North Coast **Plug-in Electric Vehicle** Readiness Plan

July 2014

REDWOOD COAST Energy Authority

The California Energy Commission provided the funding for this project through its Alternative and Renewable Fuel and Vehicle Technology Program, which issued solicitation PON-10-602 to provide funding opportunities for California's diverse regions to develop regional plug-in electric vehicle strategic plans.

PROJECT TEAM

The Redwood Coast Energy Authority was formed in 2003 to develop and implement sustainable energy initiatives that reduce energy demand, increase energy efficiency, and advance the use of clean, efficient, and renewable resources available in the region. The Energy Authority is a local government joint powers agency representing the County of Humboldt, the Cities of Eureka, Arcata, Fortuna, Rio Dell, Blue Lake, Ferndale, and Trinidad, and the Humboldt Bay Municipal Water District.

The Schatz Energy Research Center at Humboldt State University was founded in 1989 with a mission to promote the use of clean and renewable energy resources. Over the years SERC has been involved in extensive research, planning, design, and analysis activities for the development and implementation of sustainable energy systems.

GHD is one of the world's leading engineering and environmental consulting companies. Established in 1928, GHD employs more than 5,500 people across five continents and serves clients in the global markets of water, energy and resources, environment, property and buildings, and transportation.

Pacific Gas and Electric Company is one of the largest combination natural gas and electric utilities in the United States. Based in San Francisco, the company provides electric and natural gas service to approximately 15 million people throughout a 70,000-square-mile service area in northern and central California, providing electricity and natural gas to approximately 40 percent of Californians and 1 in 20 Americans.

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INTRODUCTION

The commercial introduction of plug-in electric vehicles (PEVs) into California communities is just now beginning. The state is poised to be a market leader, and the development of a robust PEV market will offer state residents numerous environmental, energy security, and economic benefits. However the successful introduction of PEVs will require coordinated efforts among key stakeholders to overcome obstacles and ensure smooth market development.

While much of the focus on early market development is in the state's metropolitan areas, there is also a need to provide planning, collaboration, and education and outreach efforts in the state's rural communities. The North Coast is a rural community that is anticipating the rollout of PEVs and in position to become a rural model for successful PEV market development. The conception of this plug-in electric vehicle readiness plan met the need for a coordinated and collaborative effort to plan for and promote PEV market development in Humboldt County and the greater North Coast region.

The purpose of this readiness plan is to guide future efforts throughout the North Coast region to support the successful introduction of PEVs and the strategic development of charging infrastructure to support the use of those vehicles. This plan was developed

through the North Coast Plug-in Electric Vehicle Readiness Project. Funded by the California Energy Commission, key components of the project included:

- Creation of a Plug-in Electric Vehicle Coordinating Council (PEVCC)
- Development of an infrastructure deployment plan
- Assessing local permitting and installation requirements for electric vehicle supply equipment (EVSE) and developing a plan to support streamlining those processes
- Developing a plan to accelerate PEV adoption in vehicle fleets
- Developing and piloting an education and outreach program to promote PEV adoption in the community

The North Coast Plug-in Electric Vehicle Readiness Project focused on the three neighboring counties of Humboldt (population 134,493), Del Norte (27,873), and Trinity (13,448). The bulk of the project's efforts were targeted at the Humboldt Bay area of Humboldt County; the majority of the North Coast region's population, about 100,000 residents, is centered in the Humboldt Bay area. The incorporated cities in the Humboldt Bay area include (from north to south) Trinidad, Arcata, Blue Lake, Eureka, Ferndale, Fortuna, and Rio Dell. It is expected that the majority of early PEV travel on the North Coast will be within this more populated region. The study did, however, examine the level of infrastructure needed to serve all areas of Humboldt County, including the more rural areas outside of the Humboldt Bay region, as well as Del Norte and Trinity counties.

During the course of the project a series of interim task reports and memos were developed that provide greater detail and additional background information to the components of this plan. These supporting documents, referenced throughout the plan, are contained in appendices which are available online at RedwoodEnergy.org/programs/electric-vehicles. A Final Project Report on the North Coast Plug-in Electric Vehicle Readiness Project is also available on that webpage.

GOALS FOR THE REGION

In March 2012 Governor Brown established a target of 1.5 million zero-emission vehicles (ZEVs – which includes both plug-in electric vehicles as well as hydrogen vehicles) on California roadways by 2025. To further this objective the State has set the supporting goal of having California's ZEV infrastructure able to support 1 million vehicles by 2020.

Achieving this ambitious target would require an estimated 3,000 PEVs on the road in the North Coast Region by 2025, equivalent to a PEV adoption of approximately 2% of all light duty vehicles in the community.

PEV Adoption Projections

The historical adoption of conventional hybrid vehicles (HEVs) is the best available indicator for the business-as-usual rate of adoption of PEVs over the next decade. Regional adoption projections were based off of vehicle registration data for Humboldt County over the decade from 2003-2012 and built on the assumption that PEV penetration in 2012 and forward would correspond to HEV penetration from 2003 forward.

Figure 1 below depicts projections of PEV adoption in Humboldt. The baseline projection follows the historical trend of HEV adoption. Two accelerated growth scenarios are also presented, representing increased rates of adoption: 10% and 25% faster than the baseline scenario. Three time intervals are emphasized in the figure near the horizontal axis. They are the intervals over which the baseline and 25% growth scenarios intersect key penetration levels (0.5%, 1%, and 2%). In other words, expected PEV penetration will reach 0.5% by 2015, but it could occur in 2014 if adoption rates are accelerated. Likewise PEV penetration could reach 1% between 2017 and 2019 and 2% between 2023 and 2026.

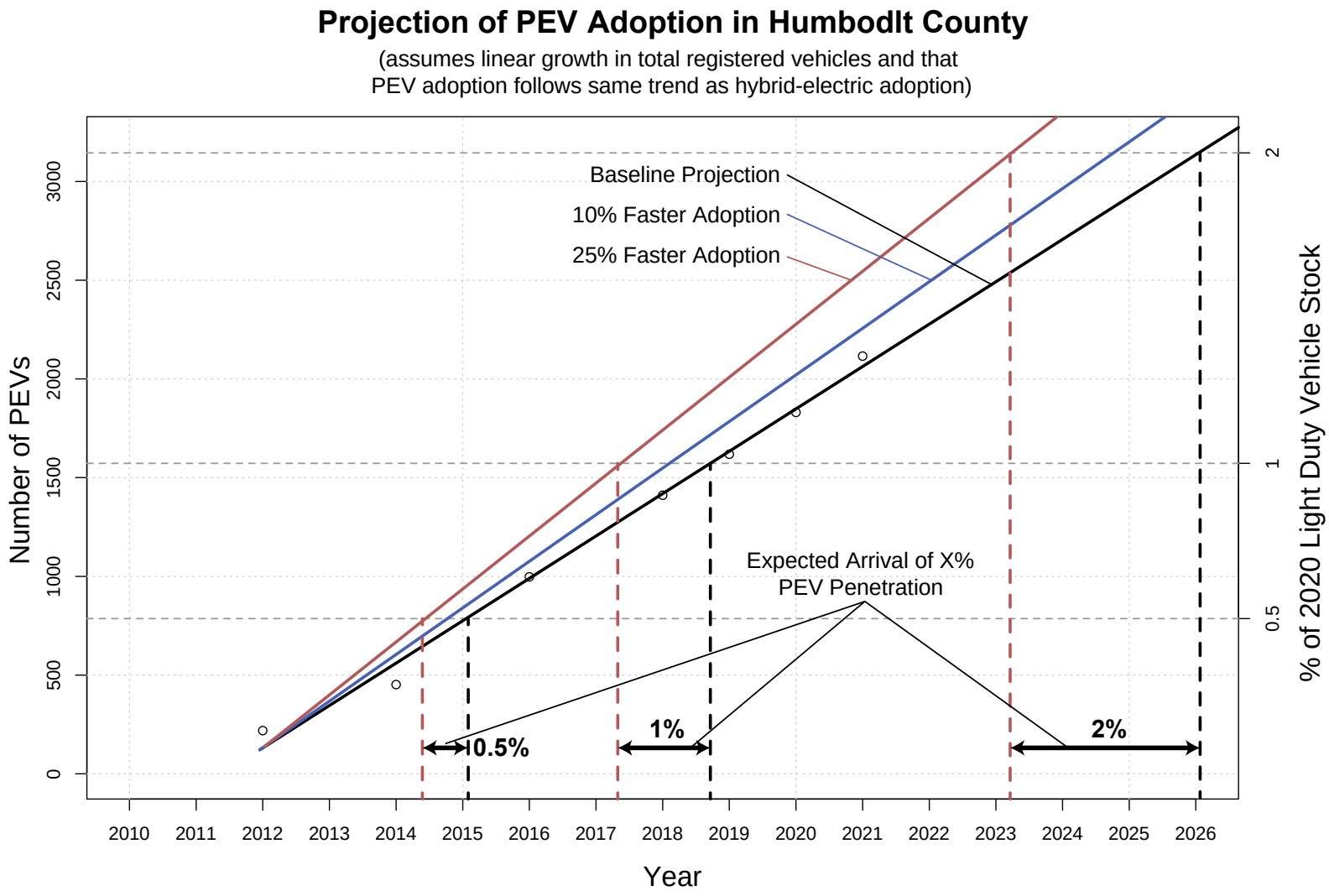

Figure 1: Using vehicle registration data for Humboldt County, PEV adoption was projected as far out as 2026. The time periods over which we expect to achieve benchmark penetration levels are depicted near the horizontal axis.

The three adoption levels from **Figure 1** – 0.5%, 1%, and 2% – form the basis for the model analyses described later in the plan. In order to effectively support PEV drivers and encourage adoption, planners should target the deployment of PEV charging infrastructure to be completed *before* adoption actually reaches these levels. Hence, the earlier end of each time interval should be interpreted as a target year for charging station deployment—this would be 2014 for 0.5%, 2017 for 1% and 2023 for 2%.

PROJECTED BENEFITS

PEVs provide numerous potential benefits, including low fuel costs (usually in the range of $1-2 per gallon of gas equivalent), higher efficiency/fuel economy, reduced operating costs, high performance, and reduced dependence on imported oil. However, the greatest benefit of PEVs is their potential to significantly reduce greenhouse gas emissions from daily activities. The North Coast PEV Project team conducted a detailed assessment of the greenhouse gas (GHG) impacts that would result from the targeted PEV adoption rate for the region. The team conducted a comprehensive accounting of projected 2020 baseline light-duty vehicle emissions in Humboldt County using a software tool developed by the California Air Resources Board (CARB) and then used the model to simulate the impact of a 1% and a 2% penetration of PEVs into the overall light-duty vehicle fleet.

A database of County registered vehicles from the Department of Motor Vehicles (DMV) was used to estimate properties of the total vehicle fleet of registered vehicles in Humboldt County. This data was combined with data from multiple models to obtain all of the required vehicle fleet characteristics. The Plug-in Electric Vehicle Infrastructure (PEVI) model, created for this project, interpolated 2010 and 2050 County travel demand model results, developed by the Humboldt County Association of Governments, to the year 2020 in order to obtain vehicle miles traveled (VMT) estimates. The EMFAC2011-LDV model developed by CARB was used to estimate characteristics that could not be determined using available County-specific data.

To calculate emissions estimates two different modeling programs were also used: the EMFAC2011 model, and the GREET model developed by the Argonne National Laboratory. The EMFAC2011-LDV model and the EMFAC2011-SG model (also created by CARB) were used to estimate tailpipe emissions, also known as pump-to-wheel emissions. The GREET model was used to estimate upstream emissions, also known as well-to-pump emissions.

Table 1 below presents the results of the analysis for the three scenarios. Reductions are achieved in the form of reduced tailpipe emissions, while the upstream emissions remain the same regardless of the level of PEV adoption. This is due to the upstream emissions rate, in kg of CO_2-per-mile, being virtually the same for gasoline and electric powered vehicles, at least in the light-duty vehicle class where most of the PEV miles traveled are accounted for. In other words, the emissions associated with the electricity needed to power a typical PEV are roughly equivalent to the emissions released during the production and distribution of the gasoline needed to fuel a comparable conventional vehicle. As a result, the overall net emissions are reduced in proportion to the penetration of PEVs.

Scenario	Tailpipe Emissions (metric tons CO_2e/day)	Upstream Emissions (metric tons CO_2e/day)	Total Emissions (metric tons CO_2e/day)	% of Baseline
Baseline	1,450	284	1,740	100%
1% PEV Adoption	1,430	284	1,720	98.9%
2% PEV Adoption	1,410	284	1,700	97.8%

Table 1: Humboldt County light-duty vehicle greenhouse gas emissions for three scenarios of PEV adoption.

To put these GHG reduction numbers in perspective, the approximately 2% projected reduction to light-duty vehicle emissions is equivalent to the total GHG emissions from the electricity and natural gas used by more 4,400 homes in the region.

Additional details on this analysis are contained in the project's *Report on Estimated Greenhouse Gas Reductions* contained in the appendices.


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Infrastructure Deployment Plan

ELECTRIC VEHICLE SUPPLY EQUIPMENT

Electric vehicle supply equipment (EVSE) is available at three different power levels that support different rates of PEV charging:

- Level 1 charging provides alternating current (AC) electricity to the PEV from a 120 Volt (V), 20 Amp (A) circuit.
- Level 2 charging provides AC electricity to the PEV from a 240 V circuit with currents up to 80 A (though typically at 30 A).
- Level 3 charging, also referred to as DC fast charging, provides direct current electricity to the PEV and the AC feeder capacity to the EVSE is typically 480 V, 3 phase with currents up to 400 A.

There is a diverse and growing range of EVSE options available on the market designed to meet the needs of different types of charging locations. Most PEV charging will likely occur while vehicles are parked at homes and fleet yards, and relatively simple EVSE can be installed in these situations.

But the availability of public and workplace charging has been identified as a critical component of facilitating accelerated PEV adoption, and these scenarios may require

more complex features. To ensure that the optimal available EVSE for a given location is selected, installation projects should:

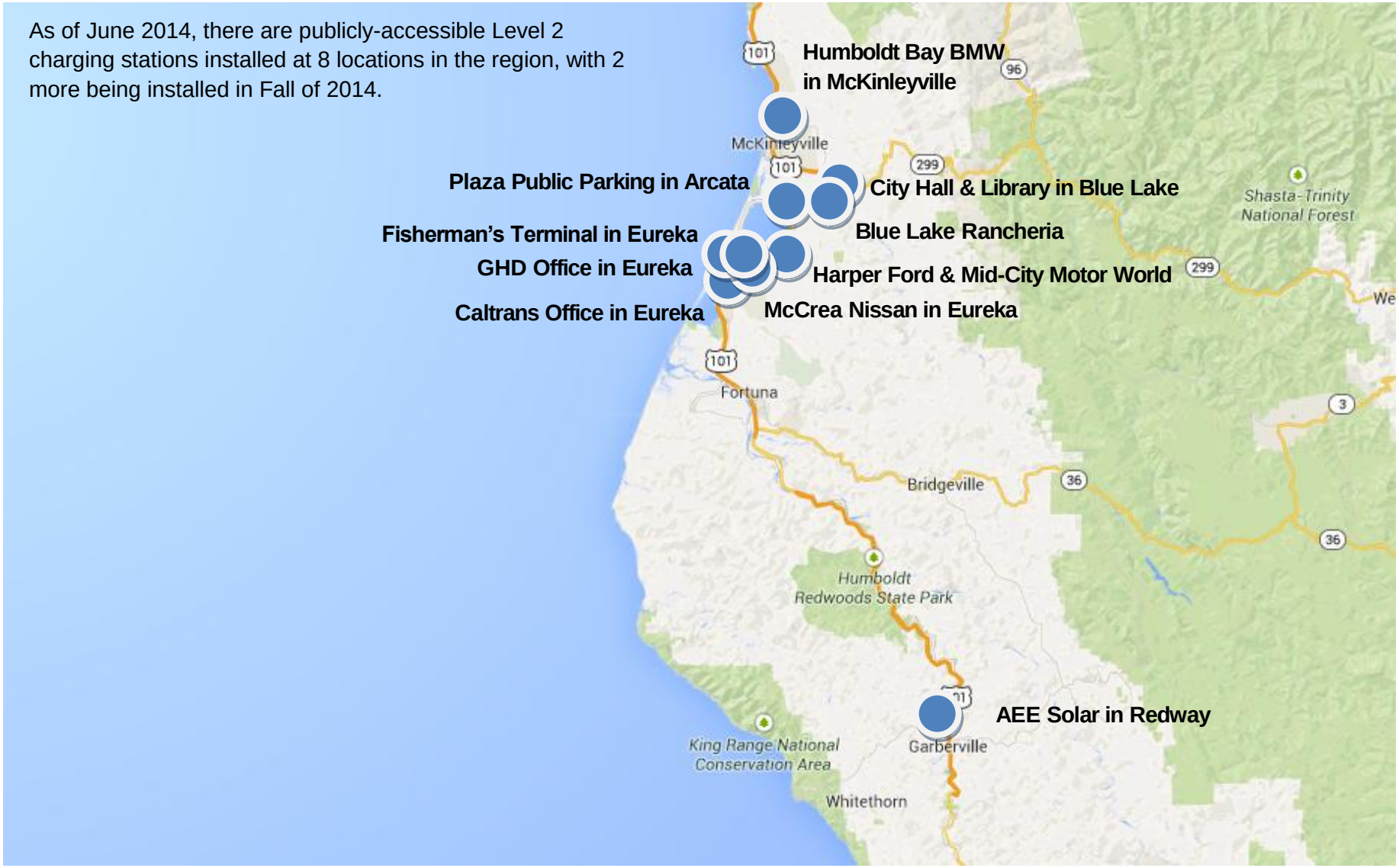
- Develop a matrix of available EVSE and their features to aid in identifying a shortlist of EVSE with the desired features. Factors to consider might include: cost, meeting open standard protocols, pay-by-credit card capabilities, if there are subscription fees or requirements for membership, data logging capabilities, durability and reliability, kW charging capacity, ability to serve more than one vehicle per charging unit, ease of use, aesthetics, and a retractable cord set to deter theft and minimize cord handling requirements.

- Evaluate the continual costs for operating a network based on each type of EVSE on the shortlist. The continual costs will include software subscription fees, network maintenance fees, code maintenance and update fees, warranty fees, cellular modem fees, and other reoccurring fees that are required to administer the network.

Open Charge Point Protocol (OCPP) is a standard that applies to data transfer and communications for EVSE. The OCPP was implemented to address the challenge of interoperability of PEV charging across the diverse landscape of EVSE. EVSE that are OCPP compliant can be accessed by any PEV driver regardless of what charging networks they may or may not belong to and what network the EVSE is associated with. The OCPP also allows EVSE owners and administrators to reconfigure the software on the EVSE to support their particular business/operations model. Currently, EVSE that are installed using funding from the State of California are required to be OCPP compliant.

CURRENTLY INSTALLED PUBLIC CHARGING STATIONS

As of June 2014, there are publicly-accessible Level 2 charging stations installed at 8 locations in the region, with 2 more being installed in Fall of 2014.



REGIONAL INFRASTRUCTURE GUIDELINES

To project the future demand for public charging infrastructure and to develop guidelines for where that infrastructure should be situated a macro-siting analysis was performed, which involved a data driven computer simulation to identify the apparent best distribution of chargers throughout the region with the goal of minimizing PEV driver inconvenience.

This first step of EVSE site identification involved use of a data driven computer simulation model herein defined as the Plug-in Electric Vehicle Infrastructure Model, or PEVI. The PEVI model considered geographic placement of chargers, number of chargers deployed, and charger type (Level 2 versus Level 3). The size of the geographic areas used in the simulation ranged from a neighborhood comprising several city blocks to vast rural sections of the North Coast comprising hundreds of square miles.

The challenge of the macro-siting task was to recommend the deployment of EVSE throughout the region for varying levels of PEV adoption. The project team accomplished this by answering the following key questions. How many chargers are needed for a given penetration of PEVs? Where should the chargers be located within the region? Should Level 2 chargers or Level 3 chargers (also known as DC fast chargers) be installed? How can the deployment be achieved in a cost-effective manner given limited resources for new infrastructure?

Answering these questions required that the following considerations all be taken into account:

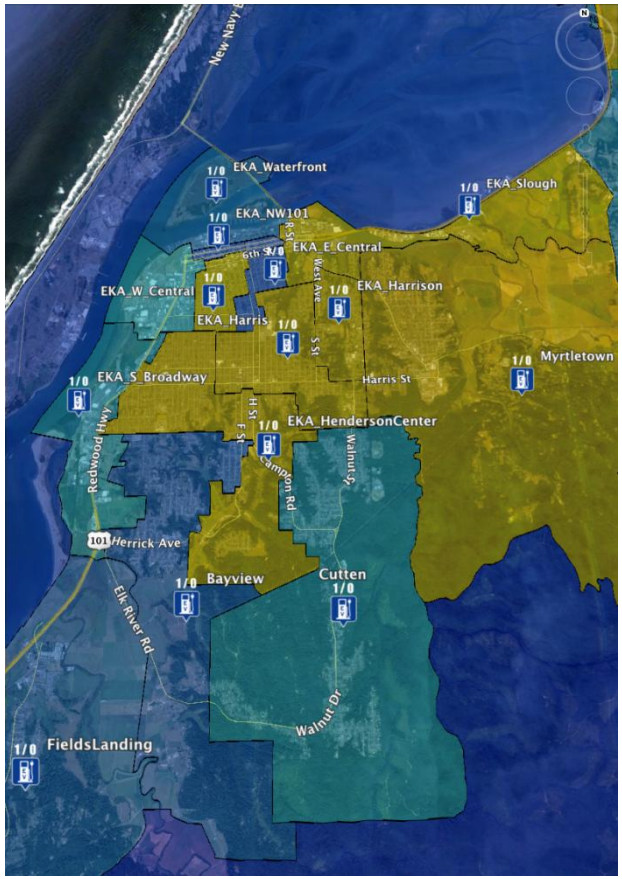
- How many PEVs do we expect in our region?
- Where within the region will the PEV drivers live?
- When do PEV drivers make their daily trips? Where and how far do they go?
- How long do drivers spend at each stop in their tour?
- If drivers have a choice of EVSE to use, which will they choose?

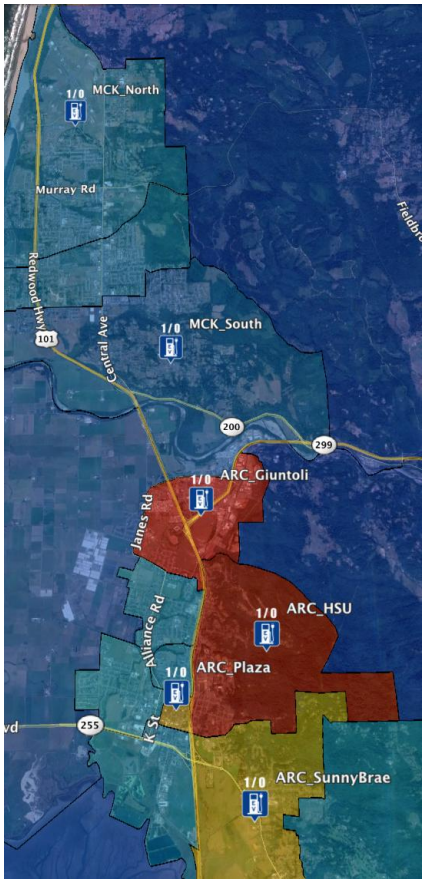
- How do drivers impact each others' access to EVSE?
- How will drivers who must charge (in order to complete their tour) be impacted by other drivers who elect to charge despite having no immediate need for the energy?
- How do drivers adapt to their circumstances (e.g. by seeking EVSE elsewhere)?
- How will a given deployment of EVSE improve the experience of drivers? Can we quantify the improvement (e.g. in terms of the number of hours of delay experienced by drivers)? If so, by how much does the EVSE improve their experience?

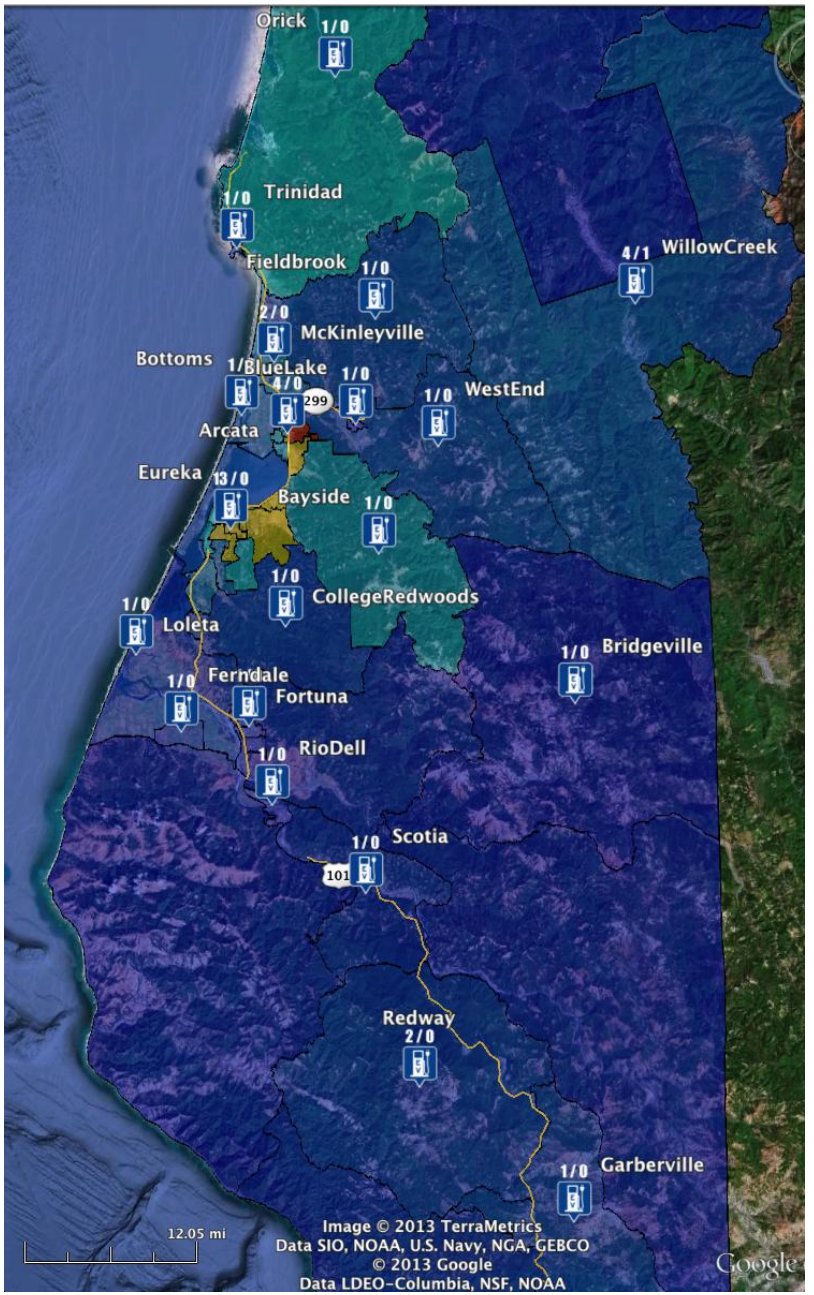
The project team managed the complexity of this problem by building the detailed PEVI simulation model. PEVI is capable of simultaneously balancing all of the above considerations. The approach is called "agent-based modeling," and it provides a flexible and powerful framework for evaluating the impact of infrastructure on PEV drivers' experiences. The PEVI model and the analysis results are described in further detail in the project's *Infrastructure Deployment Guidelines* report included in the appendices.

This modeling effort identified the need for 41 charging points in 37 travel-zone sub-areas across Humboldt County to support a PEV penetration of 2%, along with an additional 10 sites in Del Norte County and 5 sites in Trinity County.

The model identified the need for one Level-3 fast charger in Willow Creek to support intra-County travel, but the model did not assess travel between counties or inter-regional trips into and out of the region. Highways 101, 299, and 199 are the only major routes in and out of the region, and could be supported by fast chargers placed every 60-70 miles along those routes. This would mean additional fast-charge sites in the vicinity of Garberville, Scotia, Arcata/Eureka, Weaverville, near Redwood National Park, and Crescent City.







These maps illustrate the EVSE deployment guidelines for 2% penetration of PEVs (~3000 vehicles) in Humboldt County (right). Each zone is labeled by name and an icon with two numbers: # of Level 2 / # of Level 3 chargers. The detail maps are for McKinleyville and Arcata (center) and Eureka (left). Some results are occluded in these images. The coloring of each zone denotes the projected intensity of PEV travel demand into and out of that zone over an entire day.

These maps are available for download as navigable Google Earth documents at http://www.redwoodenergy.org/programs/electric-vehicles .

ALIGNMENT WITH STATE ANALYSIS

The project's targets for PEV penetration and EVSE infrastructure needs align well with the State's planning efforts. The *California Statewide PEV Infrastructure Assessment* prepared for the California Energy Commission by the National Renewable Energy Laboratory (http://www.energy.ca.gov/2013-ALT-01/documents/) estimates the need for about 2,000 PEVs on the road in the North Coast Region by 2020 to meet State goals.

The NREL Assessment considered two scenarios for future charging demand: a "home dominant" scenario and a "high public access" scenario. Depending on the scenario, the 2020 need for public charging sites was estimated to be between 40-100 Level-2 sites and 5-13 fast-charge sites across the region.

MICRO-SITING

The second phase in developing the infrastructure deployment plan was translating the results of the macro-siting analysis into on-the-ground locations within those larger geographic areas. This second step has been referred to as the micro-siting analysis. Site assessments at the parking space level were conducted for a variety of alternative host locations and those sites were ranked according to a decision matrix. The following design criteria, with weighted values based on level of importance, were included in the decision-matrix:

- Willing owner/operator or host (pass/fail screening criteria)
- Americans with Disabilities Act (ADA) accessibility potential (pass/fail screening criteria)
- Potential for minimizing delays experienced by drivers as determined by modeling analysis

- Close proximity to suitable electrical point of connection
- Minimal trenching required through paved areas
- High visibility
- Within 1/2 mile of at least 10 Basic Services as per LEED 2009
- Within 1/2 mile of connection points to other modes of transportation
- Suitable for block of multiple chargers
- Low risk of public backlash from converting significant numbers of high demand conventional parking spaces
- Well lit without the addition of dedicated lighting installed with station
- Potential for long duration charge (1 hour or more)
- Appears to support workplace and/or fleet charging in addition to public commerce charging
- Appears to be suitable for use by residents of a multi-family housing development.

Over 100 candidate sites across the region were identified for consideration, and 70 of those were assessed on the ground using the decision matrix rubric, and site owner consultations were initiated at 44 sites. This process lead to a final list of top-priority sites, and nine of these were selected as the initial phase 1 regional network target sites, show on the following map.

These nine sites represent about 20%-25% of the total number of EVSE needed by 2020 to provide the maximum benefit to PEV drivers without overbuilding the infrastructure. The goal is to have chargers at these sites installed and available in 2015 when regional PEV penetration is expected to reach 0.5%. Preliminary site plans were prepared under the supervision of a licensed civil engineer for the nine sites, along with an Engineer's Opinion of Probable Costs prepared by a licensed civil engineer using RS Means Site Work and Landscape Cost Data and bid results from recent local projects. These documents, along with additional details on the micro-siting analysis and the full list and ranking rubric results for evaluated sites are available in the *Plan for Near-term EVSE Deployment* contained in the appendices.

PROPOSED PHASE I CHARGING STATION SITES

FUTURE INFRASTRUCTURE STRATEGY

For future phases of EVSE build out, the following guidelines will be considered:

Continued Uses of the Micro-siting Rubric

To plan the rollout of subsequent stations in the network, the micro-siting rubric developed for the project should be updated and expanded to evaluate future sites:

- Develop ranking scores associated with each site based on field assessments guided by the objectives, weights, and criteria developed with the PEVCC
- Incorporate the PEVI model prioritization into the final ranking score for each site which brings the benefits of the data-driven macro-siting analysis into the decision of where EVSE should be sited
- Include the status of owner communications so that conversations with entities having site control can either be started or continued as appropriate
- The rubric should be viewed as a working tool that is being updated as new information comes in and progress is made towards developing new EVSE sites in the network.

Charging Behavior Data Collection

Since PEV transportation and publically available EVSE are in their nascent stages, there is a considerable degree of uncertainty about how best to roll-out the EVSE infrastructure so as to support PEV drivers, promote PEV adoption, and minimize stranded assets. Consumer charge behavior data can be used to inform charging network administrators, transportation planners, and State officials about the efficacy of investments made to support publically available EVSE.

By understanding peoples charging habits, infrastructure can be placed more strategically. For example:

- Stranded assets can be reduced by learning what types of locations are unpopular for charging and then avoiding installing charging stations in those types of locations unless they are needed for safety purposes.
- PEV adoption can be encouraged by learning what types of locations are popular and installing more EVSE in those locations.

Consumer charging behavior data can also show how sensitive PEV drivers are to pricing at publically owned stations when deciding where and when to charge. Network planners and administrators, and analysts can use consumer charging behavior data to learn whether or not pricing at publically accessible stations can support a for-profit charging station owner business model, or if a non-profit station owner business model or charge price subsidies are most effective in encouraging adoption. Consumer charging behavior data can be used to help funding agencies decide if available funds are best directed towards:

- Vehicle rebates to lower the cost of PEVs
- Grants to install publically accessible charging stations
- Subsidies to reduce the cost of charging at publically available charging stations
- Or some combination of the above.

Consumer charging behavior data can also be used in the development of parking policies that promote fair use of parking and charging real estate in environments of parking scarcity.

The recommended plan for collection of consumer charge behavior data consists of the following elements:

1. Select OCPP compliant, networked EVSE
2. Distribute a PEV driver feedback survey
3. Create a database
4. Update the database on a quarterly basis
5. Report out to stakeholders on an annual basis.

Selecting OCPP compliant, networked EVSE will enable the collection of the following data:

- Number of charge events per day
- Energy transferred per charge event
- Duration of charge
- Duration of transaction
- Time of day each charge event occurs

- Cost to EV driver to charge
- Availability (percentage of installed time that station is operational).

These data will allow the network administrator to determine:

- Station utilization
  - This will help determine what types of locations are popular and when it is time to install another station at a popular location.
- Frequency of PEVs remaining plugged in after their battery has been completely charged
  - This will help determine when it may be advantageous to implement a charging policy that requires PEV drivers to move their vehicles within a certain period after their battery has been fully charged, which will free up the EVSE for another PEV to charge.
- Frequency of overnight charging
  - This will help administrators understand demand for overnight charging opportunities for residents that do not have access to a dedicated parking space such as urban apartment and multi-family housing development dwellers.
- The relationship between charging price and station utilization
  - This will help administrators understand how effective their marketing campaign is in explaining the actual costs of operating and maintaining the network and the justification for the pricing structure.
  - This will also help administrators balance pricing and utilization by providing a feedback mechanism from PEV drivers.
- The reliability of various types of EVSE
  - If availability of a particular brand of EVSE is low and externalities such as vandalism have not occurred then the administrator will be able to avoid that brand of EVSE for subsequent charging station installations.
- The prevalence of vandalism in particular locations
  - From recent experience in the North Coast region, it appears certain locations are more prone to vandalism than others. Vandalism can affect the availability of stations and it will be useful for the administrator to know which areas are more prone to vandalism.

- If utilization of stations in vandalism prone areas is low then the administrator may elect to remove the EVSE to avoid incurring repeated expenses associated with repairs.
- If the location is highly utilized or important for safety reasons then the administrator can either harden the existing EVSE or install a new vandal resistant EVSE, if one becomes commercially available.

Distributing a PEV driver feedback survey and managing the data received will provide the network administrator with data that cannot be obtained from EVSE directly. A survey form was developed using Google Forms, a free online tool that allows users to create surveys, create links to the survey for use on websites and in documents, and analyze survey results. Partnering with local auto dealers to provide handouts or business cards with each purchase of a PEV would make PEV drivers aware of the survey and the local charging station network, which could result in valuable feedback. The types of data that can be collected on the survey form include:

- Frequency of use for each station in the network by individual drivers
- Additional locations where drivers would like to see EVSE
- Frequency of occurrences where a driver was not able to charge because the charging station was occupied by another PEV
- Frequency of occurrences where a driver attempted to use a charging station but it was unavailable due to equipment failure
- Frequency of occurrences where a charging station was occupied by a conventional vehicle.

The feedback survey, along with additional background information and further details of the data collection plan, are available in the *Plan to Collect Consumer Charging Behavior* contained in the appendices.

PERMITTING

The general process of EVSE permitting involves the steps illustrated in the below flowchart.

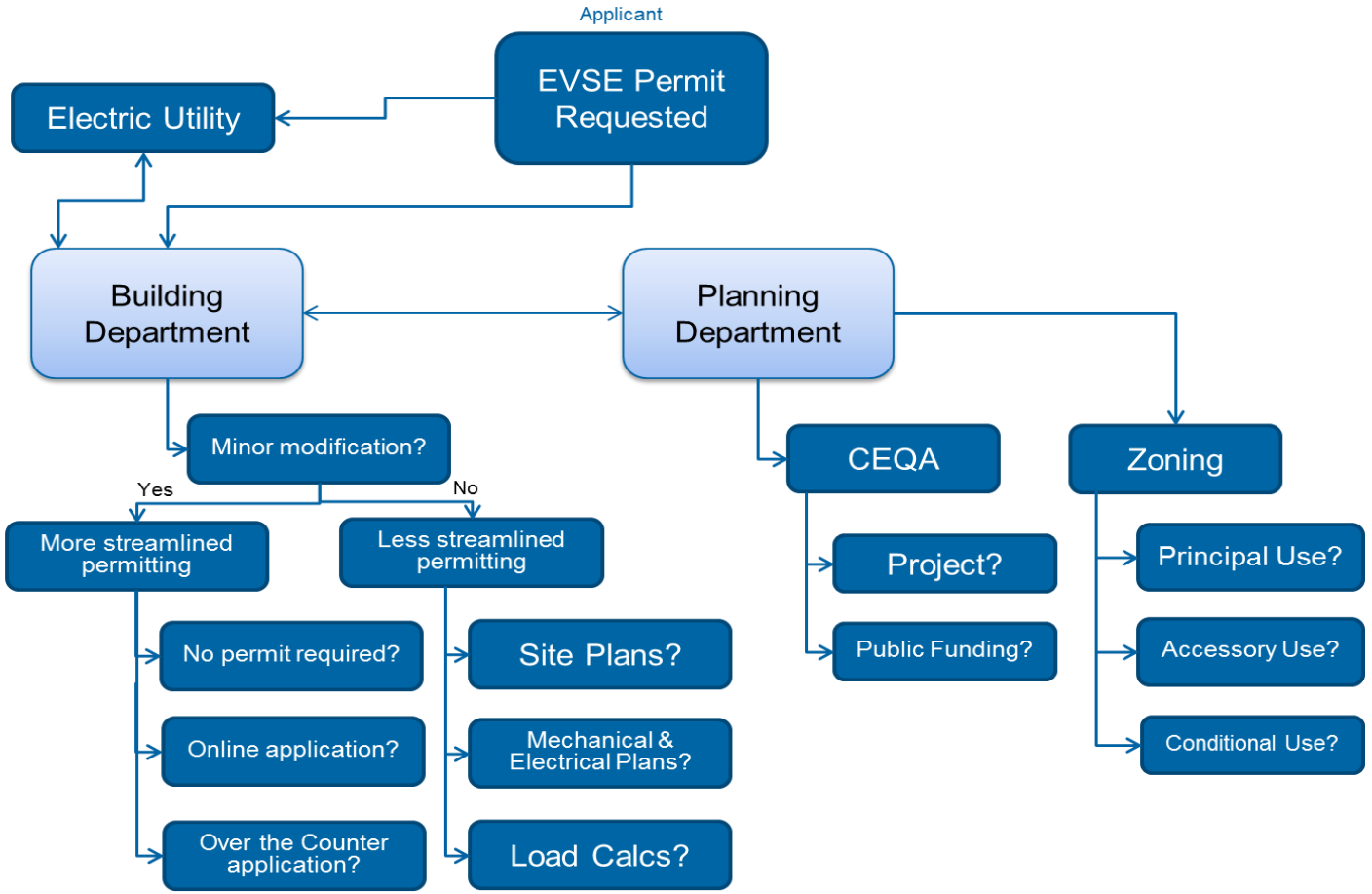


Figure 2: Flowchart of EVSE Permitting Process

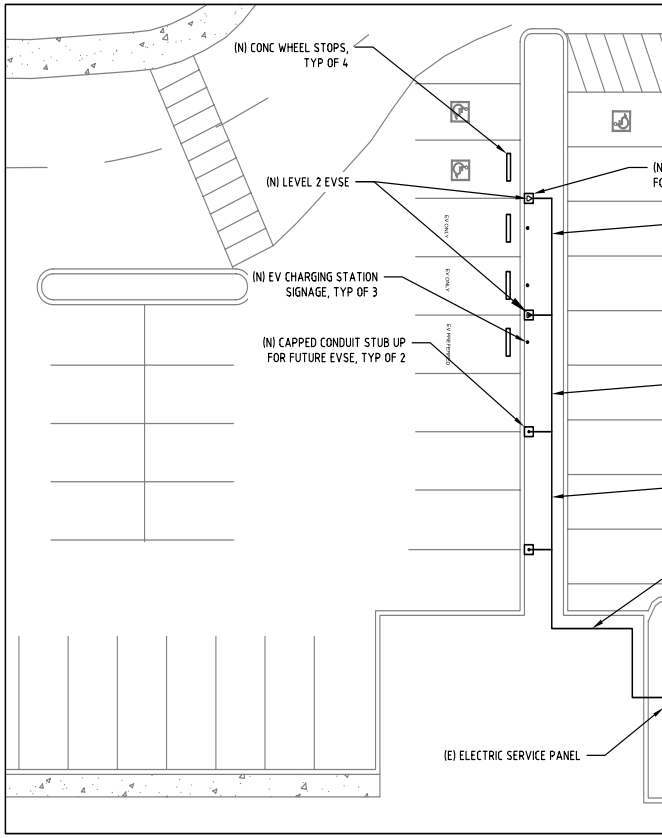
Note: CEQA is an acronym for the California Environmental Quality Act.

As shown in Figure 2, the permitting process starts with the applicant notifying the building department and the electric utility. Notifying the utility is a courtesy and, if overlooked by the applicant, the building department will involve the utility as appropriate for the type of EVSE installation under consideration. The building department will guide the applicant through the process and determine to what extent the planning department needs to be involved in the process. For simple installations, the permit may be issued over the counter without involvement of other entities.

Current EVSE permitting practices for jurisdictions in the North Coast Region were reviewed; none of the jurisdictions in the region have permitting processes specific to EVSE installations. Over the counter permitting for minor electrical work is supported by the Humboldt County Building Department, the City of Fortuna Building Department, and the City of Eureka Building Department. Conversations with building department staff with these jurisdictions indicate that typical residential and private commercial Level 1 and Level 2 EVSE are likely to be considered minor work. Aside from these exceptions, a plan check process appears to be the norm for EVSE installed in the North Coast Region.

The follow actions are recommended to streamline the EVSE permitting process in the North Coast Region:

- Include policies to encourage PEV transportation in community planning documents as part of document update cycles
- List PEV charging as a permitted use across a broad range of zoning classifications
- If a zoning review is triggered, consider the EVSE as an accessory use to another permitted use whenever possible.
- Develop a standard EVSE permitting process that can be used across the North Coast Region for typical residential installations that meet the following criteria:
    - EVSE is not accessible to the public
    - EVSE is located within 25 feet of main electrical panel
    - Results of load calculation worksheet indicates that the existing main electrical panel for the building is adequate. A sample load calculation



worksheet developed by the Governor's Office of Planning and Research is included in Appendix B.
    - Advertise the standardized process for residential permits at car dealerships, building department counters and websites.
    - Allow the standardized process to be completed using an over-the-counter permitting approach
- Establish a permit fee structure specifically for EVSE installations making fees as low as possible for each jurisdiction
- Allow second meters for EVSE to enable PEV driver access to lower rates for PEV charging provided by utilities.

Note that implementing an online permitting process for EVSE installations does not appear to be a practical goal in the North Coast Region in the near term because online permitting is not currently used in the region and establishing such a system solely for EVSE permitting is not warranted.

Additional information on current permitting processes and recommended best practices is contained in the *Plan for Streamlining Permitting, Installation, and Inspection* contained in the appendices.

NCPEV CHARGING NETWORK

The efforts that have been initiated through the NCPEV project to promote PEV adoption have been very successful, and these efforts will be sustained and expanded moving forward with the creation of the NCPEV Charging Network. In this unique public ownership model, local site hosts enter into an agreement with RCEA which will own, operate, and maintain the EVSE, and set the cost of vehicle charging to cover operation costs. The site host pays nothing and gains marketing and public image benefits. Station designs and the collection of operating data will be standardized. Stations that are in high-traffic areas and will get a lot of use can subsidize stations that are in more remote areas, will be used less, but are critical to providing required regional connectivity. This ownership model will be used to minimize costs and optimize EVSE services provided to the public.

The not-for-profit EVSE network administrator business model includes:

- Cost recovery for site hosts providing electricity for EVSE
- Maintenance of a network administration and operations fund to ensure network reliability
- A reasonable pricing structure aimed at offering local charging costs for PEVs that are competitive or below the cost of fuels for non-PEVs on a dollar-per-mile basis
- A plan to ensure a reasonable duty factor to maintain a revenue stream and availability to customers.

As the network administrator, RCEA will also provide marketing and outreach related to the charging sites including establishing and maintaining a presence for each station on the various internet sites and apps that help PEV drivers locate charging stations.

The pricing structure will be on a dollar-per-kilowatt-hour basis and include a markup to cover the projected costs of administering the network and operating and maintaining the stations. Costs will include such factors as: ongoing service fees for insurance; network software; warranties; cellular modem services; repair costs due to equipment failure, accidents, and vandalism; staff time for network administration; and future equipment upgrades. Prices will be set with the goal of covering costs while providing charging rates that are competitive or below the cost of gasoline (on a dollar-per-mile

basis for comparable vehicles). We estimate that a duty factor for the EVSE network as low as10% would be adequate to warrant a price for vehicle charging at public stations that would be cost-competitive with the price of gasoline and diesel fuels for conventional vehicles.

As PEV adoption accelerates and network utilization grows, revenue is expected to eventually exceed the cost of operation and maintenance. Surplus funds will be re-invested in expanding the charging network, reducing the need for public funds to support the ongoing growth of EVSE coverage. This regional non-profit model also will help achieve increased economies of scale, and the experience, and institutional knowledge that RCEA gains with installing EVSE throughout the region will be leveraged to add new chargers at minimal cost with a seasoned team.

The NCPEV Charging Network currently includes two existing publically accessible Level 2 charging stations, two forthcoming Level 2 stations, and will include the nine high-priority charging sites installed as part of phase 1 of the regional public charging infrastructure requirements identified in this plan.

The First North Coast PEV Ride and Drive Event

Promoting PEV Adoption

PLUG-IN ELECTRIC VEHICLE COORDINATING COUNCIL

The North Coast Plug-in Electric Vehicle Coordinating Council (PEVCC) was formed to support the development of a regional PEV readiness plan and to help carry regional efforts forward upon completion of the grant funded project. The North Coast PEVCC is a collaborative coalition comprised of City and County governments, local government Joint Powers Authorities, regional and state government agencies, utilities, educational institutions, non-profits, and business partners. The North Coast PEVCC is coordinated by the Redwood Coast Energy Authority. The mission statement of the PEVCC is:

> ***The members of the North Coast PEVCC will work together to promote and accelerate the acceptance and use of PEV technology as a key strategy for cost-effectively utilizing the full potential of our region's abundant renewable energy resources to meet our community's transportation energy needs.***

The principal responsibilities of member-organizations' representatives serving on the PEVCC are to:

- Serve as a representative and advocate for their organization.

- Participate in PEVCC meetings; all PEVCC designated representatives are required to participate in the two annual PEVCC core meetings.
- Participate in working groups; PEVCC member organizations are required to participate in at least one working group. Working group participants can be an organizations official PEVCC representative and/or other staff members/representatives when appropriate.
- Seek input from within their organization and from their stakeholders on key issues for the PEVCC's consideration.
- Seek input from within their organization and from their stakeholders regarding priorities and direction for PEVCC activities.
- Report PEVCC activities, information, and decisions back to the appropriate staff, decision makers, constituents, and stakeholders of their organization.
- Serve as a liaison between the PEVCC and their organization.

The PEVCC's Charter with the full list of members is contained in the appendices.

PUBLIC EDUCATION AND OUTREACH

Education and outreach programs should target the general public as well as key stakeholders in the community who have the ability to create policies that support PEV adoption. Education programs should also target personnel who are likely to encounter PEVs at their workplace, such as fleet operators and emergency responders. Outreach campaigns developed as part of the NCPEV project were designed to keep current and future PEV owners informed about the existing and planned policy and infrastructure that will help them to have a satisfying PEV ownership experience. All segments of the public can be encouraged to consider the advantages of PEV ownership on the North Coast using the following strategies.

Foster Partnerships & Collaborations

Education and outreach programs will be strengthened by reaching out to other communities and organizations with similar goals and compiling existing education and outreach resources. Accordingly, resources developed for NCPEV project education and outreach events and activities will be shared with other organizations and regions to exchange lessons learned and best practices.

Entities with existing readiness plans and resources include:

- Local and state governments
- Pacific Gas & Electric Company
- Automotive industry
- EV supply equipment (EVSE)/charging industry
- Electric Power Research Institute
- Rocky Mountain Institute's Project Get Ready
- U.S. Department of Energy
- California Plug-in Electric Vehicle Collaborative
- CalCars

Partnering organizations and local municipalities of the NCPEV project include: Humboldt County Association of Governments, North Coast Unified Air Quality Management District, City of Eureka, City of Arcata, Pacific Gas & Electric Company, Schatz Energy Research Center, GHD Engineering, Caltrans District 1 and Humboldt State University. Potential partners include the other incorporated cities on the North Coast, counties, other utilities, North Coast tribes, College of the Redwoods, Humboldt Electrical Vehicle Association, local car dealerships, International Brotherhood of Electrical Workers, North Coast Green Trades Association and Humboldt Builders Exchange. Ongoing collaboration will be coordinated through the North Coast PEVCC and smaller work groups.

Implement Local PEV Education Programs

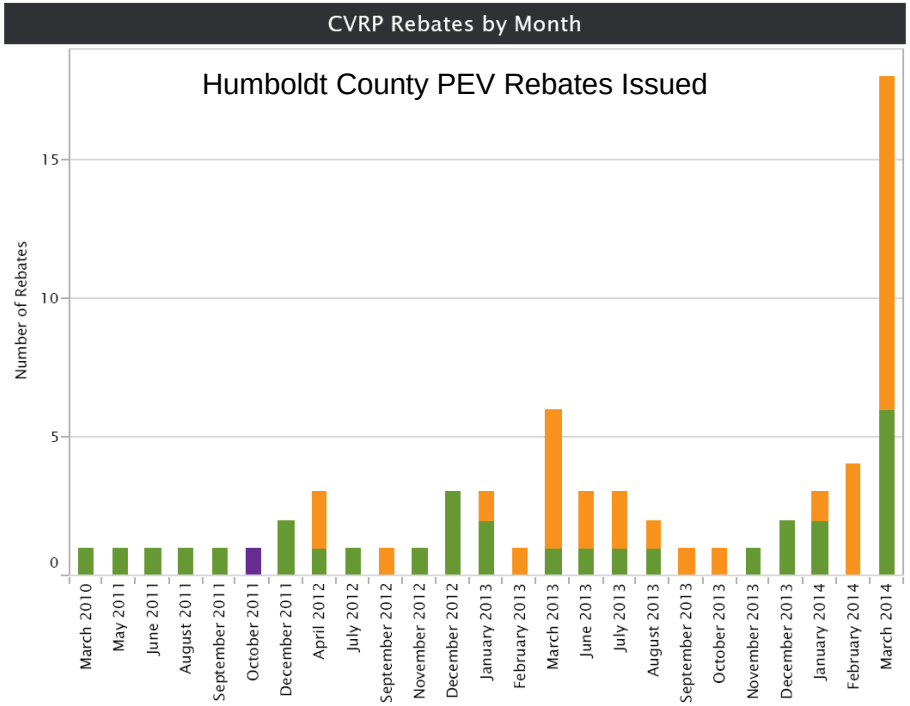
Through partnerships and collaboration, the core NCPEV project team assisted in developing and implementing diverse education programs that addressed the following sectors:

1. General Public
   - Publish periodic newsletters that include PEV consumer information, local PEV owner testimonials, local successes such as new fleet adoption or new infrastructure, and project updates
   - Develop an online presence through the Redwood Coast Energy Authority webpage (www.redwoodenergy.org) that includes:
     - Media section with press releases, photos of events and activities, links to radio spots
     - Links to past and current newsletters
     - Information about locally available PEVs, existing infrastructure and local resources
     - Links to existing resources addressing common concerns and questions regarding PEVs. For example, Advanced Energy, a company in North Carolina has developed an FAQ sheet for PEV dealerships.
     - Links to other organizations and resources, such as a vehicle buyer's guide developed by the U.S. Department of Energy.
   - Provide informational sessions or workshops for charging station users
   - NCPEV project overview presentations to community organizations such as:
     - Arcata Chamber of Commerce
     - Eureka Chamber of Commerce
     - Large institutions and businesses (Humboldt State University, St. Joseph's Hospital).
2. Local Government
   - Recruit additional participation in the PEVCC and workgroups, emphasizing the positive impact of PEVs on the local economy and environment

- Develop and implement an “EV 101” Workshop for local governments that will familiarize Councils, public works, permitting and building code staff, and fleet operators with the basics of EVs and chargers
- Collaborate with partners to implement more in-depth training specific to job roles
- Assist with updating building codes, zoning and parking rules to be PEV ready.
- Define and encourage incentives that municipalities may promote, such as preferential parking or free workplace charging
- Promote adoption of the North Coast Electric Vehicle Readiness Plan.

3. Emergency First Responders
   - Coordinate first responder PEV safety resources and training:
     - Compile materials on infrastructure safety codes, standards and emergency response
     - Reach out to community colleges or other organizations who may have curriculum or certification programs
     - Implement workshops for police and fire personnel.
4. Mechanics and Electricians
   - Coordinate PEV technical training forums or workshops for local vehicle mechanics
   - Research the Electric Vehicle Infrastructure Training Program for electrical contractors and electricians.
5. Potential Fleet Vehicle Operators
   - Recruit interested businesses and municipalities to participate in fleet adoption work groups

In late February and early March of 2014 the Redwood Coast Energy Authority conducted a pilot media and outreach campaign culminating in a public Ride and Drive event attended by over 100 community members. A very positive impact on PEV sales was confirmed by participating dealers and is evident in the Clean Vehicle Rebate Program statics for Humboldt County show below.



- Identify possible financial support and financing programs for business and municipality fleet adoption.

Implement Local PEV Outreach Activities

The NCPEV project team participated in local events, educational booths, ride-and-drives, presentations, and activities focused within the general public, local governments, non-profit organizations, and businesses. Events provided opportunities to solicit feedback from the public about project goals, progress, and results, and gather information about community needs. As mentioned previously, a PEV owner survey has also been developed for this purpose to be distributed through multiple avenues, including event tables and the webpage.

INCENTIVES

There is a variety of potential incentives, at varying levels of investment, that local municipalities, utilities and others can offer to individuals, businesses and organizations on the North Coast to encourage PEV adoption and retention. Often incentives play an important role in the deployment of a new technology that offers advantages over more established technology. Incentives can help overcome cost barriers as new technology is often more expensive, and can enhance awareness and education of new and unknown concepts. Incentives can be in the form of community infrastructure and education, as well as direct monetary offsets for PEV drivers.

Municipal Incentives

- **Provide PEV Charging**
  One prominent way for local governments to promote and support the adoption of PEVs is to provide charging infrastructure in their communities. The North Coast Electric Vehicle Readiness Plan addresses where charging stations are most needed on the North Coast; the County and Cities can use this information to determine

locations where workplace and public charging would be an appropriate investment. Municipalities can take this a step further by providing subsidized or free charging for employees, free charging vouchers for limited time periods, or by establishing a validation system for consumers conducting business within the City. Local auto dealerships may be interested in matching incentive costs through the purchase of pre-paid charging from the city to offer to prospective PEV buyers.

- **Provide Free Parking for PEVs**
  In addition to locating charging infrastructure in prime locations, municipalities could offer preferred and unrestricted parking for PEVs in all public parking areas, and free parking in metered, permitted, and pay lots. Permits issued by the municipality could exempt PEVs from ever feeding a meter or being ticketed in a time-limited parking area. Reserved spaces in high-traffic areas, potentially near bicycle or motorcycle parking, would also draw attention to PEVs in the community.

- **Encourage Green Business**
  Incentivizing businesses to adopt PEVs or encourage their consumers to consider PEVs could be as simple as implementing a voluntary Green Business Certification program that includes elements related to PEVs. The program could be implemented by a municipality, or by a local business council and supported by municipalities. The program would acknowledge local businesses that reduce their environmental impact through means that incorporate consideration of PEVs, such as fleet adoption or providing workplace charging, while promoting business vitality. The program would offer information and awareness to consumers about which businesses in the area demonstrate environmentally responsible behaviors while educating businesses on the benefits of PEVs. If a Green Business Certification program already exists, it could be updated to include elements related to PEVs.

  Certification criteria may include:
  - Provide PEV charging for employees or the public
  - Provide preferred parking for PEVs
  - Add PEVs to an existing fleet
  - Create a ‘green team’ to promote related efforts, including providing information to employees about available PEVs, rebates and workplace charging.

- **Provide Incentives for Home and Commercial Charging**
  Municipalities can coordinate with the local utility provider to set-up special rate discounts for residences and businesses that install PEV charging infrastructure in their jurisdiction. The discounts may enable a ratepayer to stay in a lower pricing tier or avoid peak charges when they add PEV charging to their electrical load. Direct rebates for the cost of adding any electric meters that may be required, providing signage for chargers that will be available to the public, or assistance with meeting any legal requirements for public charging (such as paint striping or ADA accessibility) are ways that municipalities can help residents and businesses overcome some of the cost barriers associated with PEV supply equipment. Some municipalities have gone as far as purchasing EVSE and then holding a public lottery for businesses or multi-family dwellings interested and qualified to install it. Since installation costs can vary greatly, this would be a fair way to distribute EVSE as funds become available to purchase it.

  Streamlining any permitting or inspection processes is another way address some of the barriers associated with purchasing and installing EVSE equipment. Many cities have adopted inspection checklists and same-day permitting processes that provide citizens with transparent and hassle-free tools to guide their home or business installations.

- **Support the Continuation of the PEVCC**
  Local municipalities can work on PEV-related issues, including how to incentivize PEV-ownership to accelerate adoption on the North Coast, by continuing to participate in the North Coast Plug-in Electric Vehicle Coordinating Council. Local governments can support continued efforts in becoming a PEV-ready community by designating a representative or staff whose position includes being actively involved in the Council and related working groups.

Utility Incentives

- **Subsidize EVSE**
  Utilities across the country have launched pilots or programs aimed at PEV drivers. Some are offering rebates or even free EVSE to ratepayers to incentivize the transition to PEVs in their service areas. Consumers Energy in Michigan is offering a $2,500 reimbursement towards the purchase, installation and wiring of a Level 2 home charging station to the first 2,500 qualified customers who apply. Northern

Indiana Public Service Company offers a credit of up to $1,650 towards the purchase and installation of a Level 2 home charger. Based on the success of an initial EV charger rebate program, Los Angeles Department of Water and Power is offering up to $750 towards the purchase of a Level 2 charger to residential customers and a rebate of $750, $1,000 or $15,000 depending on charger type to qualifying commercial customers. Rebates are offered on a first-come, first-served basis to the first 2,000 approved PEV customers regardless of customer sector.

Pacific Gas & Electric Company, Trinity Public Utility District and Pacific Power, the electricity service providers in the North Coast Region, currently offer varying levels of support to PEV customers but none offer rebates towards the purchase or installation of EVSE.

- **Provide Special Rates for PEV Charging**
  Related to the above, utility providers can set special rates for PEV charging. The rate plan may offer discounted rates and/or incentivize ratepayers to charge during off-peak hours which could assist the energy provider in stabilizing electricity usage in their service areas. Los Angeles Department of Water and Power customers who choose to install an optional dedicated time-of-use meter will qualify for a PEV charging discount plus receive an additional $250 credit towards their utility bill. The dedicated meter will add additional cost to the installation of their home charging system but will yield lower electricity costs for base charging.

- **Provide Customer Assistance and Resources**
  Utilities may offer assistance and guidance to customers interested in purchasing or installing EVSE. This may include expertise, information, tools, services, or training, and help connect people with appropriate electricians or installers. Although the ability to offer these services may vary, all three North Coast Region utility providers are equipped with a website that could direct interested customers to resources including available State and Federal incentives.

- **Provide Incentives to Include EVSE with Solar Installation**
  Providing rebates and incentives for installing solar electric generating systems at residences and businesses that will be used to power a PEV will support growth of both renewable energy and electric vehicles on the road.

Community Incentives

- **Private Foundations or Support Groups**
  Community groups and organizations can promote adoption of PEVs through several avenues. Some community organizations may be able to offer direct incentives, such as rebates for the purchase of a PEV or EVSE or public charging facilities, whereas some organizations may be able to offer indirect incentives such as expertise or support for policy changes. Community groups formed specifically to celebrate and promote PEVs can be a resource to potential buyers by offering their expertise and experience.

- **Integrate Promotion Policies into Community Planning**
  Policies that promote PEV adoption and PEV-friendly communities can be included in climate action planning, energy committee recommendations, historical review committee recommendations, homeowner association policies, community foundation goals, business association policies (Mainstreets, Chambers of Commerce), library foundations, and others. These groups may also lobby their local governments to include PEV promotion policies into municipal planning and zoning codes.

- **Develop Economic Opportunities Around PEVs**
  Communities may benefit from developing economic opportunities around PEVs while indirectly incentivizing PEV ownership. For example offering infrastructure and services to travelers and hosting conferences or PEV-related trainings or events would be a benefit to PEV drivers in the community and surrounding areas, and would benefit business owners taking advantage of a niche market.

FLEET ADOPTION

A fleet vehicle assessment requires identification of vehicles that might be suitable for replacement with a PEV. For those vehicles that are deemed potentially suitable, an economic analysis can be performed to evaluate the cost-effectiveness of switching to a PEV. In addition, the greenhouse gas (GHG) emission impacts can also be assessed. PEV adoption will typically result in reduced GHG emissions and can thereby help a municipality or other organization meet its GHG reduction goals.

Fleet electrification will also require the installation of electric vehicle charging equipment, also known as EVSE. The capabilities and capacities of various EVSE units should be researched and considered. Level 2 chargers will typically be suitable for charging vehicles overnight, whereas Level 3 fast chargers can be used for quick charging (i.e., 20 minutes), though at a much greater cost. Also, some EVSE units can charge multiple vehicles at one time. Based on the number of electric vehicles and their charging needs, an assessment of required EVSE must be made.

The approach developed for this task involved the following set of project activities:

1. Identify vehicle fleets in the region
2. Compile resources for fleet managers
3. Develop fleet evaluation methodology
4. Reach out to fleet managers
5. Engage with fleet managers and obtain necessary fleet data
6. Pre-screen potential fleet vehicles
7. Evaluate fleet opportunities
8. Prepare plan to accelerate PEV adoption in fleets

To facilitate the evaluation of PEV adoptions for fleet applications the Plug-In Electric Vehicle Fleet Evaluation Tool (PEV FleET) was developed. An Excel spreadsheet-based tool, PEV FleET is intended to be used by fleet operators or others who desire to

perform fleet evaluations. Users are prompted to input necessary data and then choose the vehicles they want to evaluate. Outputs from the tool include:

- Incremental initial cost
- Simple payback
- Discounted payback
- Internal rate of return
- Net present value (over a 10 year life-cycle)
- Avoided downstream tons of carbon dioxide (CO_2) per year

This tool can be used to calculate the costs and benefits in a vehicle fleet when replacing conventional internal combustion engine (ICE) vehicles with PEVs. PEVs can include both battery all-electric vehicles (BEVs) and/or plug-in hybrid electric vehicles (PHEVs). Note that the PEV FleET model assumes vehicles are being replaced at the end of their useful lives. Therefore, comparisons are between a new conventional ICE replacement vehicle and a new PEV. Costs and specifications (like fuel economy) are based on the new vehicles. Annual mileage figures, however, should typically be based on the usage characteristics of the old vehicle being replaced.

Features of the PEV FleET include:

- Includes compiled information on currently available PEVs, including cost, range, fuel economy, tax credits and California state rebates
- Includes compiled information on a sampling of available EVSE, including cost, input power, and associated annual fees
- Includes compiled information on typical EVSE installation costs
- Includes compiled information on local utility electric rates for commercial customers
- Allows individual and aggregate PEV assessment for fleet applications
- Allows evaluation of individual vehicles or a fleet of vehicles
- Allows inclusion or exclusion of the cost of electric vehicle charging infrastructure
- Allows use of State-negotiated fleet vehicle rates where applicable.

Plan to Accelerate PEV Adoption in Fleets

The Redwood Coast Energy Authority (RCEA) provides local municipalities in Humboldt County with assistance in developing and implementing sustainable energy initiatives that reduce energy demand, increase energy efficiency, and advance the use of clean, efficient, and renewable resources available in the region. This puts RCEA in a prime position to support local municipalities in the development and implementation of green fleet policies. Below is a list of actions that RCEA can take to help promote PEV adoption in fleets:

- Make presentations to elected officials and city staff
- Provide the *Plan to Accelerate PEV Adoption in Fleets* to municipal fleet operators
- Share the wealth of information and resources that have been assembled as a part of the North Coast Plug-in Electric Vehicle Readiness Project
- Make the PEV FleET tool available to municipal fleet operators
- Offer guidance and assistance to municipal fleet operators in evaluating green fleet options
- Encourage municipalities to adopt green fleet policies
- Encourage municipalities to include green fleet activities in their climate action plans
- Encourage local businesses to adopt green fleet policies
- Publicize and promote local green fleet activities
- Create a web page providing resources and information about green fleets.

Additional information is available in the *Plan to Accelerate PEV Adoption in Fleets* contained in the appendices. PEV FleET can be downloaded at http://www.redwoodenergy.org/programs/electric-vehicles.

Appendices

The following documents are available online at http://www.redwoodenergy.org/programs/electric-vehicles.

PEVCC Charter

Infrastructure Deployment Guidelines

Plan for Near-term EVSE Deployment

Plan to Collect Consumer Charging Behavior

Report on Estimated Greenhouse Gas Reductions

Plan to Mitigate On-peak Charging

Plan for Streamlining Permitting, Installation, and Inspection

Incentives Report

Plan to Accelerate PEV Adoption in Fleets

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