (April 2010).
- o Great London Authority, *London’s Electric Vehicle Infrastructure Strategy* (December 2009).

## REGIONAL GOVERNMENT PRACTICES

### Incentives

Exempt EVs from urban congestion restrictions and fees, such as tolling (if/when implemented).

Include EVs and EVI in regional transportation plans, and implementation programs for funding and air quality.

Incentivize the inclusion of EVI in any public infrastructure project that has been previously identified as a priority public charging station site. Utilize a set of standard construction plans and specifications to the extent possible to streamline installations and control installation costs.

### Sources:

- o Kelly Sims Gallagher and Erich J. Muehlegger, John F. Kennedy School of Government, Harvard University, *Giving Green to Get Green? Incentives and Consumer Adoption of Hybrid Vehicle Technology* (October 2007).

### Rules and Procedures

Work collectively on a regionwide basis to develop streamlined permitting policies and processes for EVI installation.

### Research and Programs

Study the development of Zero Emission Driving Zone regulations for zones devoted solely to nonmotorized or electrically powered vehicles. Also related are Zero Emission Parking Zones (see above under “Local Government Research and Programs”).

## REGIONAL GOVERNMENT PRACTICES

### Sources:

- o City of Minneapolis, Minnesota, John Bailey, David Morris, *Electric Vehicle Policy for the Midwest – A Scoping Document*. Prepared for the RE-AMP Network, New Rules Project (December 2009).
- o State of California, San Francisco Bay Area Mayors Mayor News Release *Mayors Aim to Make San Francisco Bay Area the Electric Vehicle Capital of the U.S.* (11/20/08).

## STATE GOVERNMENT PRACTICES

### Incentives

Establish state-level tax credits, rebates, licensing fee reductions, and HOV-lane access for EVs.

Work with private fleet operators (e.g., large companies, the taxi industry, or transit agencies) to determine what levels of incentives (such as reserved parking areas) could be provided or required to help market penetration of plug-in vehicles and associated EVI.

### Sources:

- o Kelly Sims Gallagher and Erich J. Muehlegger, John F. Kennedy School of Government, Harvard University, *Giving Green to Get Green? Incentives and Consumer Adoption of Hybrid Vehicle Technology* (October 2007).
- o Province of Ontario, Canada, Newsroom, *Press Release: Ontario Paves the Way for Electric Vehicles*, <http://news.ontario.ca/mto/en/2010/06/ontario-paves-the-way-for-electric-vehicles.html> (June 18, 2010).
- o State of Hawaii, Department of Business, Economic Development, and Tourism, *Hawaii's Electric Vehicle (EV) Rebate and Grant Programs*, <http://electricvehicle.hawaii.gov/> (Accessed June 21, 2010).
- o State of Hawaii Office of the Governor, *CT&T Signs Historic MOU with the State of Hawaii*, <http://hawaii.gov/gov/news/releases/2010-news-releases/ct-t-announces-plans-to-assemble-electric-cars-in-hawaii2018i>, (Accessed June 21, 2010).
- o State of Hawaii Office of the Governor, *Hawaii Selected as an Early Launch Site of the Nissan LEAF Electric Vehicle*, <http://hawaii.gov/gov/news/files/2010/may/hawaii-selected-as-an-early-launch-site-for-the-nissan-leaf-electric-vehicle/?searchterm=nissan>, (Accessed June 21, 2010).
- o State of Hawaii Office of the Lieutenant Governor, *Press Release: Hawaii's Electric Vehicle Rebate and Grant Program Announced*, <http://hawaii.gov/litgov/news/releases/2010-news-releases/hawai-is-electric-vehicle-rebate-and-grant-program-announced>, (May 13, 2010).
- o State of Hawaii Transportation Energy Diversification Project, *Hawaii "EV Ready" Grants Grant Opportunity Announcement*, <http://hawaii.gov/dbedt/info/energy/evrebatesgrants/Grant%20Opportunity%20Announcement%202010-06-08.pdf>, (June 2010).

### Rules and Procedures

RCW 36.70A.695(5)(d) defines "Rapid Charging Stations." Consider amending this term to "Fast Charging Station" for consistency with the above model definitions for "Charging Levels" above (i.e., Level 1 = Slow; Level 2 = Medium; Level 3 = Fast). Note that Level 3 charging is recommended to identify the increased power needed in a numerical fashion (i.e., "3"), but that this charging level is also sometimes referred to as Fast Charging (see footnote 20.) Use of "Level 3" appears in other EVI documents (see page 25 of the "Report of the Alternative Fuel Vehicle Infrastructure Working Group") (See footnote 21).

## STATE GOVERNMENT PRACTICES

The state should consider adoption of other definitions included in the model regulations, including “Electric Vehicle,” and should direct how to designate the vehicle (such as a special license plate or decal) in future legislative sessions. If during the legislative session a different definition is adopted, local governments would then go back and amend their definitions for consistency.

In 2010, Hawaii amended its statutes to remove roadblocks to charging station installation in multi-unit dwellings. The state should review RCW 64.34, Condominium Act, and other applicable RCWs and WACs, to see if there is the same limitation to be resolved in Washington and, if necessary, consider amendments in a future legislative session.

### Rules and Procedures – Charging Station Data Collection

Direct local government permitting agencies to require collection and reporting of standard installation, location, and operating data on public charging stations (above Level I) for use by EVI stakeholders.

Require all public charging stations to have smart charging capabilities, real-time communications, and data collection capabilities to enable on-site and utility-level energy management. Ensure interoperability and transparency between charging station technologies and that all EV drivers are allowed to charge at every publicly available station.

Potential Framework For Data Collection System:

- Require and regulate data collection and data availability (Legislature).
- Set standards for data protocols (Utilities and Trade Commission or Commerce).
- Warehouse and consolidate data (State DOT or Commerce).
- Make data available to public and vendors (State DOT or Commerce).
- Report on data for planning and legislative activity (Commerce).

Require the following data to be displayed at charging sites: charging speed; fee structure; claims contact information; and restrictions or other instructions.

Require the following information to be reported by permit agencies as part of the permitting process: permitting agency; equipment unique identifier; equipment specifications; location of the equipment (how the location should be specified is still to be determined —alternatives include street address, parcel number, and GPS address); date when the charger was permitted; date when the charger became operational; date when the charger is to be discontinued; charger speed (same as above); and responsible party/owner contact information.

Consider amendments to the rules that implement RCW 19.28.281 to allow the use of a demand factor table for calculating EV charging equipment and feeders, similar to the Statewide Alternative Method adopted by the State of Oregon, Ref.: ORS 455-060. EV charging equipment and feeders are rated as continuous loads by the NEC Article 625. Testing data shows that charging currents are substantially below the full rated load and that cycle times typically do not exceed three hours.

Sources:

- National Electrical Code Handbook Article 625, Electric Vehicle Charging System (2008).
- Oregon Advisory Team, *The EV Project*, Summary of Localization Findings (02-05-10).
- State of California Department of General Services Division of the State Architect: DSA – 2009 California Access Compliance Reference Manual Policies, Policy 97-03, *Interim Disabled Access Guidelines for Electric Vehicle Charging Stations* (06-05-97).
- State of California Public Utilities Commission, Order Instituting Rulemaking to Consider Alternative-Fueled Vehicle Tariffs, Infrastructure and Policies to Support California’s Greenhouse Gas Emissions Reductions Goals (08-24-09).
- State of California Vehicle Code § 22511, Zero-Emission Vehicles: Display of Decal (01-01-03). State of Delaware, Senate Bill No. 153 An Act to Amend Title 26 of the Delaware Code

## STATE GOVERNMENT PRACTICES

- Relating to Customer Sited Energy Resources (06-09-09).
- State of Hawaii, Act 290 (S.B. 1160), A Bill for an Act Relating to Electric Vehicles (07-01-97).
- State of Hawaii, Revised Statutes §291-71 Designation of parking spaces for electric vehicles; charging units and §291-72 Parking spaces reserved for electric vehicles; penalties (2009) (Effective 01-01-12).
- State of Hawaii, S.B. No. 1202, A Bill for an Act relating to Transportation Energy Initiatives (2009).
- State of Hawaii, S.B. 2231 § 196 Placement of electric vehicle charging system (2010).
- State of Minnesota, Chapter 134-H.F. No. 1250, An act relating to transportation; regulating electric vehicle infrastructure; amending Minnesota Statutes 2008, sections 16C.137, subdivision 1; 169.011, by adding subdivision; 216B02, subdivision 4; 216B-241, subdivision 9; Laws 2006, chapter 245, section 1; Laws 2008, chapter 287, article I, section 118; proposing coding for new law in Minnesota Statutes, chapter 325F (05-21-09).
- State of Oregon, Building Codes Division, Statewide Alternate Method No. OESC 09-01 (Ref: ORS 455.060) *Approval of the use of a demand factor table for calculating Electric Vehicle charging equipment services and feeders* (09-04-09).
- State of Oregon, Department of Consumer and Business Services, Building Codes Division, Division 311, *Miscellaneous Electrical Rules* (Effective 10-01-09).
- State of Oregon, Department of Consumer and Business Services Press Release *New building codes standards support electric vehicle growth* (10-14-08).
- State of Oregon, Dennis Clements, Chief Electrical Inspector, Building Codes Department, *Expediting the permit process for installation of EVSE* (02-12-10).

## Research and Programs

Ensure statewide regulations and workforce training exists for handling, transporting and recycling of lithium-ion batteries. Support and fund advanced battery research. Fund cell/battery pack and battery supplier manufacturing facilities.

Fund studies to determine the best possible reuse or repurpose of depleted EV batteries. With utility companies and others, test the integration of depleted EV batteries with smart grid technology. Establish advanced lithium-ion recycling and reuse facilities. Monitor EV battery reuse activities and recycling business models to assess if any changes are needed in state regulations, such as adoption of incentives.

Promote research, development, and demonstration projects for smart grid technology, including integration of homes, worksites, and plug-in vehicles. Make investments in a modernization of the electrical grid as part of a nationwide plan to ensure reliable electricity.

Establish funding mechanisms for workforce and consumer training on the smart grid and electric vehicle infrastructure, and for use and handling of EV and PHEV batteries.

Develop a statewide clearinghouse for identifying all battery charger and exchange locations, their use status, hours of operation, and other available services.

### Sources:

- City of Minneapolis, Minnesota, John Bailey, David Morris, Electric Vehicle Policy For the Midwest – A Scoping Document. Prepared for the RE-AMP Network, New Rules Project (December 2009).
- The Massachusetts Division of Energy Resources, Installation Guide for Electric Vehicle Charging Equipment (September 2000).
- The Royal Academy of Engineering, Electric Vehicles: charged with potential (May 2010).
- City and County of San Francisco, California, Resolution No. 715-00, File No. 001399; Resolution encouraging California Governor Gray Davis to uphold the existing California Air Resources

## STATE GOVERNMENT PRACTICES

Board zero emission vehicle mandate, which requires that at least four percent of the 2003 model year passenger cars and light duty trucks offered for sale in California be zero emission vehicles (08-07-00).

- David Diamond, Ph.D., LMI Research Institute, Impact of High Occupancy Vehicle (HOV) Lane Incentives for Hybrids in Virginia (2008).
- State of California Public Utilities Commission, Policy and Planning Division, Staff White Paper Light-Duty Vehicle Electrification in California: Potential Barriers and Opportunities (05-22-09).
- State of Oregon, Alternative Fuel Vehicle Infrastructure Working Group, Report of the Alternative Fuel Vehicle Infrastructure Working Group (January 2010).



## MEMORANDUM

**TO:** Ivan Miller, Puget Sound Regional Council  
Gustavo Collantes, Washington State Department of Commerce

**FROM:** Jim Helmer, LightMoves

**CC:** Dan Davids, Plug In America  
Anna Nelson, GordonDerr LLP

**DATE:** March 22, 2010

**SUBJECT:** **Local Government Electric Vehicle Infrastructure Phone Interviews**

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### INTRODUCTION

During the 2009 legislative session, the Washington State Legislature passed Second Substitute House Bill 1481 (2SHB 1481), an Act relating to electric vehicles. Sections 2 and 18 of the Act require development of model ordinances, model development regulations, and guidance for local governments for siting and installing electric vehicle infrastructure (EVI), in particular, battery charging stations, and appropriate handling, recycling, and storage of electric vehicle batteries and equipment.

The purpose of this memorandum is to provide information on best practices and lessons learned in other local governments in regard to ordinances, regulations, and guidance documents for siting and installing battery charging stations or battery exchange stations and related EV equipment. LightMoves and Plug In America collaborated to review legislation, codes, policies, and other documents pertaining to EVI in states and local agencies across North America. After conducting this research (*see March 22, 2010 Memorandum from Plug In America on Electric Vehicle Infrastructure Code Research*), a shorter list of local government agencies was identified that potentially had the highest value of information for follow-up phone interviews.

### OVERVIEW

The development of EVI is in its infancy stages in the United States; yet it is thought to be a critical step in creating new jobs, fostering economic growth, and reducing greenhouse gas emissions. Like any new growth industry though, acceptance can be slow, and the learning curve steep. There are many local governments considered as early adopters of supporting the development, use and widespread expansion of electric vehicles. As this report will demonstrate, many of those agencies have adopted policies and regulations on services or operations that are fully under their control, such as free public parking for electric vehicles, or setting goals to convert fleet vehicles to alternative fuel vehicles (similar to language in 2SHB 1481).

To get a broad understanding of the various approaches local governments are taking to support this new industry, the phone interviews included a range of questions that are closely related to EVI (*see Attachment A, Interview Questions*). The interview questions focused on topics included in state and

regional legislation, local codes and ordinances, fleet conversions to alternative fuel vehicles, electric vehicle (EV) charging station permit procedures, EV-related incentives, construction standards, electric utility-related issues, and a request for key documents. In nearly every case, no single person could respond to all of the questions; thus, efforts were made to contact additional representatives so as to obtain a complete set of responses. In addition to phone interviews, information was gained through electronic mail and agency web-site review. **Attachment B**, Comparison of Agency Interview Responses, is a table that summarizes the responses by topic. **Attachment C**, Agency Policies and Code Sections, contains portions of actual code language used in agencies that appear particularly useful for development of local government model regulations and guidance. The agency interviews are still in progress, and will be amended as new information is learned from these agencies and possibly other local governments. It should also be noted that statements made from individuals in these interviews may not always reflect actual agency policy.

## **ANALYSIS**

Following is a summary of information about each agency contacted:

### **Austin, Texas**

Population: 790,000

Contacts: Gordon Derr, Assistant Director of Public Works; Austan Librach, Director Emerging Transportation Technologies Specialist, Austin Energy (Municipal Power Company)

Summary: Austin participates in the Capitol Area Metropolitan Transportation Commission (CAMPO) in the development of regional EVI programs. All actions taken by Austin in reference to EVI and EVs are contained as goals in their 2009 Climate Action Plan. Austin has implemented a purchase rebate program that refunds up to \$500 for new EVs, \$250 for electric scooters and \$100 for qualifying bicycles. They also have a parking incentive program for plug-in vehicles. Austin has no public chargers in place, but is active in converting 38 of its hybrid vehicles in its fleet to Plug-in. They are utilizing State Energy Conservation (SECO) grants to fund the conversions. They have no standard construction documents or building plans and public works details, but are targeting to begin developing such documents one year from now.

### **Boise, Idaho**

Population: 220,000

Contacts: Karen Gallagher, Transportation Planner, Planning & Development Services; Beth Baird, Ground Water and Environmental Specialist

Summary: Boise has established a Green Vehicle Parking incentive in their City Code. An owner of an all electric vehicle (conversions to all electric qualify) may buy an annual \$10 permit to park for free at any Boise parking meter or public garage; however, drivers must be in compliance with time limits. Boise officials were not aware of any state or regional guidance on EVI. No permits have been issued for charging station installations, nor have there been efforts to establish procedures. The Boise fleet contains hybrid vehicles, but no plug-in vehicles. Idaho Power provides electricity to the City. There have not been any joint efforts between Idaho Power and Boise on any EVI projects.

### **Davis, California**

Population: 98,000

Contacts: Dan Doolan, Fleet Manager; Mitch Sears, Department of Public Works and General Services

Summary: Davis is recognized as being one of the most pedestrian and bicycle friendly cities in America. The City has been proactive in multi-modal, alternative transportation, and environmental protection programs for decades. Davis has adopted a Climate Action Plan as an element of its General Plan. In terms of EVI, it had charging stations in public

parking places and at City Hall installed in the 1990s as part of the City's lease of RAV 4 electric cars for fleet purposes. The City does not require private RAV 4 owners to pay for the electricity when charging at these stations; but for free use of the chargers, members of the Electric Auto Association informally assist the City in maintaining the units. While Davis has not planned for, or installed any new generation charging stations, officials are seeing new retail shopping centers constructing EV-ready parking lots to gain LEED certification points. The fleet manager in Davis makes every effort to replace fleet vehicles with alternative fuel vehicles as funding allows. Davis is in the PG&E electrical service territory, and reports that all residential meters have recently been replaced with smart "time of use" meters. Davis applied for a California Energy Commission grant in 2009 to test "Vehicle to Grid" technology but was not selected. Officials in Davis are very supportive of cleaner, alternative fuel transportation, but have a higher priority for travel by non-auto modes, such as bicycling, walking or taking transit.

**Honolulu, Hawaii**

Population: 1,300,000

Contacts: Margaret Larson, Hawaii Department of Economic Development and Tourism; Robert Primiano, Chief, Honolulu Department of Facility Maintenance; Kathy Sokugawa, Chief Planner, Honolulu Planning and Permitting; Allyn Lee, Honolulu Design and Construction (Electrical Division)

Summary: Honolulu has a free parking program for electric vehicles on city streets and public garages. Electric vehicles are identified by a special license plate. Honolulu has processed permits for private charging station installations on a case-by-case review, and used existing electrical permit procedures. Honolulu is working to comply with State legislation that requires public or private parking lots with greater than 100 spaces to have a minimum of 1% of the spaces equipped with charging stations by December 31, 2011. The percentage grows by 1% with each increase of 5,000 registered EVs in the State up to 10%. There is no State funding for this requirement at the current time; however, grant applications are in place through the Federal Stimulus Energy Efficient Block Grant program. There are also no specific directions from the State on voltage requirements, placement, construction standards, or other design considerations. Honolulu has not converted any vehicles to plug-in and has no electric vehicles, but does have a policy to buy alternative fuel vehicles. There are no requirements for new developments to install EV infrastructure at this time. City officials are not planning to install on-street charging stations. Honolulu and its electrical provider, Hawaiian Electric Company are jointly working on renewable energy projects utilizing solar photovoltaics and wind power.

**New York, New York**

Population: 8,800,000

Contacts: Howard Slatkin, Deputy Director of Strategic Planning Office of Sustainability, Mayor's Office.

Summary: New York City has not responded to phone or email requests to participate in the phone interview. LightMoves will continue to make contact with New York to determine what efforts are underway or planned on electric vehicle and related infrastructure policies and projects. Any information gained will be considered for inclusion in subsequent reports.

**Palo Alto, California**

Population: 66,000

Contacts: Karl Van Orsdol, Ph.D., Sustainability Team Leader, Energy Risk Manager; Julie Caporgno, Chief Planning and Transportation Official; Keith La Haie, Fleet Manager

Summary: Palo Alto, home of Stanford University and many leading high-tech companies such as Better Place, Hewlett-Packard, Tesla and others, is participating in the San Francisco Bay Area EV Corridor Project funded by a \$1.9M California Energy Commission grant authorized by Assembly Bill 118. Palo Alto is one of 15 cities, along with 7 counties and 4 transit and special districts, to participate in this project. Palo Alto anticipates installing 6 charging stations (12 vehicles) with grant proceeds. Tesla Motors is also installing 30 level 2 (240V) near its headquarters in a public lot available to employees, visitors, other tenants, and the general public. Palo Alto owns and operates the municipal electric and gas services. Because of this, Palo Alto's fleet is almost entirely CNG. There are some older style charging stations that the City installed for its RAV 4 electric vehicles in the early 1990s that are still being made available for the private owners of these vehicles. The City does not charge for the electricity for the infrequent use of these machines. There are no developer requirements for EVI; and if an existing property owner files a permit for an EV installation, the City will treat the application like any other electrical permit.

**Phoenix, Arizona**

Population: 1,700,000

Contacts: Mo Glancy, Deputy Director of Development Services

Summary: Phoenix is in partnership with a local car-share company that has provided 200 Smart Cars in the region. The City provides free parking for all Smart Cars, and in return is provided Smart Cars for fleet use. Officials indicate their goal is to advance this concept to electric vehicle car-share programs. Permits have been issued for private installations of EV equipment, and they have followed standard electric permit application, fee and inspection processes. Phoenix is not currently operating under any state mandates to install EVI. It is though, one of the five regions funded by the Federal Stimulus eTec grant, and stakeholder meetings with all regional partners are just now getting under way. It is anticipated that the eTec project will install more than 2,000 private and public charging stations in the Phoenix and Tucson metro areas. Development of deployment guidelines similar to those in the greater Seattle area is now underway. Phoenix is working with its two electrical service providers, Arizona Public Service and the Salt River Project on permitting procedures. At the current time, the City has no streamlined permitting for EV charging infrastructure. The City has no parking incentives for Electric Vehicles on City streets or parking facilities, but they are allowed access on the State HOV lanes.

**Portland, Oregon**

Population: 590,000

Contacts: James Mast, Portland Development Commission; Michelle Crim, Bureau of Planning and Sustainability; Rick Durst, Portland General Electric; George Beard, Portland State University

Summary: Portland participates in the Oregon State Alternative Fuel Production and Infrastructure Tax Credit Program, but must pass through its project eligibility to a pass-through partner in exchange for a lump-sum cash payment. It is setting goals for the conversion of its fleet vehicles to alternative fuel as part of its approved 2009 Climate Action Plan. In the City, there are approximately 30 EV charging stations in use, evenly mixed on public and private property. Currently the City is not charging for use of power stations in public garages. There are no on-street installations. City officials are working with Portland General Electric (PGE), Portland State University, and the State of Oregon, and other key stakeholders, as a test market of the federally funded eTec project that will provide funding for EVs and EVI. The City has no ordinances or developer regulations requiring the

installation of EV infrastructure or dedicated parking spaces at this time but is working on a streamlined permit inspection process with PGE. It plans to finalize permitting procedures as the eTec project progresses. Portland has no parking incentives for plug-in vehicles or hybrids, as it has policies to encourage alternative transportation to its downtown.

**Sacramento, California**

Population: 490,000

Contacts: Bill Boyce, Sacramento Municipal Utilities District

Summary: Sacramento is complying with state legislation to convert its fleets to alternative fuel vehicles. They support all clean fuels, except Compressed Natural Gas. The City owns and operates its own electrical utility district (SMUD), and it is actively converting hybrid electric cars to plug-ins and seeks to enter the EV market. There are 75-80 240V fast chargers throughout the City, mostly grouped in small clusters. The City is participating with other cities, the county, the state, and colleges to undertake a more extensive installation of electric charging stations throughout the entire county. Sacramento provides free parking and free charging for electric vehicles in downtown public parking garages and surface lots. Sacramento has no current mandates for EVI as part of new development, but it did have a resolution adopted in 1994 that encouraged builders to install EVI. The intent was for the provision of electric circuits and panel capacity for a 240V-40amp line to the garage for all new residential construction. This resolution has not been widely utilized though, due to a lack of EVs.

**San Diego, California**

Population: 1,250,000

Contacts: Kelly Broughton, Director of Planning & Community Investments; David Jarrell, Deputy Chief of Public Works

Summary: San Diego is one of the 5 metropolitan regions that will be participating in the \$99.8M eTec 2010 Federal Stimulus Grant for electric vehicles and charging infrastructure. San Diego has a very strong working relationship with Sempra/San Diego Gas and Electric and has been working jointly on solar initiatives. It is anticipated this working relationship will soon include electric charging system equipment. The Director of Planning and Community Investments indicated that San Diego could benefit greatly from some work in the area of standardization of EVI installations including where to locate it and how to use it. San Diego does not have any requirements for EVI for private developments, but has adopted a sustainable building policy (900-14) calling for highly efficient energy systems, and conservation of materials, water, and other resources. Council Policy 600-27 calls for the expedition of permitting for all residential, commercial, and industrial buildings built to sustainability standards. Affordable housing buildings meeting sustainability requirements are given high priority for staffing resources in an effort to expedite permits.

**San Francisco, California**

Population: 810,000

Contacts: Bob Hayden, Clean Transportation Advisor; Dept. of Environment; Bond Yee, Director of Parking and Traffic

Summary: San Francisco has been very aggressive in the application of EV test sites and forming public-private partnerships for advancing the EV industry. It is actively involved in the Bay Area EV Corridor grant with several other cities and will install over 60 charging outlets if the region-wide \$1.9M Energy Commission grant is approved. San Francisco has recently announced plans to adopt regulations requiring developers to equip new housing with EV conduits and circuitry. San Francisco has a Sustainable Financing Program where property owners who invest over \$5,000 in energy efficiency projects to their home receive up-front funding from the City, and the loan is repaid at a low interest rate over 20 years on the property tax bill. Electric vehicle charging stations and retrofit costs qualify under this

program. San Francisco has public charging stations on-street and in its public garages. Charging is free in both cases, but the driver must pay parking fees. It has an Executive Order to convert 90% of its fleet to alternative fuel vehicles. San Francisco is considering requiring any company installing a charging station on public property to have two-way communications, be interoperable with other companies' equipment, and be open access for all users, even if they are not subscribed to the company's charge plan. PG&E is the electrical service provider for all private properties, and it is currently testing a streamlined permit process with San Francisco and applicants with charging station installations. SF Public Utilities (municipally owned) provides electrical power to all city/county facilities, and since 100% of this power is produced from hydro-electric facilities, it qualifies as renewable energy. This is consistent with the City's goal to power all City-owned facilities with clean, renewable energy, including charging stations. San Francisco has no construction standards or specifications for installation of public charging stations.

### **San Jose, California**

Population: 1,100,000

Contacts: Randy Turner, Deputy Director, General Services Dept; Laura Stuchinsky, Sustainability Officer, Dept. of Transportation

Summary: The City of San Jose has been a leader in testing charging station infrastructure in the San Francisco Bay Area. It has installations on-street and in public parking structures. It has partnered with a local elementary school to place a charging station on-street in front of the campus. It is currently awaiting approval of a grant for the Bay Area EV Corridor Project along with several other Bay Area cities and counties provided by the California Energy Commission for the installation of 41 more charging stations. There are approximately 40 hybrids in the City's fleet, and one has been converted to a plug-in vehicle in the parking enforcement division. It has developed construction documents for two city-initiated capital projects to install charging infrastructure in the sidewalk area and on streetlight poles. There is a regular coordination meeting with the electrical service provider, Pacific Gas & Electric, to start work on such issues as permitting, billing, and construction requirements. San Jose does not have a streamlined permitting process for EV chargers but is planning to make this an on-line, quick process. San Jose has a Clean Vehicle Parking Incentive program for new hybrid vehicles purchased in San Jose and for electric vehicles purchased anywhere, but registered to a San Jose resident. The parking incentive is for free, unlimited parking at meters and in City-owned parking facilities downtown and in regional parks. San Jose is currently studying a range of transportation incentives to spur low- and moderate-income housing projects, including reducing parking ratios and requiring EV-ready spaces. It also has regulated the taxi industry permitting process by providing additional days of San Jose International Airport service for taxi drivers and companies that own and operate hybrid or compressed natural gas vehicles.

### **Sonoma County, California**

Population: 470,000

Contacts: Jose Obregon, Director of General Services

Summary: Sonoma County has formed an Energy and Sustainability Division in its General Services Department. It is aggressively pursuing actions contained in the County's Climate Action Plan. It has a grant application with the California Energy Commission to undertake an extensive EV infrastructure program in parallel with the Bay Area EV Corridor Project. The County also has established a financing program through California AB 811 to finance energy efficiency improvements on private property. All loans are paid back through property tax assessments over 20 years, and the improvements have to be permanently affixed to the property or structure. EV charging stations are being added as qualifying elements of work. It has loaned approximately \$12M to property owners to date and has over \$20M remaining to be loaned. Sonoma County has hybrid vehicles in its fleet and has

begun converting them to plug-in hybrids. The agency's ultimate goal is to have 100% alternative fuel vehicles. They are using Energy Efficiency Block Grants from the Federal Stimulus Program to install charging stations on streets and in public garages. At this time the County does not charge the user for power. There are no ordinances or regulations requiring EVI in new developments, but the County has adopted a Green Building Policy and is exploring adding implementation regulations for that policy. The County has been very innovative, and they have established a County-wide Climate Protection Authority which will be used to monitor climate action plan progress.

**Vacaville, California**

Population: 98,000

Contacts: Brian McClain, Fleet Manager

Summary: Vacaville, located between San Francisco and Sacramento, is not actively installing EVI although it has long been very progressive in providing facilities for EV use by employees as well as the general public. There are currently 5 charging stations at City Hall that are used by the general public. The power consumed by charging is offset by solar photovoltaic panels on the roof of City Hall. In addition, the City is building a 6-acre transportation/transit center and is again installing enough solar to power the site as well as future charging stations that are being planned in the project. Vacaville also has an innovative program where City funds are used to provide credits up to \$6,000 for any resident who buys a new zero emission vehicle or compressed natural gas (CNG) vehicle locally. At the present time Vacaville is not expanding its fleet or replacing vehicles, but it just completed a vehicle needs study and has decided that it will use CNG as primary fuel. The local utility company is PG&E. There are no plans to share CNG filling stations or EV charging stations at the current time.

**Vancouver, BC**

Population: 560,000

Contacts: Brian Beck, Low Carbon Vehicle Strategies Project Manager

Summary: Vancouver has worked with BC Hydro and many stakeholders to develop EVI deployment guidelines. The guidelines were developed in 2009 and have served as a model for most of the cities in the United States that are considering installing charging stations. Vancouver has a vision of being an all-electric vehicle City. It has passed regulations that will go into effect in April of 2011 that will require all new single-family homes to ready the garage or carport areas with a conduit and properly sized electric panel. In addition, conduits are required to the attic area to accommodate future solar panels. New multi-family dwellings will be required to have 20% of the parking spaces equipped with plug receptacles for charging and a panel sized to accommodate charging stations in all of the spaces. All bicycle storage rooms will be required to have plug receptacles for electric scooters. Motorists driving hybrids can park for free in City lots, but this incentive will be discontinued for a free charge (120v) and park program later in 2010. Vancouver also has a goal of converting all of its fleet to alternative fuel vehicles including hybrid, plug-in hybrid, electric, CNG and bio-diesel.

## **CONCLUSION**

As evidenced through the phone interviews and web research, the rollout of EVI and enabling regulations at the local government level is at a very early stage of development. While most interviewed agencies have installed some public use EV chargers, only Vancouver, British Columbia has developed processes, procedures, ordinances, or regulations for widespread use in siting, permitting, and installing EVI. Still, the intent of these interviews was to reveal best practices, take any lessons learned, and apply them to this effort.

As noted above, Vancouver passed regulations in 2009 requiring developers of new residential construction to provide conduits and electrical panel capacity for EV infrastructure in single-family homes and a percentage of spaces in multi-family dwellings. Vancouver's regulations take effect in April 2011. While Sacramento did adopt a resolution in 1994 to encourage electrical circuits and panel boxes in new homes for plug-in vehicles, the resolution has not been widely utilized due to a lack of EVs. Many agencies provide some form of parking incentives, either reduced or free parking in facilities they own or operate. States such as Hawaii and Arizona have adopted legislation allowing EVs full use of HOV lanes without meeting minimum occupancy requirements.

Most local governments are waiting for advancements in the electric automobile industry and statewide or regional direction through the passage of broader legislation, adoption of state codes, issuance of grants, and institution of workforce training programs before aggressively pursuing regulations on EVI. For those occasions where a permit is being issued for a private charging station installation, agencies are using existing electrical and civil engineering standards but have not developed permitting standards explicitly for EVI. Permit fee incentives for EV permits are not in place yet for the cities interviewed, and the permitting process lacks procedures in all agencies. San Francisco, though, is just beginning to actively test a streamlined, reduced-fee program with PG&E and property owners. Several agencies are providing low-cost loans for installation of energy efficiency improvements on private property and are including EVI as qualifying elements. Most agencies have set goals to phase out gasoline- and diesel-powered vehicles in their fleets and switch to some form of alternative fuel vehicles, such as hybrids, plug-in hybrids, all electric, compressed natural gas, or bio-diesel.

## **RECOMMENDATION**

Recommendations that stem from best practices learned from other agencies and Washington's unique position that pertains to the siting and installing of EVI by local governments are outlined below. With the passage of 2SHB 1481, the advantages of using electricity that is primarily supplied from hydro-electric power (a renewable energy source), the selection of the Pacific Northwest as a region for federal investments in infrastructure and electric vehicles, and the planned roll-out of electric vehicles and plug-in hybrid electric vehicles by major automobile makers, Washington is in a very advantageous position compared to other states. At the same time, it will take years before plug-in vehicles represent any significant share of the market place. Internal combustion engines will be the predominant form of powering vehicles for some time ahead. Thus, Washington officials should consider model development regulations and guidance that provide a range of regulations. The following list of recommendations is meant to aid in the discussion and be considered more fully in the development of the model regulations and guidance. With 2SHB 1481 in mind, these recommendations will be identified in the model regulations and guidance as either "Required," "Basic," or "Enhanced." If a local government adopts the "Required" model regulations, they can demonstrate consistency with 2SHB 1481. The "Basic" option includes both the "Required" model regulations and supporting model regulations that assist jurisdictions to efficiently allow EVI. The "Enhanced" option goes beyond allowing EVI to actively encouraging and requiring EVI.

### Siting

1. Establish zoning regulations, vehicle and traffic regulations, public works standards, and guidance documents for EVI installations for use in private developments.
2. Develop standard construction documents for the installation of EVI in the public right-of-way, public parking facilities and government fleet parking facilities.
3. Form county-wide or region-wide working groups whose focus is on all aspects of siting and installing EVI in an effective and efficient manner.
4. Work with state and utility regulators to ensure that all publicly located charging stations are available for general public use.
5. Initiate a comprehensive mapping and information system identifying the location, hours of operation, and status of charging facilities. Work with state or other parties to provide EV charging locations into a statewide clearing house of information that is readily accessible to EV users.
6. Coordinate to the extent possible, the inclusion of EVI in any public infrastructure project that has been identified as a priority public charging station site. Utilize a set of standard construction plans and specifications to the extent possible to streamline installations and control installation costs.
7. Post public charging station locations on agency websites and utilize other forms of print and electronic media to inform the general public about the locations of charging stations.

### Permitting

1. Work collectively on a region-wide basis to develop streamlined permitting policies and processes for EVI installation.
2. Guidelines should be developed and posted on-line and available in brochure form for homeowners and contractors explaining the permit process, and responsible departments and agencies administering them.
3. Make every reasonable effort to keep permitting costs down. Consider use of a flat fee or no fee for a period of time.
4. Establish rules and procedures to expedite the permit process, and reduce the number of government agency visits by the permit holder and site visits by the government agency, through innovative application and inspection programs.
5. Provide higher priority for projects involving improved energy efficiency, including EVI, or meeting certain sustainability criteria (e.g., LEED certification).

### Developer Regulations

1. Require new residential construction to have basic premises wiring and panel capacity for EV charging units. In establishing these regulations, consider prioritizing and timing them based upon different zoning districts, adequacy of the electrical grid, type, and extent of project (such as new construction or minor modification) and the market penetration of electric vehicles and plug-in hybrid electric vehicles.
2. Determine ratio of parking spaces to be EV-ready in multi-family dwellings and other uses, such as retail, hotel, or office space, based on similar factors of #1 directly above.

### Incentives

1. Encourage workplace charging infrastructure installations for employees and public use.
2. Provide parking incentives whenever possible for both PHEVs and EVs in public parking facilities and on-street.
3. Work with the development and business communities to develop a variety of temporary or permanent incentives for installing EVI voluntarily, such as modifications to parking supply, building height, or lot coverage.
4. Work with private fleet operators, for example large companies, the taxi industry or transit agencies to determine what levels of incentives would be desirable to help market penetration of plug-in vehicles and associated EVI.

## **ATTACHMENTS**

**ATTACHMENT A:** Interview Questions

**ATTACHMENT B:** Comparison of Agency Interview Responses

**ATTACHMENT C:** Agency Policies and Code Sections

# ATTACHMENT A

## INTERVIEW QUESTIONS

**Introductory Statement:** Plug In America and LightMoves are collecting information on behalf of the Washington State Department of Commerce and the Puget Sound Regional Council pertaining to **Electric Vehicle Infrastructure (EVI)** in use or planned for in cities across North America. This information will aid PSRC and Commerce to develop model ordinances, model development regulations and guidance documents for planned EVI that can be adopted by cities and counties throughout Washington.

**This interview** will focus on efforts underway by your agency, region or state involving the development of regulations, such as ordinances, codes, guidance documents, construction or developer requirements for siting and installing battery charging stations or battery exchange stations and related EV equipment.

**We will be asking some questions about your own government operations as well as public facilities in this interview. The interview contains 14 questions and should not take over 30 minutes. Do you have any questions before we start?**

### INTERVIEW

#### State or Regional Legislation and Planning Efforts involving EVI

Question 1: Are you aware of any legislative actions taken by your State to aid or encourage the transition to electric vehicle use, and to assist in broad consumer acceptance and usage of vehicles powered by electricity? This could include establishment of grants or loans for EV infrastructure. Have you implemented the legislation?

Question 2: Is your agency working with other local agencies as part of a metropolitan planning organization (MPO) or state to establish regional goals or priorities concerning EVI? This might involve short-term or long-term planning efforts, policy or goal setting, parking or electrical requirements in new construction or other EV related issues. Or it might involve construction, signage or accessibility issues.

#### Actions by Your Own Government

*(Questions to be tailored based on what we already know about them or their work from Task 1A-1)*

Question 3: Has your City (County) adopted any ordinances, regulations or guidelines requiring charging stations or other EVI in: (this could include parking ratios)

- a) publicly available off-street parking facilities
- b) government fleet parking or maintenance facilities
- c) new or replaced sidewalk areas where curbside parking is allowed
- d) new commercial or residential developments
- e) other – ADA, signage, aesthetics, enforcement, etc.

(How can we obtain copies of such ordinances and regulations?)

Question 4: Has your City (County) set any targets or goals for conversion of its fleet vehicles to alternative fuel vehicles, such as electric, bio-fuel, hydrogen or other?

(How can we obtain more information on the current fleet and conversion goals?)

Question 5: For any charging stations installed in parking facilities (public or private), do you know who is paying for the electricity used for charging electric vehicles?

Question 6: Has your jurisdiction or agency established any regulations or guidelines on the storage, handling or recycling of electric vehicle batteries for:

- a) fleet operations
- b) commercial businesses that service vehicles

Question 7: Regarding your own agency's experience with EVI, are there any lessons learned or best practices for us to consider?

#### Local Utility Company

Question 8: What utility company service area is your agency in?

Question 9: Has your agency entered into any formal or informal arrangements with the utility company to address such issues as:

- a) billing and metering for electrical consumption for charging electric vehicles
- b) peak loading concerns
- c) renewable energy sources or requirements

Question 10: Do you know if your local utility company uses electric vehicles in its fleet operations?

Question 11: Regarding coordination with utility agencies, are there any lessons learned or best practices you can share?

#### Construction Standards for EVI

Question 12: Has your agency adopted any standard plans, details or specifications for installation of EV infrastructure in buildings and parking facilities? Examples are:

- a) adopting state standards
- b) special signage and marking provisions
- c) interior ventilation requirements
- d) standards such as size, location or ratio EV parking spaces

(How can we obtain copies of the above standards?)

#### Incentives for EVI

Question 13: Has your agency, region or state implemented any incentives to consumers, developers or others to purchase electric vehicles or install EV infrastructure?

(This could include rebates, foregoing taxes or fees, bonus heights, floor area ratios, or other transferable development rights.)

Question 14: We are also going to be conducting interviews with businesses, utilities, and other stakeholders that are working on EV infrastructure. Are there specific companies or other key stakeholders in your region or state that you think we should speak with?

***That concludes our interview. Thank you. Do you have any questions of us?***

**ATTACHMENT B  
COMPARISON OF AGENCY RESPONSES**

Local Agency and State	Population	Contact(s)	State & Regional Efforts	Agency Activities	Utility Company Activities	EVI Construction Standards	EV Incentive Programs	Notes	Policies and Code Sections
Austin, Tx.	790,000	Gordon Derr, Assist. Dir. of Public Works; Austan Librach, Dir. of Emerging Transportation Technologies	Capitol Area Metropolitan Transportation Commission (CAMPO); Cental Texas Clean Cities Program	Fleet Conversion to PHEV	Austin Energy Municipal Power leads EV efforts	None	Free Parking at Meters; Vehicle Purchase Rebate Program	EV 3-Year Implementation Timeline; Central Texas Clean Cities implementing incentive programs	Central Texas Clean Cities administers Austin's "Drive Clean-Park Free" program (No provision in City Code)
Boise, Id.	220,000	Karen Gallagher, Transportation Planner; Beth Baird Environmental Specialist	None	Utilizes hybrids in fleet, but no PHEVs	Idaho Power (Cash incentive for energy efficiencies)	None	Green Vehicle Parking Incent. Program	Green Vehicle (EV only) permit requires \$10 annual payment	Chapter 10, Section 17 of Boise City Code
Davis, Ca.	98,000	Mitch Sears, Parks & General Svcs.	None	None	None	None	Free charging for RAV 4 EV owners	PG&E has installed smart time-of-use meters	Municipal Code Section 22.16.070 (Notice of EV Parking Space)
Honolulu, Hi.	1,300,000	Margaret Larson, State DBEDT Robert Primiano, Facil Maint./Fleet Kathy Sokugawa, Dept. Plan/Permit Allyn Lee, Dept. Des. & Const. Elec.	No Dev. Regs requiring EVI	No fleet conversions New Vehs. Alt. Fuel	None	None	Free Parking for EVs; Evs allowed in freeway HOV lanes	State passed legislation requiring any lot over 100 spaces to contain 1% or > charging stations by Dec 31; first year warnings, second year traffic fine to \$100	SB-297 Green Vehicles Definition, identified with EV state license plate; SB 1202 EV charging units and alternative fuel fleets for government agencies
New York, NY	8,800,000	Howard Slatkin, Mayor's Office	No Response to calls/emails	No Response to calls/emails	No Response to calls/emails	No Response to calls/emails	No Response to calls/emails	No Response to calls/emails; reviewing web-site, reports; considering special "green apple" plate	No Response to calls/emails
Palo Alto, Ca.	66,000	Karl Van Orsdol, Ph.D.; Julie Caporgno, Chief Planning and Transportation Official	Bay Area EV Corridor working group/AB118	Installing 12 chargers at City Hall	None	None	Free charging for RAV 4 EV owners	Building Official plans to streamline permit process (2010)	None

Local Agency and State	Population	Contact(s)	State & Regional Efforts	Agency Activities	Utility Company Activities	EVI Construction Standards	EV Incentive Programs	Notes	Policies and Code Sections
Phoenix, Az.	1,700,000	Mo Glancy, Dep. Dir. Devl. Svcs.	Federal Stimulus eTec grant deployment site	Developing EVI deployment guidelines, and permitting procedures	City partnership with Arizona Public Service and Salt River Project	None	None	City provides free parking for car share company (Smart Cars) in exchange for use of cars	None
Portland, Or.	590,000	James Mast, Portland Dev Comm Michele Crim, Port. Bur Plan. Svcs Rick Durst, Portland Genl Elec George Beard, Portland St Univ Janette Silick, Port. Bur Dev. Svcs	Federal Stimulus eTec grant deployment site	Developing EVI deployment guidelines	PGE Utilizes EVs in fleet	None	Free charging in public lots	Approximately 30 EV charging stations in use (public and private); state electric code meets NEC plug standards	Researching
Sacramento, Ca.	490,000	Bill Boyce, Sacramento Municipal Utilities District (SMUD)	California Energy Commission grant application with local agencies for EV Chargers	On-going conversion program from Hybrid to PHEV	SMUD leads EV efforts for City	None	Free Parking and Charging for EVs in downtown garages and lots	Approximately 75 EV 240 V fast chargers in use throughout the City	Resolution 94-189 supporting EV Readiness;
San Diego, Ca.	1,250,000	Kelly Broughton, Director of Planning & Community Investment	Federal Stimulus eTec grant deployment site	Developing EVI deployment guidelines	San Diego Gas and Electric is working with Condominium owners re: charger installations	None	Prioritization of building permits for sustainable buildings	Further research with fleet manager	Council Policy 600-27 (Sustainability Stds.); Council Policy 900-14 Sustainable Building Policy
San Francisco, Ca.	810,000	Bob Hayden, Clean Transportation Advisor, Dept. of Environment	Bay Area EV Corridor working group/AB118	Has plans to install 60+ new chargers	PG&E working with S.F. officials on EVI permit streamlining	None	Free parking and charging for EVs in City garages	Announced plans to require conduits/circuits in all new housing	Researching
San Jose, Ca.	1,100,000	Randy Turner, Dep. Dir. Genl. Svcs Laura Stuchinsky, DOT Sust. Officer	Bay Area EV Corridor working group/AB118	Fleet Conversion to PHEV, EV installations, 40+ new chargers anticipated	PG&E utilizes Plug-ins, Bay Area Corridor EV Working Group member	Yes, construction details on two public projects	Free Parking Incentives for hybrids and EVs, and extra service days for hybrid/CNG taxis	Testing installation of chargers on poles and sidewalk areas; taxi drivers/owners that use hybrid or CNG receive extra Airport coverage	Resolution Amending Parking Program #74210
Sonoma County, Ca.	470,000	Jose Obregon, Director of General Svcs.	Utilizing AB 118 funds for charging stations, and AB 811 for energy efficiency project loans to residents	Plans to convert light duty vehicles to PHEV and EV	None	None	Free charging for EV users	Formed Sonoma County Climate Protection Authority	Adopted Green Building Policy, exploring adding EV as a condition

Local Agency and State	Population	Contact(s)	State & Regional Efforts	Agency Activities	Utility Company Activities	EVI Construction Standards	EV Incentive Programs	Notes	Policies and Code Sections
Vacaville, Ca.	98,000	Brian McClain, Fleet Manager		Powering Charging Stations with solar	Partnering on solar photovoltaic	None	EV Purchase rebate program	Maximizing solar energy and reviewing low watt dynamic roadway lighting	EV Purchase Incentive Program worth up to \$6,000
Vancouver, BC	560,000	Brian Beck, Low Carbon Vehicle Strategies Project Manager; Jo Yee Yung Fung, Sustainable Transportation Program Manager	Researching	Requires EVI in residential dev., electrical service to bicycle rooms, 20% parking ratio EV ready in multi-family; alternative inspection process	Collaboration with BC Hydro, Issued joint EV deployment guidelines	Researching	Discontinuing free parking for hybrids in City owned lots, replacing with free charging for plug-ins (120V first)	Green Homes program includes EV readiness and Solar readiness (effective April 20, 2011); Strong public education and outreach	By-law 9419 for EV requirements, July, 2009; By-law 5563 regarding electrical contractor's declaration to streamline permit process (Oct. 2009)

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# ATTACHMENT C

## AGENCY POLICIES AND CODE SECTIONS

### Austin, Texas

**Parking Incentive Program.** The City of Austin's "Drive Clean--Park Free" program gives city-registered owners of hybrid vehicles that receive an EPA air pollution score of 8 or better a \$100 pre-paid parking card to park in any of the city's 3,700 parking meters. Owners must submit an application to the city and receive a bumper sticker showing their participation in the program. Eligible vehicles must be purchased at certified dealerships within the Austin City Limits. (Effective April, 2008)

### **Electric Vehicle Rebate Program.**

- Applicant must be an Austin Energy electric customer and intends to live in the Austin Energy service area for a minimum of five (5) years.
- Five (5) qualifying electric vehicles, of any combination, per applicant are eligible.
- All-electric vehicle must be new and purchased from the approved dealership list.
- Applicant may receive the following incentives: \$500 for all-electric cars, \$250 for all-electric scooters, \$150 for all-electric motorcycles and select scooters, and \$100 for all-electric bicycles.
- Funding is limited and offered on a first-come, first-serve basis.
- Final incentive level determined after Austin Energy verifies the electric vehicle is a qualifying model and sold by an approved dealership.
- Current incentive valid for the life of program (April 1, 2008 to March 31, 2010) or until program funds are expended, whichever occurs first.
- Incentive application must be submitted within sixty (60) days of vehicle purchase.
- Approved participants will receive the incentive check six (6) to eight (8) weeks from the date the application is approved.

Austin Energy reserves the right to perform a one-time spot inspection to verify the purchase is a qualifying electric vehicle. Central Texas Clean Cities administers the parking incentive and rebate programs on behalf of region. (Effective April, 2008)

### Boise, Idaho

### **City Code, ch. 10, § 1017-13. Green Vehicle Permits.**

Green Vehicle Permits for Electric Vehicles and Zero Emission Vehicles may be obtained from Boise City Parking Services. Boise City Parking Services shall issue to all licensed vehicles that qualify as an Electric Vehicle or Zero Emission Vehicle, as defined in Boise City Code 10-17-02, a permit which shall be affixed to the vehicle's front windshield. A fee of ten dollars (\$10) shall be charged for the permit. The permit issued shall be assigned only to the initial vehicle for which the permit is obtained and may not be transferred. Only those vehicles which have a validly displayed permit may park in the metered spaces without charge. (Effective October, 2008)

Davis, California

**City Code, ch. 22.16.070. Notice of Electric Vehicle Parking Space.**

Upon adoption by the city council of this article, the city engineer shall cause appropriate signs and marking to be placed in and around electric vehicle parking spaces, indicating prominently thereon the parking regulations. The signs shall state that the parking space is reserved for electric vehicles, that an electric vehicle may only park in the space for four hours, and that violators are subject to a fine and removal of their vehicle. (Effective date, researching)

**State of Hawaii**

**Hawaii State Legislation, Act 290, § 3.** (Adopted June 21, 1997, Effective July 01, 1997)

The department of transportation shall:

- (1) Establish and adopt rules pursuant to chapter 91, Hawaii Revised Statutes, for the registration of an electric vehicle in this State; and
- (2) Establish and issue a special license plate to designate that the vehicle to which the license plate is affixed is an electric vehicle.

**Hawaii State Legislation, Act 290, § 4.** (Adopted June 21, 1997, Effective July 01, 1997)

- (1) An electric vehicle on which a license plate described in section 3 is affixed shall be exempt from the payment of parking fees, including those collected through parking meters, charged by any governmental authority, other than a branch of the federal government when operated in this State; and
- (2) High occupancy vehicle restrictions or other traffic control measures.

**Hawaii State Statutes, Part IV, Section 291-71.** (Adopted 2009, Effective upon adoption)

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

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

For the purposes of this section, "electric vehicle" means an electric vehicle or neighborhood electric vehicle with an electric vehicle license plate.

**Section 291-72** (Adopted 2009, Effective January 1, 2012)

- a) Beginning January 01, 2012, any person who parks a non-electric vehicle in a space designated and marked as reserved for electric vehicles shall receive a warning.
- b) Beginning July 01, 2013, any person who parks a non-electric vehicle in a space designated and marked as reserved for electric vehicles shall be guilty of a traffic infraction under chapter 291D and shall be fined not less than \$50 nor more than \$100, and shall pay any costs incurred by the court related to assessing the fine.
- c) Any citation issued under this section may be mailed to the violator pursuant to section 291C-165(b).

## **Sacramento, California**

### **Resolution of the Sacramento City Council Supporting Electric Vehicle Readiness program (Resolution 94189, April 12, 1994).**

The city of Sacramento is committed to implementing the following electric vehicle readiness program by 1998: 1) Supporting the electric vehicle mandates of the California Air Resources Board; 2) Establishing an annual percentage of electric vehicle purchases for the city fleet; 3) Providing electric vehicle charging outlets and preferential parking for city employees who drive electric vehicles; 4) Educating and encouraging builders and planners to design and incorporate infrastructure features conducive to electric vehicles.

## **San Diego, California**

### **Council Policy No.: 600-27. Affordable/In-Fill Housing and Sustainable Buildings Expedite Program (Effective date: May 20, 2003).**

Section F: New residential, commercial, and industrial development projects which meet the “sustainable buildings” definition under City Council Policy 900-14.

### **Council Policy No.: 900-14. Sustainable Building Policy (Effective date: May 20, 2003).**

In addition to achieving LEED “Silver” Level Certification, Council Policy 900-14 encourages the following sustainable building measures for all newly constructed facilities and major renovation projects regardless of square footage:

Section 1: Design and construct mechanical and electrical systems to achieve the maximum energy efficiency achievable with current technology. Energy efficiency measures shall be selected to achieve energy efficiencies at least 22.51% better than California’s Title 24.2001 standards for both new construction and major renovation projects.

#### **Private Sector Incentives:**

It shall be the policy of the City Council to expedite the ministerial process for projects which meet the following criteria: Residential projects that provide 50% of their projected total energy use utilizing renewable energy resources, (e.g., photovoltaic, wind and fuel cells) receive highest priority.

## **San Francisco, California**

### **Resolution No. 715-00 (Effective date: July 28, 2000).**

Resolution encouraging California Governor Gray Davis to uphold the existing California Air Resources Board zero emission vehicle mandate, which requires that at least four percent (4%) of the 2003 model year passenger cars and light duty trucks offered for sale in California be zero emission vehicles.

## **San Jose, California**

### **Resolution No. 74210 (Adopted, 2004, Amended on July 1, 2009).**

WHEREAS, the City administers a Hybrid Vehicle Purchase Incentive Program that entitles hybrid vehicles bought after January 1, 2003 from licensed auto dealerships within the City of San Jose to free parking at on-street and off-street municipal parking facilities.

WHEREAS, on June 19, 2007, the City Council amended the Master Parking Rate Schedule to combine the City’s existing Clean Air and Hybrid Vehicle Parking Validation Programs into one program entitled, "Clean-Air Vehicle Program", which will modify the terms of the existing Clean-Air and Hybrid Vehicle Parking Validation Programs so that they match the program requirements to meet those for the State of California Carpool Lane sticker requirements for a Single Occupancy vehicle, with the exception of

including Neighborhood Electric Vehicles; provide that Clean-Air Vehicles must be purchased after January 1, 2000 from a licensed auto dealership in the City of San Jose; limit participation of City parking facilities to Third Street Garage, Fourth Street Garage, Market Street Garage, 2nd/san Carlos Garage, 2nd/st. James Lot, San Pedro/Bassett Lot, and-San Jose Regional Parks and parking meters throughout the City of San Jose, and add an administrative fee of \$30 for new and replacement permits to cover the administrative costs of the program; extend the modified Clean-Air Vehicle Program through June 30, 2009 and authorize the Director of Transportation to extend the modified Clean-Air Vehicle Program annually thereafter, as long as the parking supply and demand supports continuation of the program; and, authorize the Director of Transportation to add or remove any parking facility from the modified Clean-Air Vehicle Program as necessary; and

WHEREAS, on October 30, 2007, the City Council directed staff to amend the Master Parking Rate Schedule to expand the Clean-Air Vehicle Program to include all Zero Emission Vehicles registered in the City of San Jose and make Zero, Emissions Vehicles registered in the City of San Jose eligible to participate in the Clean-Air Vehicle Program.

### **Sonoma County, California**

**Building Green Policy** (Adopted 2003) Green Building for new home construction and remodeling, is the use of construction practices and materials that protect people and the environment. Green buildings are designed in an integrated manner to respond to the local climate and conditions, to use environmental resources wisely, and to consider the long-term use of the building. Specifically, green buildings are designed, built and operated to deliver improved performance over conventional building practices in the following areas:

1. Conservation of energy and water
2. Use of materials in a resource efficient manner
3. Maintenance of good indoor air quality
4. Durability and ease of maintenance
5. Integration with the site and region

### **Vacaville, California**

#### **Electric Vehicle (EV) Incentive Program** (Adopted 2004)

The city sponsors an EV lease buy-down program, which provides financial incentives to qualifying participants.

The main focus of the buy-down program is to reduce the cost of EV leasing, which can be as high as \$600/month. To offset this cost, the city of Vacaville pursued and secured federal and regional air quality grants that provided up to \$6,000 in incentives to any qualifying participant who leased or purchased a new freeway capable EV from an automobile manufacturer. As a result, participants were able to reduce their lease payment to as low as \$175/month.

### **Vancouver, British Columbia**

**Building By-law No. 9419, § 13.2.1 Electric Vehicle Charging** (Adopted July 9, 2009, Effective April 20, 2011)

#### **Section 13.2.1.1. Parking Stalls**

Each one of 20% of the parking stalls that are for use by owners or occupiers of dwelling units in a multi-family building that includes three or more dwelling units, or in the multi-family component of a mixed use building that includes three or more dwelling units must include a receptacle to accommodate use by electric vehicle charging equipment.

**Section 13.2.1.2. Electrical Room.**

The electrical room in a multi-family building, or in the multi-family component of a mixed use building, that in either case includes three or more dwelling units, must include sufficient space for the future installation of electrical equipment necessary to provide a receptacle to accommodate use by electric charging equipment for 100% of the parking stalls that are for use by owners or occupiers of the building or of the residential component of the building.”

**Electrical By-law 5563, Section 6.9 (b).** (Adopted October 07, 2009, Effective upon Adoption)

A permit holder, under section 6.12, has delivered to the City Electrician a duly completed declaration from the field safety representative named on the permit declaring that the work performed under the permit complies with the Safety standards Act and its regulations and with this By-law a person must not cover up, cut, disturb, or alter such electrical equipment.

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**LightMoves**

## **MEMORANDUM**

**TO:** Ivan Miller, Puget Sound Regional Council  
Gustavo Collantes, Washington State Department of Commerce

**FROM:** Jim Helmer, LightMoves

**CC:** Dan Davids, Plug In America  
Anna Nelson, GordonDerr LLP

**DATE:** March 22, 2010

**SUBJECT: Electric Vehicle Batteries and Equipment**

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### **INTRODUCTION**

During the 2009 legislative session, the Washington State Legislature passed Second Substitute House Bill 1481 (2SHB 1481), an Act relating to electric vehicles. Sections 2 and 18 of the Act require the development of model ordinances, model development regulations, and guidance for local governments for siting and installing electric vehicle infrastructure, in particular battery charging stations, and for appropriate handling, recycling, and storage of electric vehicle batteries and equipment.

The purpose of this memorandum is to provide information regarding electric vehicle batteries and equipment that can be used by local governments for development regulations and guidance for appropriate handling, recycling, and storage of electric vehicle batteries and equipment. In addition, this memorandum provides recommended guidance for the State and local governments for other battery-related topics.

### **OVERVIEW**

Batteries in electric vehicles differ in their role from batteries currently used with internal combustion engine vehicles. Vehicles powered exclusively by internal combustion engines utilize a battery (normally 12V) to provide cranking power to start the engine as well as deliver low voltage to accessories such as the lights and ignition. The internal combustion engine battery is recharged with the aid of an alternator when the engine is running. The much more powerful battery in an electric vehicle (EV) or plug-in hybrid electric vehicle (PHEV) serves as the source of power and propulsion for the vehicle. Batteries used in EVs and PHEVs discharge during vehicle use and are primarily recharged by plugging into a 120V or 240V plug receptacle. Because an electric motor powered by a battery pack is about three times as energy efficient as an internal combustion engine, an EV can travel much further than a conventional gas-powered car on the energy equivalent of one gallon of gasoline.

Lithium-ion batteries are currently the accepted next-generation of energy storage for EVs and PHEVs. They are lighter, more compact and more energy dense than nickel-metal hydride and other batteries currently available. Lithium-ion batteries also provide the benefit of multiple reuse options and high recyclability.

As noted above, this memorandum provides information for local governments and public utilities to consider in the development of regulations and guidance for the handling, recycling and storage of EV and PHEV batteries and system equipment. Most of the regulatory and safety provisions are set by testing laboratories, state and federal government agencies; however, local governments and public utilities can provide guidance and direction on key issues, such as reuse and recycling; energy demand management; integration with the smart grid; and education and training.

## **ANALYSIS**

### **Battery Design**

Lithium-ion batteries generally consist of three parts, the anode, the cathode and the electrolyte. However, due to the variety of construction methods available and anode and cathode materials currently in use, power, range, and charge times can vary widely. Use of different chemicals in battery production can also result in a wide range of costs, life expectancy, and recycling opportunities. Lithium-ion batteries can be made in a variety of sizes by linking individual cells and to form battery packs. The larger and heavier the vehicle, the more power and energy is used and, thus larger battery packs are required.

*State Guidance:* Ensure statewide regulations and workforce training exists for handling, transport and recycling of lithium-ion batteries. Support and fund advanced battery research. Fund cell/battery pack and battery supplier manufacturing facilities.

*Local Guidance:* Educate consumers shopping for electric vehicles that the best measure of efficiency of an electric vehicle is watt-hours per mile, which compares to miles per gallon for internal combustion engines.

### **Reuse and Recycling of Batteries**

Opportunities for the reuse of Lithium-ion batteries after the end of their normal vehicle life is expected to be widely established in the near future. Automobile manufacturers will establish standards pertaining to when a battery is no longer able to carry a sufficient charge to be used in the vehicle. It is anticipated that, at that point, Lithium-ion batteries will still retain 70-80% of their residual capacity and could be reused for energy storage. In October 2009, Nissan Motors and Sumitomo Corporation announced joint plans for a new company, expected to be operational by late 2010 in Japan and the United States, to create a market for second-life EV batteries in such applications as back-up energy storage for solar photovoltaic systems, back-up power supplies, uninterruptable power supplies and load leveling for the electric grid. It has been reported that GM is studying similar reuse business models for EV batteries.

In terms of recycling, the parts, chemicals and components of Lithium-ion batteries are highly recyclable, in contrast to lead acid batteries used in existing internal combustion engine vehicles. Given the toxicity of lead acid batteries, state law (Ch. 70.95 RCW) and state regulations (Ch. 173-331 WAC) tightly regulate the recycling and disposal of lead acid batteries. These laws and regulations do not apply to Lithium-ion batteries. Efforts are underway by industry groups and the federal government to develop increased capabilities for recycling lithium from EV batteries. The U.S. Department of Energy recently

Memorandum: Electric Vehicle Batteries and Equipment

March 22, 2010

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issued a grant to Toxco, a California company, to build the first recycling facility for lithium-ion batteries in the U.S. Toxco has been recycling single-charge and rechargeable lithium batteries used in other devices at a facility in Trail, British Columbia.

Battery exchange stations, strategically located automated facilities that can enable an EV with a swappable battery to quickly exchange a depleted battery with a fully charged battery, have been identified as providing possible EV consumer opportunities in addition to battery charging stations. If battery exchange stations are implemented, those stations would presumably remove from the exchange pool any batteries that are beyond their useful life and would find opportunities for reuse and recycling of these batteries as noted above.

*State Guidance:* Fund studies to determine the best possible reuse or repurpose of depleted EV batteries. With utility companies and others, test the integration of depleted EV batteries with Smart Grid technology. Establish advanced Lithium-ion recycling and reuse facilities. Monitor EV battery reuse activities and recycling business models to assess if any changes are needed in state regulations, such as adoption of incentives.

*Local Guidance:* Provide consumers with appropriate levels of information on the handling of EV batteries and map systems of all reuse and recycle centers and battery exchange stations.

### Energy Demand Management

Charging stations that have real-time control can adjust to utility peak-load issues and reduce or terminate charging to the vehicle battery. Similarly, batteries that are near or at full charge communicate back to the charging station to indicate state of charge and discontinue transferring energy when full. Repeatedly recharging a lithium-ion battery while it still has a portion of a charge will not result in lessening discharge voltage or reducing life expectancy of the battery (no “memory effect”).

*State Guidance:* Require all public charging stations to have smart charging capabilities and real-time communications, and data collection capabilities to enable on-site and utility-level energy management. Ensure interoperability and transparency between charging station technologies and open access to all users.

*Local Guidance:* Take no actions or adopt no development regulations that would effectually preclude the siting of electric vehicle infrastructure in areas where that use is allowed. Develop efficient and effective permitting, inspecting and recording of charging station infrastructure. Keep records and provide information as needed to assist the industry, utility companies, and State of Washington to expand the EV market.

### Integration with Smart Grid

The U.S. electrical grid carries electricity from central power generators along high voltage transmission lines (7,200V) stepping down through transformers and distribution lines to 120V or 240V for the end user. Through continuous monitoring, power plants respond to users’ demand and constantly vary outputs to provide power needed only to meet demand, since there is generally no cost-effective way to store excess power. Power plants have their greatest excess capacity at night when electrical demands are lowest.

As utility companies upgrade the existing electrical grid system to a Smart Grid, more sensors and sophisticated communications will result in more optimal ways to route power and improve load

management. Smart Grids are intended to communicate to the house as well as the car. As more renewable power sources, such as wind and solar, come on line, plug-in vehicle batteries offer a means to capture and store excess energy and backfill the grid during peak demand periods if the vehicle is not in use.

*State Guidance:* Promote research, development, and demonstration projects for Smart Grid technology, including integration of homes, worksites, and plug-in vehicles. Make investments in a modernization of the electrical grid as part of a nationwide plan to ensure reliable electricity.

*Local Guidance:* Conduct demonstration projects that integrate battery storage systems with the electrical grid and plug-in vehicles. Take actions that would support the integration of smart grid development with houses and plug-in vehicles and the placement of smart charging stations in public places.

### Education and Training

Plug-in electric vehicles, charging stations, batteries and other electric vehicle infrastructure are not widely understood. Automobile manufacturers will play a major role in providing information and training on how to optimally use plug-in vehicles and extend battery life. Schools, local governments and media outlets will also play important roles in training on such topics as assessment of house electrical panels, safety, charging tips, and locating charging stations. The Electric Vehicle Charging Infrastructure Deployment Guidelines for the Greater Seattle Area currently being developed by eTec serves as an excellent common knowledge base of EV requirements for stakeholders involved in the development of EV charging infrastructure.

*State Guidance:* Establish funding mechanisms for workforce and consumer training on the Smart Grid and electric vehicle infrastructure, and for use and handling of EV and PHEV batteries. Develop a statewide clearing house for identifying all battery charger and exchange locations, their use status, hours of operation, and other available services.

*Local Guidance:* Explore ways in which to provide education and outreach on EV and PHEV issues. Through the internet, public access TV, print media, public service announcement, and community workshops, provide education and safety tips on plug-in vehicles and battery management. Develop and maintain inventories of every permitted public charging station or battery exchange station and provide required information to the State.

## **CONCLUSION**

Washington has passed EVI legislation, is served well by renewable energy and is seeking public-private partnerships, all which lead to the opportunity to be a national leader in the research and development of advanced batteries, cell packs and systems; in building battery equipment manufacturing facilities; and in reusing or recycling all battery components. As the EV and PHEV further penetrate the automobile market, consumers will need training and education on a range of issues such as battery efficiency, battery management, and charging station characteristics. Consumer acceptance of EVs and PHEVs will greatly depend upon the effectiveness of education programs, a streamlined permitting process for home charging systems, and the availability of public charging infrastructure.

Local governments and public utilities will oversee the permitting process for EVI and EV charging stations. For some issues, such as battery exchange stations, regulations must first be adopted by the State (*see Recommendation below*). Opportunities for the reuse of EV and PHEV batteries after the end

of their normal vehicle life and integration into storage systems and the Smart Grid are expected to be widely established in the near future. Through the timely and effective implementation of 2SHB 1481, Washington and its local governments are at the forefront of creating jobs, fostering economic growth, reducing greenhouse gas emissions, reducing reliance on foreign fuels, and reducing the pollution to the Puget Sound area.

## **RECOMMENDATION**

Recommended regulatory text for consideration in drafting model ordinances, regulations, and guidance that is unique to electric vehicle batteries and equipment is provided below. This language implements requirements identified in 2SHB 1481.

“Battery exchange stations are permitted, provided the State Building Code Council has adopted rules for electric vehicle infrastructure requirements”. *See* 2SHB 1481 Sec. 2.(3)(b) and Sec. 16.

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## MEMORANDUM

**TO:** Ivan Miller, Puget Sound Regional Council  
Gustavo Collantes, Washington State Department of Commerce

**FROM:** Dan Davids, Plug in America

**CC:** Anna Nelson, GordonDerr LLP  
Jim Helmer, LightMoves

**DATE:** May 4, 2010

**SUBJECT:** **Web-based Electric Vehicle Consumer Survey**

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### INTRODUCTION

During the 2009 legislative session, the Washington State Legislature passed Second Substitute House Bill 1481(2SHB 1481), an Act relating to electric vehicles. Sections 2 and 18 of the Act require the development of model ordinances, development regulations, and guidance for local governments for siting and installing electric vehicle infrastructure (EVI), particularly regarding battery charging stations.

The purpose of this memorandum is to present information from a survey of past and present electric vehicle (EV) owners regarding their experiences with electric vehicle infrastructure (EVI) and how this information supports the proposed model development regulations and guidance for EVI.

### OVERVIEW

In the United States there are several thousand households and individuals who have considerable experience as long-term owners or lessees of factory-produced full-performance electric vehicles. The vehicles they drove, and in many cases still drive today, were produced by automakers to meet requirements of the California Zero Emissions Vehicle (ZEV) program, mandated in 1990. This program, administered by the California Air Resources Board, placed over 5,000 vehicles on the road between 1997 and 2003. These freeway-capable 100-percent-electric vehicles included the General Motors EV1 and S10, Toyota RAV4 EV, Ford Ranger EV and Th!nk, Chrysler EPIC, Nissan Altra, and Honda EV Plus.

While the majority of these vehicles were removed from service at the end of their lease terms between 2003 and 2005, there remained over 1,000 on the road in 2010. Based upon information previously gathered by Plug In America, we know that, today, these privately owned remaining vehicles include the Toyota RAV4 EV (approx. 300), General Motors S10 (approx 150), and the Ford Ranger EV (approx 250). These vehicles are in use across the United States, Canada and the United Kingdom, with the

majority still in California. The balance remains in fleets, the largest of which is represented by the 260+ RAV4 EVs operated by the electrical utility Southern California Edison.

The majority of these remaining ZEV vehicles are driven daily. There is an active community of RAV4 EV owners who share information about their cars over the internet. Topics of discussion on their forum regularly involve charging infrastructure, including installation in homes and businesses, and the status of public charging stations still in use in California. Because PIA's founders and current board of directors themselves drive these very cars, we remain in regular contact with this unique audience of past and existing EV drivers.

The web survey was designed to allow the consultant team to assess the validity of its assumptions regarding charging infrastructure as well as to identify notable signals from the user base of experienced EV drivers. The model ordinance, model development regulations and guidance documents can be informed by these results. The survey results may also be useful to local municipalities to help them better understand the perceptions and needs of current EV users. The adoption of model ordinances, model development regulations and guidance that have considered these perceptions and needs will aid the transition to EVs by the driving public.

## **ANALYSIS**

In order to assess key consumer issues for consideration in the model ordinances, model development regulations and guidance, PIA conducted a web-based survey of past and present owner-drivers of factory-produced full-performance EVs identified through web-based lists for the following vehicle owner groups: (Year ranges denote the period vehicles were in service.)

- Toyota RAV4 EV, 5-seat compact SUV (1997 to present)
- General Motors EV1, 2-seat sportscar (1998 to 2005)
- Chevrolet S10 EV, pickup truck (1998 to present)
- Ford Ranger EV, pickup truck (1997 to present)
- Ford Th!nk EV, 2-seat city car (1998 to 2005 in US, 2005 to present in Norway)

Invitations to participate in this survey were sent by email to every individual on these web-based lists. The web-based lists were used "as is" without consideration of duplicate entries or other assessment. Invitees were able to self-select for participation in the survey.

The survey was available for participation over a five-day period in mid-April 2010. Reminder emails were sent on the third, fourth and final days. About one-half of survey responses were collected within the first 48 hours, with another batch coming after the first reminder email. The total number of survey respondents was 152.

### Data Gathering

The survey asked the following core questions:

- What were/are EV drivers' basic driving patterns? (EV vs. internal combustion engine miles driven, commuting use.)
- What were EV drivers' experiences with the installation of charging equipment in their homes? (What are their perceptions of the complexity, process, and cost involved?)

- What were/are EV drivers' basic charging patterns? (Where and when do they charge?)
- Did/do owners take advantage of preferential utility rates for charging; such as Time of Use (TOU) or EV-specific rates?
- When considering possible future public charging stations, how do drivers prioritize locations?
- Did/do drivers have issues concerning persons with disabilities (ADA), and if so, what were they?
- How do owner-drivers rank the availability of incentives for EV ownership and associated charging infrastructure?
- What is the demographic profile of EV drivers?

### Data Organization

Based around the core questions above, PIA devised survey questions designed to elicit definitive evaluation of distinct issues. These issues were arranged into groupings. These groupings, in the order presented when taking the survey online, included:

- Vehicle Ownership and Use (types of vehicles and miles driven; daily commute distance)
- Charging Hardware (charging station installation experience)
- Charging Patterns (locations used by drivers, time of day used, frequency of use)
- Workplace Charging (availability at work; would it be used more if available?)
- Public Charging (problems encountered, issues with persons with disabilities)
- Going Forward (EV incentives, desired charging levels and locations for public charging stations)

Survey length ranged from five to fifteen minutes, depending upon such factors as whether there were multiple vehicles in a household and the extent of a respondent's free responses entered into text boxes. It should be noted that, like most surveys, many questions were only presented depending upon prior answers. The dependencies meant that users did not all experience the survey in the same linear fashion. For example, an owner who responded that their EV was their exclusive vehicle was not asked questions about their (nonexistent) gasoline-powered car.

The raw data was entered into an excel spreadsheet for analysis. In addition, all written comments were carefully reviewed. Individual representative written comments are reported below when they provide an insightful explanation or illustrate a range of opinion on a particular question.

## **CONCLUSIONS**

### Sample Demographics

The average age of the primary household electric vehicle driver surveyed was 52.5 years. The vast majority of respondents (146 out of 152) live in single-family houses with attached garages. This is consistent with the requirements of the original California ZEV program that only selected EV participants from single family households. More than one-half of these homes are suburban, with one in five respondents saying their homes are urban. Fewer than one in ten said they live in a rural area. Four individuals reported living in a multifamily dwelling.

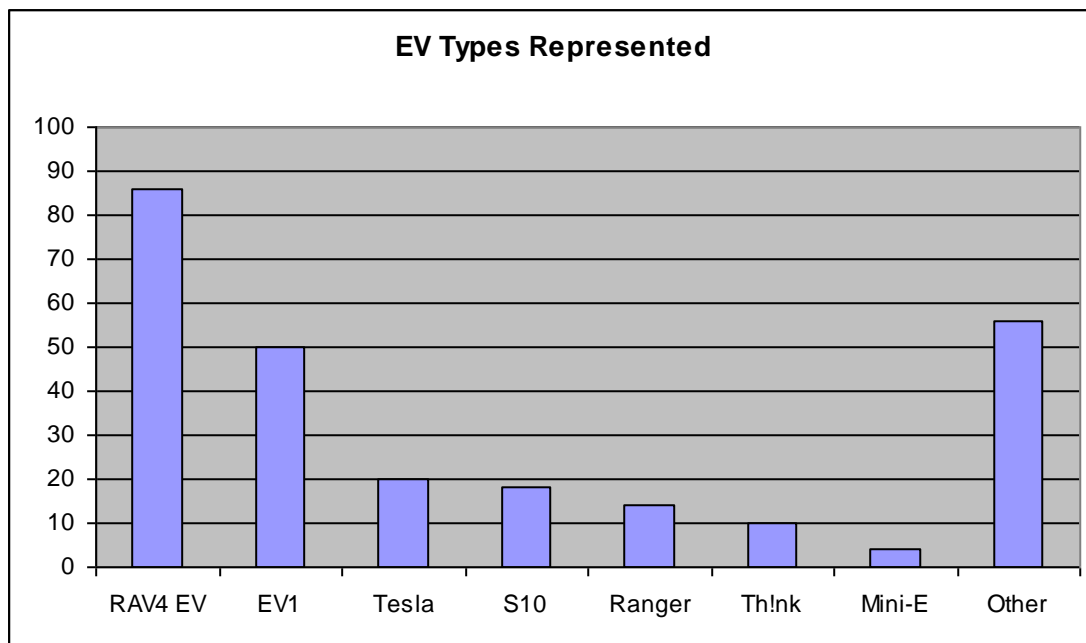
Income levels among those who chose to offer these data were distributed nearly evenly among seven listed income levels between \$50k and \$200k per year. The average EV driver household had two adults and 1.5 children in residence. 40% of households surveyed reported having solar photovoltaic (PV) systems installed on their homes. Roughly one-half of these systems were put in place subsequent to acquiring an EV.

Given the availability of new EVs and Plug in Hybrid Electric Vehicles (PHEVs) in the marketplace by the end of 2010, 53% of survey respondents said they plan to either replace or supplement their current EV with a new model.

When asked to make suggestions regarding the development of model ordinances, regulations, and guidance for electric vehicle infrastructure, 37% of survey participants did so. Fully 50% expressed a willingness to be contacted to elicit more information about their EV driving experience.

### Vehicle Ownership and Use

The 152 respondents to the survey reported having owned or leased a total of 258 EVs. The relative number of each car type reported is consistent with the numbers of each type of EV that were originally put into consumers' hands under the CA ZEV program and remain in service today, according to data kept by PIA. Newcomers, such as the Tesla Roadster and Mini-E, are reported, because many have been obtained by people who formerly drove, or continue to drive, ZEV cars. The category "other" in the chart below includes electric motorcycles, conversions, NEVs, and a number of limited production EVs from the past. Most of these are not full-performance freeway-capable cars, which was the target of our survey.



Respondents reported on the annual miles driven for each type of vehicle in their household. In multi-vehicle households, the overall usage pattern of our survey group was to favor driving the more efficient and less polluting vehicle. In other words, in multi-vehicle households, the average annual miles reported for each of the vehicle types -- hybrid, PHEV, and EV -- well exceeded miles reported for non-hybrid liquid-fueled vehicles.

## Charging Hardware – Installation Experience

A total of 77% of respondents said that they had a charging station (Level 2) installed in their home, with 54% of those having been installed by an electrical contractor. The remaining 46% was evenly split between those who said they did the installation themselves and those who chose not to answer. Because a number of years have passed since installation, a number of respondents could not remember specifics regarding circuitry or cost. However, 21% of respondents recalled using an existing circuit in their homes. The average reported installation cost was \$668. (Note that this did not include the cost of the charging station hardware, but only the cost to install a circuit and equipment.) The high end of installation costs was \$2,000 where comments suggested unique capacity or other limitations were encountered.

Of the four respondents living in multifamily housing, three said that they were able to have charging capability installed where they park. The fourth is currently driving a conversion (internal-combustion to electric), which is charged at public 120-volt (Level 1) locations.

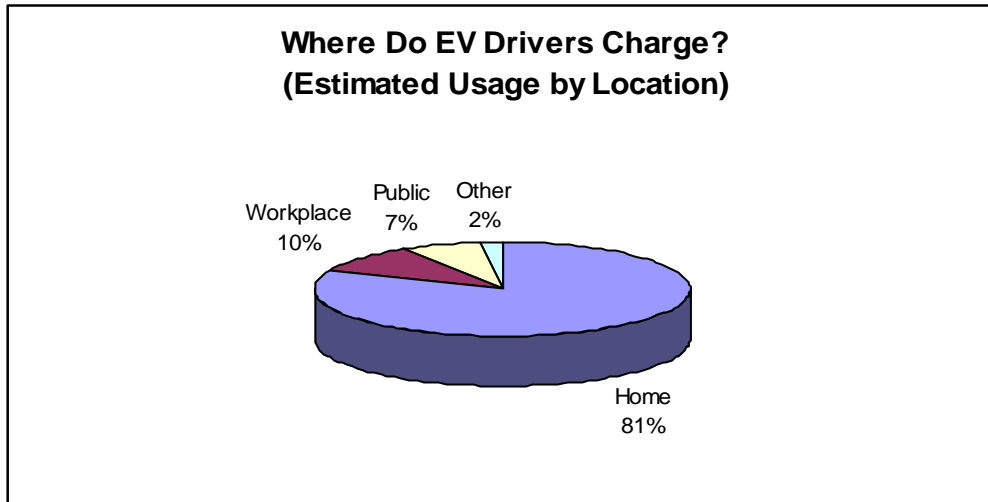
Survey participant comments regarding charging station installation generally reported the process to have been “easy” and “straightforward.” This characterization was made by respondents where the installation was done by a licensed contractor, as well as by those who opted for the do-it-yourself approach. Here are three representative quotes regarding installation:

- “The electrician ran a circuit from the panel into the garage - very simple. Government regulation considerably increased the cost and delay of the process.”
- “My charging station was originally installed by an electrician. I later hired another electrician to help me portablize (sic) the charger. When I moved house, the (new) garage had a 240V outlet, so I only needed to relocate the charger.”
- “It is irritating that (one contractor) had a lock on installations - I hope that doesn’t happen in the future. It was overly expensive...”

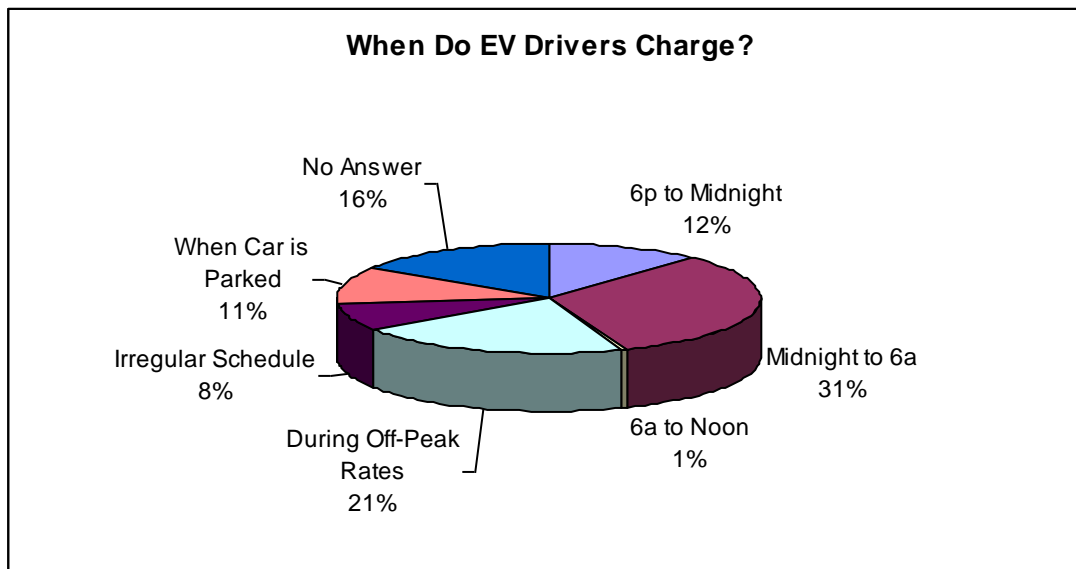
## Charging Patterns

Fully two-thirds (67%) of respondents said that they use their electric vehicle in their commute or daily routine. The average daily distance traveled using this vehicle was/is **35.2 miles**.

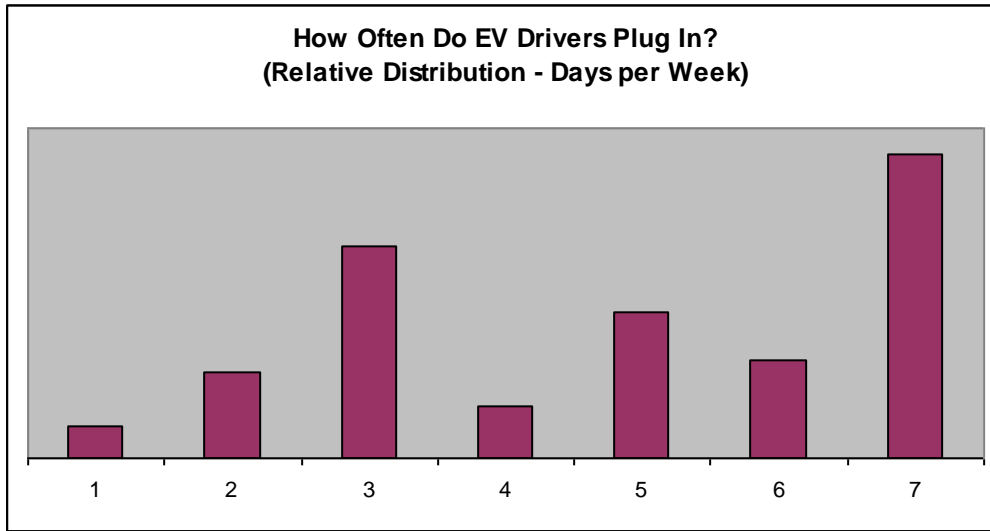
The vast majority of charging takes place at home (81%), with workplace and public charging reported by 10% and 7%, respectively.



A total of 40% of respondents reported having Time of Use (TOU) metering in effect through their electric utility, with a number reporting usage of EV-specific rates, such as PG&E's E9B rate. The following chart shows the distribution of charging times reported for a typical day. More than one-half of respondents said they charge at off-peak times or after midnight. It should be noted that most of the vehicles covered by this survey had/have charge-start programmability. Drivers are able to set the time that they want charging to begin, plug in, and forget it. Their cars are fully charged by the time they need them, and they know they have charged when their utility has either excess capacity, lower rates, or both.

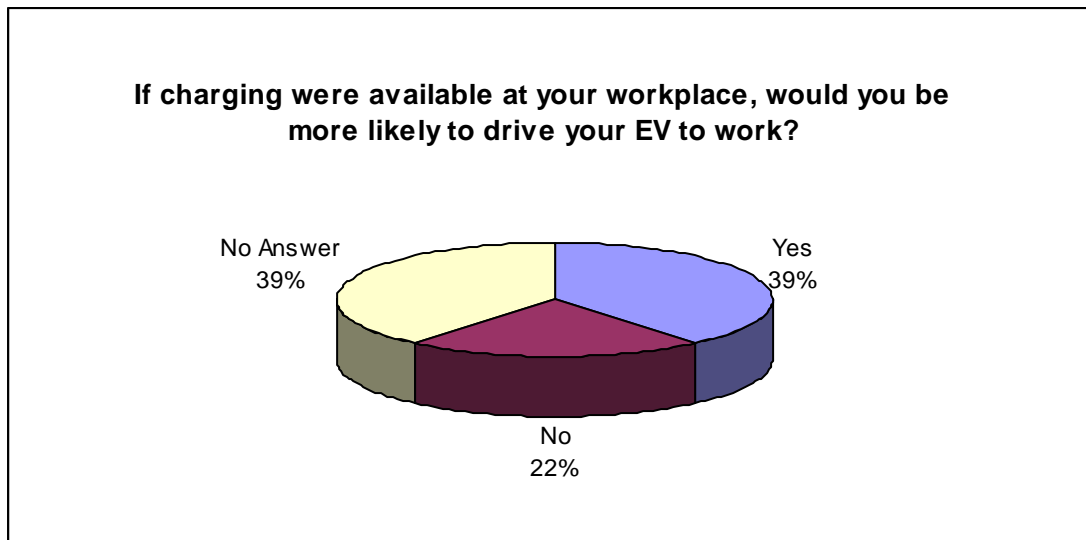


When asked how often they plug in over a typical week, EV drivers most often report charging three, five, or seven days per week. The latter two frequencies appear to reflect the periodicity of vehicle usage as a commuter car (5 times per week) or daily driver (7 times per week).



### Workplace Charging

The survey included a few questions about workplace charging. As the following chart shows, more than a third (39%) of respondents would be more likely to drive their EV to work if charging were available at their workplace. The large number that did not answer this question could be due to various factors (e.g. already charging at work, working at home, retired) but this was not explored in this survey.



Fully 65% of respondents offered comments on workplace charging. Representative among them are the following two comments which reflect two ends of the spectrum on reported employer viewpoints on providing EV charging:

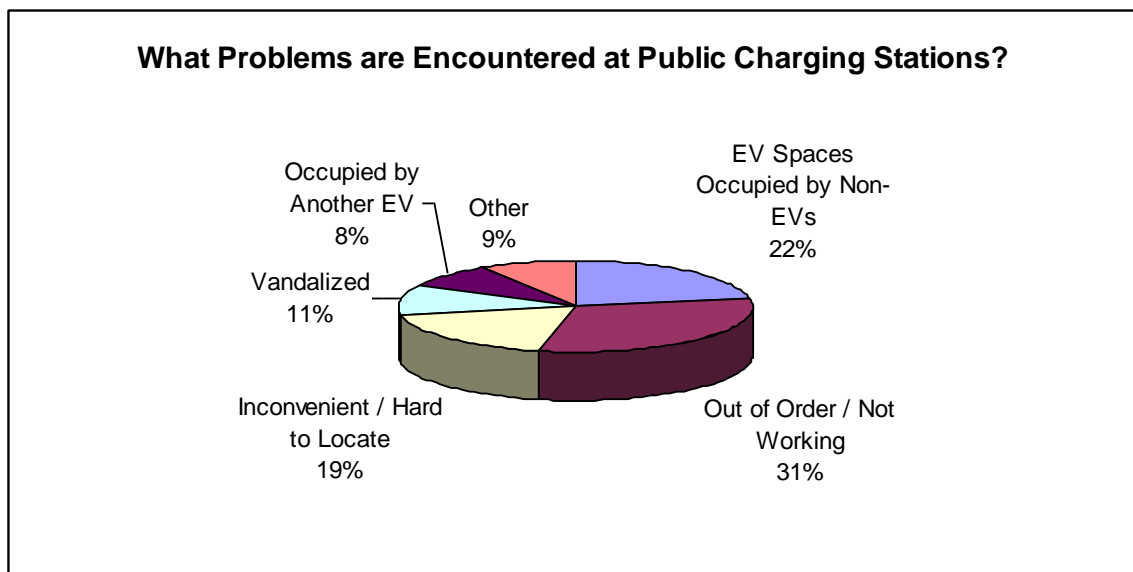
- “(Management’s) position is ‘we have never done that before, (we) won't start now’ ”
- (There are) “five dedicated 110V EV Parking spots at one of our newest facilities, though not at the headquarters where I work.”

There were also comments on the benefits of workplace charging. Here are two comments illustrating the two ends of the spectrum on this subject:

- “(I) get enough of a charge at home.”
- “My workplace is at the edge of my roundtrip range. If I could charge at work, then I would have more flexibility with doing errands before/after work. This would be a huge benefit.”

### Public Charging

Participants were asked to choose among a list of potential problems encountered by users of existing public charging stations<sup>1</sup>. The following chart summarizes the responses:



<sup>1</sup> Level 2 charging stations were deployed in California under the ZEV program between 1997 and 2003. According to the Electric Auto Association (EAA) approximately 1,300 of these stations exist today, maintained largely through the volunteer efforts of the EAA.

Representative comments about problems encountered at charging stations included:

- “Someone needs to tell Prius drivers that their car is not an EV. EV spots always seem to be taken up with a Prius.”
- “Locating chargers in other than prime parking spaces would avoid competition with ICE vehicles...”
- “Vandalism can be a problem. It would be good for next-generation chargers to communicate distress (or at least non-functionality) somehow.”
- “Siteholders must be informed of and accept responsibility for support and maintenance costs of EVSE (charging stations).”

While only one respondent reported that they use parking spaces for persons with disabilities (aka ADA parking), 3% of Respondents said that EV charging station parking spaces “have presented accessibility problems for me and/or my passengers.” When asked whether “some EV charging station parking spots should be reserved for use only by EVs with ADA parking rights,” 7% answered in the affirmative.

Representative comments concerning EV charging and accessibility for persons with disabilities include the following:

- “ADA only should be implemented later in the process.”
- “I recommend public chargers be placed AWAY from close-in parking spots to reduce blockage by non-EV's. When there are enough disabled persons driving EVs, I recommend adding more chargers to the ADA parking spots.”

#### Going Forward – User Views on Incentives and Siting

Participants were asked to rank, from most important to least important, the priority they place on charging station levels and generic locations. This produced the following ordering:

1. Home
2. Public – Level 2
3. Workplace – Level 2
4. Freeway – Level 3
5. Urban – Level 3
6. Public – Level 1

Participants were also asked to rank the importance of having charging stations in various specified public locations, not including workplace charging (which was addressed in other questions). The responses ranked charging stations in shopping centers, public parking lots, downtown areas and big-box stores as among the highest for importance, while charging stations in tourist and recreation areas and in gas stations were ranked among the lowest in importance. Ranked in the middle were other charging locations, including street-side parking, transit hubs, freeway rest areas, and airports. Additional statistical analysis on the responses could provide quantified rankings for all identified locations.

Respondents were asked their views on the importance of various incentives for EVs. Below is the resultant ranking for these incentives:

1. Rebates/Tax incentives on vehicle lease/purchase
2. Rebates/Tax incentives on home-based charge station purchase
3. HOV/Carpool lane access
- 
4. Reduced vehicle registration fees
5. EV/PHEV-only parking spaces
6. Bridge toll commute hour exemption

The highest-ranked incentive was for financial mechanisms to reduce the purchase of a new EV. Following this, and rated approximately equally, were incentives to reduce the cost of a charging station and HOV-lane access for EVs. Significantly less important to respondents were reductions in registration fees and tolls. Preferential parking for EVs was ranked very low. This is consistent with several written comments from participants saying that they do not expect or want to be treated differently when it comes to parking their EV.

#### Comments and Suggestions on Model Ordinance, Model Development Regulations and Guidance

When asked to make suggestions regarding the development of model ordinances, regulations, and guidance for electric vehicle infrastructure, 37% of survey participants did so. A review of these comments suggests three dominant themes, described here in much the same language used by commenters:

- Don't overcomplicate things – Experienced EV drivers do not believe that “range anxiety” is the bugaboo oft-reported in the media. Installation of a circuit that is fundamentally little different from a dryer outlet should be a very simple process.
- Don't give preferential treatment to EVs – Encourage public charging to **not** be located in prime parking areas. This will discourage drivers of non-EV vehicles from using these spaces.
- Keep the charging stations operational – Take care of vandalism and inoperative stations. Get the locations listed in navigation-system databases and maps. Make the information available via web and smart-phone apps.

Opinions about the siting of charging stations were summed up nicely by one survey respondent:

“Choose public locations that will benefit large numbers of users. Pick locations that prioritize medium-term charging (1-3 hours), which is ideal for large shopping centers and centralized parking, and then long-term locations (>3 hours charging), such as transportation hubs/train stations, and airports. Short-term locations (<1 hour charging) are nice, but it's more for showing that the technology is real and people are using it rather than being of great charging benefit. These locations would include grocery stores and big-box stores.”

## FINDINGS AND RECOMMENDATIONS

Many survey results reinforce recommendations described in prior research memorandums<sup>2</sup>. The following summary lists the major findings and recommendations from the survey of experienced drivers of factory-produced full-performance electric vehicles. Recommendations are linked, where applicable, to the first draft Model Document (i.e., the first draft of the Model Ordinance, Model Development Regulations, and Guidance). The findings are anticipated to be included in the Model Document in the “*Comments*” text to provide supporting information for the applicable model development regulation and guidance.

- Many EV drivers are content to charge primarily at home. They are range-aware, clearly demonstrating the ability to stay within the reachable daily range limits for their cars.
- In many multi-car households, EVs routinely become the primary vehicles, based upon miles traveled. By making it easier to charge away from home, the availability of more public charging infrastructure is likely to increase user acceptance of EVs.
- EV drivers do not want preferential treatment. They simply want to use their cars as mainstream vehicles in the greater mix.
- EV purchasers do not expect the installation of charging circuitry in their home garage to be a costly and complicated process. They view charging equipment as being no more complex than any other home appliance. They expect the installation process to be straightforward and free of unnecessary complication, and to incur a fair cost for the process. This finding should be included in the PROCEDURES chapter of the Model Document.
- Not all home charging station installations will be low cost. Best efforts need to be made to ensure that educational materials adequately inform in situations where insufficient electrical capacity will require more extensive work and expense to make a home EV-ready.
- Existing EV drivers have largely been unable to enjoy the potential benefits of workplace charging, and there exist little data on the subject. For many the distance from home to workplace is not so great that charging infrastructure located there would be of a substantial benefit. However, existing users indicate they would be more inclined to drive their EV to work if there were charging available. Initiatives should be undertaken to accelerate workplace installations with the goal of collecting data on the role these stations can play as larger numbers of EVs become available in the marketplace. This finding should be included in the ENHANCED section of the Model Document.
- Public charging stations need a commitment by site hosts to keep them operational. This includes timely response to out-of-order and vandalism situations. This finding should be included in the ZONING and STREETS, SIDEWALKS AND PUBLIC PLACES of the Model Document.
- Public charging parking spaces should not be placed in prime locations, nor adjacent (in most situations) to parking spaces for persons with disabilities (ADA). This finding should be included in the ZONING chapter of the Model Document.
- Non-EVs occupying EV-only charging spaces are reported by experienced EV drivers as creating a major barrier to their lawful use and utility. Public EV parking spaces need stepped-up

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<sup>2</sup> See March 22, 2010 Memorandum from Plug In America on Electric Vehicle Infrastructure Code Research and March 22, 2010 Memorandum from LightMoves on Local Government Electric Vehicle Infrastructure Phone Interviews.

enforcement to prevent non-EVs from occupying designated spots. This finding should be included in the VEHICLES AND TRAFFIC chapter of the Model Document.

- Level 1 charging is favored for overnight or longer term (>3 hours) parking.  
Level 2 charging is favored for shorter term parking in areas like public lots and shopping centers.  
Level 3 charging is favored to be sited at freeway locations, as opposed to urban areas.
- While every charging station site has its own unique design and usage factors, potential site hosts should consider a variety of issues as part of the siting and design process to create more successful charging-station outcomes. Some or all of these should be included in the ZONING chapter of the Model Document. Consideration should also be given to development of a **Electric Vehicle Charging Station Installation Checklist** that must be completed by the site host. This checklist shall include, as a minimum, a review of the following best practices:
  - Site location – Evaluate the site giving consideration to its perceived relative importance and usage compared to other nearby sites.
  - User base – Evaluate the charging needs for potential users of the site. This evaluation should include how far users drive to get to the site and how long they are most likely to leave their vehicles parked there.
  - Charging level(s) – Plan for and match charging levels (1, 2 or 3) to the user base for the site. (For example, Level 1 for parking times typically greater than 3 hours, Level 2 for shorter times.)
  - Parking and Charging spaces – Locate, whenever feasible, EV charging and parking spaces away from prime locations in lots and in front of businesses.
  - Parking and Charging spaces – Locate, whenever feasible, EV charging and parking spaces away from ADA parking.
  - Parking and Charging spaces – Locate EV charging and parking spaces in reasonable proximity to the main electrical supply or service panel(s) for the facility.
  - Electrical Wiring – In the case of Level 1 charging stations, consider installing conduit and supply capacity that allows for future upgrading to Level 2 charging at minimal additional circuitry expense.
  - Signage – Install recommended wayfinder and charging station signage. This signage is both for locational and enforcement purposes.
  - Signage – Install usage signage appropriate to the type and level of charging provided, including contact information to report vandalism and out-of-order conditions.
  - Maintenance – Document and commit to an ongoing plan for oversight, repair, and maintenance of installed charging stations. This plan should include training of relevant site personnel with the goal of maximizing operational readiness for all installed charging stations at the facility.

## Memorandum

**To:** Technical Advisory Committee  
**From:** Data Collection Subcommittee  
**Subject:** Conclusions from the first conference call of the subcommittee on data collection  
**Date:** April 27, 2010

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## Introduction

During the first meeting of the Technical Advisory Committee, several members expressed that collecting data from charging stations could significantly help the development of efficient markets for electric vehicles. As a result, the chairs and the consulting team agreed on the formation of a subcommittee to work on aspects of the model development regulations related to data collection.

This memorandum summarizes the discussion during the first conference call of the stakeholders that volunteered to be part of the subcommittee,

## Subcommittee Purpose

This Data Collection Subcommittee (DCS) will develop a set of recommendations regarding whether and how data collection could be incorporated into development regulations for the siting of electric vehicle charging stations. These recommendations will be presented to the Technical Advisory Committee.

## Subcommittee Membership

The DCS is composed of core members of the Technical Advisory Committee, members of the consulting team, and a group of stakeholders with expertise in the subject. The DCS roster is still open to new members and it currently includes:

- Gustavo Collantes (chair), Washington Department of Commerce
- Stephen Johnsen, Seattle Electric Vehicle Association
- Ron Johnston-Rodriguez, Port of Chelan County
- Jim Helmer, Member of the consulting team
- Dan Davids, Member of the consulting team
- Michael Pesin, Seattle City Light
- James Billmeier, Charge Northwest (not present at the first phone call)

## Data Types

The DCS discussed the various types of data that could be collected. We categorized data as “consumer-oriented” and “planning-oriented”. The later category was further categorized into “stable data” and “operation data”. Before elaborating on the conceptual definition of these categories, we note that they are not mutually exclusive—a given type of information may fall simultaneously in the two categories.

**Consumer-oriented** data refers to information that would be publicly available and that could be of value to EV owners. Data of this type could include location of the charging station, general specifications (e.g. voltage), and availability. Data of this type could be distributed to interested EV owners via a variety of means, including the Internet, smart-phone applications, vehicle-user interfaces, etc. The DCS believes that the role of government in distributing this type of data to end users is limited and that the private sector will find entrepreneurial opportunities to use these data in ways that best serve the users’ needs. Government, however, could provide a limited service, for example by showing the geographical location of charging stations on a publicly accessible web-based interface.

**Planning-oriented** data refers to information collected by the charging station, following certain protocol, about the use of the station, and that could be of value to parties (including government) who are responsible for the planning and efficient operation of the charging station network and/or the infrastructure that supports it. Data of this type could include charging time, average power, peak power, and total energy. The DCS believes that collecting these data would be critical to the effective, smart integration of electric vehicles and the power grid.

## Conclusions and Next Steps

Based on the first discussion, the DCS recommends that model development regulations and guidance should address the question of planning-oriented data collection. The DCS identified the following areas for future work:

- a- Develop a narrative that clearly explains the rationale for collecting data, from economic and societal perspectives;

For the sake of clarity in the narrative, it may be helpful to a) identify types of data users (e.g., utilities, city planners, transportation planners, clean air monitors); b) explain the questions/issues they would like to resolve with the data; and describe the particular data sets they would likely access for analysis.

Whenever appropriate, the narrative will clearly explain how certain categories of local data can be used to help communities prepare for the potential large scale market adoption of electric vehicles

- b- Develop recommendations regarding methods to collect data from charging stations;
- c- Develop recommendations regarding the protocol for data collection;

The Subcommittee will consult with experts in this area, such as the Idaho National Laboratory, to understand the data protocol process led by SAE.

- d- Develop recommendations regarding ownership and warehousing of the data collected;

In principle, the Subcommittee believes that access to most of the data sets should be available to a wide range of stakeholders, from the vehicle owner and charging station user to the Washington State Departments of Commerce, Transportation, and Ecology.

The Subcommittee believes that the responsibility of ownership and warehousing, and managing the flow of data to authorized parties may become substantial in terms of liability, labor, infrastructure and would consequently have an associated cost. An organization with a specific expertise and credibility would appear to be required. The Subcommittee identified at least two institutions that appear to have the ability to collect, analyze, and utilize the data for a variety of public purposes: a) The Idaho National Laboratory's Advanced Vehicle Testing Activity division, since it has proven its ability to collect, warehouse, analyze, and report usable vehicle data for years; and b) The Pacific Northwest National Laboratory, since it has done much work on smart grid demonstrations and interface communications with electric vehicles.

- e- Estimate cost differential for charging station with and without data collection capabilities;

The Subcommittee will consult with a variety of vendors, including eTec, Coulomb/ChargeNW, AeroVironment, and Aker Wade.

- f- Develop recommendations regarding the type of data that should be distributed to EV users and the methods for this distribution

The subcommittee believes that informing EV owners is important. Information that could be distributed to users includes location and voltage of the charging stations, current availability, charging rates, etc. The Subcommittee believes that there is a significant opportunity for the private sector to lead in this area.

- g- Whenever applicable, describe how recommendations should differ for public and private charging stations;

The Subcommittee in principle believes that public charging stations should require at least planning-oriented data.

- h- Develop recommendations to stakeholders on strategies to incent the adoption of data collection capabilities for charging stations.
- i- Develop narrative regarding how the charging payments collected through meters or charging stations is administered at utility company, State and federal level.

The Subcommittee seeks comments from the Technical Advisory Committee, particularly regarding the following questions:

- 1- Does the TAC see value in further exploring the question of data collection?
- 2- Does the TAC agree with the areas of work proposed by the DAS?

## Memorandum

**To:** Technical Advisory Committee  
**From:** Data Collection Subcommittee  
**Subject:** Proposed data items to be reported and collected  
**Date:** June 6, 2010

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### Introduction

The Data Collection Subcommittee (DCS) has decided to focus its attention on recommendations regarding collection of “stable data”. The DCS agrees that questions related to “operational data” (specific to the operation of the infrastructure) are beyond the scope of the model ordinance and guidance for electric vehicle supply equipment (EVSE) siting. The collection and analysis of operational data from charging infrastructure will be the focus of a multi-stakeholder effort convened by the Washington Department of Commerce. The DCS does believe that it is in the public interest to encourage and enable the collection of operational data, and therefore offers the following recommendation: All level 2 and level 3 EVSE deployed in the State of Washington should be capable of collecting and transmitting data on the operation of the equipment. Given the public benefits of collecting operational data, the DCS believes that the state legislature should consider providing incentives for the deployment of EVSE with such capabilities.

The DCS categorized stable data into those that are displayed at the charging site and those that are reported by the permitting agency and warehoused at a central location.

### Information displayed at the charging site

These data are needed predominantly to inform users and parking enforcement.

- 1- **Charger speed:** This refers to the speed with which the equipment charges the battery. While “speed” may not be most technically appropriate term, it may be more intuitive to users. Typically, the charger speed is categorized as Level I, Level II, and Level III or DC fast-charge, depending on the charge voltage. These denominations may be not very intuitive to users, so alternative ones may be desirable. Examples would include: a) Slow, Medium, Fast; b) X units of energy per hour of charging; c) 120V, 240V, 480V; d) combinations thereof.

- 2- **Fee and charging structure:** This refers to all the information necessary for the user to understand how the charger operates and how she will be charged for her use of it. Information in this category includes whether the equipment qualifies as a smart charger.
- 3- **Claims contact information:** The charging station should clearly display a telephone number to report any problems with its use or functioning.
- 4- **Indication of remaining charging time:** Information on the approximate time left to full charge of the battery being charged will be useful to parking enforcement and other users who may be waiting to use charger.
- 5- **Restrictions or other instructions:** The charging station should clearly display all information pertinent to the proper and safe use of the equipment and the associated parking space.
- 6- **Estimate of electricity carbon intensity:** It is recommended that the Department of Commerce collaborate with the Department of Ecology to develop labels that give users a sense of the carbon intensity of the particular charging station. This will allow users to make more informed decisions regarding their charging.

### Information reported by the permitting agency

The DCS proposes to require that the permitting agency reports the following pieces of information to the (local electric utility/Department of Commerce) as part of the permitting process:

- 1- Permitting agency;
- 2- Equipment unique identifier;
- 3- Equipment specifications;
- 4- Location of the equipment (how the location should be specified is still TBD — alternatives include street address, parcel number, and GPS address);
- 5- Date when the charger was permitted;
- 6- Date when the charger became operational;
- 7- Date when the charger is discontinued;
- 8- Charger speed (same as above);
- 9- Responsible party/owner contact information;

**ATTACHMENT:** Illustration of Data Collection and Distribution Framework

## Charging Station Data Collection

ver. 3.0

		Users of Data				
		EV Drivers	Utilities	Tax Agencies	Planners / Researchers	
<b>Reporters of Data</b>	<b>Static / Stable Data</b>					
	x	Unique EVSE Identifier			x	
	x	Tax Map Key (TMK) Parcel No.			x	
	x	Service Address	x		x	
	x	GPS Address (lat/long)	x		x	
	x	Property Owner			x	
	x	EVSE Owner			x	
	x	Responsible Party Contact Info	x		x	
	x	Station Type (Level 1,2,3, DC)	x		x	
	x	Maximum power level (kilowatts)	x		x	
	x	Date Installed			x	
	x	Date Removed from Service	x		x	
	x					
	x					
	<b>Station Owner - Operator</b>	<b>Dynamic / Operational Data</b>				
x		Unique EVSE Identifier	x	x	x	
x		Station Type (Level 1,2,3,DC)	x	x	x	
x		Maximum power level (kilowatts)	x	x	x	
x		Station Status - Available, Connected, Out of Service	x	x	x	
x		Station Status - Reservation Data	x		x	
x		Fee Structure	x		x	
x		Restrictions or Other Instructions	x		x	
x		Date/Time Stamp		x	x	
x		Unique Charge Event ID		x	x	
x		Connect/Disconnect Times		x	x	
x		Charge Start/Stop Times		x	x	
x		Average and Max Power		x	x	
x		Total KWH Delivered		x	x	
x		Rolling 15-minute Peak Power		x	x	

<b>Agencies - Regulators and Promulgators of Data</b>	<b>Legislature</b>	Require and regulate data collection and data availability
	<b>Commerce or Utilities and Trade Commission (UTC)</b>	Set standards for data protocols
	<b>Commerce or State DOT</b>	Warehouse, consolidate, and make data available to public
	<b>Commerce</b>	Evaluate data for planning and legislative activity
	<b>Local governments</b>	Require permitting agency to transmit stable data to State
<b>Private sector</b>	<b>Commerce, State DOT, or Local utility</b>	Require station owner-operator to transmit operational data to State
	<b>Private sector</b>	Create web and telematics applications using publicly available data

**Data Description:** This spreadsheet lists data gatherers/reporters down the left axis and users of data across the right axis. Check marks in column C for the permitting agency indicate data that are reported on a one-time basis. Check marks in column C for the station owner-operator indicate operational data that are reported on a dynamic basis (real-time, on request, or scheduled). There are four types of users of data shown in the right-most columns, with check marks indicating which data are important to each.

**Agency Descriptions:** At the bottom of the spreadsheet is a list of agencies and their potential roles in regulating charging-station data for public benefit. The private sector is listed for its role in promulgating tools and systems that enable use of appropriate data by the public.



**Department of Commerce**  
Innovation is in our nature.

**Washington Department of Commerce**  
Energy Policy Division  
1011 Plum Street SW  
Olympia, WA 98504-2525  
360-725-4000 • [www.commerce.wa.gov](http://www.commerce.wa.gov)

**Puget Sound Regional Council**  
**PSRC**

**Puget Sound Regional Council**  
1011 Western Avenue, Suite 500  
Seattle, WA 98104-1035  
206-464-7532 • [www.psrc.org](http://www.psrc.org)